From the Editorial Office of USDA May 6, 1944

MOST IMPORTANT RESEARCH ACHIEVEMENTS OF DEPARTMENT OF AGRICULTURE SCIENTISTS DURING RECENT YEARS

* * *

Hybrid corn: Hybrid corn, a product of scientific research, reached the stage of most vigorous commercial development at the time World War II had raised food demands to the highest point in history. It is an outstanding example, perhaps the most outstanding example, of the influence of theoretical scientific research in revolutionizing the production practices of an agricultural crop.

Since the method of hybridizing corn was first suggested by G. H. Shull in 1909, the present perfection of commercial hybrids has been developed through combined and cooperative efforts of many breeders, both in the Agricultural Research Administration of the U. S. Department of Agriculture and in State experiment stations. The Department has been working on the problem since 1916, and the present leading hybrid, U. S. 13, was developed by the two groups of plant breeders.

Although the first hybrid seed involving inbred lines was produced in 1921 in Connecticut, the industry did not really get started until nearly 15 years later. In 1943 nearly 52 percent of the country's corn acreage was planted to hybrid varieties, and almost the entire acreage in some of the leading corn States.

Since well-adapted hybrids increase the yield about 20 percent, it is estimated that the 1943 production as a result of their use was 669,000,000 bushels more than it otherwise would have been. This gain is equivalent to 7,360,000,000 pounds of pork, or 54 pounds for each man, woman, and child in the United States.

Palm Oil Substitute: Imported palm oil was used before the war not only for making shortening, oleomargarin, and soap, but also in the manufacture of tim plate and terne plate. More recently it had come into use in the cold-reduction process for sheet steel. When our imports of palm oil were largely shut off by Japanese conquests, substitutes had to be considered. The literature was rather conflicting, the cooperation of manufacturers and consumers was sought and, as it proved, the exact properties which made palm oil so suitable were unknown. Dr. K. S. Markley of the Southern Regional Research Laboratory and his associates set to work. They first considered a hydrogenated cottonseed oil because that had been tried as a substitute for palm oil in the last world war. Ordinary cottonseed oil was known to be unsuitable and the more highly hydrogenated oils also proved unsatisfactory. Finally a semi- or medium-hard hydrogenated cottonseed oil was found to approximate palm oil in properties. Upon test it proved extremely satisfactory.

This tailor-made oil costs about twice as much as palm oil, but it lasts three times as long.

Phenothiazine as an anthelmintic: Phenothiazine is a synthetic organic chemical, first prepared in the latter part of the nineteenth century. It is one of the thiazine dyes. Following the discovery and announcement that phenothiazine was effective as an insecticide, its value as an anthelmintic was studied and established in 1938-39 by Harwood, Jerstad, and Swanson, workers of the U. S. Bureau of Animal Industry. Experimentation with this drug has been continued to develop the best methods of use. Phenothiazine is now widely recognized throughout the world as a highly effective anthelmintic for the removal of many injurious internal parasites of domestic animals. It is the most valuable single drug so far discovered for combating such parasites. The drug is distributed commercially in powder form and may be administered either in gelatin capsules, in ground feed, in salt, or as a drench, the choice depending usually on the species of animals and preferred method of handling them. For use as an anthelmintic phenothiazine should be the pure product prepared especially for that purpose. The form used as an insecticide contains a conditioner which makes the drug unsuitable for administration to animals.

In 1-ounce doses phenothiazine rids sheep and goats of stomach worms, nodular worms, hookworms, and related pests. Its use prevents perforations of the sheep's intestines by the worms, thus providing us with additional war material for the making of surgical sutures at a time when they are greatly needed. In suitable doses which vary with the size of animal, phenothiazine is effective in removing several kinds of parasites from swine, cattle, horses, and mules. In very small doses this drug is effective also in removing cecal worms from poultry. These are the worms that transmit blackhead to chickens and turkeys. The extensive use that phenothiazine already has acquired for controlling animal parasites is evident from the quantity--about 3 million pounds--used in the United States in 1943.

Photoperiodism: While working with Maryland Mammoth tobacco prior to 1920, W. W. Garner and H. A. Allard of the then Bureau of Plant Industry (now Bureau of Plant Industry, Soils and Agricultural Engineering) discovered that the plants flower only when the daily period of illumination is relatively short--that is, when the days are short and the nights long. When the light periods are long the plants remain vegetative. Subsequent experiments on many kinds of plants showed clearly that they differ greatly in their growth and flowering responses with respect to the relative lengths of the daily periods of illumination and darkness to which they are exposed, some conforming to the behavior of Mammoth tobacco, others responding to relatively long illumination periods, and still others being but little affected. This discovery departed widely from the prevalent theory that more intensity of illumination was the principal light factor concerned in determining the characteristic growth, flowering, and fruiting of plants. It had great fundamental importance as pure research and, as it developed, widespread practical significance. Response to relative length of day and night largely explains why many plants flower only at certain seasons of the year, and it also largely explains changes in behavior where plants are carried from one latitude to another. It is now possible, by conducting experiments under controlled conditions, to tell in advance whether certain varieties of soybeans, peas, onions, timothy, barley, and other plants are adapted to the photoperiodic conditions known to prevail in specific localities. The experimental crops can be grown under greenhouse

conditions anyway, with supplemental artificial light as needed; if none is adapted to the locality, one or more suitable lines can be bred.

This discovery has also been particularly helpful in selecting soybean varieties that thrive and produce abundant seed for making oil, plastics, and food products in various localities. It has enabled us to produce our own beet seed domestically instead of importing it as we did formerly. It enables us to select localities where pyrethrum, a long-day plant, will thrive in the United States, and also to cross plant varieties which would not normally flower at the same time, as in the case of sugar-cane varieties. By artifically shortening the daily light period chrysanthemums and other flowers are now being brought to makret ahead of their normal season. Recently it has been found that a plant is primarily influenced by photoperiodic conditions by way of its leaves. Thus a Biloxi soybean will bloom promptly if only a few of its leaves are subjected to a short photoperiod.

It is all but impossible to calculate the flow of economic value from an original discovery so basic as that of Garner and Allard.

Plant Growth Regulators: In 1939 F. E. Gardner, P. C. Marth, and L. P. Batjer, of the then Bureau of Plant Industry, tested the effectiveness of a number of different growth-regulating substances in preventing preharvest drop of 19 leading commercial apple varieties. Two compounds, naphthaleneacetic acid and naphthalene acetamide were outstanding and about equal in effectiveness in preventing fruit drop. The sodium, potassium, and ammonium salts of naphthaleneacetic acid were also found to be very effective. Soon after publication of the results several proprietary spray compounds containing either naphthaleneacetic acid or naphthalene acetamide as the active ingredient were placed on the market. In general, commercial orchardists have found these sprays of considerable insurance against fruit loss from preharvest drop over a period of several years.

These research workers, delving deeper into the secrets of plant growth regulation, have unearthed many other new facts which may some day be of practical application. Dr. Marth has demonstrated the feasibility of controlling the time of emergence from dormancy of certain nursery stocks by suitable application of plant harmones. By such treatments the storage period may be prolonged to permit later planting of more vigorous material and to retain more of the original vigor in the planting material. Gardner and Marth corroborated the results of another scientist in the artificial production of seedless fruits, of holly, grapes, and strawberries through the use of these growth regulating substances.

Basic Facts About Vitamin A: Basic contributions to knowledge of vitamin A have been made in the foods and nutrition laboratories of the Bureau of Human Nutrition and Home Economics.

To find out the vitamin A requirements of human beings, a few years ago research workers in the laboratories fed an experimental diet to a group of men and women volunteers. Day after day the group ate only meals prepared in the laboratory kitchen.

This group received every nutrient that the human body is known to need except vitamin A, which was almost completely absent from the meals. Since one

of the early measurable effects of vitamin A lack is nightblindness, that is, failure of the eyes to adapt normally to dim light, the appearance of this condition in the subjects was taken as a sign that the body had used up most of its stored vitamin A. As soon as a volunteer showed unmistakable evidence of nightblindness, he was given measured amounts of vitamin A, first in small and then in gradually increased doses until the vitamin A received was just sufficient to keep his vision in dim light normal.

Fish-liver oil, cheese, milk, cream, and eggs are the most common animal foods containing significant amounts of vitamin A. However, green leafy and some yellow vegetables and fruits contain certain orange pigments known as carotenes, which are changed into vitamin A in the body. In the first experiments solutions of standardized cod-liver oil and pure carotene were given to supply the "measured amounts" of vitamin A. Later the minimum vitamin A requirements were measured in terms of natural foods, using peas, spinach, and carrots as sources of vitamin A. It was found that in terms of International Units the body needed about 30 to 60 percent more carotene as found in vegetable foods than it did of vitamin A found in animal foods.

This information has special timeliness for the war period, since restricted food supplies cause civilians to lean more heavily upon plant foods for their vitamin A supply. From these vitamin A experiments have come data for estimating the daily minimum vitamin A requirements of the average, normal adult. The findings became part of the informational background used when the Committee on Food and Nutrition of the National Research Council set forth recommended daily allowances of vitamins and other nutrients as a nutrition yardstick for America.

In the first experiments, some subjects showed signs of vitamin A deficiency after two weeks of the vitamin A free diet, whereas others--probably better fortified by a reserve supply of the vitamin--showed no sign of lack for several months. To learn more about the body's ability to store this vitamin a nd the rate at which it is depleted, laboratory animals were used. The results showed that moderate amounts of vitamin A obtained regularly in meals are used more economically than occasional massive amounts.

This suggests the importance of building up a "vitamin A savings bank" by regularly eating somewhat more than the daily requirement of foods containing vitamin A, when possible. To serve as an aid in determining the vitamin A value of the normal diet, analyses of vitamin A value of 128 common foods in the raw and cooked state have been made and published in these laboratories.

The Bureau's vitamin A researches have progressed over a number of years. This work was started under the supervision of Dr. Lela Booher, more recently under the supervision of Dr. Elsa Orent-Keiles, while various scientists have help responsible posts in carrying out the work. Mrs. Elizabeth Callison had direct leadership of studies to determine human vitamin A requirements.

Scientific Sizing: Major savings to the clothing industry and to consumers alike are beginning to result from the Bureau's work on measuring women and children as a basis for sizing clothing. Lack of scientific data on the body measurements needed in sizing garments is at the root of the chaotic condition which has always existed in the sizing of clothing--particularly for women and children. Department stores complained of a $10,000,000 headache each year from returns and exchanges because of wrong size. Mothers complained of wasting time, money, and energy buying clothes that failed to fit children at home--age of a child was no dependable guide to clothes sizes.

Gaining cooperation of 20 colleges and universities, and with funds furnished by the Works Progress Administration, scientific workers in the clothing laboratories, under direction of Miss Ruth O'Brien, weighed and measured nearly 150,000 boys and girls. Thirty-six clothing construction measurements were taken on these boys and girls, who ranged from 4 to 17 years of age, and represented 16 States.

From data obtained, the Bureau recommended a two-way method of sizing children's clothes based on height and girth at hip. The height-hip system is very similar to the system by which men have bought their shirts and other garments for years--according to a few guide dimensions. The Bureau's scientists continued by measuring 15,000 women from 18 years old to 80. Fifty-eight measurements used in constructing patterns and garments were recorded, and weight was taken as a further check on bodily proportions. Universities and other institutions in representative sections of the country cooperated.

From the data, the Bureau recommended height and weight combined, rather than the customary bust measure, for predicting fit of full-length garments. For garments for the upper part of the body, height and bust combined offer the best guides to a fit. For lower trunk garments, height and hip girths are good guides. No single measurement is adequate as a basis for sizing garments and patterns, the survey conclusively showed.

As a result of these measurement studies, some pattern companies and clothing manufacturers are now making use of the new sizing system for children's garments. On the basis of the Bureau's work, new standards for body sizes for boys' garments have been adopted by the American Standards Association, which serves as a link between scientists and the trade. While awaiting developments in the women's wear field, one large mail-order house has already gone ahead to use the Bureau's data and the recommended sizing methods for sizing its women's garments.

Smear 62 for screwworms: This smear was developed at the laboratory at Menard, Texas, as a combined effort of the laboratory, largely the work of Roy Melvin. Its first practical test on a large scale was made in the summer of 1941. It is now widely used throughout the area where the screwworm occurs, and has probably been largely responsible for holding to a minimum an excessive and widespread outbreak this season, with resulting savings of millions of dollars worth of cattle.

A new poisoned bait for the Mormon cricket: This bait, consisting of a sodium flousilicate, mill-run bran, and sawdust mixture, is a development of the laboratory at Bozeman, Mont., and represents the combined work of a number of individuals under the leadership of John R. Parker. It was first given widespread use in 1939, and has resulted in savings of hundreds of thousands of dollars in control work during the past three seasons by reducing the costs of materials furnished by the Government and of labor in their application. Savings as a result of cooperative control efforts where this material has been used total in excess of fifty million dollars in the last three years.

An Aerosol: The project looking to the development of a fine-fog method of dividing and spreading insecticides was started in April 1941 and its results were put into practical use early in 1943. The new aerosol development was

primarily the result of an idea originated by Dr. Lyle D. Goodhue and developed by him and W. N. Sullivan. The discovery includes principally an insecticide material with an activator that makes the mixture work better, dissolved in a highly volatile, noninflamable and nontoxic solvent which propels and atomizes the insecticide into a fog, all in a container which keeps the mixture under high pressure ready for instant release. The new aerosol got into use just in time to be of great value in the war. The entire output consisting of millions of containers has been requisitioned by the military authorities and is in use on the various fighting fronts to protect our men from irritations and dangers of mosquitoes, flies, and other insects. When this method of fighting insects can be made available for general use, its value will be incalculable. In other words, the principle of this method of control may be so important as to revolutionize many of the current practices for the control of serious pests.

Increasing the yield of Penicillin: The observations which led to the discovery of penicillin were made in 1929 by Alexander Fleming, a British scientist. He was annoyed to find one day that some stray mold spores were growing in a culture of germs he was studying. A germ-free zone around this stray mold indicated to him that it was giving off a substance that was killing the germs in his culture. This substance turned out to be penicillin. It was named for the mold which produces it.

But very little was heard of this discovery until the summer of 1941. At that time Dr. Florey and Dr. Heatley, two British scientists who were largely responsible for the application of Fleming's observations, came to this country to stimulate interest in the pilot-plant production of the new product. After conferences with members of the National Research Council and scientists of the Department of Agriculture, the men were sent to our Northern Regional Research Laboratory located at Peoria, Ill., and operated by the Bureau of Agricultural and Industrial Chemistry. This laboratory was selected because it had had wide experience in the use of molds in the fermentation field and because it had one of the largest collections of molds in the world.

Dr. Heatley stayed at the laboratory and went to work in cooperation with our fermentation experts to try to increase the yield of penicillin. The yield was so small at that time that it amounted to a bottleneck. They also developed methods for purifying penicillin. These studies were supported by the Committee on Medical Research in the Office of Scientific Research and Development. The studies are still going on and have been of great value to those who are now working to perfect the commercial production of penicillin.

By proper feeding of the molds and by improving the strains of molds that produce penicillin, the laboratory workers were able to increase the yield one hundredfold. The work at our laboratory, as well as that in industrial laboratories, was so promising that Dr. A. N. Richards, Chairman of the Committee on Medical Research, called a meeting of representatives of commercial manufacturers of pharmaceutical supplies in December of 1941 and made available to them the results of the work at the Northern Laboratory which had been so successful. Largely as a result of that conference, a number of industrial firms started the production of penicillin on a semi-commercial scale. Penicillin is now being produced on a large scale by more than 15 commercial firms.

This is the sort of problem our Regional Research Laboratories are prepared to solve. Their pilot-plant facilities enable them to take research beyond the test-tube stage and into semi-commercial production. Penicillin, promising as it is today, was not produced in sufficient quantities to make it of any great importance until research in the Peoria Laboratory found a way to increase the yield so that it was possible for industry to go ahead on a semi-commercial scale.

Speeding up Calcium Gluconate production: Following up research which resulted in a practical method of using molds to ferment glucose into gluconic acid, which combined with lime as calcium gluconate, is widely used in medicine. Department chemists have further improved the process by making it semi-continuous. Three chemists have discovered that addition of a small quantity of boron compound promotes the biochemical process. Use of the boron, together with improved equipment and better molds as fermentation agents, makes it possible to produce calcium gluconate in about half the time formerly required.

Chemists of the Department of Agriculture who began the research 12 years ago found that the action of certain molds on a solution of glucose, or corn sugar, produces gluconic acid. This acid is important in the manufacture of calcium gluconate, a calcium or lime compound that can be assimilated by animals. Molds are microscopic plants, and--like other plants--need air to grow. At first the molds were grown on the surface of shallow pans, but these were not adapted to large-scale use in manufacturing plants.

The chemists continued the experiments, and, in 1935, the Department of Agriculture announced the invention of a rotating drum in which the glucose solution is fermented. The air which is necessary to the growth of the molds is forced into the drum at one end under pressure and is removed through the other end.

After studying many molds to find out which ones are best for making gluconic acid for calcium gluconate, Department of Agriculture chemists report that the best found so far is a mold known technically as Aspergillus niger (strain 3). This particular mold does a good job at fermenting the glucose.

Though the rotating-drum method reduced the cost of making calcium gluconate from $150 to 50 cents a pound, the chemists encountered one difficulty with the process. When the molds were exposed to an increasing concentration of gluconic acid which was formed in the glucose solution, they stopped working. Calcium carbonate, or common chalk, was added to neutralize the effect of the acid, but the calcium gluconate produced was not very soluble and separated out, clogging up the drum. Then three chemists of the Bureau of Agricultural and Industrial Chemistry, A. J. Moyer, E. J. Umberger, and J. J. Stubbs, who had been studying fermentation processes, discovered that the addition of a little borax or boric acid to the fermenting liquor keeps the calcium gluconate in solution and lets the molds finish their work. Later, the calcium gluconate may be separated from the solution free from boron.

Norepol: Norepol, the rubber substitute from vegetable oils announced in 1942 by the Department of Agriculture as having been made in the Northern Regional Research Laboratory at Peoria, Illinois, is now in commercial production. Two companies making rubber according to the Norepol formula have given the product trade names of their own. Other companies are turning out a finished

product under the name of Norepol and some are making an intermediate material sold to manufacturers of rubber articles for the ultimate consumer.

The war has hastened commercial adoption of this infant industry that was in the pilot plant stage a short time ago. The pilot-plant policy of the Research Administration's Bureau of Agricultural and Industrial Chemistry--adopted with the establishment of the 4 Regional Research Laboratories for industrial utilization of farm commodities--has been a factor in getting the new product into use as well as speeding work on other rubber intermediates in the Department. The pilot plant serves as an intermediate stage between the laboratory test tube and commercial production. The wholehearted cooperation of industry had much to do with the rapid development of Norepol.

W. J. Sparks, co-inventor of butyl rubber and an expert in polymerization chemistry, joined the staff of the Peoria Laboratory soon after it started. It was he who blocked out the basic reactions for the production from vegetable oil of the rubber-like product now called Norepol (abbreviation for NOrthern, REgional, POLymer), in the autumn of 1939.

Later Sparks went back to the industrial firm that had previously employed him. The work he had started was then carried on in the Bureau by Dr. J. C. Cowan, who developed the specific reactions that resulted in the laboratory product from soybean, corn, or other vegetable oils. Then, under the supervision of Dr. R. H. Manley, who had come to the laboratory as head of the Division of Oil and Protein Research, Dr. Cowan--with Dr. Waldo C. Ault and Dr. Howard M. Teeter--went ahead on the process and pilot-plant trials and became co-inventors of the Norepol process which is known only to the Government and those who are using it to manufacture rubber.

Department chemists say the Norepol process has practically no relationship to the factice process, which also produces a rubber-like substance, except that both use vegetable oils. The factice process, which has long been established, consists principally in treating semidrying oils with sulfur or reactive compounds of sulfur. In making Norepol, instead of treating the entire oil, from whatever crop it may come, a definite series of chemical reactions is employed during the course of which selected constituents of the oil are used, leaving other constituents as useful byproducts. Essentially, the process consists in the controlled polymerization of the linoleic acid in the oil.

The Department first described Norepol as having a number of the valuable characteristics of natural rubber in considerable degree, including 200 percent stretch, tensile strength of 500 pounds to the square inch, and excellent resistance to oxidation and to the effects of water and alcohol. The general run of natural rubber has a 600 percent stretch and a tensil strength of 3,000 pounds or more. However, for certain purposes Norepol is highly useful.

Since the first public report, and as a result of tests in the Peoria pilot plant and by a number of factories, improvements have been made in the product. In particular, the necessary constituents can now be produced in purer form and there is better control of the polymerization process.

Tests at the Laboratory and in commercial plants show possibilities for many uses for Norepol, including molded and extruded articles--such as rubber heels, fruit jar rings, tubing, and gasket material. Because of the over-all rubber situation, careful choice must be made among the various possible uses.

A point of much interest in the over-all economy of wartime is that what is left of vegetable oils after the separation of material for Norepol, including glycerol, can be used by industries that consume vegetable oils to make some of the same products they have been making from the whole oil.

Dehydrating food: Dehydrated vegetables take about one-third the ocean freight space required for similar products processed in other forms. Realizing this tremendous cargo saving opportunity, the former Agricultural Marketing Administration (now absorbed by the Food Distribution Administration) on May 26, 1942, announced a program to encourage expansion of the domestic industry to meet increased needs of American and United Nations military forces. At that time about 20 plants, with a production capacity of about 15,000,000 pounds annually were operating in the United States.

In 1941 chemists and engineers of the Agricultural Research Administration were at work in the Western Regional Research Laboratory on the basic research that made this quick wartime expansion of the industry possible. Immediately after Pearl Harbor, pilot plant, or semicommercial, dehydrators were quickly built and put to dehydrating vegetables.

Investigations on the dehydration of meat got under way at the Beltsville Research Center at Beltsville, Maryland, about the same time, leading to results having prompt commercial application. The methods worked out for the preparation, processing, and packaging of dehydrated vegetables were offered to the industry in 1942 through two dehydration schools, one at Rochester, New York, for the eastern half of the country and one at Albany, California, for the West.

To carry out the program, an interdepartmental committee composed of representatives of the Department of Agriculture, Army, and the War Production Board was set up. Last summer, the WPB, on the recommendation of Secretary Wickard and the Food Requirements Committee, established a bank of critical materials to permit conversion and construction of additional dehydration facilities. An additional bank of materials was provided in the latter months of 1942.

A New Way to Make Alcohol from Wheat: Scientists in the Agricultural Research Administration have found that the diastase in granular wheat flour can be activated so as to convert its own starch into fermentable sugars through the use of less malt than has heretofore been used when alcohol was made from grain.

This new discovery by Dr. A. K. Balls and Irwin W. Tucker of the Bureau of Agricultural and Industrial Chemistry was developed in the laboratory and then tested on a large scale in a beverage distillery now producing industrial alcohol. It comes at a time when distillers are turning more to wheat for producing their industrial alcohol, so that corn, the grain customarily used for that purpose in normal times, may be used in the feeding of livestock.

An important observation during the development of this new process indicates the possibility of separating the protein and the starch at the beginning of the alcohol process. If this can be achieved industrially without too much expense, a large amount of protein for livestock feed may be made available before distillation, instead of being recovered from distillers' slop as at present. Possibly some of this protein might even find uses as human food. Plants which formerly produced their alcohol from molasses, might be able to use this new process and thereby save the malt that would ordinarily be used in fermentation, as w ell as recovering a large amount of valuable protein as a byproduct.

Lacquer from Cow's Milk: With war limiting supplies of tin available for coating milk cans, dairy scientists are now looking to the cow herself to furnish some of the critical materials needed in transporting and packaging her products. Paul D. Watson, associate chemist of the Bureau of Dairy Industry, has developed a lacquer-substitute for the tin coating on cans used for evaporated and condensed milk and on the cans used for shipping fluid milk and cream. Watson's lacquer, on which he has just filed applications for 2 public service patents, is made largely from lactic acid, with a small proportion of castor oil or some other vegetable oil.

Lactic acid is obtained by fermenting the milk sugar in whey, which is a byproduct of cheese and casein manufacture. Commercial production of lactic acid from whey, as well as from other agricultural sources, is already established. Finding a profitable outlet for all the whey produced at large cheese factories has long been a difficult problem.

Preliminary tests with the new lacquer, both in the Bureau's laberatories and by several manufacturers of coating materials for metals, have given promising results. All the ingredients needed to make the lacquer are readily obtainable, and no unsurmountable difficulties in making or applying the lacquer are apparent, Mr. Watson says.

Although the Bureau's research has been directed mainly toward insuring a supply of suitable containers for milk and other dairy products in spite of the tin shortage, protective lacquers that can be applied directly to iron and steel and other materials would be of value to the whole sheet-metal industry. The Bureau's new lacquer is also suitable for many purposes other than a protective coating. It may be used for impregnating, gluing, and molding various articles.

New Method for Dehydrating Cheese: A new method for dehydrating natural American Cheddar cheese for lend-lease or other uses, which is more direct than the commercial procedures now in use and which will also release spray-drying equipment for drying other foods, was developed in the Agriculture Research Administration.

Dr. George P. Sanders of the Bureau of Dairy Industry, who devised the new method, found that if natural full-fat cheese is grated and then partly dried at room temperatures, the fat will be sealed up in the numerous case-hardened particles of curd. The particles can then be dehydrated in a tunnel drier or by any other heated-air method, without loss of fat.

Heretofore, commercial companies have been unable to use direct methods in dehydrating cheese of normal fat content, because the heat of dehydration caused the fat to melt and run out. Some processors have overcome this difficulty by first processing the full-fat cheese with heat and water, and usually with a chemical emulsifier, into a milky paste that can be spray-dried. In another commercial process, the fat is removed from the milk used in making the cheese and then added to the dried cheese.

The Bureau's new method is more direct and the resulting product is a natural cheese, minus only the water.

Natural Cheddar cheese in its original state usually contains about 36 percent water, but the dehydrated flakes as prepared in the Bureau's laboratories contain about 3 percent water. The dehydrated flakes thus contain all the fat and other solids, but weigh only two-thirds as much as the original cheese.

The flakes can be packaged loose or they can be compressed to the same density as the original cheese, or to two-thirds its volume. The compressed cheese can be easily broken up, and it can be consumed directly or used in almost any other way that cheese is ordinarily used.

If the flakes are compressed into rectangular or block form instead of the round shapes typical of natural Cheddar cheese, considerable additional storage or shipping space can be saved. Compared to the original cheese packed in round boxes, the dehydrated compressed blocks would occupy between 53 and 56 percent as much storage or shipping space.

Targhee and Columbia Sheep: The development of the Columbia and Targhee breeds of sheep is not strictly basic research but has resulted rather from utilization of basic knowledge of genetics. The development of the two breeds represents a skillful application of genetic laws and principles by scientists of the Bureau of Animal Industry.

Major credit for the development of Columbia sheep belongs jointly to E. L. Shaw, F. R. Marshall, and D. A. Spencer. Credit for the Targhee belongs to A. D. Spencer and W. A. Denecke. In both cases several others, mostly geneticists and station directors, were involved.

The development of these breeds has exceptional regional importance from a production standpoint, since they are primarily adapted to the intermountain ranges of the West. But the breeds also have national significance from a commercial and a monetary standpoint because of the excellent quality of their fleece and meat. The earning power of Columbia sheep is estimated to be $1 to $2 a head greater than average well-bred range sheep. That of the Targhee breed is somewhat less.

The Columbia is the result of cross breeding select Lincoln rams with Rambouillet ewes and proceeding from this original crossbred by mating the most select first-cross rams with carefully selected first-cross ewes and interbreeding the rams and ewes descending from them. The foundation of the Targhee breed was laid by mating select Rambouillet rams with select ewes of Corriedale x Lincoln-Rambouillet, and Lincoln x Rambouillet combinations, and interbreeding the rams and ewes descending from these matings. The Targhee came from rigid selections of these matings.

Forest Products Research: Experimental work on wood and paperboard container problems has been carried on at the Forest Products Laboratory for many years but has been expanded manyfold since the job of solving the packaging, loading, and shipping problems for all ordnance equipment and supplies was assigned to the Laboratory in 1942 by the Army Ordnance Department. Not only have hundreds of items, including antiaircraft guns, armored trailers and cars, ammunition, mobile shop trucks, rifles, and "bazookas," been protected against damage or loss by these redesigned or newly designed containers, but in addition great economies in shipping space have been worked out, to the degree that considerably fewer ships were required for such shipments, at a time when shipping space was a vital consideration in the shipment of supplies for the support of our troops in different parts of the world, as well as in Lend-Lease shipments. Detailed procedures of cleaning, rustproofing, and wrapping many artillery items were worked out, and a great many commercial greaseproof and waterproof papers were tested to determine their suitability for wrapping Ordnance equipment for overseas shipment. Assistance is also being rendered the Army Air Force and the War Food Administration in solving packaging and shipping problems.

Production of wood sugar from wood waste and low-quality timber has been greatly advanced by the pilot-plant investigation recently completed by the Forest Products Laboratory at the request of the War Production Board. This very important contribution to the war effort is a development and application of the German Scholler process. The results were highly satisfactory in the production of this wood sugar, from which ethyl alcohol or high protein livestock feed can be produced. Plans are about completed for the erection in this country of the first commercial plant for the production of wood-sugar alcohol. The large-scale production of alcohol from wood waste will aid considerably in the conservation of the grain supply in the United States for domestic and Lend-Lease needs. It has been shown that a number of chemicals of military importance can be derived from the lignin in wood waste and pulp mill waste liquors, including alcohols, glycols, tar acids, hydrocarbons, naphthene, and heavy, high boiling oils.

Papreg, the high-strength resin-impregnated paper plastic, developed at the Forest Products Laboratory, has been adopted to many military uses, such as equipment cases, aircraft ammunition boxes, gunner's seats, and parts for gun turrets. The developments include laminated paper plastics filled with low-cost lignin recovered from waste pulping liquors; these have distinct possibilities as substitutes for the conventional resin-bonded paper plastics; also the lignin has possibilities as an extender for the critical phenolic resins commonly used in these products.

Forest Economics: Several years work by the Division of Forest Economics on the complex problem of federal contributions in lieu of taxes on national forest lands culminated in the issuance of the Federal Real Estate Board's report, "Federal Contributions to States and Local Governmental Units with Respect to Federally Owned Real Estate" (1943; H.D. 216). The recommendations of the Board were based on and are wholly consistent with the contributions plan developed by the Forest Service but generalized for application to the several types of federally-owned conservation lands. The release of the Board's report constitutes a major landmark on the road to a permanent solution to the thorny contributions problem.

The investigations in process on the experimental forest at Crossett, Arkansas, have been aimed at the basic financial problem of forestry--i.e., how to harvest more and better forest products, yet keep the forest lands in condition to meet future needs. The completion of the first comprehensive report on the results of these studies (now in press, entitled "Financial Aspects of Selective Timber Management in Second-Growth Shortleaf-Loblolly Pine-Hardwood Stands") is a landmark in this phase of forest research. The economic practicality of partial short-interval cutting in the shortleaf-loblolly type of southern pine forest has been demonstrated conclusively. It has been shown that good forestry is good business. This is precisely what has been needed to accelerate the adoption of sound management practices on private forest lands, and the wholesome results of this impetus are already in evidence throughout the South.

The Otsego Forest Products Cooperative Association, Inc., at Cooperstown, N. Y., has been sponsored by the Forest Service as a pilot plant for the development of cooperatives in the farm forest field. After a slow and difficult organization stage, this Association has now attained a stable level of continuous operation. It is by far the largest cooperative now functioning in the farm forestry field, with 934 members and a thoroughly modern processing plant equipped with band saw. Local community interest in and support of the project has grown steadily. In the face of current operating difficulties and the pressure of other types of farm enterprise, plant operations have been adapted to wartime exigencies, and almost 2 million board feet high quality lumber were turned out during the past year, most of which channeled directly to war uses. Management practices on farm woodlands throughout the area have been improved markedly, and the financial returns from the sale of forest products by Association members have been stepped up appreciably.

Forest Management Research: Naval stores research has recently developed methods by which gum naval stores yields can be increased 17 percent or better on commercial operations by applying chemicals to freshly chipped trees. The method results in higher money returns to the operator, ranging roughly between $400 and $700 additional net profit per crop of 10,000 trees, depending on how faithfully proper methods of chemical stimulation are followed. The two methods developed in this search and currently recommended to and tried by the industry are (1) biweekly chipping of the turpentine trees with application of 40 percent sulfuric acid to the fresh streak, and (2) weekly chipping (a normal procedure) followed by application of 25 percent caustic soda solution. With the same labor, the second procedure gives somewhat higher yields, but where labor is scarce the former method is very advantageous.

Improving Sagebrush Range Lands: On much of the 96 million acres of sagebrush range land in the West, range owners and operators have been faced with two very serious problems growing out of the prevalence of this very low-value shrub. On the one hand sagebrush crowds out the vigorous growth of more valuable forage plants, makes herding difficult, contributes to the straying and loss of sheep, brushes considerable amounts of wool from sheep fleeces, and otherwise hinders effective livestock grazing. On the other hand, when the range has been burned in an effort to eliminate the brush and the necessary precautions have not been observed, a great reduction of valuable forage and loss of soil has usually resulted, to say nothing of occasional serious damage caused when the brush fires have got out of hand and raged through other range areas or destroyed buildings and other private property.

A study completed in 1942 has proved that heavy stands of sagebrush can be eliminated by burning with only negligible losses, and that when such burning is properly planned and executed and includes intelligent management of the range for a season or two after burning, grazing capacity will be greatly increased--60 to 300 percent increases have been recorded. Where planned burning is carried out, grazing animals are unrestricted in their movements, ewes produce a more steady flow of milk, and lambs make better growth and are seldom lost. These and other benefits fully justify the investigations necessary to develop these safe methods.

Range Reseeding: Recent studies at several western forest and range experiment stations have pointed the way to successful seeding of valuable forage plants on several million acres of depleted range lands. Increases in forage production of from 2 to over 10 times, enough to far more than justify the cost, result from reseeding in accordance with the principles which have so far been developed. Ranges that are producing considerably less than their soil and climate can support are most promising for planting. Many valuable forage species are available for planting throughout the West, although comparatively few have so far been found suited to the driest and more severe sites. As a result of many tests, effective and economical methods of planting have been developed for most types of ranges. These provide for covering the seed, an essential consideration, and where necessary, preparing the soil and reducing the stand of low value competing vegetation.

Forest Grazing in Southeast Cattle Production: In the Coastal Plain of Georgia and North Carolina cattle are usually turned loose in the woods each year to make the best use they could of the understory of grass and other low vegetation to be found there. With the growing need for meat for the Army bases and war plants established in the Southeast, interest in making better use of native forage has developed. Research by our Appalachian Forest and Range Experiment Station (in cooperation with the Bureau of Animal Industry, Bureau of Plant Industry, Soils and Agricultural Engineering, and the State experiment stations) has shown during the past four years that the native forage of the Coastal Plain provides a cheap and valuable source of feed on which an efficient and profitable livestock operation can be based. This native forage must be supplemented during the fall and winter, however, when the forage is deficient in protein and minerals.

The research has shown for example that if cattle receive protein supplements during this latter period, they make much fuller use of range forage. Cows which received 14 pounds of cottonseed meal per head per week between mid-October and the end of January made an average gain of 22 pounds per head, in contrast to an average loss of 81 pounds per head in unsupplemented animals. The better condition of the cows reduced the death losses and permitted a high calf crop. The experimental herd produced at the rate of 91 calves for a hundred cows. This contrasts with an average of only 40 to 50 calves per hundred cows handled under usual Coastal Plain practice. Information from this project should be worth several million dollars a year to farmers and timberland owners, according to the Georgia Forest Farmers' Association. Range cattle production in the Southeast is expanding under war stimulus and these better returns provide opportunities for raising the standard of living of the people as well as increasing the production of meat in the area.

Forest Products Research: Under the sponsorship of the War Production Board the Forest Products Laboratory undertook a pilot plant study to develop methods for laminating ship timbers. The study has reached a stage where it is possible to produce acceptable glued white oak timbers under properly controlled conditions. Laminated timbers permit the use of lumber and reduce the demand for large timbers which have been difficult to obtain.

Soil Conservation Research: Soil- and water-conserving farming methods are carefully devised to salvage and rebuild that valuable raw material, the soil, for continued profitable use. To do this, a soil-conservation farm plan redesigns the farmer's factory or plant. As in the modernizing of an industrial plant, every change made in the farmer's fields is based on thousands of carefully controlled laboratory tests and closely watched field trials. Today 19 soil and water conservation experiment stations located in farming areas throughout the country are delving into the secrets of soil, rain, wind, and growing crops.

By studying the private life of a raindrop, research men have devised a unique rain machine that can be regulated to produce the effect of a typical Great Lakes drizzle or one of the sudden drenching spring downpours of the Southwest on various types of soils and crops. Tilting plots of earth that can be sloped to any accurate degree have helped determine the comparative soil-holding powers of various grasses and other close-growing plants on sloping fields.

Fine-gaged laboratory instruments and ingenious weather-imitating devices are adding, bit by carefully weighed bit, to the store of tested facts making it possible to adopt soil saving farming patterns to the specific needs and capabilities of each acre. These recent achievements exemplify the immediate practical value of the Soil Conservation Service's research program.

Stratified Flow: By caging a miniature river and reservoir in glass, the SCS, in cooperation with the California Institute of Technology, has discovered that a muddy stream can be shuttled through and out of a reservoir merely by its own action, without the use of conduit or by-pass. Because silt, the stream-borne mud or soil that piles up behind dams to choke reservoirs and destroy irreplaceable reservoir sites, is a constant serious threat to power production, community water supplies, and irrigation, this discovery promises to save millions of dollars annually.

Research of the Service's sedimentation specialists has established the fact that a stream retains its identity after entering a reservoir, continuing to flow in a layer through under or over the still water. Its action depends on temperature and the amount of sediment or silt it contains. A silt-laden current slides under the clear water of a reservoir as heavy cream poured into coffee slides under the clear hot liquid. After trapping these flows or density currents in glass, watching and recording their action, research workers predict that engineers will eventually be able to use these layered flows of water into and through reservoirs as accurately as an accountant can use the keys of an adding machine, channeling a clear stream of snow water through a reservoir to the city's mains, a muddy stream through the same basin to a drain that feeds sandy irrigation canals where the silt or mud will seal leaks in the sandy ditches, storing a salty stream in a known layer or strata until it can be drained off to return to the sea.

Brighton Dam and Reservoir, recently completed by the Washington Suburban Sanitary Commission to increase the water supply for suburban communities of Washington, D. C., is the first to make use of the principle of stratified flow in the special design of its outlets. Besides furnishing a "test case" for the effective use of density currents to preserve reservoir capacity, the new structure will contribute additional data, with special equipment installed to allow periodic measurements of the underflows as they come down to the dam. Engineers are making immediate use of the new understanding of density currents to preserve the capacity of reservoirs already built, drawing off known silted streams through low outlets originally designed for emergency draining or other purposes.

Potato Machinery Revised for Contouring: In the potato-growing area of Aroostook County, Maine, as in many other parts of the United States, productive topsoil is no more than a thin mantle over virtually solid bedrock. An entire agricultural industry for the county is thus dependent on retaining and building up this vital layer of soil.

Contouring and terracing across the slope, urgently needed soil-conserving practices, have now been made practical for the rocky, hilly country through deft revisions readily adaptable to standard potato machinery. This achievement in machinery design, worked out by J. W. Slosser of SCS, has an immediate value in the far northern county where a short growing season puts a premium on efficient, rapid operation of the potato planter, sprayer, and digger. Contouring alone has been shown to increase potato yields by 30 bushels an acre, an increase that would more than repay the cost of the research in one season. At the Presque Isle, Me., Experiment Station and on a nearby research farm the potato planter, spray rig, and digger were put through their paces on the contour.

The planting operation is the most important single process in potato culture and one of the most difficult. The heavy planter, as originally made, would slip sidewise on the curving slope-crossing rows of contoured fields, and seeding and fertilizer parts were too far apart to track, one behind the other, accurately around a curve. By reversing fertilizer boxes, reducing the length of the machine (incidentally saving some 80 pounds of metal), soil conservation technicians made the planter into a compact unit that rounds the curves of contour rows, accurately placing seed pieces in spaced drills and distributing fertilizer in the same rows. Fertilizer openers and seed shoes, redesigned to allow for full floating action, reduce field breakage from stones. There is no side slippage on slopes up to 18 percent.

Originally the potato sprayer, operated by two men, was drawn behind a tractor. Distance of spray mechanism from the front wheels caused damage to the vines as the sprayer failed to follow accurately in the path of the tractor on the curve. Mounting the spray rig on the front of the tractor makes the operation a one-man task, and simple guards on the wheels protect the vines.

The digger, necessarily wide, would tumble potatoes, dirt, and debris to the lower side of the tilted bed when operated across slope, damaging or losing much of the crop. By making the side wheel adjustable to the slope, technician Slosser has made it possible to keep the revolving "conveyor belt" or bed of the digger accurately level, properly separating potatoes from vines and soil. These inexpensive revisions, worked out through careful field trials

and machine shop designing, are readily applied to standard equipment, economically and efficiently retooling potato farming for soil and water conservation.

Hydraulic Design of Drop Structures for Gully Control: Taming the rush of eroding water is an essential part of soil conservation. A recurring problem for hydraulic engineers in the construction of concrete drop structures to control arroyos or gullies has been the prevention of undermining by the scouring action of the water. A safety measure against this eroding effect of falling water is the stilling basin incorporated in the design of the drop structure at its base. Heretofore each of these basins or shelves to catch and tame the falling stream has been designed as part of a specific structure and no general design procedure has ever been developed.

Now, the Research Division of SCS has brought a "gully washer" into the laboratory and poured it into a series of stilling basins varying in dimensions of depth and length. Watching the glassed profile of the stream as it flows through drop structure and stilling basin, research men have taken movies of the flowing water, measured its speed, determined its patterns as related to erosive action. From these careful laboratory measurements and observations, engineers have formulated certain rules for the construction of these basins designed to save them from being washed out in the flash floods that characterize the Southwest and Southern California. By formulating a general dependable solution for this one comparatively small erosion problem, SCS scientists have effected an inestimable saving in cost of materials, and in the prevention of possible failure.

Tannin-Producing Sumac: Imported Sicilian sumac has provided this country with much of the tannin used for tanning fine, pliable leathers. When imports were cut off by war, Hillculture scientists of SCS renewed their efforts to develop practical ways of selecting, growing, and harvesting erosion-controlling sumac for tannin.

The principal drawback to profitable tannin production in this country has been the great amount of hand labor required to harvest the sumac. In cooperation with the Iowa State Experiment Station, SCS has developed mechanical harvesting, drying, and baling processes that permitted the production of about 26 tons of sumac leaves from one small area for commercial tanneries last year. This may forecast a profitable new farm crop that can be grown on steep slopes and eroded land.

At Floris, Iowa, where the State experiment station is located, the Service has helped in the contour planting of white sumac seedlings, selected for their tannin-producing qualities. High-yielding strains of both white and black sumac common to the Eastern States are being selected for further experimental planting, now that mechanical harvesting and processing methods have been devised.

At the Floris Station, scientists assembled a sumac harvester from a caterpillar-type tractor and parts of a combine. This machine gathered only the leafy tops of the plant which were then windrowed for sun-drying. Mine-blower and air tunnel were enlisted to complete the drying of the harvested tops and a thresher separated tannin-containing leaves from stems and woody

portions. A hay baler packed the leaves in 75 pound bales. As a result of this pioneer harvesting effort, farmer programs are now under way to collect and dry a substantial amount of tannin-producing sumac leaf during the current season.

########

From Editorial Office of USDA
(Mr. Harding, 4842, or Miss Arnold, 4875)

NO. 6
Office of Information
Revised August 1, 1944

MOST IMPORTANT RESEARCH ACHIEVEMENTS OF DEPARTMENT OF AGRICULTURE SCIENTISTS DURING RECENT YEARS

Cork Substitute: Noreseal, a cork substitute, is a wartime product developed in the Northern Regional Research Laboratory of the Bureau of Agricultural and Industrial Chemistry, at Peoria, Ill. It can be made from the pith of such farm waste residues as cornstalks, peanut hulls, sugarcane bagasse, and similar material. It can be made in rod or sheet form, or poured directly into the cap of the bottle, and is particularly satisfactory as a seal for bottled beverages. The product is now in semi-commercial production, and bids fair to remain a successful enterprise after the war is over. It is the final result of literally hundreds of experiments.

Phosphate Drink for Cattle: Cattle in southern Texas have been getting phosphate drinks, with benefit to their health and growth, in experiments conducted by the Bureau of Animal Industry and Texas scientists in cooperation with the King Ranch of that State. The phosphates are added to the drinking water to make up for insufficient supplies of phosphorus in the native vegetation. In the past some stockmen have added bonemeal and other forms of phosphorus to the feed and placed it in self-feeders. Still others have applied superphosphate to the soil as a fertilizer. Putting the phosphates in the drinking water, besides being convenient for the cattle owner, enables each animal to get its supply in a soluble form readily assimilated.

The phosphate salts have been given experimentally in two forms, disodium phosphate and defluorinated triple superphosphate, in quantities sufficient to supply 6.5 grams of phosphorus in 6 gallons of water. The defluorinated product must be used because of the poisonous effect of fluorine. The treatment has resulted in more productive breeding stock and better gains by calves.

Scientific Collections: The maintenance of large collections of small quantities of viable seeds of many varieties of important economic crops and cultures of organisms of importance to agriculture is part of the work of the Bureau of Plant Industry, Soils, and Agricultural Engineering. Many of the items in these various collections are kept in cold storage, which reduces the frequency of regrowing crops to supply viable seed. In addition to the collections of seeds of crop plants, there are also collections of fungi and of soil bacteria. These collections have proved an important factor in the process of scientific work in many places outside the Department and even in other parts of the world. For example, the mold Penicillium, found by an English scientist to produce a powerful bactericide, was identified for him by Department scientists at Beltsville, Md., who started an extensive mold collection.

The various lots of seed of crops are usually regrown every few years to maintain their viability so that when needed they may be drawn upon for use by Department plant breeders, State experiment stations, or elsewhere. The plant scientists have recorded, insofar as possible, the characteristics of the various varieties so that when attempts are made to create a new variety to suit different conditions, promising genetic material may be readily located.

The Department's collection of wheat varieties totals approximately 8,500 drawn from every country where wheat is grown. There are about 300 varieties in the corn collection, including a large number grown by North and South American Indians, and modern varieties that have been or may be used in the development of hybrids. The Department has 4,000 varieties of barley, 3,000 of oats, 1,000 of rice, 400 of flax, and between 200 and 300 of sorghums.

The Plant Industry Station at Beltsville, Md., now has an herbarium collection of fungi, mostly those which grow on food plants or other plants of economic importance, that totals nearly 450,000 specimens. Through possession of this extensive museum of fungi it is possible for the Department's mycologists to identify specimens for scientific workers and for other purposes.

The Department also maintains at the Station one of the largest collections in the world of soil bacteria, including hundreds of strains of legume nodule bacteria which are kept in standard cultures for comparison with cultures offe for sale to the public. The different strains of soil bacteria of all kinds are available to scientists anywhere in the world. These collections have bee an important means for cooperation in carrying on scientific work.

Louse Powders for the Armed Forces: For the treatment of man for destruction of lice two formulas of louse powders were developed by E. F. Knipling and his associates in the Bureau of Entomology and Plant Quarantine at Orlando, Fla. Body lice were maintained in a colony, and research subjects were hired for feeding the lice and for conducting a large number of tests with insecticides. Materials showing promise in jar tests were applied to the inside of the sleev and legs of underwear and this portion of the underwear was then taped onto th leg or arm of the research subject. Various stages of lice were introduced in these abbreviated garments where they remained for 24 hours. At the end of this time, the number killed by the treatment was determined. In the case of promising lousicides new lice were added to the garment each day to determine the period of effectiveness.

In this manner an activated pyrethrum powder known as MYL was developed. This powder killed lice for one to two weeks and in most instances a single treatment was sufficient. However, a formula containing DDT gave protection for three weeks and sometimes longer. This material remained in the clothing long enough to kill the young as they hatched from the eggs; therefore it was not necessary to add an ovicide as was done in the MYL treatment. These powders have been adopted by the armed forces and have been the means of controlling typhus epidemics in the present war.

Small-Type Turkey: Since about 1930 there has been a simultaneous increase in the number of turkeys raised and in the average size of turkeys produced. However, there has not been a corresponding increase in the demand for the heavier birds and this has resulted in a price differential of from 1 to 6 cents per pound in favor of smaller market turkeys. This demand on the part of consumers seems to be based on sound considerations and is likely to be permanent. In view of this trend, the Bureau of Animal Industry in 1934 at the Research Center, began an experimental project on the development of a small-type turkey. Marked progress has been made in fixing the desired characteristics in this small-type turkey.

Several standard varieties, the wild turkey, and White Austrian turkeys imported from Scotland have been crossed in the development of this small-type turkey. From the crossbred progeny selections are being made. The chief characteristics desired are as follows: Live wight of young toms at market age, 12 to 17 pounds; corresponding weight of young hens, 7½ to 10 pounds; color, white; a compact body with moderately short legs, moderately long keel bone, and an abundance of meat, especially on the breast and legs; early maturity, resulting in a finished condition (U. S. Prime) with respect to fat, fleshing, and feathering at the age of 24 weeks; reasonably high egg production and high fertility, hatchability, and viability.

Soil Conservation Research: Soil- and water-conserving farming methods are carefully devised to salvage and rebuild that valuable raw material, the soil, for continued profitable use. To do this, a soil-conservation farm plan redesigns the farmer's factory or plant. As in the modernizing of an industrial plant, every change made in the farmer's fields is based on thousands of carefully controlled laboratory tests and closely watched field trials. Today 19 soil and water conservation experiment stations located in farming areas throughout the country are delving into the secrets of soil, rain, wind, and growing crops.

By studying the private life of a raindrop, research men in the Soil Conservation Service have devised a unique rain machine that can be regulated to produce the effect of a typical Great Lakes drizzle or one of the sudden drenching spring downpours of the Southwest on various types of soils and crops. Tilting plots of earth that can be sloped to any accurate degree have helped determine the comparative soil-holding powers of various grasses and other close-growing plants on sloping fields.

Fine-gaged laboratory instruments and ingenious weather-imitating devices are adding, bit by carefully weighed bit, to the store of tested facts making it possible to adapt soil saving farming patterns to the specific needs and capabilities of each acre. These recent achievements exemplify the immediate practical value of SCS's research program.

Sweetpotato Starch: The sweetpotato promises to become an important industrial crop, as the result of the development by the Bureau of Agricultural and Industrial Chemistry of a process for making high quality white starch. A frowers' cooperative of more than 1,000 members at Laurel, Miss., has produced in a single season as much as 3,000,000 pounds of starch. Already the product is being used for sizing and finishing in cotton mills and by the laundry, baking, and confectionery industries. This new enterprise offers farmers an opportunity to add another profitable cash crop to their present farm programs. A large plant is being built this year at Clewiston, Fla., that is based on the results of research by the Bureau.

Lacquer From Cow's Milk: With war limiting supplies of tin available for coating milk cans, dairy scientists are now looking to the cow herself to furnish some of the critical materials needed in transporting and packaging her product. Paul D. Watson, associate chemist of the Bureau of Dairy Industry, has developed a lacquer substitute for the tin coating on cans used for evaporated and condensed milk and on the cans used for shipping fluid milk and cream. Watson's lacquer, on which he has filed applications for 2 public service patents, is made largely from lactic acid, with a small proportion of castor oil or some other vegetable oil.

Lactic acid is obtained by fermenting the milk sugar in whey, which is a by-product of cheese and casein manufacture. Commercial production of lactic acid from whey, as well as from other agricultural sources, is already established. Finding a profitable outlet for all the whey produced at large cheese factories has long been a difficult problem.

Preliminary tests with the new lacquer, both in the Bureau's laboratories and by several manufacturers of coating materials for metals, have given promising results. All the ingredients needed to make the lacquer are readily obtainable, and no unsurmountable difficulties in making or applying the lacquer are apparent, Mr. Watson says.

Although the Bureau's research has been directed mainly toward insuring a supply of suitable containers for milk and other dairy products in spite of the tin shortage, protective lacquers that can be applied directly to iron and steel and other materials would be of value to the whole sheet-metal industry. The Bureau's new lacquer is also suitable for many purposes other than a protective coating. It may be used for impregnating, gluing, and molding various articles.

Forest Management Research: Naval stores research by Forest Service has recently developed methods by which gum naval stores yields can be increased 17 percent or better on commercial operations by applying chemicals to freshly chipped trees. The method results in higher money returns to the operator, ranging roughly between $400 and $700 additional net profit per crop of 10,000 trees, depending on how faithfully proper methods of chemical stimulation are followed. The two methods developed in this search and currently recommended to and tried by the industry are (1) biweekly chipping of the turpentine trees with application of 40 percent sulfuric acid to the fresh streak, and (2) weekly chipping (a normal procedure) followed by application of 25 percent caustic soda solution. With the same labor, the second procedure gives somewhat higher yields, but where labor is scarce the former method is very advantageous.

Gas Treatment Worth Millions to Citrus Growers: Many oranges, though ripe, lack the full yellow color expected of the fruit. This handicap has been overcome by results of research conducted by the Bureau of Agricultural and Industrial Chemistry, beginning in 1923 and lasting about 12 years. By treating a green-colored orange with ethylene gas the green color is bleached out, leaving the orange a beautiful yellow. This treatment, now in general use, cost the taxpayers about $4,000 and is estimated to be worth about $4,000,000 a year to the producers of citrus fruit in Florida alone and about the same amount to producers in California.

Dye Research Worth Millions: The gay fast colors that men and women are wearing today are largely the result of research by chemists of the U. S. Department of Agriculture during and immediately following the first World War. This research developed new technical methods for the production of intermediates, fast and brilliant dyes for cotton. This one piece of research has expanded the cotton market more than a million dollars a year, as well as providing the public with gayly colored clothes that will not fade.

Phenothiazine as an Anthelmintic: Phenothiazine is a synthetic organic chemical, first prepared in the latter part of the nineteenth century. It is one of the thiazine dyes. Following the discovery and announcement that phenothiazine was effective as an insecticide, its value as an anthelmintic was studied and established in 1938-39 by Harwood, Jerstad, and Swanson, workers of the Bureau of Animal Industry. Experimentation with this drug has been continued to develop the best methods of use. Phenothiazine is now widely recognized throughout the world as a highly effective anthelmintic for the removal of many injurious internal parasites of domestic animals. It is the most valuable single drug so far discovered for combating such parasites. The drug is distributed commercially in powder form and may be administered either in gelatin capsules, in ground feed, in salt, or as a drench, the choice depending usually on the species of animals and preferred method of handling them. For use as an anthelmintic, phenothiazine should be the pure product prepared especially for that purpose.

In 1-ounce doses phenothiazine rids sheep and goats of stomach worms, nodular worms, hookworms, and related pests. Its use prevents the spoiling of the sheep's intestines by nodular worms, thus providing us with additional war material for making surgical sutures at a time when they are greatly needed. In suitable doses which vary with the size of animal, phenothiazine is effective in removing several kinds of parasites from swine, cattle, horses, and mules. In very small doses this drug is effective also in removing cecal worms from poultry. These are the worms that transmit blackhead to chickens and turkeys. The extensive use that phenothiazine already has acquired for controlling animal parasites is evident from the quantity--about 3 million pounds--used in the United States in 1943. Very recently a mixture of 9 parts salt and 1 part phenothiazine has been found largely to prevent acquisition of the parasite, when made available to sheep.

New Method for Dehydrating Cheese: A new method for dehydrating natural American Cheddar cheese for lend-lease or other uses, which is more direct than the commercial procedures now in use and which will also release spray-drying equipment for drying other foods, was developed in the Agricultural Research Administration.

Dr. George P. Sanders, of the Bureau of Dairy Industry, who devised the new method, found that if natural full-fat cheese is grated and then partly dried at room temperatures, the fat will be sealed up in the numerous case-hardened particles of curd. The particles can then be dehydrated in a tunnel drier or by any other heated-air method, without loss of fat.

Heretofore, commercial companies have been unable to use direct methods in dehydrating cheese of normal fatcontent, because the heat of dehydration caused the fat to melt and run out. Some processors have overcome this difficulty by first processing the full-fat cheese with heat and water, and usually with a chemical emulsifier, into a milky paste that can be spray-dried. In another commercial process, the fat is removed from the milk used in making the cheese and then added to the dried cheese.

The Bureau's new method is more direct and the resulting product is a natural cheese, minus only the water. Natural Cheddar cheese in its original state usually contains about 36 percent water, but the dehydrated flakes as prepared in the Bureau's laboratories contain about 3 percent water. The dehydrated flakes thus contain all the fat and other solids, but weigh only two-thirds as much as the original cheese.

The flakes can be packaged loose or they can be compressed to the same density as the original cheese, or to two-thirds its volume. The compressed cheese can be easily broken up, and it can be consumed directly or used in almost any other way that cheese is ordinarily used.

If the flakes are compressed into rectangular or block form instead of the round shapes typical of natural Cheddar cheese, considerable additional storage or shipping space can be saved. Compared to the original cheese packed in round boxes, the dehydrated compressed blocks would occupy between 53 and 56 percent as much storage or shipping space.

"Hexes" Cattle Flukes: As a result of the resourceful experimentation of a Bureau of Animal Industry scientist who had formerly been a South Seas island missionary, a successful chemical treatment for liver flukes--long a serious menace to cattle raising in parts of Texas and other western areas--has been devised and is now being used by the cattlemen.

The scientist who perfected the treatment is Dr. O. Wilford Olsen. Flukes are difficult to reach by medication, since they seek out the liver for attack. Scientists had found a drug with the five-syllable name, hexachlorethane, to be effective against these small, flat, leaf-shaped parasites, but it was difficult to administer because of its insolubility in water. Dr. Olsen found that bentonite combined well with hexachlorethane in water to make a smooth emulsion that was easy to give as a drench.

Once interpreter to the king of one of the South Sea islands, Dr. Olsen found little difficulty in translating his scientific lore into language that practical Texas cattlemen found easy to understand. When Texas State prison officials let him try out the remedy on part of the prison herd, the results proved a convincing demonstration of the value of the treatment in liver fluke control. The mounting demand for hexachlorethane that followed this demonstration led to substantial commercial production and distribution of the drug.

Dehydrating Food: Dehydrated vegetables take about one-third the ocean freight space required for similar products processed in other forms. Realizing this tremendous cargo saving opportunity, the former Agricultural Marketing Administration (now absorbed by the Office of Distribution) on May 26, 1942, announce a program to encourage expansion of the domestic industry to meet increased needs of American and United Nations military forces. At that time about 20 plants, with a production capacity of about 15,00,000 pounds, annually, were operating in the United States.

In 1941 chemists and engineers of the Agricultural Research Administration were at work in the Western Regional Research Laboratory on the basic research that made this quick wartime expansion of the industry possible. Immediately after Pearl Harbor, pilot plant, or semicommercial, dehydrators were quickly built and put to dehydrating vegetables. Around 500 million pounds of food were dehydrated in 1943, and much of it was done according to methods worked out in the Western Laboratory.

Investigations on the dehydration of meat got under way at the Beltsville Research Center, about the same time, leading to results having prompt commercial application. The methods worked out for the preparation, processing, and packaging of dehydrated vegetables were offered to the industry in 1942 through

two dehydration schools, one at Rochester, N. Y., for the eastern half of the country and one at Albany, Calif., for the West.

To carry out the program, an interdepartmental committee composed of representatives of the Department of Agriculture, Army, and the War Production Board was set up. Last summer, the WPB, on the recommendation of Secretary Wickard and the Food Requirements Committee, established a bank of critical materials to permit conversion and construction of additional dehydration facilities. An additional bank of materials was provided in the latter months of 1942.

Nerepol: Norepol, the rubber substitute from vegetable oils announced in 1942 by the Department of Agriculture as having been made in the Northern Regional Research Laboratory at Peoria, Ill., is now in commercial production. Two companies making rubber according to the Norepol formula have given the product trade names of their own. Other companies are turning out a finished product under the name of Norepol and some are making an intermediate material sold to manufacturers of rubber articles for the ultimate consumer.

The war has hastened commercial adoption of this infant industry that was in the pilot plant stage a short time ago. The pilot-plant policy of the agricultural Research Administration's Bureau of Agricultural and Industrial Chemistry--adopted with the establishment of the four Regional Research Laboratories for industrial utilization of farm commodities--has been a factor in getting the new product into use as well as speeding work on other rubber intermediates in the Department. The pilot plant serves as an intermediate stage between the laboratory test tube and commercial production. The wholehearted cooperation of industry had much to do with the rapid development of Norepol.

The Department first described Norepol as having a number of the valuable characteristics of natural rubber in considerable degree, including 200 percent stretch, tensile strength of 500 pounds to the square inch, and excellent resistance to oxidation and to the effects of water and alcohol. The general run of natural rubber has a 600 percent stretch and a tensile strength of 3,000 pounds or more. However, for certain purposes Norepol is highly useful.

Since the first public report, and as a result of tests in the Peoria pilot plant and by a number of factories, improvements have been made in the product. In particular, the necessary constituents can now be produced in purer form and there is better control of the polymerization process.

Tests at the Laboratory and in commercial plants show possibilities for many uses for Norepol, including molded and extruded articles--such as rubber heels, tubing, and gasket material. Because of the over-all rubber situation, careful choice must be made among the various possible uses. A point of much interest in the over-all economy of wartime is that what is left of vegetable oils after the separation of material for Norepol, including glycerol, can be used by industries that consume vegetable oils to make some of the same products they have been making from the whole oil.

Apple Sirup: One of the first wartime accomplishments to come out of the Department of Agriculture's Eastern Regional Research Laboratory, at Philadelphia, Pa., was the development of apple sirup, a food product from sound but off-grade apples. It can also be made from apple peels and cores from canning and dehydration plants. It is a delicious table sirup, and especially fine for baking cakes, since its moisture-holding qualities prevent cakes from drying

out rapidly. Apple sirup is also a good substitute for glycerine, now needed in making explosives, and is being used on large scale by one of the large cigarette manufacturers. Five commercial plants in the United States and Canada turned out more than 4 million pounds of apple sirup last year.

Photoperiodism: While working with Maryland Mammoth tobacco prior to 1920, W. W. Garner and H. A. Allard of the then Bureau of Plant Industry (now Bureau of Plant Industry, Soils and Agricultural Engineering) discovered that the plants flower only when the daily period of illumination is relatively short--that is, when the days are short and the nights long. When the light periods are long the plants remain vegetative. Subsequent experiments on many kinds of plants showed clearly that they differ greatly in the growth and flowering responses with respect to the relative lengths of the daily periods of illumination and darkness to which they are exposed, some conforming to the behavior of Mammoth tobacco others responding to relatively long illumination periods, and still others being but little affected.

This discovery departed widely from the prevalent theory that more intensity of illumination was the principal light factor concerned in determining the characteristic growth, flowering, and fruiting of plants. It had great fundamental importance as pure research and, as it developed, widespread practical significance. Response to relative length of day and night largely explains why many plants flower only at certain seasons of the year, and it also largely explains changes in behavior where plants are carried from one latitude to another. It is now possible, by conducting experiments under controlled conditions, to tell in advance whether certain varieties of soybeans, peas, onions, timothy, barley and other plants are adaped to the photoperiodic conditions known to prevail in specific localities. The experimental crops can be grown under greenhouse conditions anyway, with supplemental artificial light as needed; if none is adapted to the locality, one or more suitable lines can be bred.

This discovery has also been particularly helpful in selecting soybean varietie that thrive and produce abundant seed for making oil, plastics, and food products in various localities. It has enabled us to produce our own beet seed domestically instead of importing it as we did formerly. It enables us to select localities where pyrethrum, a long-day plant, will thrive in the United States, and also to cross plant varieties which would not normally flower at the same time, as in the case of sugar cane varieties. By artifically shortening the daily light period chrysanthemums and other flowers are now being brought to market ahead of their normal season. Recently it has been found that a plant is primarily influenced by photoperiodic conditions by way of its leaves. Thus a Biloxi soybean will bloom promptly if only a few of its leaves are subjected to a short photoperiod. It is all but impossible to calculate the flow of economic value from an original discovery so basic as that of Garner and Allard.

Forest Products Research: Under the sponsorship of the War Production Board the Forest Products Laboratory of the Forest Service undertook a pilot-plant study to develop methods for laminating ship timbers. The study has reached a stage where it is possible to produce acceptable glued white oak timbers under properly controlled conditions. Laminated timbers permit the use of lumber and reduce the demand for large timbers which have been difficult to obtain.

Basic Facts About Vitamin A: Basic contribution to knowledge of vitamin A have been made in the foods and nutrition laboratories of the Bureau of Human Nutrition and Home Economics.

To find out the vitamin A requirements of human beings, a few years ago research workers in the laboratories fed an experimental diet to a group of men and women volunteers. Day after day the group ate only meals prepared in the laboratory kitchen. This group received every nutrient that the human body is known to need except vitamin A, which was almost completely absent from the meals. Since one of the early measurable effects of vitamin A lack is night-blindness, that is, failure of the eyes to adapt normally to dim light, the appearance of this condition in the subjects was taken as a sign that the body had used up most of its stored vitamin A. As soon as a volunteer showed unmistakable evidence of nightblindness, he was given measured amounts of vitamin A, first in small and then in gradually increased doses until the vitamin A received was just sufficient to keep his vision in dim light normal.

Fish-liver oil, cheese, milk, cream, and eggs are the most common animal foods containing significant amounts of vitamin A. However, green leafy and some yellow vegetables and fruits contain certain orange pigments known as carotenes, which are changed into vitamin A in the body. In the first experiments solutions of standardized cod-liver oil and pure carotene were given to supply the "measured amounts" of vitamin A. Later the minimum vitamin A requirements were measured in terms of natural foods, using peas, spinach, and carrots as sources of vitamin A. It was found that in terms of International Units the body needed about 30 to 60 percent more carotene as found in vegetable foods than it did of vitamin A found in animal foods.

This information has special timeliness for the war period, since restricted food supplies cause civilians to lean more heavily upon plant foods for their vitamin A supply. From these vitamin A experiments have come data for estimating the daily minimum vitamin A requirements of the average, normal adult. The findings became part of the informational background used when the Committee on Food and Nutrition of the National Research Council set forth recommended daily allowances of vitamins and other nutrients as a nutrition yardstick for America.

In the first experiments, some subjects showed signs of vitamin A deficiency after two weeks of the vitamin A free diet, whereas others--probably better fortified by a reserve supply of the vitamin--showed no sign of lack for several months. To learn more about the body's ability to store this vitamin and the rate at which it is depleted, laboratory animals were used. The results showed that moderate amounts of vitamin A obtained regularly in meals are used more economically than occasional massive amounts.

This suggests the importance of building up a "vitamin A savings bank" by regularly eating somewhat more than the daily requirement of foods containing vitamin A, when possible. To serve as an aid in determining the vitamin A value of the normal diet, analyses of vitamin A value of 128 common foods in the raw and cooked state have been made and published in these laboratories.

The Bureau's vitamin A researches have progressed over a number of years. This work was started under the supervision of Dr. Lela Booher, more recently under the supervision of Dr. Elsa Orent-Keiles, while various scientists have held responsible posts in carrying out the work. Mrs. Elizabeth Callison had direct leadership of studies to determine human vitamin A requirements.

Aerosol: The project looking to the development of a fine-fog method of dividing and spreading insecticides was started in April 1941 by the Bureau of Entomology and Plant Quarantine and its results were put into practical use early in 1943. The new aerosol development was primarily the result of an idea originated by Dr. Lyle D. Goodhue and developed by him and W. N. Sullivan. The discovery includes principally an insecticide material with an activator that makes the mixture work better, dissolved in a highly volatile, noninflammable and nontoxic solvent which propels and atomizes the insecticide into a fog, all in a container which keeps the mixture under high pressure ready for instant release. The new aerosol got into use just in time to be of great value in the war. The entire output consisting of millions of containers has been requisitioned by the military authorities and is in use on the various fighting fronts to protect our men from irritations and dangers of mosquitoes, flies, and other insects. When this method of fighting insects can be made available for general use, its value will be incalculable. In other words, the principle of this method of control may be so important as to revolutionize many of the curren practices for the control of serious pests.

Increasing Yield of Penicillin: The observations which led to the discovery of penicillin were made in 1929 by Alexander Fleming, a British scientist. He was annoyed to find one day that some stray mold spores were growing in a culture of germs he was studying. A germ-free zone around this stray mold indicated to him that it was giving off a substance that was killing the germs in his culture. This substance turned out to be penicillin. It was named for the mold which produces it.

But very little was heard of this discovery until the summer of 1941. At that time Dr. Florey and Dr. Heatley, two British scientists who were largely responsible for the application of Fleming's observations, came to this country to stimulate interest in the pilot-plant production of the new product. After conferences with members of the National Research Council and scientists of the Department of Agriculture, the men were sent to our Northern Regional Research Laboratory located at Peoria, Ill., and operated by the Bureau of Agricultural and Industrial Chemistry. This laboratory was selected because it had had wide experience in the use of molds in the fermentation field and because it had one of the largest collections of molds in the world.

Dr. Heatley stayed at the laboratory and went to work in cooperation with our fermentation experts to try to increase the yield of penicillin. The yield was so small at that time that it amounted to a bottleneck. They also developed methods for purifying penicillin. These studies were supported by the Committee on Medical Research in the Office of Scientific Research and Development. The studies are still going on and have been of great value to those who are now working to perfect the commercial production of penicillin.

By proper feeding of the molds and by improving the strains of molds that produce penicillin, the laboratory workers were able to increase the yield one hundredfold. The work at our laboratory, as well as that in industrial laboratories, was so promising that Dr. A. N. Richards, Chairman of the Committee on Medical Research, called a meeting of representatives of commercial manufacturers of pharmaceutical supplies in December of 1941 and made available to them the results of the work at the Northern Laboratory which had been so successful. Largely as a result of that conference, a number of industrial firms started the production of penicillin on a semi-commercial scale.

Penicillin is now being produced on a commercial scale by 21 plants in the United States and Canada. By the end of this year these plants will be turning out penicillin at the rate of 200 billion units a month. That's enough to treat 250,000 serious cases of infection. Scientists of the Department of Agriculture have played an important part in the development of this drug. They increased the yield of penicillin more than 100 times. They developed the particular strains of mold which are used to make all of the penicillin now being produced. Their investigations made it possible for industrial firms to start commercial production at once. As a result of these accomplishments penicillin has been made available to our armed forces much sooner than would otherwise have been possible.

This is the sort of problem our four Regional Research Laboratories are prepared to solve. Their pilot-plant facilities enable them to take research beyond the test-tube stage and into semi-commercial production. Penicillin, promising as it is today, was not produced in sufficient quantities to make it of any great importance until research in the Peoria Laboratory found a way to increase the yield so that it was possible for industry to go ahead on a semi-commercial scale.

Tannin-Producing Sumac: Imported Sicilian sumac has provided this country with much of the tannin used for tanning fine, pliable leathers. When imports were cut off by war, hillculture scientists of the Soil Conservation Service renewed their efforts to develop practical ways of selecting, growing, and harvesting erosion-controlling sumac for tannin.

The principal drawback to profitable tannin production in this country has been the great amount of hand labor required to harvest the sumac. In cooperation with the Iowa Experiment Station, SCS has developed mechanical harvesting, drying, and baling processes that permitted the production of about 26 tons of sumac leaves from one small area for commercial tanneries last year. This may forecast a profitable new farm crop that can be grown on steep slopes and eroded land.

At the Floris, Iowa, Hillculture Farm, operated cooperatively by SCS and the Iowa State Experiment Station, the Service has helped in the contour planting of white sumac seedlings, selected for their tannin-producing qualities. High-yielding strains of both white and black sumac common to the Eastern States are being selected for further experimental planting, now that mechanical harvesting and processing methods have been devised.

At the Floris Station, scientists assembled a sumac harvester from a caterpillar-type tractor and parts of a combine. This machine gathered only the leafy tops of the plant which were then windrowed for sun-drying. Mineblower and air tunnel

were enlisted to complete the drying of the harvested tops and a thresher separated tannin-containing leaves from stems and woody portions. A hay baler packed the leaves in 75 pound bales. As a result of this pioneer harvesting effort, farmer programs are now under way to collect and dry a substantial amount of tannin-producing sumac leaf during the current season.

Disease Resistance in Crops: One of the greatest improvements brought about in crops by plant breeders has been the disease resistance, which, along with such characteristics as heavy yielding capacity and adaptability to various climatic conditions, has enabled farmers to produce much more on the same acreage, with the same quantity of fertilizer, and with less labor per unit. Notable among the crops which have been reinforced by disease-resistant characteristic are wheat, oats, potatoes, sugarcane, and sugar beets, but practically all crops, large and small, have been improved to some extent in this direction.

Each year sees the announcement of several new varieties of various kinds of crops, a large number of them owing much of their promise to disease resistance. In 1943 the Department of Agriculture issued 35 such announcements covering cereals, forage plants, vegetables, tree and small fruits. Some plant breeding accomplishments in disease resistance have become classics, such, for instance, as the saving of the sugarcane industry in Louisiana through the development of varieties resistant to mosaic disease. The work which resulted in the development of sugar beets resistant to curly top comes near being in the same class, as does also the cooperative potato breeding program and the cooperative work on breeding disease resistant and high yielding cereals.

Research Helps Naval Stores Producers: Producers of gum naval stores are now getting over a million dollars a year more than they did a few years ago before chemists of the Department of Agriculture took the naval stores problem to the laboratory. Research in this field has given the industry a permanent set of standards for grading rosin, estimated to be worth $150,000 a year to pine tree farmers; developed better barrel gluing and an improved dehydrator for turpentine estimated to save the industry $250,000 a year; developed improved still settings worth $200,000 a year; a method for improving quality of pine gum, valued at $150,000 a year; developed methods for controlling turpentine distillation, worth $100,000 a year; introduced improved turpentine storage conditions valued at $100,000 a year; developed a new type steam turpentine still which, when used in conjunction with gum cleaning, is worth $2,500 a year to each user; advised producers how to prevent rosin losses in chips, resulting in savings of $200,000 a year; and proved that gum contaminated with iron rust from rusty equipment can lower the quality of rosin as much as 3 or 4 grades, reducing the income of producers of gum naval stores around half a million dollars a year.

New Poisioned Bait for Mormon Cricket: This bait, consisting of a sodium fluesilicate, mill-run bran, and sawdust mixture, is a development of the Bureau of Entomology and Plant Quarantine laboratory at Bozeman, Mont., and represents the combined work of a number of individuals under the leadership of John R. Parker. It was first given wide-spread use in 1939, and has resulted in savings of hundreds of thousands of dollars in control work during the past three seasons by reducing the costs of materials furnished by the Government and of labor in their application. Savings as a result of cooperative control efforts where this material has been used total in excess of $50 million in the last three years.

Speeding up Calcium Gluconate Production: Following up research which resulted in a practical method of using molds to ferment glucose into gluconic acid, which combined with lime as calcium gluconate, widely used in medicine., chemists have further improved the process by making it semi-continuous. They have discovered that addition of a small quantity of boron compound promotes the biochemical process. Use of the boron, together with improved equipment and better molds as fermentation agents, makes it possible to produce calcium gluconate in about half the time formerly required.

Chemists of the Bureau of Agricultural and Industrial Chemistry, who began the research 12 years ago, found that the action of certain molds on a solution of glucose, or corn sugar, produces gluconic acid. This acid is important in the manufacture of calcium gluconate, a calcium or lime compound that can be assimilated by animals. Molds are microscopic plants and--like other plants--need air to grow. At first the molds were grown on the surface of shallow pans, but these were not adapted to large-scale use in manufacturing plants.

The chemists continued the experiments, and, in 1935, the Department of Agriculture announced the invention of a retating drum in which the glucose solution is fermented. The air which is necessary to the growth of the molds is forced into the drum at one end under pressure and is removed through the other end. After studying many molds to find out which ones are best for making gluconic acid for calcium gluconate, Department chemists reported that the best found so far is a mold known technically as Aspergillus niger (strain 3). This particular mold does a good job at fermenting the glucose.

Though the rotating-drum method reduced the cost of making calcium gluconate from $1.50 to 50 cents a pound, the chemists encountered one difficulty with the process. When the molds were exposed to an increasing concentration of gluconic acid which was formed in the glucose solution, they stopped working. Calcium carbonate, or common chalk, was added to neutralize the effect of the acid, but the calcium gluconate produced was not very soluble and separated out, clogging up the drum. Then three chemists of the Bureau, A. J. Moyer, E. J. Umberger, and J. J. Stubbs, who had been studying fermentation processes, discovered that the addition of a little borax or boric acid to the fermenting liquor keeps the calcium gluconate in solution and lets the molds finish their work. Later, the calcium gluconate may be separated from the solution free from boron.

Improving Sagebrush Range Lands: On much of the 96 million acres of sagebrush range land in the West, range owners and operators have been faced with two very serious problems growing out of the prevalence of this very low-value shrub. On the one hand, sagebrush crowds out the vigorous growth of more valuable forage plants, makes herding difficult, contributes to the straying and loss of sheep, brushes considerable amounts of wool from sheep fleeces, and otherwise hinders effective livestock grazing. On the other hand, when the range has been burned in an effort to eliminate the brush and the necessary precautions have not been observed, a great reduction of valuable forage and loss of soil has usually resulted, to say nothing of occasional serious damage caused when the brush fires got out of hand and raged through other range areas or destroyed buildings and other private property.

A study completed in 1942 by the Forest Service has proved that heavy stands of sagebrush can be eliminated by burning with only negligible losses, and that when such burning is properly planned and executed and includes intelligent management of the range for a season or two after burning, grazing capacity will be greatly increased--60 to 300 percent increases have been recorded. Where planned burning is carried out, grazing animals are unrestricted in their movements, ewes produce a more steady flow of milk, and lambs make better growth and are seldom lost. These and other benefits fully justify the investigations necessary to develop these safe methods.

Preserving Chicken Feathers: Wet chicken feathers may be preserved for several weeks by a simple treatment, with salt and hydrochloric acid, developed by research workers of the Bureau of Animal Industry. Fifteen pounds of common salt and a pint of commercial concentrated hydrochloric acid are dissolved in 30 gallons of water, for each 15 pounds of wet feathers to be preserved. A tight 50-gallon wooden barrel makes a convenient container. Wet feathers are a by-product of chicken dressing plants, but normally they decompose too rapidly to permit their shipment to feather-processing establishments. The preservative makes possible the industrial use of millions of pounds of chicken feathers that formerly were wasted or used as fertilizer. The new treatment is cheaper and more efficient than chemicals previously tried.

The method is essentially one of pickling. The solution costs initially only about $1\frac{1}{4}$ cents per pound of wet feathers treated. The expense is further reduced by the fact that several lots of feathers can be preserved in the same solution.

Smear 62 for Screwworms: This smear was developed by the Bureau of Entomology and Plant Quarantine at its laboratory at Menard, Tex., as a combined effort of the laboratory, largely the work of Roy Melvin. Its first practical test on a large scale was made in the summer of 1941. It is now widely used throughout the area where the screwworm occurs, and has probably been largely responsible for holding to a minimum an excessive and widespread outbreak during 1944, with resulting savings of millions of dollars worth of cattle.

Hybrid Onion: The first hybrid onion variety was released to growers by the Department of Agriculture in 1944 as a result of experiments started about ten years earlier. Producing hybrid onion seed on a commercial scale had seemed almost an impossibility because of the nearness of the male and female parts until plant breeders discovered a male sterile onion, which made possible hybridization with male fertile strains on a field scale. As a result of this discovery, scientists of the Bureau of Plant Industry, Soils, and Agricultural Engineering and the University of California developed the first commercial onion hybrid, California Hybrid Red No. 1, which is adapted to growing in central California, southern Utah, and southern Nevada. This new early variety has yielded at rates ranging from 460 to 768 100-pound bags per acre and is said to yield generally 50 percent more per acre than the usual early varieties for those areas.

The discovery of the strain of onion without fertile pollen has led to the production, through breeding, of other male sterile lines that promise to be useful in producing hybrid seed from combinations with other varieties. (A male sterile strain may be carried on by planting "head sets" and in other ways known to plant breeders.) As a result of the possibilities in male sterile strains the field is now open for the development of hybrid strains of various varieties for different regions, reasons, and conditions.

Targhee and Columbia Sheep: The development of the Columbia and Targhee breeds of sheep is not strictly basic research but has resulted rather from utilization of basic knowledge of genetics. The development of the two breeds represents a skillful application of genetic laws and principles by scientists of the Bureau of Animal Industry.

Major credit for the development of Columbia sheep belongs jointly to E. L. Shaw, F. R. Marshall, and D. A. Spencer. Credit for the Targhee belongs to A. D. Spencer and A. A. Denecke. In both cases several others, mostly geneticists and station directors, were involved.

The development of these breeds has exceptional regional importance from a production standpoint, since they are primarily adapted to the inter-mountain ranges of the West. But the breeds also have national significance from a commercial and a monetary standpoint because of the excellent quality of their fleece and meat. The earning power of Columbia sheep is estimated to be $1 to $2 a head greater than average well-bred range sheep. That of the Targhee breed is somewhat less.

The Columbia is the result of cross breeding select Lincoln rams with Rambouillet ewes and proceeding from this original crossbred by mating the most select first-cross rams with carefully selected first-cross ewes and interbreeding the rams and ewes descending from them. The foundation of the Targhee breed was laid by mating select Rambouillet rams with select ewes of Corriedale X Lincoln-Rambouillet, and Lincoln X Rambouillet combinations, and interbreeding the rams and ewes descending from these matings. The Targhee came from rigid selections of these matings.

Range Reseeding: Recent studies by the Forest Service at several western forest and range experiment stations have pointed the way to successful seeding of valuable forage plants on several million acres of depleted range lands. Increases in forage production of from 2 to over 10 times, enough to far more than justify the cost, result from reseeding in accordance with the principles so far developed. Ranges producing considerably less than their soil and climate can support are most promising for planting. Many valuable forage species are available for planting throughout the West; although comparatively few have so far been found suited to the driest and more severe sites. As a result of many tests, effective and economical methods of planting have been developed for most types of ranges. These provide for covering the seed, an essential consideration, and where necessary, preparing the soil and reducing the stand of low-value competing vegetation.

Scientific Sizing: Major savings to the clothing industry and to consumers alike are beginning to result from the Bureau of Human Nutrition and Home Economics's work on measuring women and children as a basis for sizing clothing. Lack of scientific data on the body measurements needed in sizing garments is at the root of the chaotic condition which has always existed in the sizing of clothing--particularly for women and children. Department stores complained of a $10,000,000 headache each year from returns and exchanges because of wrong size. Mothers complained of wasting time, money, and energy buying clothes that failed to fit children at home--age of a child was no dependable guide to clothes sizes.

Gaining cooperation of 20 college and universities, and with funds furnished by the Works Progress Administration, scientific workers in the clothing laboratories, under direction of Miss Ruth O'Brien, weighed and measured nearly 150,000 boys and girls. Thirty-six clothing construction measurements were taken on these boys and girls, who ranged from 4 to 17 years of age and represented 16 States.

From data obtained, the Bureau recommended a two-way method of sizing children's clothes based on height and girth at hip. The height-hip system is very similar to the system by which men have bought their shirts and other garments for years according to a few guide dimensions. The Bureau's scientists continued by measuring 15,000 women from 18 years old to 80. Fifty-eight measurements used in constructing patterns and garments were recorded, and weight was taken as a further check on bodily proportions. Universities and other institutions in representative sections of the country cooperated.

From the data, the Bureau recommended height and weight combined, rather than the customary bust measure, for predicting fit of full-length garments. For garments for the upper part of the body, height and bust combined offer the best guides to a fit. For lower trunk garments, height and hip girths are good guides. No single measurement is adequate as a basis for sizing garments and patterns, the survey conclusively showed.

As a result of these measurement studies, some pattern companies and clothing manufacturers are now making use of the new sizing system for children's garments On the basis of the Bureau's work, new standards for body sizes for boys' garment have been adopted by the American Standards Association, which serves as a link between scientists and the trade. While awaiting developments in the women's wear field, one large mail-order house has already gone ahead to use the Bureau's data and the recommended sizing methods for sizing its women's garments.

Inexpensive, Effective Dip for Sheep Ticks: Derris powder or cube powder having a 5 percent rotenone content, added to water at the rate of 6 ounces of the powder to 100 gallons, makes an effective dip for eradicating sheep ticks, or keds, from farm and range flocks. The value of this inexpensive dip was determined by tests conducted by N. G. Cobbett and C. E. Smith, parasitologists of the Bureau of Animal Industry. In Colorado, Smith dipped over 1,000 sheep, representing 5 farm flocks. In New Mexico Cobbett dipped nearly 9,000 range sheep. The dip stayed in the fleeces of the sheep long enough to destroy the young ticks that emerged from the pupal cases remaining in the wool after dipping. This treatment has superior efficacy in killing ticks following a single dipping, and is, moreover, cheaper than the previously recommended commercial dips.

Stratified Flow: By caging a miniature river and reservoir in glass, the Soil Conservation Service, in cooperation with the California Institute of Technology, has discovered that a muddy stream can be shuttled through and out of a reservoir merely by its own action, without the use of conduit or by-pass. Because silt, the stream-borne mud or soil that piles up behind dams to choke reservoirs and destroy irreplaceable reservoir sites, is a constant serious threat to power production, community water supplies, and irrigation, this discovery promises to save millions of dollars annually.

Research of the Service's sedimentation specialists has established the fact that a stream retains its identity after entering a reservoir, continuing to flow in a layer through under or over the still water. Its action depends on temperature and the amount of sediment or silt it contains. A silt-laden current slides under the clear water of a reservoir as heavy cream poured into coffee slides under the clear hot liquid. After trapping these flows or density currents in glass, watching and recording their action, research workers predict that engineers will eventually be able to use these layered flows of water into and through reservoirs as accurately as an accountant can use the keys of an adding machine, channeling a clear stream of snow water through a reservoir to the city's mains, a muddy stream through the same basin to a drain that feeds sandy

irrigation canals where the silt or mud will seal leaks in the sandy ditches, storing a salty stream in a known layer or strata until it can be drained off to return to the sea.

Brighton Dam and Reservoir, completed by the Washington Suburban Sanitary Commission to increase the water supply for suburban communities of Washington, D. C., is the first to make use of the principle of stratified flow in the special design of its outlets. Besides furnishing a "test case" for the effective use of density currents to preserve reservoir capacity, the new structure will contribute additional data, with special equipment installed to allow periodic measurements of the underflows as they come down to the dam. Engineers are making immediate use of the new understanding of density currents to preserve the capacity of reservoirs already built, drawing off known silted streams through low outlets originally designed for emergency draining or other purposes.

Weather-Yield Relationships: The importance of weather factors in relation to crop yields and the farmer's ultimate prosperity has long been recognized by everyone. But attempts to express these relationships in terms of mathematical formulas have been difficult because the final yield of a crop depends not only on a large number of such factors but also upon the particular combinations in which they occur.

Through a study of the joint effects of temperature and precipitation on crops in Indiana, Iowa, and Ohio, Walter A. Hendricks and John C. Schoel, agricultural statisticians of the Bureau of Agricultural Economics, have developed equations for measuring these joint relationships, making it possible to determine more accurately the outcome of the crop. Knowledge of how critical weather factors influence the growth and development of crops is very important in developing new varieties, improving cultural practices, and forecasting production.

In making the analysis, the best available estimates of average corn yields in the three States for the years 1890-1939 inclusive, published by BAE, were used together with temperature and precipitation data made available by the Weather Bureau, Department of Commerce. Such data are sufficiently extensive so that an equation containing a large number of constants may be fitted with some degree of confidence in the outcome.

The fundamental concepts of a regression equation developed by earlier investigators were retained in this tudy. The theory was merely extended to include joint relationships of the two weather factos used in the analysis.

The effect of temperature and precipitation during June, July, and August was investigated. Since such effects are not constant through the growing season, analysis of the data was designed to measure these effects separately for each of the months and for each week during the period. The analysis disclosed that high temperatures have a beneficial effect on final yield when sufficient moisture is available and a detrimental effect on yield when the moisture supply is deficient. The beneficial effects of high temperature increase as the available moisture supply is increased and vice versa. The effects of precipitation are influenced by the temperature. The beneficial effects of above-average precipitation and the detrimental effects of below-average precipitation increase as the temperature is increased. The effects of temperature and precipitation on corn yields in Ohio and Indiana are greatest at about midpoint of the growing season. In Iowa, the effects of temperature and precipitation appear to be greatest early in the growing season.

The success of this analysis leads investigators to believe that there is no reason why other weather factors could not be included in such analyses, in addition to temperature and precipitation. Each weather factor that is included would increase the number of constants to be evaluated from the data, but there are a few additional factors that might be included to good advantage. Relative humidity, evaporation rate, and infiltration have been suggested.

Research Saves Soybean Growers Money: Soybean growers in the Middle West during past processing seasons suffered considerable loss through dockage at the elevators because of the presence of a high percentage of green beans. They are now assured of relief from such dockage, which has been running from 5 to 30 cents a bushel, as a result of studies made by chemists of the Department of Agriculture. They found that the retention of the green color is apparently the result of hot, dry weather in late summer, but that the green beans are of normal composition. They also determined that the green color that went on into the oil when the beans were crushed could be removed simply by increasing the usual amount of bleach. These findings brought about a liberalization of the dockage, resulting, according to estimates, in a saving of $1,000,000 to soybean growers in Illinois alone.

Plant Growth Regulators: In 1939 F. E. Gardner, P. C. Marth, and L. P. Batjer, of the then Bureau of Plant Industry, (now the Bureau of Plant Industry, Soils, and Agricultural Engineering), tested the effectiveness of a number of different growth-regulating substances in preventing preharvest drop of 19 leading commercial apple varieties. Two compounds, naphthaleneacetic acid and naphthalene acetamide were outstanding and about equal in effectiveness in preventing fruit drop. The sodium, potassium, and ammonium salts of naphthaleneacetic acid were also found to be very effective. Soon after publication of the results several proprietary spray compounds containing either naphthaleneacetic acid or naphthalene acetamide as the active ingredient were placed on the market. In general, commercial orchardists have found these sprays of considerable insurance against fruit loss from preharvest drop over a period of several years.

These research workers, delving deeper into the secrets of plant growth regulation have unearthed many other new facts which may some day be of practical application. Dr. Marth has demonstrated the feasibility of controlling the time of emergence from dormancy of certain nursery stocks by suitable application of plant harmones. By such treatments the storage period may be prolonged to permit later planting of more vigorous material and to retain more of the original vigor in the planting material. Gardner and Marth corroborated the results of another scientist in the artificial production of seedless fruits, of holly, grapes, and strawberries through the use of these growth-regulating substances.

Forest Grazing in Southeast Cattle Production: In the Coastal Plain of Georgia and North Carolina cattle are usually truned loose in the woods each year to make the best use they could of the understory of grass and other low vegetation to be found there. With the growing need for meat for the Army bases and war plants established in the Southeast, interest in making better use of native forage has developed. Research by our Appalachian Forest and Range Experiment Station (in cooperation with the Bureau of Animal Industry, Bureau of Plant Industry, Soils, and Agricultural Engineering and the State experiment stations) has shown during the past years that the native forage of the Coastal Plain provides a cheap and valuable source of feed on which an efficient and profitable livestock operation can be based. This native forage must be supplemented during the fall and winter, however, when the forage is deficient in protein and minerals.

Potato Machinery Revised for Contouring: In the potato-growing area of Aroostock County, Maine, as in many other parts of the United States, productive topsoil is no more than a thin mantle over virtually solid bedrock. An entire agricultural industry for the county is thus dependent on retaining and building up this vital layer of soil.

Contouring and terracing across the slope, urgently needed soil-conserving practices, have now been made practical for the rocky, hilly country through deft revisions readily adaptable to standard potato machinery. This achievement in machinery design, worked out by J. W. Slosser of the Soil Conservation Service has an immediate value in the far northern county where a short growing season puts a premium on efficient, rapid operation of the potato planter, sprayer, and digger. Contouring alone has been shown to increase potato yields by 30 bushels an acre, an increase that would more than repay the cost of the research in one season. At the Presque Isle, Maine, Experiment Station and on a nearby research farm the potato planter, spray rig, and digger were put through their paces on the contour.

The planting operation is the most important single process in potato culture and one of the most difficult. The heavy planter, as originally made, would slip sidewise on the curving slope-crossing rows of contoured fields, and seeding and fertilizer parts were too far apart to track, one behind the other, accurately around a curve. By reversing fertilizer boxes, reducing the leng length of the machine (incidentally saving some 80 pounds of metal), soil conservation technicians made the planter into a compact unit that rounds the curves of contour rows, accurately placing seed pieces in spaced drills and distributing fertilizer in the same rows. Fertilizer openers and seed shoes, redesigned to allow for full floating action, reduce field breakage from stones. There is no side slippage on slopes up to 18 percent.

Originally the potato sprayer, operated by two men, was drawn behind a tractor. Distance of spray mechanism from the front wheels caused damage to the vines as the sprayer failed to follow accurately in the path of the tractor on the curve. Mounting the spray rig on the front of the tractor makes the operation a one-man task, and simple guards on the wheels protect the vines.

The digger, necessarily wide, would tumble potatoes, dirt, and debris to the lower side of the tilted bed when operated across slope, damaging or losing much of the crop. By making the side wheel adjustable to the slope, Technician Slosser has made it possible to keep the revolving "conveyor belt" or bed of the digger accurately level, properly separating potatoes from vines and soil. These inexpensive revisions, worked out through careful field trials and machine shop designing, are readily applied to standard equipment, economically and efficiently retooling potato farming for soil and water conservation.

Hybrid Corn: Hybrid corn, a product of scientific research, reached the stage of most vigorous commercial development at the time World War II had raised food demands to the highest point in history. It is an outstanding example, perhaps the most outstanding example, of the influence of theoretical scientific research in revolutionizing the production practices of an agricultural crop.

Since the method of hybridizing corn was first suggested by G. H. Shull in 1909, the present perfection of commercial hybrids has been developed through combined and cooperative efforts of many breeders, both in the Agricultural Research Administration of the Department of Agriculture and in State experiment stations. The Department has been working on the problem since 1916, and the present leading hybrid, U. S. 13, was developed by the two groups of plant breeders.

Although the first hybrid seed involving inbred lines was produced in 1921 in Connecticut, the industry did not really get started until nearly 15 years later In 1943 nearly 52 percent of the country's corn acreage was planted to hybrid varieties, and almost the entire acreage in some of the leading corn States. Since well-adapted hybrids increase the yield about 20 percent, it is estimated that the 1943 production as a result of their use was 669,000,000 bushels more than it otherwise would have been. This gain is equivalent to 7,360,000,000 pounds of pork, or 54 pounds for each man, woman, and child in the United States

Forest Economics: Several years work by the Forest Service Division of Forest Economics on the complex problem of Federal contributions in lieu of taxes on national forest lands culminated in the issuance of the Federal Real Estate Board's report, Federal Contributions to States and Local Governmental Units with Respect to Federally Owned Real Estate (1943: H. D. 216). The recommendations of the Board were based on and are wholly consistent with the contribution plan developed by the Service but generalized for application to the several types of federally owned conservation lands. The release of the Board's report constitutes a major landmark on the road to a permanent solution to the thorny contributions problem.

The investigations in process on the experimental forest at Crossett, Ark., have been aimed at the basic financial problem of forestry--i.e., how to harvest more and better forest products, yet keep the forest lands in condition to meet future needs. The completion of the first comprehensive report on the results of these studies (entitled "Financial Aspects of Selective Cutting in the Management of Second-Growth Pine-Hardwood Forests West of the Mississippi River") is a landmark in this phase of forest research. The economic practicality of partial short-interval cutting in the shortleaf-loblolly type of southern pine forest has been demonstrated conclusively. It has been shown that good forestry is good business. This is precisely what has been needed to accelerate the adoption of sound management practices on private forest lands, and the wholesome results of this impetus are already in evidence throughout the South.

The Otsego Forest Products Cooperative Association, Inc., at Cooperstown, N. Y., has been sponsored by the Service as a pilot plant for the development of cooperatives in the farm forest field. After a slow and difficult organization stage, this Association has now attained a stable level of continuous operation. It is by far the largest cooperative now functioning in the farm forestry field; with 934 members and thoroughly modern processing plant equipped with bandssaw. Local community interest in and support of the project has grown steadily. In the face of current operating difficulties and the pressure of other types of farm enterprise, plant operations have been adapted to wartime exigencies, and almost 2 million board feet high-quality lumber were turned out during the past year, most of which channeled directly to war uses. Management practices on far woodlands throughout the area have been improved markedly, and the financial returns from the sale of forest products by Association members have been steppe up appreciably.

Milk Constituents: Over the years Department of Agriculture scientists have performed notable work on butterfat, casein, and other milk constituents. Work done early this century showed that it was unwise to use high-acid cream in making butter, and thus revolutionized butter making the world over. Butter made from pasteurized, nonacid cream was found to have exceptional keeping qualities. More recently George E. Holm, George R. Greenbank, and others in the Bureau of Dairy Industry have given close study to the oxidation of fats, and the relationship between such oxidation and changes in the flavor of butter and whole-milk powder. These investigations, initially in the field of pure research, resulted in many very practical applications to a wide variety of fats and oils. In April 1942 Holm received the Borden Award for his work which had led to a far better understanding than ever before of why fats and oils spoil and of methods of preventing spoilage. As a result of these investigations improved methods of handling and preserving whole-milk powder were ready when war made them urgent.

Holm's work on proteins and other milk constituents has also been outstanding. He perfected a method of preparing pure butteroil and so packaging it that it would keep almost indefinitely under extreme climatic conditions. He discovered long ago that fats do not spoil unless a certain amount of oxygen is present to combine with them. Studies of casein have made possible the large-scale production of a very pure product. Both grading and manufacturing processes have been improved. Department scientists have also discovered how dairymen may avoid the development of undesirable odors in milk caused by feed flavors. Millions of gallons of milk are rejected from the fluid-milk market annually because of bad flavor or odor, so caused. If all dairymen observed the recommended feeding practices it is quite probable that $15 or $20 million a year would be added to their incomes.

Palm Oil Substitute: Imported palm oil was used before the war not only for making shortening, oleomargain, and soap, but also in the manufacture of tin plate and terne plate. More recently it had come into use in the cold-reduction process for sheet steel. When our imports of palm oil were largely shut off by Japanese conquests, substitutes had to be considered. The literature was rather conflicting, the cooperation of manufacurers and consumers was sought and, as it proved, the exact properties which made palm oil so suitable were unknown. Dr. K. S. Markley and associates of the Bureau of Agricultural and Industrial Chemistry's Southern Regional Research Laboratory, set to work. They first considered a hydrogenated cottonseed oil because that had been tried as as a substitute for palm oil in World War I. Ordinary cottonseed oil was known to be unsuitable and the more highly hydrogenated oils also proved unsatisfactory. Finally a semi- or medium-hard hydrogenated cottonseed oil was found to approximate palm oil in properties. Upon test it proved extremely satisfactory. This tailor-made oil costs about twice as much as palm oil, but lasts three times as long.

Forest Products Research: Experimental work on wood and paperboard container problems has been carried on at the Forest Products Laboratory of the Forest Service for many years, but has been expanded manyfold since the job of solving the packaging, loading, and shipping problems for all ordnance equipment and supplies was assigned to the Laboratory in 1942 by the Army Ordnance Department. Not only have hundreds of items, including antiaircraft guns, armored trailers and cars, ammunition, mobile shop trucks, rifles, and "bazookas," been protected

against damage or loss by redesigned or newly designed containers, but great economies in shipping space have been worked out, so that considerably fewer ships are required when shipping space is a vital consideration in shipment of supplies for support of our troops in different parts of the world, as well as in Lend Lease shipments. Detailed procedures of cleaning, rust-proofing, and wrapping many artillery items were worked out and many commercial greaseproof and waterproof papers were tested to determine their suitability for wrapping Ordnance equipment for overseas. Assistance is also given the Army Air Force and the War Food Administration in solving packaging and shipping problems.

Production of wood sugar from wood waste and low-quality timber has been greatly advanced by recent pilot-plant investigation by the Laboratory at the request of the War Production Board. This important contribution to the war effort is a development and application of the German Scholler process. The results were highly satisfactory in production of wood sugar, from which ethyl alcohol or high protein livestock feed can be produced. Plans are about completed for the erection in this country of the first commercial plant for the production of wood-sugar alcohol. The large-scale production of alcohol from wood waste will aid considerably in conserving grain for domestic and Lend-Lease needs. It has been shown that a number of chemicals of military importance can be derived from the lignin in wood waste and pulp mill waste liquors, including alcohols, glycols, tar acids, hydre-carbons, naphthene, and heavy, high boiling oils.

Papreg, the high-strength resin-impregnated paper plastic, developed at the Laboratory, has been adapted to many military uses, such as equipment cases, aircraft ammunition boxes, gunner's seats, and parts for gun turrets. The developments include laminated paper plastics filled with low-cost lignin recovered from waste pulping liquors; these have possibilities as substitutes for the conventional resin-bonded paper plastics. The lignin has possibilities as an extender for the critical phenolic resins commonly used in these products.

Hydraulic Design of Drop Structures for Gully Control: Taming the rush of eroding water is an essential part of soil conservation. A recurring problem for hydraulic engineers in construction of concrete drop structures to control arroyos or gullies has been undermining by the scouring action of the water. A safety measure against this is the stilling basin incorporated in the design of the drop structure at its base. Heretofore each of these basins or shelves to catch and tame the falling stream has been designed as part of a specific structure.

Now, the Research Division of the Soil Conservation Service has brought a "gully washer" into the laboratory and poured it into a series of stilling basins varying in depth and length. Watching the glassed profile of the stream as it flows through drop structure and stilling basin, SCS men have taken movies of the flowing water, measured its speed, determined its patterns as related to erosion. From these laboratory measurements and observations, engineers have formulated rules for the construction of these basins, designed to save them from being washed out in the flash floods of the Southwest and southern California. By formulating a general dependable solution for this comparatively small erosion problem, SCS scientists have effected an inestimable saving in cost of materials and in the prevention of possible failure.

U. S. DEPARTMENT OF AGRICULTURE

Office of Information
Mr. Harding, 4842
Miss Arnold, 4875

No. 6
Revised August 1, 1944

MOST IMPORTANT RESEARCH ACHIEVEMENTS OF DEPARTMENT OF AGRICULTURE SCIENTISTS DURING RECENT YEARS

Cork Substitute: Noreseal, a cork substitute, is a wartime product developed in the Northern Regional Research Laboratory of the Bureau of Agricultural and Industrial Chemistry, at Peoria, Ill. It can be made from the pith of such farm waste residues as cornstalks, peanut hulls, sugarcane bagasse, and similar material. It can be made in rod or sheet form, or poured directly into the cap of the bottle, and is particularly satisfactory as a seal for bottled beverages. The product is now in semi-commerical production, and bids fair to remain a successful enterprise after the war is over. It is the final result of literally hundreds of experiments.

Phosphate Drink for Cattle: Cattle in southern Texas have been getting phosphate drinks, with benefit to their health and growth, in experiments conducted by the Bureau of Animal Industry and Texas scientists in cooperation with the King Ranch of that State. The phosphates are added to the drinking water to make up for insufficient supplies of phosphorus in the native vegetation. In the past some stockmen have added bonemeal and other forms of phosphorus to the feed and placed it in self-feeders. Still others have applied superphosphate to the soil as a fertilizer.

[illegible]. Putting the phosphates in the drinking water, besides being convenient for the cattle owner, enables each animal to get its supply in a soluble form readily assimilated.

The phosphate salts have been given experimentally in two forms, disodium phosphate and defluorinated triple superphosphate, in quantities sufficient to supply 6.5 grams of phosphorus in 6 gallons of water. The defluorinated product must be used because of the poisonous effect of fluorine. The treatment has resulted in more productive breeding stock and better gains by calves.

Scintific Collections: The maintenance of large collections of small quantities of viable seeds of many varieties of important economic crops and cultures of organisms of importance to agriculture is part of the work of the Bureau of Plant Industry, Soils, and Agricultural Engineering. Many of the items in these various collections are kept in cold storage, which reduces the frequency of regrowing crops to supply viable seed. In addition to the collections of seeds of crop plants, there are also collections of fungi and of soil bacteria. These collections have proved an important factor in the process of scientific work in many places outside the Department and even in other parts of the world. For example, the mold Penicillium, found by an English scientist to produce a powerful bactericide, was identified for him by Department scientists at Beltsville, Md., who started an extensive mold collection.

The various lots of seed of crops are usually regrown every few years to maintain their viability so that when needed they may be drawn upon for use by Department plant breeders, State experiment stations, or elsewhere. The plant scientists have recorded, insofar as possible, the characteristics of the various varieties so that when attempts are made to create a new variety to suit different conditions promising genetic material may be readily located.

The Department's collection of wheat varieties totals approximately 8,500 drawn from every country where wheat is grown. There are about 300 varieties in the corn collection, including a large number grown by North and South American Indians, and modern varieties that have been or may be used in the development of hybrids. The Department has 4,000 varieties of barley, 3,000 of oats, 1,000 of rice, 400 of flax, and between 200 and 300 of sorghums.

The Plant Industry Station at Beltsville, Md., now has an herbarium collection of fungi, mostly those which grow on food plants or other plants of economic importance, that totals nearly 450,000 specimens. Through possession of this extensive museum of fungi it is possible for the Department's mycologists to identify specimens for scientific workers and for other purposes.

The Department also maintains at the Station one of the largest collections in the world of soil bacteria, including hundreds of strains of legume nodule bacteria which are kept in standard cultures for comparison with cultures offered for sale to the public. The different strains of soil bacteria of all kinds are available to scientists anywhere in the world. These collections have been an important means for cooperation in carrying on scientific work.

Louse Powders for the Armed Forces: For the treatment of man for destruction of lice two formulas of louse powders were developed by E. F. Knipling and his associates in the Bureau of Entomology and Plant Quarantine at Orlando, Fla. Body lice were maintained in a colony, and research subjects were hired for feeding the lice and for conducting a large number of tests with insecticides. Materials showing promise in jar tests were applied to the inside of the sleeve and legs of underwear and this portion of the underwear was then taped onto the leg or arm of the research subject. Various stages of lice were introduced into these abbreviated garments where they remained for 24 hours. At the end of this time, the number killed by the treatment was determined. In the case of promising lousicides new lice were added to the garment each day to determine the period of effectiveness.

In this manner an activated pyrethrum powder known as MYL was developed. This powder killed lice for one to two weeks and in most instances a single treatment was sufficient. However, a formula containing DDT gave protection for three weeks and sometimes longer. This material remained in the clothing long enough to kill the young as they hatched from the eggs; therefore it was not necessary to add an ovicide as was done in the MYL treatment. These powders have been adopted by the armed forces and have been the means of controlling typhus epidemics in the present war.

Small-Type Turkey: Since about 1930 there has been a simultaneous increase in the number of turkeys raised and in the average size of turkeys produced. However, there has not been a corresponding increase in the demand for the heavier birds and this has resulted in a price differential of from 1 to 6 cents per pound in favor of smaller market turkeys. This demand on the part of consumers seems to be based on sound considerations and is likely to be permanent. In view of this trend, the Bureau of Animal Industry in 1934 at the Research Center, began an experimental project on the development of a small-type turkey. Marked progress has been made in fixing the desired characteristics in this small-type turkey.

Several standard varieties, the wild turkey, and White Austrian turkeys imported from Scotland have been crossed in the development of this small-type turkey. From the crossbred progeny selections are being made. The chief characteristics desired are as follows: Live weight of young toms at market age, 12 to 17 pounds; corresponding weight of young hens, 7½ to 10 pounds; color, white; a compact body with moderately short legs, moderately long keel bone, and an abundance of meat, especially on the breast and legs; early maturity, resulting in a finished condition (U. S. Prime) with respect to fat, fleshing, and feathering at the age of 24 weeks; reasonably high egg production and high fertility, hatchability, and viability.

Soil Conservation Research: Soil- and water-conserving farming methods are carefully devised to salvage and rebuild that valuable raw material, the soil, for continued profitable use. To do this, a soil-conservation farm plan redesigns the farmer's factory or plant. As in the modernizing of an industrial plant, every change made in the farmer's fields is based on thousands of carefully controlled laboratory tests and closely watched field trials. Today 19 soil and water conservation experiment stations located in farming areas throughout the country are delving into the secrets of soil, rain, wind, and growing crops.

By studying the private life of a raindrop, research men in the Soil Conservation Service have devised a unique rain machine that can be regulated to produce the effect of a typical Great Lakes drizzle or one of the sudden drenching spring downpours of the Southwest on various types of soils and crops. Tilting plots of earth that can be sloped to any accurate degree have helped determine the comparative soil-holding powers of various grasses and other close-growing plants on sloping fields.

Fine-gaged laboratory instruments and ingenious weather-imitating devices are adding, bit by carefully weighed bit, to the store of tested facts making it possible to adapt soil saving farming patterns to the specific needs and capabilities of each acre. These recent achievements exemplify the immediate practical value of SCS's research program.

Sweetpotato Starch: The sweetpotato promises to become an important industrial crop, as the result of the development by the Bureau of Agricultural and Industrial Chemistry of a process for making high quality white starch. A growers' cooperative of more than 1,000 members at Laurel, Miss., has produced in a single season as much as 3,000,000 pounds of starch. Already the product is being used for sizing and finishing in cotton mills and by the laundry, baking, and confectionery industries. This new enterprise offers farmers an opportunity to add another profitable cash crop to their present farm programs. A large plant is being built this year at Clewiston, Fla., that is based on the results of research by the Bureau.

Lacquer From Cow's Milk: With war limiting supplies of tin available for coating milk cans, dairy scientists are now looking to the cow herself to furnish some of the critical materials needed in transporting and packaging her product. Paul D. Watson, associate chemist of the Bureau of Dairy Industry, has developed a lacquer substitute for the tin coating on cans used for evaporated and condensed milk and on the cans used for shipping fluid milk and cream. Watson's lacquer, on which he has filed applications for 2 public service patents, is made largely from lactic acid, with a small proportion of castor oil ~~or some other vegetable~~ oil.

Lactic acid is obtained by fermenting the milk sugar in whey, which is a by-product of cheese and casein manufacture. Commercial production of lactic acid from whey, as well as from other agricultural sources, is already established. Finding a profitable outlet for all the whey produced at large cheese factories has long been a difficult problem.

Preliminary tests with the new lacquer, both in the Bureau's laboratories and by several manufacturers of coating materials for metals, have given promising results. All the ingredients needed to make the lacquer are readily obtainable, and no unsurmountable difficulties in making or applying the lacquer are apparent, Mr. Watson says.

Although the Bureau's research has been directed mainly toward insuring a supply of suitable containers for milk and other dairy products in spite of the tin shortage, protective lacquers that can be applied directly to iron and steel and other materials would be of value to the whole sheet-metal industry. The Bureau's new lacquer is also suitable for many purposes other than a protective coating. It may be used for impregnating, gluing, and molding various articles.

Forest Management Research: Naval stores research by Forest Service has recently developed methods by which gum naval stores yields can be increased 17 percent or better on commercial operations by applying chemicals to freshly chipped trees. The method results in higher money returns to the operator, ranging roughly between $400 and $700 additional net profit per crop of 10,000 trees, depending on how faithfully proper methods of chemical stimulation are followed. The two methods developed in this search and currently recommended to and tried by the industry are (1) biweekly chipping of the turpentine trees with application of 40 percent sulfuric acid to the fresh streak, and (2) weekly chipping (a normal procedure) followed by application of 25 percent caustic soda solution. With the same labor, the second procedure gives somewhat higher yields, but where labor is scarce the former method is very advantageous.

Gas Treatment Worth Millions to Citrus Growers: Many oranges, though ripe, lack the full yellow color expected of the fruit. This handicap has been overcome by results of research conducted by the Bureau of Agricultural and Industrial Chemistry, beginning in 1923 and lasting about 12 years. By treating a green-colored orange with ethylene gas the green color is bleached out, leaving the orange a beautiful yellow. This treatment, now in general use, cost the taxpayers about $4,000 and is estimated to be worth about $4,000,000 a year to the producers of citrus fruit in Florida alone and about the same amount to producers in California.

Dye Research Worth Millions: The gay fast colors that men and women are wearing today are largely the result of research by chemists of the U. S. Department of Agriculture during and immediately following the first World War. This research developed new technical methods for the production of intermediates, fast and brilliant dyes for cotton. This one piece of research has expanded the cotton market more than a million dollars a year, as well as providing the public with gayly colored clothes that will not fade.

Phenothiazine as an Anthelmintic: Phenothiazine is a synthetic organic chemical, first prepared in the latter part of the nineteenth century. It is one of the thiazine dyes. Following the discovery and announcement that phenothiazine was effective as an insecticide, its value as an anthelmintic was studied and established in 1938-39 by Harwood, Jerstad, and Swanson, workers of the Bureau of Animal Industry. Experimentation with this drug has been continued to develop the best methods of use. Phenothiazine is now widely recognized throughout the world as a highly effective anthelmintic for the removal of many injurious internal parasites of domestic animals. It is the most valuable single drug so far discovered for combating such parasites. The drug is distributed commercially in powder form and may be administered either in gelatin capsules, in ground feed, in salt, or as a drench, the choice depending usually on the species of animals and preferred method of handling them. For use as an anthelmintic, phenothiazine should be the pure product prepared especially for that purpose.

In 1-ounce doses phenothiazine rids sheep and goats of stomach worms, nodular worms, hookworms, and related pests. Its use prevents the spoiling of the sheep's intestines by nodular worms, thus providing us with additional war material for making surgical sutures at a time when they are greatly needed. In suitable doses which vary with the size of animal, phenothiazine is effective in removing several kinds of parasites from swine, cattle, horses, and mules. In very small doses this drug is effective also in removing cecal worms from poultry. These are the worms that transmit blackhead to chickens and turkeys. The extensive use that phenothiazine already has acquired for controlling animal parasites is evident from the quantity--about 3 million pounds--used in the United States in 1943. Very recently a mixture of 9 parts salt and 1 part phenothiazine has been found largely to prevent acquisition of the parasite, when made available to sheep.

New Method for Dehydrating Cheese: A new method for dehydrating natural American Cheddar cheese for lend-lease or other uses, which is more direct than the commercial procedures now in use and which will also release spray-drying equipment for drying other foods, was developed in the Agricultural Research Administration.

Dr. George P. Sanders, of the Bureau of Dairy Industry, who devised the new method, found that if natural full-fat cheese is grated and then partly dried at room temperatures, the fat will be sealed up in the numerous case-hardened particles of curd. The particles can then be dehydrated in a tunnel drier or by any other heated-air method, without loss of fat.

Heretofore, commercial companies have been unable to use direct methods in dehydrating cheese of normal fatcontent, because the heat of dehydration caused the fat to melt and run out. Some processors have overcome this difficulty by first processing the full-fat cheese with heat and water, and usually with a chemical emulsifier, into a milky paste that can be spray-dried. In another commercial process, the fat is removed from the milk used in making the cheese and then added to the dried cheese.

The Bureau's new method is more direct and the resulting product is a natural cheese, minus only the water. Natural Cheddar cheese in its original state usually contains about 36 percent water, but the dehydrated flakes as prepared in the Bureau's laboratories contain about 3 percent water. The dehydrated flakes thus contain all the fat and other solids, but weigh only two-thirds as much as the original cheese.

The flakes can be packaged loose or they can be compressed to the same density as the original cheese, or to two-thirds its volume. The compressed cheese can be easily broken up, and it can be consumed directly or used in almost any other way that cheese is ordinarily used.

If the flakes are compressed into rectangular or block form instead of the round shapes typical of natural Cheddar cheese, considerable additional storage or shipping space can be saved. Compared to the original cheese packed in round boxes, the dehydrated compressed blocks would occupy between 53 and 56 percent as much storage or shipping space.

"Hexes" Cattle Flukes: As a result of the resourceful experimentation of a Bureau of Animal Industry scientist who had formerly been a South Seas island missionary, a successful chemical treatment for liver flukes--long a serious menace to cattle raising in parts of Texas and other western areas--has been devised and is now being used by the cattlemen.

The scientist who perfected the treatment is Dr. O. Wilford Olsen. Flukes are difficult to reach by medication, since they seek out the liver for attack. Scientists had found a drug with the five-syllable name, hexachlorethane, to be effective against these small, flat, leaf-shaped parasites, but it was difficult to administer because of its insolubility in water. Dr. Olsen found that bentonite combined well with hexachlorethane in water to make a smooth emulsion that was easy to give as a drench.

Once interpreter to the king of one of the South Sea islands, Dr. Olsen found little difficulty in translating his scientific lore into language that practical Texas cattlemen found easy to understand. When Texas State prison officials let him try out the remedy on part of the prison herd, the results proved a convincing demonstration of the value of the treatment in liver fluke control. The mounting demand for hexachlorethane that followed this demonstration led to substantial commercial production and distribution of the drug.

Dehydrating Food: Dehydrated vegetables take about one-third the ocean freight space required for similar products processed in other forms. Realizing this tremendous cargo saving opportunity, the former Agricultural Marketing Administration (now absorbed by the Office of Distribution) on May 26, 1942, announced a program to encourage expansion of the domestic industry to meet increased needs of American and United Nations military forces. At that time about 20 plants, with a production capacity of about 15,00,000 pounds annually, were operating in the United States.

In 1941 chemists and engineers of the Agricultural Research Administration were at work in the Western Regional Research Laboratory on the basic research that made this quick wartime expansion of the industry possible. Immediately after Pearl Harbor, pilot plant, or semicommercial, dehydrators were quickly built and put to dehydrating vegetables. Around 500 million pounds of food were dehydrated in 1943, and much of it was done according to methods worked out in the Western Laboratory.

Investigations on the dehydration of meat got under way at the Beltsville, Research Center, about the same time, leading to results having prompt commercial application. The methods worked out for the preparation, processing, and packaging of dehydrated vegetables were offered to the industry in 1942 through

two dehydration schools, one at Rochester, N. Y., for the eastern half of the country and one at Albany, Calif., for the West.

To carry out the program, an interdepartmental committee composed of representatives of the Department of Agriculture, Army, and the War Production Board was set up. Last summer, the WPB, on the recommendation of Secretary Wickard and the Food Requirements Committee, established a bank of critical materials to permit conversion and construction of additional dehydration facilities. An additional bank of materials was provided in the latter months of 1942.

Nerepol: Norepol, the rubber substitute from vegetable oils announced in 1942 by the Department of Agriculture as having been made in the Northern Regional Research Laboratory at Peoria, Ill., is now in commercial production. Two companies making rubber according to the Norepol formula have given the product trade names of their own. Other companies are turning out a finished product under the name of Norepol and some are making an intermediate material sold to manufacturers of rubber articles for the ultimate consumer.

The war has hastened commercial adoption of this infant industry that was in the pilot plant stage a short time ago. The pilot-plant policy of the agricultural Research Administration's Bureau of Agricultural and Industrial Chemistry--adopted with the establishment of the Four Regional Research Laboratories for industrial utilization of farm commodities--has been a factor in getting the new product into use as well as speeding work on other rubber intermediates in the Department. The pilot plant serves as an intermediate stage between the laboratory test tube and commercial production. The wholehearted cooperation of industry had much to do with the rapid development of Norepol.

The Department first described Norepol as having a number of the valuable characteristics of natural rubber in considerable degree, including 200 percent stretch, tensile strength of 500 pounds to the square inch, and excellent resistance to oxidation and to the effects of water and alcohol. The general run of natural rubber has a 600 percent stretch and a tensile strength of 3,000 pounds or more. However, for certain purposes Norepol is highly useful.

Since the first public report, and as a result of tests in the Peoria pilot plant and by a number of factories, improvements have been made in the product. In particular, the necessary constituents can now be produced in purer form and there is better control of the polymerization process.

Tests at the Laboratory and in commercial plants show possibilities for many uses for Norepol, including molded and extruded articles--such as rubber heels, tubing, and gasket material. Because of the over-all rubber situation, careful choice must be made among the various possible uses. A point of much interest in the over-all economy of wartime is that what is left of vegetable oils after the separation of material for Norepol, including glycerol, can be used by industries that consume vegetable oils to make some of the same products they have been making from the whole oil.

Apple Sirup: One of the first wartime accomplishments to come out of the Department of Agriculture's Eastern Regional Research Laboratory, at Philadelphia Pa., was the development of apple sirup, a food product from sound but off-grade apples. It can also be made from apple peels and cores from canning and dehydration plants. It is a delicious table sirup, and especially fine for baking cakes, since its moisture-holding qualities prevent cakes from drying

out rapidly. Apple sirup is also a good substitute for glycerine, now needed in making explosives, and is being used on large scale by one of the large cigarette manufacturers. Five commercial plants in the United States and Canada turned out more than 4 million pounds of apple sirup last year.

Photoperiodism: While working with Maryland Mammoth tobacco prior to 1920, W. W. Garner and H. A. Allard of the then Bureau of Plant Industry (now Bureau of Plant Industry, Soils and Agricultural Engineering) discovered that the plants flower only when the daily period of illumination is relatively short--that is, when the days are short and the nights long. When the light periods are long the plants remain vegetative. Subsequent experiments on many kinds of plants showed clearly that they differ greatly in the growth and flowering. responses with respect to the relative lengths of the daily periods of illumination and darkness to which they are exposed, some conforming to the behavior of Mammoth tobacco others responding to relatively long illumination periods, and still others being but little affected.

This discovery departed widely from the prevalent theory that more intensity of illumination was the principal light factor concerned in determining the characteristic growth, flowering, and fruiting of plants. It had great fundamental importance as pure research and, as it developed, widespread practical significance. Response to relative length of day and night largely explains why many plants flower only at certain seasons of the year, and it also largely explains changes in behavior where plants are carried from one latitude to another. It is now possible, by conducting experiments under controlled conditions, to tell in advance whether certain varieties of soybeans, peas, onions, timothy, barley and other plants are adaped to the photoperiodic conditions known to prevail in specific localities. The experimental crops can be grown under greenhouse conditions anyway, with supplemental artificial light as needed; if none is adapted to the locality, one or more suitable lines can be bred.

This discovery has also been particularly helpful in selecting soybean varieties that thrive and produce abundant seed for making oil, plastics, and food products in various localities. It has enabled us to produce our own beet seed domestically instead of importing it as we did formerly. It enables us to select localities where pyrethrum, a long-day plant, will thrive in the United States, and also to cross plant varieties which would not normally flower at the same time, as in the case of sugar cane varieties. By artifically shortening the daily light period chrysanthemums and other flowers are now being brought to market ahead of their normal season. Recently it has been found that a plant is primarily influenced by photoperiodic conditions by way of its leaves. Thus a Biloxi soybean will bloom promptly if only a few of its leaves are subjected to a short photoperiod. It is all but impossible to calculate the flow of economic value from an original discovery so basic as that of Garner and Allard.

Forest Products Research: Under the sponsorship of the War Production Board the Forest Products Laboratory of the Forest Service undertook a pilot-plant study to develop methods for laminating ship timbers. The study has reached a stage where it is possible to produce acceptable glued white oak timbers under properly controlled conditions. Laminated timbers permit the use of lumber and reduce the demand for large timbers which have been difficult to obtain.

Basic Facts About Vitamin A: Basic contribution to knowledge of vitamin A have been made in the foods and nutrition laboratories of the Bureau of Human Nutrition and Home Economics.

To find out the vitamin A requirements of human beings, a few years ago researc workers in the laboratories fed an experimental diet to a group of men and women volunteers. Day after day the group ate only meals prepared in the laboratory kitchen. This group received every nutrient that the human body is known to need except vitamin A, which was almost completely absent from the meals. Since one of the early measurable effects of vitamin A lack is night-blindness, that is, failure of the eyes to adapt normally to dim light, the appearance of this condition in the subjects was taken as a sign that the body had used up most of its stored vitamin A. As soon as a volunteer showed unmistakable evidence of nightblindness, he was given measured amounts of vitamin A, first in small and then in gradually increased doses until the vitamin A received was just sufficient to keep his vision in dim light normal.

Fish-liver oil, cheese, milk, cream, and eggs are the most common animal foods containing significant amounts of vitamin A. However, green leafy and some yellow vegetables and fruits contain certain orange pigments known as carotenes, which are changed into vitamin A in the body. In the first experiments solution of standardized cod-liver oil and pure carotene were given to supply the "measured amounts" of vitamin A. Later the minimum vitamin A requirements were measured in terms of natural foods, using peas, spinach, and carrots as sources of vitamin A. It was found that in terms of International Units the body needed about 30 to 60 percent more carotene as found in vegetable foods than it did of vitamin A found in animal foods.

This information has special timeliness for the war period, since restricted food supplies cause civilians to lean more heavily upon plant foods for their vitamin A supply. From these vitamin A experiments have come data for estimating the daily minimum vitamin A requirements of the average, normal adult. The findings became part of the informational background used when the Committee on Food and Nutrition of the National Research Council set forth recommended daily allowances of vitamins and other nutrients as a nutrition yardstick for America.

In the first experiments, some subjects showed signs of vitamin A deficiency after two weeks of the vitamin A free diet, whereas others--probably better fortified by a reserve supply of the vitamin--showed no sign of lack for several months. To learn more about the body's ability to store this vitamin and the rate at which it is depleted, laboratory animals were used. The results showed that moderate amounts of vitamin A obtained regularly in meals are used more economically than occasional massive amounts.

This suggests the importance of building up a "vitamin A savings bank" by regularly eating somewhat more than the daily requirement of foods containing vitamin A, when possible. To serve as an aid in determining the vitamin A value of the normal diet, analyses of vitamin A value of 128 common foods in the raw and cooked state have been made and published in these laboratories.

The Bureau's vitamin A researches have progressed over a number of years. This work was started under the supervision of Dr. Lela Booher, more recently under the supervision of Dr. Elsa Orent-Keiles, while various scientists have held responsible posts in carrying out the work. Mrs. Elizabeth Callison had direct leadership of studies to determine human vitamin A requirements.

Aerosol: The project looking to the development of a fine-fog method of dividing and spreading insecticides was started in April 1941 by the Bureau of Entomology and Plant Quarantine and its results were put into practical use early in 1943. The new aerosol development was primarily the result of an idea originated by Dr. Lyle D. Goodhue and developed by him and W. N. Sullivan. The discovery includes principally an insecticide material with an activator that makes the mixture work better, dissolved in a highly volatile, noninflammable and nontoxic solvent which propels and atomizes the insecticide into a fog, all in a container which keeps the mixture under high pressure ready for instant release. The new aerosol got into use just in time to be of great value in the war. The entire output consisting of millions of containers has been requisitioned by the military authorities and is in use on the various fighting fronts to protect our men from irritations and dangers of mosquitoes, flies, and other insects. When this method of fighting insects can be made available for general use, its value will be incalculable. In other words, the principle of this method of control may be so important as to revolutionize many of the curren practices for the control of serious pests.

Increasing Yield of Penicillin: The observations which led to the discovery of penicillin were made in 1929 by Alexander Fleming, a British scientist. He was annoyed to find one day that some stray mold spores were growing in a culture of germs he was studying. A germ-free zone around this stray mold indicated to him that it was giving off a substance that was killing the germs in his culture. This substance turned out to be penicillin. It was named for the mold which produces it.

But very little was heard of this discovery until the summer of 1941. At that time Dr. Florey and Dr. Heatley, two British scientists who were largely responsible for the application of Fleming's observations, came to this country to stimulate interest in the pilot-plant production of the new product. After conferences with members of the National Research Council and scientists of the Department of Agriculture, the men were sent to our Northern Regional Research Laboratory located at Peoria, Ill., and operated by the Bureau of Agricultural and Industrial Chemistry. This laboratory was selected because it had had wide experience in the use of molds in the fermentation field and because it had one of the largest collections of molds in the world.

Dr. Heatley stayed at the laboratory and went to work in cooperation with our fermentation experts to try to increase the yield of penicillin. The yield was so small at that time that it amounted to a bottleneck. They also developed methods for purifying penicillin. These studies were supported by the Committee on Medical Research in the Office of Scientific Research and Development. The studies are still going on and have been of great value to those who are now working to perfect the commercial production of penicillin.

By proper feeding of the molds and by improving the strains of molds that produce penicillin, the laboratory workers were able to increase the yield one hundredfold. The work at our laboratory, as well as that in industrial laboratories, was so promising that Dr. A. N. Richards, Chairman of the Committee on Medical Research, called a meeting of representatives of commercial manufacture of pharmaceutical supplies in December of 1941 and made available to them the results of the work at the Northern Laboratory which had been so successful. Largely as a result of that conference, a number of industrial firms started th production of penicillin on a semi-commercial scale.

Penicillin is now being produced on a commercial scale by 21 plants in the United States and Canada. By the end of this year these plants will be turning out penicillin at the rate of 200 billion units a month. That's enough to trea 250,000 serious cases of infection. Scientists of the Department of Agricultur have played an important part in the development of this drug. They increased the yield of penicillin more than 100 times. They developed the particular strains of mold which are used to make all of the penicillin now being produced. Their investigations made it possible for industrial firms to start commercial production at once. As a result of these accomplishments penicillin has been made available to our armed forces much sooner than would otherwise have been possible.

This is the sort of problem our four Regional Research Laboratories are prepared to solve. Their pilot-plant facilities enable them to take research beyond the test-tube stage and into semi-commercial production. Penicillin, promising as it is today, was not produced in sufficient quantities to make it of any great importance until research in the Peoria Laboratory found a way to increase the yield so that it was possible for industry to go ahead on a semi-commercial scale.

Tannin-Producing Sumac: Imported Sicilian sumac has provided this country with much of the tannin used for tanning fine, pliable leathers. When imports were cut off by war, hillculture scientists of the Soil Conservation Service renewed their efforts to develop practical ways of selecting, growing, and harvesting erosion-controlling sumac for tannin.

The principal drawback to profitable tannin production in this country has been the great amount of hand labor required to harvest the sumac. In cooperation wi the Iowa Experiment Station, SCS has developed mechanical harvesting, drying, an baling processes that permitted the production of about 26 tons of sumac leaves from one small area for commercial tanneries last year. This may forecast a profitable new farm crop that can be grown on steep slopes and eroded land.

At the Floris, Iowa, Hillculture Farm, operated cooperatively by SCS and the Iow State Experiment Station, the Service has helped in the contour planting of white sumac seedlings, selected for their tannin-producing qualities. High-yielding strains of both white and black sumac common to the Eastern States are being selected for further experimental planting, now that mechanical harvesting and pr cessing methods have been devised.

At the Floris Station, scientists assembled a sumac harvester from a caterpillar-type tractor and parts of a combine. This machine gathered only the leafy tops of the plant which were then windrowed for sun-drying. Mineblower and air tunnel

were enlisted to complete the drying of the harvested tops and a thresher separated tannin-containing leaves from stems and woody portions. A hay baler packed the leaves in 75 pound bales. As a result of this pioneer harvesting effort, farmer programs are now under way to collect and dry a substantial amount of tannin-producing sumac leaf during the current season.

Disease Resistance in Crops: One of the greatest improvements brought about in crops by plant breeders has been the disease resistance, which, along with such characteristics as heavy yielding capacity and adaptability to various climatic conditions, has enabled farmers to produce much more on the same acreage, with the same quantity of fertilizer, and with less labor per unit. Notable among the crops which have been reinforced by disease-resistant characteristic are wheat, oats, potatoes, sug rcane, and sugar beets, but practically all crops, large and small, have been improved to some extent in this direction.

Each year sees the announcement of several new varieties of various kinds of crops, a large number of them owing much of their promise to disease resistance. In 1943 the Department of Agriculture issued 35 such announcements covering cereals, forage plants, vegetables, tree and small fruits. Some plant breeding accomplishments in disease resistance have become classics, such, for instance, as the saving of the sugarcane industry in Louisiana through the development of varieties resistant to mosaic disease. The work which resulted in the development of sugar beets resistant to curly top comes near being in the same class, as does also the cooperative potato breeding program and the cooperative work on breeding disease resistant and high yielding cereals.

Research Helps Naval Stores Producers: Producers of gum naval stores are now getting over a million dollars a year more than they did a few years ago before chemists of the Department of Agriculture took the naval stores problem to the laboratory. Research in this field has given the industry a permanent set of standards for grading rosin, estimated to be worth $150,000 a year to pine tree farmers; developed better barrel gluing and an improved dehydrator for turpentine, estimated to save the industry $250,000 a year; developed improved still settings worth $200,000 a year; a method for improving quality of pine gum, valued at $150,000 a year; developed methods for controlling turpentine distillation, worth $100,000 a year; introduced improved turpentine storage conditions valued at $100,000 a year; developed a new type steam turpentine still which, when used in conjunction with gum cleaning, is worth $2,500 a year to each user; advised producers how to prevent rosin losses in chips, resulting in savings of $200,000 a year; and proved that gum contaminated with iron rust from rusty equipment can lower the quality of rosin as much as 3 or 4 grades, reducing the income of producers of gum naval stores around half a million dollars a year.

New Poisioned Bait for Mormon Cricket: This bait, consisting of a sodium fluesilicate, mill-run bran, and sawdust mixture, is a development of the Bureau of Entomology and Plant Quarantine laboratory at Bozeman, Mont., and represents the combined work of a number of individuals under the leadership of John R. Parker. It was first given wide-spread use in 1939, and has resulted in savings of hundreds of thousands of dollars in control work during the past three seasons by reducing the costs of materials furnished by the Government and of labor in their application. Savings as a result of cooperative control efforts where this material has been used total in excess of $50 million in the last three years.

Speeding up Calcium Gluconate Production: Following up research which resulted in a practical method of using molds to ferment glucose into gluconic acid, which combined with lime as calcium gluconate, widely used in medicine, chemists have further improved the process by making it semi-continuous. They have discovered that addition of a small quantity of boron compound promotes the biochemical process. Use of the boron, together with improved equipment and better molds as fermentation agents, makes it possible to produce calcium gluconate in about half the time formerly required.

Chemists of the Bureau of Agricultural and Industrial Chemistry, who began the research 12 years ago, found that the action of certain molds on a solution of glucose, or corn sugar, produces gluconic acid. This acid is important in the manufacture of calcium gluconate, a calcium or lime compound that can be assimilated by animals. Molds are microscopic plants and--like other plants--need air to grow. At first the molds were grown on the surface of shallow pans, but these were not adapted to large-scale use in manufacturing plants.

The chemists continued the experiments, and, in 1935, the Department of Agriculture announced the invention of a rotating drum in which the glucose solution is fermented. The air which is necessary to the growth of the molds is forced into the drum at one end under pressure and is removed through the other end. After studying many molds to find out which ones are best for making gluconic acid for calcium gluconate, Department chemists reported that the best found so far is a mold known technically as Aspergillus niger (strain 3). This particular mold does a good job at fermenting the glucose.

Though the rotating-drum method reduced the cost of making calcium gluconate from $150 to 50 cents a pound, the chemists encountered one difficulty with the process. When the molds were exposed to an increasing concentration of gluconic acid which was formed in the glucose solution, they stopped working. Calcium carbonate, or common chalk, was added to neutralize the effect of the acid, but the calcium gluconate produced was not very soluble and separated out, clogging up the drum. Then three chemists of the Bureau, A. J. Moyer, E. J. Umberger, and J. J. Stubbs, who had been studying fermentation processes, discovered that the addition of a little borax or boric acid to the fermenting liquor keeps the calcium gluconate in solution and lets the molds finish their work. Later, the calcium gluconate may be separated from the solution free from boron.

Improving Sagebrush Range Lands: On much of the 96 million acres of sagebrush range land in the West, range owners and operators have been faced with two very serious problems growing out of the prevalence of this very low-value shrub. On the one hand, sagbrush crowds out the vigorous growth of more valuable forage plants, makes herding difficult, contributes to the straying and loss of sheep, brushes considerable amounts of wool from sheep fleeces, and otherwise hinders effective livestock grazing. On the other hand, when the range has been burned in an effort to eliminate the brush and the necessary precautions have not been observed, a great reduction of valuable forage and loss of soil has usually resulted, to say nothing of occasional serious damage caused when the brush fires got out of hand and raged through other range areas or destroyed buildings and other private property.

A study completed in 1942 by the Forest Service has proved that heavy stands of sagebrush can be eliminated by burning with only negligible losses, and that when such burning is properly planned and executed and includes intelligent management of the range for a season or two after burning, grazing capacity will be greatly increased--60 to 300 percent increases have been recorded. Where planned burning is carried out, grazing animals are unrestricted in their movements, ewes produce a more steady flow of milk, and lambs make better growth and are seldom lost. These and other benefits fully justify the investigations necessary to develop these safe methods.

Preserving Chicken Feathers: Wet chicken feathers may be preserved for several weeks by a simple treatment, with salt and hydrochloric acid, developed by research workers of the Bureau of Animal Industry. Fifteen pounds of common salt and a pint of commercial concentrated hydrochloric acid are dissolved in 30 gallons of water, for each 15 pounds of wet feathers to be preserved. A tight 50-gallon wooden barrel makes a convenient container. Wet feathers are a by-product of chicken dressing plants, but normally they decompose too rapidly to permit their shipment to feather-processing establishments. The preservative makes possible the industrial use of millions of pounds of chicken feathers that formerly were wasted or used as fertilizer. The new treatment is cheaper and more efficient than chemicals previously tried.

The method is essentially one of pickling. The solution costs initially only about 1¼ cents per pound of wet feathers treated. The expense is further reduced by the fact that several lots of feathers can be preserved in the same solution.

Smear 62 for Screwworms: This smear was developed by the Bureau of Entomology and Plant Quarantine at its laboratory at Menard, Tex., as a combined effort of the laboratory, largely the work of Roy Melvin. Its first practical test on a large scale was made in the summer of 1941. It is now widely used throughout the area where the screwworm occurs, and has probably been largely responsible for holding to a minimum an excessive and widespread outbreak during 1944, with resulting savings of millions of dollars worth of cattle.

Hybrid Onion: The first hybrid onion variety was released to growers by the Department of Agriculture in 1944 as a result of experiments started about ten years earlier. Producing hybrid onion seed on a commercial scale had seemed almost an impossibility because of the nearness of the male and female parts until plant breeders discovered a male sterile onion, which made possible hybridization with male fertile strains on a field scale. As a result of this discovery, scientists of the Bureau of Plant Industry, Soils, and Agricultural Engineering and the University of California developed the first commercial onion hybrid, California Hybrid Red No. 1, which is adapted to growing in central California, southern Utah, and southern Nevada. This new early variety has yielded at rates ranging from 460 to 768-pound bags per acre and is said to yield generally 50 percent more per acre than the usual early varieties for those areas.

The discovery of the strain of onion without fertile pollen has led to the production, through breeding, af other male sterile lines that promise to be useful in producing hybrid seed from combinations with other varieties. (A male sterile strain may be carried on by planting "head sets" and in other ways known to plant breeders.) As a result of the possibilities in male sterile strains the field is now open for the development of hybrid strains of various varieties for different regions, seasons, and conditions.

Targhee and Columbia Sheep: The development of the Columbia and Targhee breeds of sheep is not strictly basic research but has resulted rather from utilization of basic knowledge of genetics. The development of the two breeds represents a skillful application of genetic laws and principles by scientists of the Bureau of Animal Industry.

Major credit for the development of Columbia sheep belongs jointly to E. L. Shaw, F. R. Marshall, and D. A. Spencer. Credit for the Targhee belongs to A. D. Spencer and W. A. Donecke. In both cases several others, mostly geneticists and station directors, were involved.

The development of these breeds has exceptional regional importance from a production standpoint, since they are primarily adapted to the inter-mountain ranges of the West. But the breeds also have national significance from a commercial and a monetary standpoint, because of the excellent quality of their fleece and meat. The earning power of Columbia sheep is estimated to be $1 to $2 a head greater than average well-bred range sheep. That of the Targhee breed is somewhat less.

The Columbia is the result of cross breeding select Lincoln rams with Rambouillet ewes and proceeding from this original crossbred by mating the most select first-cross rams with carefully selected first-cross ewes and interbreeding the rams and ewes descending from them. The foundation of the Targhee breed was laid by mating select Rambouillet rams with select ewes of Corriedale X Lincoln-Rambouillet, and Lincoln X Rambouillet combinations, and interbreeding the rams and ewes descending from these matings. The Targhee came from rigid selections of these matings.

Range Reseeding: Recent studies by the Forest Service at several western forest and range experiment stations have pointed the way to successful seeding of valuable forage plants on several million acres of depleted range lands. Increases in forage production of from 2 to over 10 times, enough to far more than justify the cost, result from reseeding in accordance with the principles so far developed. Ranges producing considerably less than their soil and climate can support are most promising for planting. Many valuable forage species are available for planting throughout the West, although comparatively few have so far been found suited to the driest and more severe sites. As a result of many tests, effective and economical methods of planting have been developed for most types of ranges. These provide for covering the seed, an essential consideration, and where necessary, preparing the soil and reducing the stand of low-value competing vegetation.

Scientific Sizing: Major savings to the clothing industry and to consumers alike are beginning to result from the Bureau of Human Nutrition and Home Economics's work on measuring women and children as a basis for sizing clothing. Lack of scientific data on the body measurements needed in sizing garments is at the root of the chaotic condition which has always existed in the sizing of clothing--particularly for women and children. Department stores complained of a $10,000,000 headache each year from returns and exchanges because of wrong size. Mothers complained of wasting time, money, and energy buying clothes that failed to fit children at home--age of a child was no dependable guide to clothes sizes.

Gaining cooperation of 20 colleges and universities, and with funds furnished by the Works Progress Administration, scientific workers in the clothing laboratories, under direction of Miss Ruth O'Brien, weighed and measured nearly 150,000 boys and girls. Thirty-six clothing construction measurements were taken on these boys and girls, who ranged from 4 to 17 years of age and represented 16 States.

From data obtained, the Bureau recommended a two-way method of sizing children's clothes based on height and girth at hip. The height-hip system is very similar to the system by which men have bought their shirts and other garments for years according to a few guide dimensions. The Bureau's scientists continued by measuring 15,000 women from 18 years old to 80. Fifty-eight measurements used in constructing patterns and garments were recorded, and weight was taken as a further check on bodily proportions. Universities and other institutions in representative sections of the country cooperated.

From the data, the Bureau recommended height and weight combined, rather than the customary bust measure, for predicting fit of full-length garments. For garments for the upper part of the body, height and bust combined offer the best guides to a fit. For lower trunk garments, height and hip girths are good guides. No single measurement is adequate as a basis for sizing garments and patterns, the survey conclusively showed.

As a result of these measurement studies, some pattern companies and clothing manufacturers are now making use of the new sizing system for children's garments On the basis of the Bureau's work, new standards for body sizes for boys' garment have been adopted by the American Standards Association, which serves as a link between scientists and the trade. While awaiting developments in the women's wear field, one large mail-order house has already gone ahead to use the Bureau's data and the recommended sizing methods for sizing its women's garments.

Inexpensive, Effective Dip for Sheep Ticks: Derris powder or cube powder having a 5 percent rotenone content, added to water at the rate of 6 ounces of the powder to 100 gallons, makes an effective dip for eradicating sheep ticks, or keds, from farm and range flocks. The value of this inexpensive dip was determined by tests conducted by N. G. Cobbett and C. E. Smith, parasitologists of the Bureau of Animal Industry. In Colorado, Smith dipped over 1,000 sheep, representing 5 farm flocks. In New Mexico Cobbett dipped nearly 9,000 range sheep. The dip stayed in the fleeces of the sheep long enough to destroy the young ticks that emerged from the pupal cases remaining in the wool after dipping. This treatment has superior efficacy in killing ticks following a single dipping, and is, moreover, cheaper than the previously recommended commercial dips.

Stratified Flow: By caging a miniature river and reservoir in glass, the Soil Conservation Service, in cooperation with the California Institute of Technology, has discovered that a muddy stream can be shuttled through and out of a reservoir merely by its own action, without the use of conduit or by-pass. Because silt, the stream-borne mud or soil that piles up behind dams to choke reservoirs and destroy irreplaceable reservoir sites, is a constant serious threat to power production, community water supplies, and irrigation, this discovery promises to save millions of dollars annually.

Research of the Service's sedimentation specialists has established the fact that a stream retains its identity after entering a reservoir, continuing to flow in a layer through under or over the still water. Its action depends on temperature and the amount of sediment or silt it contains. A silt-laden current slides under the clear water of a reservoir as heavy cream poured into coffee slides under the clear hot liquid. After trapping these flows or density currents in glass, watching and recording their action, research workers predict that engineers will eventually be able to use these layered flows of water into and through reservoirs as accurately as an accountant can use the keys of an adding machine, channeling a clear stream of snow water through a reservoir to the city's mains, a muddy stream through the same basin to a drain that feeds sandy

irrigation canals where the silt or mud will seal leaks in the sandy ditches, storing a salty stream in a known layer or strata until it can be drained off to return to the sea.

Brighton Dam and Reservoir, completed by the Washington Suburban Sanitary Commission to increase the water supply for suburban communities of Washington, D. C., is the first to make use of the principle of stratified flow in the special design of its outlets. Besides furnishing a "test case" for the effective use of density currents to preserve reservoir capacity, the new structure will contribute additional data, with special equipment installed to allow periodic measurements of the underflows as they come down to the dam. Engineers are making immediate use of the new understanding of density currents to preserve the capacity of reservoirs already built, drawing off known silted streams through low outlets originally designed for emergency draining or other purposes.

Weather-Yield Relationships: The importance of weather factors in relation to crop yields and the farmer's ultimate prosperity has long been recognized by everyone. But attempts to express these relationships in terms of mathematical formulas have been difficult because the final yield of a crop depends not only on a large number of such factors but also upon the particular combinations in which they occur.

Through a study of the joint effects of temperature and precipitation on crops in Indiana, Iowa, and Ohio, Walter A. Hendricks and John C. School, agricultura statisticians of the Bureau of Agricultural Economics, have developed equations for measuring these joint relationships, making it possible to determine more accurately the outcome of the crop. Knowledge of how critical weather factors influence the growth and development of crops is very important in developing new varieties, improving cultural practices, and forecasting production.

In making the analysis, the best available estimates of average corn yields in the three States for the years 1890-1939 inclusive, published by BAE, were use together with temperature and precipitation data made available by the Weather Burpau, Department of Commerce. Such data are sufficiently extensive so that a equation containing a large number of constants may be fitted with some degree of confidence in the outcome.

The fundamental concepts of a regression equation developed by earlier investigators were retained in this tudy. The theory was merely extended to include joint relationships of the two weather factors used in the analysis.

The effect of temperature and precipitation during June, July, and August was investigated. Since such effects are not constant through the growing season, analysis of the data was designed to measure these effects separately for each of the months and for each week during the period. The analysis disclosed that high temperatures have a beneficial effect on final yield when sufficient moisture is available and a detrimental effect on yield when the moisture supply is deficient. The beneficial effects of high temperature increase as the available moisture supply is increased and vice versa. The effects of precipitation are influenced by the temperature. The beneficial effects of above-average precipitation and the detrimental effects of below-average precipitation increase as the temperature is increased. The effects of temperature and precipitation on corn yields in Ohio and Indiana are greatest at about midpoint of the growing season. In Iowa, the effects of temperature and precipitation appear to be greatest early in the growing season.

The success of this analysis leads investigators to believe that there is no reason why other weather factors could not be included in such analyses, in addition to temperature and precipitation. Each weather factor that is included would increase the number of constants to be evaluated from the data, but there are a few additional factors that might be included to good advantage. Relative humidity, evaporation rate, and infiltration have been suggested.

Research Saves Soybean Growers Money: Soybean growers in the Middle West during past processing seasons suffered considerable loss through dockage at the elevators because of the presence of a high percentage of green beans. They are now assured of relief from such dockage, which has been running from 5 to 30 cents a bushel, as a result of studies made by chemists of the Department of Agriculture. They found that the retention of the green color is apparently the result of hot, dry weather in late summer, but that the green beans are of normal composition. They also determined that the green color that went on into the oil when the beans were crushed could be removed simply by increasing the usual amount of bleach. These findings brought about a liberalization of the dockage, resulting, according to estimates, in a saving of $1,000,000 to soybean growers in Illinois alone.

Plant Growth Regulators: In 1939 F. E. Gardner, P. C. Marth, and L. P. Batjer, of the then Bureau of Plant Industry, (now the Bureau of Plant Industry, Soils, and Agricultural Engineering), tested the effectiveness of a number of different growth-regulating substances in preventing preharvest drop of 19 leading commercial apple varieties. Two compounds, naphthaleneacetic acid and naphthalene acetamide were outstanding and about equal in effectiveness in preventing fruit drop. The sodium, potassium, and ammonium salts of naphthaleneacetic acid were also found to be very effective. Soon after publication of the results several proprietary spray compounds containing either naphthaleneacetic acid or naphthalene acetamide as the active ingredient were placed on the market. In general, commercial orchardists have found these sprays of considerable insurance against fruit loss from preharvest drop over a period of several years.

These research workers, delving deeper into the secrets of plant growth regulation have unearthed many other new facts which may some day be of practical application. Dr. Marth has demonstrated the feasibility of controlling the time of emergence from dormancy of certain nursery stocks by suitable application of plant harmones. By such treatments the storage period may be prolonged to permit later planting of more vigorous material and to retain more of the original vigor in the planting material. Gardner and Marth corroborated the results of another scientist in the artificial production of seedless fruits, of holly, grapes, and strawberries through the use of these growth-regulating substances.

Forest Grazing in Southeast Cattle Production: In the Coastal Plain of Georgia and North Carolina cattle are usually truned loose in the woods each year to make the best use they could of the understory of grass and other low vegetation to be found there. With the growing need for meat for the Army bases and war plants established in the Southeast, interest in making better use of native forage has developed. Research by our Appalachian Forest and Range Experiment Station (in cooperation with the Bureau of Animal Industry, Bureau of Plant Industry, Soils, and Agricultural Engineering and the State experiment stations) has shown during the past years that the native forage of the Coastal Plain provides a cheap and valuable source of feed on which an efficient and profitable livestock operation can be based. This native forage must be supplemented during the fall and winter, however, when the forage is deficient in protein and minerals.

Potato Machinery Revised for Contouring: In the potato-growing area of Aroostock County, Maine, as in many other parts of the United States, productive topsoil is no more than a thin mantle over virtually solid bedrock. An entire agricultural industry for the county is thus dependent on retaining and building up this vital layer of soil.

Contouring and terracing across the slope, urgently needed soil-conserving practices, have now been made practical for the rocky, hilly country through deft revisions readily adaptable to standard potato machinery. This achievement in machinery design, worked out by J. W. Slosser of the Soil Conservation Service has an immediate value in the far northern county where a short growing season puts a premium on efficient, rapid operation of the potato planter, sprayer, and digger. Contouring alone has been shown to increase potato yields by 30 bushels an acre, an increase that would more than repay the cost of the research in one season. At the Presque Isle, Maine, Experiment Station and on a nearby research farm the potato planter, spray rig, and digger were put through their paces on the contour.

The planting operation is the most important single process in potato culture and one of the most difficult. The heavy planter, as originally made, would slip sidewise on the curving slope-crossing rows of contoured fields, and seeding and fertilizer parts were too far apart to track, one behind the other, accurately around a curve. By reversing fertilizer boxes, reducing the leng[illegible]length of the machine (incidentally saving some 80 pounds of metal), soil conservation technicians made the planter into a compact unit that rounds the curves of contour rows, accurately placing seed pieces in spaced drills and distributing fertilizer in the same rows. Fertilizer openers and seed shoes, redesigned to allow for full floating action, reduce field breakage from stones. There is no side slippage on slopes up to 18 percent.

Originally the potato sprayer, operated by two men, was drawn behind a tractor. Distance of spray mechanism from the front wheels caused damage to the vines as the sprayer failed to follow accurately in the path of the tractor on the curve. Mounting the spray rig on the front of the tractor makes the operation a one-man task, and simple guards on the wheels protect the vines.

The digger, necessarily wide, would tumble potatoes, dirt, and debris to the lower side of the tilted bed when operated across slope, damaging or losing much of the crop. By making the side wheel adjustable to the slope, Technician Slosser has made it possible to keep the revolving "conveyor belt" or bed of the digger accurately level, properly separating potatoes from vines and soil. These inexpensive revisions, worked out through careful field trials and machine shop designing, are readily applied to standard equipment, economically and efficiently retooling potato farming for soil and water conservation.

Hybrid Corn: Hybrid corn, a product of scientific research, reached the stage of most vigorous commercial development at the time World War II had raised food demands to the highest point in history. It is an outstanding example, perhaps the most outstanding example, of the influence of theoretical scientific research in revolutionizing the production practices of an agricultural crop.

Since the method of hybridizing corn was first suggested by G. H. Shull in 1909, the present perfection of commercial hybrids has been developed through combined and cooperative efforts of many breeders, both in the Agricultural Research Administration of the Department of Agriculture and in State experiment stations. The Department has been working on the problem since 1916, and the present leading hybrid, U. S. 13, was developed by the two groups of plant breeders.

Although the first hybrid seed involving inbred lines was produced in 1921 in Connecticut, the industry did not really get started until nearly 15 years later. In 1943 nearly 52 percent of the country's corn acreage was planted to hybrid varieties, and almost the entire acreage in some of the leading corn States. Since well-adapted hybrids increase the yield about 20 percent, it is estimated that the 1943 production as a result of their use was 669,000,000 bushels more than it otherwise would have been. This gain is equivalent to 7,360,000,000 pounds of pork, or 54 pounds for each man, woman, and child in the United States.

Forest Economics: Several years work by the Forest Service Division of Forest Economics on the complex problem of Federal contributions in lieu of taxes on national forest lands culminated in the issuance of the Federal Real Estate Board's report, Federal Contributions to States and Local Governmental Units with Respect to Federally Owned Real Estate (1943: H. D. 216). The recommendations of the Board were based on and are wholly consistent with the contribution plan developed by the Service but generalized for application to the several types of federally owned conservation lands. The release of the Board's report constitutes a major landmark on the road to a permanent solution to the thorny contributions problem.

The investigations in process on the experimental forest at Crossett, Ark., have been aimed at the basic financial problem of forestry--i.e., how to harvest more and better forest products, yet keep the forest lands in condition to meet future needs. The completion of the first comprehensive report on the results of these studies (entitled "Financial Aspects of Selective Cutting in the Management of Second-Growth Pine-Hardwood Forests West of the Mississippi River") is a landmark in this phase of forest research. The economic practicality of partial short-interval cutting in the shortleaf-loblolly type of southern pine forest has been demonstrated conclusively. It has been shown that good forestry is good business. This is precisely what has been needed to accelerate the adoption of sound management practices on private forest lands, and the wholesome results of this impetus are already in evidence throughout the South.

The Otsego Forest Products Cooperative Association, Inc., at Cooperstown, N. Y., has been sponsored by the Service as a pilot plant for the development of cooperatives in the farm forest field. After a slow and difficult organization stage, this Association has now attained a stable level of continuous operation. It is by far the largest cooperative now functioning in the farm forestry field, with 934 members and thoroughly modern processing plant equipped with bandssaw. Local community interest in and support of the project has grown steadily. In the face of current operating difficulties and the pressure of other types of farm enterprise, plant operations have been adapted to wartime exigencies, and almost 2 million board feet high-quality lumber were turned out during the past year, most of which channeled directly to war uses. Management practices on farm woodlands throughout the area have been improved markedly, and the financial returns from the sale of forest products by Association members have been stepped up appreciably.

Milk Constituents: Over the years Department of Agriculture scientists have performed notable work on butterfat, casein, and other milk constituents. Work done early this century showed that it was unwise to use high-acid cream in making butter, and thus revolutionized butter making the world over. Butter made from pasteurized, nonacid cream was found to have excentional keeping qualities. More recently George E. Holm, George R. Greenbank, and others in the Bureau of Dairy Industry have given close study to the oxidation of fats and the relationship between such oxidation and changes in the flavor of butter and whole-milk powder. These investigations, initially in the field of pure research, resulted in many very practical applications to a wide variety of fats and oils. In April 1942 Holm received the Borden Award for his work which had led to a far better understanding than ever before of why fats and oils spoil and of methods of preventing spoilage. As a result of these investigations improved methods of handling and preserving whole-milk powder were ready when war made them urgent.

Holm's work on proteins and other milk constituents has also been outstanding. He perfected a method of preparing pure butteroil and so packaging it that it would keep almost indefinitely under extreme climatic conditions. He discovered long ago that fats do not spoil unless a certain amount of oxygen is present to combine with them. Studies of casein have made possible the large-scale production of a very pure product. Both grading and manufacturing processes have been improved. Department scientists have also discovered how dairymen may avoid the development of undesirable odors in milk caused by feed flavors. Millions of gallons of milk are rejected from the fluid-milk market annually because of bad flavor or odor, so caused. If all dairymen observed the recommended feeding practices it is quite probable that $15 or $20 million a year would be added to their incomes.

Palm Oil Substitute: Imported palm oil was used before the war not only for making shortening, oleomargain, and soap, but also in the manufacture of tin plate and terne plate. More recently it had come into use in the cold-reduction process for sheet steel. When our imports of palm oil were largely shut off by Japanese conquests, substitutes had to be considered. The literature was rather conflicting, the cooperation of manufacurers and consumers was sought and, as it proved, the exact properties which made palm oil so suitable were unknown. Dr. K. S. Markley and associates of the Bureau of Agricultural and Industrial Chemistry's Southern Regional Research Laboratory, set to work. They first considered a hydrogenated cottonseed oil because that had been tried as a substitute for palm oil in World War I. Ordinary cottonseed oil was known to be unsuitable and the more highly hydrogenated oils also proved unsatisfactory. Finally a semi- or medium-hard hydrogenated cottonseed oil was found to approximate palm oil in properties. Upon test it proved extremely satisfactory. This tailor-made oil costs about twice as much as palm oil, but lasts three times as long.

Forest Products Research: Experimental work on wood and paperboard container problems has been carried on at the Forest Products Laboratory of the Forest Service for many years, but has been expanded manyfold since the job of solving the packaging, loading, and shipping problems for all ordnance equipment and supplies was assigned to the Laboratory in 1942 by the Army Ordnance Department. Not only have hundreds of items, including antiaircraft guns, armored trailers and cars, ammunition, mobile shop trucks, rifles, and "bazookas," been protected

against damage or loss by redesigned or newly designed containers, but great economies in shipping space have been worked out, so that considerably fewer ships are required when shipping space is a vital consideration in shipment of supplies for support of our troops in different parts of the world, as well as in Lend Lease shipments. Detailed procedures of cleaning, rustproofing, and wrapping, many artillery items were worked out and many commercial greaseproof and waterproof papers were tested to determine their suitability for wrapping Ordnance equipment for overseas. Assistance is also given the Army Air Force and the War Food Administration in solving packaging and shipping problems.

Production of wood sugar from wood waste and low-quality timber has been greatly advanced by recent pilot-plant investigation by the Laboratory at the request of the War Production Board. This important contribution to the war effort is a development and application of the German Scholler process. The results were highly satisfactory in production of wood sugar, from which ethyl alcohol or high protein livestock feed can be produced. Plans are about completed for the erection in this country of the first commercial plant for the production of wood-sugar alcohol. The large-scale production of alcohol from wood waste will aid considerably in conserving grain for domestic and Lend-Lease needs. It has been shown that a number of chemicals of military importance can be derived from the lignin in wood waste and pulp mill waste liquors, including alcohols, glycols, tar acids, hydre-carbons, naphthene, and heavy, high boiling oils.

Papreg, the high-strength resin-impregnated paper plastic, developed at the Laboratory, has been adapted to many military uses, such as equipment cases, aircraft ammunition boxes, gunner's seats, and parts for gun turrets. The developments include laminated paper plastics filled with low-cost lignin recovered from waste pulping liquors; these have possibilities as substitutes for the conventional resin-bonded paper plastics. The lignin has possibilities as an extender for the critical phenolic resins commonly used in these products.

Hydraulic Design of Drop Structures for Gully Control: Taming the rush of eroding water is an essential part of soil conservation. A recurring problem for hydraulic engineers in construction of concrete drop structures to control arroyos or gullies has been undermining by the scouring action of the water. A safety measure against this is the stilling basin incorporated in the design of the drop structure at its base. Heretofore each of these basins or shelves to catch and tame the falling stream has been designed as part of a specific structure.

Now, the Research Division of the Soil Conservation Service has brought a "gully washer" into the laboratory and poured it into a series of stilling basins varying in depth and length. Watching the glassed profile of the stream as it flows through drop structure and stilling basin, SCS men have taken movies of the flowing water, measured its speed, determined its patterns as related to erosion. From these laboratory measurements and observations, engineers have formulated rules for the construction of these basins, designed to save them from being washed out in the flash floods of the Southwest and southern California. By formulating a general dependable solution for this comparatively small erosion problem, SCS scientists have effected an inestimable saving in cost of materials and in the prevention of possible failure.

Master Sample: The value of devising a uniform and integrated system for making agricultural surveys has become more evident since the war started, and in answer to the need the Bureau of Agricultural Economics has set up a "Master Sample", a sample of farms which is in effect a small replica of all the farms in the United States. Principal features of the plan include:

1. Three independent samples, each containing approximately 100,000 farms, or 1/54th of the farms in the United States. Used separately, they will each provide a cross-section of American farms or they can be combined to make one national sample of about 300,000 farms. 2. Sampling of every county in the United States containing agricultural enterprises. Within each county the sample is stratified geographically. 3. Selection in each such county of small sample area (sampling units) which, on the average, consist of clusters of about six farms each. The average number of farms in a sampling unit will vary from one part of the country to another because of sampling problems involved. The average is lowest in the Corn Belt and highest in some of the southern States. 4. Use in conjunction with the Census of Agriculture. The Master Sample will be highly effective here; it can be regarded as a part of the census and used to provide a selection of schedules for quick preliminary tabulations. 5. Selection of samples from it for studies on such topics as home canning, victory gardens, or manpower, since the Master Sample can be used to sample the rural population as well as to sample farms.

The Master Sample, because it provides a great increas in sampling efficiency over current methods, will provide the same information with smaller samples as is now obtained through larger surveys; or if a sample of the same size is used, its greater precision will provide more complete and more accurate information than is now obtained. It will also yield greater accuracy per dollar spent than is now possible.

No. 6
Revised January 1, 1945
A USDA Document

U. S. DEPARTMENT OF AGRICULTURE

Office of Information
Mr. Harding, 4842
Miss Arnold, 4875

IMPORTANT RECENT ACHIEVEMENTS OF DEPARTMENT OF AGRICULTURE SCIENTISTS

Tannin-Producing Sumac: Since imports of Sicilian sumac were halted by war, Soil Conservation Service hillculture scientists have successfully developed practical ways to select, grow, and harvest erosion-controlling sumac for the kind of tannin needed for the tanning of fine, pliable leathers.

Principal drawback to profitable tannin production in this country has been the prohibitive amount of hand labor required for harvesting. In cooperation with the Iowa Agricultural Experiment Station, SCS has developed mechanical harvesting, drying, and baling processes that permitted the production, for commercial tanneries in 1943, of about 26 tons of sumac leaves from only a small area. This achievement may foreshadow a profitable new farm crop that can be grown with benefit to the soil on hitherto wasted steep slopes and eroded land.

At the Floris, Iowa, Hillculture Farm managed cooperatively by SCS and the Iowa Station, contour plantings have been made of white sumac seedlings, selected for their tannin-producing qualities. High-yielding strains of both white and black sumac common to the Eastern States are being selected for further experimental planting.

At the Floris Farm, scientists designed and assembled a sumac harvester to gather only the leafy tops of the plant. Mine-blower and air tunnel completed the drying and a thresher separated tannin-containing leaves from stems. A hay baler packed the leaves in 75 pound bales. As a result of this pioneer harvesting effort, farmer programs are now under way for collection of sumac leaf.

Cork Substitute: Noreseal, a cork substitute, is a wartime product developed in the Northern Regional Research Laboratory of the Bureau of Agricultural and Industrial Chemistry, at Peoria, Ill. It can be made from the pith of such farm waste residues as cornstalks, peanut hulls, sugarcane bagasse, and similar material. It can be made in rod or sheet form, or poured directly into the cap of the bottle, and is particularly satisfactory as a seal for bottled beverages. The product is now in semi-commercial production, and bids fair to remain a successful enterprise after the war is over. It is the final result of literally hundreds of experiments.

Naval Stores Yields Increased: Naval stores research by the Forest Service has recently developed methods by which naval stores yields can be increased 40 percent or better on commercial operations by applying chemicals to freshly chipped trees. The method results in higher money returns to the operator, ranging roughly between $400 and $700 additional net profit per crop of 10,000 trees, depending on how faithfully proper methods of chemical stimulation are followed. The three methods developed in this research and currently recommended to and tried by the industry are: (1) Application of sulphuric acid for the first 6 to 8 streaks to get

newly worked timber into full production early in the year; (2) Periodic acid treatment to all streaks chipped during spring and summer months; and (3) skip-acid treatment--the timber is chipped weekly but acid is applied only every other week. The second procedure gives the highest yields, but where labor is scarce, the first or third method is advantageous.

Phosphate Drink for Cattle: Cattle in southern Texas have been getting phosphate drinks, with benefit to their health and growth, in experiments conducted by the Bureau of Animal Industry and Texas scientists in cooperation with the King Ranch of that State. The phosphates are added to the drinking water to make up for insufficient supplies of phosphorus in the native vegetation. In the past some stockmen have added bonemeal and other forms of phosphorus to the feed and placed it in self-feeders. Still others have applied superphosphate to the soil as a fertilizer. Putting the phosphates in the drinking water, besides being convenient for the cattle owner, enables each animal to get its supply in a soluble form readily assimilated. The phosphate salts have been given experimentally in two forms, disodium phosphate and defluorinated triple superphosphate, in quantities sufficient to supply 6.5 grams of phosphorus in 6 gallons of water. The defluorinated product must be used because of the poisonous effect of fluorine. The treatment has resulted in more productive breeding stock and better gains by calves

"Staypak" is a form of compressed wood of high density and strength, is another new Forest Products Laboratory development. Compreg and Impreg, wood impregnated with synthetic resins, are earlier developments which promise to make wood adaptable to many specialized uses. By compression, the density and strength of the impregnated wood can be increased.

"Uralloy": is the Forest Products Laboratory's name for a group of products resulting from development of methylolurea treatment of wood to make it harder, stiffer, and more stable dimensionally. Three public service patents have been granted covering the Laboratory's basic work on the treatments and products.

Scientific Collections: The maintenance of large collections of small quantities of viable seeds of many varieties of important economic crops and cultures of organisms of importance to agriculture is part of the work of the Bureau of Plant Industry, Soils, and Agricultural Engineering. Many of the items in these various collections are kept in cold storage, which reduces the frequency of regrowing crops to supply viable seed. In addition to the collections of seeds of crop plants, there are also collections of fungi and of soil bacteria. These collections have proved an important factor in the process of scientific work in many places outside the Department and even in other parts of the world. For example, the mold Penicillium, found by an English scientist to produce a powerful bactericide, was identified for him by Department scientists at Beltsville, Md., who started an extensive mold collection.

The various lots of seed of crops are usually regrown every few years to maintain their viability so that when needed they may be drawn upon for use by Department plant breeders, State experiment stations, or elsewhere. The plant scientists have recorded, insofar as possible, the characteristics of the various varieties so that when attempts are made to create a new variety to suit different conditions promising genetic material may be readily located.

The Department's collection of wheat varieties totals approximately 8,500 drawn from every country where wheat is grown. There are about 300 varieties in the corn collection, including a large number grown by North and South American Indians, and modern varieties that have been or may be used in the development of hybrids. The Department has 4,000 varieties of barley, 3,000 of oats, 1,000 of rice, 400 of flax, and between 200 and 300 of sorghums.

The Plant Industry Station at Beltsville, Md., now has an herbarium collection of fungi, mostly those which grow on food plants or other plants of economic importance, that totals nearly 450,000 specimens. Through possession of this extensive museum of fungi it is possible for the Department's mycologists to identify specimens for scientific workers and for other purposes.

The Department also maintains at the Station one of the largest collections in the world of soil bacteria, including hundreds of strains of legume nodule bacteria which are kept in standard cultures for comparison with cultures offered for sale to the public. The different strains of soil bacteria of all kinds are available to scientists anywhere in the world. These collections have been an important means for cooperation in carrying on scientific work.

Louse Powders for the Armed Forces: For the treatment of man for destruction of lice two formulas of louse powders were developed by E. F. Knipling and his associates in the Bureau of Entomology and Plant Quarantine at Orlando, Fla. Body lice were maintained in a colony, and research subjects were hired for feeding the lice and for conducting a large number of tests with insecticides. Materials showing promise in jar tests were applied to the inside of the sleeve and legs of underwear and this portion of the underwear was then taped onto the leg or arm of the research subject. Various stages of lice were introduced into these abbreviated garments where they remained for 24 hours. At the end of this time, the number killed by the treatment was determined. In the case of promising lousicides new lice were added to the garment each day to determine the period of effectiveness.

In this manner an activated pyrethrum powder known as MYL was developed. This powder killed lice for one to two weeks and in most instances a single treatment was sufficient. However, a formula containing DDT gave protection for three weeks and sometimes longer. This material remained in the clothing long enough to kill the young as they hatched from the eggs; therefore it was not necessary to add an ovicide as was done in the MYL treatment. These powders have been adopted by the Armed Forces and have been the means of controlling typhus epidemics in the present war.

Small-Type Turkey: Since about 1930 there has been a simultaneous increase in the number of turkeys raised and in the average size of turkeys produced. However, there has not been a corresponding increase in the demand for the heavier birds and this has resulted in a price differential of from 1 to 6 cents per pound in favor of smaller market turkeys. This demand on the part of consumers seems to be based on sound considerations and is likely to be permanent. In view of this trend, the Bureau of Animal Industry in 1934 at the Research Center, began an experimental project on the development of a small-type turkey. Marked progress has been made in fixing the desired characteristics in this small-type turkey.

Several standard varieties, the wild turkey, and White Austrian turkeys imported from Scotland have been crossed in the development of this small-type turkey. From the crossbred progeny selections are being made. The chief characteristics desired are as follows: Live weight of young toms at market age, 12 to 17 pounds; corresponding weight of young hens, 7½ to 10 pounds; color, white; a compact body with moderately short legs, moderately long keel bone, and an abundance of meat, especially on the breast and legs; early maturity, resulting in a finished condition (U. S. Prime) with respect to fat, fleshing, and feathering at the age of 24 weeks; reasonably high egg production and high fertility, hatchability, and viability.

Soil Conservation Research: Soil- and water-conserving farming methods are carefully devised to salvage and rebuild that valuable raw material, the soil, for continued production. These methods are combined as needed in a soil conservation farm plan which puts each acre of the specific farm so planned to the use for which it is best suited, protected with the appropriate conservation practices. In short, such a farm plan redesigns the farmer's factory for efficient, modern production. As in the modernizing of an industrial plant, every change is based on thousands of carefully controlled laboratory tests and closely watched field trials, coordinated under the direction of the Research Division of the Soil Conservation Service.

Today 19 soil and water-conservation experiment stations located in farming areas throughout the country are delving into the secrets of soil, rain, wind, and growing crops. By studying the private life of a raindrop SCS scientists have devised a unique rain machine that can be regulated to produce every variation in rainfall from a gentle drizzle to a drenching downpour on various types of soils and crops. Tilting plats of earth that can be sloped to an accurat degree have helped determine the comparative soil-holding powers of various grasses and other close-growing plants on sloping fields. Fine-gaged laboratory instruments and ingenious weather-imitating devices are adding, bit by carefully weighed bit, to the store of tested facts that make it possible to adapt soil-saving farming methods to the specific needs and capabilities of each acre in a wide variety of agricultural areas.

Sweetpotato Starch: The sweetpotato promises to become an important industrial crop, as the result of the development by the Bureau of Agricultural and Industrial Chemistry, of a process for making high quality white starch. A growers' cooperative of more than 1,000 members at Laurel, Miss., has produced in a single season as much as 3,000,000 pounds of starch. Already the product is being used for sizing and finishing in cotton mills and by the laundry, baking, and confectionery industries. This new enterprise offers farmers an opportunity to add another profitable cash crop to their present farm programs. A large plant is being built this year at Clewiston, Fla., that is based on the results of research by the Bureau.

Lacquer From Cow's Milk: With war limiting supplies of tin available for coating milk cans, dairy scientists are now looking to the cow herself to furnish some of the critical materials needed in transporting and packaging her product.

Paul D. Watson, associate chemist of the Bureau of Dairy Industry, has developed a lacquer substitute for the tin coating on cans used for evaporated and condensed milk and on the cans used for shipping fluid milk and cream. Watson's lacquer, on which he has filed applications for 2 public service patents, is made largely from lactic acid, with a small proportion of castor oil or some other vegetable oil.

Lactic acid is obtained by fermenting the milk sugar in whey, which is a by-product of cheese and casein manufacture. Commercial production of lactic acid from whey, as well as from other agricultural sources, is already established. Finding a profitable outlet for all the whey produced at large cheese factories has long been a difficult problem.

Preliminary tests with the new lacquer, both in the Bureau's laboratories and by several manufacturers of coating materials for metals, have given promising results. All the ingredients needed to make the lacquer are readily obtainable, and no unsurmountable difficulties in making or applying the lacquer are apparent, Mr. Watson says.

Although the Bureau's research has been directed mainly toward insuring a supply of suitable containers for milk and other dairy products in spite of the tin shortage, protective lacquers that can be applied directly to iron and steel and other materials would be of value to the whole sheet-metal industry. The Bureau's new lacquer is also suitable for many purposes other than a protective coating. It may be used for impregnating, gluing, and molding various articles.

Gas Treatment Worth Millions to Citrus Growers: Many oranges, though ripe, lack the full yellow color expected of the fruit. This handicap has been overcome by results or research conducted by the Bureau of Agricultural and Industrial Chemistry, beginning in 1923 and lasting about 12 years. By treating a green-colored orange with ethylene gas the green color is bleached out, leaving the orange a beautiful yellow. This treatment, now in general use, cost the taxpayers about $4,000 and is estimated to be worth about $4,000,000 a year to the producers of citrus fruit in Florida alone and about the same amount to producers in California.

Dye Research Worth Millions: The gay fast colors that men and women are wearing today are largely the result of research by chemists of the U. S. Department of Agriculture during and immediately following the first World War. This research developed new technical methods for the production of intermediates, fast and brilliant dyes for cotton. This one piece of research has expanded the cotton market more than a million dollars a year, as well as providing the public with gayly colored clothes that will not fade.

Phenothiazine as an Anthelmintic: Phenothiazine is a synthetic organic chemical first prepared in the latter part of the nineteenth century. It is one of the thiazine dyes. Following the discovery and announcement that phenothiazine was effective as an insecticide, its value as an anthelmintic was studied and established in 1938-39 by Harwood, Jerstad, and Swanson, workers of the Bureau of Animal Industry. Experimentation with this drug has been continued to

develop the best methods of use. Phenothiazine is now widely recognized throughout the world as a highly effective anthelmintic for the removal of many injurious internal parasites of domestic animals. It is the most valuable single drug so far discovered for combating such parasites. The drug is distributed commercially in powder form and may be administered either in gelatin capsules, in ground feed, in salt, or as a drench, the choice depending usually on the species of animals and preferred method of handling them. For use as an anthelmintic, phenothiazine should be the pure product prepared especially for that purpose.

In 1-ounce doses phenothiazine rids sheep and goats of stomach worms, nodular worms, hookworms, and related pests. Its use prevents the spoiling of the sheep's intestines by nodular worms, thus providing us with additional war material for making surgical sutures at a time when they are greatly needed. In suitable doses which vary with the size of animal, phenothiazine is effective in removing several kinds of parasites from swine, cattle, horses, and mules. In very small doses this drug is effective also in removing cecal worms from poultry. These are the worms that transmit blackhead to chickens and turkeys. The extensive use that phenothiazine already has acquired for controlling animal parasites is evident from the quantity--about 3 million pounds--used in the United States in 1943. Very recently a mixture of 9 parts salt and 1 part phenothiazine has been found largely to prevent acquisition of the parasite, when made available to sheep.

New Method for Dehydrating Cheese: A new method for dehydrating natural American Cheddar cheese for lend-lease or other uses, which is more direct than the commercial procedures now in use and which will also release spray-drying equipment for drying other foods, was developed in the Agricultural Research Administration.

Mr. George P. Sanders, of the Bureau of Dairy Industry, who devised the new method, found that if natural full-fat cheese is grated and then partly dried at room temperatures, the fat will be sealed up in the numerous case-hardened particles of curd. The particles can then be dehydrated in a tunnel drier or by any other heated-air method, without loss of fat.

Heretofore, commercial companies have been unable to use direct methods in dehydrating cheese of normal fat content, because the heat of dehydration caused the fat to melt and run out. Some processors have overcome this difficulty by first processing the full-fat cheese with heat and water, and usually with a chemical emulsifier, into a milky paste that can be spray-dried. In another commercial process, the fat is removed from the milk used in making the cheese and then added to the dried cheese.

The Bureau's new method is more direct and the resulting product is a natural cheese, minus only the water. Natural Cheddar cheese in its original state usually contains about 36 percent water, but the dehydrated flakes as prepared in the Bureau's laboratories contain about 3 percent water. The dehydrated flakes thus contain all the fat and other solids, but weigh only two-thirds as much as the original cheese.

The flakes can be packaged loose or they can be compressed to the same density as the original cheese, or to two-thirds its volume. The compressed cheese can be easily broken up, and it can be consumed directly or used in almost any other way that cheese is ordinarily used.

If the flakes are compressed into rectangular or block form instead of the round shapes typical of natural Cheddar cheese, considerable additional storage or shipping space can be saved. Compared to the original cheese packed in round boxes, the dehydrated compressed blocks would occupy between 53 and 56 percent as much storage or shipping space.

"Hexes" Cattle Flukes: As a result of the resourceful experimentation of a Bureau of Animal Industry scientist who had formerly been a South Seas Island missionary, a successful chemical treatment for liver flukes--long a serious menace to cattle raising in parts of Texas and other western areas--has been devised and is now being used by the cattlemen.

The scientist who perfected the treatment is Dr. O. Wilford Olsen. Flukes are difficult to reach by medication, since they seek out the liver for attack. Scientists had found a drug with the five-syllable name, hexachlorethane, to be effective against these small, flat, leaf-shaped parasites, but it was difficult to administer because of its insolubility in water. Dr. Olsen found that bentonite combined well with hexachlorethane in water to make a smooth emulsion that was easy to give as a drench.

Once interpreter to the King of one of the South Sea Islands, Dr. Olsen found little difficulty in translating his scientific lore into language that practical Texas cattlemen found easy to understand. When Texas State prison officials let him try out the remedy on part of the prison herd, the results proved a convincing demonstration of the value of the treatment in liver fluke control. The mounting demand for Hexachlorethane that followed this demonstration led to substantial commercial production and distribution of the drug.

Dehydrating Food: Dehydrated vegetables take about one-third the ocean freight space required for similar products processed in other forms. Realizing this tremendous cargo saving opportunity, the former Agricultural Marketing Administration (now absorbed by the Office of Distribution) on May 26, 1942, announced a program to encourage expansion of the domestic industry to meet increased needs of American and United Nations military forces. At that time about 20 plants, with a production capacity of about 15,000,000 pounds, annually, were operating in the United States.

In 1941 chemists and engineers of the Agricultural Research Administration were at work in the Western Regional Research Laboratory on the basic research that made this quick wartime expansion of the industry possible. Immediately after Pearl Harbor, pilot plant, or semicommercial, dehydrators were quickly built and put to dehydrating vegetables. Around 500 million pounds of food were dehydrated in 1943, and much of it was done according to methods worked out in the Western Laboratory.

Investigations on the dehydration of meat got under way at the Beltsville Research Center, about the same time, leading to results having prompt commercial application. The methods worked out for the preparation, processing, and packaging of dehydrated vegetables were offered to the industry in 1942 through two dehydration schools, one at Rochester, N. Y., for the eastern half of the country and one at Albany, Calif., for the West.

To carry out the program, an interdepartmental committee composed of representatives of the Department of Agriculture, Army, and the War Production Board was set up. Last summer, the WPB, on the recommendation of Secretary Wickard and the Food Requirements Committee, established a bank of critical materials to permit conversion and construction of additional dehydration facilities. An additional bank of materials was provided in the latter months of 1942.

Norepol: Norepol, the rubber substitute from vegetable oils announced in 1942 by the Department of Agriculture as having been made in the Northern Regional Research Laboratory at Peoria, Ill., is now in commercial production. Two companies making rubber according to the Norepol formula have given the product trade names of their own. Other companies are turning out a finished product under the name of Norepol and some are making an intermediate material sold to manufacturers of rubber articles for the ultimate consumer.

The war has hastened commercial adoption of this infant industry that was in the pilot plant stage a short time ago. The pilot-plant policy of the agricultural Research Administration's Bureau of Agricultural and Industrial Chemistry--adopted with the establishment of the four Regional Research Laboratories for industrial utilization of farm commodities--has been a factor in getting the new product into use as well as speeding work on other rubber intermediates in the Department. The pilot plant serves as an intermediate stage between the laboratory test tube and commercial production. The wholehearted cooperation of industry had much to do with the rapid development of Norepol.

The Department first described Norepol as having a number of the valuable characteristics of natural rubber in considerable degree, including 200 percent stretch, tensile strength of 500 pounds to the square inch, and excellent resistance to oxidation and to the effects of water and alcohol. The general run of natural rubber has a 600 percent stretch and a tensile strength of 3,000 pounds or more. However, for certain purposes Norepol is highly useful.

Since the first public report, and as a result of tests in the Peoria pilot plant and by a number of factories, improvements have been made in the product. In particular, the necessary constituents can now be produced in purer form and there is better control of the polymerization process.

Tests at the Laboratory and in commercial plants show possibilities for many uses for Norepol, including molded and extruded articles--such as rubber heels, tubing, and gasket material. Because of the over-all rubber situation, careful choice must be made among the various possible uses. A point of much interest in the over-all economy of wartime is that what is left of vegetable oils after the separation of material for Norepol, including glycerol, can be used by industries that consume vegetable oils to make some of the same products they have been making from the whole oil.

Apple Sirup: One of the first wartime accomplishments to come out of the Department of Agriculture's Eastern Regional Research Laboratory, at Philadelphia Pa., was the development of apple sirup, a food product from sound but off-grade apples. It can also be made from apple peels and cores from canning and dehydration plants. It is a delicious table sirup, and especially fine for baking cakes, since its moisture-holding qualities prevent cakes from drying out rapidly. Apple sirup is also a good substitute for glycerine, now needed in making explosives, and is being used on large scale by one of the large cigarette manufacturers. Five commercial plants in the United States and Canada turned out more than 4 million pounds of apple sirup last year.

Photoperiodism: While working with Maryland Mammoth tobacco prior to 1920, W. W. Garner and H. A. Allard of the then Bureau of Plant Industry (now Bureau of Plant Industry, Soils and Agricultural Engineering) discovered that the plants flower only when the daily period of illumination is relatively short--that is, when the days are short and the nights long. When the light periods are long the plants remain vegetative. Subsequent experiments on many kinds of plants showed clearly that they differ greatly in the growth and flowering, responding with respect to the relative lengths of the dairy periods of illumination and darkness to which they are exposed, some conforming to the behavior of Mammoth tobacco, others responding to relatively long illumination periods, and still others being but little affected.

This discovery departed widely from the prevalent theory that more intensity of illumination was the principal light factor concerned in determining the characteristic growth, flowering, and fruiting of plants. It had great fundamental importance as pure research and, as it developed, widespread practical significance. Response to relative length of day and night largely explains why many plants flower only at certain seasons of the year, and it also largely explains changes in behavior where plants are carried from one latitude to another. It is now possible, by conducting experiments under controlled conditions, to tell in advance whether certain varieties of soybeans, peas, onions, timothy, barley, and other plants are adapted to the photoperiodic conditions known to prevail in specific localities. The experimental crops can be grown under greenhouse conditions anyway, with supplemental artificial light as needed; if none is adpated to the locality, one or more suitable lines can be bred.

This discovery has also been particularly helpful in selecting soybean varieties that thrive and produce abundant seed for making oil, plastics, and food products in various localities. It has enabled us to produce our own beet seed domestically instead of importing it as we did formerly. It enables us to select localities where pyrethrum, a long-day plant, will thrive in the United States, and also to cross plant varieties which would not normally flower at the same time, as in the case of sugarcane varieties. By artifically shortening the daily light period chrysanthemums and other flowers are now being brought to market ahead of their normal season. Recently it has been found that a plant is primarily influenced by photoperiodic conditions by way of its leaves. Thus a Biloxi soybean will bloom promptly if only a few of its leaves are subjected to a short photoperiod, It is all but impossible to calculate the flow of economic value from an original discovery so basic as that of Garner and Allard.

Forest Products Research: Under the sponsorship of the War Production Board the Forest Products Laboratory of the Forest Service undertook a pilot-plant study to develop methods for laminating ship timbers. The study has reached a stage where it is possible to produce acceptable glued white oak timbers under properly controlled conditions. Laminated timbers permit the use of lumber and reduce the demand for large timbers which have been difficult to obtain.

Basic Facts About Vitamin A: Basic contributions to knowledge of vitamin A have been made in the foods and nutrition laboratories of the Bureau of Human Nutrition and Home Economics.

To find out the vitamin A requirements of human beings, a few years ago research workers in the laboratories fed an experimental diet to a group of men and women volunteers. Day after day the group ate only meals prepared in the laboratory kitchen. This group received every nutrient that the human body is known to need except vitamin A, which was almost completely absent from the meals. Since one of the early measurable effects of vitamin A lack is night-blindness, that is, failure of the eyes to adapt normally to dim light, the appearance of this condition in the subjects was taken as a sign that the body had used up most of its stored vitamin A. As soon as a volunteer showed unmistakable evidence of nightblindness, he was given measured amounts of vitamin A, first in small and then in gradually increased doses until the vitamin A received was just sufficient to keep his vision in dim light normal.

Fish-liver oil, cheese, milk, cream, and eggs are the most common animal foods containing significant amounts of vitamin A. However, green leafy and some yellow vegetables and fruits contain certain orange pigments known as carotenes, which are changed into vitamin A in the body. In the first experiments, solution of standardized cod-liver oil and pure carotene were given to supply the "measured amounts" of vitamin A. Later the minimum vitamin A requirements were measured in terms of natural foods, using peas, spinach, and carrots as sources of vitamin A. It was found that in terms of International Units the body needed about 30 to 60 percent more carotene as found in vegetable foods than it did of vitamin A found in animal foods.

This information has special timeliness for the war period, since restricted food supplies cause civilians to lean more heavily upon plant foods for their vitamin A supply. From these vitamin A experiments have come data for estimating the daily minimum vitamin A requirements of the average, normal adult. The findings became part of the informational background used when the Committee on Food and Nutrition of the National Research Council set forth recommended daily allowances of vitamins and other nutrients as a nutrition yardstick for America.

In the first experiments, some subjects showed signs of vitamin A deficiency after two weeks of the vitamin A free diet, whereas others--probably better fortified by a reserve supply of the vitamin--showed no sign of lack for several months. To learn more about the body's ability to store this vitamin and the rate at which it is depleted, laboratory animals were used. The results showed that moderate amounts of vitamin A obtained regularly in meals are used more economically than occasional massive amounts.

This suggests the importance of building up a "vitamin A savings bank" by regularly eating somewhat more than the daily requirement of foods containing vitamin A, when possible. To serve as an aid in determining the vitamin A value of the normal diet, analyses of vitamin A value of 128 common foods in the raw and cooked state have been made and published in these laboratories.

The Bureau's vitamin A researches have progressed over a number of years. This work was started under the supervision of Dr. Lela Booher, more recently under the supervision of Dr. Elsa Orent-Keiles, while various scientists have held responsible posts in carrying out the work. Mrs. Elizabeth Callison had direct leadership of studies to determine human vitamin A requirements.

Aerosol: The project looking to the development of a fine-fog method of dividing and spreading insecticides was started in April 1941 by the Bureau of Entomology and Plant Quarantine and its results were put into practical use early in 1943. The new aerosol development was primarily the result of an idea originated by Dr. Lyle D. Goodhue and developed by him and W. N. Sullivan. The discovery includes principally an insecticide material with an activator that makes the mixture work better, dissolved in a highly volatile, noninflammable and nontoxic solvent which propels and atomizes the insecticide into a fog, all in a container which keeps the mixture under high pressure ready for instant release. The new aerosol got into use just in time to be of great value in the war. The entire output consisting of millions of containers has been requisitioned by the military authorities and is in use on the various fighting fronts to protect our men from irritations and dangers of mosquitoes, flies, and other insects. When this method of fighting insects can be made available for general use, its value will be incalculable. In other words, the principle of this method of control may be so important as to revolutionize many of the current practices for the control of serious pests.

Increasing Yield of Penicillin: The observations which led to the discovery of penicillin were made in 1929 by Alexander Fleming, a British scientist. He was annoyed to find one day that some stray mold spores were growing in a culture of germs he was studying. A germ-free zone around this stray mold indicated to him that it was giving off a substance that was killing the germs in his culture. This substance turned out to be penicillin. It was named for the mold which produces it.

But very little was heard of this discovery until the summer of 1941. At that time Dr. Florey and Dr. Heatley, two British scientists who were largely responsible for the application of Fleming's observations, came to this country to stimulate interest in the pilot-plant production of the new product. After conferences with members of the National Research Council and scientists of the Department of Agriculture, the men were sent to our Northern Regional Research Laboratory located at Peoria, Ill., and operated by the Bureau of Agricultural and Industrial Chemistry. This laboratory was selected because it had had wide experience in the use of molds in the fermentation field and because it had one of the largest collections of molds in the world.

Dr. Heatley stayed at the laboratory and went to work in cooperation with our fermentation experts to try to increase the yield of penicillin. The yield was so small at that time that it amounted to a bottleneck. They also developed

methods for purifying penicillin. These studies were supported by the Committee on Medical Research in the Office of Scientific Research and Development. The studies are still going on and have been of great value to those who are now working to perfect the commercial production of penicillin.

By proper feeding of the molds and by improving the strains of molds that produce penicillin, the laboratory workers were able to increase the yield one hundredfold. The work at our laboratory, as well as that in industrial laboratories, was so promising that Dr. A. N. Richards, Chairman of the Committee on Medical Research, called a meeting of representatives of commercial manufacture of pharmaceutical supplies in December of 1941 and made available to them the results of the work at the Northern Laboratory which had been so successful. Largely as a result of that conference, a number of industrial firms started the production of penicillin on a semi-commercial scale.

Penicillin is now being produced on a commercial scale by 21 plants in the United States and Canada. By the end of this year these plants will be turning out penicillin at the rate of 200 billion units a month. That's enough to treat 250,000 serious cases of infection. Scientists of the Department of Agrioulture have played an important part in the development of this drug. They increased the yield of penicillin more than 100 times. They developed the particular strains of mold which are used to make all of the penicillin now being produced. Their investigations made it possible for industrial firms to start commercial production at once. As a result of these accomplishments penicillin has been made available to our Armed Forces much sooner than would otherwise have been possible.

This is the sort of problem our four Regional Research Laboratories are prepared to solve. Their pilot-plant facilities enable them to take research beyond the test-tube stage and into semi-commercial production. Penicillin, promising as it is today, was not produced in sufficient quantities to make it of any great importance until research in the Peoria Laboratory found a way to increase the yield so that it was possible for industry to go ahead on a semi-commercial scale.

Disease Resistance in Crops: One of the greatest improvements brought about in crops by plant breeders has been the disease resistance, which, along with such characteristics as heavy yielding capacity and adaptability to various climatic conditions, has enabled farmers to produce much more on the same acreage, with the same quantity of fertilizer, and with less labor per unit. Notable among the crops which have been reinforced by disease-resistant characteristic are wheat, oats, potatoes, sugarcane, and sugar beets, but practically all crops, large and small, have been improved to some extent in this direction.

Each year sees the announcement of several new varieties of various kinds of crops, a large number of them owing much of their promise to disease resistance. In 1943 the Department of Agriculture issued 35 such announcements covering cereals, forage plants, vegetables, tree and small fruits. Some plant breeding accomplishments in disease resistance have become classics, such, for instance, as the saving of the sugarcane industry in Louisiana through the development of

varieties resistant to mosaic disease. The work which resulted in the development of sugar beets resistant to curly top comes near being in the same class, as does also the cooperative potato breeding program and the cooperative work on breeding disease resistant and high yielding cereals.

Research Helps Naval Stores Producers: Producers of gum naval stores are now getting over a million dollars a year more than they did a few years ago before chemists of the Department of Agriculture took the naval stores problem to the laboratory. Research in this field has given the industry a permanent set of standards for grading rosin, estimated to be worth $150,000 a year to pine tree farmers; developed better barrel gluing and an improved dehydrator for turpentine estimated to save the industry $250,000 a year; developed improved still settings worth $200,000 a year; a method for improving quality of pine gum, valued at $150,000 a year; developed methods for controlling turpentine distillation, worth $100,000 a year; introduced improved turpentine storage conditions valued at $100,000 a year; developed a new type steam turpentine still which, when used in conjunction with gum cleaning, is worth $2,500 a year to each user; advised producers how to prevent rosin losses in chips, resulting in savings of $200,000 a year; and proved that gum contaminated with iron rust from rusty equipment can lower the quality of rosin as much as 3 or 4 grades, reducing the income of producers of gum naval stores around half a million dollars a year.

New Poisoned Bait for Mormon Cricket: This bait, consisting of a sodium fluosilicate, mill-run bran, and sawdust mixture, is a development of the Bureau of Entomology and Plant Quarantine laboratory at Bozeman, Mont., and represents the combined work of a number of individuals under the leadership of John R. Parker. It was first given wide-spread use in 1939, and has resulted in savings of hundreds of thousands of dollars in control work during the past three seasons by reducing the costs of materials furnished by the Government and of labor in their application. Savings as a result of cooperative control efforts where this material has been used total in excess of $50 million in the last three years.

Speeding up Calcium Gluconate Production: Following up research which resulted in a practical method of using molds to ferment glucose into gluconic acid, which combined with lime as calcium gluconate, widely used in medicine, chemists have further improved the process by making it semi-continuous. They have discovered that addition of a small quantity of boron-compound promotes the biochemical process. Use of the boron, together with improved equipment and better molds as fermentation agents, makes it possible to produce calcium gluconate in about half the time formerly required.

Chemists of the Bureau of Agricultural and Industrial Chemistry, who began the research 12 years ago, found that the action of certain molds on a solution of glucose, or corn sugar, produces gluconic acid. This acid is important in the manufacture of calcium gluconate, a calcium or lime compound that can be assimilated by animals. Molds are microscopic plants and--like other plants--need air to grow. At first the molds were grown on the surface of shallow pans, but these were not adapted to large-scale use in manufacturing plants.

The chemists continued the experiments, and, in 1935, the Department of Agriculture announced the invention of a rotating drum in which the glucose solution is formented. The air which is necessary to the growth of the molds is forced into the drum at one end under pressure and is removed through the other end. After studying many molds to find out which ones are best for making gluconic acid for calcium gluconate, Department chemists reported that the best found so far is a mold known technically as Aspergillus niger (strain 3). This particular mold does a good job at formenting the glucose.

Though the rotating-drum method reduced the cost of making calcium gluconate from $150 to 50 cents a pound, the chemists encountered one difficulty with the process. When the molds were exposed to an increasing concentration of gluconic acid which was formed in the glucose solution, they stopped working. Calcium carbonate, or common chalk, was added to neutralize the effect of the acid, but the calcium gluconate produced was not very soluble and separated out, clogging up the drum. Then three chemists of the Bureau, A. J. Moyer, E. J. Umberger, and J. J. Stubbs, who had been studying fermentation processes, discovered that the addition of a little borax or boric acid to the fermenting liquor keeps the calcium gluconate in solution and lets the molds finish their work. Later, the calcium gluconate may be separated from the solution free from boron.

Improving Sagebrush Range Lands: On much of the 96 million acres of sagebrush range land in the West, range owners and operators have been faced with two very serious problems growing out of the prevalence of this very low-value shrub. On the one hand, sagebrush crowds out the vigorous growth of more valuable forage plants, makes herding difficult, contributes to the straying and loss of sheep, brushes considerable amounts of wool from sheep fleeces, and otherwise hinders effective livestock grazing. On the other hand, when the range has been burned in an effort to eliminate the brush and the necessary precautions have not been observed, a great reduction of valuable forage and loss of soil has usually resulted, to say nothing of occasional serious damage caused when the brush fires got out of hand and raged through other range areas or destroyed buildings and other private property.

A study completed in 1942 by the Forest Service has proved that heavy stands of sagebrush can be eliminated by burning with only negligible losses, and that when such burning is properly planned and executed and includes intelligent management of the range for a season or two after burning, grazing capacity will be greatly increased--60 to 300 percent increases have been recorded. Where planned burning is carried out, grazing animals are unrestricted in their movements, ewes produce a more steady flow of milk, and lambs make better growth and are seldom lost. These and other benefits fully justify the investigations necessary to develop those safe methods.

Preserving Chicken Feathers: Wet chicken feathers may be preserved for several weeks by a simple treatment, with salt and hydrochloric acid, developed by research workers of the Bureau of Animal Industry. Fifteen pounds of common salt and a pint of commercial concentrated hydrochloric acid are dissolved in 30 gallons of water, for each 15 pounds of wet feathers to be preserved. A tight 50-gallon wooden barrel makes a convenient container. Wet feathers are a by-product of chicken dressing plants, but normally they decompose too rapidly to

permit their shipment to feather-processing establishments. The preservative makes possible the industrial use of millions of pounds of chicken feathers that formerly were wasted or used as fertilizer. The new treatment is cheaper and more efficient than chemicals previously tried.

The method is essentially one of pickling. The solution costs initially only about 1¼ cents per pound of wet feathers treated. The expense is further reduced by the fact that several lots of feathers can be preserved in the same solution.

Smear 62 for Screwworms: This smear was developed by the Bureau of Entomology and Plant Quarantine at its laboratory at Menard, Tex., as a combined effort of the laboratory, largely the work of Roy Melvin. Its first practical test on a large scale was made in the summer of 1941. It is now widely used throughout the area where the screwworm occurs, and has probably been largely responsible for holding to a minimum an excessive and widespread outbreak during 1944, with resulting savings of millions of dollars worth of cattle.

Hybrid Onion: The first hybrid onion variety was released to growers by the Department of Agriculture in 1944 as a result of experiments started about ten years earlier. Producing hybrid onion seed on a commercial scale had seemed almost an impossibility because of the nearness of the male and female parts until plant breeders discovered a male sterile onion, which made possible hybridization with male fertile strains on a field scale. As a result of this discovery, scientists of the Bureau of Plant Industry, Soils, and Agricultural Engineering and the University of California developed the first commercial onion hybrid, California Hybrid Red No. 1, which is adapted to growing in central California, southern Utah, and southern Neveda. This new early variety has yielded at rates ranging from 460 to 768 100-pound bags per acre and is said to yield generally 50 percent more per acre than the usual early varieties for those areas.

The discovery of the strain of onion without fertile pollen has led to the production, through breeding, of other male sterile lines that promise to be useful in producing hybrid seed from combinations with other varieties. (A male sterile strain may be carried on by planting "head sets" and in other ways known to plant breeders.) As a result of the possibilities in male sterile strains the field is now open for the development of hybrid strains of various varieties for different regions, seasons, and conditions.

Targhee and Columbia Sheep: The development of the Columbia and Targhee breeds of sheep is not strictly basic research but has resulted rather from utilization of basic knowledge of genetics. The development of the two breeds represents a skillful application of genetic laws and principles by scientists of the Bureau of Animal Industry.

Major credit for the development of Columbia sheep belongs jointly to E. L. Shaw, F. R. Marshall, and D. A. Spencer. Credit for the Targhee belongs to A. D. Spencer and W. A. Denecke. In both cases several others, mostly geneticists and station directors, were involved.

The development of these breeds has exceptional regional importance from a production standpoint, since they are primarily adapted to the inter-mountain ranges of the West. But the breeds also have national significance from a commercial and a monetary standpoint because of the excellent quality of their fleece and meat. The earning power of Columbia sheep is estimated to be $1 to $2 a head greater than average well-bred range sheep. That of the Targhee breed is somewhat less.

The Columbia is the result of cross breeding select Lincoln rams with Rambouillot ewes and proceeding from this original crossbred by mating the most select first-cross rams with carefully selected first-cross ewes and interbreeding the rams and ewes descending from them. The foundation of the Targhee breed was laid by mating select Rambouillot rams with select ewes of Corriedale X Lincoln-Rambouillot, and Lincoln X Rambouillot combinations, and interbreeding the rams and ewes descending from these matings. The Targhee came from rigid selections of these matings.

Range Reseeding: Recent studies by the Forest Service at several western forest and range experiment stations have pointed the way to successful seeding of valuable forage plants on several million acres of depleted range lands. Increases in forage production of from 2 to over 10 times, enough to far more than justify the cost, result from reseeding in accordance with the principles so far developed. Ranges producing considerably less than their soil and climate can support are most promising for planting. Many valuable forage species are available for planting throughout the West, although comparatively few have so far been found suited to the driest and more severe sites. As a result of many tests, effective and economical methods of planting have been developed for most types of ranges. These provide for covering the seed, an essential consideration, and where necessary, preparing the soil and reducing the stand of low-value competing vegetation.

Scientific Sizing: Major savings to the clothing industry and to consumers alike are beginning to result from the Bureau of Human Nutrition and Home Economics' work on measuring women and children as a basis for sizing clothing. Lack of scientific data on the body measurements needed in sizing garments is at the root of the chaotic condition which has always existed in the sizing of clothing--particularly for women and children. Department stores complained of a $10,000,000 headache each year from returns and exchanges "because of wrong size." Mothers complained of wasting time, money, and energy buying clothes that failed to fit children at home--age of a child was no dependable guide to clothes sizes.

Gaining cooperation of 20 colleges and universities, and with funds furnished by the Works Progress Administration, scientific workers in the clothing laboratories, under direction of Miss Ruth O'Brien, weighed and measured nearly 150,000 boys and girls. Thirty-six clothing construction measurements were taken on these boys and girls, who ranged from 4 to 17 years of age and represented 16 States.

From data obtained, the Bureau recommended a two-way method of sizing children's clothes based on height and girth at hip. The height-hip system is very similar to the system by which men have bought their shirts and other garments for years

according to a few guide dimensions. The Bureau's scientists continued by measuring 15,000 women from 18 years old to 80. Fifty-eight measurements used in constructing patterns and garments were recorded, and weight was taken as a further check on bodily proportions. Universities and other institutions in representative sections of the country cooperated.

From the data, the Bureau recommended height and weight combined, rather than the customary bust measure, for predicting fit of full-length garments. For garments for the upper part of the body, height and bust combined offer the best guides to a fit. For lower trunk garments, height and hip girths are good guides. No single measurement is adequate as a basis for sizing garments and patterns, the survey conclusively showed.

As a result of these measurement studies, some pattern companies and clothing manufacturers are now making use of the new sizing system for children's garments. On the basis of the Bureau's work, new standards for body sizes for boys' garments have been adopted by the American Standards Association, which serves as a link between scientists and the trade. While awaiting developments in the women's wear field, one large mail-order house has already gone ahead to use the Bureau's data and the recommended sizing methods for sizing its women's garments.

Inexpensive, Effective Dip for Sheep Ticks: Derris powder or cube powder having a 5 percent rotenone content, added to water at the rate of 6 ounces of the powder to 100 gallons, makes an effective dip for eradicating sheep ticks, or keds, from farm and range flocks. The value of this inexpensive dip was determined by tests conducted by N. G. Cobbett and C. E. Smith, parasitologists of the Bureau of Animal Industry. In Colorado, Smith dipped over 1,000 sheep, representing 5 farm flocks. In New Mexico Cobbett dipped nearly 9,000 range sheep. The dip stayed in the fleeces of the sheep long enough to destroy the young ticks that emerged from the pupal cases remaining in the wool after dipping. This treatment has superior efficacy in killing ticks following a single dipping, and is, moreover, cheaper than the previously recommended commercial dips.

Stratified Flow: By caging a miniature river and reservoir in glass, the Soil Conservation Service, in cooperation with the California Institute of Technology, has discovered how to shuttle a silt-laden stream through and out of a reservoir by making enlightened use of the stream's own action. Since the annual cost of reservoir silting is estimated as high as 50 million dollars, this discovery promises to save the country vast sums in safeguarded power production, community water supplies, and irrigation.

Research of the Service's sedimentation specialists has established the fact that a stream retains its identity after entering a reservoir, continuing to flow in a layer through, under, or over the still water. Its action depends on temperature and the amount of sediment or silt it contains. A silt-laden current slides under the clear water of a reservoir as heavy cream poured into coffee slides under the clear, hot, brown liquid.

average precipitation and the detrimental effects of below-average precipitation increase as the temperature is increased. The effects of temperature and precipitation on corn yields in Ohio and Indiana are greatest at about midpoint of the growing season. In Iowa, the effects of temperature and precipitation appear to be greatest early in the growing season.

The success of this analysis leads investigators to believe that there is no reason why other weather factors could not be included in such analyses, in addition to temperature and precipitation. Each weather factor that is included would increase the number of constants to be evaluated from the data, but there are a few additional factors that might be included to good advantage. Relative humidity, evaporation rate, and infiltration have been suggested.

Research Saves Soybean Growers Money: Soybean growers in the Middle West during past processing seasons suffered considerable loss through dockage at the elevators because of the presence of a high percentage of green beans. They are now assured of relief from such dockage, which has been running from 5 to 30 cents a bushel, as a result of studies made by chemists of the Department of Agriculture. They found that the retention of the green color is apparently the result of hot, dry weather in late summer, but that the green beans are of normal composition. They also determined that the green color that went on into the oil when the beans were crushed could be removed simply by increasing the usual amount of bleach. These findings brought about a liberalization of the dockage, resulting, according to estimates, in a saving of $1,000,000 to soybean growers in Illinois alone.

Plant Growth Regulators: In 1939 F. E. Gardner, P. C. Marth, and L. P. Batjer of the then Bureau of Plant Industry (now the Bureau of Plant Industry, Soils, and Agricultural Engineering), tested the effectiveness of a number of different growth-regulating substances in preventing preharvest drop of 19 leading commercial apple varieties. Two compounds, naphthaleneacetic acid and naphthalene acetamide were outstanding and about equal in effectiveness in preventing fruit drop. The sodium, potassium, and ammonium salts of naphthaleneacetic acid were also found to be very effective. Soon after publication of the results several proprietary spray compounds containing either naphthaleneacetic acid or naphthalene acetamide as the active ingredient were placed on the market. In general, commercial orchardists have found these sprays of considerable insurance against fruit loss from preharvest drop over a period of several years.

These research workers, delving deeper into the secrets of plant growth regulation have unearthed many other new facts which may some day be of practical application. Dr. Marth has demonstrated the feasibility of controlling the time of emergence from dormancy of certain nursery stocks by suitable application of plant hormones. By such treatments the storage period may be prolonged to permit later planting of more vigorous material and to retain more of the original vigor in the planting material. Gardner and Marth corroborated the results of another scientist in the artificial production of seedless fruits, of holly, grapes, and strawberries through the use of these growth-regulating substances.

Forest Grazing in Southeast Cattle Production: In the Coastal Plain of Georgia and North Carolina cattle are usually turned loose in the woods each year to make the best use they could of the understory of grass and other low vegetation to be found there. With the growing need for meat for the Army bases and war plants established in the Southeast, interest in making better use of native forage has developed. Research by our Appalachian Forest and Range Experiment Station (in cooperation with the Bureau of Animal Industry, Bureau of Plant Industry, Soils, and Agricultural Engineering and the State experiment stations) has shown during the past years that the native forage of the Coastal Plain provides a cheap and valuable source of feed on which an efficient and profitable livestock operation can be based. This native forage must be supplemented during the fall and winter, however, when the forage is deficient in protein and minerals.

Potato Machinery Revised for Contouring: In the potato-growing area of Aroostook County, Maine, as in many other parts of the United States, productive topsoil is no more than a thin mantle over virtually solid bedrock. An entire agricultural industry for the county is thus dependent on retaining and building up this vital layer of soil.

Contouring and terracing, urgently needed soil-conserving practices, have now been made practical for the rocky, hilly country through deft revisions of standard potato machinery worked out by J. W. Slosser of the Soil Conservation Service. In the northern county, a short growing season puts a premium on efficient, rapid operation of the potato planter, sprayer, and digger.

Contouring alone has been shown to increase potato yields by 30 bushels an acre, an increase that would more than repay the cost of the research in one season. At the Presque Isle (Maine) Experiment Station and on a nearby research farm the potato planter, spray rig, and digger were put through their paces on the contour.

The planting operation is the most important single process in potato culture and one of the most difficult. The heavy planter, as originally made, would slip sidewise on the curving slope-crossing rows of contoured fields, and seeding and fertilizer parts were too far apart to track, one behind the other, accurately around a curve. By reversing fertilizer boxes, reducing the length of the machine (incidentally saving some 80 pounds of metal) soil conservation technicians made the planter into a compact unit that rounds the curves of contour rows, accurately placing seed pieces in spaced drills and distributing fertilizer in the same rows. Fertilizer openers and seed shoes, redesigned to allow for full floating action, reduce field breakage from stones. There is no side slippage on fields as steep as 18 percent in slope, or rising 18 feet for every 100 feet of horizontal distance.

Originally the potato sprayer, operated by two men, was drawn behind a tractor. Distance of spray mechanism from the front wheels caused damage to the vines as the sprayer failed to follow accurately in the path of the tractor on the curve. Mounting the spray rig on the front of the tractor makes the operation a one-man task, and simple guards on the wheels protect the vines.

The digger, necessarily wide, would tumble potatoes, dirt, and debris to the lower side of the tilted bed when operated across slope, damaging or losing much of the crop. By making the side wheel adjustable to the slope, technician Slosser has made it possible to keep the revolving "conveyor belt" or bed of the digger on the level, properly separating potatoes from vines and soil.

These inexpensive revisions, worked out through careful field trials and machine shop designing, are readily applied to standard equipment, economically and efficiently retooling potato farming for soil and water conservation.

Hybrid Corn: Hybrid corn, a product of scientific research, reached the stage of most vigorous commercial development at the time World War II had raised food demands to the highest point in history. It is an outstanding example, perhaps the most outstanding example, of the influence of theoretical scientific research in revolutionizing the production practices of an agricultural crop.

Since the method of hybridizing corn was first suggested by G. H. Shull in 1909, the present perfection of commercial hybrids has been developed through combined and cooperative efforts of many breeders, both in the Agricultural Research Administration of the Department of Agriculture and in State experiment stations. The Department has been working on the problem since 1916, and the present leading hybrid, U. S. 13, was developed by the two groups of plant breeders.

Although the first hybrid seed involving inbred lines was produced in 1921 in Connecticut, the industry did not really get started until nearly 15 years later. In 1943 nearly 52 percent of the country's corn acreage was planted to hybrid varieties, and almost the entire acreage in some of the leading corn States. Since well-adapted hybrids increase the yield about 20 percent, it is estimated that the 1943 production as a result of their use was 669,000,000 bushels more than it otherwise would have been. This gain is equivalent to 7,360,000,000 pounds of pork, or 54 pounds for each man, woman, and child in the United States.

Forest Economics: Several years work by the Forest Service Division of Forest Economics on the complex problem of Federal contributions in lieu of taxes on national forest lands culminated in the issuance of the Federal Real Estate Board's report, Federal Contributions to States and Local Governmental Units with Respect to Federally Owned Real Estate (1943: H. D. 216). The recommendations of the Board were based on and are wholly consistent with the contributions plan developed by the Service but generalized for application to the several types of federally owned conservation lands. The release of the Board's report constitutes a major landmark on the road to a permanent solution to the thorny contributions problem.

The investigations in process on the experimental forest at Crossett, Ark., have been aimed at the basic financial problem of forestry--i.e., how to harvest more and better forest products, yet keep the forest lands in condition to meet future needs. The completion of the first comprehensive report on the results of these studies (entitled "Financial Aspects of Selective Cutting in the Management of Second-Growth Pine-Hardwood Forests West of the Mississippi River") is

a landmark in this phase of forest research. The economic practicality of partial short-interval cutting in the shortleaf-loblolly type of southern pine forest has been demonstrated conclusively. It has been shown that good forestry is good business. This is precisely what has been needed to accelerate the adoption of sound management practices on private forest lands, and the wholesome results of this impetus are already in evidence throughout the South.

The Otsego Forest Products Cooperative Association, Inc., at Cooperstown, N. Y., has been sponsored by the Service as a pilot plant for the development of cooperatives in the farm forest field. After a slow and difficult organization stage, this Association has now attained a stable level of continuous operation. It is by far the largest cooperative now functioning in the farm forestry field, with 934 members and thoroughly modern processing plant equipped with band saw. Local community interest in and support of the project has grown steadily. In the face of current operating difficulties and the pressure of other types of farm enterprise, plant operations have been adapted to wartime exigencies, and almost 2 million board feet high-quality lumber were turned out during the past year, most of which channeled directly to war uses. Management practices on farm woodlands throughout the area have been improved markedly, and the financial returns from the sale of forest products by Association members have been stepped up appreciably.

Milk Constituents: Over the years Department of Agriculture scientists have performed notable work on butterfat, casein, and other milk constituents. Work done early this century showed that it was unwise to use high-acid cream in making butter, and thus revolutionized butter making the world over. Butter made from pasteurized, nonacid cream was found to have exceptional keeping qualities. More recently George E. Holm, George R. Greenbank, and others in the Bureau of Dairy Industry have given close study to the oxidation of fats and the relationship between such oxidation and changes in the flavor of butter and whole-milk powder. These investigations, initially in the field of pure research, resulted in many very practical applications to a wide variety of fats and oils. In April 1942 Holm received the Borden Award for his work which had led to a far better understanding than ever before of why fats and oils spoil and of methods of preventing spoilage. As a result of these investigations improved methods of handling and preserving whole-milk powder were ready when war made them urgent.

Holm's work on proteins and other milk constituents has also been outstanding. He perfected a method of preparing pure butteroil and so packaging it that it would keep almost indefinitely under extreme climatic conditions. He discovered long ago that fats do not spoil unless a certain amount of oxygen is present to combine with them. Studies of casein have made possible the large-scale production of a very pure product. Both grading and manufacturing processes have been improved. Department scientists have also discovered how dairymen may avoid the development of undesirable odors in milk caused by feed flavors. Millions of gallons of milk are rejected from the fluid-milk market annually because of bad flavor or odor, so caused. If all dairymen observed the recommended feeding practices it is quite probable that $15 or $20 million a

year would be added to their incomes.

Palm Oil Substitute: Imported palm oil was used before the war not only for making shortening, oleomargarin, and soap, but also in the manufacture of tin plate and terne plate. More recently it had come into use in the cold-reduction process for sheet steel. When our imports of palm oil were largely shut off by Japanese conquests, substitutes had to be considered. The literature was rather conflicting, the cooperation of manufacturers and consumers was sought and, as it proved, the exact properties which made palm oil so suitable were unknown. Dr. K. S. Markley and associates of the Bureau of Agricultural and Industrial Chemistry's Southern Regional Research Laboratory, set to work. They first considered a hydrogenated cottonseed oil because that had been tried as a substitute for palm oil in World War I. Ordinary cottonseed oil was known to be unsuitable and the more highly hydrogenated oils also proved unsatisfactory. Finally a semi- or medium-hard hydrogenated cottonseed oil was found to approximate palm oil in properties. Upon test it proved extremely satisfactory. This tailor-made oil costs about twice as much as palm oil, but lasts three times as long.

Forest Products Research: Experimental work on wood and paperboard container problems has been carried on at the Forest Products Laboratory of the Forest Service for many years, but has been expanded many fold since the job of solving the packaging, loading, and shipping problems for all ordnance equipment and supplies was assigned to the Laboratory in 1942 by the Army Ordnance Department. Not only have hundreds of items, including anti-aircraft guns, armored trailers and cars, ammunition, mobile shop trucks, rifles, and "bazookas," been protected against damage or loss by redesigned or newly designed containers, but great economies in shipping space have been worked out, so that considerably fewer ships are required when shipping space is a vital consideration in shipment of supplies for support of our troops in different parts of the world, as well as in Lend Lease shipments. Detailed procedures of cleaning, rust-proofing, and wrapping many artillery items were worked out and many commercial greaseproof and waterproof papers were tested to determine their suitability for wrapping Ordnance equipment for overseas. Assistance is also given the Army Air Force and the War Food Administration in solving packaging and shipping problems.

Production of wood sugar from wood waste and low-quality timber has been greatly advanced by recent pilot-plant investigation by the Laboratory at the request of the War Production Board. This important contribution to the war effort is a development and application of the German Scholler process. The results were highly satisfactory in production of wood sugar, from which ethyl alcohol or high protein livestock feed can be produced. Plans are about completed for the erection in this country of the first commercial plant for the production of wood-sugar alcohol. The large-scale production of alcohol from wood waste will aid considerably in conserving grain for domestic and Lend-Lease needs. It has been shown that a number of chemicals of military importance can be derived from the lignin in wood waste and pulp mill waste liquors, including alcohols, glycols, tar acids, hydre-carbons, naphthene, and heavy, high boiling oils.

Papreg, the high-strength resin-impregnated paper plastic, developed at the Laboratory, has been adapted to many military uses, such as equipment cases, aircraft ammunition boxes, gunner's seats, and parts for gun turrets. The developments include laminated paper plastics filled with low-cost lignin recovered from waste pulping liquors; these have possibilities as substitutes for the conventional resin-bonded paper plastics. The lignin has possibilities as an extender for the critical phenolic resins commonly used in these products.

Hydraulic Design of Drop Structures for Gully Control: Taming the rush of eroding water is an essential part of soil conservation. A recurring problem for hydraulic engineers in constructing concrete drop structures to control gullies has been the undermining of the structure by the water's scouring action. A safety measure against this undermining action is the stilling basin incorporated in the design of the drop structure at its base. Hitherto, each of these basins or shelves to catch and tame the falling stream has been newly designed as part of a specific structure.

The Research Division of the Soil Conservation Service brought a "gully washer" into the laboratory and poured it into a series of stilling basins varying in depth and length. Watching the glassed profile of the stream as it flowed through drop structure and stilling basin, SCS technicians took movies of the flowing water, measured its speed, determined its patterns as related to erosion. From these laboratory measurements and observation, Service engineers formulated dependable rules for the design of stilling basins.

By working out a general, reliable formula to solve this comparatively small erosion problem, SCS scientists have effected an inestimable saving in cost of materials, in time, and in prevention of failure.

Master Sample: The value of devising a uniform and integrated system for making agricultural surveys has become more evident since the war started, and in answer to the need the Bureau of Agricultural Economics has set up a "Master Sample," a sample of farms which is in effect a small replica of all the farms in the United States. Principal features of the plan include:

1. Three independent samples, each containing approximately 100,000 farms, or 1/54th of the farms in the United States. Used separately, they will each provide a cross-section of American farms or they can be combined to make one national sample of about 300,000 farms. 2. Sampling of every county in the United States containing agricultural enterprises. Within each county the sample is stratified geographically. 3. Selection in each such county of small sample area (sampling units) which, on the average, consist of clusters of about six farms each. The average number of farms in a sampling unit will vary from one part of the country to another because of sampling problems involved. The average is lowest in the Corn Belt and highest in some of the Southern States. 4. Use in conjunction with the Census of Agriculture. The Master Sample will be highly effective here; it can be regarded as a part of the census and used to provide a selection of schedules for quick preliminary tabulations.

5. Selection of samples from it for studies on such topics as home canning, victory gardens, or manpower, since the Master Sample can be used to sample the rural population as well as to sample farms.

The Master Sample, because it provides a great increase in sampling efficiency over current methods, will provide the same information with smaller samples as is now obtained through larger surveys; or if a sample of the same size is used, its greater precision will provide more complete and more accurate information than is now obtained. It will also yield greater accuracy per dollar spent than is now possible.

Office of Information
Mr. Harding, 4842
Miss Arnold, 4875

No. 6
Revised August 1, 1945
A USDA Document

U. S. DEPARTMENT OF AGRICULTURE

IMPORTANT RECENT ACHIEVEMENTS OF DEPARTMENT OF AGRICULTURE SCIENTISTS

Insect Repellents: Early tests by the Bureau of Entomology and Plant Quarantine at Orlando, Fla., made it possible to recommend some good insect repellents to the armed forces for use in Italy as well as in other areas. Dimethyl phthalate, Indalone, and 2-ethylhexanediol 3,1-1 were found effective for a variety of insects, and combinations of them proved equally as effective as the individual ingredients for specific insects. It is, therefore, possible for the armed forces to obtain in one bottle an insect repellent against a wide variety of biting insects including mosquitoes, sandflies, eye gnats, and biting flies.

Studies also showed these repellents could be used effectively for protecting men from chiggers and would afford some degree of protection against ticks that affect man. The repellent is applied to the inside of the cuffs of the trousers, sleeves, and between the button surfaces so as to form a barrier against chiggers that tend to crawl into the clothing. More recent developments with insect repellents have shown even more efficient chemicals, but the increased efficiency is not sufficient to justify a change in the recommendation now. It is expected that even better repellents will be developed for postwar uses and that some of them may also be used against insects that affect animals or even crops. Over 300 million 2-ounce bottles of these repellents have been purchased by the armed forces.

Tropical Plant Introduction Garden: Since the establishment of the Federal Experiment Station in Puerto Rico in 1902, one of the largest collections of tropical plants in the Western Hemisphere has been built up at Mayaguez. The collection includes over 7,000 species. A valuable collection of Cinchona varieties, the plant from which quinine is obtained, is being maintained, and, insofar as possible, the highest yielding strains are being added to the collection as they become known and available. In addition, the collection also includes a planting of the highest-yielding known strains of the rubber plant, Hevea brasiliensis. These are but two of many such economic species being grown and cultivated at this tropical outpost in Puerto Rico.

Protection of Fabrics from Fungi and Insects: Great quantities of cloth deteriorate each year from stain and rot caused by the fungus growth, mildew. Seeking effective and cheap mildew-resistant treatments for cotton fabrics, textile specialists of the Bureau of Human Nutrition and Home Economics tested almost all the known mildew-proofing materials, and of 150 treatments found about one-third effective and 10 both effective and simple enough for home application. One of these--a new treatment developed in the Bureau's laboratories--combined such advantages that a public service patent was obtained to protect it for public use. This process, employing cadmium or copper salts with morpholine, is comparatively inexpensive, and effective for

both home and commercial use. It can be used for awnings, sails, tents, shower curtains, and covers for porch furniture.

In cooperation with the Bureau of Entomology and Plant Quarantine, the textile specialists subjected 16 of the mildew-preventive treatments to termite attack, and found 5 resistant.

A rapid, dependable soil suspension test for determining the resistance of treated fabrics to mildew was developed by the Bureau's textile specialists. Although devised for use in testing household fabrics, this was found applicable to testing of sandbags, camouflage cloth, and similar military fabrics. It has been included in the Proposed Federal Specifications of Test Methods for Mildew Resistance, for the evaluation of chemicals and chemically treated fabrics offered for Government purchase.

Soil and Water Conservation Research: A soil conservation farm plan is designed to put every acre to its best use according to its individual capabilities and to treat it according to its individual needs. Such a plan redesigns the farmer's "plant" for more efficient operation.

As in the modernizing of an industrial plant, the redesigning of the farm is based on the results of a multitude of laboratory and plot studies and carefully watched field trials. In cooperation with State agricultural experiment stations, Federal research agencies, and interested individuals, Soil Conservation Service research scientists delve into the secrets of soil, rain, wind, and growing crops.

By studying the private life of a raindrop, for example, they have developed a unique rain machine that can be regulated to produce variations in rainfall from gentle drizzle to drenching downpour, to test the effects of different kinds of vegetative cover as protection for various types of soil. Tilting plots of earth that can be sloped to any degree have helped to determine the comparative soil-holding powers of grasses and other close-growing plants on sloping fields. Wind-tunnel studies are contributing valuable information on the causes and manner of soil movement by wind. Fine-gaged laboratory instruments and ingenious weather-imitating devices are adding, bit by carefully weighed bit, to the store of tested facts contributing to the development of new and improved soil-conservation practices and to the refinement of existing practices.

Though it is difficult to evaluate any isolated part of the conservation research program, its contribution to agricultural advancement is indicated by the following proved advantages of soil-conservation farming. It has provided a practical guide for greater crop diversification. It has meant savings in seed, fertilizer, labor, and power, as well as of soil. It has permitted the greatest possible degree of protection--and even improvement--to soil and water resources under the pressure of intensified wartime production. It offers the farmer and rancher a sound avenue for shifts in type or intensity of production to meet varying market or other demands in time of war or peace.

Master Sample: The Bureau of Agricultural Economics, in cooperation with the Bureau of the Census, has recently completed the drawing of a "Master Sample" of farms, which is in effect a small replica of all the farms in the United States. Every county containing agricultural enterprises is represented. The sample consists of about 67,000 small sample areas which average about 2.5 square miles in size and contain, on the average, about 5 farms each.

One of the principal features of the Master Sample is its adaptability to various needs. The number of sample areas to be enumerated for any survey can vary widely, depending on the type of survey, the universe to be covered, and the accuracy desired. The sample can be used not only for Nation-wide studies, but for regional, State, or special crop area studies as well. A further advantage of this sample over other sampling designs is that in clustering the units of observation (farms) by sample areas, considerable savings in survey costs are effected through reduction in travel between farms. This results in a great increase in sampling efficiency per dollar spent.

The first use of the Master Sample was in connection with the 1945 census of agriculture. In addition to the standard schedule to cover all farms, the Census Bureau obtained more detailed information in a supplementary schedule covering all farms included in the sample areas. The supplementary data will be expanded to national totals and thus will provide a wealth of information which could not otherwise be obtained for the amount of money appropriated for the 1945 census.

The materials assembled in the drawing of the Master Sample will be very useful and will save much in costs of future samples. These materials consist of (1) large-scale highway maps of all counties in the United States with information on them useful for sampling; (2) listing sheets showing all villages, towns, and cities having an estimated population of 100 or more; (3) tabulations of farms and dwellings by small geographic areas; (4) transparent "positive" county maps through which an unlimited number of county maps showing the sample areas can be reproduced by the ozalid process; and (5) aerial photographs covering over 90 percent of the sample areas. If additional sample areas are needed for any county or group of counties, these can be readily provided at relatively small cost.

Forest Products Research: Experimental work on wood and paperboard container problems has been carried on at the Forest Products Laboratory of the Forest Service for many years, but has been expanded manyfold since the job of solving the packaging, loading, and shipping problems for all ordnance equipment and supplies was assigned to the Laboratory in 1942 by the Army Ordnance Department. Not only have hundreds of items, including anti-aircraft guns, armored trailers and cars, ammunition, mobile shop trucks, rifles, and "bazookas," been protected against damage or loss by redesigned or newly designed containers, but great economies in shipping space have been worked out, so that considerably fewer ships are required when shipping space is a vital consideration in shipment of supplies for support of our troops in different parts of the world, as well as in lend-lease shipments. Detailed procedures of cleaning, rustproofing, and wrapping many artillery items were

worked out and many commercial greaseproof and waterproof papers were tested to determine their suitability for wrapping ordnance equipment for overseas. Assistance is also given the Army Air Forces and other Department of Agriculture agencies in solving packaging and shipping problems.

Production of wood sugar from wood waste and low-quality timber has been greatly advanced by recent pilot-plant investigation by the Laboratory at the request of the War Production Board. This important contribution to the war effort is a development and application of the German Scholler process. The results were highly satisfactory in production of wood sugar, from which ethyl alcohol or high protein livestock feed can be produced. The first commercial plant for the production of wood-sugar alcohol has been erected at Springfield, Oreg., and will begin operation in 1945. The large-scale production of alcohol from wood waste will aid considerably in conserving grain for domestic and lend-lease needs.

It has been shown that a number of chemicals of military importance can be derived from the lignin in wood waste and pulp mill waste liquors, including alcohols, glycols, tar acids, hydrocarbons, naphthene, and heavy, high-boiling oils.

Papreg, the high-strength resin-impregnated paper plastic, developed at the Laboratory, has been adapted to many military uses, such as equipment cases, aircraft ammunition boxes, gunner's seats, and parts for gun turrets. The developments include laminated paper plastics filled with low-cost lignin recovered from waste pulping liquors; these have possibilities as substitutes for the conventional resin-bonded paper plastics. The lignin has possibilities as an extender for the critical phenolic resins commonly used in these products.

Breeding for Better-Keeping Eggs: Some eggs keep better than others, under the same conditions, because of the breeding of the hens that laid them. This recent finding by poultry specialists of the Bureau of Animal Industry opens up a new field of opportunity in poultry breeding.

During the last four years the scientists have observed individual and family differences in the keeping quality of eggs. Using the shrinkage of the thick portion of the white, during storage, as a measure of deterioration, the poultrymen found such shrinkage to be 62 percent for eggs laid by hens of one line of breeding and only 33 percent for another line.

A related study involving shrinkages in the weight of eggs during storage pointed to the quality of egg shells as a major influence. Some shells are more porous than others. In two divergent lines of chickens, loss of egg weight through shrinkage was about 60 percent greater in one than in the other. The results of the tests indicate that shell quality can be improved through family selection of breeding stock on the basis of eggs that have relatively low shrinkage when stored.

Milk Products and Constituents: Over the years scientists in the Bureau of Dairy Industry have performed notable work on butterfat, casein, lactose, and other milk constituents. Work done early in this century by L. A. Rogers showed that a butter made from pasteurized sweet cream had exceptional keeping qualities, and this knowledge has revolutionized buttermaking the world over. During the same early period the work of L. S. Palmer established the nature of the pigments in milk.

More recently George E. Holm, G. R. Greenbank, and others in the Bureau have studied oxidation of fats and the relationship between such oxidation and changes in flavors of butter and dried whole milk. These investigations, initially in the field of pure research, resulted in many very practical applications to a wide variety of fats and oils, and led to a much better understanding of spoilage of fats and oils and of its prevention. A method of preparing pure butteroil and so packaging it that it keeps almost indefinitely under adverse conditions of storage also was developed. As a result, improved methods of handling and preserving dried whole milk were ready for application when war made them urgent.

Early fundamental work by W. Mansfield Clark established many relationships in the field of acid-base equilibria. The practical applications of this work have been universal and specifically have been of inestimable value in the manufacture and quality control of dairy products. Control of cheese-making processes and the manufacture of high-grade casein are two examples.

The work of Byron H. Webb on the relationship of temperatures of processing and of phosphates to the production of color, flavor, and instability in evaporated milk has made possible the production of a more uniform, more palatable, and hence more attractive concentrated milk.

Investigations on the amino acids of casein by Ben H. Nicolet and L. A. Shinn have corrected gross misconceptions of the composition of casein and are of great value in work on protein in nutrition.

Basic experimentation by E. O. Whittier, S. P. Gould, and others in the production of textile fiber from casein has aided in the establishment of a domestic casein-fiber industry and has protected the United States from the domination of this field by foreign patentees.

New Type of Cotton Bandage Fabric: A new type of all-cotton gauze bandage that tends to fit and cling better than ordinary gauze and allows greater freedom of movement in bandaged joints has been developed by the Bureau of Agricultural and Industrial Chemistry.

The particularly valuable properties of the new fabric are a high degree of stretchability which makes the bandage partly self-fitting so that it conforms to irregular surfaces, sufficient elasticity to make it flexible and somewhat self-tightening without restricting the circulation of the blood, and a roughened surface which causes layers of bandage to cling together in contrast to the slipperiness of ordinary gauze. These new characteristics have been found especially desirable in head, knee, arm, and elbow dressings.

The Surgical Department of the U. S. Naval Hospital in New Orleans reported, after six months of experimental tests with the new bandage, that it is

superior to regular gauze, particularly for orthopedic use. Because of its semi-elastic and nonslip features, this new material should enable inexperienced persons to do a better job of bandaging.

The bandage, which was developed in the Southern Regional Research Laboratory in New Orleans, is made by chemically treating ordinary open-weave gauze. It is now in pilot-plant production.

Hybrid Onion: The first hybrid onion variety was released to growers by the Bureau of Plant Industry, Soils, and Agricultural Engineering in 1944 as a result of experiments started about ten years earlier. Producing hybrid onion seed on a commercial scale had seemed almost impossible because of the nearness of the male and female parts, until plant breeders discovered a male sterile onion which made possible hybridization with male fertile strains on a field scale. As a result of this discovery, scientists of the Bureau and the University of California developed the first commercial onion hybrid, California Hybrid Red No. 1, adapted to growing in central California, southern Utah, and southern Nevada. This new early variety has yielded at rates ranging from 460 to 768 100-pound bags per acre and is said to yield generally 50 percent more per acre than the usual early varieties for those areas.

The discovery of the strain of onion without fertile pollen has led to the production, through breeding, of other male sterile lines that promise to be useful in producing hybrid seed from combinations with other varieties. (A male sterile strain may be carried on by planting "head sets" and in other ways known to plant breeders.) As a result of the possibilities in male sterile strains, the field is now open for the development of hybrid strains of various varieties for different regions, seasons, and conditions.

Methyl Bromide Fumigation for Delousing Clothing and Equipment: Three methods involving the use of methyl bromide for fumigating clothing to destroy body lice, developed by the Bureau of Entomology and Plant Quarantine, are in extensive use by the military forces as one measure to prevent typhus. These methods are: (1) An individual gastight fumigation bag with a proper amount of the fumigant contained in a glass ampule, for the fumigation of one soldier's outfit; (2) lightweight, inexpensive, demountable fumigation vaults which can be operated in batteries for delousing the clothing of large numbers of men at one time; and (3) ground pits covered with various available materials such as raincoats, tarpaulins, paper, etc., for emergency use.

In addition to individual fumigation bags issued as standard equipment to U. S. forces for the North African campaign in 1943, demountable fumigation vaults were used overseas. As an important safeguard of the health of our civilian population, the vault method has been installed also at debarkation ports in the United States for delousing war prisoners, returning army personnel and refugees, and for treatment of salvage materials.

Spending Habits Surveyed: The first comprehensive picture of the country's spending and saving was made possible when the Bureau of Human Nutrition and Home Economics cooperated with other Government agencies in making a Nation-wide survey of consumer purchases of 1935-36. The completed set of 47 reports, of which the Bureau prepared 22, provides an unusually detailed analysis of the spending and saving habits of families with different incomes, living in cities, in villages, and on farms. A smaller study, also national in scope, was made in 1941.

The reports, which shed light on how Americans spend their money for food, housing, transportation, and other items, provide a factual basis for economists and others concerned with policies and programs and their effects on families in varying circumstances. The war increased the usefulness and significance of these reports. They were used in planning the civilian supply of food, shoes, and other clothing, housefurnishings, and other consumer goods, and for decisions on rationing food, shoes, and other items. They were examined to determine the effect of sales, excise, and income taxes on general welfare and many details of the bond campaigns. They are basic to studying the impact of price changes on various groups of families. In addition, they will serve as bench marks for measuring progress to higher levels of living in the postwar years.

Vegetable Waste Valuable Source of Poultry Feed: Broilers fed on broccoli-leaf meal produce fine flavored meat, according to the results of cooperative research between the Bureau of Agricultural and Industrial Chemistry and the Delaware Agricultural Experiment Station. Chicks fed a standard mash to which had been added 8 percent of dried broccoli-leaf meal not only grew well, but the meat had a highly pleasing flavor. Chicks fed on this mixture were compared to similar chicks fed on alfalfa-leaf meal. Those receiving the broccoli meal made the fastest growth. Carrot, lima bean, and turnip meals were about equal to alfalfa, and pea vine meal was a little lower. The flavor of the meat of all broilers fed on the vegetable leaf meals was good, but that of the birds fed on broccoli-leaf meal was the best and unusually fine.

This development is the outgrowth of an attempt of the Eastern Regional Research Laboratory at Philadelphia, Pa., to find uses for the large tonnage of waste leaves that occur in the production and processing of vegetable crops. Investigations by laboratory scientists showed that the blade portions of the leaves, free of stems, were unexpectedly high in protein, containing from 30 to 36 percent in some cases. This is higher than the 20 percent found in alfalfa-leaf meal and approaches the 40 to 45 percent for oil meals. The research revealed that the leaves are also high in carotene, or provitamin A, and in riboflavin, both of which are needed in poultry feed.

Research, now in the pilot-plant stage, is being continued and enlarged in the hope that industry will develop methods for the profitable utilization of the thousands of tons of waste vegetable leaves produced each year.

Derris Comes to the Western Hemisphere: One of the two important sources of the insecticide rotenone is the root of the plant Derris elliptica. This species was the one commonly grown in Malaya and Sumatra, where a large percentage of the rotenone used in the United States previous to the war was produced. Since 1935, the Federal Experiment Station in Puerto Rico has been studying the production of Derris. As a result of these investigations, the station had available for distribution large quantities of propagating material. During the past two years, in cooperation with the Foreign Economic Administration and the Office of Foreign Agricultural Relations, over two million cuttings have been shipped from the Federal station to various countries in Latin America in order to produce this crop in the Western Hemisphere.

Stratified Flow: By caging a miniature river and reservoir in glass, the Soil Conservation Service, in cooperation with the California Institute of Technology, has found how to shuttle a silt-laden stream through and out of a reservoir by making enlightened use of the stream's own action. Because the annual cost of reservoir silting is estimated as high as 50 million dollars, this discovery promises to save the country vast sums in safeguarded power production, community water supplies, and irrigation water.

Research of the Service's sedimentation specialists has established the fact that a stream retains its identity after entering a reservoir, continuing to flow in a layer through, under, or over the still water. The stream's action depends on the temperature and amount of sediment or silt it contains. A silt-laden current slides under the clear water of a reservoir as heavy cream poured into a cup of coffee slides under the clear, brown liquid.

The research workers first trapped these flows, or density currents, in glass and then watched and recorded their action. They predict that engineers eventually will be able to use the layered flows of water as accurately as an accountant can use the keys of an adding machine. For instance, an understanding of stratified flow will allow the channeling of a clear stream of snow water through the reservoir to city mains. A muddy stream may be channeled through the same basin to a drain feeding sandy irrigation canals so the silt will seal leaks in the sandy ditches. A salty stream can be stored in a known layer or stratum until it can be drained off.

Brighton Dam and Reservoir, near Washington, D. C., was the first to be constructed so as to make use of the principle of stratified flow in the special design of its outlets. Observations have shown that these outlets carried off from 2 to 10 times the amount of sediment that would have gone over a spillway with the same volume of water. Engineers are making immediate use of the new understanding of density currents to preserve the capacity of reservoirs already built, drawing off known silted streams through low outlets originally designed for emergency draining.

Phosphatase Test for Cheddar Cheese: A practical method for testing Cheddar cheese, to determine whether or not the milk used in making the cheese was pasteurized, has recently been developed by George P. Sanders and Oscar S. Sager, of the Bureau of Dairy Industry. The new improved method is a modification of the phosphatase test commonly used in testing milk to determine the adequacy of pasteurization.

More than 350 samples of Cheddar cheese, of which records of the milk treatment were available, were tested by the new method. All samples of cheese made from raw milk gave very strongly positive tests; some of these were more than 1 year old and one more than 5 years old. All samples made from underpasteurized milk gave results that were positive in varying degree. None of the cheese made from milk pastuerized at 143° F. for 30 minutes, or at 160° or higher for about 15 seconds, gave positive tests, regardless of the age of the cheese. A decrease of 2° in the pasteurizing temperature, or the addition of as little as 0.1 percent of raw milk to pasteurized milk, could be detected in the cheese.

Since laws have recently been passed in several States requiring that all cheese sold be made from pasteurized milk, or that the cheese be cured for a definite period of time prior to retail sale, the development of this reliable test is an achievement of great importance to both the cheese industry and the consuming public. That Cheddar cheese of uniformly high quality can be made from pasteurized milk was demonstrated by earlier Bureau research, and its pasteurized-milk method of cheesemaking is being widely accepted by the cheese industry.

U.S.D.A.-34 Sweet Corn for the Tropics: The sweet corns commonly grown in the continental United States cannot be successfully grown in the tropics. Several years ago, the Federal Experiment Station in Puerto Rico developed, through selection and breeding, a sweet corn adapted to tropical conditions. This corn is now growing in practically every tropical area of the world. In recent years, thousands of pounds of seed have been provided to our armed forces fighting in tropical countries to make available one source of fresh vegetables for our men.

DDT Applications With Flying Spray Gun: The development of DDT for control of mosquitoes by the Bureau of Entomology and Plant Quarantine brought about a need for new methods of applying this insecticide. By the end of 1943, C. N. Husman and O. M. Longcoy developed a portable sprayer that can be used in any conventional type of small airplane such as the Piper Cub. It consists of a tank in place of the second seat of the plane, a pipe leading to a pressure pump driven by a small propeller from the wing, and another pipe leading from the pump to a venturi mounted through the fuselage. As the wind comes through the venturi it picks up the fine sprays delivered from nozzles mounted on the edge of the venturi and breaks them up into a very finely atomized spray. The equipment covers a swath width of 40 feet in an effective manner so that oil or water solutions can be applied at the rate of 2 quarts per acre.

This equipment has been used in different theaters of the war during the past two years and is covered by a U. S. Public Service Patent. This equipment can be used in any type plane and should be adaptable for use by private or commercial plane owners in applying insecticides. A slight modification of the sprayer enables one to apply insecticidal dusts at the rate of 2 pounds per acre.

Basic Facts About Vitamin A: To find out the vitamin A requirements of human beings, research workers in the food and nutrition laboratories of the Bureau of Human Nutrition and Home Economics fed an experimental diet to volunteer adults. Especially prepared meals contained every nutrient that the human body is known to need except vitamin A, which was almost completely absent. Since one early measurable effect of vitamin A lack is night blindness--failure of the eyes to adapt normally to dim light--appearance of this condition was taken as a sign that a subject's body had used up most of its stored vitamin A. Measured amounts of vitamin A were then given in gradually increased doses until the subject received just enough vitamin A to keep vision normal in dim light.

In the first experiments, solution of standardized cod-liver oil and pure carotene provided the measured amounts of vitamin A. Later, the minimum requirements were measured in terms of natural food, using peas, spinach, and carrots as sources of carotenes, which are changed into vitamin A in the body. It was found that the body needs about 30 to 60 percent more carotene as found in vegetable foods than it does of vitamin A found in animal foods. This finding has special timeliness for the war period when restricted food supplies have caused civilians to lean more heavily upon plant foods for vitamin A.

Data for estimating daily minimum vitamin A requirements of the average normal adult have come from these experiments. The data were included in the informational background used when the Committee on Food and Nutrition of the National Research Council set forth recommended daily allowances of vitamins and other nutrients as a nutrition yardstick for America.

Some subjects in the first experiment showed signs of vitamin A deficiency after two weeks, whereas others--probably better fortified by a vitamin A reserve--showed no lack for several months. To learn more about the body's ability to store this vitamin and the rate of depletion, laboratory animals were used. Results showed that moderate amounts of vitamin A obtained regularly in meals are used more economically than occasional massive amounts. This suggests the importance of building up a "vitamin A savings bank" by eating, when possible, generous amounts of foods providing this vitamin. To aid in determining vitamin A value of normal diet, the laboratories analyzed this value in 128 common foods, raw and cooked.

Started under supervision of Dr. Lela Booher, the Bureau's vitamin A researches have continued more recently under Dr. Elsa Orent-Keiles, while various other scientists have held responsible posts. Mrs. Elizabeth Callison had direct leadership of studies to determine human vitamin A requirements.

Small-Type Turkey: Since about 1930 there has been a simultaneous increase in the number of turkeys raised and in the average size of turkeys produced. However, there has not been a corresponding increase in the demand for the heavier birds and this has resulted in a price differential of from 1 to 6 cents per pound in favor of smaller market turkeys. This demand on the part of consumers seems to be based on sound considerations and is likely to be permanent. In view of this trend, the Bureau of Animal Industry in 1934, at the Agricultural Research Center, Beltsville, Md., began an experimental project on the development of a small-type turkey. Marked progress has been made in fixing the desired characteristics in this small-type turkey.

Several standard varieties, the wild turkey, and White Austrian turkeys imported from Scotland have been crossed in the development of this small-type turkey. From the crossbred progeny selections are being made. The chief characteristics desired are as follows: Live weight of young toms at market age, 12 to 17 pounds; corresponding weight of young hens, 7½ to 10 pounds; color, white; compact body with moderately short legs, moderately long keel bone, and an abundance of meat, especially on the breast and legs; early maturity, resulting in a finished condition (U.S. Prime) with respect to fat, fleshing, and feathering at the age of 24 weeks; reasonably high egg production and high fertility, hatchability, and viability.

Several of the turkeys have proved to be excellent layers as shown by the production of more than 200 eggs in a year. Their eggs excelled also in fertility and hatchability. In addition, the high market quality of these excellent layers is above average as judged by body conformation and early maturity of their offspring.

Introduced Bamboos Prove Valuable: For several years, the Federal Experiment Station in Puerto Rico introduced various species of bamboo but not until 1935 was extensive work undertaken in this field. By selection and testing, several species of bamboo have now been found valuable for industrial purposes and likewise highly resistant to the powder-post beetle which often attacks and destroys bamboo. As a result of these introductions and expansion of the plantings, a new bamboo furniture industry has been established in Puerto Rico, and several other new industries utilizing bamboo are in the offing as soon as sufficient planting material becomes available.

Determining the Farmer's Water Budget: Weather is the "whether" of farming. The more accurately the farmer can gage the moisture available for crops at various times of the year, the more successful his farming operations are likely to be. The Soil Conservation Service has added to the farmer's weather knowledge a slide rule for measuring the amounts of soil moisture available seasonally at various locations in comparison with the amounts of soil moisture actually needed in the same areas for ideal crop conditions.

Measurement of soil moisture is not a simple matter of compiling rainfall figures. It is necessary to consider the factor of "evapotranspiration" or release of moisture to the air by direct evaporation and through the exhalation of plants as well. The rate of evapotranspiration in cold climates differs greatly from that in hot, dry regions. By developing a dependable formula for computing these differing rates, the Service has made it possible to measure, accurately and quickly, the varying amounts of moisture needed for crop production in specific areas on the basis of ordinary Weather Bureau records of temperature and rainfall.

This formula already has been put to practical use in irrigated areas to compute the amount of supplementary water that can be used most efficiently and the length of time it is most likely to be needed. It also has been useful in analyzing the probability of successful growth of necessary war crops in areas where they were not commonly grown before.

The method is proving helpful in finding the most favorable locations for various kinds of crops, in extending the range of present types of crops, and in determining the probability of success in planting, harvesting, or processing crops with rigid moisture and temperature requirements. Conservationists expect it to be used increasingly in the development and refinement of soil and water conservation practices.

DDT Residual Sprays for Fly and Mosquito Control: Early experiments by the Bureau of Entomology and Plant Quarantine with DDT showed that houseflies died within about 45 minutes and mosquitoes within a couple of hours after coming in contact with unpainted wood and screen surfaces that had been treated with kerosene sprays containing 5 percent of the chemical. For more than a year, the spray residue left in the boxes and cages was effective in killing flies and mosquitoes. When similar sprays were used in the vicinity of Orlando, Fla., on the walls of dairy barns and upon screen doors and windows, they killed flies throughout the summer months.

At Beltsville, Md., similar sprays were effective for more than one year in dairy, hog, and sheep barns. In Texas, South Dakota, Montana, and Indiana, the tests were as effective as those made in the South and East. The minimum amount of spray needed for effective control throughout a season depends to some extent upon the formula used, kind of surface sprayed, and suitability of the location for flies to congregate. Small amounts of DDT seem sufficient when placed in locations frequented by flies and mosquitoes.

A single application of a DDT residual spray applied to buildings on 18 square miles of land in the rice fields of Arkansas demonstrated almost complete elimination of the malaria mosquito for an entire season. Poultry houses treated subsequently contained no malaria mosquitoes, but untreated houses had as many as 2,000 to 4,000 adult mosquitoes. The sprays proved so effective they are now being used by the U. S. Public Health Service in large-scale control of malaria in the Southern States.

Nutritive Value of Plant Proteins: Laboratory studies by the Bureau of Human Nutrition and Home Economics showed conclusively that proteins of soybeans, peanuts, cottonseed, wheat germ, and corn germ have nutritive values so high that they may be counted on to "extend" or "spare" the proteins of meat, milk, eggs, and other animal foods in times of short supply.

A very practical way to use these plant proteins to advantage, the studies showed, is to team them with abundant breadstuffs and cereals. Strangely, such combinations sometimes prove actually more nourishing than the components would suggest. Example: In feeding experiments with young rats, adding 15 parts of soybean flour to 85 parts of wheat flour in bread increased its growth promoting values five fold.

Among these plant proteins chosen for investigation, wheat and corn germ proved definitely superior, the wheat germ in turn being higher than the corn germ in its nutritive value for promoting growth. Wheat germ thus appears to be the plant protein food that comes nearest to the proteins of meat, eggs, and milk in biological value.

Disease Resistance in Crops: One of the greatest improvements brought about in crops by plant breeders has been disease resistance, which, along with such characteristics as heavy yielding capacity and adaptability to various climatic conditions, has enabled farmers to produce much more on the same acreage, with the same quantity of fertilizer, and with less labor per unit. Notable among the crops which have been reinforced by disease-resistant characteristics, are

wheat, oats, potatoes, sugarcane, and sugar beets, but practically all crops, large and small, have been improved to some extent in this direction.

Each year sees the announcement of several new varieties of various kinds of crops, a large number of them owing much of their promise to disease resistance. In 1943 the Bureau of Plant Industry, Soils, and Agricultural Engineering issued 35 such announcements covering cereals, forage plants, vegetables, and tree and small fruits. Some plant-breeding accomplishments in disease resistance have become classics, such, for instance, as the saving of the sugarcane industry in Louisiana through the development of varieties resistant to mosaic disease. The work which resulted in the development of sugar beets resistant to curly top comes near being in the same class, as do also the cooperative potato breeding program and the cooperative work on breeding disease-resistant and high-yielding cereals.

Weather-Yield Relationships: The importance of weather factors in relation to crop yields and the farmer's ultimate prosperity has long been recognized by everyone. But attempts to express these relationships in terms of mathematical formulas have been difficult because the final yield of a crop depends not only on a large number of such factors but also upon the particular combinations in which they occur.

Through a study of the joint effects of temperature and precipitation on crops in Indiana, Iowa, and Ohio, Walter A. Hendricks and John C. School, statisticians of the Bureau of Agricultural Economics, have developed equations for measuring these joint relationships, making it possible to determine more accurately the outcome of the crop. Knowledge of how critical weather factors influence the growth and development of crops is very important in developing new varieties, improving cultural practices, and forecasting production.

In making the analysis, the best available estimates of average corn yields in the three States for the years 1890-1939 inclusive, published by BAE, were used together with temperature and precipitation data made available by the Weather Bureau, Department of Commerce. Such data are sufficiently extensive so that an equation containing a large number of constants may be fitted with some degree of confidence in the outcome.

The fundamental concepts of a regression equation developed by earlier investigators were retained in this study. The theory was merely extended to include joint relationships of the two weather factors used in the analysis.

The effect of temperature and precipitation during June, July, and August was investigated. Since such effects are not constant through the growing season, analysis of the data was designed to measure these effects separately for each month and each week during the period.

The analysis disclosed that high temperatures have a beneficial effect on final yield when sufficient moisture is available and a detrimental effect on yield when the moisture supply is deficient. The beneficial effects of high temperature increase as the available moisture supply is increased and vice versa. The effects of precipitation are influenced by the temperature. The beneficial

effects of above-average precipitation and the detrimental effects of below-average precipitation increase as the temperature increases. The effects of temperature and precipitation on corn yields in Ohio and Indiana are greatest at about midpoint of the growing season. In Iowa, the effects of temperature and precipitation appear to be greatest early in the growing season.

The success of this analysis leads investigators to believe that there is no reason why other weather factors could not be included in such analyses, in addition to temperature and precipitation. Each weather factor that is include would increase the number of constants to be evaluated from the data, but there are a few additional factors that might be included to good advantage. Relativ humidity, evaporation rate, and infiltration have been suggested.

Stubble Mulch Cultivation: Giant duststorms of the early 1930's vividly emphasized the climatic hazards of farming in the Great Plains, a region renowned for livestock, grain, and other agricultural products. In response to the urgent needs of farmers and ranchers, the Soil Conservation Service early began developing methods of protecting the inherently fertile Plains soils from the effects of uncertain rainfall, strong winds, and wide variations in temperature.

Stubble mulching--protecting the soil against wind and water erosion by using the straw as cover after harvest instead of burning it or plowing it under--is proving one of the most effective conservation practices evolved in this and other western areas.

Test plots and field trials set up in cooperation with the University of Nebraska, showed that stubble mulching increased infiltration of water, improved the structure of the soil, reduced runoff of rain and melting snow water, slowed evaporation, and lessened erosion by wind and water.

Next, the research workers faced the task of devising cultivation methods that would not disturb the mulch of crop residues. In 1938, soil conservationists attached flat, V-shaped sweeps to a modified one-row cultivator for early experiments with subsurface tillage that would stir the soil from beneath without turning under the protective stubble. Five years later, 8,000 commercially produced machines, operated on the same principle, were in use on 500,000 acres of war-crop producing Plains farms alone. For seedbed preparation, scientists reversed the motion of a rotary hoe, changing its digging action to treading that would firm the soil and break up clods and straw without removing or piling up crop residues.

For planting row crops, a corn planter was equipped with disk furrow openers and stub runners. The runners passed beneath the surface residue without clogging, and the disks threw out a furrow, leaving crop residues on the ground between rows. To cultivate corn, subtilling sweeps were set to operate between rows, cutting roots of weeds and stirring the ground, with rolling coulters to shield the plants.

Microbiological studies of soils with crop-residue cover are under way, to discover what effect stubble mulching may have on the action of the tiny organisms that help transfer nutrients from soil to plant. In turn, the information will enable soil conservationists to determine more precisely the conditions under which this practice is most effective.

Stubble mulching also is practiced widely in the Pacific Northwest and is edging elsewhere beyond the boundaries of the Great Plains, especially where water conservation is an urgent need. This development of stubble-mulch cultivation is typical of much soil conservation research, carrying the study of a potential farming practice through every phase from microbiological studies to machinery design.

Cotton Hosiery Studied: Directed by Congress to investigate cotton hosiery as a possible outlet for more American-grown cotton, the Bureau of Human Nutrition and Home Economics began in 1939 to make laboratory and service tests. Accomplishments of this research proved of timely value in the wartime clothing situation. When the silk crisis came, the Bureau was able to make available to the trade over 200 designs for women's full-fashioned cotton hose. These included sheer, medium, and heavy weights in plain and fancy weave for street, work, and dress wear. Some of these designs were reproduced exactly in marketed hose, and all of the designs furnished manufacturers with ideas for developing their own exclusive designs.

Other phases of this research provided information on yarns, finishes, and hosiery construction at a time when this was especially needed. These studies also showed how medium staple lengths of cotton fiber can be used acceptably in hosiery manufacture. Wearing qualities were determined by actually putting into service hose made of different varieties of cotton and with different yarn and fabric constructions. These studies have had an important influence on making cotton hosiery once again an accepted article in the well-dressed woman's wardrobe. They have shown cotton growers and hosiery manufacturers the possibilities of American-grown cotton in high-grade hosiery manufacture. And they have contributed important methodology to the scientific study of a standard article of clothing.

Poisoned Bait for Mormon Cricket: This bait, consisting of a sodium fluosilicate, mill-run bran, and sawdust mixture, is a development of the Bureau of Entomology and Plant Quarantine laboratory at Bozeman, Mont., and represents the combined work of a number of individuals under the leadership of John R. Parker. It was first given widespread use in 1939, and has resulted in savings of hundreds of thousands of dollars in control work during the past three seasons by reducing the costs of materials furnished by the Government and of labor in their application. Savings as a result of cooperative control where this material has been used total in excess of $50 million in the last three years.

Speeding Up Calcium Gluconate Production: Following up research which resulted in a practical method of using molds to ferment glucose into gluconic acid which, combined with lime as calcium gluconate, is widely used in medicine--chemists have further improved the process by making it semi-continuous. They have discovered that addition of a small quantity of boron compound promotes the

biochemical process. Use of the boron,together with improved equipment and better molds as fermentation agents, makes it possible to produce calcium gluconate in about half the time formerly required.

Chemists of the Bureau of Agricultural and Industrial Chemistry, who began the research 12 years ago, found that the action of certain molds on a solution of glucose, or corn sugar, produces gluconic acid. This acid is important in the manufacture of calcium gluconate, a calcium or lime compound that can be assimilated by animals. Molds are microscopic plants and--like other plants--need air to grow. At first the molds were grown on the surface of shallow pans but these were not adapted to large-scale use in manufacturing plants.

The chemists continued the experiments, and, in 1935, the Bureau announced the invention of a rotating drum in which the glucose solution is fermented. The air necessary to the growth of the molds is forced into the drum at one end under pressure and is removed through the other end. After studying many molds to find out which ones are best for making gluconic acid for calcium gluconate the chemists reported that the best found so far is a mold known technically as Aspergillus niger (strain 3). This particular mold does a good job at fermenting the glucose.

Though the rotating-drum method reduced the cost of making calcium gluconate from $1.50 to 50 cents a pound, the chemists encountered one difficulty with the process. When the molds were exposed to an increasing concentration of gluconic acid formed in the glucose solution, they stopped working. Calcium carbonate, or common chalk, was added to neutralize the effect of the acid, but the calcium gluconate produced was not very soluble and separated out, clogging up the drum. Then three chemists of the Bureau, A. J. Moyer, E. J. Umberger, and J. J. Stubbs, who had been studying fermentation processes, discovered that the addition of a little borax or boric acid to the fermenting liquor keeps the calcium gluconate in solution and lets the molds finish their work. Later, the calcium gluconate may be separated from the solution free from boron.

Scientific Sizing: Major savings to the clothing industry and to consumers alik are beginning to result from the Bureau of Human Nutrition and Home Economics' work on measuring women and children as a basis for sizing clothing. Lack of scientific data on the body measurements needed in sizing garments is at the root of the chaotic condition which has always existed in the sizing of clothing particularly for women and children. Department stores complained of a $10,000,000 headache each year from returns and exchanges "because of wrong size." Mothers complained of wasting time, money, and energy buying clothes that failed to fit children at home--age of a child was no dependable guide to clothes sizes.

Gaining cooperation of 20 colleges and universities, and with funds furnished by the Works Progress Administration, scientific workers in the clothing laboratories, under direction of Miss Ruth O'Brian, weighed and measured nearly 150,000 boys and girls. Thirty-six clothing construction measurements were taken of these boys and girls, who ranged from 4 to 17 years of age and represented 16 States.

From data obtained, the Bureau recommended a two-way method of sizing children's clothes based on height and girth at hip. The Height-hip system is very similar to the system by which men have bought their shirts and other garments for years according to a few guide dimensions. The Bureau's scientists continued by measuring 15,000 women from 18 years old to 80. Fifty-eight measurements used in constructing patterns and garments were recorded, and weight was taken as a further check on bodily proportions. Universities and other institutions in representative sections of the country cooperated.

From the data, the Bureau recommended height and weight combined, rather than the customary bust measure, for predicting fit of full-length garments, For garments for the upper part of the body, height and bust combined offered the best guides to a fit. For lower trunk garments, height and hip girths are good guides. No single measurement is adequate as a basis for sizing garments and patterns, the survey conclusively showed.

As a result of these measurement studies, some pattern companies and clothing manufacturers are now making use of the new sizing system for children's garments. On the basis of the Bureau's work, new standards for body sizes for boys' garments have been adopted by the American Standards Association, which serves as a link between scientists and the trade. While awaiting developments in the women's wear field, one large mail-order house has already gone ahead to use the Bureau's data and the recommended sizing methods for sizing its women's garments.

New Method for Dehydrating Cheese: A new method for dehydrating natural American Cheddar cheese for lend-lease or other uses, which is more direct than the commercial procedures now in use and which will also release spray-drying equipment for drying other foods, developed.

George P. Sanders, of the Bureau of Dairy Industry, who devised the new method, found that if natural full-fat cheese is grated and then partly dried at room temperatures, the fat will be sealed up in the numerous case-hardened particles of curd. The particles can then be dehydrated in a tunnel drier or by any other heated-air method, without loss of fat.

Heretofore, commercial companies have been unable to use direct methods in dehydrating cheese of normal fat content, because the heat of dehydration caused the fat to melt and run out. Some processors have overcome this difficulty by first processing the full-fat cheese with heat and water, and usually with a chemical emulsifier, into a milky paste that can be spray-dried. In another commercial process, the fat is removed from the milk used in making the cheese and then added to the dried cheese.

The Bureau's new method is more direct and the resulting product is a natural cheese, minus only the water. Natural Cheddar cheese in its original state usually contains about 36 percent water, but the dehydrated flakes as prepared in the Bureau's laboratories contain about 3 percent water. The dehydrated flakes thus contain all the fat and other solids, but weigh only two-thirds as much as the original cheese.

The flakes can be packaged loose or they can be compressed to the same density as the original cheese, or two-thirds its volume. The compressed cheese can be easily broken up, and it can be consumed directly or used in almost any other way that cheese is ordinarily used.

If the flakes are compressed into rectangular or block form instead of the round shapes typical of natural Cheddar cheese, considerable additional storage or shipping space can be saved. Compared to the original cheese packed in round boxes, the dehydrated compressed blocks would occuby between 53 and 56 percent as much storage or shipping space.

Inexpensive, Effective Dip for Sheep Ticks: Derris powder or cube powder havi a 5 percent rotenone content, added to water at the rate of 6 ounces of the powder to 100 gallons, makes an effective dip for eradicating sheep ticks, or keds, from farm and range flocks. The value of this inexpensive dip was determined by tests conducted by N. G. Cobbett and C. E. Smith, parasitologists of the Bureau of Animal Industry. In Colorado, Smith dipped over 1,000 sheep, representing 5 farm flocks. In New Mexico, Cobbett dipped nearly 9,000 range sheep. The dip stayed in the fleeces of the sheep long enough to destroy the young ticks that emerged from the pupal cases remaining in the wool after dipping. This treatment has superior efficacy in killing ticks following a single dipping, and is, moreover, cheaper than the previously recommended commercial dips. Powders having more or less than 5 percent rotenone content may be used if the quantity of powder is adjusted to supply the proper total amount of rotenone.

Naval Stores Yields Increased: Naval stores research by the Forest Service has recently developed methods by which Naval stores yields can be increased 40 percent or better in commercial operations by applying chemicals to freshly chipped trees. The method results in higher money returns to the operator; ranging roughly between $400 and $700 additional net profit per crop of 10,000 trees, depending on how faithfully proper methods of chemical stimulation are followed. The three methods developed in this research and currently recommende to and tried by the industry are: (1) Application of sulphuric acid for the first 6 to 8 streaks to get newly worked timber into full production early in the year; (2) periodic acid treatment to all streaks chipped during spring and summer months; and (3) skip-acid treatment--the timber is chipped weekly but acic is applied only every other week. The second procedure gives the highest yields, but where labor is scarce, the first or third method is advantageous.

Plant Growth Regulators: In 1939 F. E. Gardner, P. C. Marth, and L. P. Batjer, of the then Bureau of Plant Industry (now the Bureau of Plant Industry, Soils, and Agricultural Engineering), tested the effectiveness of a number of different growth-regulating substances in preventing preharvest drop of 19 leading commercial apple varieties. Two compounds, naphthaleneacetic acid and naphthalene acetamide were outstanding and about equal in effectiveness in preventing fruit drop. The sodium, potassium, and ammonium salts of naphthaleneacetic acid were also found to be very effective. Soon after the publication of the results, several proprietary spray compounds containing either naphthaleneacetic acid or naphthalene acetamide as the active ingredient were placed on the market. In general, commercial orchardists have found these sprays of considerable insurance against fruit loss from preharvest drop over a period of several years.

These research workers, delving deeper into the secrets of plant growth regulation, have unearthed many other new facts which may some day be of practical application. Dr. Marth has demonstrated the feasibility of controlling the time of emergence from dormancy of certain nursery stocks by suitable application of plant hormones. By such treatments, the storage period may be prolonged to permit later planting of more vigorous material and to retain more of the original vigor in the planting material. Gardner and Marth corroborated the results of another scientist in the artificial production of seedless fruits, holly, grapes, and strawberries through the use of these growth-regulating substances.

Research Saves Soybean Growers Money: Soybean growers in the Middle West during past processing seasons suffered considerable loss through dockage at the elevators because of a high percentage of green beans. They are now assured of relief from such dockage, which has been running from 5 to 30 cents a bushel, as a result of studies made by chemists of the Bureau of Agricultural and Industrial Chemistry. They found that the retention of the green color is apparently the result of hot, dry weather in late summer, but that the green beans are of normal composition. They also determined that the green color going into the oil when the beans were crushed can be removed simply by increasing the usual amount of bleach. These findings brought about a liberalization of the dockage, resulting, according to estimates, in a saving of $1,000,000, to soybean growers, in a year, in Illinois alone.

"Hexes" Cattle Flukes: As a result of the resourceful experimentation of a Bureau of Animal Industry scientist who had formerly been a South Sea Island missionary, a successful chemical treatment for liver flukes—long a serious menace to cattle raising in parts of Texas and other western areas—has been devised and is now being used by the cattlemen.

The scientist who perfected the treatment is Dr. O. Wilford Olsen. Flukes are difficult to reach by medication, since they seek out the liver for attack. Scientists had found a drug with the five-syllable name, hexachlorethane, to be effective against these small, flat, leaf-shaped parasites, but it was difficult to administer because of its insolubility in water. Dr. Olsen found that bentonite combined well with hexachlorethane in water to make a smooth emulsion that was easy to give as a drench.

Once interpreter to the king of one of the South Sea Islands, Dr. Olsen found little difficulty in translating his scientific lore into language that practical Texas cattlemen found easy to understand. When Texas State prison officials let him try out the remedy on part of the prison herd, the results proved a convincing demonstration of the value of the treatment in liver fluke control. The mounting demand for hexachlorethane that followed this demonstration led to substantial commercial production and distribution of the drug.

Improving Sagebrush Range Lands: On much of the 96 million acres of sagebrush range land in the West, range owners and operators have been faced with two very serious problems growing out of the prevalence of this very low-value shrub.

On the one hand, sagebrush crowds out the vigorous growth of more valuable forage plants, makes herding difficult, contributes to the straying and loss of sheep, brushes considerable amounts of wool from sheep fleeces, and otherwise hinders effective livestock grazing. On the other hand, when the range has been burned in an effort to eliminate the brush and the necessary precautions have not been observed, a great reduction of valuable forage and loss of soil has usually resulted, to say nothing of occasional serious damage caused when the brush fires got out of hand and raged through other range areas or destroyed buildings and other private property.

A study completed in 1942 by the Forest Service proved that heavy stands of sagebrush can be eliminated by controlled burning with only negligible losses, and that when such burning is properly planned and executed and includes intelligent management of the range for a season or two after burning, grazing capacity will be greatly increased--60 to 300 percent increases have been recorded. Where planned burning is carried out, grazing animals are unrestricted in their movements, ewes produce a more steady flow of milk, and lambs make better growth and are seldom lost. These and other benefits fully justify the investigation necessary to develop those safe methods.

Cork Substitute: Noreseal, a cork substitute, is a wartime product developed in the Northern Regional Research Laboratory, of the Bureau of Agricultural and Industrial Chemistry, at Peoria, Ill. It can be made from the pith of such farm waste residues as cornstalks, peanut hulls, sugarcane bagasse, and similar material. It can be made in rod or sheet form, or poured directly into the cap of the bottle, and is particularly satisfactory as a seal for bottled beverages. The product is now in semi-commercial production, and bids fair to remain a successful enterprise after the war.

Forest Grazing in Southeast Cattle Production: In the Coastal Plain of Georgia and North Carolina cattle are usually turned loose in the woods each year to make the best use they can of the understory of grass and other low vegetation to be found there. With the growing need for meat for the Army bases and war plants established in the Southeast, interest in making better use of native forage has developed. Research by the Forest Service's Appalachian Forest and Range Experiment Station (in cooperation with the Bureau of Animal Industry, Bureau of Plant Industry, Soils, and Agricultural Engineering, and State experiment stations) has shown during the past years that the native forage of the Coastal Plain provides a cheap and valuable source of feed on which an efficient and profitable livestock operation can be based. This native forage must be supplemented during the fall and winter, however, when the forage is deficient in protein and minerals.

Phenothiazine as an Anthelmintic: Phenothiazine is a synthetic organic chemical first prepared in the latter part of the nineteenth century. It is one of the thiazine dyes. Following the discovery and announcement that phenothiazine was effective as an insecticide, its value as an anthelmintic was studied and established in 1938-39 by Harwood, Jerstad, and Swanson, workers of the Bureau of Animal Industry. Experimentation with this drug has been continued to develop the best methods of use. Phenothiazine is now widely recognized throughout the world as a highly effective anthelmintic for the removal of

many injurious internal parasites of domestic animals. It is the most valuable single drug so far discovered for combating such parasites. The drug is distributed commercially in powder form and may be administered either in gelatin capsules, in ground feed, in salt, or as a drench, the choice depending usually on the species of animals and preferred method of handling them. For use as an anthelmintic, phenothiazine should be the pure product prepared especially for that purpose.

In 1-ounce doses, phenothiazine rids sheep and goats of stomach worms, nodular worms, hookworms, and related pests. Its use prevents the spoiling of the sheep's intestines by nodular worms, thus providing us with additional war material for making surgical sutures at a time when they are greatly needed. In suitable doses which vary with the size of animal, phenothiazine is effective in removing several kinds of parasites from swine, cattle, horses, and mules. In very small doses this drug is effective also in removing cecal worms from poultry. These are the worms that transmit blackhead to chickens and turkeys. The extensive use that phenothiazine already has acquired for controlling animal parasites is evident from the quantity--about 3 million pounds--used in the United States in 1943. Recently a mixture of 9 parts salt and 1 part phenothiazine, when made available to sheep, has been found largely to prevent acquisition of the parasite.

Increasing Yield of Penicillin: The observations which led to the discovery of penicillin were made in 1929 by Alexander Fleming, a British scientist. He was annoyed to find one day that some stray mold spores were growing in a culture of germs he was studying. A germ-free zone around this stray mold indicated to him that it was giving off a substance that was killing the germs in his culture. This substance turned out to be penicillin. It was named for the mold which produces it.

But very little was heard of this discovery until the summer of 1941, when Dr. Florey and Dr. Heatley, two British scientists who were largely responsible for the application of Fleming's observations, came to this country to stimulate interest in the pilot-plant production of the new product. After conferences with members of the National Research Council and scientists of the Department of Agriculture, the men were sent to the Northern Regional Research Laboratory, at Peoria, Ill., operated by the Bureau of Agricultural and Industrial Chemistry. This laboratory was selected because it had had wide experience in the use of molds in the fermentation field and had one of the largest collections of molds in the world.

Dr. Heatley stayed at the laboratory and went to work in cooperation with our fermentation experts to try to increase the yield of penicillin. The yield was so small at that time that it amounted to a bottleneck. They also developed methods of purifying penicillin. These studies were supported by the Committee on Medical Research in the Office of Scientific Research and Development. The studies are still going on and have been of great value to those who are now working to perfect the commercial production of penicillin.

By proper feeding of the molds and by improving the strains of molds that produce penicillin, the laboratory workers were able to increase the yield more than one hundredfold. The work at the laboratory, as well as that in industrial laboratories, was so promising that Dr. A. N. Richards, Chairman of the Committee on Medical Research, called a meeting of representatives of commercial manufacturers of pharmaceutical supplies in December 1941 and made available to them the successful results of the work at the laboratory. Largely as a result of that conference, a number of industrial firms started production of penicillin on a semi-commercial scale.

Penicillin is now being produced on a commercial scale by 21 plants in the United States and Canada. By the end of 1944 these plants will be turning out penicillin at the rate of more than 200 billion units a month. That's enough to treat 250,000 serious cases of infection. Bureau scientists have played an important part in the development of this drug. They increased the yield of penicillin more than 100 times. They developed the particular strains of mold used to make all the penicillin now being produced. Their investigations made it possible for industrial firms to start commercial production at once. As a result of these accomplishments, penicillin was made available to our armed forces much sooner than would otherwise have been possible.

This is the sort of problem the four Regional Research Laboratories are prepared to solve. Their pilot-plant facilities enable them to take research beyond the test-tube stage and into semi-commercial production. Penicillin, promising as it is today, was not produced in sufficient quantities to make it of any great importance until research in the Peoria laboratory found a way to increase the yield so that it was possible for industry to go ahead on a commercial scale.

Phosphate Drink for Cattle: Cattle in southern Texas have been getting phosphate drinks, with benefit to their health and growth, in experiments conducted by the Bureau of Animal Industry and Texas scientists in cooperation with the King Ranch of that State. The phosphates are added to the drinking water to make up for insufficient supplies of phosphorus in the native vegetation. In the past some stockmen have added bonemeal and other forms of phosphorus to the feed and placed it in self-feeders. Still others have applied superphosphate to the soil as a fertilizer. Putting the phosphates in the drinking water, besides being convenient for the cattle owner, enables each animal to get its supply in a soluble form readily assimilated. The phosphate salts have been given experimentally in two forms, disodium phosphate and defluorinated triple superphosphate, in quantities sufficient to supply 6.5 grams of phosphorus in 6 gallons of water. The defluorinated product must be used because of the poisonous effect of fluorine. The treatment has resulted in more productive breeding stock and better gains by calves.

Forest Economics: Several years of work by the Forest Service Division of Forest Economics on the complex problem of Federal contributions in lieu of taxes on national forest lands culminated in the issuance of the Federal Real Estate Board's report, Federal Contributions to States and Local Governmental Units with Respect to Federally Owned Real Estate (1943: H. D. 216). The recommendations of the Board were based on and are wholly consistent with the contributions plan developed by the Service but generalized for application to

the several types of federally owned conservation lands. The release of the board's report constitutes a major landmark on the road to a permanent solution to the thorny contributions problem.

The investigations in process on the experimental forest at Crossett, Ark., have been aimed at the basic financial problem of forestry--i.e., how to harvest more and better forest products, yet keep the forest lands in condition to meet future needs. The completion of the first comprehensive report on the results of these studies (entitled "Financial Aspects of Selective Cutting in the Management of Second-Growth Pine-Hardwood Forests West of the Mississippi River") is a landmark in this phase of forest research. The economic practicality of partial short-interval cutting in the shortleaf-loblolly type of southern pine forest has been demonstrated conclusively. It has been shown that good forestry is good business. This is precisely what has been needed to accelerate the adoption of sound management practices on private forest lands, and the wholesome results of this impetus are already in evidence throughout the South.

The Otsego Forest Products Cooperative Association, Inc., at Cooperstown, N.Y., has been sponsored by the Service as a pilot plant for the development of cooperatives in the farm forest field. After a slow and difficult organization stage, this association has now attained a stable level of continuous operation. It is by far the largest cooperative now functioning in the farm forestry field, with 934 members and a thoroughly modern processing plant equipped with band saw. Local community interest in and support of the project has grown steadily. In the face of current operating difficulties and the pressure of other types of farm enterprise, plant operations have been adapted to wartime exigencies, and almost 2 million board-feet of high-quality lumber were turned out during the past year, most of which channeled directly to war uses. Management practices on farm woodlands throughout the area have been improved markedly, and the financial returns from the sale of forest products by association members have been stepped up appreciably.

Palm Oil Substitute: Imported palm oil was used before the war not only for making shortening, oleomargarin, and soap, but also in the manufacture of tin plate and terne plate. More recently it came into use in the cold-reduction process for sheet steel. When our imports of palm oil were largely shut off by Japanese conquests, substitutes had to be considered. The literature was rather conflicting, the cooperation of manufacturers and consumers was sought and, as it proved, the exact properties which made palm oil so suitable were unknown.

Dr. K. S. Markley and associates of the Bureau of Agricultural and Industrial Chemistry's Southern Regional Laboratory, at New Orleans, La., set to work. They first considered a hydrogenated cottonseed oil because that had been tried as a substitute for palm oil in World War I. Ordinary cottonseed oil was known to be unsuitable and the more highly hydrogenated oils also proved unsatisfactory. Finally a semi- or medium-hard hydrogenated cottonseed oil was found to approximate palm oil in properties. Upon test it proved extremely satisfactory. This tailor-made oil costs about twice as much as palm oil, but lasts three times as long.

Lacquer From Cow's Milk: With war limiting supplies of tin available for coating milk cans, dairy scientists now look to the cow herself to furnish some of the critical materials needed in transporting and packaging her product. Paul D. Watson, chemist of the Bureau of Dairy Industry, has developed a lacquer substitute for the tin coating on cans used for evaporated and condensed milk and for shipping fluid milk and cream. Watson's lacquer is made largely from lactic acid, with a small proportion of castor oil or some other vegetable oil. The product and the process have been patented and assigned to the Secretary of Agriculture (U.S. Patent 2,363,103, November 21, 1944).

Lactic acid is obtained by fermenting the milk sugar in whey, which is a by-product of cheese and casein manufacture. Commercial production of lactic acid from whey, as well as from other agricultural sources, is already established. Finding a profitable outlet for all the whey produced at large cheese factories has long been a difficult problem.

Tests with the new lacquer, both in the Bureau's laboratories and by several manufacturers of coating materials for metals, have given promising results. All the ingredients needed to make the lacquer are readily obtainable, and no unsurmountable difficulties in making or applying the lacquer are apparent, Mr. Watson says.

Although the Bureau's research has been directed mainly toward insuring a supply of suitable containers for milk and other dairy products in spite of the tin shortage, protective lacquers that can be applied directly to iron and steel and other materials would be of value to the whole sheet-metal industry. The Bureau's new lacquer is also suitable for many purposes other than a protective coating, such as impregnating, gluing, and molding various articles.

Preserving Chicken Feathers: Wet chicken feathers may be preserved for several weeks by a simple treatment, with salt and hydrochloric acid, developed by research workers of the Bureau of Animal Industry. Fifteen pounds of common salt and a pint of commercial concentrated hydrochloric acid are dissolved in 30 gallons of water, for each 15 pounds of wet feathers to be preserved. A tight 50-gallon wooden barrel makes a convenient container. Wet feathers are a byproduct of chicken dressing plants, but normally they decompose too rapidly to permit their shipment to feather-processing establishments. The preservative makes possible the industrial use of millions of pounds of chicken feathers that formerly were wasted or used as fertilizer. The new treatment is cheaper and more efficient than chemicals previously tried.

The method is essentially one of pickling. The solution costs initially only about 1¼ cents per pound of wet feathers treated. The expense is further reduced by the fact that several lots of feathers can be preserved in the same solution.

Uralloy: This is the name given by the Forest Products Laboratory, Forest Service, for a group of products resulting from development of methylolurea treatment of wood to make it harder, stiffer, and more stable dimensionally. Three public service patents have been granted covering the Laboratory's basic work on the treatments and products.

Apple Sirup: One of the first wartime accomplishments to come out of the Bureau of Agricultural and Industrial Chemistry's Eastern Regional Research Laboratory, at Philadelphia, Pa., was the development of apple sirup, a food product from sound but off-grade apples. It can also be made from apple peels and cores from canning and dehydration plants. It is a delicious table sirup, and especially fine for baking cakes, since its moisture-holding qualities prevent cakes from drying out rapidly. Apple sirup is also a good substitute for glycerine, now needed in making explosives, and is being used on large scale by one of the large cigarette manufacturers. Five commercial plants in the United States and Canada turned out more than 5 million pounds of apple sirup in 1944.

Scientific Collections: The maintenance of large collections of small quantities of viable seeds of many varieties of important economic crops and cultures of organisms of importance to agriculture is part of the work of the Bureau of Plant Industry, Soils, and Agricultural Engineering. Many of the items in these various collections are kept in cold storage, which reduces the frequency of regrowing crops to supply viable seed. In addition to the collections of seeds of crop plants, there are also collections of fungi and of soil bacteria. These collections have proved important factors in scientific work in many places outside the Department of Agriculture and even in other parts of the world. For example, the mold Penicillium, found by an English scientist to produce a powerful bactericide, was identified for him by Department scientists at Beltsville, Md., who started an extensive mold collection.

The various lots of seed of crops are usually regrown every few years to maintain their viability so that when needed they may be drawn upon for use by Department plant breeders, State experiment stations, or elsewhere. The plant scientists have recorded, insofar as possible, the characteristics of the various varieties so that when attempts are made to create a new variety to suit different conditions promising genetic material may be readily located.

The collection of wheat varieties totals approximately 8,500, drawn from every country where wheat is grown. There are about 300 varieties in the corn collection, including a large number grown by North and South American Indians, and modern varieties that have been or may be used in the development of hybrids. There are 4,000 varieties of barley, 3,000 of oats, 1,000 of rice, 400 of flax, and between 200 and 300 of sorghums.

The Plant Industry Station at Beltsville, Md., has a herbarium collection of fungi, mostly those which grow on food plants or other plants of economic importance, that totals nearly 450,000 specimens. Through possession of this extensive museum of fungi, it is possible for mycologists to identify specimens for scientific workers and for other purposes.

The Station also has one of the largest collections in the world of soil bacteria, including hundreds of strains of legume nodule bacteria kept in standard cultures for comparison with cultures offered for sale to the public. The different strains of soil bacteria of all kinds are available to scientists anywhere in the world. These collections are important for cooperation in carrying scientific work.

Columbia and Targhee Sheep: The development of Columbia and Targhee breeds of sheep is not strictly basic research but has resulted rather from utilization of basic knowledge of genetics. The development of the two breeds represents a skillful application of genetic laws and principles by scientists of the Bureau of Animal Industry.

Major credit for the development of Columbia sheep belongs jointly to E. L. Shaw, F. R. Marshall, and D. A. Spencer. Credit for the Targhee belongs to A. D. Spencer and W. A. Denecke. In both cases several others, mostly geneticists and station directors, were involved.

The development of these breeds has exceptional regional importance from a production standpoint, since they are primarily adapted to the inter-mountain ranges of the West. But the breeds also have national significance from a commercial and a monetary standpoint because of the excellent quality of their fleece and meat. The earning power of Columbia sheep is estimated to be $1 to $2 a head greater than average well-bred range sheep. That of the Targhee breed is somewhat less.

The Columbia is the result of cross breeding select Lincoln rams with Rambouillet ewes and proceeding from this original crossbred by mating the most select first-cross rams with carefully selected first-cross ewes and interbreeding the rams and ewes descending from them. The foundation of the Targhee breed was laid by mating select Rambouillet rams with select ewes of Corriedale X Lincoln-Rambouillet, and Lincoln X Rambouillet combinations, and interbreeding the rams and ewes descending from these matings. The Targhee came from rigid selections of these matings.

Dehydrating Food: Dehydrated vegetables take about one-third the space as similar products processed in other forms. Realizing this tremendous cargo saving opportunity, the former Agricultural Marketing Administration (now absorbed by the Office of Distribution), on May 26, 1942, announced a program to encourage expansion of the domestic industry to meet increased needs of American and United Nations military forces. At that time about 20 plants, with a production capacity of about 15,000,000 pounds annually, were operating in the United States.

In 1941 chemists and engineers of the Bureau of Agricultural and Industrial Chemistry, were at work in the Western Regional Research Laboratory, Albany, Calif., on the basic research that made this quick wartime expansion possible. Immediately after Pearl Harbor, pilot plant, or semicommercial, dehydrators were quickly built and put to dehydrating vegetables. Around 500 million pounds of food were dehydrated in 1943, and much of it was done according to methods worked out in the laboratory.

Investigations on the dehydration of meat got under way at the Agricultural Research Center, Beltsville, Md., about the same time, leading to results having prompt commercial application. The methods worked out for the preparation, processing, and packaging of dehydrated vegetables were offered to the industry in 1942 through two dehydration schools, one at Rochester, N. Y., for the eastern half of the country and one at Albany, Calif. for the West.

To carry out the program, an interdepartmental committee composed of representatives of the Department of Agriculture, Army, and the War Production Board was set up.

Range Reseeding: Recent studies by the Forest Service at several western forest and range experiment stations have pointed the way to successful seeding of valuable forage plants on several million acres of depleted range lands. Increases in forage production of from 2 to over 10 times, enough to far more than justify the cost, result from reseeding in accordance with the principles so far developed. Ranges producing considerably less than their soil and climate can support are most promising for planting. Many valuable forage species are available for planting throughout the West, although comparatively few have so far been found suited to the driest and more severe sites. As a result of many tests, effective and economical methods of planting have been developed for most types of ranges. These provide for covering the seed, an essential consideration, and where necessary, preparing the soil and reducing the stand of low-value competing vegetation.

Hybrid Corn: Hybrid corn, a product of scientific research, reached the stage of most vigorous commercial development at the time World War II had raised food demands to the highest point in history. It is an outstanding example, perhaps the most outstanding, of the influence of theoretical scientific research in revolutionizing the production practices of an agricultural crop.

Since the method of hybridizing corn was first suggested by G. H. Shull in 1909, the present perfection of commercial hybrids has been developed through combined and cooperative efforts of many breeders, both in the Bureau of Plant Industry, Soils, and Agricultural Engineering, and in State experiment stations. The Bureau has been working on the problem since 1916, and the present leading hybrid, U. S. 13, was developed by the two groups of plant breeders.

Although the first hybrid seed involving inbred lines was produced in 1921 in Connecticut, the industry did not really get started until nearly 15 years later. In 1943 nearly 52 percent of the country's corn acreage and almost the entire acreage in some of the leading corn States were planted to hybrid varieties. Since well-adapted hybrids increase the yield about 20 percent, it is estimated that the 1943 production as a result of their use was 669,000,000 bushels more than it otherwise would have been.

Sweetpotato Starch: The sweetpotato promises to become an important industrial crop, as the result of the development by the Bureau of Agricultural and Industrial Chemistry of a process for making high quality white starch. A growers' cooperative of more than 1,000 members at Laurel, Miss., has produced in a single season as much as 3,000,000 pounds of starch. Already the product is being used for sizing and finishing in cotton mills and by the laundry, baking, and confectionery industries. This new enterprise offers farmers an opportunity to add another profitable cash crop to their present farm programs. A large multi-million-dollar plant, based on the results of the Bureau's research, is nearing completion at Clewiston, Fla.

Laminated Ship Timbers: Under the sponsorship of the War Production Board, the Forest Products Laboratory, Forest Service, undertook a pilot-plant study to develop methods for laminating ship timbers. The study has made it possible to produce acceptable glued white oak timbers under properly controlled conditions. Laminated timbers permit the use of small-dimension lumber and reduce the demand for large timbers which have been difficult to obtain.

Photoperiodism: While working with Maryland Mammoth tobacco prior to 1920, W. W. Garner and H. A. Allard, of the then Bureau of Plant Industry (now Bureau of Plant Industry, Soils, and Agricultural Engineering), discovered that the plants flower only when the daily period of illumination is relatively short--that is, when the days are short and the nights long. When the light periods are long, the plants remain vegetative. Subsequent experiments on many kinds of plants showed clearly that they differ greatly in growth and flowering, responding with respect to the relative lengths of the daily periods of illumination and darkness to which they are exposed, some conforming to the behavior of Mammoth tobacco, others responding to relatively long illumination periods, and still others being but little affected.

This discovery departed widely from the prevalent theory that mere intensity of illumination was the principal light factor in determining the characteristic growth, flowering, and fruiting of plants. It had great fundamental importance as pure research and, as it developed, widespread practical significance. Response to relative length of day and night largely explains why many plants flower only at certain seasons of the year, and also largely explains changes in behavior where plants are carried from one latitude to another. It is now possible, by conducting experiments under controlled conditions, to tell in advance whether certain varieties of soybeans, peas, onions, timothy, barley, and other plants are adapted to the photoperiodic conditions prevailing in specific localities. Experimental crops can be grown under greenhouse conditions anyway, with supplemental artificial light as needed; if none is adapted to the locality, one or more suitable lines can be bred.

This discovery also has been particularly helpful in selecting soybean varieties that thrive and produce abundant seed for making oil, plastics, and food products in various localities. It enables us to produce our own beet seed domestically instead of importing it as formerly. It enables us to select localities where pyrethrum, a long-day plant, will thrive in the United States, and also to cross plant varieties which would not normally flower at the same time, as in the case of sugarcane varieties. By artificially shortening the daily light period, chrysanthemums and other flowers are now brought to market ahead of their normal season. Recently it has been found that a plant is primarily influenced by photoperiodic conditions by way of its leaves. Thus a Biloxi soybean will bloom promptly if only a few of its leaves are subjected to a short photoperiod. It is all but impossible to calculate the economic value from an original discovery so basic as that of Garner and Allard.

Staypak: This is a form of compressed wood of high density and strength, another new development of the Forest Products Laboratory, Forest Service. Compreg and Impreg, wood impregnated with synthetic resins, are earlier developments which promise to make wood adaptable to many specialized uses. By compression, the density and strength of the impregnated wood can be increased.

Norepol: Norepol, the rubber substitute from vegetable oils announced in 1942 as having been made in the Northern Regional Research Laboratory at Peoria, Ill., is now in commercial production. Two companies making rubber according to the Norepol formula have given the product trade names of their own. Other companies are turning out a finished product under the name of Norepol and some are making an intermediate material sold to manufacturers of rubber articles for the ultimate consumer.

The war has hastened commercial adoption of this infant industry that was in the pilot plant stage a short time ago. The pilot-plant policy of the Bureau of Agricultural and Industrial Chemistry--adopted with the establishment of the four Regional Research Laboratories for industrial utilization of farm commodities--has been a factor in getting the new product into use as well as speeding work on other rubber intermediates. The pilot plant serves as an intermediate stage between the laboratory test tube and commercial production. The wholehearted cooperation of industry had much to do with the rapid development of Norepol.

Norepol was first described as having a number of the valuable characteristics of natural rubber in considerable degree, including 200 percent stretch, tensile strength of 500 pounds to the square inch, and excellent resistance to oxidation and to the effects of water and alcohol. The general run of natural rubber has a 600 percent stretch and a tensile strength of 3,000 pounds or more. However, for certain purposes Norepol is highly useful.

Since the first public report, and as a result of tests in the Peoria pilot plant and by a number of factories, improvements have been made in the product. In particular, the necessary constituents can now be produced in purer form and there is better control of the polymerization process.

Tests at the Laboratory and in commercial plants show possibilities for many uses of Norepol, including molded and extruded articles--such as rubber heels, tubing, and gasket material. Because of the over-all rubber situation, careful choice must be made among the various possible uses. A point of much interest in the over-all economy of wartime is that what is left of vegetable oils after the separation of material for Norepol, including glycerol, can be used by industries that consume vegetable oils to make some of the same products they have been making from the whole oil.

U. S. DEPARTMENT OF AGRICULTURE

Office of Information
Mr. Harding, 4842
Miss Arnold, 4875

No. 6
Revised January 15, 1946
A USDA Document

IMPORTANT RECENT ACHIEVEMENTS OF DEPARTMENT OF AGRICULTURE SCIENTISTS

Wood "Sandwich" Construction: Design data developed at the Forest Products Laboratory, Forest Service, for wood sandwich constructions (soft, lightweight core material with thin, high-strength facings) used as skins for airplane wings and fuselages, have been used by the armed forces in the development of new high-speed aircraft. Wartime conditions and limitations of materials restricted the use of sandwich constructions to aircraft structures. But they have broad peacetime uses in products requiring combinations of high rigidity, light weight, and sound or heat insulation. Examples of potential uses are wall panels, flooring, refrigerator cars, boats, automobile bodies, doors and special shipping containers.

Favorite Tropical Lawn Grass: Since 1936 the Federal Experiment Station in Puerto Rico has been experimenting with Zoysia matrella or Manila grass for use on tropical lawns. This grass has been receiving publicity in the States as an ideal lawn grass. In Puerto Rico under tropical conditions it has proven superior to such commonly used grasses as Java, Bermuda, Centipede, St. Augustine, and carpet. Manila grass has a pleasing moderately deep shade of green, grows slowly, requires relatively little attention in weeding and mowing, produces a thick mat which feels like a heavy rug under foot, has practically no insects and diseases, withstands drought, and grows well in moderately dense shade. It is one of the few plants that can survive under bamboo, which requires considerable moisture and, in addition, is an extremely heavy feeding plant. Manila grass is tough and withstands considerable foot wear, but it is difficult to cut with a hand lawn mower. A rotary power mower, however, cuts it easily. The grass at present must be propagated by sod blocks but the Station is seeking a seed treatment to induce higher germination. Seed is produced abundantly in Puerto Rico, whereas little seeding has been reported under most conditions in the United States.

Cash Crops from Poor Land: Hillculture research of the Soil Conservation Service finds crops that fit poor and hilly farm lands and that pay on them. One of these crops is wild beach plum. Native to barren sand dunes of northeastern United States, the beach plum will grow as far west as Iowa. This hardy plant helps to prevent erosion, and the tart-flavored fruit makes good jelly and preserves. A 5-year test with wild beach plums on an acre of low-grade farm land at Beltsville, Md., showed the plant can make good returns on poor land under soil conservation practices. After 5 years, the plants yielded 60 bushels of fruit worth $240. The land was prepared and seeded about the same as for corn, using 5-foot drill rows.

At Auburn, Ala., the "miracle" vine--kudzu--increased returns by $10 to the acre on a plot of poor farm land over a similar plot under ordinary corn-cotton rotations. A 4-year rotation of cotton-corn-kudzu-kudzu netted the farmer $40 an acre more than a comparison field with a repeated cotton-corn rotation. On the second field, 48 pounds of nitrogen an acre was used to fertilize the cotton and 32 pounds of nitrogen to fertilize the corn. One more example of a crop that will grow on hilly land: Cane and vine fruits such as black raspberry and grapes "anchor" soil and utilize waste areas on many farms. Besides beautifying the farm setting, they boost farm income.

2, 4-D Kills Weeds: The growth-regulating chemical, 2, 4-dichlorophenoxyocetic acid (called 2, 4-D for short) has been studied by the Bureau of Plant Industry, Soils and Agricultural Engineering for a number of years which has brought out its various degrees of usefulness in the control of some common weeds in pastures, lawns, small-grain fields and cornfields. In the dilute solutions used it does not kill plants of the grass family. It has proved unusually effective in killing such common competitors of grass as dandelion, broad-leaved and narrow-leaved plantain, chickweed and others. The bureau research men have also found it effective against annual bindweed and promising against perennial bindweed. The experimenters have found that one of the effects of the chemical is to stimulate some kinds of weeds to use up their reserve food supply so the plants starve to death in the periods when their leaves are not producing starch.

Vitamin A in Butter: Since 1941 the Bureau of Dairy Industry has been cooperating with some 20 State agricultural experiment station laboratories to determine (1) the average vitamin A potency of the creamery butter produced in the United States; (2) the effect of commercial methods of storage on the vitamin A potency; and (3) the vitamin A potency of the butter sold on the retail markets.

The results of the Nation-wide survey, which were compiled by the Bureau during the year, show that about 64 percent of the creamery butter is produced in summer and about 36 percent in winter. The summer butter has averaged nearly 18,000 International Units of vitamin A per pound and the winter butter about 11,000, making the average potency of the total annual output approximately 15,000 International Units per pound. The survey showed also there is practically no loss of potency during ordinary commercial storage and handling of the butter, and that butter sold on the retail markets also averaged about 15,000 International Units of vitamin A per pound. Butter of the average potency, when consumed at the prewar rate of 18 pounds per capita per year, furnishes about 15 percent of the daily vitamin A allowance for normal adults.

Butter containing as much as 23,000 International Units is frequently produced in summer, under very good pasture conditions, but there are large fluctuations in the vitamin A potency of the butter produced from month to month and from State to State. The difference in vitamin A potency is largely the result of differences in the carotene content of the roughage feeds available to the cows in different seasons and regions. Research by the Bureau of Dairy Industry and by other investigators has shown that it is possible, by proper feeding, to produce butter in winter with the same high vitamin A potency as the summer butter. Research workers are now turning their attention to the development of methods which will be sufficiently practical and economical to enable more farmers to feed as well in winter as they do in summer.

Rutin: Rutin is a little known flavonol glucoside that occurs in various plants, including tobacco. In its work on the industrial utilization of tobacco, the Eastern Regional Research Laboratory determined the percentage of rutin in different kinds of green and cured tobacco and developed methods for the extraction of rutin from tobacco and other plants. By means of these methods, it extracted enough rutin from flue-cured tobacco for cooperative research on its biological effects by the Bureau of Animal Industry and on its therapeutic value by the Medical School of the University of Pennsylvania.

Rutin was found to be nontoxic to laboratory animals and to clinical patients. The clinical tests showed rutin to be definitely effective in treating a pathological condition known as "increased capillary fragility" which is sometimes associated with high blood pressure and causes minute blood vessels or capillaries to rupture--occasionally in the eye or brain with attendant blindness or apoplexy. Most of the patients treated with rutin showed marked improvement, especially where rutin was combined with remedies for high blood pressure.

Analysis showed that buckwheat was more promising as a commercial source of rutin than any other plant examined. While the percentage of rutin in buckwheat is highest (about 3 percent on dry weight of plant exclusive of roots) when the plant is in bloom and before any seeds are set, the greatest yield per acre would be obtained about 3 weeks later when the plants have made their maximum growth and set all their seed. At that time the yield per acre would be 3-1/2 to 4 times as great as at the time of highest concentration in the plant. Most of the rutin is in the leaves; very little is in the stems, and none is in the seeds. Much of the rutin is lost when the plants are dried, especially if they are dried slowly. Under the best conditions of drying, more than a third of the rutin is lost.

The Eastern Regional Laboratory prepared about 20 pounds of rutin of medicinal purity from freshly harvested buckwheat plants. That was more rutin than had ever been isolated before, and samples adequate for evaluation were supplied to more than a hundred physicians and pharmacologists for use in clinical studies. The results gave further evidence of the value of rutin for reducing increased capillary fragility to normal and showed that rutin can be used safely with thiocyanates and other drugs for reducing high blood pressure. Rutin is now in commercial production.

Insect Repellents: Early tests by the Bureau of Entomology and Plant Quarantine at Orlando, Fla., made it possible to recommend some good insect repellents to the armed forces for use in Italy as well as in other areas. Dimethyl phthalate, Indalone, and 2-ethylhexanediol 3,1-1 were found effective for a variety of insects, and combinations of them proved equally as effective as the individual ingredients for specific insects. It is, therefore, possible for the armed forces to obtain in one bottle an insect repellent against a wide variety of biting insects including mosquitoes, sandflies, eye gnats, and biting flies.

Studies also showed these repellents could be used effectively for protecting men from chiggers and would afford some degree of protection against ticks that affect man. The repellent is applied to the inside of the cuffs of the trousers, sleeves, and between the button surfaces so as to form a barrier against chiggers that tend to crawl into the clothing. More recent developments with insect repellents have shown even more efficient chemicals, but the increased efficiency is not sufficient to justify a change in the recommendation now. It is expected that even better repellents will be developed for postwar uses and that some of them may also be used against insects that affect animals or even crops. Over 300 million 2-ounce bottles of these repellents have been purchased by the armed forces.

Tropical Plant Introduction Garden: Since the establishment of the Federal Experiment Station in Puerto Rico in 1902, one of the largest collections of tropical plants in the Western Hemisphere has been built up at Mayaguez. The collection includes over 7,000 species. A valuable collection of Cinchona varieties, the plant from which quinine is obtained, is being maintained, and, insofar as possible, the highest yielding strains are being added to the collection as they become known

and available. In addition, the collection also includes a planting of the highest-yielding known strains of the rubber plant, Hevea brasiliensis. These are but two of many such economic species being grown and cultivated at this tropical outpost in Puerto Rico.

Penicillin as a Preserving Agent: Experiments by the Bureau of Dairy Industry have recently opened a new field of possible usefulness for penicillin through its destructive action against bacterial spores. It is believed that the drug may be effective as a preserving agent in certain commercial fields, including food preservation, paper manufacture, and in processes associated with the tanning, wool and rubber industries. Bacterial spores, a dormant resistant form of germ life, occur widely in nature, causing deterioration and spoilage of some industrial materials, and occasionally fatal poisoning in canned foods. They are a major problem in the commercial canning of nonacid foods.

Earlier work of the Bureau had shown that mild heating started the growth of many species of spores. Since penicillin is most effective against nonspores when they are actively multiplying, it was thought that it might also act against spores when they are stimulated to start growth. By incubating spores in a fluid containing small amounts of penicillin it was found that after beginning to germinate the spores become sufficiently unstable to be attacked by the drug, which results in the destruction of a high percentage of them. The effectiveness of penicillin in destroying bacterial spores, together with its nontoxic nature and its rapidly increasing availability, suggest its possible use as a food-preserving agent. The Bureau of Dairy Industry is especially interested in the possibilities for sterilizing evaporated milk and preserving fresh milk for longer periods.

Protection of Fabrics from Fungi and Insects: Great quantities of cloth deteriorate each year from stain and rot caused by the fungus growth, mildew. Seeking effective and cheap mildew-resistant treatments for cotton fabrics, textile specialists of the Bureau of Human Nutrition and Home Economics tested almost all the known mildew-proofing materials, and of 150 treatments found about one-third effective and 10 both effective and simple enough for home application. One of these--a new treatment developed in the Bureau's laboratories--combined such advantages that a public service patent was obtained to protect it for public use. This process, employing cadmium or copper salts with morpholine, is comparatively inexpensive, and effective for both home and commercial use. It can be used for awnings, sails, tents, shower curtains, and covers for porch furniture. In cooperation with the Bureau of Entomology and Plant Quarantine, the textile specialists subjected 16 of the mildew-preventive treatments to termite attack, and found 5 resistant. A rapid, dependable soil-suspension test for determining the resistance of treated fabrics to mildew was developed by the Bureau's textile specialists. Although devised for use in testing household fabrics, this was found applicable to testing of sandbags, camouflage cloth, and similar military fabrics. It has been included in the Proposed Federal Specifications of Test Methods for Mildew Resistance, for the evaluation of chemicals and chemically treated fabrics offered for Government purchase.

Free-fall Container for Aerial Delivery: A new and successful type of free-fall container was developed by the Forest Products Laboratory as a means of delivering supplies to beleaguered forces from aircraft without the use of parachutes. The container is collapsible, easily assembled, and adapted to production-line fabrication. The fiberboard container is equipped with fieldboard airfoil wings, which

cause the box to rotate on its vertical axis in descent, reducing both the rate of fall and the landing impact. Some of its advantages over parachute delivery are: In war the container is less easily spotted by the enemy; the container and "lifting" apparatus are one unit; the load cannot be caught in trees or dragged over the ground by wind after landing; the cost per pound of supplies delivered is reduced. In peacetime it should prove useful for supplying fire-fighting crews in the forests and other isolated groups such as timber crews, and for emergency delivery of foods and medical supplies to victims of floods and other disasters. As a means of regular delivery of mail, express, perishable foods, and other items to outlying communities it would fit in admirably with the recently developed airplane pick-up system.

Soil and Water Conservation Research: A soil conservation farm plan is designed to put every acre to its best use according to its individual capabilities and to treat it according to its individual needs. Such a plan redesigns the farmer's "plant" for more efficient operation. As in the modernizing of an industrial plant, the redesigning of the farm is based on the results of a multitude of laboratory and plot studies and carefully watched field trials. In cooperation with State agricultural experiment stations, Federal research agencies, and interested individuals, Soil Conservation Service research scientists delve into the secrets of soil, rain, wind, and growing crops.

By studying the private life of a raindrop, for example, they have developed a unique rain machine that can be regulated to produce variations in rainfall from gentle drizzle to drenching downpour, to test the effects of different kinds of vegetative cover as protection for various types of soil. Tilting plots of earth that can be sloped to any degree have helped to determine the comparative soil-holding powers of grasses and other close-growing plants on sloping fields. Wind-tunnel studies are contributing valuable information on the causes and manner of soil movement by wind. Fine-gaged laboratory instruments and ingenious weather-imitating devices are adding, bit by carefully weighed bit, to the store of tested facts contributing to the development of new and improved soil-conservation practices and to the refinement of existing practices.

Though it is difficult to evaluate any isolated part of the conservation research program, its contribution to agricultural advancement is indicated by the following proved advantages of soil-conservation farming. It has provided a practical guide for greater crop diversification. It has meant savings in seed, fertilizer, labor, and power, as well as of soil. It has permitted the greatest possible degree of protection--and even improvement--to soil and water resources under the pressure of intensified wartime production. It offers the farmer and rancher a sound avenue for shifts in type or intensity of production to meet varying markets, or other conditions.

Rapid Multiplication of New Varieties: The new oats variety, Clinton, developed by the Bureau of Plant Industry, Soils, and Agricultural Engineering and the Iowa Experiment Station, provides a good example of rapid increase of a new crop to reach early commercial production. This high-yielding, stiff-strawed variety was built up from a few pounds to 20 tons in a little over a year. The first lot of seed, 25 pounds, was harvested at Ames, Iowa, in July 1943, planted in November on irrigated land at Mesa, Ariz., where 2,000 pounds was harvested in April 1944. This ton of seed was sown May 20 of the same spring on irrigated land at Aberdeen, Idaho, and 20 tons harvested in August. This 20 tons, or about 1,200 bushels,

was planted by farmer seed growers in the Middle West in the spring of 1945, resulting in providing 40,000 bushels (1,280,000 pounds) of seed for 1946 planting. Interest of farmers in new varieties produced by research men is largely responsible for improvements in methods of increasing new varieties. In the big oats-producing region of the northern Mississippi valley new varieties have been taking hold very rapidly. Here in years when rusts are not particularly bad new varieties are increasing yields by 10 to 15 percent and in bad rust years by as much as 100 percent over what they would have been with the use of old susceptible varieties.

Norelac: A new thermoplastic resin suitable for use in lacquers was developed by the Northern Regional Research Laboratory. This product, named "Norelac", is a polyamide of dimeric fat acids and is made by reacting ethylene diamine with a mixture of dimeric fat acids or their esters prepared from the unsaturated acids of soybean oil or of other vegetable oil. Norelac promises to serve as a substitute for shellac in some uses, since it makes a good protective coating for wood and metal. It adheres well to most surfaces and has good resistance to water, alkali, acid, vegetable oils, and some organic solvents. Its thermoplastic property makes it useful as a binder for laminating metal foils and cellulosic sheet materials and as a self-sealing coating for wrapping materials and containers, especially those intended for dehydrated foods. An industrial firm became sufficiently interested in the possibilities of this new oil product to produce it on a pilot-plant scale and to supply prospective consumers with substantial samples. This assures thorough evaluation of the product by a large number of industries for many possible uses.

New Diet Aid: A new aid for nutritionists and others engaged in planning diets or calculating the nutritive value of food supplies is the Federal Government publication, Tables of Food Composition in Terms of Eleven Nutrients, Miscellaneous Publication No. 572 issued by the Department of Agriculture. The tables, which bring under one cover the composition of 275 common foods in terms of 11 nutrients, were prepared by the Department's Bureau of Human Nutrition and Home Economics and the Committee on Food Composition of the National Research Council's Food and Nutrition Board. Previous publications by the Bureau showing the proximate composition of foods have dealt with a more limited number of the important nutrients.

The new publication gives average values for food energy, protein, fat, carbohydrate, vitamin A value, thiamine, riboflavin, niacin, ascorbic acid, water, and refuse. The values given are derived from all available literature of nutrition research and from unpublished data from laboratories that have analyzed foods through arrangements with the National Research Council. In addition to foods believed to be most commonly used in the United States, the tables include as many of the less common foods as present data warrant. All of the values are stated in terms of 100 grams edible portion, and in terms of 1 pound as brought into the house for consumption.

The Bureau's task of gathering and evaluating food composition data traces its origin back to Dr. W. O. Atwater, first director of the Department of Agriculture's nutrition research. In 1869, as director of the Agricultural Experiment Station in Connecticut, Atwater published the first analysis of an American food--corn. Later, with his Department of Agriculture associates, he published a collection of tables showing the nutritional make-up of familiar foods--which became a "bible" to the nutrition scientists of that day.

The Committee on Food Composition organized in 1942 at the request of the Quartermaster Corps has been collecting recent data on the composition of Army foods and Army rations. These have been included in the published tables because they represent products which are already available or soon will be available to civilians.

Master Sample: The Bureau of Agricultural Economics, in cooperation with the Bureau of the Census, has recently completed the drawing of a "Master Sample" of farms, which is in effect a small replica of all the farms in the United States. Every county containing agricultural enterprises is represented. The sample consists of about 67,000 small sample areas which average about 2.5 square miles in size and contain, on the average, about 5 farms each.

One of the principal features of the Master Sample is its adaptability to various needs. The number of sample areas to be enumerated for any survey can vary widely, depending on the type of survey, the universe to be covered, and the accuracy desired. The sample can be used not only for Nation-wide studies, but for regional, State, or special crop-area studies as well. A further advantage of this sample over other sampling designs is that in clustering the units of observation (farms) by sample areas, considerable savings in survey costs are effected through reduction in travel between farms. This results in a great increase in sampling efficiency per dollar spent.

The first large-scale use of the Master Sample was in connection with the 1945 census of agriculture. It has also been used in connection with a number of field surveys by BAE as well as by other agencies, and materials are being made available to State agricultural experiment stations in connection with their surveys. The materials assembled in the drawing of the Master Sample will be very useful and will save much in costs of future samples. These materials consist of (1) large-scale highway maps of all counties in the United States with information on them useful for sampling; (2) listing sheets showing all villages, towns, and cities having an estimated population of 100 or more; (3) tabulations of farms and dwellings by small geographic areas; (4) transparent "positive" county maps from which an unlimited number of county maps showing the sample areas can be reproduced by the ozalid process; and (5) aerial photographs covering over 90 percent of the sample areas. If additional sample areas are needed for any county or group of counties, these can be readily provided at a relatively small cost.

New Method Permits Use of Old Tobacco Beds: Tobacco growers have had to use new ground sterilized by brush fires to grow their transplants in order to avoid too much damage from molds and weeds. Recently the Department has developed a new way to keep out weeds and diseases in these beds--sterilizing the ground with chemicals. The treatment consists in applying in the fall a mixture of calcium cyanamide (Cyanamid) and urea (uramon). The former protects against weeds. The mixture does even a better job of killing weeds, and also presents root knot, black root rot, and other diseases. The chemicals can be obtained wherever fertilizers are sold. For a square yard of tobacco bed the specialists recommend a pound of urea and a half pound of calcium cyanamide. With such an application of the mixture in the fall they have obtained an average of 21 good transplants per square foot, and almost no weeds.

Frozen Fruit Products: Frozen fruit puree was developed by the Western Regional Research Laboratory as a means of utilizing fully ripe fruit that cannot be shipped or handled in the fresh-fruit market. It can be made from any fully ripe, raw fruit that has a decided flavor. Its manufacture makes possible the maximum utilization of a fruit crop for food, since fruit that cannot be marketed in the fresh condition, because of physical deficiencies or over-abundance, can be converted into frozen puree (if it is internally sound and full-flavored) and kept in frozen storage for future use. Frozen fruit purees serve as flavor bases for ice creams, sherbets, ices and beverages, and they are also suitable for the manufacture of jam, Velva Fruit frozen dessert and frozen jellied fruit. The two products last mentioned, also developed by the Western Regional Laboratory, are made from uncooked fruit juice or puree, with addition of sugar and a stabilizer--gelatin in the first and rapid-set citrus pectin in the second. Velva Fruit has been produced commercially in the eastern part of the United States. It is very promising as an outlet for surplus cantaloupes. Heretofore, cantaloupes have not been used successfully in manufacturing food products.

Laminating Timbers for Exterior Use: A superior glued, laminated wood product, with joints that endure the ravages of fresh or salt water, weather, and severe conditions of heat and moisture, was produced by the use of special synthetic resin adhesives and a curing technique developed by the Forest Products Laboratory. This process was developed when the Navy's shipbuilding requirements for large-size, high-grade, solid timbers could not be met by the lumber industry.

The new technique consists in gluing the laminations into flat or curved ship parts such as keels, stems, frames, and skegs with low-temperature-setting phenol, resorcinol, or melamine resin glues and heating the clamped assembly at suitable temperatures and for periods of time to produce joints of high strength, water resistance, and durability.

With this curing technique, it is possible to produce glued laminated timbers and other wood products that are suitable for most uses to which solid wood can be put. Gluing permits the fabrication of large members from material of small size. The use of dry lumber reduces seasoning defects incident to the drying of large green timbers. Likewise material defects, which reduce the usefulness of solid wood products, can be eliminated in the laminated product. Peacetime uses for glued laminated wood products produced by this process include timbers, arches, ready-shaped members, implement and tool parts, and prefabricated building parts.

Breeding for Better-Keeping Eggs: Some eggs keep better than others, under the same conditions, because of the breeding of the hens that laid them. This recent finding by poultry specialists of the Bureau of Animal Industry opens up a new field of opportunity in poultry breeding.

During the last four years the scientists have observed individual and family differences in the keeping quality of eggs. Using the shrinkage of the thick portion of the white, during storage, as a measure of deterioration, the poultrymen found such shrinkage to be 62 percent for eggs laid by hens of one line of breeding and only 33 percent for another line.

A related study involving shrinkages in the weight of eggs during storage pointed to the quality of egg shells as a major influence. Some shells are more porous than others. In two divergent lines of chickens, loss of egg weight through shrinkage was about 60 percent greater in one than in the other. The results of the tests indicate that shell quality can be improved through family slection of breeding stock on the basis of eggs that have relatively low shrinkage when stored.

Tropical Kudzu: In cooperation with the Soil Conservation Service, the Federal Experiment Station in Puerto Rico has been working on new legumes for the Western Hemisphere Tropics. Pueraria phaseoloides, locally named "Tropical Kudzu," appears to have all the favorable points which have made Kudzu so popular in the Southern States. Ordinary Kudzu will not thrive in the Tropics, but Tropical Kudzu, its close relative, thrives well and produces a heavy forage crop. It serves excellently as a soil erosion plant, and will control erosion on steep hillsides and deep gullies. The protein content of the leaves is high, and it is palatable to animals. It grows well together with other grasses, thus improving the quality of fresh cut feed. It is resistant to drought which is a distinct advantage in Puerto Rico. Interest in this legume has been widespread, and requests for seed have been received from nearly every tropical country of the Western Hemisphere, as well as from the southernmost areas of the United States.

Furnace-type Lumber Dry Kiln: A furnace-type lumber dry kiln has been developed at the Forest Products Laboratory for use at small sawmills that are operated without steam and where an adequate supply of freshly cut sawdust is available for fuel. The general design is similar to the usual internal-fan type of kiln except for the method of supplying heat and humidity. Heat is furnished by a sawdust-burning furnace that is located in the control room at the rear of the drying chamber. Humidity is furnished by utilizing the moisture from the lumber being dried and by a waterspray system. Although this kiln was originally intended for the drying of box and crating lumber at mills where steam was not available, it can be used also for drying high-grade items 1 to 2 inches thick. Operated in conjunction with sawmills, the kiln offers an economical means of drying freshly cut lumber rapidly and with little degrade.

New Varieties in Volume: The records of the Bureau of Plant Industry, Soils, and Agricultural Engineering for the 4-year period ending with 1944 showed well over a hundred new varieties of crops of various kinds had been released to the public in that time as a result of research by Department and cooperating State scientists. Many of the new crops of this and preceding years were of importance in increasing output at a time when high production was called for to meet war demands for food and industrial materials. Such work is continuous--chain effort to produce higher-yielding, disease- and pest-resistant crops well adapted to certain areas and suited to modern methods of production and processing.

Sons of Proved Sires Raise Milk Production in Farm Herds: As a part of its experimental breeding work with proved sires at Beltsville and at its several field stations, the Bureau of Dairy Industry loans its young unproved bulls to farmers and other cooperators who agree to keep production records on the daughters of the bulls. The young bulls, which are sons of the proved sires in the experimental herds, are thus "proved" in outside herds and this proof affords a means of measuring the progress being made toward "fixing" an inheritance for high levels of production in the experimental herds.

Seventeen young unproved Jersey bulls bred at the Jeanerette, La., field station that have been loaned and used in farm herds in the vicinity of that station now have 297 daughters with butterfat production records that on the average are 32 pounds higher than the records of the 297 dams. Thirteen, or 77 percent, of these bulls sired daughters that on the average were better than the dams. Twenty-five young unproved Holstein bulls bred at the Woodward, Okla., station that were proved in cooperators' herds increased the production of their 282 daughters by an average of 45 pounds of butterfat, compared with the production of the dams. Twenty-four of these bulls, or 96 percent, sired daughters that were better on the average than the dams.

Some of the outstanding bulls thus discovered are then loaned for service in artificial breeding organizations and in cooperative bull associations, where their superior breeding inheritance is widely disseminated. One proved Holstein bull was loaned to the New York State Breeders' Cooperative in 1941 and in the following 3-year period "artificially sired" some 3,000 calves.

Resin-treated Paper Overlays for Veneer and Plywood: Structural veneers and plywoods overlaid with resin-treated paper--an outgrowth of the Forest Products Laboratory's research in plastic paper laminates--withstood rigorous wartime use for cargo aircraft and glider flooring, trunks, medical supply kits, table tops, and a variety of other products. Peacetime uses in housing hold even more promise because the paper overlay resists face checking of the veneers, improves water resistance and strength properties, makes possible the use of lower grade veneers, and enhances appearance by covering wood defects without decreasing the paintability of the product.

New Type of Cotton Bandage Fabric: A new type of all-cotton gauze bandage that tends to fit and cling better than ordinary gauze and allows greater freedom of movement in bandaged joints has been developed by the Bureau of Agricultural and Industrial Chemistry. The particularly valuable properties of the new fabric are a high degree of stretchability which makes the bandage partly self-fitting so that it conforms to irregular surfaces, sufficient elasticity to make it flexible and somewhat self-tightening without restricting the circulation of the blood, and a roughened surface which causes layers of bandage to cling together in contrast to the slipperiness of ordinary gauze. These new characteristics have been found especially desirable in head, knee, arm, and elbow dressings. The Surgical Department of the U. S. Naval Hospital in New Orleans reported, after six months of experimental tests with the new bandage, that it is superior to regular gauze, particularly for orthopedic use. Because of its semielastic and nonslip features, this new material should enable inexperienced persons to do a better job of bandaging. The bandage, which was developed in the Southern Regional Research Laboratory in New Orleans, is made by chemically treating ordinary open-weave gauze. It is now in pilot-plant production.

Hybrid Onion: The first hybrid onion variety was released to growers by the Bureau of Plant Industry, Soils, and Agricultural Engineering in 1944. Producing hybrid onion seed on a commercial scale had seemed almost impossible, until plant breeders discovered a male sterile onion which made possible hybridization with male fertile strains on a field scale. As a result, scientists of the Bureau and the University of California developed the first commercial onion hybrid, California Hybrid Red No. 1, adapted to growing in central California, southern Utah, and southern Nevada.

This new early variety has yielded from 460 to 768 100-pound bags per acre, generally 50 percent more per acre than the usual early varieties for those areas. (A male sterile strain may be carried on by planting "head sets" and in other ways known to plant breeders.) As a result of the possibilities in male sterile strains the field is now open for the development of hybrid strains of various varieties for different regions, seasons, and conditions.

Methyl Bromide Fumigation for Delousing Clothing and Equipment: Three methods involving the use of methyl bromide for fumigating clothing to destroy body lice, developed by the Bureau of Entomology and Plant Quarantine, are in extensive use by the military forces as one measure to prevent typhus. These methods are: (1) An individual gastight fumigation bag with a proper amount of the fumigant contained in a glass ampule, for the fumigation of one soldier's outfit; (2) lightweight, inexpensive, demountable fumigation vaults which can be operated in batteries for delousing the clothing of large numbers of men at one time; and (3) ground pits covered with various available materials such as raincoats, tarpaulins, paper, etc., for emergency use.

In addition to individual fumigation bags issued as standard equipment to U. S. forces for the North African campaign in 1943, demountable fumigation vaults were used overseas. As an important safeguard of the health of our civilian population, the vault method has been installed also at debarkation ports in the United States for delousing war prisoners, returning army personnel and refugees, and for treatment of salvage materials.

Utilization of New Species and Wood Wastes for Paper: By developing and adapting pulp-making processes to hitherto little-used wood species and wood wastes of lumber camps, sawmills, and veneer mills, the Forest Products Laboratory was able during the war to help paper manufacturers overcome shortages in raw materials, labor and transportation facilities. Hardwood "weed" species were shown to provide adequate reserves of pulpwood, in many instances relatively close to mills accustomed to obtaining supplies from distant areas, thereby reducing the heavy burden on railroads and trucking lines. Laboratory research demonstrated that these little-used hardwoods could yield profitable quantities of pulp for newsprint, book and magazine papers, wrapping paper, and other products. Experience gained by manufacturers in the use of these species will undoubtedly stimulate continued use of them in postwar years, thereby broadening the domestic base of supply and utilizing neglected species which have come to predominate in many cutover areas from which preferred species have been removed.

Spending Habits Surveyed: The first comprehensive picture of the country's spending and saving was made possible when the Bureau of Human Nutrition and Home Economics cooperated with other Government agencies in making a Nation-wide survey of consumer purchases of 1935-36. The completed set of 47 reports, of which the Bureau prepared 22, provides an unusually detailed analysis of the spending and saving habits of families with different incomes, living in cities, in villages, and on farms. A smaller study, also national in scope, was made in 1941. The reports, which shed light on how Americans spend their money for food, housing, transportation, and other items, provide a factual basis for economists and others concerned with policies and programs and their effects on families in varying circumstances. The war increased the usefulness and significance of these reports. They were used in planning the civilian supply of food, shoes, and other clothing, house furnishings, and other consumer goods, and for decisions on rationing food, shoes, and other items. They were examined to determine the effect of sales, excise, and income

taxes on general welfare and many details of the bond campaigns. They are basic to studying the impact of price changes on various groups of families. In addition, they will serve as bench marks for measuring progress to higher levels of living in the postwar years.

Vegetable Waste Valuable Source of Poultry Feed: Broilers fed on broccoli-leaf meal produce fine flavored meat, according to the results of cooperative research between the Bureau of Agricultural and Industrial Chemistry and the Delaware Agricultural Experiment Station. Chicks fed a standard mash to which had been added 8 percent of dried broccoli-leaf meal not only grew well, but the meat had a highly pleasing flavor. Chicks fed on this mixture were compared to similar chicks fed on alfalfa-leaf meal. Those receiving the broccoli meal made the fastest growth. Carrot, lima bean, and turnip meals were about equal to alfalfa, and pea vine meal was a little lower. The flavor of the meat of all broilers fed on the vegetable leaf meals was good, but that of the birds fed on broccoli-leaf meal was the best and unusually fine. This development is the outgrowth of an attempt of the Eastern Regional Research Laboratory at Philadelphia, Pa., to find uses for the large tonnage of waste leaves that occur in the production and processing of vegetable crops. Investigations by laboratory scientists showed that the blade portions of the leaves, free of stems, were unexpectedly high in protein, containing from 30 to 36 percent in some cases. This is higher than the 20 percent found in alfalfa-leaf meal and approaches the 40 to 45 percent for oil meals. The research revealed that the leaves are also high in carotene, or provitamin A, and in riboflavin, both of which are needed in poultry feed. Research, now in the pilot-plant stage, is being continued and enlarged in the hope that industry will develop methods for the profitable utilization of the thousands of tons of waste vegetable leaves produced each year.

Derris Comes to the Western Hemisphere: One of the two important sources of the insecticide rotenone is the root of the plant Derris elliptica. This species was the one commonly grown in Malaya and Sumatra, where a large percentage of the rotenone used in the United States previous to the war was produced. Since 1935, the Federal Experiment Station in Puerto Rico has been studying the production of Derris. As a result of these investigations, the station had available for distribution large quantities of propagating material. During the past two years, in cooperation with the Foreign Economic Administration and the Office of Foreign Agricultural Relations, over two million cuttings have been shipped from the Federal station to various countries in Latin America in order to produce this crop in the Western Hemisphere.

Pure Wood Pulps for Special Uses: The Forest Products Laboratory has developed a process by which alpha cellulose can be produced from wood in greater quantity per unit of raw wood and in purer form than is possible by present pulping methods. The process makes possible the use of wood cellulose for such special products as rayon for truck tires and sausage casings. Chemically, the product is similar to cotton-linters alpha cellulose. The process yields, on a commercially feasible basis, 48 to 50 percent of high-grade alpha cellulose from semichemical pulp as compared with yields of about 38 percent of a more degraded alpha cellulose from present pulping processes. The purity of product and the approximately 25 percent increase in yield possible with the process enhance its commercial possibilities.

Stratified Flow: By caging a miniature river and reservoir in glass, the Soil Conservation Service, in cooperation with the California Institute of Technology, has found how to shuttle a silt-laden stream through and out of a reservoir by making enlightened use of the stream's own action. Because the annual cost of reservoir silting is estimated as high as 50 million dollars, this discovery promises to save the country vast sums in safeguarded power production, community water supplies, and irrigation water.

Research of the Service's sedimentation specialists has established the fact that a stream retains its identity after entering a reservoir, continuing to flow in a layer through, under, or over the still water. The stream's action depends on the temperature and amount of sediment or silt it contains. A silt-laden current slides under the clear water of a reservoir as heavy cream poured into a cup of coffee slides under the clear, brown liquid.

The research workers first trapped these flows, or density currents, in glass and then watched and recorded their action. They predict that engineers eventually will be able to use the layered flows of water as accurately as an accountant can use the keys of an adding machine. For instance, an understanding of stratified flow will allow the channeling of a clear stream of snow water through the reservoir to city mains. A muddy stream may be channeled through the same basin to a drain feeding sandy irrigation canals so the silt will seal leaks in the sandy ditches. A salty stream can be stored in a known layer or stratum until it can be drained off.

Brighton Dam and Reservoir, near Washington, D. C., was the first to be constructed so as to make use of the principle of stratified flow in the special design of its outlets. Observations have shown that these outlets carried off from 2 to 10 times the amount of sediment that would have gone over a spillway with the same volume of water. Engineers are making immediate use of the new understanding of density currents to preserve the capacity of reservoirs already built, drawing off known silted streams through low outlets originally designed for emergency draining.

Phosphatase Test for Cheddar Cheese: A practical method for testing Cheddar cheese, to determine whether or not the milk used in making the cheese was pasteurized, has recently been developed by George P. Sanders and Oscar S. Sager, of the Bureau of Dairy Industry. The new improved method is a modification of the phosphatase test commonly used in testing milk to determine the adequacy of pasteurization.

More than 350 samples of Cheddar cheese, of which records of the milk treatment were available, were tested by the new method. All samples of cheese made from raw milk gave very strongly positive tests; some of these were more than 1 year old and one more than 5 years old. All samples made from under-pasteurized milk gave results that were positive in varying degree. None of the cheese made from milk pasteurized at 143°F. for 30 minutes, or at 160° or higher for about 15 seconds, gave positive tests, regardless of the age of the cheese. A decrease of 2° in the pasteurizing temperature, or the addition of as little as 0.1 percent of raw milk to pasteurized milk, could be detected in the cheese.

Since laws have recently been passed in several States requiring that all cheese sold be made from pasteurized milk, or that the cheese be cured for a definite period of time prior to retail sale, the development of this reliable test is an achievement of great importance to both the cheese industry and the consuming public. That Cheddar cheese of uniformly high quality can be made from pasteurized milk was demonstrated by earlier Bureau research, and its pasteurized-milk method of cheesemaking is being widely accepted by the cheese industry.

U.S.D.A.-34 Sweet Corn for the Tropics: The sweet corns commonly grown in the continental United States cannot be successfully grown in the tropics. Several years ago, the Federal Experiment Station in Puerto Rico developed, through selection and breeding, a sweet corn adapted to tropical conditions. This corn is now growing in practically every tropical area of the world. In recent years, thousands of pounds of seed have been provided to our armed forces fighting in tropical countries to make available one source of fresh vegetables for our men.

DDT Applications With Flying Spray Gun: The development of DDT for control of mosquitoes by the Bureau of Entomology and Plant Quarantine brought about a need for new methods of applying this insecticide. By the end of 1943, C. N. Husman and O. M. Longcoy developed a portable sprayer that can be used in any conventional type of small airplane such as the Piper Cub. It consists of a tank in place of the second seat of the plane, a pipe leading to a pressure pump driven by a small propeller from the wing, and another pipe leading from the pump to a venturi mounted through the fuselage. As the wind comes through the venturi it picks up the fine sprays delivered from nozzles mounted on the edge of the venturi and breaks them up into a very finely atomized spray. The equipment covers a swath width of 40 feet in an effective manner so that oil or water solutions can be applied at the rate of 2 quarts per acre. This equipment has been used in different theaters of the war during the past two years and is covered by a U. S. public service patent. This equipment can be used in any type plane and should be adaptable for use by private or commercial plane owners in applying insecticides. A slight modification of the sprayer enables one to apply insecticidal dusts at the rate of 2 pounds per acre.

Basic Facts About Vitamin A: To find out the vitamin A requirements of human beings, research workers in the food and nutrition laboratories of the Bureau of Human Nutrition and Home Economics fed an experimental diet to volunteer adults. Especially prepared meals contained every nutrient that the human body is known to need except vitamin A, which was almost completely absent. Since one early measurable effect of vitamin A is night blindness--failure of the eyes to adapt normally to dim light--appearance of this condition was taken as a sign that a subject's body had used up most of its stored vitamin A. Measured amounts of vitamin A were then given in gradually increased doses until the subject received just enough vitamin A to keep vision normal in dim light.

In the first experiments, solution of standardized cod-liver oil and pure carotene provided the measured amounts of vitamin A. Later, the minimum requirements were measured in terms of natural food, using peas, spinach, and carrots as sources of carotenes, which are changed into vitamin A in the body. It was found that the body needs about 30 to 60 percent more carotene as found in vegetable foods than it does of vitamin A found in animal foods. This finding had special timeliness for the war period when restricted food supplies caused civilians to lean more heavily upon plant foods for vitamin A. Data for estimating daily minimum

vitamin A requirements of the average normal adult have come from these experiments. The data were included in the informational background used when the Committee on Food and Nutrition of the National Research Council set forth recommended daily allowances of vitamins and other nutrients as a nutrition yardstick for America.

Some subjects in the first experiment showed signs of vitamin A deficiency after two weeks, whereas others--probably better fortified by a vitamin A reserve--showed no lack for several months. To learn more about the body's ability to store this vitamin and the rate of depletion, laboratory animals were used. Results showed that moderate amounts of vitamin A obtained regularly in meals are used more economically than occasional massive amounts. This suggests the importance of building up a "vitamin A savings bank" by eating, when possible, generous amounts of foods providing this vitamin. To aid in determining vitamin A value of normal diet, the laboratories analyzed this value in 128 common foods, raw and cooked.

Started under supervision of Dr. Lela Booher, the Bureau's vitamin A researches have continued more recently under Dr. Elsa Orent-Keiles, while various other scientists have held responsible posts. Mrs. Elizabeth Callison had direct leadership of studies to determine human vitamin A requirements.

Small-Type Turkey: Since about 1930 there has been a simultaneous increase in the number of turkeys raised and in the average size of turkeys produced. However, there has not been a corresponding increase in the demand for the heavier birds and this has resulted in a price differential of from 1 to 6 cents per pound in favor of smaller market turkeys. This demand on the part of consumers seems to be based on sound considerations and is likely to be permanent. In view of this trend, the Bureau of Animal Industry in 1934, at the Agricultural Research Center, Beltsville, Md., began an experimental project on the development of a small-type turkey. Marked progress has been made in fixing the desired characteristics in this small-type turkey.

Several standard varieties, the wild turkey, and White Austrian turkeys imported from Scotland have been crossed in the development of this small-type turkey. From the crossbred progeny selections are being made. The chief characteristics desired are as follows: Live weight of young toms at market age, 12 to 17 pounds; corresponding weight of young hens, 7½ to 10 pounds; color, white; compact body with moderately short legs, moderately long keel bone, and an abundance of meat, especially on the breast and legs; early maturity, resulting in a finished condition (U.S. Prime) with respect to fat, fleshing, and feathering at the age of 24 weeks; reasonably high egg production and high fertility, hatchability, and viability.

Several of the turkeys have proved to be excellent layers as shown by the production of more than 200 eggs in a year. Their eggs excelled also in fertility and hatchability. In addition, the high market quality of these excellent layers is above average as judged by body conformation and early maturity of their offspring.

Introduced Bamboos Prove Valuable: For several years, the Federal Experiment Station in Puerto Rico introduced various species of bamboo but not until 1935 was extensive work undertaken in this field. By selection and testing, several species of bamboo have now been found valuable for industrial purposes and likewise

highly resistant to the powder-post beetle which often attacks and destroys bamboo. As a result of these introductions and expansion of the plantings, a new bamboo furniture industry has been established in Puerto Rico, and several other new industries utilizing bamboo are in the offing as soon as sufficient planting material becomes available.

Dual-purpose Farm Ponds: One of the important biological aspects of soil and water conservation work encouraged by the Soil Conservation Service is managing farm ponds for fish production. Such farm fish ponds supply the farmer's table with a high-vitamin food costing only a few cents a pound. During 1945, farmers in soil conservation districts stocked more than 4 thousand ponds with some 6 million fish supplied by the Fish and Wildlife Service and the States. The ponds should yield 250 pounds of food for every surface acre of water. Another thing about ponds is that they heal over ugly gullies and save soil likely to wash away. Ponds transform "sick" land into a thing of beauty.

In most instances, fish is only a byproduct of the pond. Farmers and ranchers build ponds primarily to have a water supply on the place. Thus, they save labor and time in not having to haul water long distances. Water comes in handy for livestock, domestic use, irrigation, spraying orchards, fire protection and ice. In the West, ponds are often a lifesaver for cattle. They furnish water during dry seasons and make it possible to graze parts of the range that otherwise would be too far from water to use.

DDT Residual Sprays for Fly and Mosquito Control: Early experiments by the Bureau of Entomology and Plant Quarantine with DDT showed that houseflies died within about 45 minutes and mosquitoes within a couple of hours after coming in contact with unpainted wood and screen surfaces that had been treated with kerosene sprays containing 5 percent of the chemical. For more than a year, the spray residue left in the boxes and cages was effective in killing flies and mosquitoes. When similar sprays were used in the vicinity of Orlando, Fla., on the walls of dairy barns and upon screen doors and windows, they killed flies throughout the summer months.

At Beltsville, Md., similar sprays were effective for more than one year in dairy, hog, and sheep barns. In Texas, South Dakota, Montana, and Indiana, the tests were as effective as those made in the South and East. The minimum amount of spray needed for effective control throughout a season depends to some extent upon the formula used, kind of surface sprayed, and suitability of the location for flies to congregate. Small amounts of DDT seem sufficient when placed in locations frequented by flies and mosquitoes.

A single application of a DDT residual spray applied to buildings on 18 square miles of land in the rice fields of Arkansas demonstrated almost complete elimination of the malaria mosquito for an entire season. Poultry houses treated subsequently contained no malaria mosquitoes, but untreated houses had as many as 2,000 to 4,000 adult mosquitoes. The sprays proved so effective they are now being used by the U. S. Public Health Service in large-scale control of malaria in the Southern States.

Nutritive Value of Plant Proteins: Laboratory studies by the Bureau of Human Nutrition and Home Economics showed conclusively that proteins of soybeans, peanuts, cottonseed, wheat germ, and corn germ have nutritive values so high that they may be counted on to "extend" or "spare" the proteins of meat, milk, eggs, and other animal foods in times of short supply. A very practical way to use these plant proteins to advantage, the studies showed, is to team them with abundant breadstuffs and cereals. Strangely, such combinations sometimes prove actually more nourishing than the components would suggest. Example: In feeding experiments with young rats, adding 15 parts of soybean flour to 85 parts of wheat flour in bread increased its growth-promoting values five fold. Among these plant proteins chosen for investigation, wheat and corn germ proved definitely superior, the wheat germ in turn being higher than the corn germ in its nutritive value for promoting growth. Wheat germ thus appears to be the plant protein food that comes nearest to the proteins of meat, eggs, and milk in biological value.

Disease Resistance in Crops: One of the greatest improvements brought about in crops by plant breeders has been disease resistance, which, along with such characteristics as heavy yielding capacity and adaptability to various climatic conditions, has enabled farmers to produce much more on the same acreage, with the same quantity of fertilizer, and with less labor per unit. Notable among the crops which have been reinforced by disease-resistant characteristics, are wheat, oats, potatoes, sugarcane, and sugar beets, but practically all crops, large and small, have been improved to some extent in this way. Some accomplishments in disease resistance have become classics, such, for instance, as the saving of the sugarcane industry in Louisiana through the development of varieties resistant to mosaic disease. The development of sugar beets resistant to curly top is in the same class, as also the cooperative potato breeding program and breeding better cereals.

Weather-Yield Relationships: The importance of weather factors in relation to crop yields and the farmer's ultimate prosperity has long been recognized by everyone. But attempts to express these relationships in terms of mathematical formulas have been difficult because the final yield of a crop depends not only on a large number of such factors but also upon the particular combinations in which they occur. Through a study of the joint effects of temperature and precipitation on crops in Indiana, Iowa, and Ohio, Walter A. Hendricks and John C. School, statisticians of the Bureau of Agricultural Economics, have developed equations for measuring these joint relationships, making it possible to determine more accurately the outcome of the crop. Knowledge of how critical weather factors influence the growth and development of crops is very important in developing new varieties, improving cultural practices, and forecasting production.

In making the analysis, the best available estimates of average corn yields in the three States for the years 1890-1939 inclusive, published by BAE, were used together with temperature and precipitation data made available by the Weather Bureau, Department of Commerce. Such data are sufficiently extensive so that an equation containing a large number of constants may be fitted with some degree of confidence in the outcome. The fundamental concepts of a regression equation developed by earlier investigators were retained in this study. The theory was merely extended to include joint relationships of the two weather factors used in the analysis. The effect of temperature and precipitation during June, July, and August was investigated. Since such effects are not constant through the growing season, analysis of the data was designed to measure these effects separately for each month and each week during the period.

The analysis disclosed that high temperatures have a beneficial effect on final yield when sufficient moisture is available and a detrimental effect on yield when the moisture supply is deficient. The beneficial effects of high temperature increase as the available moisture supply is increased and vice versa. The effects of precipitation are influenced by the temperature. The beneficial effects of above-average precipitation and the detrimental effects of below-average precipitation increase as the temperature increases. The effects of temperature and precipitation on corn yields in Ohio and Indiana are greatest at about midpoint of the growing season. In Iowa, the effects of temperature and precipitation appear to be greatest early in the growing season. The success of this analysis leads investigators to believe that there is no reason why other weather factors could not be included in such analyses, in addition to temperature and precipitation. Each weather factor that is included would increase the number of constants to be evaluated from the data, but there are a few additional factors that might be included to good advantage. Relative humidity, evaporation rate, and infiltration have been suggested.

Stubble Mulch Cultivation: Giant duststorms of the early 1930's vividly emphasized the climatic hazards of farming in the Great Plains, a region renowned for livestock, grain, and other agricultural products. In response to the urgent needs of farmers and ranchers, the Soil Conservation Service early began developing methods of protecting the inherently fertile Plains soils from the effects of uncertain rainfall, strong winds, and wide variations in temperature. Stubble mulching--protecting the soil against wind and water erosion by using the straw as cover after harvest instead of burning it or plowing it under--is proving one of the most effective conservation practices evolved in this and other western areas.

Test plots and field trials set up in cooperation with the University of Nebraska, showed that stubble mulching increased infiltration of water, improved the structure of the soil, reduced runoff of rain and melting snow water, slowed evaporation, and lessened erosion by wind and water. Next, the research workers faced the task of devising cultivation methods that would not disturb the mulch of crop residues. In 1938, soil conservationists attached flat, V-shaped sweeps to a modified one-row cultivator for early experiments with subsurface tillage that would stir the soil from beneath without turning under the protective stubble. Five years later, 8,000 commercially produced machines, operated on the same principle, were in use on 500,000 acres of war-crop-producing Plains farms alone. For seedbed preparation, scientists reversed the motion of a rotary hoe, changing its digging action to treading that would firm the soil and break up clods and straw without removing or piling up crop residues.

For planting row crops, a corn planter was equipped with disk furrow openers and stub runners. The runners passed beneath the surface residue without clogging, and the disks threw out a furrow, leaving crop residues on the ground between rows. To cultivate corn, subtilling sweeps were set to operate between rows, cutting roots of weeds and stirring the ground, with rolling coulters to shield the plants. Microbiological studies of soils with crop-residue cover are under way, to discover what effect stubble mulching may have on the action of the tiny organisms that help transfer nutrients from soil to plant. In turn, the information will enable soil conservationists to determine more precisely the conditions under which this practice is most effective.

Stubble mulching also is practiced widely in the Pacific Northwest and is edging elsewhere beyond the boundaries of the Great Plains, especially where water conservation is an urgent need. This development of stubble-mulch cultivation is typical of much soil conservation research, carrying the study of a potential farming practice through every phase from microbiological studies to machinery design.

Cotton Hosiery Studied: Directed by Congress to investigate cotton hosiery as a possible outlet for more American-grown cotton, the Bureau of Home Nutrition and Home Economics began in 1939 to make laboratory and service tests. Accomplishments of this research proved of timely value in the wartime clothing situation. When the silk crisis came, the Bureau was able to make available to the trade over 200 designs for women's full-fashioned cotton hose. These included, sheer, medium, and heavy weights in plain and fancy weave for street, work, and dress wear. Some of these designs were reproduced exactly in marketed hose, and all of the designs furnished manufacturers with ideas for developing their own exclusive designs. Other phases of this research provided information on yarns, finishes, and hosiery construction at a time when this was especially needed. These studies also showed how medium staple lengths of cotton fiber can be used acceptably in hosiery manufacture. Wearing qualities were determined by actually putting into service hose made of different varieties of cotton and with different yarn and fabric constructions. These studies have had an important influence on making cotton hosiery once again an accepted article in the well-dressed woman's wardrobe. They have shown cotton growers and hosiery manufacturers the possibilities of American-grown cotton in high-grade hosiery manufacture. And they have contributed important methodology to the scientific study of a standard article of clothing.

Poisoned Bait for Mormon Cricket: This bait, consisting of a sodium fluosilicate, mill-run bran, and sawdust mixture, is a development of the Bureau of Entomology and Plant Quarantine laboratory at Bozeman, Mont., and represents the combined work of a number of individuals under the leadership of John R. Parker. It was first given widespread use in 1939, and has resulted in savings of hundreds of thousands of dollars in control work during the past three seasons by reducing the costs of materials furnished by the Government and of labor in their application. Savings as a result of cooperative control where this material has been used total in excess of $50 million in the last three years.

Scientific Sizing: Major savings to the clothing industry and to consumers alike are beginning to result from the Bureau of Human Nutrition and Home Economics' work on measuring women and children as a basis for sizing clothing. Lack of scientific data on the body measurements needed in sizing garments is at the root of the chaotic condition which has always existed in the sizing of clothing--particularly for women and children. Department stores complained of a $10,000,000 headache each year from returns and exchanges "because of wrong size." Mothers complained of wasting time, money, and energy buying clothes that failed to fit children at home--age of a child was no dependable guide to clothes size.

Gaining cooperation of 20 colleges and universities, and with funds furnished by the Works Progress Administration, scientific workers in the clothing laboratories, under direction of Miss Ruth O'Brian, weighed and measured nearly 150,000 boys and girls. Thirty-six clothing construction measurements were taken of these boys and girls, who ranged from 4 to 17 years of age and represented 16 States. From

data obtained, the Bureau recommended a two-way method of sizing children's clothes based on height and girth at hip. The height-hip system is very similar to the system by which men have bought their shirts and other garments for years according to a few guide dimensions. The Bureau's scientists continued by measuring 15,000 women from 18 years old to 80. Fifty-eight measurements used in constructing patterns and garments were recorded, and weight was taken as a further check on bodily proportions. Universities and other institutions in representative sections of the country cooperated.

From the data, the Bureau recommended height and weight combined, rather than the customary bust measure, for predicting fit of full-length garments. For garments for the upper part of the body, height and bust combined offered the best guides to a fit. For lower trunk garments, height and hip girths are good guides. No single measurement is adequate as a basis for sizing garments and patterns, the survey conclusively showed.

As a result of these measurement studies, some pattern companies and clothing manufacturers are now making use of the new sizing system for children's garments. On the basis of the Bureau's work, new standards for body sizes for boys' garments have been adopted by the American Standards Association, which serves as a link between scientists and the trade. While awaiting developments in the women's wear field, one large mail-order house has already gone ahead to use the Bureau's data and the recommended sizing methods for sizing its women's garments.

New Method for Dehydrating Cheese: A new method for dehydrating natural American Cheddar cheese for lend-lease or other uses, which is more direct than the commercial procedures now in use and which will also release spray-drying equipment for drying other foods was developed by George P. Sanders, of the Bureau of Dairy Industry, who devised the new method and found that if natural full-fat cheese is grated and then partly dried at room temperatures, the fat will be sealed up in the numerous case-hardened particles of curd. The particles can then be dehydrated in a tunnel drier or by any other heated-air method, without loss of fat.

The Bureau's new method is more direct and the resulting product is a natural cheese, minus only the water. Natural Cheddar cheese in its original state usually contains about 36 percent water, but the dehydrated flakes as prepared in the Bureau's laboratories contain about 3 percent water. The dehydrated flakes thus contain all the fat and other solids, but weigh only two-thirds as much as the original cheese. The flakes can be packaged loose or they can be compressed to the same density as the original cheese, or two-thirds its volume. The compressed cheese can be easily broken up, and it can be consumed directly or used in almost any other way that cheese is ordinarily used.

Inexpensive, Effective Dip for Sheep Ticks: Derris powder or cube powder having a 5 percent rotenone content, added to water at the rate of 6 ounces of the powder to 100 gallons, makes an effective dip for eradicating sheep ticks, or keds, from farm and range flocks. The value of this inexpensive dip was determined by tests conducted by N. G. Cobbett and C. E. Smith, parasitologists of the Bureau of Animal Industry. In Colorado, Smith dipped over 1,000 sheep, representing 5 farm flocks. In New Mexico, Cobbett dipped nearly 9,000 range sheep. The dip stayed in the fleeces of the sheep long enough to destroy the young ticks that emerged from the pupal cases remaining in the wool after dipping. This treatment has superior efficacy in killing ticks following a single dipping, and is, moreover, cheaper than the previously recommended commercial dips. Powders having more or less than 5 percent rotenone content may be used if the quantity of powder is adjusted to supply the proper total amount of rotenone.

Naval Stores Yields Increased: Naval stores research by the Forest Service has recently developed methods by which Naval stores yields can be increased 40 percent or better in commercial operations by applying chemicals to freshly chipped trees. The method results in higher money returns to the operator, ranging roughly between $400 and $700 additional net profit per crop of 10,000 trees, depending on how faithfully proper methods of chemical stimulation are followed. The three methods developed in this research and currently recommended to and tried by the industry are: (1) Application of sulphuric acid for the first 6 to 8 streaks to get newly worked timber into full production early in the years; (2) periodic acid treatment to all streaks chipped during spring and summer months; and (3) skip-acid treatment--the timber is chipped weekly but acid is applied only every other week. The second procedure gives the highest yields, but where labor is scarce, the first or third method is advantageous.

Plant Growth Regulators: In 1939 F. E. Gardner, P. C. Marth, and L. P. Batjer, of the then Bureau of Plant Industry (now the Bureau of Plant Industry, Soils, and Agricultural Engineering), tested the effectiveness of a number of different growth-regulating substances in preventing preharvest drop of 19 leading commercial apple varieties. Two compounds, naphthaleneacetic acid and naphthalene acetamide were outstanding and about equal in effectiveness in preventing fruit drop. The sodium, potassium, and ammonium salts of naphthaleneacetic acid were also found to be very effective. Soon after the publication of the results, several proprietary spray compounds containing either naphthaleneacetic acid or naphthalene acetamide as the active ingredient were placed on the market. In general, commercial orchardists have found these sprays effective against apple and pear loss from preharvest drop. Research workers have unearthed many other facts which may some day be of practical application. Dr. Marth has demonstrated the feasibility of controlling the time of emergence from dormancy of certain nursery stocks by suitable application of plant hormones. By such treatments, the storage period may be prolonged to permit later planting of more vigorous material and to retain more of the original vigor in the planting material. Gardner and Marth corroborated the results of another scientist in the artificial production of seedless fruits, holly, grapes, and strawberries through the use of these growth-regulating substances.

Research Saves Soybean Growers Money: Soybean growers in the Middle West during past processing seasons suffered considerable loss through dockage at the elevators because of a high percentage of green beans. They are now assured of relief from such dockage, which has been running from 5 to 30 cents a bushel, as a result of studies made by chemists of the Bureau of Agricultural and Industrial Chemistry. They found that the retention of the green color is apparently the result of hot, dry weather in late summer, but that the green beans are of normal composition. They also determined that the green color going into the oil when the beans were crushed can be removed simply by increasing the usual amount of bleach. These findings brought about a liberalization of the dockage, resulting, according to estimates, in a saving of $1,000,000, to soybean growers, in a year, in Illinois alone.

"Hexes" Cattle Flukes: As a result of the resourceful experimentation of a Bureau of Animal Industry scientist who had formerly been a South Sea Island missionary, a successful chemical treatment for liver flukes--long a serious menace to cattle raising in parts of Texas and other western areas--has been devised and is now being used by the cattlemen. The scientist who perfected the treatment is Dr. O. Wilfred Olsen. Flukes are difficult to reach by medication, since they seek out

the liver for attack. Scientists had found a drug with the five-syllable name, hexachlorethane, to be effective against these small, flat, leaf-shaped parasites, but it was difficult to administer because of its insolubility in water. Dr. Olsen found that bentonite combined well with hexachlorethane in water to make a smooth emulsion that was easy to give as a drench. Once interpreter to the king of one of the South Sea Islands, Dr. Olsen found little difficulty in translating his scientific lore into language that practical Texas cattlemen found easy to understand. When Texas State prison officials let him try out the remedy on part of the prison herd, the results proved a convincing demonstration of the value of the treatment in liver fluke control. The mounting demand for hexachlorethane that followed this demonstration led to substantial commercial production and distribution of the drug.

Improving Sagebrush Range Lands: On much of the 96 million acres of sagebrush range land in the West, range owners and operators have been faced with two very serious problems growing out of the prevalence of this very low-value shrub. On the one hand, sagebrush crowds out the vigorous growth of more valuable forage plants, makes herding difficult, contributes to the straying and loss of sheep, brushes considerable amounts of wool from sheep fleeces, and otherwise hinders effective livestock grazing. On the other hand, when the range has been burned in an effort to eliminate the brush and the necessary precautions have not been observed, a great reduction of valuable forage and loss of soil has usually resulted, to say nothing of occasional serious damage caused when the brush fires got out of hand and raged through other range areas,or destroyed buildings and other private property.

A study completed in 1942 by the Forest Service proved that heavy stands of sagebrush can be eliminated by controlled burning with only negligible losses, and that when such burning is properly planned and executed and includes intelligent management of the range for a season or two after burning, grazing capacity will be greatly increased--60 to 300 percent increases have been recorded. Where planned burning is carried out, grazing animals are unrestricted in their movements, ewes produce a more steady flow of milk, and lambs make better growth and are seldom lost. These and other benefits fully justify the investigation necessary to develop those safe methods.

Cork Substitute: Noreseal, a cork substitute, is a wartime product developed in the Northern Regional Research Laboratory, of the Bureau of Agricultural and Industrial Chemistry, at Peoria, Ill. It can be made from the pith of such farm waste residues as cornstalks, peanut hulls, sugarcane bagasse, and similar material. It can be made in rod or sheet form, or poured directly into the cap of the bottle, and is particularly satisfactory as a seal for bottled beverages. The product is now in semi-commercial production, and bids fair to remain a successful enterprise.

Forest Grazing in Southeast Cattle Production: In the Coastal Plain of Georgia and North Carolina cattle are usually turned loose in the woods each year to make the best use they can of the understory of grass and other low vegetation to be found there. With the growing need for meat for the Army bases and war plants established in the Southeast, interest in making better use of native forage had developed. Research by the Forest Service's Appalachian Forest and Range Experiment Station (in cooperation with the Bureau of Animal Industry, Bureau of Plant Industry, Soils, and Agricultural Engineering, and State experiment stations) has

shown during the past years that the native forage of the Coastal Plain provides a cheap and valuable source of feed on which an efficient and profitable livestock operation can be based. This native forage must be supplemented during the fall and winter, however, when the forage is deficient in protein and minerals.

Phenothiazine as an Anthelmintic: Phenothiazine is a synthetic organic chemical first prepared in the latter part of the nineteenth century. It is one of the thiazine dyes. Following the discovery and announcement that phenothiazine was effective as an insecticide, its value as an anthelmintic was studied and established in 1938-39 by Harwood, Jerstad, and Swanson, workers of the Bureau of Animal Industry. Experimentation with this drug has been continued to develop the best methods of use. Phenothiazine is now widely recognized throughout the world as a highly effective anthelmintic for the removal of many injurious internal parasites of domestic animals. It is the most valuable single drug so far discovered for combating such parasites. The drug is distributed commercially in powder form and may be administered either in gelatin capsules, in ground feed, in salt, or as a drench, the choice depending usually on the species of animals and preferred method of handling them. For use as an anthelmintic, phenothiazine should be the pure product prepared especially for that purpose.

In 1-ounce doses, phenothiazine rids sheep and goats of stomach worms, nodular worms, hookworms, and related pests. Its use prevents the spoiling of the sheep's intestines by nodular worms, thus providing an additional war material for making surgical sutures at a time when they were greatly needed. In suitable doses which vary with the size of animal, phenothiazine is effective in removing several kinds of parasites from swine, cattle, horses, and mules. In very small doses this drug is effective also in removing cecal worms from poultry. These are the worms that transmit blackhead to chickens and turkeys. The extensive use that phenothiazine already has acquired for controlling animal parasites is evident from the quantity--about 3 million pounds--used in the United States in 1943. Recently a mixture of 9 parts salt and 1 part phenothiazine, when made available to sheep, has been found largely to prevent acquisition of the parasite.

Increasing Yield of Penicillin: The observations which led to the discovery of penicillin were made in 1929 by Alexander Fleming, a British scientist. He was annoyed to find one day that some stray mold spores were growing in a culture of germs he was studying. A germ-free zone around this stray mold indicated to him that it was giving off a substance that was killing the germs in his culture. This substance turned out to be penicillin. It was named for the mold which produces it.

But very little was heard of this discovery until the summer of 1941, when Dr. Florey and Dr. Heatley, two British scientists who were largely responsible for the application of Fleming's observations, came to this country to stimulate interest in the pilot-plant production of the new product. After conferences with members of the National Research Council and scientists of the Department of Agriculture, the men were sent to the Northern Regional Research Laboratory, at Peoria, Ill., operated by the Bureau of Agricultural and Industrial Chemistry. This laboratory was selected because it had had wide experience in the use of molds in the fermentation field and had one of the largest collections of molds in the world.

Dr. Heatley stayed at the laboratory and went to work in cooperation with our fermentation experts to try to increase the yield of penicillin. The yield was so small at that time that it amounted to a bottleneck. They also developed methods of purifying penicillin. These studies were supported by the Committee on Medical Research in the Office of Scientific Research and Development. The studies are still going on and have been of great value to those who are now working to perfect the commercial production of penicillin.

By proper feeding of the molds and by improving the strains of molds that produce penicillin, the laboratory workers were able to increase the yield more than one hundredfold. The work at the laboratory, as well as that in industrial laboratories, was so promising that Dr. A. N. Richards, Chairman of the Committee on Medical Research, called a meeting of representatives of commercial manufacturers of pharmaceutical supplies in December 1941 and made available to them the successful results of the work at the laboratory. Largely as a result of that conference, a number of industrial firms started production of penicillin on a semi-commercial scale.

Penicillin is now being produced on a commercial scale by 21 plants in the United States and Canada. By the end of 1944 these plants were turning out penicillin at the rate of more than 200 billion units a month. That's enough to treat 250,000 serious cases of infection. Bureau scientists have played an important part in the development of this drug. They increased the yield of penicillin more than 100 times. They developed the particular strains of mold used to make all the penicillin now being produced. Their investigations made it possible for industrial firms to start commercial production at once. As a result of these accomplishments, penicillin was made available to our armed forces much sooner than would otherwise have been possible.

This is the sort of problem the four Regional Research Laboratories are prepared to solve. Their pilot-plant facilities enable them to take research beyond the test-tube stage and into semi-commercial production. Penicillin, promising as it is today, was not produced in sufficient quantities to make it of any great importance until research in the Peoria laboratory found a way to increase the yield so that it was possible for industry to go ahead on a commercial scale.

Phosphate Drink for Cattle: Cattle in southern Texas have been getting phosphate drinks, with benefit to their health and growth, in experiments conducted by the Bureau of Animal Industry and Texas scientists in cooperation with the King Ranch of that State. The phosphates are added to the drinking water to make up for insufficient supplies of phosphorus in the native vegetation. In the past some stockmen have added bonemeal and other forms of phosphorus to the feed and placed it in self-feeders. Still others have applied superphosphate to the soil as a fertilizer. Putting the phosphates in the drinking water, besides being convenient for the cattle owner, enables each animal to get its supply in a soluble form readily assimilated. The phosphate salts have been given experimentally in two forms, disodium phosphate and defluorinated triple superphosphate, in quantities sufficient to supply 6.5 grams of phosphorus in 6 gallons of water. The defluorinated product must be used because of the poisonous effect of fluorine. The treatment has resulted in more productive breeding stock and better gains by calves.

Forest Economics: Several years of work by the Forest Service Division of Forest Economics on the complex problem of Federal contributions in lieu of taxes on national forest lands culminated in the issuance of the Federal Real Estate Board's report, Federal Contributions to States and Local Governmental Units with Respect to Federally Owned Real Estate (1943: H. D.216). The recommendations of the Board were based on and are wholly consistent with the contributions plan developed by the Service but generalized for application to the several types of federally owned conservation lands. The release of the board's report constitutes a major landmark on the road to a permanent solution to the thorny contributions problem.

The investigations in process on the experimental forest at Crossett, Ark., have been aimed at the basic financial problem of forestry--i.e., how to harvest more and better forest products, yet keep the forest lands in condition to meet future needs. The completion of the first comprehensive report on the results of these studies (entitled Financial Aspects of Selective Cutting in the Management of Second-Growth Pine-Hardwood Forests West of the Mississippi River) is a landmark in this phase of forest research. The economic practicality of partial short-interval cutting in the shortleaf-loblolly type of southern pine forest has been demonstrated conclusively. It has been shown that good forestry is good business. This is precisely what has been needed to accelerate the adoption of sound management practices on private forest lands, and the wholesome results of this impetus are already in evidence throughout the South.

The Otsego Forest Products Cooperative Association, Inc., at Cooperstown, N. Y., has been sponsored by the Service as a pilot plant for the development of cooperatives in the farm forest field. After a slow and difficult organization stage, this association has now attained a stable level of continuous operation. It is by far the largest cooperative now functioning in the farm forestry field, with 934 members and a thoroughly modern processing plant equipped with band saw. Local community interest in and support of the project has grown steadily. In the face of current operating difficulties and the pressure of other types of farm enterprise, plant operations have been adapted to wartime exigencies, and almost 2 million board-feed of high-quality lumber were turned out during the past year, most of which channeled directly to war uses. Management practices on farm woodlands throughout the area have been improved markedly, and the financial returns from the sale of forest products by association members have been stepped up appreciably.

Palm Oil Substitute: Imported palm oil was used before the war not only for making shortening, oleomargarin, and soap, but also in the manufacture of tin plate and terne plate. More recently it came into use in the cold-reduction process for sheet steel. When our imports of palm oil were largely shut off by Japanese conquests, substitutes had to be considered. The literature was rather conflicting, the cooperation of manufacturers and consumers was sought and, as it proved, the exact properties which made palm oil so suitable were unknown. Dr. K. S. Markley and associates of the Bureau of Agricultural and Industrial Chemistry's Southern Regional Laboratory, at New Orleans, La., set to work. They first considered a hydrogenated cottonseed oil because that had been tried as a substitute for palm oil in World War I. Ordinary cottonseed oil was known to be unsuitable and the more highly hydrogenated oils also proved

unsatisfactory. Finally a semi- or medium-hard hydrogenated cottonseed oil was found to approximate palm oil in properties. Upon test it proved extremely satisfactory. This tailor-made oil costs about twice as much as palm oil, but lasts three times as long.

Preserving Chicken Feathers: Wet chicken feathers may be preserved for several weeks by a simple treatment, with salt and hydrochloric acid, developed by research workers of the Bureau of Animal Industry. Fifteen pounds of common salt and a pint of commercial concentrated hydrochloric acid are dissolved in 30 gallons of water, for each 15 pounds of wet feathers to be preserved. A tight 50-gallon wooden barrel makes a convenient container. Wet feathers are a byproduct of chicken dressing plants, but normally they decompose too rapidly to permit their shipment to feather-processing establishments. The preservative makes possible the industrial use of millions of pounds of cnicken feathers that formerly were wasted or used as fertilizer. The new treatment is cheaper and more efficient than chemicals previously tried. The method is essentially one of pickling. The solution costs initially only about 1¼ cents per pound of wet feathers treated. The expense is further reduced by the fact that several lots of feathers can be preserved in the same solution.

Uralloy: This is the name applied by the Forest Products Laboratory to a group of products resulting from development of methylolurea treatment of wood to make it harder, stiffer, and more stable dimensionally. Three public service patents have been granted covering the Laboratory's basic work on the treatments and products.

Apple Sirup: One of the first wartime accomplishments to come out of the Bureau of Agricultural and Industrial Chemistry's Eastern Regional Research Laboratory, at Philadelphia, Pa., was the development of apple sirup, a food product from sound but off-grade apples. It can also be made from apple peels and cores from canning and dehydration plants. It is a delicious table sirup, and especially fine for baking cakes, since its moisture-holding qualities prevent cakes from drying out rapidly. Apple sirup is also a good substitute for glycerine, now needed in making explosives, and is being used on large scale by one of the large cigarette manufacturers. Five commercial plants in the United States and Canada turned out more than 5 million pounds of apple sirup in 1944.

Scientific Collections: The maintenance of large collections of small quantities of viable seeds of many varieties of important economic crops and cultures of organisms of importance to agriculture is part of the work of the Bureau of Plant Industry, Soils, and Agricultural Engineering. Many of the items in these various collections are kept in cold storage. There are also collections of fungi and of soil bacteria. These collections have proved important factors in scientific work in many places outside the Department of Agriculture and even in other parts of the world. For example, the mold Penicillium, found by an English scientists to produce a powerful bactericide, was identified for him by Department scientists at Beltsville, Md., who started an extensive mold collection.

The various lots of seed of crops are usually regrown every few years to maintain their viability so that when needed they may be drawn upon for use by Department plant breeders, State experiment stations, or others. The plant scientists have recorded, insofar as possible, the characteristics of the various varieties so that when attempts are made to create a new variety to suit different conditions promising genetic material may be readily located. The collection of wheat varieties totals approximately 8,500, drawn from every country where wheat is grown. There are about 300 varieties in the corn collection, including a large number grown by North and South American Indians, and modern varieties that have been or may be used in the development of hybrids. There are 4,000 varieties of barley, 3,000 of oats, 1,000 of rice, 400 of flax, and between 200 and 300 of sorghums.

The Plant Industry Station at Beltsville, Md., has a herbarium collection of fungi, mostly those which grow on food plants or other plants of economic importance, that totals nearly 450,000 specimens. Through possession of this extensive museum of fungi, it is possible for mycologists to identify specimens for scientific workers and for other purposes. The Station also has one of the largest collections in the world of soil bacteria, including hundreds of strains of legume nodule bacteria kept in standard cultures for comparison with cultures offered for sale to the public. The different strains of soil bacteria of all kinds are available to scientists anywhere in the world. These collections are important for cooperation in carrying on scientific work.

Columbia and Targhee Sheep: The development of Columbia and Targhee breeds of sheep is not strictly basic research but has resulted rather from utilization of basic knowledge of genetics. The development of the two breeds represents a skillful application of genetic laws and principles by scientists of the Bureau of Animal Industry. Major credit for the development of Columbia sheep belongs jointly to E. L. Shaw, F. R. Marshall, and D. A. Spencer. Credit for the Targhee belongs to D. A. Spencer and W. A. Denecke. In both cases several others, mostly geneticists and station directors, were involved.

The development of these breeds has exceptional regional importance from a production standpoint, since they are primarily adapted to the inter-mountain ranges of the West. But the breeds also have national significance from a commercial and a monetary standpoint because of the excellent quality of their fleece and meat. The earning power of Columbia sheep is estimated to be $1 to $2 a head greater than average well-bred range sheep. That of the Targhee breed is somewhat less. The Columbia is the result of cross breeding select Lincoln rams with Rambouillet ewes and proceeding from this original crossbred by mating the most select first-cross rams with carefully selected first-cross ewes and interbreeding the rams and ewes descending from them. The foundation of the Targhee breed was laid by mating select Rambouillet rams with select ewes of Corriedale X Lincoln-Rambouillet, and Lincoln X Rambouillet combinations, and interbreeding the rams and ewes descending from these matings. The Targhee came from rigid selections of these matings.

Dehydrating Food: Dehydrated vegetables take about one-third the space as similar products processed in other forms. Realizing this tremendous cargo-saving opportunity, the former Agricultural Marketing Administration, on May 26, 1942, announced a program to encourage expansion of the domestic industry to meet increased needs of American

and United Nations military forces. At that time about 20 plants, with a production capacity of about 15,000,000 pounds annually, were operating in the United States. In 1941 chemists and engineers of the Bureau of Agricultural and Industrial Chemistry, were at work in the Western Regional Research Laboratory, Albany, Calif., on the basic research that made this quick wartime expansion possible. Immediately after Pearl Harbor, pilot plant, or semi-commercial, dehydrators were quickly built and put to dehydrating vegetables. Around 500 million pounds of food were dehydrated in 1943, and much of it was done according to methods worked out in the laboratory. Investigations on the dehydration of meat got under way at the Agricultural Research Center, Beltsville, Md., about the same time, leading to results having prompt commercial application. The methods worked out for the preparation, processing, and packaging of dehydrated vegetables were offered to the industry in 1942 through two dehydration schools, one at Rochester, N. Y., for the eastern half of the country and one at Albany, Calif., for the West. To carry out the program, an interdepartmental committee composed of representatives of the Department of Agriculture, Army, and the War Production Board was set up.

Range Reseeding: Recent studies by the Forest Service at several western forest and range experiment stations have pointed the way to successful seeding of valuable forage plants on several million acres of depleted range lands. Increases in forage production of from 2 to over 10 times, enough to far more than justify the cost, result from reseeding in accordance with the principles so far developed. Ranges producing considerably less than their soil and climate can support are most promising for planting. Many valuable forage species are available for planting throughout the West, although comparatively few have so far been found suited to the driest and most severe sites. As a result of many tests, effective and economical methods of planting have been developed for most types of ranges. These provide for covering the seed, an essential consideration, and where necessary, preparing the soil and reducing the stand of low-value competing vegetation.

Hybrid Corn: Hybrid corn, a product of scientific research, reached the stage of most vigorous commercial development at the time World War II had raised food demands to the highest point in history. It is an outstanding example, perhaps the most outstanding, of the influence of theoretical scientific research in revolutionizing the production practices of an agricultural crop. Since the method of hybridizing corn was first suggested by G. H. Shull in 1909, the present perfection of commercial hybrids has been developed through combined and cooperative efforts of many breeders, both in the Bureau of Plant Industry, Soils, and Agricultural Engineering, and in State experiment stations. The Bureau has been working on the problem since 1916, and the present leading hybrid, U. S. 13, was developed by the two groups of plant breeders. Although the first hybrid seed involving inbred lines was produced in 1921 in Connecticut, the industry did not really get started until nearly 15 years later. In 1945 64 percent of the country's corn acreage and almost the entire acreage in some of the leading corn States, was planted to hybrid varieties. Since well-adapted hybrids increase the yield about 20 percent, it is estimated that the 1945 production as a result of their use was roughly 750,000,000 bushels more than it otherwise would have been.

Sweetpotato Starch: The sweetpotato promises to become an important industrial crop, as the result of the development by the Bureau of Agricultural and Industrial Chemistry of a process for making high-quality white starch. A growers' cooperative of more than 1,000 members at Laurel, Miss., has produced in a single season as much as 3,000,000 pounds of starch. Already the product is being used for sizing and finishing in cotton mills and by the laundry, baking, and confectionery industries. This new enterprise offers farmers an opportunity to add another profitable cash crop to their present farm programs. A large multi-million-dollar plant, based on the results of the Bureau's research, is nearing completion at Clewiston, Fla.

Photoperiodism: While working with Maryland Mammoth tobacco prior to 1920, W. W. Garner and H. A. Allard, of the then Bureau of Plant Industry (now Bureau of Plant Industry, Soils, and Agricultural Engineering), discovered that the plants flower only when the daily period of illumination is relatively short--that is, when the days are short and the nights long. When the light periods are long, the plants remain vegetative. Subsequent experiments on many kinds of plants showed clearly that they differ greatly in growth and flowering, responding with respect to the relative lengths of the daily periods of illumination and darkness to which they are exposed, some conforming to the behavior of Mammoth tobacco, others responding to relatively long illumination periods, and still others being but little affected.

This discovery departed widely from the prevalent theory that mere intensity of illumination was the principal light factor in determining the characteristic growth, flowering, and fruiting of plants. It had great fundamental importance as pure research and, as it developed, widespread practical significance. Response to relative length of day and night largely explains why many plants flower only at certain seasons of the year, and also largely explains changes in behavior where plants are carried from one latitude to another. It is now possible, by conducting experiments under controlled conditions, to tell in advance whether certain varieties of soybeans, peas, onions, timothy, barley, and other plants are adapted to the photoperiodic conditions prevailing in specific localities. Experimental crops can be grown under greenhouse conditions anyway, with supplemental artificial light as needed; if none is adapted to the locality, one or more suitable lines can be bred.

This discovery also has been particularly helpful in selecting soybean varieties that thrive and produce abundant seed for making oil, plastics, and food products in various localities. It enables us to produce our own beet seed domestically instead of importing it as formerly. It enables us to select localities where pyrethrum, a long-day plant, will thrive in the United States, and also to cross plant varieties which would not normally flower at the same time, as in the case of sugarcane varieties. By artificially shortening the daily light period, chrysanthemums and other flowers are now brought to market ahead of their normal season.

Staypak: This is a form of compressed wood of high density and strength, another new development of the Forest Products Laboratory. Compreg and Impreg, wood impregnated with synthetic resins, are earlier developments which promise to make wood adaptable to many specialized uses. By compression, the density and strength of the impregnated wood can be increased.

U. S. DEPARTMENT OF AGRICULTURE

Office of Information
Mr. Harding, 4842
Miss Arnold, 4875

No. 6
Revised July 1, 1946
A USDA Document

IMPORTANT RECENT ACHIEVEMENTS OF DEPARTMENT OF AGRICULTURE SCIENTISTS

Rutin: Rutin is a little known flavonol glucoside that occurs in various plants, including tobacco. In work on the industrial utilization of tobacco, the Eastern Regional Research Laboratory of the Bureau of Agricultural and Industrial Chemistry determined the percentage of rutin in different kinds of green and cured tobacco and developed methods for the extraction of rutin from tobacco and other plants. By these methods, it extracted enough rutin from flue-cured tobacco for cooperative research on its biological effects by the Bureau of Animal Industry and on its therapeutic value by the Medical School of the University of Pennsylvania.

Rutin was found to be nontoxic to laboratory animals and to clinical patients. The clinical tests showed rutin to be definitely effective in treating a pathological condition known as "increased capillary fragility" which is sometimes associated with high blood pressure and causes minute blood vessels or capillaries to rupture--occasionally in the eye or brain with attendant blindness or apoplexy. Most of the patients treated with rutin showed marked improvement, especially where it was combined with remedies for high blood pressure.

Analysis showed that buckwheat is more promising than any other plant examined as a commercial source of rutin. While the percentage of rutin in buckwheat is highest (about 3 percent on dry weight of plant exclusive of roots) when the plant is in bloom and before any seeds are set, the greatest yield per acre is obtained about 3 weeks later when the plants have made their maximum growth and set all their seed. At that time the yield per acre is $3\frac{1}{2}$ to 4 times as great as at the time of highest concentration in the plant. Most of the rutin is in the leaves; very little is in the stems, and none is in the seeds. Much of the rutin is lost when the plants are dried, especially if they are dried slowly. Under the best drying conditions, more than a third of the rutin is lost.

In 1944 and 1945 the Eastern Laboratory prepared about 40 pounds of rutin of medicinal purity from freshly harvested buckwheat plants. That was more rutin than had ever been isolated before, and samples adequate for evaluation were supplied to more than a hundred physicians and pharmacologists for use in clinical studies. The results gave further evidence of the value of rutin for reducing increased capillary fragility to normal and showed that rutin can be used safely with thiocyanates and other drugs for reducing high blood pressure. Rutin is now in commercial production.

Air Transport of Farm Products: Agriculture has a considerable stake in air transportation, because of the speed with which perishable products can be carried to distant markets. Air freight presumably will make it possible for farmers to ship perishables to many new markets. Rail freight from California requires 10 days or more to reach the eastern seaboard, but air freight will make possible the retailing of perishables from the West Coast or Gulf areas to eastern markets 24 hours after harvest. Experimental shipments have been made, some in cargo holds of passenger planes. Early tests indicated that air-borne products must be handled differently than rail-borne. Air transport opens a new field with new requirements to the package industry. Airline operators and plane designers are giving increased attention to this new business.

Some growers already are learning to pick and handle their products properly for air shipment. For best development of this new mode of freight transportation, planes and airport facilities should be properly adapted to cargo handling, with adequate attention to refrigeration, ventilation and storage. In the long run, of course, cost will be the major deciding factor in these developments. This survey is based on studies of air transport in a report by a group of the Inter-Bureau Committee on Post-War Programs under F. L. Thomsen, Bureau of Agricultural Economics.

High-Frequency Heat for Gluing Wood Products: Methods and equipment for using radio-frequency heating to set glues in wood products have been developed by the Forest Products Laboratory of the Forest Service for the Army and Navy. Speed advantages of such heating were applied to wood products for war purposes, including parts of ships and boats, buildings, and furniture, and electrical equipment, inexpensive presses, and pressing methods were devised.

Experience demonstrated that high-frequency dielectric heating can be employed advantageously in the mass production of articles which require the use of expensive jigs and other apparatus. The rapidity with which the glue is set--in seconds rather than hours--enables manufacturers to use such apparatus at a much faster rate, thus cutting unit costs of their products. High-frequency heat appears to hold especially great promise in furniture manufacture and production of laminated timbers for land structures and ships.

Preserving Chicken Feathers: Wet chicken feathers may be preserved for several weeks, by a simple treatment, with salt and hydrochloric acid, developed by research workers of the Bureau of Animal Industry. Fifteen pounds of common salt and a pint of commercial concentrated hydrochloric acid are dissolved in 30 gallons of water for each 15 pounds of wet feathers to be preserved. A tight 50-gallon wooden barrel makes a convenient container. Wet feathers are a byproduct of chicken dressing plants, but normally they decompose too rapidly to permit their shipment to feather-processing establishments. The preservative makes possible the industrial use of millions of pounds of chicken feathers that formerly were wasted or used as fertilizer. The new treatment is cheaper and more efficient than chemicals previously tried. The method is essentially one of pickling. The solution costs initially only about $1\frac{1}{4}$ cents per pound of wet feathers treated. The expense is further reduced by the fact that several lots of feathers can be preserved in the same solution.

DDT Residual Sprays for Fly and Mosquito Control: Early experiments by the Bureau of Entomology and Plant Quarantine with DDT showed that houseflies died within about 45 minutes and mosquitoes within a couple of hours after coming in contact with unpainted wood and screen surfaces that had been treated with kerosene sprays containing 5 percent of the chemical. For more than a year, the spray residue left in the boxes and cages was effective in killing flies and mosquitoes. When similar sprays were used in the vicinity of Orlando, Fla., on the walls of dairy barns and upon screen doors and windows, they killed flies throughout the summer months.

At Beltsville, Md., similar sprays were effective for more than one year in dairy, hog, and sheep barns. In Texas, South Dakota, Montana, and Indiana, the tests were as effective as those made in the South and East. The minimum amount of spray needed for effective control throughout a season depends to some extent upon the formula used, kind of surface sprayed, and suitability of the location for flies to congregate. Small amounts of DDT seem sufficient when placed in locations frequented by flies and mosquitoes.

A single application of a DDT residual spray applied to buildings on 18 square miles of land in the rice fields of Arkansas demonstrated almost complete elimination of the malaria mosquito for an entire season. Poultry houses treated subsequently contained no malaria mosquitoes, but untreated houses had as many as 2,000 to 4,000 adult mosquitoes. The sprays proved so effective they are now being used by the U. S. Public Health Service in large-scale control of malaria in the Southern States.

New Diet Aid: A new aid for nutritionists and others engaged in planning diets or calculating the nutritive value of food supplies is the publication, Tables of Food Composition in Terms of Eleven Nutrients, Miscellaneous Publication No. 57: issued by the Department of Agriculture. The tables, which bring under one cover the composition of 275 common foods in terms of 11 nutrients, were prepared by the Bureau of Human Nutrition and Home Economics and the Committee on Food Composition of the National Research Council's Food and Nutrition Board. Previous publications by the Bureau showing the proximate composition of foods have dealt with a more limited number of the important nutrients.

The new publication gives average values for food energy, protein, fat, carbohydrate, vitamin A value, thiamine, riboflavin, niacin, ascorbic acid, water, and refuse. The values given are derived from all available literature of nutrition research and from unpublished data from laboratories that have analyzed foods through arrangements with the National Research Council. In addition to foods believed to be most commonly used in the United States, the tables include as many of the less common foods as present data warrant. All the values are stated in terms of 100 grams edible portion, and in terms of 1 pound as brought into the house for consumption.

The Bureau's task of gathering and evaluating food composition data traces its origin back to Dr. W. O. Atwater, first director of the Department of Agriculture' nutrition research. In 1869, as director of the Agricultural Experiment Station in Connecticut, Atwater published the first analysis of an American food--corn. Later, with his Department associates, he published a collection of tables showing the nutritional make-up of familiar foods--which became a "bible" to the nutrition scientists of that day.

The Committee on Food Composition organized in 1942 at the request of the Quartermaster Corps has been collecting recent data on the composition of Army foods and Army rations. These have been included in the published tables because they represent products which are already available or soon will be available to civilians.

Dual-Purpose Farm Ponds: One of the important biological aspects of soil and water conservation encouraged by the Soil Conservation Service is managing farm ponds for fish production. Such farm fish ponds supply the farmer's table with a high-vitamin food costing only a few cents a pound. During 1945, farmers in soil conservation districts stocked more than 4 thousand ponds with some 6 million fish supplied by the Fish and Wildlife Service and the States. The ponds should yield 250 pounds of food for every surface acre of water. Another thing about ponds is that they heal over ugly gullies and save soil likely to wash away. Ponds transform "sick" land into a thing of beauty.

In most instances, fish are only byproducts of the pond. Farmers and ranchers build ponds primarily to have a water supply on the place. Thus, they save labor and time in not having to haul water long distances. Water comes in handy for

livestock, domestic use, irrigation, spraying orchards, fire protection, and ice. In the West, ponds are often lifesavers for cattle. They furnish water during dry seasons and make it possible to graze parts of the range that otherwise would be too far from water to use.

Water-Repellent Preservatives for Wood: The Forest Products Laboratory of the Forest Service has brought a basis for standardization to the field of water repellents for lumber and plywood. This has been achieved by establishing suitable methods of testing water-repellent preservatives on which specifications can be based, by developing formulas for satisfactory water-repellent preservatives, and by clarifying nomenclatures and definitions that differentiate water-repellent preservatives from preservative wood sealers.

Water-repellent preservatives give wood moderate protection from rapid changes in moisture content and from attack by bluestain and decay fungi without inconvenient or expensive methods of treatment. During the war, these preservatives were widely used on wood boats and ships, wood truck bodies, container plywood for overseas shipment, and hutments for overseas use. Many peacetime uses are anticipated in a variety of wood products, such as doors, window sash, and some furniture, where water-repellent preservatives afford adequate protection.

Scientific Collections: The maintenance of large collections of small quantities of viable seeds of many varieties of important economic crops and cultures of organisms of importance to agriculture is part of the work of the Bureau of Plant Industry, Soils, and Agricultural Engineering. Many of the items in these various collections are kept in cold storage. There are also collections of fungi and of soil bacteria. These collections have proved important factors in scientific work in many places outside the USDA and even in other parts of the world. For example, the mold Penicillium, found by an English scientist to produce a powerful bactericide, was identified for him by a USDA scientist at Beltsville, Md., who started an extensive mold collection.

The various lots of seed of crops are usually regrown every few years to maintain their viability so that when needed they may be drawn upon for use by USDA plant breeders, State experiment stations, or others. The plant scientists have recorded, insofar as possible, the characteristics of the various varieties so that when attempts are made to create a new variety to suit different conditions promising genetic material may be readily located. The collection of wheat varieties totals approximately 8,500, drawn from every country where wheat is grown. There are about 300 varieties in the corn collection, including a large number grown by North and South American Indians, and modern varieties that have been or may be used in the development of hybrids. There are 4,000 varieties of barley, 3,000 of oats, 1,000 of rice, 400 of flax, and between 200 and 300 of sorghums.

The Plant Industry Station at Beltsville, Md., has an herbarium collection of fungi, mostly those which grow on food plants or other plants of economic importance, that totals nearly 450,000 specimens. Through possession of this extensive museum of fungi, it is possible for mycologists to identify specimens for scientific workers and for other purposes. The station also has one of the largest collections in the world of soil bacteria, including hundreds of strains of legume nodule bacteria kept in standard cultures for comparison with cultures offered for sale to the public. The different strains of soil bacteria of all kinds are available to scientists anywhere in the world. These collections are important for cooperation in carrying on scientific work.

Farmers and Radio: The Bureau of Agricultural Economics, at the request of the Federal Communications Commission, has conducted a study of the attitudes of rural people toward the radio. Personal interviews were made in 2,535 rural households. There is no question about the high regard in which the farm population holds the radio. Those who don't have radios are anxious to get one. Its two great services in the eyes of farm people are, first, as a source of news and market information and, second, as a source of entertainment and company. The men stress its importance for news and information. The women mostly set its entertainment value somewhat higher.

News programs are reported by an overwhelming majority of rural people as the ones they would miss most if their radios were taken away. As to the kind of program they like best, farm people select the more "serious" programs. News and market reports, hymns and religious music, sermons and religious programs, and farm talks are given high preference. Old-time music is preferred by 50 percent of farm men and women. The rural non-farm men and women also list such programs as among those they like best, but they more frequently name quiz programs, entertainment with comedians and popular singers, dance music, and sports broadcasts.

Increasing Yield of Penicillin: Penicillin was available to heal the wounds and save the lives of many thousands of soldiers and civilians during the war as the result of research at the Northern Regional Research Laboratory of the Bureau of Agricultural and Industrial Chemistry. By properly feeding the molds and improving the strains of molds that produce penicillin, the scientists there were able to increase the yield more than a hundredfold.

In July 1941, Dr. H. W. Florey, of the Oxford University Medical School, came to this country from England to enlist aid in making penicillin available for treating infections, especially those resulting from war wounds. He had demonstrated, by clinical tests, the curative properties of penicillin. Dr. Florey was referred to the Laboratory because it has one of the largest collections of molds in the world, and the staff has had long experience in the use of micro-organisms for the production of chemicals. Within a year, important discoveries and developments had made commercial production of penicillin feasible. One of the first discoveries of the Laboratory scientists was that yields of penicillin could be greatly increased by adding corn steep liquor (a byproduct of cornstarch manufacture) and lactose (milk sugar) to the culture medium in which the mold is grown. In seeking higher-yielding strains, molds from many parts of the world were brought to the Laboratory for testing. The highest yields were produced by a mold found growing on a cantaloupe. Other accomplishments of the research workers were improved methods of recovery and purification of penicillin.

In connection with the research on penicillin at the Laboratory, studies were completed on the production of the chloroform-insoluble penicillin, or Penicillin X, in submerged culture. This type of penicillin is several times as potent on many organisms as commercial penicillin (mainly Penicillin G). Medical research has shwon that, in some cases, Penicillin X is strikingly superior compared with other drugs, or with commercial penicillin. It proved highly effective in treating a series of gonorrhea cases that did not yield to treatment with sulfa drugs; also in certain types of pneumonia and in streptococcus infections that resisted other treatments, including commercial penicillin. Cultures of the new mold are now available to commercial producers who wish to supply the more potent drug to physicians and hospitals.

From January to June 1943, the total production of penicillin was about 400 million units, enough to treat only 400 serious cases. In 1945, the production jumped to over 7,000 billion units. Meantime, the wholesale price dropped from $20 to 60 cents per 100,000 units. This large increase in production and great reduction in price are largely attributable to the research work of the Laboratory in developing higher-yielding strains of molds and improved production methods. About 6 million pounds of lactose and 12 million pounds of corn steep liquor are used annually in making this drug.

Penicillin is nontoxic to man in the quantities used and has proved effective in treating pneumonia, bacterial infections, osteomyelitis, gonorrhea, syphilis, and gas gangrene.

The penicillin project at the Northern Laboratory has been terminated.

Cushioning Materials for Packing: The Forest Products Laboratory of the Forest Service has developed a method of determining the properties of cushioning materials for use in the design of cushioned packages for shipment of machinery, instruments, and other products subject to damage in transit. Such a method, which can be used to evaluate cushioning properties accurately in specific units, fulfills a need long expressed by such organizations as the American Society for Testing Materials, the Technical Association of the Pulp and Paper Industry, and by industry in general.

Selection of cushioning materials hitherto was purely an empirical procedure, and no method was available for determining the actual volume of cushioning material needed. Many packages were either underdesigned and consequently subject to a high percentage of breakage, or overdesigned and wasteful of critical material, with consequent higher freight costs and waste of shipping space.

The new method enables manufacturers of cushioning materials to develop new cushions to meet the specific needs of any industry and enables industry in general to design packages within specific cost limits. The growth of freight shipment by air emphasizes the need for accurate design of packages of minimum weight and volume, and the method developed by the Laboratory makes possible fuller use of this means of transportation.

Cash Crops From Poor Land: Hillculture research of the Soil Conservation Service finds crops that fit poor and hilly farm lands and that pay on them. One of these crops is wild beach plum. Native to barren sand dunes of northeastern United States, the beach plum will grow as far west as Iowa. This hardy plant helps to prevent erosion, and the tart-flavored fruit makes good jelly and preserves. A 5-year test with wild beach plums on an acre of low-grade farm land at Beltsville, Md., showed the plant can make good returns on poor land under soil conservation practices. After 5 years, the plants yielded 60 bushels of fruit worth $240. The land was prepared and seeded about the same as for corn, using 5-foot drill rows.

At Auburn, Ala., the "miracle" vine--kudzu--increased returns by $10 to the acre on a plot of poor farm land over a similar plot under ordinary corn-cotton rotations. A 4-year rotation of cotton-corn-kudzu-kudzu netted the farmer $40 an acre more than a comparison field with a repeated cotton-corn rotation. On the second field, 48 pounds of nitrogen an acre was used to fertilize the cotton and

32 pounds of nitrogen to fertilize the corn. More examples of crops that will grow on hilly land: Cane and vine fruits such as black raspberry and grapes "anchor" soil and utilize waste areas on many farms. Besides beautifying the farm setting, they boost farm income.

Farm Wage Stabilization: California had some interesting experiences with wage control and stabilization by public agencies during the war. Wage ceilings were applied for specific farm jobs, and the system not only was successful in stabilizing rates of pay, but was equally beneficial in obtaining more effective use of the labor supply. Workers did not have to waste as much time shopping about from job to job to get the best wages.

A study of two years of farm wage stabilization in California by William H. Metzler, Bureau of Agricultural Economics, noted many of the difficulties arising under this system as well as its successful features. "The method of arriving at optimum ceiling rates requires further development. Pressure groups agitating for one wage rate or another have more influence in this process than a strictly public program would seem to call for. More objective means of determination need to be developed." Although both growers and workers regarded wage ceilings with suspicion at the start, support from both groups developed in later stages.

"Hexes" Cattle Flukes: As a result of the resourceful experimentation of a Bureau of Animal Industry scientist who had formerly been a South Sea Island missionary, a successful chemical treatment for liver flukes--long a serious menace to cattle raising in parts of Texas and other western areas--has been devised and is now being used by the cattlemen. The scientist who perfected the treatment is Dr. O. Wilfred Olsen. Flukes are difficult to reach by medication, since they seek out the liver for attack. Scientists had found a drug with the five-syllable name hexachlorethane, to be effective against these small, flat, leaf-shaped parasites, but it was difficult to administer because of its insolubility in water. Dr. Olsen found that bentonite combined well with hexachlorethane in water to make a smooth emulsion that was easy to give as a drench. Once interpreter to the King of one of the South Sea Islands, Dr. Olsen found little difficulty in translating his scientific lore into language that practical Texas cattlemen found easy to understand. When Texas State prison officials let him try out the remedy on part of the prison herd, the results proved a convincing demonstration of the value of the treatment in liver fluke control. The mounting demand for hexachlorethane that followed this demonstration led to substantial commercial production and distribution of the drug.

High-Strength Laminated Paper Plastics: The Forest Products Laboratory of the Forest Service has developed a laminated paper plastic called papreg, which has more than twice the tensile strength of the best laminates previously developed, and is equal to them in other mechanical properties.

High-strength paper laminates are expected to find future application for many uses where such characteristics as corrosion resistance, low thermal conductivity, resilience, dielectric properties, resistance to denting, and high stiffness per unit of weight are important in addition to high strength. Such applications might include interior partitioning for boats, aircraft, and railway passenger cars, large-size home refrigerator and radio cabinets, and industrial and home fan blades. The high strength of this plastic, plus its suitability for low-pressure molding, promises to permit the use of papreg for large-size structural members and other items where plastic materials have previously been unsuitable.

Scientific Sizing: Major savings to the clothing industry and to consumers alike are beginning to result from the Bureau of Human Nutrition and Home Economics' work on measuring women and children as a basis for sizing clothing. Lack of scientific data on the body measurements needed in sizing garments is at the root of the chaotic condition which has always existed in the sizing of clothing--particularly for women and children. Department stores complained of a $10,000,000 headache each year from returns and exchanges "because of wrong size." Mothers complained of wasting time, money, and energy buying clothes that failed to fit children at home--age of a child was no dependable guide to clothes size.

Gaining cooperation of 20 colleges and universities, and with funds furnished by the Works Progress Administration, scientific workers in the clothing laboratories, under direction of Miss Ruth O'Brian, weighed and measured nearly 150,000 boys and girls. Thirty-six clothing construction measurements were taken of these boys and girls, who ranged from 4 to 17 years of age and represented 16 States. From data obtained, the Bureau recommended a two-way method of sizing children's clothes based on height and girth at hip. The height-hip system is very similar to the system by which men have bought their shirts and other garments for years according to a few guide dimensions. The Bureau's scientists continued by measuring 15,000 women from 18 years old to 80. Fifty-eight measurements used in constructing patterns and garments were recorded, and weight was taken as a further check on bodily proportions. Universities and other institutions in representative sections of the country cooperated.

From the data, the Bureau recommended height and weight combined, rather than the customary bust measure, for predicting fit of full-length garments. For garments for the upper part of the body, height and bust combined offered the best guides to a fit. For lower trunk garments, height and hip girths are good guides. No single measurement is adequate as a basis for sizing garments and patterns, the survey conclusively showed.

As a result of these measurement studies, some pattern companies and clothing manufacturers are now making use of the new sizing system for children's garments. On the basis of the Bureau's work, new standards for body sizes for boys' garments have been adopted by the American Standards Association, which serves as a link between scientists and the trade. While awaiting developments in the women's wear field, one large mail-order house has already gone ahead to use the Bureau's data and the recommended sizing methods for sizing its women's garments.

Protection of Fabrics from Fungi and Insects: Great quantities of cloth deteriorate each year from stain and rot caused by the fungus growth, mildew. Seeking effective and cheap mildew-resistant treatments for cotton fabrics, textile specialists of the Bureau of Human Nutrition and Home Economics tested almost all the known mildew-proofing materials, and of 150 treatments found about one-third effective and 10 both effective and simple enough for home application. One of these--a new treatment developed in the Bureau's laboratories--combined such advantages that a public service patent was obtained to protect it for public use. This process, employing cadmium or copper salts with morpholine, is comparatively inexpensive, and effective for both home and commercial use. It can be used for awnings, sails, tents, shower curtains, and covers for porch furniture. In cooperation with the Bureau of Entomology and Plant Quarantine, the textile specialists subjected 16 of the mildew-preventive treatments to termite attack, and found 5 resistant. A rapid, dependable soil-suspension test for determing the resistance of treated fabrics to mildew was developed by the Bureau's textile specialists.

Although devised for use in testing household fabrics, this was found applicable to testing of sandbags, camouflage cloth, and similar military fabrics. It has been included in the Proposed Federal Specifications of Test Methods for Mildew Resistance, for the evaluation of chemicals and chemically treated fabrics offered for Government purchase.

Method for Making Bakers' Cheese From Dried Skim Milk: A method of making bakers' cheese from dried skim milk, instead of liquid skim milk as has been the practice, was developed recently by the Bureau of Dairy Industry. Much of the fresh skim milk formerly available for bakers' cheese now goes to drying plants. With dried skim milk available, the manufacture of bakers' cheese need no longer be confined to the areas where fresh skim milk is obtainable; it may be extended to areas far from receiving and drying plants. The market for dried skim milk would thus be increased. Some economies would be possible if the cheese were manufactured at or near the bakeries where it is to be used, because costs of transportation, storage, and freezing usually incurred in handling and shipping bakers' cheese could be reduced. Bakers themselves could store the relatively non-perishable dried skim milk and make the cheese as their needs arose.

Bakers' cheese is used by baking establishments for making cheese pies, cheese cakes, and other similar soft cheese pastries. The procedure for reconstituting the dried skim milk and making the cheese is simple and economical, utilizing the usual equipment in a cottage cheese or Cheddar cheese factory. Baking tests with cheese made by the Bureau's method have given satisfactory results.

The method reconstitutes the dried skim milk with a quantity of water, to produce a milk with a higher solids content than normal milk. A good lactic starter and a small amount of rennet are added to the reconstituted milk, which is allowed to coagulate for 4 to 16 hours, depending on the temperature. When firmly coagulated, the curd is placed in muslin bags (without being heated or cut) and allowed to stand until most of the whey has drained off. It is then ready for use or packaging in suitable containers for marketing.

The yield of finished cheese varies from 1 3/4 to 2 1/4 pounds per pound of dried skim milk, depending on manufacturing conditions and amount of moisture wanted in the cheese.

Pectin Products in New Food Specialties: New food products have been developed in the Western Regional Research Laboratory of the Bureau of Agricultural and Industrial Chemistry in which modified pectin is used like gelatin or starch in powdered mixtures for preparing a jelly-like dessert. Modified pectin was used for preparing a fruit-spread from uncooked fruit juice or puree preserved by freezing. The scientists of the Laboratory also developed a ready-to-use, low-sugar jellied fruit dessert or fruit salad sterilized by heat and preserved in airtight cans. More than 20 million cans of the latter product were packed commercially for use in army field rations during the latter part of the war. Because of its superior quality, good storage stability, and relative simplicity of manufacture, this product offers much pomise in the postwar food market as a convenient, ready-to-use dessert or salad.

More Vegetable Oils in Sight: World production of the major vegetable oils has been strongly upward since before World War I. This is especially true of palm, palm-kernel, and coconut oils. Looking ahead, it is believed that 10 years hence total world output of the major oil crops may reach a level about one-third higher than that of the prewar period 1934-38. World net export of major oil crops may also expand, perhaps as much as 20 percent by 1955. This will not necessarily mean serious chronic surpluses of fats and oils, as readjustments in agricultural production the world over will make it possible for high-cost producers to shift to other commodities, while increased consumption in such countries as the Soviet Union, China, and India will require larger supplies. Most of the expansion in exports will be in tropical oils, which will give these areas an additional basis for exchange with the Temperate Zones. Africa and the Far East, for example, will be in a position to buy more factory goods from the United States and Europe. These conclusions are found in a study of world trends in major oil crops by Peter L. Hansen, Bureau of Agricultural Economics.

Improved Plywood: Improved plywood for such wartime applications and uses as shipping containers and overseas troop hutments resulted in large part from research and developments at the Forest Products Laboratory of the Forest Service. Improvement in the mold and decay resistant properties of soybean and casein glued plywood was an outstanding result of studies of the preservative treatment of plywood and veneers. This plywood was markedly successful in combating tropical decay, mold, humidity, and other causes of deterioration in housing, shipping containers, and similar outdoor structures. The development is expected to broaden the usefulness of protein-glued plywood in such peace-time pursuits as building construction and packaging for foreign trade.

Breeding for Better-Keeping Eggs: Some eggs keep better than others, under the same conditions, because of the breeding of the hens that laid them. This recent finding by poultry specialists of the Bureau of Animal Industry opens up a new field of opportunity in poultry breeding.

During the last four years the scientists have observed individual and family differences in the keeping quality of eggs, Using the skrinkage of the thick portion of the white, during storage, as a measure of deterioration, the poultry-men found such shrinkage to be 62 percent for eggs laid by hens of one line of breeding and only 33 percent for another line.

A related study involving shrinkages in the weight of eggs during storage pointed to the quality of egg shells as a major influence. Some shells are more porous than others. In two divergent lines of chickens, loss of egg weight through shrinkage was about 60 percent greater in one than in the other. The results of the tests indicate that shell quality can be improved through family selection of breeding stock on the basis of eggs that have relatively low shrinkage when stored.

Tropical Plant Introduction Garden: Since the establishment of the Federal Experiment Station in Puerto Rico in 1902, one of the largest collections of tropical plants in the Western Hemisphere has been built up at Mayaguez. The collection includes over 7,000 species. A valuable collection of Cinchona varieties, the plant from which quinine is obtained, is maintained, and, insofar as possible, the highest yielding strains are added to the collection as they become known and available. In addition, the collection also includes a planting of the highest yielding known strains of the rubber plant, Hevea brasiliensis. These are but two of many such economic species grown and cultivated at this tropical outpost in Puerto Rico.

Apple Sirup: Early in the war the Eastern Regional Research Laboratory of the Bureau of Agricultural and Industrial Chemistry developed a bland apple sirup from off-grade apples that has assumed wide commercial importance during the past three years and has been accepted by the cigarette industry as a humectant to replace glycerine in tobacco. Also, the Laboratory has studied modification of the sirup for uses other than as a tobacco humectant. It developed a very palatable sirup from apple juice for food, such as table sirup, which does not have the tartness and flavor of apples. It differs from sirup developed for tobacco in not having the slightly bitter aftertaste that results from the presence of calcium salts.

The Laboratory also has developed a process for recovering the volatile flavoring constituents of apple juice in the form of an essence. Blending this essence with a good grade of commercial apple-juice concentrate results in a full-flavor concentrate which with the mere addition of water, becomes a beverage having the taste and aroma of fresh apple juice. The steps in the process include: (1) Rapid evaporation of about 10 percent of the juice; (2) mechanical separation of the vapors from the unvaporized juice; and (3) fractionation of the vapors to obtain a concentrated flavor or essence. In addition to being convenient for preparing beverages, an apple-juice concentrate to which apple essence has been added has obvious uses in the preparation of sherbets, ices, and fruit jellies. The essence may also find applications in the preparation of table and candy-coating sirups. This new process has been applied commercially by several firms. From present indications, apple essence manufacture will be widely adopted throughout the apple industry.

Hybrid Corn: Hybrid corn, a product of scientific research, reached the stage of most vigorous commercial development at the time World War II had raised food demands to the highest point in history. It is an outstanding example, perhaps the most outstanding, of the influence of theoretical scientific research in revolutionizing the production practices of an agricultural crop. Since the method of hybridizing corn was first suggested by G. H. Shull in 1909, the present perfection of commercial hybrids has been developed through combined and cooperative efforts of many breeders, both in the Bureau of Plant Industry, Soils, and Agricultural Engineering, and in State experiment stations. The Bureau has been working on the problem since 1916, and the present leading hybrid, U. S. 13, was developed by the two groups of plant breeders. Although the first hybrid seed involving inbred lines was produced in 1921 in Connecticut, the industry did not really get started until nearly 15 years later. In 1945, 64 percent of the country's corn acreage and almost the entire acreage in some of the leading corn States, was planted to hybrid varieties. Since well-adapted hybrids increase the yield about 20 percent, it is estimated that the 1945 production as a result of their use was roughly 750,000,000 bushels more than it otherwise would have been.

Molding Processes for Compreg: The Forest Products Laboratory of the Forest Service has developed two methods of molding resin-treated compressed wood (compreg) to desired shapes, such as aircraft motor test clubs, airplane antenna masts, and machining dies. Both methods are expected to find numerous applications in the manufacture of specialty products of compreg.

One method consists of laminating large blanks containing uncured treating resin, carving them with wood-working tools to the desired shape in one plane but with double to treble the final thickness, and then molding them to the desired thickness in a split mold under sufficient heat to set the resin simultaneously with the pressing operation.

The other method, known as expansion molding, is not yet in commercial use. To utilize it, hot single plies of resin-treated veneer are precompressed under conditions that chill and jell the resin but do not set it. A number of these plies are cut to shape and laid in a mold to fit snugly. The mold is then closed and locked, and heat is applied. The heat causes the jellied resin to flow and releases the pent-up compression of the plies. An expansion force is thus generated that causes the plies to press against the restraining mold, thereby eliminating the need of a molding press.

Small-Type Turkey: Since about 1930 there has been a simultaneous increase in the number of turkeys raised and in the average size of turkeys produced. However, there has not been a corresponding increase in the demand for the heavier birds, and this has resulted in a price differential of from 1 to 6 cents per pound in favor of smaller market turkeys. This demand on the part of consumers seems to be based on sound considerations and is likely to be permanent. In view of this trend, the Bureau of Animal Industry in 1934, at Beltsville, Md., began an experimental project on the development of a small-type turkey. Marked progress has been made in fixing the desired characteristics in this small-type turkey.

Several standard varieties, the wild turkey, and White Austrian turkeys imported from Scotland have been crossed in the development of this small-type turkey. From the crossbred progeny selections are being made. The chief characteristics desired are as follows: Live weight of young toms at market age, 12 to 17 pounds; corresponding weight of young hens, 7½ to 10 pounds; color, white; compact body with moderately short legs, moderately long keel bone, and an abundance of meat, especially on the breast and legs; early maturity, resulting in a finished condition (U. S. Prime) with respect to fat, fleshing, and feathering at the age of 24 weeks; reasonably high egg production and high fertility, hatchability, and viability.

Several of the turkeys have proved to be excellent layers as shown by the production of more than 200 eggs in a year. Their eggs excelled also in fertility and hatchability. In addition, the high market quality of these excellent layers is above average as judged by body conformation and early maturity of their offspring.

Norelac: A new thermoplastic resin suitable for use in lacquers was developed by the Northern Regional Research Laboratory of the Bureau of Agricultural and Industrial Chemistry. This product, named Norelac, is a polyamide of dimeric fat acids and is made by reacting ethylene diamine with a mixture of dimeric fat acids or their esters prepared from the unsaturated acids of soybean oil or other vegetable oil. Norelac promises to serve as a substitute for shellac in some uses, since it makes a good protective coating for wood and metal. It adheres well to most surfaces and has good resistance to water, alkali, acid, vegetable oils, and some organic solvents. Its thermoplastic property makes it useful as a binder for laminating metal foils and cellulosic sheet materials and as a self-sealing coating for wrapping materials and containers, especially those intended for dehydrated foods. An industrial firm became sufficiently interested in the possibilities of this new oil product to produce it on a pilot-plant scale and to supply prospective consumers with substantial samples. This assures thorough evaluation of the product by a large number of industries for many possible uses.

Family-Operated Farms: The annual earnings of farm families followed the same general pattern, regardless of type of farming, through the period 1930-1945. A study of typical family-operated farms by Ronald W. Jones and Wylie D. Goodsell Bureau of Agricultural Economics, shows the trend of farm income and where and how the money was made during those years.

Looking ahead somewhat, the writers conclude that prices of farm products will remain at relatively high levels for at least two more years, because of demands for relief in 1946 and the Steagall commitments to support prices at near parity levels, at least through 1948. Net rental values are exceedingly high relative to current land value. Returns on land investments have been high for the last four years and have been increasing since 1940. Machinery and labor will become increasingly available and will stimulate land buying by present operators for enlargement of farms. Unemployed war workers and returning servicemen will tend to increase the competition for farms. Finally, mortgage credit is easily available at low rates for buying farm land.

This study is topped off by the observation that nothing so completely wrecks the economic life of a farming community as the aftermath of a full-fledged, unhampered, Grade-A boom in land prices, and poses the question, "Is another land boom ahead?"

Field Test Determines American Foulbrood in Bee Hives: A new flash test for field use to determine the presence of Bacillus larvae, the causative organism of the bee disease, American foulbrood, has been discovered by the Division of Bee Culture, Bureau of Entomology and Plant Quarantine. It was found that enzymes produced by this organism hydrolyze milk. A dead bee larva is placed in milk at 70°C. Curdling occurs in about one minute when the disease organism is present. Hydrolyzing of the curd then begins and is usually completed within 10 minutes if the milk is warmed, leaving a yellow serous residue. A much longer time is required at room temperatures. This is the first accurate field test to be developed for the determination of American foulbrood by apiculturists.

Free-Fall Container for Aerial Delivery: A new and successful type of free-fall container has been developed by the Forest Products Laboratory of the Forest Service as a means of delivering supplies to beleaguered forces from aircraft without the use of parachutes. The container is collapsible, easily assembled, and adapted to production-line fabrication. The fiberboard container is equipped with fieldboard airfoil wings, which cause the box to rotate on its vertical axis in descent, reducing both the rate of fall and the landing impact. Some of its advantages over parachute delivery are: In war the container is less easily spotted by the enemy; the container and "lifting" apparatus are one unit; the load cannot be caught in trees or dragged over the ground by wind after landing; the cost per pound of supplies delivered is reduced. In peacetime it should prove useful for supplying fire-fighting crews in forests and other isolated groups such as timber crews, and for emergency delivery of foods and medical supplies to victims of floods and other disasters. As a means of regular delivery of mail, express, perishable foods, and other items to outlying communities, it would fit in admirably with the recently developed airplane pick-up system.

Sweetpotato Starch: The sweetpotato promises to become an important industrial crop, as the result of the development by the Bureau of Agricultural and Industrial Chemistry of a process for making high-quality white starch. A growers' cooperative of more than 1,000 members at Laurel, Miss., has produced in a single season as much as 3,000,000 pounds of starch. Already the product

is being used for sizing and finishing in cotton mills and by the laundry, baking, and confectionary industries. This new enterprise offers farmers an opportunity to add another profitable cash crop to their present farm programs. A large multi-million-dollar plant, based on the results of the Bureau's research, is now in operation at Clewiston, Fla.

Wood "Sandwich" Construction: Design data developed at the Forest Products Laboratory of the Forest Service for wood sandwich constructions (soft, light-weight core material with thin, high-strength facings), used as skins for airplane wings and fuselages, have been used by the armed forces in the development of new high-speed aircraft. Wartime conditions and limitations of materials restricted the use of sandwich constructions to aircraft structures. But they have broad peacetime uses in products requiring combinations of high rigidity, light weight, and sound or heat insulation. Examples of potential uses are wall panels, flooring, refrigerator cars, boats, automobile bodies, doors, and special shipping containers.

Plant Growth Regulators: In 1939 F. E. Gardner, P. C. Marth, and L. P. Batjer, of the then Bureau of Plant Industry (now the Bureau of Plant Industry, Soils, and Agricultural Engineering), tested the effectiveness of a number of different growth regulating substances in preventing preharvest drop of 19 leading commercial apple varieties. Two compounds, naphthaleneacetic acid and naphthalene acetamide were outstanding and about equal in effectiveness in preventing fruit drop. The sodium, potassium, and ammonium salts of naphthaleneacetic acid were also found to be very effective. Soon after the publication of the results, several proprietary spray compounds containing either naphthaleneacetic acid or naphthalene acetamide as the active ingredient were placed on the market. In general, commercial orchardists have found these sprays effective against apple and pear loss from preharvest drop. Research workers have unearthed many other facts which may some day be of practical application. Dr. Marth has demonstrated the feasibility of controlling the time of emergence from dormancy of certain nursery stocks by suitable application of plant hormones. By such treatments, the storage period may be prolonged to permit later planting of more vigorous material and to retain more of the original vigor in the planting material. Gardner and Marth corroborated the results of another scientist in the artificial production of seedless fruits, holly, grapes, and strawberries through the use of these growth-regulating substances.

Farm Tenancy: About three-eighths of the Nation's farms were operated by tenants in 1940. Tenancy has been increasing gradually since 1880, when the Census first reported data on the tenure status of farmers. For the country as a whole, the highest percentage of tenancy was reached in 1930; at that time 42.4 percent of all farms were operated by tenants. Since that date the trend has been slightly downward for the Southern States but has continued upward in the North and West. In 1940 New Hampshire had the lowest proportion of tenant farms, 6.4 percent, while Mississippi had the highest rate, 66.2 percent. In one Mississippi county (Lefloro) 94.2 percent of the farms were operated by tenants, the highest for any county in the United States. The whole story of farm tenancy is presented graphically in a study entitled "A Graphic Summarization of Farm Tenure" by Max M. Tharp and Howard A. Turner, Bureau of Agricultural Economics.

Frozen Fruit Products: Frozen fruit puree has been developed by the Western Regional Research Laboratory of the Bureau of Agricultural and Industrial Chemistry as a means of utilizing fully ripe fruit that cannot be shipped or handled in the fresh-fruit market. It can be made from any fully ripe, raw fruit that has a decided flavor. Its manufacture makes possible the maximum utilization of a fruit crop for food, since fruit that cannot be marketed fresh because of physical deficiencies or over-abundance can be converted into frozen puree (if it is internally sound and full-flavored) and kept in frozen storage for future use. Frozen fruit purees serve as flavor bases for ice creams, sherbets, ices, and beverages, and are also suitable for the manufacture of jam, Velva Fruit frozen dessert, and frozen jellied fruit. The two products last mentioned, also developed by the Western Laboratory, are made from uncooked fruit juice or puree, with addition of sugar and a stabilizer--gelatin in the first and rapid-set citrus pectin in the second. Velva Fruit has been produced commercially in the eastern United States. It is very promising as an outlet for surplus cantaloups. Heretofore, cantaloups have not been used successfully in manufacturing food products.

Spending Habits Surveyed: The first comprehensive picture of the country's spending and saving was made possible when the Bureau of Human Nutrition and Home Economics cooperated with other Government agencies in making a Nation-wide survey of consumer purchases of 1935-36. The completed set of 47 reports, of which the Bureau prepared 22, provides an unusually detailed analysis of the spending and saving habits of families with different incomes, living in cities, in villages, and on farms. A smaller study, also national in scope, was made in 1941. The reports, which shed light on how Americans spend their money for food, housing, transportation, and other items, provide a factual basis for economists and others concerned with policies and programs and their effects on families in varying circumstances. The war increased the usefulness and significance of these reports. They were used in planning the civilian supply of food, shoes, and other clothing, house furnishings, and other consumer goods, and for decisions on rationing food, shoes, and other items. They were examined to determine the effect of sales, excise, and income taxes on general welfare and many details of the bond campaigns. They are basic to studying the impact of price changes on various groups of families. In addition, they serve as bench marks for measuring progress to higher levels of living in the postwar years.

Range Reseeding: Recent studies by the Forest Service at several western forest and range experiment stations have pointed the way to successful seeding of valuable forage plants on several million acres of depleted range lands. Increases in forage production of from 2 to over 10 times, enough to far more than justify the cost, result from reseeding in accordance with the principles so far developed. Ranges producing considerably less than their soil and climate can support are most promising for planting. Many valuable forage species are available for planting throughout the West, although comparatively few have so far been found suited to the driest and most severe sites. As a result of many tests, effective and economical methods of planting have been developed for most types of ranges. These provide for covering the seed, an essential consideration, and where necessary, preparing the soil and reducing the stand of low-income competing vegetation.

Pine-Gum Cleaning: Large amounts of high-grade rosin and turpentine have been made by a number of pine-gum refineries from pine gum cleaned by a process developed by the Bureau of Agricultural and Industrial Chemistry's Naval Stores Research Division. There has been an increase each year in the amount of gum

cleaned and distilled according to the Bureau's recommendations, with higher yields, better products, and increased income to the gum farmer. A continuous gum-distilling process to replace the present batch process is being evolved and has progressed to the stage of successful pilot-plant runs with prospects of early industrial application.

Favorite Tropical Lawn Grass: Since 1936 the Federal Experiment Station in Puerto Rico has been experimenting with Zoysia matrella or Manila grass for use on tropical lawns. This grass has received publicity in the States as an ideal lawn grass. In Puerto Rico under tropical conditions it has proven superior to such commonly used grasses as Java, Bermuda, centipede, St. Augustine, and carpet. Manila grass has a pleasing moderately deep shade of green, grows slowly, requires relatively little attention in weeding and mowing, produces a thick mat which feels like a heavy rug under foot, has practically no insects and diseases, withstands drought, and grows well in moderately dense shade. It is one of the few plants that can survive under bamboo, which requires considerable moisture and, in addition, is an extremely heavy feeding plant. Manila grass is tough and withstands considerable foot wear, but it is difficult to cut with a hand lawn mower. A rotary power mower, however, cuts it easily. The grass at present must be propagated by sod blocks but the station is seeking a seed treatment to induce higher germination. Seed is produced abundantly in Puerto Rico, whereas little seeding has been reported under most conditions in the United States.

Master Sample: The Bureau of Agricultural Economics, in cooperation with the Bureau of the Census, has completed the drawing of a "Master Sample" of farms, which is in effect a small replica of all the farms in the United States. Every county containing agricultural enterprises is represented. The sample consists of about 67,000 small sample areas which average about 2.5 square miles in size and contains an average of about 5 farms each.

One of the principal features of the Master Sample is its adaptability to various needs. The number of sample areas to be enumerated for any survey can vary widely, depending on the type of survey, the universe to be covered, and the accuracy desired. The sample can be used not only for Nation-wide studies, but for regional, State, or special crop-area studies as well. A further advantage of this sample over other sampling designs is that in clustering the units of observation (farms) by sample areas, considerable savings in survey costs are effected through reduction in travel between farms. This results in a great increase in sampling efficiency per dollar spent.

The first large-scale use of the Master Sample was in connection with the 1945 census of agriculture. It has also been used in connection with field surveys by BAE as well as by other agencies, and materials are being made available to State agricultural experiment stations in connection with their surveys. The materials assembled in the drawing of the sample are very useful and will save much in costs of future samples. These materials consist of: (1) Large-scale highway maps of all counties in the United States with information on them useful for sampling; (2) listing sheets showing all villages, towns, and cities having an estimated population of 100 or more; (3) tabulations of farms and dwellings by small geographic areas; (4) transparent "positive" county maps from which an unlimited number of county maps showing the sample areas can be reproduced by the ozalid process; and (5) aerial photographs covering over 90 percent of the sample areas. If additional sample areas are needed for any county or group of counties, these can be readily provided at relatively small cost.

Naval Stores Yields Increased: Naval stores research by the Forest Service has recently developed methods by which naval stores yields can be increased 40 percent or better in commercial operations by applying chemicals to freshly chipped trees. The method results in higher money returns to the operator, ranging roughly between $400 and $700 additional net profit per crop of 10,000 trees, depending on how faithfully proper methods of chemical stimulation are followed. The three methods developed in this research and currently recommended to and tried by the industry are: (1) Application of sulphuric acid for the first 6 to 8 streaks to get newly worked timber into full production early in the years; (2) periodic acid treatment of all streaks chipped during spring and summer months; and (3) skip-acid treatment--the timber is chipped weekly but acid is applied only every other week. The second procedure gives the highest yields, but where labor is scarce, the first or third method is advantageous.

Phosphate Drink for Cattle: Cattle in southern Texas have been getting phosphate drinks, with benefit to their health and growth, in experiments conducted by the Bureau of Animal Industry and Texas scientists in cooperation with the King Ranch of that State. The phosphates are added to the drinking water to make up for insufficient supplies of phosphorus in the native vegetation. In the past some stockmen have added bonemeal and other forms of phosphorus to the feed and placed it in self-feeders. Still others have applied superphosphate to the soil as a fertilizer. Putting the phosphates in the drinking water, besides being convenient for the cattle owner, enables each animal to get its supply in a soluble form readily assimilated. The phosphate salts have been given experimentally in two forms, disodium phosphate and defluorinated triple superphosphate, in quantities sufficient to supply 6.5 grams of phosphorus in 6 gallons of water. The defluorinated product must be used because of the poisonous effect of fluorine. The treatment has resulted in more productive breeding stock and better gains by calves.

Basic Facts About Vitamin A: To find out the vitamin A requirements of human beings, research workers in the food and nutrition laboratories of the Bureau of Human Nutrition and Home Economics fed an experimental diet to volunteer adults. Especially prepared meals contained every nutrient that the human body is known to need except vitamin A, which was almost completely absent. Since one early measurable effect of vitamin A is night blindness--failure of the eyes to adapt normally to dim light--appearance of this condition was taken as a sign that a subject's body had used up most of its stored vitamin A. Measured amounts of vitamin A were then given in gradually increased doses until the subject received just enough vitamin A to keep vision normal in dim light.

In the first experiments, solution of standardized cod-liver oil and pure carotene provided the measured amounts of vitamin A. Later, the minimum requirements were measured in terms of natural food, using peas, spinach, and carrots as sources of carotenes, which are changed into vitamin A in the body. It was found that the body needs about 30 to 60 percent more carotene as found in vegetable foods than it does of vitamin A found in animal foods. This finding had special timeliness for the war period when restricted food supplies caused civilians to lean more heavily upon plant foods for vitamin A. Data for estimating daily minimum vitamin A requirements of the average normal adult have come from these experiments. The data were included in the informational background used when the Committee on Food and Nutrition of the National Research Council set forth recommended daily allowances of vitamins and other nutrients as a nutrition yardstick for America.

Some subjects in the first experiment showed signs of vitamin A deficiency after two weeks, whereas others--probably better fortified by a vitamin A reserve--showed no lack for several months. To learn more about the body's ability to store this vitamin and the rate of depletion, laboratory animals were used. Results showed that moderate amounts of vitamin A obtained regularly in meals are used more economically than occasional massive amounts. This suggests the importance of building up a "vitamin A savings bank" by eating, when possible, generous amounts of food providing this vitamin. To aid in determining vitamin A value of normal diet, the laboratories analyzed this value in 128 common foods, raw and cooked.

Started under supervision of Dr. Lela Booher, the Bureau's vitamin A researches have continued more recently under Dr. Elsa Orent-Keiles, while various other scientists have held responsible posts. Mrs. Elizabeth Callison had direct leadership of studies to determine human vitamin A requirements.

Improved Cotton Tire Cord: Research on tire-cord materials was started early in the war by the Southern Regional Research Laboratory of the Bureau of Agricultural and Industrial Chemistry to provide the armed forces with the most dependable tires possible. To develop a cord that would be satisfactory for use with synthetic rubber, laboratory scientists first investigated what is known as low-gauge cotton cord, which they believed would outwear and outrun the larger or high-gauge cotton cord used for many years. Then they selected certain commercially available varieties of cotton from which they believed better cord could be made. The first experimental tires (size 7.50 - 20) were for 2½ ton trucks, and were made with 90 percent synthetic and 10 percent natural rubber. They were officially tested at the Army ordnance tire-testing grounds at San Antonio, Tex.

All tires tested gave satisfactory results, but those made with cord from improved varieties of cotton gave higher mileage and had better resistance to rocks and other obstacles than those of standard cotton cord. Tires made from cotton of the Stoneville variety were roughly 20 percent better than the standard cord; those made from S X P cotton, 75 percent better; and those made from Wilds variety, 132 percent better. These tests were made in 1943. Tests in 1944 showed that rayon and improved cotton cord performed better in the light-truck tires than standard cotton cord.

In passenger car tests, in which no rayon cords were tested, both standard and improved cotton cords gave entirely satisfactory performance. With one recapping, both the standard and improved cotton cords ran 68,000 miles and were still in good condition.

Land Use: A study of wartime use of cropland and possible readjustments to a peacetime pattern has been made by the Bureau of Agricultural Economics. The wartime acreage of cropland in the United States (1943) was slightly below prewar and suggestions for the postwar period would extend that reduction to a full 2 percent. Intertilled crop acreage was up 6 percent, but after the war the suggested pattern would put it down 3 percent below the 1935-39 average. A level of close-growing crop acreage 4 percent below that of prewar years was suggested for the postwar pattern. Even under the pressure of wartime cropping, the acreage of sod-forming tame hay and rotation pasture gained 7 percent, and in the interest of economic production and stable farming systems this gain would be extended to 26 percent after the war.

Judging Future Milk-Producing Ability of Dairy Calves: Some years ago the Bureau of Dairy Industry began a study of the dairy calf udder to determine whether there is any relationship between the glandular formations at early ages and future milk-producing capacity. They discovered the mammary glands begin to develop soon after the calf is born and pass through a series of definite stages as the calf gets older, and that some calves reach a definite stage of glandular development much earlier than others and some much later.

The size, shape, and stage of development of the gland in each quarter of the udder can be determined by feeling through the skin with the fingers. After examining about 200 calves at monthly intervals from birth to 18 months, the investigators established a "standard" for measuring the development at various ages.

All heifer calves in the Beltsville (Md.) herd have been examined and given a numerical grade which indicates whether the stage of development is ahead of or behind the standard or average for any given age. When the calves come into milk production, their production records are compared with the grades assigned to them as calves.

Nearly 100 cows (52 Holsteins and 45 Jerseys) graded for mammary development when they were calves have now completed production records. Those judged to have had advanced development at 4 months have produced approximately 4,000 pounds more milk a year (on the average) than those with retarded development. The grades assigned at about 4 months were a better index to future production than those assigned at other ages.

Results obtained in the Beltsville herd are encouraging, since they indicate it may be possible to predict the relative producing ability of dairy calves at 4 months. But the investigators do not yet recommend the method for general use, because they don't know whether it will work as well in other herds as in this experimental herd. It needs to be tested in a large number of other herds.

Forest Grazing in Southeast Cattle Production: The urgent need for greater meat production during the war revealed the necessity of making better use of native forage on forest lands in the Coastal Plain of Georgia, North Carolina, and Louisiana. Research by the Appalachian and Southern Forest Experiment Stations of the Forest Service (in cooperation with the Bureau of Animal Industry, Bureau of Plant Industry, Soils, and Agricultural Engineering, and State experiment stations) has shown that these areas furnish good forage for about 7 months, March through September. During fall and winter, the native forage must be supplemented with a small ration of protein concentrate or farm pasture or farm-raised feed must be provided. This is necessary to maintain weight and condition of grazing animals and to assure satisfactory livestock gains during the following spring and summer.

Phenothiazine as Anthelmintic: Phenothiazine is a synthetic organic chemical first prepared in the latter part of the nineteenth century. It is one of the thiazine dyes. Following the discovery and announcement that phenothiazine was effective as an insecticide, its value as an anthelmintic was studied and established in 1938-39 by Harwood, Jerstad, and Swanson, workers of the Bureau of Animal Industry. Experimentation with this drug has been continued to develop the best methods of use. Phenothiazine is now widely recognized throughout the world as a highly effective anthelmintic for the

removal of many injurious internal parasites of domestic animals. It is the most valuable single drug so far discovered for combating such parasites. The drug is distributed commercially in powder form and may be administered either in gelatin capsules, in ground feed, in salt, or as a drench, the choice depending usually on the species of animals and preferred method of handling them. For use as an anthelmintic, phenothiazine should be the pure product prepared especially for that purpose.

In 1-ounce doses, phenothiazine rids sheep and goats of stomach worms, nodular worms, hookworms, and related pests. Its use prevents the spoiling of the sheep's intestines by nodular worms, thus providing an additional war material for making surgical sutures at a time when they were greatly needed. In suitable doses which vary with the size of animal, phenothiazine is effective in removing several kinds of parasites from swine, cattle, horses, and mules. In very small doses this drug is effective also in removing cecal worms from poultry. These are the worms that transmit blackhead to chickens and turkeys. The extensive use that phenothiazine already has acquired for controlling animal parasites is evident from the quantity--about 3 million pounds--used in the United States in 1943. Recently a mixture of 9 parts salt and 1 part phenothiazine, when made available to sheep, has been found largely to prevent acquisition of the parasite.

Hybrid Onion: The first hybrid onion variety was released to growers by the Bureau of Plant Industry, Soils, and Agricultural Engineering in 1944. Producing hybrid onion seed on a commercial scale had seemed almost impossible, until plant breeders discovered a male sterile onion which made possible hybridization with male fertile strains on a field scale. As a result, scientists of the Bureau and the University of California developed the first commercial onion hybrid, California Hybrid Red No. 1, adapted to growing in central California, southern Utah, and southern Nevada.

This new early variety has yielded from 460 to 768 100-pound bags per acre, generally 50 percent more per acre than the usual early varieties for those areas. (A male sterile strain may be carried on by planting "head sets" and in other ways known to plant breeders.) As a result of the possibilities in male sterile strains the field is now open for the development of hybrid strains of various varieties for different regions, seasons, and conditions.

Vegetable Waste Valuable Source of Poultry Feed: Broilers fed on broccoli-leaf meal produce fine flavored meat, according to the results of cooperative research by the Bureau of Agricultural and Industrial Chemistry and the Delaware Agricultural Experiment Station. Chicks fed a standard mash to which had been added 8 percent of dried broccoli-leaf meal not only grew well, but the meat had a highly pleasing flavor. Chicks fed on this mixture were compared to similar chicks fed on alfalfa-leaf meal. Those receiving the broccoli meal made the fastest growth. Carrot, lima bean, and turnip meals were about equal to alfalfa, and pea-vine meal was a little lower. The flavor of the meat of all broilers fed on the vegetable leaf meals was good, but that of the birds fed on broccoli-leaf meal was the best and unusually fine. This development is the outgrowth of an attempt of the Eastern Regional Research Laboratory to find uses for the large tonnage of waste leaves that occur in the production and processing of vegetable crops. Investigations by laboratory scientists showed that the blade portions of the leaves, free of stems, were unexpectedly high in protein, containing from 30 to 36 percent in some cases. This is higher than the 20 percent

found in alfalfa-leaf meal and approaches the 40 to 45 percent for oil meals. The research revealed that the leaves are also high in carotene, or provitamin A, and in riboflavin, both of which are needed in poultry feed. Research, now in the pilot-plant stage, is being continued and enlarged in the hope that industry will develop methods for the profitable utilization of the thousands of tons of waste vegetable leaves produced each year.

Nutritive Value of Plant Proteins: Laboratory studies by the Bureau of Human Nutrition and Home Economics showed conclusively that proteins of soybeans, peanuts, cottonseed, wheat germ, and corn germ have nutritive value so high that they may be counted on to "extend" or "spare" the proteins of meat, milk, eggs, and other animal foods in times of short supply. A very practical way to use these plant proteins to advantage, the studies showed, is to team them with abundant breadstuffs and cereals. Strangely, such combinations sometimes prove actually more nourishing than the components would suggest. Example: In feeding experiments with young rats, adding 15 parts of soybean flour to 85 parts of wheat flour in bread increased its growth-promoting values five-fold. Among these plant proteins chosen for investigation, wheat and corn germ proved definitely superior, the wheat germ in turn being higher than the corn germ in its nutritive value for promoting growth. Wheat germ thus appears to be the plant protein food that comes nearest to the proteins of meat, eggs, and milk in biological value.

Insecticide Dispersing Equipment: Recent development of the more effective insecticides, such as DDT, has made it necessary to develop equipment to disperse these materials properly and economically. As early as 1928 the Bureau of Entomology and Plant Quarantine studied methods for the proper dispersal and adherence of concentrated conventional sprays. Spray mixtures were applied in atomized form in such a manner that effective coverage was obtained with a small volume of liquid. Insecticide formulations were tried that were 100 times more concentrated than conventional insecticides then in common use. These sprays were applied with various known types of spraying equipment. Considerable information was obtained on atomizing principles, particle size, and adherence.

The Bureau, in cooperation with industry, has recently tested models of power blowers designed to disperse the new insecticides in finely atomized forms. Different types of nozzle assemblies have been developed for atomizing liquid insecticides and for introducing dusts and liquid, either alone or in combination, into air blasts. Tallest shade trees can be effectively covered by this method. Much less spray material is used by this method than by the conventional type equipment used for applying dilute liquid insecticides. The new mist blowers are especially well adapted for the treatment of shade and roadside trees and orchards.

Comparing 3 Methods of Preserving Alfalfa Hay: It is generally recognized that losses of dry matter, protein, and carotene occur in the harvesting and preserving of forage crops for winter feed. If such losses in the field and storage could be avoided or reduced, dairy farmers would have better and cheaper feed for milk production, and more of it.

Newer methods of harvesting and storing forage crops include (1) making "grass" silage and (2) curing the crop in the mow with forced ventilation. The Bureau of Dairy Industry began experiments several years ago at Beltsville, (Md.) to see whether these methods offer advantages over the conventional method of handling forage by curing the crop in the field and storing it in the mow.

In two preliminary trials, alfalfa hay grown at Beltsville was made into silage by the wilting method. It was fed to dairy cows in comparison with the best alfalfa hay on the market. In one trial milk production was the same on both rations, and in the other it was slightly in favor of the silage.

In another experiment, alfalfa was cut from the same field at about the same time for making silage and curing in the field. The part used for field-cured hay was cut when the field was one-fourth to one-half in bloom, and the part used for silage was cut 2 or 3 days earlier. About half the silage crop was rained on. The hay had no rain damage, but when cured it was rated as about a medium U.S. No. 2 grade. The silage ration produced more live weight, as well as 7.3 percent more milk, than the field-cured hay.

In another experiment, alfalfa was cut from the same field at the same time for (1) making silage, (2) barn-cured hay, and (3) field-cured hay. In this, the two kinds of hay were much better grade than in the preceding comparison, but the silage still held an advantage of about 3 percent in milk yield over the barn-cured hay and the field-cured hay. At the time the different rations were fed, the protein yield per acre (as compared with the amount of protein in the freshly harvested crop) was 84 percent for the silage, 79 percent for the barn-cured hay, and only 60 percent for the field-cured hay. At feeding time, the carotene in the silage dropped from 308 micrograms per gram of dry matter to 82, the barn-cured hay to 22, and the field-cured hay to 12.

Making silage apparently conserved more protein, dry matter, and carotene per acre, and produced more milk, than curing the crop in the field or barn. Expenditures for labor and machinery were less (per ton of dry matter fed) for making silage than for handling the crop by the other methods.

Columbia and Targhee Sheep: The development of Columbia and Targhee breeds of sheep is not strictly basic research but has resulted rather from utilization of basic knowledge of genetics. The development of the two breeds represents a skillful application of genetic laws and principles by scientists of the Bureau of Animal Industry. Major credit for the development of Columbia sheep belongs jointly to E. L. Shaw, F. R. Marshall, and D. A. Spencer. Credit for the Targhee belongs to D. A. Spencer and W. A. Denecke. In both cases several others, mostly geneticists and station directors, were involved.

The development of these breeds has exceptional regional importance from a production standpoint, since they are primarily adapted to the inter-mountain ranges of the West. But the breeds also have national significance from a commercial and a monetary standpoint because of the excellent quality of their fleece and meat. The earning power of Columbia sheep is estimated to be $1 to $2 a head greater than average well-bred range sheep. That of the Targhee breed is somewhat less. The Columbia is the result of cross breeding select Lincoln rams with Rambouillet ewes and proceeding from this original crossbred by mating the most select first-cross rams with carefully selected first-cross ewes and interbreeding the rams and ewes descending from them. The foundation of the Targhee breed was laid by mating select Rambouillet rams with select ewes of Corriedale X Lincoln-Rambouillet, and Lincoln X Rambouillet combinations, and interbreeding the rams and ewes descending from these matings. The Targhee came from rigid selections of these matings.

Introduced Bamboos Prove Valuable: For several years, the Federal Experiment Station in Puerto Rico introduced various species of bamboo, but not until 1935 was extensive work undertaken in this field. By selection and testing, several species of bamboo have now been found valuable for industrial purposes and likewise highly resistant to the powder-post beetle which often attacks and destroys bamboo. As a result of these introductions and expansion of the plantings, a new bamboo furniture industry has been established in Puerto Rico, and several other new industries utilizing bamboo are in the offing as soon as sufficient planting material becomes available.

Soil and Water Conservation Research: A soil conservation farm plan is designed to put every acre to its best use according to its individual capabilities and to treat it according to its individual needs. Such a plant redesigns the farmer's "plant" for more efficient operation. As in the modernizing of an industrial plant, the redesigning of the farm is based on the results of a multitude of laboratory and plot studies and carefully watched field trials. In cooperation with State agricultural experiment stations, Federal research agencies, and interested individuals, Soil Conservation Service research scientists delve into the secrets of soil, rain, wind, and growing crops.

By studying the private life of a raindrop, for example, they have developed a unique rain machine that can be regulated to produce variations in rainfall from gentle drizzle to drenching downpour, to test the effects of different kinds of vegetative cover as protection for various types of soil. Tilting plots of earth that can be sloped to any degree have helped to determine the comparative soil-holding powers of grasses and other close-growing plants on sloping fields. Wind-tunnel studies are contributing valuable information on the causes and manner of soil movement by wind. Fine-gaged laboratory instruments and ingenious weather-imitating devices are adding, bit by carefully weighed bit, to the store of tested facts contributing to the development of new and improved soil-conservation practices and to the refinement of existing practices.

Though it is difficult to evaluate any isolated part of the conservation research program, its contribution to agricultural advancement is indicated by the following proved advantages of soil-conservation farming. It has provided a practical guide for greater crop diversification. It has meant savings in seed, fertilizer, labor, and power, as well as of soil. It has permitted the greatest possible degree of protection--and even improvement--to soil and water resources under the pressure of intensified wartime production. It offers the farmer and rancher a sound avenue for shifts in type or intensity of production to meet varying markets, or other conditions.

Rot-Proofing Fabrics: The effectiveness of the acetylation treatment in preserving cotton fabrics against mildew and bacterial rot was confirmed by extensive tests at the Southern Regional Research Laboratory of the Bureau of Agricultural and Industrial Chemistry. This treatment partially converts the cellulose of the cotton fiber to cellulose acetate, which cannot be utilized as food by cellulose-destroying micro-organisms. As a practical test, several bags, made of acetylated cotton fabric sewn with acetylated cotton thread, were filled with sand and left in contact with the soil and exposed to the weather on the grounds of the laboratory at New Orleans. After 2 years, these bags were still intact and serviceable. Numerous samples of acetylated cotton fabrics also showed almost complete

resistance to rotting when buried for 6 months in soil especially prepared to have a high content of cellulose-destroying micro-organisms. The most highly acetylated fabrics gave the best results. Because a high degree of acetylation is costly, the fundamentals of the process are being studied by the Laboratory, with the hope that greater knowledge of the chemical reaction and its control will permit the production, at materially lower cost, of treated fabrics having moderate acetyl contents but a high degree of resistance to mildew and rot.

The partially acetylated cotton fabric, yarn, and sewing thread should be satisfactory for making mildew-proofed clothing, tents and awnings, fish nets, and bags for packaging of fruit, vegetables, and other foods.

Photoperiodism: While working with Maryland Mammoth tobacco prior to 1920, W. W. Garner and H. A. Allard, of the then Bureau of Plant Industry (now Bureau of Plant Industry, Soils, and Agricultural Engineering), discovered that the plants flower only when the daily period of illumination is relatively short--that is, when the days are short and the nights long. When the light periods are long, the plants remain vegetative. Subsequent experiments on many kinds of plants showed clearly that they differ greatly in growth and flowering, responding with respect to the relative lengths of the daily periods of illumination and darkness to which they are exposed, some conforming to the behavior of Mammoth tobacco, others responding to relatively long illumination periods, and still others being but little affected.

This discovery departed widely from the prevalent theory that mere intensity of illumination was the principal light factor in determining the characteristic growth, flowering, and fruiting of plants. It had great fundamental importance as pure research and, as it developed, widespread practical significance. Response to relative length of day and night largely explains changes in behavior where plants are carried from one latitude to another. It is now possible, by conducting experiments under controlled conditions, to tell in advance whether certain varieties of soybeans, peas, onions, timothy, barley, and other plants are adapted to the photoperiodic conditions prevailing in specific localities. Experimental crops can be grown under greenhouse conditions anyway, with supplemental artificial light as needed; if none is adapted to the locality, one or more suitable lines can be bred.

This discovery also has been particularly helpful in selecting soybean varieties that thrive and produce abundant seed for making oil, plastics, and food products in various localities. It enables us to produce our own beet seed domestically instead of importing it as formerly. It enables us to select localities where pyrethrum, a long-day plant, will thrive in the United States, and also to cross plant varieties which would not normally flower at the same time, as in the case of sugarcane varieties. By artificially shortening the daily light period, chrysanthemums and other flowers are now brought to market ahead of their normal season.

Wartime Production: The stakes for production of food and feed were set amazingly high during the war, yet farmers met or exceeded most of them. During each war year after 1941 there were produced more milk, meat, poultry, eggs, soybeans, peanuts, beans, and peas--in short, more total food--than in any of the 5 prewar years. By 1944 gross farm production was one-fourth more than in the prewar period 1935-39. Between 1939 and 1944 production

increased twice as much as it did during the whole 20 years of peacetime from 1919 to 1939. The Bureau of Agricultural Economics has brought the whole story together in a study called "Farm Production in War and Peace," by Glen T. Barton and Martin R. Cooper.

Stubble Mulch Cultivation: Giant dust storms of the early 1930's vividly emphasized the climatic hazards of farming in the Great Plains, a region renowned for livestock, grain, and other agricultural products. In response to the urgent needs of farmers and ranchers, the Soil Conservation Service early began developing methods of protecting the inherently fertile Plains soils from the effects of uncertain rainfall, strong winds, and wide variations in temperature. Stubble mulching--protecting the soil against wind and water erosion by using the straw as cover after harvest instead of burning it or plowing it under--is proving one of the most effective conservation practices evolved in this and other western areas.

Test plots and field trials, set up in cooperation with the University of Nebraska, showed that stubble mulching increased infiltration of water, improved the structure of the soil, reduced runoff of rain and melting snow water, slowed evaporation, and lessened erosion by wind and water. Next, the research workers faced the task of devising cultivation methods that would not disturb the mulch of crop residues. In 1938, soil conservationists attached flat, V-shaped sweeps to a modified one-row cultivator for early experiments with subsurface tillage that would stir the soil from beneath without turning under the protective stubble. Five years later, 8,000 commercially produced machines, operated on the same principle, were in use on 500,000 acres of war-crop-producing Plains farms alone. For seedbed preparation, scientists reversed the motion of a rotary hoe, changing its digging action to treading that would firm the soil and break up clods and straw without removing or piling up crop residues.

For planting row crops, a corn planter was equipped with disk furrow openers and stub runners. The runners passed beneath the surface residue without clogging, and the disks threw out a furrow, leaving crop residues on the ground between rows. To cultivate corn, subtilling sweeps were set to operate between rows, cutting roots of weeds and stirring the ground, with rolling colters to shield the plants. Microbiological studies of soils with crop-residue cover are under way, to discover what effect stubble mulching may have on the action of the tiny organisms that help transfer nutrients from soil to plant. In turn, the information will enable soil conservationists to determine more precisely the conditions under which this practice is most effective.

Stubble mulching also is practiced widely in the Pacific Northwest and is edging elsewhere beyond the boundaries of the Great Plains, especially where water conservation is an urgent need. This development of stubble-mulch cultivation is typical of much soil conservation research, carrying the study of a potential farming practice through every phase from microbiological studies to machinery design.

DDT Applications With Flying Spray Gun: The development of DDT for control of mosquitoes by the Bureau of Entomology and Plant Quarantine brought about a need for new methods of applying this insecticide. By the end of 1943, C. N. Husman and O. M. Longcoy developed a portable sprayer that can be used in any conventional type of small airplane such as the Piper Cub. It consists

of a tank in place of the second seat of the plane, a pipe leading to a pressure pump driven by a small propeller from the wing, and another pipe leading from the pump to a venturi mounted through the fuselage. As the wind comes through the venturi it picks up the fine sprays delivered from nozzles mounted on the edge of the venturi and breaks them up into a very finely atomized spray. The equipment covers a swath width of 40 feet in an effective manner so that oil or water solutions can be applied at the rate of 2 quarts per acre. This equipment has been used in different theaters of the war during the past two years and is covered by a U. S. public service patent. This equipment can be used in any type plane and should be adaptable for use by private or commercial plane owners in applying insecticides. A slight modification of the sprayer enables one to apply insecticidal dusts at the rate of 2 pounds per acre.

Insect Repellents: Early tests by the Bureau of Entomology and Plant Quarantine at Orlando, Fla., made it possible to recommend some good insect repellents to the armed forces for use in Italy as well as in other areas. Dimethyl phthalate, Indalone, and 2-ethylhexanediol 3,1-1 were found effective for a variety of insects, and combinations of them proved equally as effective as the individual ingredients for specific insects. It is, therefore, possible for the armed forces to obtain in one bottle an insect repellent against a wide variety of biting insects including mosquitoes, sandflies, eye gnats, and biting flies.

Studies also showed these repellents could be used effectively for protecting men from chiggers and would afford some degree of protection against ticks that affect man. The repellent is applied to the inside of the cuffs of the trousers, sleeves, and between the button surfaces so as to form a barrier against chiggers that tend to crawl into the clothing. More recent developments with insect repellents have shown even more efficient chemicals, but the increased efficiency is not sufficient to justify a change in the recommendation now. It is expected that even better repellents will be developed for postwar uses and that some of them may also be used against insects that affect animals or even crops. Over 300 million 2-ounce bottles of these repellents have been purchased by the armed forces.

New Crop Varieties in Volume: The records of the Bureau of Plant Industry, Soils, and Agricultural Engineering for the 4-year period ending with 1944 showed well over a hundred new varieties of crops of various kinds had been released to the public in that time as a result of research by Department and cooperating State scientists. Many of the new crops of this and preceding years were of importance in increasing output at a time when high production was called for to meet war demands for food and industrial materials. Such work is continuous--chain effort to produce higher-yielding, disease and pest resistant crops well adapted to certain areas and suited to modern methods of production and processing.

Plywood Adhesive From Soybean Meal or Corn Gluten: A new waterproof plywood adhesive having considerable binding strength was developed by the Northern Regional Research Laboratory of the Bureau of Agricultural and Industrial Chemistry. It is made by combining solvent-extracted soybean meal freed of its water-soluble constituents, or corn gluten, with phenolic resin in the intermediate or water-soluble form. A commercial trial demonstrated that excellent plywood could be fabricated with such a glue, which becomes insoluble on setting. A plywood manufacturer made practical use of this discovery and has consumed large quantities of a commercial brand of soybean meal in making waterproof plywood. A manufacturer of soybean meal offered to supply a large amount of

the proper quality to companies that might become interested in the use of soybean-modified, phenolic-resin plywood adhesive. So there is good prospect for increased industrial utilization of soybean meal in adhesives.

Since the new adhesive costs less than other waterproof adhesives and results in plywood suitable for use as such, or as concrete-pouring forms in building houses and other structures, it should help to reduce the cost of construction on farms and elsewhere in the postwar period.

Inexpensive, Effective Dip for Sheep Ticks: Derris powder or cube powder having a 5 percent rotenone content, added to water at the rate of 6 ounces of the powder to 100 gallons, makes an effective dip for eradicating sheep ticks, or keds, from farm and range flocks. The value of this inexpensive dip was determined by tests conducted by N. G. Cobbett and C. E. Smith, parasitologists of the Bureau of Animal Industry. In Colorado, Smith dipped over 1,000 sheep, representing 5 farm flocks. In New Mexico, Cobbett dipped nearly 9,000 range sheep. The dip stayed in the fleeces of the sheep long enough to destroy the young ticks that emerged from the pupal cases remaining in the wool after dipping. This treatment has superior efficacy in killing ticks following a single dipping, and is, moreover, cheaper than the previously recommended commercial dips. Powders having more or less than 5 percent rotenone content may be used if the quantity of powder is adjusted to supply the proper total amount of rotenone.

Disease Resistance in Crops: One of the greatest improvements brought about in crops by plant breeders has been disease resistance, which, along with such characteristics as heavy yielding capacity and adaptability to various climatic conditions, has enabled farmers to produce much more on the same acreage, with the same quantity of fertilizer, and with less labor per unit. Notable among the crops which have been reinforced by disease-resistant characteristics, are wheat, oats, potatoes, sugarcane, and sugar beets, but practically all crops, large and small, have been improved to some extent in this way. Some accomplishments in disease resistance have become classics, such, for instance, as the saving of the sugarcane industry in Louisiana through the development of varieties resistant to mosaic disease. The development of sugar beets resistant to curly top is in the same class, as are also the cooperative potato breeding program and breeding better cereals.

Cross-Breeding Experiment With Dairy Cattle: The Bureau of Dairy Industry began this experiment in 1939 at Beltsville (Md.) to explore the cross-breeding of dairy cattle.

Few experiments in crossing dairy breeds have been conducted before, especially with animals of known producing ability. All foundation animals in the experiment were of known production or transmitting ability. Production-tested cows of four dairy breeds--Holsteins, Jerseys, Guernseys, and Red Danes--were available, as were also proved sires of the same breeds except Guernseys. Funds for the experiment were available through the Bankhead-Jones Act of 1935.

The experiment differs from the usual pattern of cross-breeding, in that only a limited number of interhybrid matings are being tried. The major plan calls for continuous introduction of new genes (units of inheritance) through the use of proved sires of the respective breeds. Females resulting from the mating of two breeds are being mated to a proved sire of a third breed. The resulting

3-breed females so far have been mated to a proved sire of one of the same breeds as in the first cross, for a second round of the three breeds involved. All cows are milked 3 times a day for 365 days, and bred 4½ months after calving. No culling is practiced and all females are tested for production.

Thirty-two females representing various combinations of two breeds have completed production records, averaging 12,842 pounds of milk and 592 pounds of butterfat, at the average age of 2 years 2 months. The great majority of these 32 crossbred heifers are better producers than their dams. Some increase was expected because of the high level of production inheritance transmitted by the proved sires. The expected amount was estimated by careful analysis of the production ability evidenced in the ancestry of these heifers. The actual increase, however, turned out to be approximately 20 percent more (on the average) than was expected. This may be the result of hybrid vigor.

Four 3-breed heifers have completed production records, averaging 14,837 pounds of milk and 645 pounds of butterfat, at the average age of 1 year 11 months. So far every 3-breed heifer is better than her 2-breed dam.

One of the striking characteristics shown by all the crossbred heifers is their persistency in milk production. In many cases the monthly butterfat production varies less than 10 pounds from the high to the low month.

New Method Permits Use of Old Tobacco Beds: Tobacco growers have had to use new ground sterilized by brush fires to grow their transplants in order to avoid too much damage from molds and weeds. Recently the Department has developed a new way to keep out weeds and diseases in these beds--sterilizing the ground with chemicals. The treatment consists in applying in the fall a mixture of calcium cyanamide (Cyanamid) and urea (uramon). The former protects against weeds. The mixture does even a better job of killing weeds, and also prevents root knot, black root rot, and other diseases. The chemicals can be obtained wherever fertilizers are sold. For a square yard of tobacco bed the specialists recommend a pound of urea and a half pound of calcium cyanamide. With such an application of the mixture in the fall they have obtained an average of 21 good transplants per square foot, and almost no weeds.

Tropical Kudzu: In cooperation with the Soil Conservation Service, the Federal Experiment Station in Puerto Rico has been working on new legumes for the Western Hemisphere tropics. Pueraria phaseoloides, locally named tropical kudzu, appears to have all the favorable points which have made kudzu so popular in the Southern States. Ordinary kudzu will not thrive in the tropics, but tropical kudzu, its close relative, thrives well and produces a heavy forage crop. It serves excellently as a soil erosion plant, and will control erosion on steep hillsides and deep gullies. The protein content of the leaves is high, and it is palatable to animals. It grows well together with other grasses, thus improving the quality of fresh cut feed. It has drought resistance, which is a distinct advantage in Puerto Rico. Interest in this legume has been widespread, and requests for seed have been received from nearly every tropical country of the Western Hemisphere, as well as from the southernmost areas of the United States.

Stratified Flow: By caging a miniature river and reservoir in glass, the Soil Conservation Service, in cooperation with the California Institute of Technology, has found how to shuttle a silt-laden stream through and out of a reservoir by making enlightened use of the stream's own action. Because the annual cost of

reservoir silting is estimated as high as 50 million dollars, this discovery promises to save the country vast sums in safeguarded power production, community water supplies, and irrigation water.

Research of the Service's sedimentation specialists has established the fact that a stream retains its identity after entering a reservoir, continuing to flow in a layer through, under, or over the still water. The stream's action depends on the temperature and amount of sediment or silt it contains. A silt-laden current slides under the clear water of a reservoir as heavy cream poured into a cup of coffee slides under the clear, brown liquid.

The research workers first trapped these flows, or density currents, in glass and then watched and recorded their action. They predict that engineers eventually will be able to use the layered flows of water as accurately as an accountant can use the keys of an adding machine. For instance, an understanding of stratified flow will allow the channeling of a clear stream of snow water through the reservoir to city mains. A muddy stream may be channeled through the same basin to a drain feeding sandy irrigation canals so the silt will seal leaks in the sandy ditches. A salty stream can be stored in a known layer or stratum until it can be drained off.

Brighton Dam and Reservoir, near Washington, D. C., was the first to be constructed so as to make use of the principle of stratified flow in the special design of its outlets. Observations have shown that these outlets carried off from 2 to 10 times the amount of sediment that would have gone over a spillway with the same volume of water. Engineers are making immediate use of the new understanding of density currents to preserve the capacity of reservoirs already built, drawing off known silted streams through low outlets originally designed for emergency draining.

Cotton Hosiery Studied: Directed by Congress to investigate cotton hosiery as a possible outlet for more American-grown cotton, the Bureau of Human Nutrition and Home Economics began in 1939 to make laboratory and service tests. Accomplishments of this research proved of timely value in the wartime clothing situation. When the silk crisis came, the Bureau was able to make available to the trade over 200 designs for women's full-fashioned cotton hose. These included, sheer, medium, and heavy weights in plain and fancy weave for street, work, and dress wear. Some of these designs were reproduced exactly in marketed hose, and all of the designs furnished manufacturers with ideas for developing their own exclusive designs. Other phases of this research provided information on yarns, finishes, and hosiery construction at a time when this was especially needed. These studies also showed how medium staple lengths of cotton fiber can be used acceptably in hosiery manufacture. Wearing qualities were determined by actually putting into service hose made of different varieties of cotton and with different yarn and fabric constructions. These studies have had an important influence on making cotton hosiery once again an accepted article in the well-dressed woman's wardrobe. They have shown cotton growers and hosiery manufacturers the possibilities of American-grown cotton in high-grade hosiery manufacture. And they have contributed important methodology to the scientific study of a standard article of clothing.

Forest Economics: Lumber shortages not only may prevent attainment of current housing goals, but also are likely to continue throughout the first postwar decade, according to recent Forest Service appraisals of the lumber situation. Estimates of postwar lumber supplies and requirements indicate a deficit of as much as 7 billion board feet annually during peak years of the anticipated postwar building boom, and an average annual deficit for the postwar decade of 2 to 3 billion feet. The discrepancy in prospective supplies is even greater when we consider the need for rebuilding depleted lumber stocks, which currently are 10 to 12 billion board feet below prewar levels.

Chief reliance for postwar lumber supplies must be placed upon domestic production, since it is expected that net imports of lumber will be relatively small. Annual lumber production in the postwar decade is not likely to exceed 33 billion board feet. In the postwar years, scarcity of easily accessible high-quality timber is expected to be the primary deterrent to higher levels of lumber output.

To bring postwar lumber supply and demand more nearly into balance, it will be necessary to build up and maintain forest productivity on a much higher level than at present. Although this is a long-term undertaking, beginning a program of remedial action would show results at an early date. Specific FS proposals for such a program include: Improved and increased use of local forest resources; aid to small sawmill operators to increase their efficiency; help for small woodland owners in marketing their products; accelerated forest planting on private land; improved protection against fire, insects, and disease; establishment of forest cooperative associations; intensified forest research; regulatory measures to stop forest destruction; public ownership of land not suited to private forestry; and intensified timber management of the national forests.

Rapid Multiplication of New Crop Varieties: The new oats variety, Clinton, developed by the Bureau of Plant Industry, Soils, and Agricultural Engineering and the Iowa Experiment Station, provides a good example of rapid increase of a new crop to reach early commercial production. This high-yielding, stiff-strawed variety was built up from a few pounds to 20 tons in a little over a year. The first lot of seed, 25 pounds, was harvested at Ames, Iowa, in July 1943, planted in November on irrigated land at Mesa, Ariz., where 2,000 pounds was harvested in April 1944. This ton of seed was sown May 20 of the same spring on irrigated land at Aberdeen, Idaho, and 20 tons harvested in August. This 20 tons, or about 1,200 bushels, was planted by farmer seed growers in the Middle West in the spring of 1945, resulting in providing 40,000 bushels (1,280,000 pounds) of seed for 1946 planting. Interest of farmers in new varieties produced by research men is largely responsible for improvements in methods of increasing new varieties. In the big oats-producing region of the northern Mississippi valley new varieties have been taking hold very rapidly. Here in years when rusts are not particularly bad new varieties are increasing yields by 10 to 15 percent and in bad rust years by as much as 100 percent over what they would have been with the use of old susceptible varieties.

2, 4-D Kills Weeds: The growth-regulating chemical, 2, 4-dichlorophenoxyacetic acid (called 2, 4-D for short) has been studied by the Bureau of Plant Industry, Soils, and Agricultural Engineering for a number of years, which has brought out its various degrees of usefulness in the control of some common weeds in pastures, lawns, small-grain fields, and cornfields. In the dilute solutions

used, it does not kill plants of the grass family. It has proved unusually effective in killing such common competitors of grass as dandelion, broad-leaved and narrow leaved plantain, chickweed, and others. The bureau research men have also found it effective against annual bindweed and promising against perennial bindweed. The experimenters have found that one of the effects of the chemical is to stimulate some kinds of weeds to use up their reserve food supply so the plants starve to death in the periods when their leaves are not producing starch.

New Method of Statistical Analysis: The cost of crop production, probable size of a crop, or answers to hundreds of economic questions are usually determined by analyzing large numbers of figures on the subject. Thus, the best method of securing and analyzing such sample data is an ever-present problem for economists. The Bureau of Agricultural Economics has experimented with a new statistical technique known as sequential analysis. With this new method, the size of a sample necessary to reach an accurate conclusion does not have to be determined beforehand. Instead, observations are taken in sequence until sufficient information is obtained to reach a conclusion with a given degree of accuracy. This war-developed statistical method cuts down the number of required observations by about half, yet at the same time promises to give accurate results. Although sequential analysis has been used primarily in the inspection of manufactured products, BAE hopes to apply it to the collection and analysis of agricultural data.

BAE also is cooperating with the Cowles Commission of Chicago University in developing other new statistical methods for analyzing economic data. The approach in this work involves consideration of simultaneous systems of economic relationships. These relationships are assumed to be subject to random disturbances, thus preventing them from being satisfied exactly. The new technique removes the bias inherent in the old method of correlation analysis. The present statistical research promises to provide better methods for predicting economic behavior as well as a better understanding of our economic structure.

U. S. DEPARTMENT OF AGRICULTURE

Office of Information
Mr. Harding, 4842
Miss Arnold, 4875

No. 6
Revised January 1, 1947
A USDA Document

IMPORTANT RECENT ACHIEVEMENTS OF DEPARTMENT OF AGRICULTURE SCIENTISTS

Slobolt Lettuce: One of the most up-and-coming new vegetables recently introduced to the seed trade by the Department of Agriculture is Slobolt lettuce, so named because it is slow to "bolt" seed stems in warm weather. Nonheading, long-standing, Slobolt produces usable leaves 3 weeks longer than the well-known commercial leaf-lettuce varieties. It is the result of 10 years of breeding and selection by Dr. Ross Thompson of the Bureau of Plant Industry, Soils, and Agricultural Engineering. Seed is now available from most seed houses and Slobolt is being grown successfully in many parts of the country.

Dehydrofreezing Process Preserves Foods: A new process of food preservation that combines most of the advantages of dehydration--namely, reduction in weight and volume--with freezing, has attracted much interest among food processors. The process, termed dehydrofreezing, was developed by the Western Regional Research Laboratory of the Bureau of Agricultural and Industrial Chemistry, and involves carrying the product through the first cycle of dehydration, and then freezing. Since the vitamins and flavor are virtually undamaged by this initial dehydration treatment, the product retains the fresh quality, and in some instances, notably boysenberries and apricots among the fruit products investigated, it retains the original shape. In consequence of the weight and volume economies, dehydrofreezing effects savings in packaging materials. The load on refrigeration systems also is materially reduced. Reconstitution of dehydrofrozen foods is easier than that of dehydrated foods because of the greater moisture content of the former. Implications for the fruit and vegetable industries are lowered transportation, storage, packaging, and refrigeration costs.

Insecticide Revolutionizes Livestock Industry: The livestock industry in the United States used to suffer an annual loss of over $1,000,000 each season because bloodsucking flies injured stock. This astounding profit leak became obvious to stockmen in 1945, when demonstrations on fly control were held by the Bureau of Entomology and Plant Quarantine in cooperation with State and other interested agencies. The demonstrations showed that treated stock, ordinarily heavily infested, gained an average of 50 pounds of beef per animal over untreated stock during the 60-day fly period in midsummer, and that a gain of 5 to 15 percent in milk production could be expected. During the 1946 season millions of cattle and other livestock were sprayed with water-dispersible DDT insecticide by stockmen and farmers. This practice has radically changed livestock management in many areas in the United States.

Corn Belt breeders are now fattening cattle during summer months. Heretofore summer feeding was totally unprofitable. Ranchmen are now aware that they may expect a gain of over 2,000 pounds of beef for each pound of DDT used during the fly season. Dairymen are spraying barns and buildings as well as cattle to gain the 5 to 15 percent increase they may expect in dairy-products production. These major changes in the livestock industry all occurred during the spring and summer of 1946, and are now standard practice in most stock-producing areas.

Farm Opportunities for Veterans: By late summer, 1946, over one million veterans had returned to farms, besides a large number of industrial workers. Of the veterans farming that summer, 700,000 were farm operators or members of farm families and 300,000 were hired workers. Veterans made up 9 percent of all persons employed on the Nation's farms. They numbered about two-thirds as many men as had left farm work for the armed services during the war.

These facts are in a report from the Bureau of Agricultural Economics, entitled "Farm Opportunities." This report estimates the number of farms likely to become available for veterans and other newcomers in agriculture. It was reckoned that farms becoming available to new operators during the first 5 years after the war would include 600,000 because of deaths and retirements, 200,000 because owners and tenants change to other jobs, roughly 10,000 from military land suitable for farming and divided and sold, and 40,000 from new land in development projects already finished or under way.

In addition, considerable land-development work, already started, authorized, or planned, eventually will improve land for many inadequate farms and for an additional 75,000 to 100,000 family-sized farms. This work involved drainage, clearing, flood control, and irrigation. Fifteen to 20 years or more may be required to get this job done.

Better Home Canning of Low-Acid Foods: Three years of intensive research on household canning methods have enabled the Bureau of Human Nutrition and Home Economics to recommend new and improved processes (temperatures and heating times for food in a canner) for home canning of low-acid foods. These foods include meats and practically all vegetables, except tomatoes, commonly canned in home kitchens. Procedures previously recommended were based mainly on industry's research. This work had shown that steam pressure is essential to safeguard low-acid food against botulism. When adapting industrial processes it was customary to lengthen them considerably to provide safety margins, since housewives could not copy industrial methods and precision. Hence excessive processing often made home-canned low-acid foods unattractive and low in vitamins.

In the Bureau's research, more than 4,000 glass jars and tin cans of beef, pork, chicken, and 12 low-acid vegetables were prepared, packed, and processed in home-type steam-pressure canners in the way homemakers do the job. Temperature changes inside jars and cans were recorded by sealed-in termocouples. To verify the amount of heat required to sterilize the foods, some packs were experimentally inoculated with bacteria even more heat-resistant than the botulinus bacillus. According to results of this work, vegetables in pint glass jars, and some in quart glass jars, may be processed at home in 25 to 50 percent less time than was previously recommended. It is necessary to lengthen processing times for a few vegetables, if quart-size glass jars are used. The new processing times for foods home canned in tin are quite similar to those in commercial use. For home-canned meats processing temperature has been set at 240° F. (10 pounds pressure), replacing 250° F. (15 pounds pressure) formerly recommended.

These improved directions offer important advantages to the 20,000 or more American families that annually can some of their own food supply. Using a steam-pressure canner, homemakers may now turn out a product which combines safety with better flavor, texture, and nutritive value than in the past, and at a saving of time and fuel. Since the new processes make safe canning more attractive, there is prospect that more homemakers will adopt the steam-pressure method for low-acid foods, which cannot be safely canned in a boiling water bath,

oven, or open kettle. Aside from dubious safety, spoilage due to inadequate processing of home-canned foods has been excessive. In one recent year, spoilage of low-acid vegetables alone due to improper canning methods was estimated at a $1,500,000 loss.

Progress in Vanilla Research: The Department of Agriculture Experiment Station in Puerto Rico has conducted an experimental program with vanilla since 1907, when cuttings were introduced from the Florida Agricultural Experiment Station. The commercial industry was beginning to grow about 1917, when a root rot appeared that has limited production and expansion of the vanilla industry to date. In 1927 a member of this station identified the casual organism as a fusarium root rot. In cooperation with the Insular Government, investigations since that time have been devoted largely to cross-breeding for varietal resistance and to study of the cultural practices which support vigorous healthy growth. A system of growing vanilla, using lath shade admitting about 50 percent sunlight, has been devised and is showing considerable commercial promise. The 1/3-acre experimental plot contains the best vanilla grown in the history of Puerto Rico and is stimulating hopes among growers for a paying industry in idle mountainous sections of the island. The station also is conducting research on the chemistry of curing vanilla beans that is leading to improved and more rapid procedures in curing.

More Eggs from Less Feed: Eggs account for more than half the income from poultry, although the rapid increase of the broiler industry in the last 50 years has been a significant development in poultry keeping, according to T. C. Byerly, poultry specialist of the Bureau of Animal Industry. In general it takes about a pound less feed to produce a dozen eggs than it did 50 years ago. Three average hens nowadays lay as many eggs as four average hens did 50 years ago. An increase in eggs per hen probably is the most important poultry gain during the half century. This is due primarily to the careful work of poultry breeders who have applied skillfully knowledge gained through experience and research in poultry genetics.

Seven 1,000-Pound Butterfat Cows Bred in One Herd: Accumulation of good germ plasm in the Holstein herd at Beltsville, Md., where the Bureau of Dairy Industry has followed the proved-sire system of breeding since the herd was established in 1919, is indicated by the increasing number of high-production records in the herd in recent years. During the past year, 3 cows have each made a record of more than 1,000 pounds of butterfat on 3 milkings a day for 365 days. This makes a total of 7 cows that have exceeded the 1,000-pound mark in this herd in the last 5 years. Two cows have exceeded the mark for the second time.

A herd that has produced 7 cows producing more than 1,000 pounds of butterfat on 3 milkings daily for 365 days adds emphasis to the value of the proved-sire system of breeding, especially when it is considered that only about 61 cows in all Holstein history have reached this mark under these same conditions, and that fewer than 400 Holsteins have produced 1,000 pounds of butterfat when milked 3 or more times a day. Three breed records in the 3-milkings-a-day class are now held by Beltsville Holsteins. In addition to the three 1,000-pound records, one other cow made 900 pounds of butterfat and 7 others made more than 800 pounds. Four of these cows started on test under 4 years of age.

In the 1945 Honor List for production, cows in the Beltsville herd won 2 first places, 2 second places, and 4 third places--all in the 3-milkings-a-day class. The herd itself ranked second among all herds in the Honor List with an average of 18 points per cow for the 28 cows enrolled, or a total of 516 points. The first-place herd had 41 cows with an average of 15 points, or a total of 615 points

Raindrop Erosion: When raindrops strike bare soil, or thin films of water covering it, particles of clay, silt, and sand and bits of fine gravel fly through the air like tiny rockets. This is splash erosion. Much unprotected soil can be moved by splash erosion, depending upon soil type and velocity of raindrops. Experiments carried out by the Soil Conservation Service at Coshocton, Ohio, indicate that 8.25 inches of artificial rainfall, falling at a velocity of 19 feet per second, caused a 1-inch layer of soil to erode and splash away. This seems bad enough, but when the raindrop velocity is increased to 35 feet per second, the erosive action is 10 times as great. Moreover, the impact of raindrops on bare soil breaks down soil aggregates and seals the surface so as to reduce the rate of water infiltration into the soil. Farmers have science on their side when they prefer slow, soaking rains to hard thundershowers. Vegetative cover that breaks the impact of raindrops offers the best known means of preventing splash erosion. The Coshocton studies give added proof of the value of winter cover crops and stubble-mulch practices.

Rapid Method of Detecting Compression Wood: A simple electric-light box was devised by the Forest Products Laboratory of the Forest Service for the quick detection of compression wood, an abnormal type of wood produced on the lower side of leaning softwood trees. Such wood has erratic strength properties, shrinks excessively and unevenly along the grain, and is unusually hard and unsuited for many uses. Only an experienced eye can detect it. The box throws a beam of light through thin cross-sections of wood and thus shows up compression wood even to unskilled workers, because it is much more opaque than normal wood. It should find many uses in shops employing refined construction methods for aircraft, ladders, masts, oars, structural members of buildings, and even boxes, in all of which compression wood is objectionable.

Cotton Gin Improvements: "Mistifiers," which eliminate static electricity generated by movement of dry cotton through a gin and permit ginning of full-weight bales, have been investigated by agricultural engineers of the Bureau of Plant Industry, Soils, and Agricultural Engineering. Static electricity causes cotton to bunch up, clogs the gin machinery, prevents lint from packing uniformly in the press box, and creates a fire hazard. The engineers found that adding sulfanated oil mist to the lint eliminates the static and permits better, continuous ginning and pressing of the lint into full-weight bales. The "mistifiers" are being tested in 18 commercial gins. New cotton-cleaning systems increasing bale values $8 to $16 each have been devised by the engineers in the past year. Superimposed upon regular ginning equipment, the cleaners remove dirt, leaves, sticks, and other trash that accumulate inordinately in machine-picked cotton.

Casein Bristles Used in Making Brushes: The Eastern Regional Research Laboratory of the Bureau of Agricultural and Industrial Chemistry has developed a process for making bristles from casein. In response to the commercial interest in casein bristles as a substitute for natural bristles, recent research on this product has been directed particularly toward a completely continuous process of manufacture. It is now possible to carry the product much nearer to finished condition without resort to batch handling. The continuous process should be more economical and should yield a product of somewhat greater uniformity. Recently this process was brought to successful commercial development by a large brush manufacturing company which uses the bristles in paint brushes.

Method Helps Nurserymen Meet Japanese Beetle Quarantine: Nursery stock grown within the area regulated because of the Japanese beetle must be inspected or subjected to one of several approved treatments in order to be certified for shipment outside the infested area. Following intensive experimentation by

the Bureau of Entomology and Plant Quarantine, use of DDT for treating soil in nursery plots and potting soil was authorized on March 21, 1946, as a means of obtaining certification of plants grown in such soil. The new treatment requires the use of only 25 pounds of technical DDT per acre in comparison with the 1,000 pounds of lead arsenate previously necessary. The labor involved in making the application is also materially reduced. This improved method is one of the greatest advances yet made in aiding nurserymen to obtain certification of their plants.

Analysis of Farm-Family Spending: How much of their incomes do farm families spend for family living? Some answers to this question are supplied in a technical study of family budgets for a group of farm belt farmers, by Willard W. Cochrane and Mary D. Grigg, of the Bureau of Agricultural Economics. For example, they found that among these families (1942) those who had incomes of $1,000 to $2,000 a year spent 62.4 percent of their incomes for family living. The figure decreased steadily through various income groups until it appeared that those with incomes of $8,000 to $9,000 a year spent only 22.5 percent of their income for family living. This report is a highly technical analysis of the subject, presenting its conclusions after two types of analyses, which it calls static and dynamic analysis.

Introduced Bamboos Valuable: For several years the Department of Agriculture Experiment Station in Puerto Rico introduced various species of bamboo, and in 1935 more extensive work was undertaken in this field. At present 36 species and varieties have been established on the station grounds. Several of these have been found highly resistant to the bamboo powder-post beetle which often destroys cut culms. Some of the resistant species have been found valuable for the manufacture of furniture, fishing rods, and similar items. To promote the use of bamboo in Puerto Rico, over 50,000 offsets have been distributed in cooperation with insular agencies and about 1,300 offsets have been distributed in 13 foreign countries. In addition the station has supplied over 200,000 linear feet of cured culms to several industries in Puerto Rico which utilize bamboo.

Breeding Better Hogs: Faster-growing hogs of superior conformation and greater liveability are resulting from experiments of the Regional Swine Breeding Laboratory, Ames, Iowa, conducted by the Bureau of Animal Industry and 13 State agricultural experiment stations. The research involves carefully planned systems of matings in which inbreeding, signifying the use of closely related parents, has a prominent part. The main purpose of inbreeding is to fix desirable characteristics. Hogmen, using their farms as proving grounds, are cooperating with the scientists by testing boars produced by the various systems of breeding. Thus far, over 500 boars from the various projects have been released to farmers for practical tests of breeding excellence. Five breeds and 3 lines from crossbred foundations are represented in the research. The degree of inbreeding in most of the lines ranges between 25 and 50 percent. Experiment-station data, with reports from farmers, indicate that mating boars from good inbred lines to noninbred sows results in about 100 pounds more weight per litter, when the pigs are 6 months old, than that of litters sired by noninbred boars of the same breeding as the sows. Crosses involving three inbred lines, all within the same breed, are a promising method of growing still more pork per mating.

Calf-Feeding Schedule Saves Milk: After several years of research to determine the nutritional requirements of dairy calves, the Bureau of Dairy Industry has devised methods by which calves can be raised using no salable whole milk and with very little skim milk. By proper feeding Holstein calves can be weaned successfully from all milk at 45 days of age and Jerseys at 60 days of age.

In brief, the method calls for giving the calf its mother's colostrum for 3 days and then feeding skim milk in moderate amounts (1 pound per 10 pounds of body weight daily) for 45 or 60 days, depending on the breed. Good-quality hay is fed as early as the calf will eat it, and the skim milk is supplemented with cod-liver oil to furnish the needed vitamin A, until the calf is getting enough carotene in the hay to meet requirements for vitamin A.

Because skim milk contains only half as much energy as whole milk, the energy intake is less during the first month or so than when whole milk is fed. Calves fed skim milk in place of whole milk do not make quite as good gains as desired during the first month, even though they make up the loss in weight later. This slower rate of gain on skim-milk feeding and early weaning can be overcome by supplementing the skim milk with tested energy-rich feeds, such as flaxseed jelly (prepared by cooking flaxseed in a small amount of water), corn meal, ground soybeans, oatmeal gruel, and a concentrate mixture. The supplement was mixed in the skim milk and feeding began at 5 to 12 days of age, using 1/4 pound per day at the start and increasing to 1/2, or in some cases 1 pound, in a few days.

Except for the soybeans, the calves took the supplements in the skim milk satisfactorily. The flaxseed jelly, concentrate mixture, and corn meal proved to be the best. Soybeans were very unpalatable, while the oatmeal gruel caused very pasty feces. Calves that got the flaxseed supplement in skim milk gained twice as much during the first month as those that got no supplement. Calves that got the concentrate mixture in skim milk did almost as well as those that got the flaxseed jelly. Fortifying the skim milk with energy-rich feeds enables the calves to grow faster and make good gains, thus making it possible to wean them from all milk satisfactorily at an early age.

Tailoring Tools to Contour: Not long ago, potato farmers in the rolling-hill country of Aroostook County, Maine, were on the horns of a dilemma. If they kept on farming up and down hill, they would eventually lose all their topsoil and be forced out of business. But when they put in terraces and farmed on the contour, they had machinery troubles. Conventional planters, sprayers, and harvesters simply did not produce best results. These Maine farmers had a lot at stake. Theirs is a fine potato county. Aroostook County farms yield an average of 275 bushels of potatoes to the acre. Each harvest around 12 million barrels of spuds are sent to market or put in storage. Fortunately, they could rely on the scientific knowledge of Soil Conservation Service researchers and engineers. In particular, they had the help of John W. Slosser, who spent several years redesigning potato machinery for efficient operation along hillsides.

Take the potato sprayer, for example. The old type multiple-row sprayer, with rigid cross boom, gave trouble over terraces and along fairly steep slopes. The up-hill nozzles were too high; the down-hill nozzles too low. Slosser set to work and came out with a new principle. On his sprayer each boomlet slides along the ground on a metal shoe. Thus the nozzles are always the same height from the ground--the right height for an efficient job. Slosser also rigged up a tank truck that carries 770 gallons of water, meters out the spray chemicals, and then makes a perfect mix.

Then Slosser tackled the multirow planters and diggers--again with happy results. He hinged the working parts of a 2-row pull-type planter to a bar controlled by the soil surface. Not only does this insure proper depth and spacing, but the planter can be operated by one man instead of the two commonly employed. On the potato digger Slosser doubled efficiency by hinging the rear of the digger

blade and elevator to follow the ground level. Then he arranged a crank and leveler so that the rear wheels and the separating platform can be leveled for side-hill operation. The majority of Maine potato farmers are now saving their soil and producing excellent crops, though some machinery problems remain to be solved, and are still under study.

Ethyl Alcohol Production from Wood Waste: Since construction began of an Oregon plant to produce ethyl alcohol from Douglas-fir wood waste by a laboratory-devised process, the Forest Products Laboratory of the Forest Service, through continuing research, has increased the plant's potential output from 4,000,000 to more than 5,000,000 gallons annually. This research makes possible a continuous process of wood hydrolysis rather than the batch process hitherto used in Germany and elsewhere. The time necessary for hydrolysis has been reduced to one-eighth that used in the German Scholler process, and simultaneously the yield of alcohol per ton of wood has been stepped up by about 10 percent. At the same time better fermentation methods were developed by which both yield and concentration of alcohol from wood sugar are increased. Moreover, it was found that, on the residue remaining in the still after removal of the alcohol, fodder yeast rich in vitamin content could be grown at the rate of 2 pounds of dried yeast per gallon of alcohol produced.

Onion Hybrid Heralds Others: Sweet, mild (not hot), high-yielding California Hybrid Red No. 1, first onion hybrid developed as a commercial crop, heralds the possibility of hybrids of numerous other vegetables for home and commercial gardeners. It was developed by plant breeders of the California Experiment Station and the Bureau of Plant Industry, Soils, and Agricultural Engineering through experiments started about 12 years ago. A red globe with white flesh, it is especially adapted to central California, southern Utah, and southern Nevada, but has been used in some other parts of the Southwest and even in Australia, the home of one of its parents. A true early hybrid, the variety yields 460 to more than 750 100-pound bags per acre, far above the usual yield of early onions in those early onion areas. Bulbs weigh nearly a pound on the average. It is not a storage variety but may be kept successfully 3 to 4 months after harvest.

The hybrid was achieved by breeding male-sterile onion strains that bear seed but do not supply pollen. This method of obtaining highly prized hybrid vigor in onions through commercial production of seed is expected to make possible a general increase of 20 to 50 percent in yields of onions. This method has also been applied experimentally to such crops as tomatoes, cucumbers, squashes, melons, barley, and grain sorghum. A male-sterile barley has already been found, but with barley and sorghum there are difficulties beyond those encountered in the commercial production of hybrid onion seed.

Motor Fuels and Other Products from Agricultural Residues: A process for converting corncobs, sugarcane bagasse, peanut and oat hulls, cottonseed hulls and burs, and flax shives into sugar solutions for fermentation and chemical processing into liquid motor fuels (with several byproducts) has been developed on a laboratory scale by the Northern Regional Research Laboratory of the Bureau of Agricultural and Industrial Chemistry. It is a continuous 2-stage process for converting the cellulose of such materials into a solution of dextrose, and the hemicellulose (principally xylan) into a solution of xylose and furfural, leaving the lignin as an insoluble residue. In the first stage about 95 percent of the xylan is converted by treatment with dilute sulfuric acid into xylose and a small amount of furfural. In the second stage the cellulose is converted into dextrose by a novel procedure that includes impregnation of the dried material with concentrated sulfuric acid at a low temperature. The conversion is accomplished in

1 to 2 percent of the time and with less than 25 percent of the acid required by other known concentrated-acid processes. The xylose can be converted by known chemical processes into furfural, an important material for chemical industries, or, after the small quantity of furfural in the original xylose solution is removed and the solution is neutralized with lime and filtered, the xylose can be recovered in crystalline form or mixed with dextrose and converted by bacterial fermentation into butyl alcohol and acetone.

The dextrose solution, resulting from digestion of the acid-impregnated cellulosic material with water, can be fermented with yeast into ethyl alcohol. Crystallization of the dextrose may offer commercial possibilities. This process was recommended by the Department of Agriculture for further trial on a semiworks scale as a part of the Government program for the development of synthetic liquid fuels from nonpetroleum sources. The research is now moving into semicommercial-scale production at a new plant recently constructed under the Synthetic Liquid Fuels Project at Peoria, Ill. This plant is designed to handle enough agricultural residues to produce at capacity 2,000 pounds of glucose in 10 percent solution, 1,600 pounds of xylose in 15 percent solution, 200 pounds of furfural, and 1,000 pounds of lignin in an 8-hour day. From the fermentable material 500 gallons of alcohol can be made per day. This experimental work will accomplish two purposes. It will show maximum yields of various products from a given tonnage of different agricultural residues, and will provide a basis for computing costs and determining the feasibility of commercial production.

Cotton Distributive Industry: In May 1945 a conference was held at Memphis on postwar agricultural and economic problems of the Cotton Belt. One of the lines of study set up by this conference was that covering costs and margins in distributing cotton products. A preliminary report was issued by the committee for this study, of which L. D. Howell, of the Bureau of Agricultural Economics, was chairman. This study in effect laid open a cross-section of the cotton distributive industry. It put under its research microscope all present practices and techniques relating to yarn, thread, and cloth, and surveyed the practices and charges of manufacturers, wholesalers, and retailers. The object of the report, in addition to presenting a factual picture of the trade as it exists, was to suggest any possible means of increasing efficiency, reducing costs, and expanding outlets.

It found 1,248 cotton-manufacturing establishments, of which 349 were primarily engaged in spinning, twisting, winding, and spooling cotton yarn, 661 in weaving fabrics more than 12 inches wide, 163 weaving or braiding fabrics 12 inches and narrower, and 75 spinning, twisting, and making cotton sewing thread and other thread. The goods that come from cotton looms are 90 percent grade goods over 12 inches wide, 10 percent colored yarn goods. Margins for wholesaling and retailing textile products in 1939 averaged about 40 percent of the retail price of finished goods and about 5 times as much as the returns to growers for the cotton. This indicates somewhat the importance of reducing costs of distributing cotton products. For example, a reduction of 10 percent in wholesalers' and retailers' margins in 1939 would have amounted to about as much as one-half of the returns realized by growers.

Favorite Tropical Lawn Grass: Since 1936 the Department of Agriculture Experiment Station in Puerto Rico has been experimenting with Zoysia matrella, or Manila grass, for use on tropical lawns. This grass has received publicity in the States as an ideal lawn grass. In Puerto Rico under tropical conditions it has proven superior to such commonly used grasses as Java, Bermuda, centipede, St. Augustine, and carpet. Manila grass has a pleasing, moderately deep shade of green, grows

slowly, requires less attention in weeding and mowing, produces a thick mat which feels like a heavy rug under foot, has no serious insects and diseases, withstands drought, and grows well in moderately dense shade. It is tough and withstands considerable foot wear, but is difficult to cut with a hand lawn mower. A rotary-power mower, however, cuts it easily. At present the grass must be propagated by sod blocks, but the station is seeking a seed treatment to induce higher germination. Seed is produced abundantly in Puerto Rico, but little seeding has been reported under most conditions in the United States.

Starfish Meal for Growing Chickens: Starfish, though a serious pest in oyster beds, may be an asset to poultry growers, the Bureau of Animal Industry concludes from a series of tests of starfish meal fed to young growing chickens. Shortages of protein feeds for livestock led research workers to experiment with several materials formerly discarded or poorly utilized by various industries. One was starfish, which oystermen take in quantity in cleaning oyster beds. Whole starfish, when sun dried and ground into meal, contains about 39 percent protein, 19 percent calcium, and smaller quantities of other nutrients including phosphorus. Tests of its suitability for poultry feeding showed that it compares favorably with sardine meal, familiar as an ingredient of poultry feeds. Though a good source of protein, starfish meal gave best results when fed in rather small quantities. Too large an amount supplies an excess of calcium. On the basis of these tests, the investigators advise poultrymen to limit this meal to 3.5 to 5 percent of the diet. Even this limited proportion supplies chicks with considerable protein and calcium enough for their needs.

Bulls Spreading Good Germ Plasm to Farm Herds: Bulls bred by the Bureau of Dairy Industry in the experimental herds at Beltsville, Md., and at its several other field stations, are contributing their good germ plasm to improvement of the Nation's dairy cattle through their services in artificial-breeding organizations, and also through service in herds owned by institutions and by individual farmers who cooperate in proving the young bulls. In the last 3 years 50 Beltsville-bred bulls and 6 bulls bred at the other stations have been selected for use in artificial-breeding associations. Thirty-nine of these bulls are still in active service, and at a conservative estimate of 500 cows to each bull they sired nearly 20,000 calves last year. Beltsville-bred bulls have already sired more than 12,000 calves in the New York State Artificial Breeders Cooperative Association alone. Also on loan now to individual farmers, institutions, and cooperative-breeding organizations are 77 Holstein bulls, 37 Jersey bulls, and 27 Red Dane bulls from the Beltsville herds and about 150 Holstein and Jersey bulls from the other field stations.

The kind of germ plasm that farmers can expect by cooperating with the Bureau in proving young bulls from its experimental herds is indicated by the results obtained with 332 bulls (from 7 Bureau stations) that have already been proved. These 332 bulls sired 4,619 daughters with a mature-equivalent average production of 10,914 pounds of milk and 426 pounds of butterfat. Most of them were milked and tested under Dairy Herd Improvement Association conditions. These daughters produced 690 pounds more milk and 30 pounds more butterfat on the average than their dams. Approximately 80 percent of the 332 bulls sired daughters that averaged better than their dams.

South Welcomes New Legume: As a cover crop to hold the soil during winter and to increase its fertility, blue lupine has made a tremendous hit with peanut producers in Georgia, Alabama, and Florida. During the war more peanuts were needed for food and oil. This placed a heavy burden on the highly erodible, sandy soils of the Peanut Belt. Alarmed at the possibility of severe land damage,

farmers asked the Soil Conservation Service to help them find a suitable winter cover crop to follow the peanut harvest.

Blue lupine was the answer. Used as a soil builder in central European countries for more than two centuries, blue lupine is now flourishing in southern United States. It grows well on soils of low fertility and produces an abundant seed crop. Blue lupine, like many other legumes, has root nodules that extract nitrogen from the air and improve the soil when the lupine is plowed under in the spring. The plant's drawback is that it has an alkaloid poisonous to most livestock. Farmers of Georgia, Alabama, and Florida harvested an estimated 50 million pounds of blue lupine seed during 1946 to use for planting in the fall of 1947. Annual seed production may reach 100 million pounds in 5 years. In the South's Peanut Belt farmers say blue lupine has come to stay.

Hydrogenation of Lignin and Wood: It has been shown from research at the Forest Products Laboratory of the Forest Service that lignin dissolved in organic solvents or suspended in water can be made to react with hydrogen gas at elevated temperatures and pressures in the presence of various metallic catalysts. Among the products of the reaction are several new cyclic alcohols that had never been previously described in the literature. These show promise as plastic solvents, antiknock agents for motor fuel, and toxic agents. By varying the hydrogenation conditions, phenolic compounds which may find use in plastics and complex neutral oils, together with a plasticlike residue, are obtained.

Wood waste or chips also can be hydrogenated in aqueous suspension to produce soluble lignin decomposition compounds and a cellulose pulp residue. This is a possible new pulping process that will be studied further by the laboratory. Under more severe hydrogenation conditions the cellulose can be converted to glycerine and sugars. In this case the entire wood is converted to liquid products. All these findings are too new to predict their future application now. Most of the data have been obtained in small bombs and in continuous hydrogenation equipment designed for other hydrogenation reactions. Continuous hydrogenation equipment is being built for further work.

Wilt-Resistant Alfalfa: Major developments in the alfalfa-improvement program during the past few years include the production of bacterial-wilt-resistant varieties and experimental hybrids. Ranger and Buffalo maintain good stands in wilt-infested areas for many years after such standard varieties as Grimm and Common have been killed by the disease. Wilt-resistant strains found in Turkestan, Asia, north of the Himalaya Mountains, were intercrossed with domestic strains of desirable characters to produce the new varieties.

Ranger was produced by plant breeders of the Bureau of Plant Industry, Soils, and Agricultural Engineering in cooperation with the Nebraska Experiment Station. In regions where bacterial wilt is not a factor, Ranger is about equal to Grimm in forage, seed productivity, and cold resistance. It is recommended for northern regions of the United States where bacterial wilt is prevalent. It was released for commercial production in 1940, and several thousand acres are now producing seed each year. Buffalo, which originated from selections made from a field of old Kansas Common, was produced by the Bureau and the Kansas station. It compares favorably with Kansas Common in yield and adaptation, but is more resistant to bacterial wilt and therefore yields much more where this wilt is a factor. Buffalo, like Kansas Common, is best adapted in the general latitude of Kansas and south and east of that State.

Aconitic and Itaconic Acids Produced from Byproduct of Cane-Sugar Manufacture: A process, developed by the Bureau of Agricultural and Industrial Chemistry, for recovering the plastics intermediate, aconitic acid, from sugarcane molasses in the course of cane-sugar manufacture, has reached the stage at which it is ready for full-scale commercial operation. Recently one sugar mill produced about 10 tons of the crude calcium aconitate from a portion of its second, or "B", molasses by simply heating the molasses, allowing the separated salt to settle, and then collecting the salt and washing it with hot water. Another sugar company furnished a sufficient quantity of its "B" molasses to permit continuance of pilot-plant experiments after the 1945-46 grinding season ended, and complete data were obtained for the design of a full-scale aconitate-recovery plant which the company expected to operate during the 1946-47 season. This company grinds an average of 3,000 tons of cane per day and plans to recover 2 pounds of calcium aconitate per ton, equivalent to 1½ tons of aconitic acid per day, throughout the grinding season of 90 to 100 days.

Pilot-plant work has been carried out by the Bureau on the liberation of aconitic acid from the crude salt and crystallization of a high grade of the acid for commercial use in manufacture of plastics. Most of the calcium aconitate produced in the pilot-plant experiments was used in development of a process for converting the crude salt directly to itaconic acid, a substituted acrylic acid useful in manufacturing plastics, by removal of one molecule of carbon dioxide from each molecule of aconitic acid as fast as formed. This was accomplished by acidifying a slurry of crude calcium aconitate with sulfuric acid and heating the material under presses until no more carbon dioxide was evolved. The filtrate from the spent charge yielded about ⅔ pound of itaconic acid crystals per pound of aconitate used.

Net Worth of Farm Business: How much money is the entire farm business of the U. S. worth? A group of economists in the Bureau of Agricultural Economics have been bringing together an annual balance sheet of agriculture. This balance sheet for last year was also published by the Federal Reserve Board. Viewed as a composite business American agriculture was valued at $101,500,000,000 on January 1, 1946; farm real estate was valued at $56,584,000,000, other physical assets at $24,888,000,000, and financial assets of farm operators totaled $20,050,000,000. Owners had an equity in this total amounting to $93,185,000,000, and creditors had an$8,337,000,000 claim on these assets.

As compared with a year before, total physical assets of farms increased 9 percent. Real estate alone increased 13 percent, livestock 9, household equipment 2, machinery and motor vehicles 1. Crops on hand decreased 6 percent. As against the large increases in holdings of cash and Government bonds which farmers acquired during the war years, some deterioration in the farm plant must be reckoned. It was estimated that the net shrinkage in value of farm buildings, machinery, and equipment as a result of low maintenance may have been nearly $8[illegible]00,000,000 for the years 1942-45. The total farm mortgage debt declined by $190,000,000 to $5,081,000,000 during the year 1945. The mortgage debt declined 23 percent between January 1, 1940, and 1946.

New Method for Quinine Analysis: A simple rapid method of extracting and determining quinine in cinchona bark has been devised at the Department of Agriculture Experiment Station in Puerto Rico. The method has the advantage of requiring small samples of bark (1 gram) and can be used to determine small amounts of quinine; any quinidine present also is measured as quinine. The method may be particularly useful in evaluating young cinchona seedlings for anti-malarial constituents in a breeding and selection program. The method also can be used in assaying samples of cinchona bark for commercial purposes.

Lead Arsenate Controls Tapeworms in Lambs: In tests conducted in South Dakota to find a satisfactory treatment for diarrhea, or scouring, in lambs, investigators of the Bureau of Animal Industry and South Dakota State College traced the cause of scouring in late summer to the common sheep tapeworm and found that 1 gram dose of lead arsenate would remove infestations of this parasite without injuring the lambs. They report the treatment to be applicable elsewhere in the Northern Plains for lambs similarly affected. Early in the study post-mortem examinations of scouring animals disclosed the presence of many tapeworms. However gross parasitism, particularly by roundworms, is believed to contribute to the disease, and for this reason proper medication, to remove stomach worms and related roundworms, and pasture rotation, are advised as important control measures.

Taking their clew from previous reports by other scientists that a small amount of lead arsenate might remove tapeworms and not injure lambs, the investigators conducted critical tests from August to October with range Rambouillet lambs born during May and June. The dosage was 1 gram of lead arsenate in a No. 13 gelatin capsule. In one test on 8 scouring lambs the treatment removed 72 tapeworm heads and a large quantity of segments. The general efficiency of the treatment was approximately 92 percent. Treated lambs showed no ill effects from the medication, and recovered from scouring and improved in condition within a week after treatment.

Grazing Experiments Improve Pastures: Results with experimental grazing plots at several field stations of the Bureau of Dairy Industry show decisively that efforts to improve pastures by various treatments and combinations of seedings can be successful. For example, at the Lewisburg, Tenn., station one plot seeded in 1942 to a mixture of orchard grass and ladino clover furnished a total of 232 cow-days of grazing in 1943. The calculated yield of milk was 7,462 pounds per acre and the net value of the milk above cost of feed, fertilizer, and mowing was $212. A similar plot of pasture sod which received no seeding or other treatment furnished only 64 cow-days of grazing per acre and the net value of the milk produced was only $48. In another comparison 2 plots were handled exactly the same except that one was mowed twice during each season and the other was not mowed. The value of the milk produced on the mowed plot was $55.80 for 1945 as compared with $47.86 for the plot not mowed. The cost of mowing was $1.74 per acre.

At the Willard, N. C., and Columbia, S. C., stations, kudzu continues to give excellent grazing results. At Columbia a field planted to kudzu in 1941 produced a calculated yeild of 3,984 pounds of 4-percent fat-corrected milk per acre, or 2,388 pounds of digestible nutrients. This would have a value equivalent to 1.5 tons of alfalfa hay per acre. At the Huntley, Mont., station experiments comparing the carrying capacity of alfalfa and ladino clover seeded with different grasses showed that ladino clover was far superior to alfalfa in the grass combinations tested. The alfalfa has practically disappeared from the plots, while the ladino stand is still good indicating that 5 years is about as long as alfalfa can be expected to persist in this area.

Staypak: The resin-treated and compressed wood known as compreg developed by the Forest Products Laboratory of the Forest Service is more brittle than the original wood. To meet the demand for a tougher compressed product than compreg, a compressed wood containing no resin was developed by the laboratory. It will not lose its compression under swelling conditions as will ordinary compressed untreated wood. This material, named "staypak," is made by modifying the compressing conditions so as to cause the lignin-cementing material between the cellulose fibers to flow sufficiently to eliminate the internal stresses. Staypak is not so water resistant as compreg, but is twice as tough and has higher tensile and flexural properties.

The natural finish of staypak is almost as good as that of compreg. Under weathering conditions, however, it is definitely inferior to compreg. For outdoor use staypak should have a good synthetic resin varnish or paint finish. The heat treatment used in making staypak is not sufficiently severe to give the wood a significant reduction in hygroscopicity. Staypak consequently is only slightly more resistant to decay, termites, and marine borers than normal untreated wood of the same species. Staypak can be used in the same way as compreg where extremely high water resistance is not needed. It shows promise for use in propellers, tool handles, forming dies, and connector plates where high impact strength is needed. It is not being manufactured commercially as yet.

Hybrid Alfalfa: A number of experimental hybrids have been produced by the Bureau of Plant Industry, Soils, and Agricultural Engineering in natural field crossing blocks. In a two-year test at the Nebraska Agricultural Experiment Station, the better hybrids and polycrosses yielded 4.16 to 4.34 tons per acre, compared with 3.43 tons for Grimm, a superiority of 20 to 27 percent. In a seed production test at the Utah Agricultural Experiment Station, some of the hybrids yielded 660 pounds of seed an acre, compared with 450 pounds for Grimm, an increase of 47 percent. As yet there is no hybrid seed available.

Rutin Extracted Commercially from Buckwheat Plants: Rutin is a little known flavonol glucoside occurring in various plants, including tobacco. In work on the industrial utilization of tobacco, the Eastern Regional Research Laboratory of the Bureau of Agricultural and Industrial Chemistry determined the percentage of rutin in different kinds of green and cured tobacco and developed methods for the extraction of rutin from tobacco and other plants. By these methods the Bureau extracted enough rutin from flue-cured tobacco for cooperative research on biological effects of rutin by the Bureau of Animal Industry on its therapeutic value by the Medical School of the University of Pennsylvania.

Rutin was found to be nontoxic to laboratory animals and clinical patients. The clinical tests showed it to be definitely effective in treating a pathological condition known as "increased capillary fragility," which is sometimes associated with high blood pressure and causes minute blood vessels or capillaries to rupture--occasionally in the eye or brain with attendant blindness or apoplexy. Most of the patients treated with rutin showed marked improvement, especially where it was combined with remedies for high blood pressure.

Analysis showed that buckwheat is more promising than any other plant examined as a commercial source of rutin. While the percentage of rutin in buckwheat is highest (about 3 percent on dry weight of plant exclusive of roots) when the plant is in bloom and before any seeds are set, the greatest yield per acre is obtained about 3 weeks later when the plants have made their maximum growth and set all their seed. At this time the yield per acre is $3\frac{1}{2}$ to 4 times as great as at the time of highest concentration in the plant. Most of the rutin is in the leaves, very little is in the stems, and none is in the seeds. Much of the rutin is lost when the plants are dried, especially if dried slowly. Under the best drying conditions more than a third of the rutin is lost.

During the summer of 1945 about 300 pounds of rutin were extracted from green buckwheat plants by 4 drug manufacturers with technical guidance by chemists of the laboratory. This rutin was used by the firms' research staffs and supplied in tablet or capsule form to interested physicians for experimental use.

Approximately 12 pharmaceutical companies planned to manufacture rutin during the 1946 season, with an indicated production of from 10,000 to 20,000 pounds. This quantity is sufficient to treat 200,000 to 400,000 cases for a full year. The

higher production figure (20,000 pounds) would require about 4,500 tons of fresh buckwheat plants or an equivalent quantity of dried buckwheat leaf meal.

City Market for Fresh Fruits and Vegetables: Problems of a big central wholesale market in a modern city, plus an intelligent plan for such a market, are reflected in a study made by Wendall Calhoun, of the Bureau of Agricultural Economics, for the city of Cincinnati. This study embraces all essential considerations of the fruit and vegetable market in Cincinnati, its present operation and future needs, and boils down the job to be done as essentially a big moving operation. Total supplies on the Cincinnati market average about a thousand tons per day the year round. In heavy seasonal periods and on certain days of the week as much as 2 thousand tons are handled in a single day.

Distribution of these fresh fruits and vegetables is the only industry of its type in which the great majority of buyers regularly come in person to the market to make purchases. Of course this greatly affects the arrangement of physical facilities needed. Practically all buyers are in markets at the same time, usually early in the morning. The wholesale distribution of fruits and vegetables is a horizontal industry, which must practically be conducted at a one-story level. Buildings in a good produce market must consist essentially of covered platforms at the height of motor-truck tailboards and railway-car doors.

The BAE study sets up a proposed consolidated produce market and an economic blueprint necessary to change existing facilities. Involved in the project are 49 acres of land, 370 buildings to be removed, excavation of 575,000 cubic yards of earth, and building of a freight underpass, 1,000-foot railroad viaduct, 4,000 lineal feet of railroad track, 185,000 square yards of pavement, etc.

Sodium Fluoride Removes Swine Roundworms: The drug that has thus far been found to be most efficient against roundworms, or ascarids, in swine is sodium fluoride, the Bureau of Animal Industry reports. Its proper use may be expected to eliminate about 95 percent of these worms, the commonest and most injurious parasites of swine. Other known drugs are only 50 to 75 percent effective. Though sodium fluoride is a poison commonly used against household insects and other pests, it has proved to be safe for pigs in the small quantities recommended. Under experimental conditions, the best treatment consisted in feeding pigs for 1 day on a mixture containing, by weight, 1 part of sodium fluoride (technical grade) and 99 parts of dry ground feed. Giving this small quantity of the drug in the feed affords some natural protection, both because of self-limited intake and because of vomiting that tends to follow occasional overeating. Animals not accustomed to dry ground feed should receive nonmedicated feed for a day or two before being dosed. Groups of 2 to 30 animals have been treated successfully. The use of sodium fluoride is advised by the Bureau scientists only as an adjunct to sound measures of prevention and control, such as the system of swine sanitation familiar to most swine raisers.

Better Milk Yields by Housing Cows in Pen Barns: At the Huntley, Mont., field station of the Bureau of Dairy Industry, where both the conventional type of stanchion barn and the pen-type barn are used for housing milk cows, better milk yields have been obtained from the cows housed in pen barns than from those in stanchion barns.

In an experiment to compare the merits of the two systems of handling cows in milk, two comparable groups of cows were used. One group was fed a rather liberal grain ration and the other a limited grain ration, each group being housed first in one type of barn and then in the other. All cows were milked 3 times a day. The 7 cows fed the liberal grain ration produced on the average 18,402 pounds of milk and 684 pounds of butterfat (calculated to maturity) when housed in the pen

barn. This was 19 percent more milk and 18 percent more butterfat than they produced when kept in the stanchion barn. The 7 cows fed the limited grain ration produced on the average 14,319 pounds of milk and 501 pounds of butterfat (calculated to maturity) when housed in the pen barn. This was 8 percent more milk and 6 percent more butterfat than they produced when kept in the stanchion barn.

Each system has advantages and disadvantages, which vary with local conditions. The pen barn, or loafing barn as it is sometimes called, often consists of an open shed that can be partly or completely closed against severe weather. The cows run loose and get their roughage from mangers or racks inside the barn or outside in the lots. They are milked and fed grain in a separate milking barn. The stanchion barn has a concrete floor and the cows are always confined by rigid stanchions, even while being fed and milked, although they may exercise in an open lot when the weather permits. The pen-barn floor is of earth, and the manure and bedding are allowed to accumulate. The manure can be removed once or twice a year, whereas manure must be removed daily from the stanchion barn. The pen barn requires considerably more bedding, however, and this is an important disadvantage if bedding is scarce or expensive. The cows unquestionably are more comfortable in the pen-type barn, and this probably was the reason for the higher milk production in the pen barn in the Huntley experiment.

Laminated Paper Plastics Containing Lignin: New lignin plastics evolved by the Forest Products Laboratory of the Forest Service and commercial cooperators, and now in commercial production, give strong promise of providing a quantity outlet for much lignin wasted annually by many pulp mills. The plastic consists of paper filled with lignin, which serves as the bonding agent in place of more expensive synthetic resins. For many electrical and decorative applications, it has been found equal to, or better than, more costly plastics.

New Things in Clover: Cumberland and Midland--two superior new red clover varieties, which yield up to a ton more hay an acre than the common clovers of this type--are examples of accomplishments in a cooperative red-clover improvement program carried on by the Bureau of Plant Industry, Soils, and Agricultural Engineering and several State experiment stations. Midland is adapted to the middle or central part of the Corn Belt and to areas with similar climatic conditions in the Eastern States. In all Western States it is recommended for production of certified seed. Cumberland, another piece of good fortune from 13 years of testing, is a superior variety adapted to the southern part of the red clover belt. It has good growth characteristics and disease resistance and in its area frequently yields a ton more per acre than unadapted red clover.

Another new variety, as yet unnamed, has lived over in the third year, or second harvest year, indicating the possibility of developing superior varieties of red clover that are in effect perennial. Dixie crimson clover, a new hard-seeded variety developed by the Bureau and the Georgia and North Carolina Agricultural Experiment Stations, promises to eliminate a serious hazard in growing common crimson clover--that of stand failures brought about by immediate germination of the seed. Ladino white clover, the giant variety now the symbol of large yields of high-quality feed, has proved its value in widely separated parts of the country.

Rot-Proofing Fabrics: Effectiveness of the acetylation treatment in preserving cotton fabrics against mildew and bacterial rot has been confirmed by extensive tests at the Southern Regional Research Laboratory of the Bureau of Agricultural and Industrial Chemistry. This treatment partly converts the cellulose of the cotton fiber to cellulose acetate, which cannot be utilized as food by cellulose-destroying microorganisms. As a practical test, several bags made of acetylated cotton fabric sewn with acetylated cotton thread were filled with sand and left

in contact with the soil and exposed to the weather on the grounds of the laboratory at New Orleans.

After 2 years these bags were still intact and serviceable. Numerous samples of acetylated cotton fabrics also showed almost complete resistance to rotting when buried for 6 months in soil especially prepared to have a high content of cellulose-destroying microorganisms. The most highly acetylated fabrics gave the best results. Because a high degree of acetylation is costly, the fundamentals of the process are being studied by the laboratory, with the hope that greater knowledge of the chemical reaction and its control will permit the production, at materially lower cost, of treated fabrics having moderate acetyl contents but a high degree of resistance to mildew and rot. Experiments have been conducted on a pilot-plant scale to obtain materials for testing and to determine whether existing commercial finishing machinery can be adapted to the partial acetylation process. The partly acetylated cotton fabric, yarn, and sewing thread should be satisfactory for making mildew-proof clothing, tents and awnings, fish nets, and bags for packaging fruit, vegetables, and other foods, and for numerous other uses.

Distributive Costs in Tobacco Industry: A breakdown of the national farm-to-retail price spread for tobacco and tobacco products, and possible ways of reducing the spread, are discussed in a report from the Bureau of Agricultural Economics by L. D. Howell and Wade P. Young. Marketing and manufacturing margins usually cover costs of such services as assembling, selling, storing, financing, manufacturing, transporting, wholesaling, and retailing. These services are rendered by a number of agencies. Estimates show that in 1939 about 11.6 percent of the consumer's tobacco dollar went to growers for American tobacco, 3.6 for tobacco imported, 1.2 to wholesalers of leaf tobacco, 25.2 to manufacturers, 36 for Federal and State excise taxes, 4 to wholesalers of tobacco products, and 18.4 to retailers. Estimates made to show the relative importance of cost items indicate that Federal and State excise taxes accounted for about 36 percent of the retail price of all tobacco products combined, salaries and wages 17.8, advertising 4.2, operating profits of all agencies except farmers 10.3, and all other expenses of manufacturing and distributing about 16.5.

Soil Protection Nets More Dollars: Money talks--and it offers a convincing argument. Additional proof that soil conservation pays off handsomely in added farm income has been furnished by recent studies by the Soil Conservation Service in cooperation with State agricultural experiment stations. The studies cover representative areas in all parts of the U. S. In each area field men selected a number of farms as nearly alike in size, land capability, and operation as possible. They appraised the amount of soil conservation already in effect on each farm. They got crop and livestock data from each farmer. Then as a final step they divided the farms into two groups: (1) Those having a good conservation score; and (2) those having a relatively low conservation score.

The results were amazing. In Greenville County, S. C., for example, 40 farms having an average conservation score of 86 earned an annual gross income of $3,624 per farm, or $36.62 per acre. Sixteen other comparable farms with a rating of only 46 showed a gross income of $1,896 per farm, or $23.07 per acre. The farms with a high rating produced $13.55 more per acre than those with a low rating. In Jefferson County, Ill., 26 farms with a conservation score of 83 had an average gross income of $20.80 per acre, as compared with $12.97 per acre for 26 other farms in the same locality having a score of 40. The average gross income from the farms with the most conservation was $1,400 a year greater than from comparable farms having less conservation. Furthermore, the average farm in the conservation group produced enough crops and livestock to feed 63

adults a full diet for one year, whereas the average farm in the second group would support only 41 people for a year. Even in Lancaster County, Pa.--one of the richest farming counties in the Nation--conservation practices clearly paid off in dollars and cents on a per-acre ratio of $88.61 to $70.85, or an advantage of $17.76 per acre for the farms having well-established conservation programs.

In general the studies indicate that soil conservation practices will increase gross farm income from 50 to 75 percent in the Southeast, from 25 to 40 in the Northeast, from 15 to 25 in the Middle West, and from 10 to 20 in the Southwest and Pacific Coast region. Soil-conservation farming is the only known assurance of a permanently productive agriculture.

Aerial Photographs Forest Tax Assessment: The Forest Service and the Maine State Bureau of Taxation recently joined in a project to determine the feasibility of using aerial photographs in assessment of forest lands for property taxation. In order to assess forest land in accordance with equitable and standardized procedures, it is necessary to have information on the basic productivity of forest land and the kind and quantity of standing timber. Getting the needed information from timber cruises is usually too costly relative to the amount of tax revenue involved. A less expensive method is needed if forest lands are to be equitably taxed.

Hancock County, Maine, was chosen as an area suitable for experimentation because of its wide variety and mixture of forest types. Aerial photographs on the scale of 4 inches to the mile were made, using infrared film and a minus-blue filter. Results from photographs have been very gratifying. It was possible not only to determine the acreage of each stand-size class of timber, but also to subdivide the various stand-size classes into 10 species and valuation categories. The composition of forest cover was readily determined, permitting preparation of maps delineating land areas according to their basic timber-producing potential. Five categories of land were utilized for purposes of assessment, with productivity indexes ranging from 100 to zero. With such inventory data covering land and timber, tax assessors can develop assessment rolls so that similar properties receive essentially the same tax treatment.

Potatoes 40 Percent Better: The 25 new potato varieties released to growers since the beginning of the National Potato Breeding Program in 1929 have been an important factor in boosting U. S. potato yields from about 110 bushels an acre 25 years ago to more than 150 bushels the past 2 seasons (1945-46). Evidence that new varieties have been well received by growers is that one-fourth of all certified seed in the United States in 1945 consisted of varieties released since 1932. None of these will meet the needs of growers in all States. Thirty-five experiment stations are cooperating with the Bureau of Plant Industry, Soils, and Agricultural Engineering in the nation-wide program.

Scientists believe it is possible to find some degree of resistance to all important diseases and insects that attack potatoes. All the available characters are not to be found in any one variety but are distributed among a relatively large number. The research program is consolidating its forces in greenhouses and fields towards packing into single varieties more resistance to more diseases and as many as possible of the other good qualities farmers want in their potatoes.

Norelac: A new thermoplastic resin suitable for use in lacquers has been developed by the Northern Regional Research Laboratory of the Bureau of Agricultural and Industrial Chemistry. This product, named Norelac, is a polyamide of dimeric fat acids and is made by reacting ethylene diamine with a mixture of

dimeric fat acids or their esters prepared from the unsaturated acids of soybean oil or other vegetable oil. Norelac is promising as a substitute for shellac in some uses, since it makes a good protective coating for wood and metal. It adheres well to most surfaces and has good resistance to water, alkali, acid, vegetable oils, and some organic solvents. Its thermoplastic property makes it useful as a binder for laminating metal foils and cellulosic sheet materials and as a self-sealing coating for wrapping materials and containers, especially those for dehydrated foods. An industrial firm became sufficiently interested in the possibilities of this new oil product to produce it on a pilot-plant scale and to supply prospective consumers with substantial samples. This assures thorough evaluation of the product by a large number of industries for many possible uses.

Most Pork from 100 Pounds of Feed: The output of pork and lard that can be gained from a given amount of feed is very important to livestock men. A study by L. A. Atkinson and John W. Klein, of the Bureau of Agricultural Economics, shows the effect of changes in the marketing weight of hogs upon the relationship between feed consumption and output of hogs as measured in various ways. Their conclusion is that the weight of hogs at which the largest physical output per hundred feed units is obtained is about 175 pounds live weight.

Growth-Regulating Chemicals: Studies of various plant growth-regulating chemicals are going on steadily at the Plant Industry Station, Beltsville, Md. Some uses, as a result of studies made by the Department of Agriculture and other agencies at various places, are now quite well established, such as stimulation of rooting of cuttings that ordinarily do not root readily and prevention of pre-harvest drop of apples and pears. Recent tests at the station indicate that the growth regulator 2,4-D (2,4-dichlorophenoxyacetic acid) greatly reduces the time required for ripening bananas, and there are indications that bananas so ripened are of better quality than those picked green and ripened in the ordinary manner.

Sweetpotato Starch Large-Scale Production: Sweetpotatoes promise to become an important industrial crop as the result of the development by the Bureau of Agricultural and Industrial Chemistry of a process for extracting from them a high-quality white starch. A growers' cooperative of more than 1,000 members at Laurel, Miss., produced sweetpotato starch on a small scale for 10 years and introduced the product for sizing and finishing in cotton mills and for use by the laundry, baking, and confectionary industries. A large multimillion-dollar plant at Clewiston, Fla., using a process based on the Bureau's research, began commercial production in January 1946.

The new starch plant and associated facilities, modern and well equipped in every respect, affords an outlet for sweetpotatoes from 12,000 or more acres annually. The domestic supply of high-grade root starches for food and industrial applications will be augmented by 50 million pounds or more a year, and some 20 million pounds or more a year will be added to the supply of carbohydrate feed for southern livestock. Chemists and engineers of the Southern Regional Research Laboratory gave technical advice and assistance, during the test runs at the new plant, in the operation and adjustment of the processes and equipment for washing, shredding, grinding, screening, centrifugal purification, bleaching, dewatering, and drying.

How Are People Going to Spend Their Money? As part of a national survey made for the Federal Reserve Board, a group in the Bureau of Agricultural Economics, headed by N. J. Wall, summarized estimates by consumers themselves on prospective spending and saving during 1946. The liquid assets of the country were surveyed and answers sought to the questions, how are these assets going to be used, what will be the trend of savings and of spending? Only a small proportion of people

expected to spend their money for cars or other durable goods during 1946--11 percent said they would probably buy cars, 28 other durable items, only 7 expected to buy or build houses.

Of course the report recognizes that consumers' intentions are affected by price, supply, or other changes in the market. A major conclusion was that the purchasing power from current income in 1946 would be augmented by over $2,000,000,000 from liquid assets and a smiliar amount from borrowing for purchase of cars and other durable goods, and by at least $3,000,000,000 from liquid assets and $7,000,000,000 from borrowing for purchase of houses. The report is well fortified by tables of spending and saving by various population groups.

2,4-D Kills Weeds: Studies on the growth-regulating chemical, 2,4-dichlorophenoxyacetic acid (called 2,4-D), by the Bureau of Plant Industry, Soils, and Agricultural Engineering for a number of years have brought out its degrees of usefulness in control of some common weeds in pastures, lawns, and small-grain, sugarcane, and corn fields. In the dilute solutions used it does not kill plants of the grass family. It has proved unusually effective in killing such common competitors of grass as dandelion, broad-leaved and narrow-leaved plantain, chickweed, and others. Bureau research men have found it effective against annual bindweed, Japanese honeysuckle, and promising against perennial bindweed. One effect of the chemical is to check the growth of the leaves of some kinds of weeds and at the same time cause them to use up their reserve food supply so they starve to death.

There are indications that weed seeds may be killed in the soil of fields used for annual crops by applying 2,4-D to the soil, and also that it may kill weed seeds in manure piles, but these methods are still experimental. Tests show that 2,4-D itself is not poisonous to farm animals. A simple and inexpensive method has been developed for cleaning 2,4-D from sprayers. All but fill the sprayer with water (preferably hot), add 2 teaspoons of household ammonia per quart of water, and allow to soak overnight or longer. After thoroughly flushing with water, the sprayer should be sufficiently free of 2,4-D to use in applying insecticides to garden plants or ornamentals.

Plywood Adhesive from Soybean Meal or Corn Gluten: A new waterproof plywood adhesive having considerable binding strength has been developed by the Northern Regional Research Laboratory of the Bureau of Agricultural and Industrial Chemistry. It is made by combining solvent-extracted soybean meal freed of its water-soluble constituents, or corn gluten, with phenolic resin in the intermediate or water-soluble form. A commercial trial demonstrated that excellent plywood could be fabricated with such a glue, which becomes insoluble on setting. A plywood manufacturer made practical use of this discovery and has consumed large quantities of a commercial brand of soybean meal in making waterproof plywood. A manufacturer of soybean meal offered to supply a large amount of the proper quality to companies interested in the use of a soybean-modified, phenolic-resin plywood adhesive. So prospects are good for increased industrial utilization of soybean meal in adhesives. Since the new adhesive costs less than other waterproof adhesives and results in plywood suitable for use as such, or as concrete-pouring forms in building houses and other structures, it should help to reduce constructions costs on farms and elsewhere.

How and Where Feed Is Consumed: If you were to make a livestock-feed map of this country you would find it a surprisingly complex job. What stock, for example, eats the corn and where? What is the importance of pasture and grazing in our livestock economy? How much feed goes into the making of milk, eggs, and the like? Livestock probably consume 3 times as many calories in all kinds of feed as

the people of this country consume in all kinds of food. About two-thirds of the feed eaten by livestock, however, consists of products inedible for humans. It takes several times as much grain when fed to livestock to support a man a day as it does if he eats the grain directly; but much of this grain is used to finish off the meat produced on grass and make it more palatable and valuable. Meat, milk, and eggs furnish animal proteins and are important protective foods for humans.

An intensive study of feed consumed by livestock in 1941-42 shows that about 46 percent of all corn fed went to hogs. Hogs and poultry used about 60 percent of all concentrates. Over half the hay went to dairy cattle, but horses and mules took more of it than did beef cattle and sheep combined. Beef and dairy cattle each get about one-third of the pasture. Dairy cattle get about 30 percent of all feed combined, beef cattle 19, and hogs 16. In the South 30 to 40 percent of corn goes to horses and mules, whereas less than 10 percent is fed them in most other regions. In the Northeast a third to a half of corn is fed to poultry; and in Washington, California, and Utah over 40 percent of all grain fed goes to poultry. For all feeds combined, including pasture, dairy cattle get over half the feed in 8 States, and in only 7 States did they receive less than 20 percent of all feed used there. Beef cattle got over 30 percent of all feed in 9 States (west of the Missouri River).

The feed units per head of livestock or per unit of products for the country as a whole, required to produce 100 pounds of the products, are as follows: Sheep 1,985 units, cattle and calves liveweight 769, turkeys 583, chickens 676, eggs 508, hogs 466, broilers 461, milk 123. A complete analysis of the disposal and use of feed by livestock is in a study by R. D. Jennings, of the Bureua of Agricultural Economics.

New Storage for Potatoes: Potatoes may taste better later in the season, thanks to a new type of storage house developed by engineers of the Bureau of Plant Industry, Soils, and Agricultural Engineering in cooperation with several State experiment stations. The house enables cool air to circulate under and around the potato bins instead of through the mass of potatoes, a method known as shell cooling. The high relative humidity in the bins helps lessen shrinkage and deterioration, but the air outside the bins has somewhat lower relative humidity which reduces damage to the structure. Shrinkage losses of the 10 million bushels of late-crop potatoes now stored each year in improved storages of this type in the U. S. are 1 to 10 percent less than in other types. Shell cooling and other improvements in storage houses are being widely adopted in Maine, Michigan, North Dakota, Nebraska, and Colorado.

Frozen Fruit Products: Frozen fruit puree has been developed by the Western Regional Research Laboratory of the Bureau of Agricultural and Industrial Chemistry as a means of utilizing fully ripe fruit that cannot be shipped or handled in the fresh-fruit market. It can be made from any fully ripe, raw fruit with a decided flavor. Its manufacture makes possible the maximum utilization of a fruit crop for food, since fruit that cannot be marketed fresh because of physical deficiencies or overabundance can be converted into frozen puree (if internally sound and full flavored) and kept in frozen storage for future use. Frozen fruit purees serve as flavor bases for ice creams, sherbets, ices, and beverages, and are also suitable for the manufacture of jam, Velva Fruit frozen dessert, and frozen jellied fruit. The two products last mentioned, also developed by the laboratory, are made from uncooked fruit juice or puree, with addition of sugar and a stabilizer--gelatin in the first and rapid-set citrus pectin in the second. Velva Fruit has been produced commercially in the eastern

U. S. It is very promising as an outlet for surplus cantaloups, which heretofore have not been used successfully in manufacturing food products.

Problem of Citrus Fruit Surpluses: Twenty-five years ago the citrus crop was about 36 million boxes. By 1937-38 it had reached 115 million boxes. Last year, except for the Florida hurricane, the crop might have totalled 200 million boxes. Looking ahead some 20 years, observers estimate a further increase of 50 percent or more. In other words, the citrus industry faces a tremendous problem of disposal. A long study by a committee headed by F. L. Thomsen, of the Bureau of Agricultural Economics, seeks to find new efficiencies and outlets in marketing of citrus fruits. It discusses marketing practices and costs in great detail. For instance, the cost of handling citrus from tree to car is now about 19 percent of all marketing charges and 14 percent of the consumer's dollar spent for citrus fruit. Manifestly any cuts made in costs on this end will directly benefit growers. With labor costs likely to remain high, the probable improvements in this field will come from labor-saving machinery. Machine filling of bags, for example, may be much more widely adopted.

The railroads are adopting various improvements such as the overhead bunker cars carrying greater loads and promising a substantial reduction in freight rates; faster diesel-powdered short trains that may reduce running time by as much as a third; and refrigerator cars of lightweight streamlined design with better shock absorbers, heavier insulation, and the like. The possibility of much further development in boat transportation of citrus also promises lower transportation costs. Trucks were moving as much as 17 percent of all interstate shipments of citrus from Florida last year and about 39 percent of all Texas shipments. Ironing out the various motor-vehicle laws among States will help greatly to expand truck traffic and lower its costs. Many technical improvements may improve the quality of juices and thus enlarge the markets. Notable improvements have been made within a year in pasteurizing and extracting, resulting in less peel oil in the juices. Further outlets for citrus are seen in the numerous byproducts being developed. These include cattle feed from pulp, citrus molasses, alcohol, essential oils, ascorbic acid, yeast, pectin, jelly, bland syrup, and the like. Some marketing specialists believe cattle feed containing molasses and citrus pectin are the most promising byproducts now commercially produced.

Sweetpotato-Vine Harvester: An experimental sweetpotato-vine harvester developed by engineers of the Bureau of Plant Industry, Soils, and Agricultural Engineering promises an easy means of saving the vines for feed. Present practice is to leave them in the fields, a handicap in harvesting the sweetpotatoes and of little value except as humus for succeeding crops. Where sweetpotato weevils infest the soil, the vines also furnish food and shelter for them and make their control difficult. Engineers working on the vine harvester have estimated that sweetpotato vines and cull roots could furnish succulent roughage for a million dairy cows annually. The vine harvester is reported inexpensive to build and simple in operation and will harvest vines at the rate of a half acre an hour. In a heavy crop from 10 to 20 tons a day can be harvested with a light tractor. Where the machine is used the sweetpotato beds must be uniform in size and shape.

Allyl Starch, Promising New Coating Material: A new type of resinous coating material that looks like varnish, withstands high temperatures and the action of most chemicals and solvents, and can be made from starches of farm crops, has been developed by the Eastern Regional Research Laboratory of the Bureau of Agricultural and Industrial Chemistry. The product, known as allyl starch, is prepared by treating starch with either allyl chloride or allyl bromide and is quite different from the carbohydrate compounds previously made by this method.

When freshly prepared, allyl starch and other allyl carbohydrates are soluble in most paint and varnish solvents, which makes possible their ready application to wood, metal, glass, paper, textile, and other surfaces. Upon curing, in contact with air or by application of heat, they undergo complex chemical changes that produce a hard smooth surface extremely resistant to organic solvents, oils, acids, alkalies, and heat. Alcohol, gasoline, acetone, and other liquids spilled on the surface coated with allyl starch leave no mark.

Boat flag poles coated with this material and subjected to continuous day and night service stood up well in experimental tests. Allyl starch coatings are easily applied and possess such desirable characteristics as transparency, high gloss, hardness, and adequate flexibility. In addition to being soluble in certain varnish solvents, allyl carbohydrates are thermosetting, which means they harden under heat or pressure as well as under ordinary atmospheric conditions, and can be used as plastics. Indications are that allyl starch will find wide application as a protective coating, particularly for interior use, and in the plastic field.

Reducing Fresh Fruit and Vegetable Marketing Costs: One of the largest items of waste in marketing fresh fruits and vegetables is damage done in transit on railroads. Claim payments by Class I railroads for damage to these products during the 5-year period 1935-39 included unlocated damages as the largest single item of claim, accounting for 63.8 percent of the total amount paid for all causes. This type of damage is due chiefly to rough handling in transit or to faulty methods of preparation when the product was shipped. Perhaps the most common shortcoming in this field relates to the loading and bracing of the load in the freight car. Careless loading and bracing of shipments of these perishables can undo all the results of scientific cultivation, control of disease, attractive packaging, and so on. Certain methods of loading and bracing of these shipments are much superior to others.

So important is this matter that students of the marketing problem say efficiency in rail transportation of these perishables is virtually impossible unless the carload is properly put in and braced at the outset. These and other conclusions relating to loss and waste in rail transportation of fresh fruits and vegetables are results of a study by Philip L. Breakiron, of the Bureau of Agricultural Economics.

Flavor Recovered from Apples and Oranges: The Eastern Regional Research Laboratory of the Bureau of Agricultural and Industrial Chemistry has developed a process for recovering the volatile flavoring constituents of apple juice in the form of an essence. Blending this essence with good-grade commercial apple-juice concentrate results in a full-flavor concentrate which, with the mere addition of water, becomes a beverage having the taste and aroma of fresh apple juice. In addition to being convenient for preparing beverages, an apple-juice concentrate to which apple essence has been added has obvious uses in the preparation of sherbets, ices, and fruit jellies. The essence may also find applications in the preparation of table and candy-coating syrups.

The best essences, as regards both intensity and pleasantness of flavor, were from McIntosh and Delicious (Red and Golden) apples. Stayman, Jonathan, and Baldwin essences were rated as good, Grimes Golden and Northern Spy as fair, and Rhode Island Greening as poor. Since in most apple regions blends of varieties have to be used for practical reasons, the relative evaluations are only a general guide; but where some choice of varieties can be exercised, these ratings should prove useful. The new process has been applied commercially by several firms.

Indications are that apple-essence manufacture will be widely adopted by the apple industry.

To determine the feasibility of recovering the volatile flavor constituents of orange juice by the same method, the flavor recovery equipment of the laboratory was shipped to the Bureau's Citrus Products Laboratory at Winter Haven, Fla., where fresh orange juice was available in quantity. The orange essence obtained was somewhat similar in its ethereal character to apple essence, but at the same relative concentration (referred to fresh juice) it was much milder as a flavoring material. When mixed in normal proportions with a drink reconstituted from orange concentrate, it tended to mask the cooked and other off-flavors developed during processing and storage.

Clinton Oats: Clinton oats is a recently developed variety that promises to insure a good crop of higher feeding value even during bad years. Clinton is not a hybrid but a new variety that comes from hybrid origin. Its chief advantages over other varieties are higher yields, stiffer straw, and greater weight per bushel. This medium-early, upstanding, easily combined, rust and smut resistant variety was developed by the Bureau of Plant Industry, Soils, and Agricultural Engineering in cooperation with the Iowa, Illinois, and Indiana experiment stations. It is highly resistant to helminthosporium disease which recently has caused much damage in many areas.

Average yield of Clinton in 1945 in Iowa community trials was 84 bushels an acre. With the development of new disease-resistant varieties of oats of superior grain quality, the value of the crop for feeding has been greatly enhanced. This much better quality is revitalizing oats as a commercial grain when wheat and barley are greatly needed for other purposes. Greater appreciation of oats as feed for farm animals also is evidenced by livestock producers and animal-husbandry and nutrition specialists.

Cheaper Pectin in Prospect for Food Uses: As the result of studies on modified (low-methoxyl) pectin and the development of new products containing it, this material may soon be produced commercially from fruit wastes at a cost appreciably less than that of producing pectin by the alcohol method generally used. The method of the Western Regional Research Laboratory of the Bureau of Agricultural and Industrial Chemistry, based on a continuous countercurrent extraction that isolates the low-methoxyl pectin by acid, is under pilot-plant test at an industrial plant in southern California where citrus wastes are available in quantity. The method can be applied also to other waste fruits, and an economic analysis to determine the feasibility of using apple thinnings for pectin production is under way. A large tonnage of immature apples is removed from the trees annually by commercial growers, and the problem is to concentrate the supply to assure economic processing. Films prepared from pectinic acid (completely demethylated pectin) show promise for the manufacture of sausage casings because of their special properties, including transparancy, light color, flexibility, low shear resistance, and digestibility.

One-Variety Cotton Communities: The advantages of cotton improvement in one-variety communities were first pointed out in 1909 by O. F. Cook, of the Bureau of Plant Industry (now the Bureau of Plant Industry, Soils, and Agricultural Engineering). The plan was first demonstrated through volunteer cooperation of communities of farmers in irrigated valleys of the Southwestern States. In 1925 the State California Legislature enacted a law prohibiting the planting of more than one variety of cotton in certain designated areas. By 1945 one-variety production had been estabilshed in one or more communities in 500 of the approximately 700 cotton-producing counties, with a total of 7,071,000 acres, or about 40 percent of

the total U.S. acreage, in single-variety production. From this acreage 4,172,000 bales of cotton of improved quality were produced, representing 45 percent of the total production for that year.

The total number of communities was reduced from 2,194 in 1944 to 1,799 in 1945, but the number of grower members in the one-variety associations increased from 299,000 in 1944 to 319,000 in 1945. This substantial progress has been made by consolidating the smaller communities into larger unit areas for larger volume production of cotton of the same variety and staple. This has stimulated manufacturers to buy cotton by variety at premium prices from the one-variety areas. It is estimated the extra cash return to grower members from larger yields and premiums for a superior product was about $62,000,000 in 1945.

Pine-Gum Cleaning and Distillation: Large amounts of high-grade rosin and turpentine have been made by a number of pine-gum refineries from pine gum cleaned by a process developed by the Bureau of Agricultural and Industrial Chemistry. There has been an increase each year in the amount of gum cleaned and distilled according to the Bureau's recommendations, with higher yields, better products, and increased income to the gum farmer. A continuous gum-distilling process to replace the present batch process for pine gum has been developed from the pilot-plant stage to plant-scale operation. The outstanding advantage of the continuous still is that the steam consumption is only about half that required for the batch steam distillation process.

Nightshade Berries Removed from Canning Peas: Nightshade is a troublesome weed in the commercial pea-growing areas of Oregon and Washington, where about one-fourth of the Nation's supply of canned peas is packed. Its immature berries, which closely resemble peas, sometimes contaminate mechanically harvested shelled peas because they are not removed by the usual cleaning equipment. A simple, inexpensive method for removing the berries and other foreign material from mechanically shelled green peas has been developed by the Bureau of Agricultural and Industrial Chemistry's Fruit and Vegetable Products Laboratory, Pullman, Wash., in cooperation with the Washington Agricultural Experiment Station and commercial pea canners. This new process is based on the difference in the wetability of shelled peas and nightshade berries.

This difference is enhanced by applying a very small quantity of mineral oil in a preliminary treatment, after which the peas are fed mechanically into the top of a tank containing a foaming emulsion. Properly handled, this mixture permits the nightshade berries, other weed seeds, and debris to float away, while the peas settle to the bottom of the tank where they may be drawn off. Most of the oil is removed from the peas by rinsing, and all but a minute trace is removed in the usual blanching operation before canning. During the 1946 season the cleaning process was in large-scale commercial use at 4 canneries that had installed "in line" machines capable of cleaning from 2 to 4 tons of shelled peas per hour.

Air Transport of Farm Products: Agriculture has a considerable stake in air transportation, because of the speed with which perishable products can be carried to distant markets. Air freight presumably will make it possible for farmers to ship perishables to many new markets. Rail freight from California requires 10 days or more to reach the eastern seaboard, but air freight will make possible the retailing of perishables from the West Coast or Gulf areas to eastern markets 24 hours after harvest. Experimental shipments have been made, some in cargo holds of passenger planes. Early tests indicated that air-borne products must be handled differently than rail borne. Air transport opens a new field with new requirements to the package industry. Airline operators and plane designers are giving increased attention to this new business.

Some growers already are learning to pick and handle their products properly for air shipment. For best development of this new mode of freight transportation, planes and airport facilities should be properly adapted to cargo handling, with adequate attention to refrigeration, ventilation, and storage. In the long run, of course, cost will be the major deciding factor in these developments. This survey is based on studies of air transport by a group of the Inter-Bureau Committee on Post-War Programs under F. L. Thomsen, Bureau of Agricultural Economics

High-Frequency Heat for Gluing Wood Products: Methods and equipment for using radio-frequency heating to set glues in wood products have been developed by the Forest Products Laboratory of the Forest Service. It has been demonstrated that high-frequency dielectric heating can be employed advantageously in the mass production of articles which require the use of expensive jigs and other apparatus. The rapidity with which the glue is set--in seconds rather than hours--enables manufacturers to use such apparatus at a much faster rate, thus cutting unit costs of their products. High-frequency heat appears to hold especially great promise in furniture manufacture and production of laminated timbers for land structures and ships.

DDT Residual Sprays for Fly and Mosquito Control: Early experiments by the Bureau of Entomology and Plant Quarantine with DDT showed that houseflies died within about 45 minutes and mosquitoes within a couple of hours after coming in contact with unpainted wood and screen surfaces treated with kerosene sprays containing 5 percent of the chemical. For more than a year the spray residue left in the boxes and cages effectively killed flies and mosquitoes. Similar sprays used in the vicinity of Orlando, Fla., on the walls of dairy barns, screen doors, and windows killed flies through out the summer months.

At Beltsville, Md., similar sprays were effective for more than one year in dairy, hog, and sheep barns. In Texas, South Dakota, Montana, and Indiana, the tests were as effective as those in the South and East. The minimum amount of spray needed for effective control throughout a season depends to some extent on the formula used, kind of surface sprayed, and suitability of the location for flies to congregate. Small amounts of DDT seem sufficient when placed in locations frequented by flies and mosquitoes.

A single application of a DDT residual spray applied to buildings on 18 square miles of land in the rice fields of Arkansas demonstrated almost complete elimination of the malaria mosquito for an entire season. Poultry houses treated subsequently contained no malaria mosquitoes, but untreated houses had as many as 2,000 to 4,000 adult mosquitoes. The sprays proved so effective they are now being used by the Public Health Service in large-scale control of malaria in the South.

New Diet Aid: A new aid for nutritionists and others engaged in planning diets or calculating the nutritive value of food supplies is the publication, Tables of Food Composition in Terms of Eleven Nutrients, Miscellaneous Publication 572 issued by the Department of Agriculture. The tables, which bring under one cover the composition of 275 common foods in terms of 11 nutrients, were prepared by the Bureau of Human Nutrition and Home Economics and the Committee on Food Composition of the National Research Council's Food and Nutrition Board. Previous publications by the Bureau showing the proximate composition of foods have dealt with a more limited number of the important nutrients.

The publication gives average values for food energy, protein, fat, carbohydrate, vitamin A value, thiamine, riboflavin, niacin, ascorbic acid, water, and refuse. The values given are derived from all available literature of nutrition research and from unpublished data from laboratories that have analyzed foods through

arrangements with the Council. In addition to foods believed to be most commonly used in the U.S., the tables include as many of the less common foods as present data warrant. All the values are stated in terms of 100 grams edible portion and of 1 pound as brought into the house for consumption.

The Bureau's task of gathering and evaluating food composition data traces its origin back to Dr. W. O. Atwater, first director of the Department's nutrition research. In 1869, as director of the Agricultural Experiment Station in Connecticut, Atwater published the first analysis of an American food--corn. Later, with Department associates, he published tables showing the nutritional make-up of familiar foods, which became a "bible" to the nutrition scientists of that day.

The Committee on Food Composition, organized in 1942 at the request of the Quartermaster Corps, has collected recent data on the composition of Army foods and rations. These are included in the published tables because they represent products already available or soon available to civilians.

Water-Repellent Preservatives for Wood: The Forest Products Laboratory of the Forest Service has brought standardization basis to the field of water repellents for lumber and plywood. It has established suitable methods of testing water-repellent preservatives on which specifications can be based, by developing formulas for satisfactory water-repellent preservatives, and by clarifying nomenclatures and definitions that differentiate water-repellent preservatives from preservative wood sealers.

Water-repellent preservatives give wood moderate protection from rapid changes in moisture content and from attack by bluestain and decay fungi without inconvenient or expensive methods of treatment. During the war these preservatives were widely used on wood boats and ships, wood truck bodies, container plywood for overseas shipment, and hutments for overseas use. Many peacetime uses are anticipated in a variety of wood products, such as doors, window sash, and some furniture, where water-repellent preservatives afford adequate protection.

Cushioning Materials for Packing: The Forest Products Laboratory of the Forest Service has developed a method of determining the properties of cushioning materials for use in the design of cushioned packages for shipment of machinery, instruments, and other products subject to damage in transit. Such a method, which evaluates cushioning properties accurately in specific units, fulfills a need long expressed by such organizations as the American Society for Testing Materials, Technical Association of the Pulp and Paper Industry, and industry in general.

Selection of cushioning materials hitherto was purely empirical, and no method was available for determining the actual volume of cushioning material needed. Many packages were either underdesigned and consequently subject to a high percentage of breakage, or overdesigned and wasteful of critical material, with consequent higher freight costs and waste of shipping space.

The new method enables manufacturers of cushioning materials to develop new cushions to meet the specific needs of any industry and enables industry in general to design packages within specific cost limits. The growth of freight shipment by air emphasizes the need for accurate design of packages of minimum weight and volume, and the method developed by the laboratory makes possible fuller use of this means of transportation.

Cash Crops from Poor Land: Hillculture research of the Soil Conservation Service finds crops that fit poor and hilly farm lands and that pay on them. One of these crops is wild beach plum. Native to barren sand dunes of northeastern U.S., the beach plum grows as far west as Iowa. This hardy plant helps to prevent erosion, and the tart-flavored fruit makes good jelly and preserves. A 5-year test with wild beach plums on an acre of low-grade farm land at Beltsville, Md., showed the plant can make good returns on poor land under soil-conservation practices. After 5 years the plants yielded 60 bushels of fruit worth $240. The land was prepared ans sceded about the same as for corn, using 5-foot drill rows.

At Auburn, Ala., the "miracle" vine--kudzu--increased returns by $10 to the acre on a plot of poor farm land over a similar plot under ordinary corn-cotton rotations. A 4-year rotation of cotton-corn-kudzu-kudzu netted the farmer $40 an acre more than a comparison field with a repeated cotton-corn rotation. On the second field, 48 pounds of nitrogen an acre was used to fertilize the cotton and 32 pounds of nitrogen to fertilize the corn. More examples of crops that will grow on hilly land: Cane and vine fruits such as black raspberry and grapes "anchor" soil and utilize waste areas on many farms. Besides beautifying the farm setting, they boost farm income.

Scientific Sizing: Major savings to the clothing industry and to consumers alike are beginning to result from the Bureau of Human Nutrition and Home Economics' work on measuring women and children as a basis for sizing clothing. Lack of scientific data on the body measurements needed in sizing garments is at the root of the chaotic condition which has always existed in the sizing of clothing--particularly for women and children. Department stores complained of a $10,000,000 headache each year from returns and exchanges "because of wrong size." Mothers complained of wasting time, money, and energy buying clothes that failed to fit children at home--age of a child was no dependable guide to clothes size.

With cooperation of 20 colleges and universities and funds furnished by the Works Progress Administration, scientists in the clothing laboratories, under direction of Miss Ruth O'Brien, weighed and measured nearly 150,000 boys and girls. The scientists took 36 clothing construction measurements of the boys and girls, who ranged from 4 to 17 years of age and represented 16 States. From data obtained the Bureau recommended a two-way method of sizing children's clothes based on height and girth at hip. The height-hip system is very similar to the system by which men have bought their shirts and other garments for years according to a few guide dimensions. The scientists continued by measuring 15,000 women from 18 to 80 years old. They recorded 58 measurements used in constructing patterns and garments, and took weight as a further check on bodily proportions. Universities and other institutions in representative sections of the country cooperated.

From the data the Bureau recommended height and weight combined, rather than the customary bust measure, for predicting fit of full-length garments. For garments for the upper part of the body, height and bust combined offer the best guides to a fit. For lower trunk garments, height and hip girths are good guides. No single measurement is adequate as a basis for sizing garments and patterns, the survey conclusively showed.

As a result of these measurement studies, some pattern companies and clothing manufacturers now use the new sizing system for children's garments. On the basis of the Bureau's work, new standards for body sizes for boys' garments have been adopted by the American Standards Association, which serves as a link between scientists and the trade. While awaiting developments in the women's wear field, one large mail-order house has already used the Bureau's data and the recommended sizing methods for sizing its women's garments.

Making Bakers' Cheese from Dried Skim Milk: A method of making bakers' cheese from dried skim milk, instead of liquid skim milk as has been the practice, was developed recently by the Bureau of Dairy Industry. Much of the fresh skim milk formerly available for bakers' cheese now goes to drying plants. With dried skim milk available, the manufacture of bakers' cheese need no longer be confined to the areas where fresh skim milk is obtainable; it may be extended to areas far from receiving and drying plants. The market for dried skim milk would thus be increased. Some economies would be possible if the cheese were manufactured at or near the bakeries where used, because costs of transportation, storage, and freezing usually incurred in handling and shipping bakers' cheese could be reduced. Bakers themselves could store the relatively nonperishable dried skim milk and make the cheese as their needs arise.

Bakers' cheese is used by baking establishments for making cheese pies, cheese cakes, and other similar soft cheese pastries. The procedure for reconstituting the dried skim milk and making the cheese is simple and economical, utilizing the usual equipment in a cottage cheese or Cheddar cheese factory. Baking tests with cheese made by the Bureau's method have given satisfactory results. The method reconstitutes the dried skim milk with a quantity of water, to produce a milk with a higher solids content than normal milk. A good lactic starter and a small amount of rennet are added to the reconstituted milk, which is allowed to coagulate for 4 to 16 hours, depending on the temperature. When firmly coagulated, the curd is placed in muslin bags (without being heated or cut) and allowed to stand until most of the whey has drained off. It is then ready for use or packaging in suitable containers for marketing. The yield of finished cheese varies from 1 3/4 to 2 1/4 pounds per pound of dried skim milk, depending on manufacturing conditions and amount of moisture wanted in the cheese.

Breeding for Better-Keeping Eggs: Some eggs keep better than others under the same conditions, because of the breeding of the hens that laid them. This recent finding by poultry specialists of the Bureau of Animal Industry opens up a new field of opportunity in poultry breeding.

During the past four years the scientists have observed individual and family differences in the keeping quality of eggs. Using the shrinkage of the thick portion of the white during storage as a measure of deterioration, the poultrymen found such shrinkage to be 62 percent for eggs laid by hens of one line of breeding and only 33 percent for another line.

A related study involving shrinkage in the weight of eggs during storage pointed to the quality of egg shells as a major influence. Some shells are more porous than others. In two divergent lines of chickens, loss of egg weight through shrinkage was about 60 percent greater in one than in the other. The results of the tests indicate that shell quality can be improved through family selection of breeding stock on the basis of eggs that have relatively low shrinkage when stored.

Hybrid Corn: Hybrid corn, a product of scientific research, reached the stage of most vigorous commercial development at the time World War II had raised food demands to the highest point in history. It is an outstanding example, perhaps the most outstanding, of the influence of theoretical scientific research in revolutionizing the production practices of an agricultural crop. Since the method of hybridizing corn was first suggested by G. H. Shull in 1909, the present perfection of commercial hybrids has been developed through combined and cooperative efforts of many breeders, both in the Bureau of Plant Industry, Soils, and Agricultural Engineering and in State experiment stations. The Bureau has been working on the problem since 1916, and the present leading hybrid, U. S. 13, was

developed by the two groups of plant breeders. Although the first hybrid seed involving inbred lines was produced in 1921 in Connecticut, the industry did not really get started until nearly 15 years later. In 1946, 67 percent of the country's corn acreage and almost the entire acreage in some of the leading corn States was planted to hybrid varieties. Since well-adapted hybrids increase the yield about 20 percent, it is estimated that the 1946 production as a result of their use was roughly 750,000,000 bushels more than it otherwise would have been.

Field Test Determines American Foulbrood in Bee Hives: A new flash test for field use to determine the presence of bacillus larvae, the causative organism of the bee disease, American foulbrood, has been discovered by the Bureau of Entomology and Plant Quarantine. It was found that enzymes produced by this organism hydrolyze milk. A dead bee larva is placed in milk at 70° C. Curdling occurs in about one minute when the disease organism is present. Hydrolyzing of the curd then begins and is usually completed within 10 minutes if the milk is warmed, leaving a yellow serous residue. A much longer time is required at room temperatures. This is the first accurate field test to be developed for determination of American foulbrood by apiculturists.

Range Reseeding: Recent studies by the Forest Service at several western forest and range experiment stations have pointed the way to successful seeding of valuable forage plants on several million acres of depleted range lands. Increases in forage production of from 2 to over 10 times, enough to far more than justify the cost, result from reseeding in accordance with the principles so far developed. Ranges producing considerably less than their soil and climate can support are most promising for planting. Many valuable forage species are available for planting throughout the West, although comparatively few are suited to the driest and most severe sites. As a result of many tests effective and economical methods of planting have been developed for most types of ranges. These provide for covering the seed, an essential consideration, and where necessary preparing the soil and reducing the stand of low-income competing vegetation.

Master Sample: The Bureau of Agricultural Economics, in cooperation with the Bureau of the Census, has completed the drawing of a "Master Sample" of farms, which is in effect a small replica of all the farms in the United States. Every county containing agricultural enterprises is represented. The sample consists of about 67,000 small sample areas which average about 2.5 square miles in size and contains an average of about 5 farms each.

One of the principal features of the Master Sample is its adaptability to various needs. The number of sample areas to be enumerated for any survey may vary widely, depending on the type of survey, the universe to be covered, and the accuracy desired. The sample can be used not only for Nation-wide studies, but for regional, State, or special crop-area studies as well. A further advantage of this sample over other sampling designs is that in clustering the units of observation (farms) by sample areas, considerable savings in survey costs are effected through reduction in travel between farms. This results in a great increase in sampling efficiency per dollar spent.

The first large-scale use of the Master Sample was in connection with the 1945 census of agriculture. It has also been used in connection with field surveys by BAE as well as by other agencies, and materials are being made available to State agricultural experiment stations in connection with their surveys. The materials assembled in the drawing of the sample are very useful and will save much in costs of future samples. These materials consist of: (1) Large-scale highway maps of all counties in the U.S. with information on them useful for sampling; (2) listing sheets showing all villages, towns, and cities having an estimated population of

100 or more; (3) tabulations of farms and dwellings by small geographic areas; (4) transparent "positive" county maps from which an unlimited number of county maps showing the sample areas can be reproduced by the ozalid process; and (5) aerial photographs covering over 90 percent of the sample areas. If additional sample areas are needed for any county or group of counties, these can be readily provided at relatively small cost.

Naval Stores Yields Increased: Naval stores research by the Forest Service has recently developed methods by which naval stores yields can be increased 40 percent or better in commercial operations by applying chemicals to freshly chipped trees. The method results in higher money returns to the operator, ranging roughly between $400 and $700 additional net profit per crop of 10,000 trees, depending on how faithfully proper methods of chemical stimulation are followed. The three methods developed in this research, and recommended to and tried by the industry, are: (1) Application of sulphuric acid for the first 6 to 8 streaks to get newly worked timber into full production in early years; (2) periodic acid treatment of all streaks chipped during spring and summer months; and (3) skip-acid treatment--the timber is chipped weekly but acid is applied only every other week. The second procedure gives the highest yields, but where labor is scarce, the first or third method is advantageous.

Improved Cotton Tire Cord: Research on tire-cord materials was started early in the war by the Southern Regional Research Laboratory of the Bureau of Agricultural and Industrial Chemistry to provide the armed forces with the most dependable tires possible. To develop a cord that would be satisfactory for use with synthetic rubber, laboratory scientists first investigated what is known as low-gauge cotton cord, which they believed would outwear and outrun the larger or high-gauge cotton cord used for many years. Then they selected certain commercially available varieties of cotton from which they believed better cord could be made. The first experimental tires (size 7.50 - 20) were for 2½ ton trucks, and were made with 90 percent synthetic and 10 percent natural rubber. They were officially tested at the Army ordnance tire-testing grounds at San Antonio, Tex.

All tires tested in 1943 gave satisfactory results, but those made with cord from improved varieties of cotton gave higher mileage and better resisted rocks and other obstacles than those of standard cotton cord. Tires made from cotton of the Stoneville variety were roughly 20 percent better than the standard cord; those made from S X P cotton, 75 percent better; and those made from Wilds variety, 132 percent better. Tests in 1944 showed that rayon and improved cotton cord performed better in the light-truck tires than standard cotton cord. In passenger car tests, in which no rayon cords were tested, both standard and improved cotton cords performed entirely satisfactorily. With one recapping, both the standard and improved cotton cords ran 68,000 miles and were still in good condition.

Phenothiazine as Anthelmintic: Phenothiazine is a synthetic organic chemical first prepared in the latter part of the nineteenth century. It is one of the thiazine dyes. Following the discovery and announcement that phenothiazine was effective as an insecticide, its value as an anthelmintic was studied and established in 1938-39 by Harwood, Jerstad, and Swanson, workers of the Bureau of Animal Industry. Experimentation with this drug has been continued to develop the best methods of use. Phenothiazine is now widely recognized throughout the world as a highly effective anthelmintic for the removal of many injurious internal parasites of domestic animals. It is the most valuable single drug so far discovered for combating such parasites. The drug is distributed commercially in powder form and may be administered either in gelatin capsules, in ground feed, in salt, or as a drench, the choice depending usually on the species of

animals and preferred method of handling them. For use as an anthelmintic, phenothiazine should be the pure product prepared especially for that purpose.

In 1-ounce doses phenothiazine rids sheep and goats of stomach worms, nodular worms, hookworms, and related pests. Its use prevents the spoiling of the sheep's intestines by nodular worms, thus providing an additional war material for making surgical sutures when they were greatly needed. In suitable doses which vary with the size of animals, phenothiazine is effective in removing several kinds of parasites from swine, cattle, horses, and mules. In very small doses this drug is effective also in removing cecal worms from poultry. These worms transmit blackhead to chickens and turkeys. The extensive use that phenothiazine already has acquired for controlling animal parasites is evident from the quantity--about 3 million pounds--used in the United States in 1944. Recently a mixture of 9 parts salt and 1 part phenothiazine, when made available to sheep, has been found largely to prevent acquisition of the parasite.

Nutritive Value of Plant Proteins: Laboratory studies by the Bureau of Human Nutrition and Home Economics showed conclusively that proteins of soybeans, peanuts, cottonseed, wheat germ, and corn germ have nutritive value so high that they may be counted on to "extend" or "spare" the proteins of meat, milk, eggs, and other animal foods in times of short supply. A very practical way to use these plant-proteins to advantage, the studies showed, is to team them with abundant breadstuffs and cereals. Strangely, such combinations sometimes actually prove more nourishing than the components suggest. Example: In feeding experiments with young rats, adding 15 parts of soybean flour to 85 parts of wheat flour in bread increased its growth-promoting values fivefold. Among the plant proteins chosen for investigation, wheat and corn germ proved definitely superior, the wheat germ in turn being higher than the corn germ in nutritive value for promoting growth. Wheat germ thus appears to be the plant protein food that comes nearest to the proteins of meat, eggs, and milk in biological value.

Insecticide Dispersing Equipment: Recent development of the more effective insecticides, such as DDT, has made it necessary to develop equipment to disperse these materials properly and economically. As early as 1928 the Bureau of Entomology and Plant Quarantine studied methods for the proper dispersal and adherence of concentrated conventional sprays. Spray mixtures were applied in atomized form so as to get effective coverage with a small volume of liquid. Insecticide formulations tried were 100 times more concentrated than conventional insecticides then in common use. These sprays were applied with various known types of spraying equipment. Considerable information was obtained on atomizing principles, particle size, and adherence.

The Bureau, in cooperation with industry, has recently tested models of power blowers designed to disperse the new insecticides in finely atomized forms. Different types of nozzle assemblies have been developed for atomizing liquid insecticides and for introducing dusts and liquid, either alone or in combination, into air blasts. Tallest shade trees can be effectively covered by this method. Much less spray material is used by this method than by the conventional type equipment used for applying dilute liquid insecticides. The new mist blowers are especially well adapted for treatment of shade and roadside trees and orchards.

Soil and Water Conservation Research: A soil-conservation farm plan is designed to put every acre to its best use according to its individual capabilities and to treat it according to its individual needs. Such a plant redesigns the farmer's "plant" for more efficient operation. As in the modernizing of an industrial plant, the redesigning of the farm is based on the results of a

multitude of laboratory and plot studies and carefully watched field trials. In cooperation with State agricultural experiment stations, Federal research agencies, and interested individuals, Soil Conservation Service research scientists delve into the secrets of soil, rain, wind, and growing crops.

By studying the private life of a raindrop, for example, they have developed a unique rain machine that can be regulated to produce variations in rainfall from gentle drizzle to drenching downpour, to test the effects of different kinds of vegetative cover as protection for various types of soil. Tilting plots of earth that can be sloped to any degree have helped to determine the comparative soil-holding powers of grasses and other close-growing plants on sloping fields. Wind-tunnel studies are contributing valuable information on the causes and manner of soil movement by wind. Fine-gaged laboratory instruments and ingenious weather-imitating devices are adding, bit by carefully weighed bit, to the store of tested facts contributing to the development of new and improved soil-conservation practices and to the refinement of existing practices.

Though it is difficult to evaluate any isolated part of the conservation research program, its contribution to agricultural advancement is indicated by the following proved advantages of soil-conservation farming. It has provided a practical guide for greater crop diversification. It has meant savings in seed, fertilizer, labor, and power as well as of soil. It permitted the greatest possible degree of protection--and even improvement--to soil and water resources under the pressure of intensified wartime production. It offers the farmer and rancher a sound avenue of shifts in type or intensity of production to meet varying markets or other conditions.

Photoperiodism: While working with Maryland Mammoth tobacco prior to 1920, W. W. Garner and H. A. Allard, of the then Bureau of Plant Industry (now Bureau of Plant Industry, Soils, and Agricultural Engineering), discovered that the plants flower only when the daily period of illumination is relatively short--that is, when the days are short and the nights long. When the light periods are long, the plants remain vegetative. Subsequent experiments on many kinds of plants showed clearly that they differ greatly in growth and flowering, responding with respect to the relative lengths of the daily periods of illumination and darkness to which they are exposed, some conforming to the behavior of Mammoth tobacco, others responding to relatively long illumination periods, and still others being but little affected.

This discovery departed widely from the prevalent theory that mere intensity of illumination was the principal light factor in determining the characteristic growth, flowering, and fruiting of plants. It had great fundamental importance as pure research, and as it developed widespread practical significance. Response to relative length of day and night largely explains changes in behavior where plants are carried from one latitude to another. It is now possible, by conducting experiments under controlled conditions, to tell in advance whether certain varieties of soybeans, peas, onions, timothy, barley, and other plants are adapted to the photoperiodic conditions prevailing in specific localities. Experimental crops can be grown under greenhouse conditions anyway, with supplemental artificial light as needed; if none is adapted to the locality, one or more suitable lines can be bred.

This discovery also has been particularly helpful in selecting soybean varieties that thrive and produce abundant seed for making oil, plastics, and food products in various localities. It enables us to produce our own beet seed domestically instead of importing it as formerly. It enables us to select localities where

pyrethrum, a long-day plant, will thrive in the United States, and also to cross plant varieties which would not normally flower at the same time, as in the case of sugarcane varieties. By artifically shortening the daily light period, chrysanthemums and other flowers are now brought to market ahead of their normal season.

Cross-Breeding Experiment with Dairy Cattle: The Bureau of Dairy Industry began this experiment in 1939 at Beltsville (Md.) to explore the cross-breeding of dairy cattle. Few experiments in crossing dairy breeds had been conducted before, especially with animals of known producing ability. All foundation animals in the experiment were of known production or transmitting ability. Production-tested cows of four dairy breeds--Holsteins, Jerseys, Guernseys, and Red Danes--were available, as were also proved sires of the same breeds except Guernseys. Funds for the experiment were available through the Bankhead-Jones Act of 1935.

The experiment differs from the usual pattern of cross-breeding, in that only a limited number of interhybrid matings are being tried. The major plan calls for continuous introduction of new genes (units of inheritance) through the use of proved sires of the respective breeds. Females resulting from the mating of two breeds are being mated to a proved sire of a third breed. The resulting 3-breed females so far have been mated to a proved sire of one of the same breeds as in the first cross, for a second round of the three breeds involved. All cows are milked 3 times a day for 365 days, and bred 4½ months after calving. No culling is practiced and all females are tested for production.

Thirty-two females representing various combinations of the two breeds have completed production records, averaging 12,842 pounds of milk and 592 pounds of butterfat, at the average age of 2 years 2 months. The great majority of these 32 crossbred heifers are better producers than their dams. Some increase was expected because of the high level of production inheritance transmitted by the proved sires. The expected amount was estimated by careful analysis of the production ability evidenced in the ancestry of these heifers. The actual increase, however, turned out to be approximately 20 percent more (on the average) than was expected. This may be the result of hybrid vigor.

Four 3-breed heifers have completed production records, averaging 14,837 pounds of milk and 645 pounds of butterfat, at the average age of 1 year 11 months. So far every 3-breed heifer is better than her 2-breed dam. One of the striking characteristics shown by all the crossbred heifers is their persistency in milk production. In many cases the monthly butterfat production varies less than 10 pounds from the high to the low month.

New Method of Statistical Analysis: The cost of crop production, probable size of a crop, or answers to hundreds of economic questions are usually determined by analyzing large numbers of figures on the subject. Thus the best method of securing and analyzing such sample data is an ever-present problem for economists. The Bureau of Agricultural Economics has experimented with a new statistical technique known as sequential analysis. With this new method the size of a sample necessary to reach an accurate conclusion does not have to be determined beforehand. Instead observations are taken in sequence until sufficient information is obtained to reach a conclusion with a given degree of accuracy. This war-developed statistical method cuts down the number of required observations by about half, yet at the same time promises to give accurate result. Although sequential analysis has been used primarily in the inspection of manufactured products, BAE hopes to apply it to the collection and analysis of agricultural data.

BAE also is cooperating with the Cowles Commission of Chicago University in developing other new statistical methods for analyzing economic data. The approach in this work involves consideration of simultaneous systems of economic relationships. These relationships are assumed to be subject to random disturbances, thus preventing them from being satisfied exactly. The new technique removes the bias inherent in the old method of correlation analysis. The present statistical research promises to provide better methods for predicting economic behavior as well as a better understanding of our economic structure.

Copper and Manganese Reserves in Young Animals: Observations have recently been made at the U. S. Plant, Soil, and Nutrition Laboratory at Ithaca, N.Y., on guinea pigs, rabbits, and rats with respect to copper and manganese reserves of the young. Animals are born into the world with a reserve store of copper in their livers. This reserve is usually enough to tide the young over the suckling period in which the intake of copper is inadequate due to the low copper content of milk. Since the copper reserves are depleted during the suckling period, it is necessary in the interest of adequate nutrition to supply some source of available copper during a prolonged period of suckling. As contrasted to copper, the same animals were born with little or no reserves of manganese in their livers. However it appeared that the animals studied obtained enough manganese in the dam's milk to permit manganese to steadily rise in the suckling offspring. Whether or not the dam's milk supplies enough manganese for optimum nutrition of the young remains to be determined.

Cobalt Deficiency in the United States: The U. S. Plant, Soil, and Nutrition Laboratory at Ithaca, N.Y., is making surveys of mineral deficiencies in the U.S. Cobalt deficiency seems to be more widespread than had been previously anticipated. Reports of cobalt deficiency in forage animals have been made from Wisconsin to Maine and along the Coastal Plain to Florida. Deficiency of cobalt in the forage results in a loss of appetite in the animals, some anemia, and a general "wasting away." If the deficiencies are extreme and are not corrected, they result in the eventual death of the animal. The deficiency may be cured by feeding the animal small amounts of cobalt salts. Through a study of the various reports, evidence is accumulating that certain types of soils are more apt to be deficient in cobalt than other types. It is hoped that, through a detailed study of the cobalt content of soils and vegetation in various regions, a generalization as to the type of soil and the amount of cobalt necessary to give best growth of animals may be reached. It is possible that in many areas just sufficient cobalt is present to give fair growth of the animals and actual deficiency symptoms are not recognizable. It may be that additional cobalt in these cases would result in better growth and health of the animals, and it is anticipated that careful laboratory studies of the problem will lead to the correction of these marginal deficiencies, as well as the precise demarcation of the areas where acute deficiencies occur.

Vitamin C Content of Tomatoes: Factors which might influence the vitamin C content of tomato fruits have been studied at the U. S. Plant, Soil, and Nutrition Laboratory at Ithaca, N.Y., for a number of years. The results to date indicate that soil fertilization has little or no influence on the amount of this vitamin in ripe tomato fruits, except that the application of large amounts of nitrogenous fertilizers tends to reduce the vitamin C content. On the other hand, the amount of light received by the fruits while they are ripening apparently has a tremendous influence upon their vitamin C content. Regardless of the amount of illumination which the leaves of the plant receive, tomato fruits which ripen in the shade are low in vitamin C. Shading only the fruits is as effective in producing a low vitamin C content as shading the whole plant. Conversely, exposing only the fruits to full sunshine is as effective in producing fruits

containing large amounts of vitamin C as exposing the whole plant to full sunshine. The wide variations observed in the vitamin C content of tomato fruits may be largely the result of differing degrees of illumination of the fruits during ripening. Part of the varietal differences may be related to this factor and plant breeders may want to keep this in mind in selecting new tomato varieties. The application of nitrogenous fertilizers may reduce the vitamin C content simply by resulting in greater shading of the fruits.

Columbia and Targhee Sheep: The development of Columbia and Targhee breeds of sheep is not strictly basic research, but has resulted rather from utilization of basic knowledge of genetics. The development of the two breeds represents skillful application of genetic laws and principles by scientists of the Bureau of Animal Industry. Major credit for the development of Columbia sheep belongs jointly to E. L. Shaw, F. R. Marshall, and D. A. Spencer. Credit for the Targhee belongs to D. A. Spencer and W. A. Denecke. In both cases several others, mostly geneticists and station directors, were involved.

The development of these breeds has exceptional regional importance from a production standpoint, since they are primarily adapted to the intermountain ranges of the West. But the breeds also have national significance from a commercial and a monetary standpoint because of the excellent quality of their fleece and meat. The earning power of Columbia sheep is estimated to be $1 to $2 a head greater than average well-bred range sheep. That of the Targhee breed is somewhat less. The Columbia is the result of cross breeding select Lincoln rams with Rambouillet ewes and proceeding from this original crossbred by mating the most select first-cross rams with carefully selected first-cross ewes and interbreeding the rams and ewes descending from them. The foundation of the Targhee breed was laid by mating select Rambouillet rams with select ewes of Corriedale X Lincoln-Rambouillet, and Lincoln X Rambouillet combinations, and interbreeding the rams and ewes descending from these matings. The Targhee came from rigid selections of these matings.

Tropical Kudzu: In cooperation with the Soil Conservation Service, the Department of Agriculture Experiment Station in Puerto Rico has been working on new legumes for the Western Hemisphere tropics. Pueraria phaseoloides, locally named tropical kudzu, appears to have all the favorable points which have made kudzu so popular in the Southern States. Ordinary kudzu will not thrive in the tropics, but tropical kudzu, its close relative, thrives well and produces a heavy forage crop. It serves excellently as a soil-erosion plant, and will control erosion on steep hillsides and deep gullies. The protein content of the leaves is high, and the plant is palatable to animals. It grows well together with other grasses, thus improving the quality of fresh cut feed. It has drought resistance, a distinct advantage in Puerto Rico. Interest in this legume has been widespread, and requests for seed have been received from nearly every tropical country of the Western Hemisphere, as well as from the southernmost areas of the U.S.

U. S. DEPARTMENT OF AGRICULTURE

Office of Information
Mr. Harding, 4842
Miss Arnold, 4875

No. 6
Revised July 1, 1947
A USDA Document

IMPORTANT RECENT ACHIEVEMENTS OF DEPARTMENT OF AGRICULTURE SCIENTISTS

Soluble Sausage Casings from Fruit Wastes: A new pectinate material, made from citrus peel or apple pomace and used as a soluble protective covering for sausage and other meat products, was recently developed by the Bureau of Agricultural and Industrial Chemistry's Western Regional Research Laboratory at Albany, Calif. The method for making this new coating material is simple and easily controlled. A 2 percent dispersion of low-methoxyl pectin is prepared and adjusted to a suitable acidity. A calcium salt is added in a quantity so a calcium pectinate solution will form at about 158° and the material will gel when cooled to 104°. The sausage or other meat product, molded into any desired shape, is dipped in the warm solution for about 3 seconds, after which the liquid coating is dried in a current of air for half an hour to form a strong gelled film coating. Treated products can then be stored in the usual way. If the coated meat product is boiled, the film will dissolve; if fried or roasted, the film, which is tender and edible, may be eaten with the meat.

Ham and Eggs Get Scientific O.K.: Confirming practical experience, scientists in the Bureau of Animal Industry have shown why ham and eggs are an efficient, satisfying food combination. One reason is because the proteins of those foods supplement each other so well that the two, when eaten together, supply more nourishment than when eaten separately. That, in substance, is the result of a series of tests on rats involving these and other protein foods. Previous experiments had shown that the protein in pork enhanced the value of bread eaten with it. Now it appears that the protein of eggs enhances the value of the protein in pork when ham and eggs, for instance, are eaten together. The whole is therefore greater than the sum of its constituent parts! Although the protein in dry-cured ham was inferior to that of spray-dried eggs in growth-promoting value, when the diet contained equal parts of ham and egg protein the growth-promoting value was practically the same as for eggs alone. When the diet contained two parts of ham and one part of egg, the growth-promoting value was somewhat higher than the computed value, but lower than the value for eggs alone. The addition of the sulfur-containing amino acids, cystine and methionine, also proved advantageous in promoting growth. The general results of the tests provide further evidence of the superiority of carefully selected combination of foods and food supplements over the same products eaten separately.

Ethyl Alcohol from Whey: Successful alcoholic fermentation of the lactose, or milk sugar, in whey has been perfected by the scientists of the Bureau of Dairy Industry. Whey, a by-product of cheese and casein manufacturing plants, is one of the cheapest sources of fermentable sugar when normal whey supplies are available. Furthermore, the disposal of waste whey offers difficulties in stream pollution. Before the war the Bureau scientists demonstrated that alcohol could be produced from whey. Subsequently search was made for yeast strains that would perform the fermentation process more efficiently, and, as a result, a large and varied collection of lactose-fermenting yeasts was assembled and tested. One of the yeasts, known as Torula cremoris, did a complete job of fermentation in 55 hours, proving far superior to any competitor among the yeasts under observation. It was finally selected for pilot-plant trials by Bureau workers. Experimental yields of ethyl alcohol averaged 84 percent in the plant, as compared with nearly 91 percent in the laboratory. The best temperature for fermentation is around 33° to 34° and for best results the whey is slightly acidified before fermentation.

Yeast equal to only about 2 percent of the weight of the lactose is required. The equipment required is relatively inexpensive. The alcohol can be made as a by-product of cheese or casein manufacture, using waste steam to concentrate the alcohol. The whey protein and slops remaining make an excellent by-product feed for cattle. Thus a former waste product, which was hard to dispose of, may become an asset and a valuable source of useful products.

Fight Oats Disease: There is a rust hole in the armor of Clinton oats, a new variety distributed in 1944 by the Department of Agriculture and the Iowa, Illinois, and Indiana Experiment Stations. The hole is the result of a fungus, a specific race of crown or leaf rust. Among scores of races of leaf- and stem-searing fungi and other diseases that attack the oats crop, it is the most dangerous enemy that threatens this high-yielding, upstanding variety. This flaw in Clinton illustrates the unending struggle of plant breeders to build genetic bulwarks against the shifting tides of disease. Clinton's present difficulty is a striking example of the ups and downs that result from improvements by the geneticists on the one hand and the chance development of new races of destructive fungi on the other.

Today oats are attacked by literally scores of races of rusts, smuts, and other diseases. There are now at least 75 races of oat rusts, some attacking leaves, some stems. The peculiar qualities necessary to pierce Clinton's armor are in Race No. 45 and several other minor races of the leaf rusts of oats. At present the loss because of Race 45 is not likely to be important as it is minor, and some less well-known oat varieties are resistant to it. But Clinton oats has been going places and in a few years, in the absence of a better variety, it will be grown on large acreages in the North Central States. This would mean easy picking for a pushing pest just starting out. It could spread like the proverbial "wildfire" if climatic conditions were favorable. So the oats breeders are already working to develop a new variety with the high yield and the many disease-resistance factors of Clinton and, in addition, resistance to leaf rust Race No. 45.

Women Buyers' Preference in Textiles: The preference of women buyers among certain ready-made textile yard goods is the subject of a survey conducted by the Bureau of Agricultural Economics. The survey shows, for instance, that 59 percent of the women buy ready-made house dresses and that the rest make their own, wear old street dresses, or use slacks. Other questions taken up in the survey: What fibers do women prefer? What qualities in ready-made items do they consider important? What do women say are the good and bad points of cotton and rayon in fabrics or articles in which these fibers compete?

Progress in Vanilla Research: The Department of Agriculture Experiment Station in Puerto Rico has conducted experiments with vanilla since 1907, when cuttings were introduced from the Florida Experiment Station. The commercial industry began to grow about 1917, when a root rot appeared which has limited production and expansion of the vanilla industry to date. In 1927 a member of this station identified the causal organism as a fusarium root rot. In cooperation with the P.R. Insular Government, investigations since that time have been devoted largely to crossbreeding for varietal resistance and to study of the cultural practices which support vigorous healthy growth. A system of growing vanilla, using lath shade admitting about 50 percent sunlight, has been devised and shows considerable commercial promise. The first year's flowering and fruiting has exceeded all expectations. One commercial grower has entered into a long-term experiment with the station, testing the method on a commercial scale. Widespread interest has resulted and the experiment is being watched by vanilla growers as the hope for the future of this new industry.

Wartime Revolution in Farming: Agricultural production increased twice as much between 1939 and 1944 as it did in the preceding 20 years. Even though one-fourth of the production in 1944 and 1945 went to military and other war emergency uses, there was enough food to provide civilians with a per capita food consumption 10 percent higher than in 1935-39. The story behind these revolutionary developments was told in Changes in Farming in War and Peace, by Sherman E. Johnson, of the Bureau of Agricultural Economics. Although unusually favorable weather contributed to increased farm production during the war, technological developments were more important. These included mechanization, increased lime and fertilizer, cover crops, and other conservation practices, improved varieties of plants, better balanced feeding of livestock, and more effective control of insects and disease. These developments were not all made during the war. Foundations for many of them had been laid years before, but drought and depression prevented their application. War provided the patriotic and financial incentives that made record production possible.

Studies with Radioactive Phosphorus: By use of radioactive phosphorus in fertilizer on test crops of ryegrass, soil scientists of the Bureau of Plant Industry, Soils, and Agricultural Engineering have shown that crops on various soil types may use very differently the phosphorus added in fertilizer. On some the plants use much more of the phosphorus already in the soil. Radioactive phosphorus (obtained from one of the atomic energy establishments), when it gets into plants, can be measured with an instrument known as a Geiger counter. The scientists measured the amounts of the radioactive phosphorus taken into the ryegrass in the various test pots.

The tests showed these striking differences in the use made of the phosphorus added and of that already in the soil. In a sandy loam soil (Evesboro) from the Plant Industry Station at Beltsville, Md., which contained little native phosphorus, the grass got 80 percent of what it used from the applied superphosphate and only 20 percent from that stored in the soil. In a heavy clay loan (Davidson) from Orange County, Va., typical of the general farming soils of the Southeast, the grass got 60 percent from the fertilizer added and 40 percent from the soil. In a silt loam (Caribou) from Aroostook County, Me., heavy with native phosphorus partly accumulated from years of fertilizing, the test grass got only 12 percent of its phosphorus from the fertilizer added and 88 percent from the soil.

Researchers of the Bureau and the North Carolina Experiment Station are now conducting tests on a field scale on corn, cotton, and tobacco farms. Through radioactive materials, they hope to find facts resulting in better use of fertilizer, lime, and organic matter and better profits for farmers.

Progress of Farm Mechanization: Technological developments have had a profound effect on American agriculture in the last 100 years. One farm worker in 1945 produced enough agricultural products to support himself and 13½ other persons. In 1920 one farm worker supported himself and 9 others and in 1820 himself and about 3 others. Each man-hour of farm labor meant 44 percent more gross production in 1945 than in 1917-21. About half the savings in hours per unit of production resulted from mechanization. These and many other developments in the last century due to mechanization are the subject of a publication of the Bureau of Agricultural Economics, now in preparation. Emphasis is given to the effect of the developments in the last 25 years on the volume of food production, labor requirements, farm employment, and efficiency in production.

Costs and Benefits of Soil Conservation: It is becoming clearer every year that soil conservation farming pays better if it goes all the way. A 7-year study by the Soil Conservation Service of the records of 48 farms in Illinois shows a markedly higher net income for farms with high conservation scores over farms with low conservation scores. At the start of the period, in 1939, the two groups of farms were almost identical in productivity and earnings. Crop yield indexes were 100.2 for the high conservation farms and 99.7 for the low conservation farms. Net incomes per acre were $9.87 and $9.84 respectively.

Twenty-four of the farms adopted conservation programs during the 7 years. Land use remained about the same, but the farms with high conservation scores put in more legume pasture and incorporated needed soil conservation practices into cropping and cultivation systems. Crop yields, as measured by the crop yield index, averaged 6 points higher on these farms throughout the study. Livestock production also averaged higher on these farms. Over this 7-year period the farms with high conservation scores had an average gross income per acre of $4.72 more than the farms with low conservation scores. Conservation expenses averaged 4.9 percent of the gross income on the farms with high conservation and 3.4 percent on the farms with low conservation scores.

Net farm income per acre averaged $13.88 for the high conservation farms and $9.56 for the low conservation farms. This is an annual difference of $4.32 per acre in net income, and a total difference for the 7-year period of $30.24 per acre in favor of the farms with scientifically planned conservation programs. For a farm of 200 acres, that would be an added net income of $6,048 while the farmer was putting the conservation plan on his land.

Conservative Grazing. Recent studies by the Forest Service at several western experiment stations have shown that conservative stocking increases beef production and maintains the range in better condition than heavy stocking.

In grazing studies conducted cooperatively with the Soil Conservation Service at the Central Plains Experimental Range near Nunn, Colo., yearling cattle on conservatively stocked range, 40 head per section, gained 251 pounds per head during a 6-month summer season. Estimated net returns averaged $993 per section of land. Similar cattle on heavily stocked range, 60 head per section, gained only 211 pounds per head and returns per section were $847.

On mountain summer range at FS's Manitow Experimental Range in Colorado, conservative stocking, which removed about 35% of all the herbage annually, produced 547 pounds of green forage per acre, while heavily stocked range--comparable at the beginning of the experiment--produced only 236 pounds.

Studies at the U. S. Range Livestock Experiment Station, Miles City, Mont., in cooperation with the Bureau of Animal Industry and Montana Experiment Station, showed that Hereford breeding cows on conservatively stocked northern plains range produced 6 percent larger calf crops, and the calves averaged 28 pounds per head larger at weaning time, over a 12-year period, than similar cows on heavily stocked range. These differences in calf crop and weaning weight amounted to 45 pounds greater calf production per cow annually from conservative stocking. Costs of forage and supplemental feed averaged $1.50 higher per cow year with heavy stocking. In addition, cows from conservatively stocked range, sold at the end of breeding, brought over $12.00 per head more than cows from heavily grazed range. Conservative stocking maintained the vigor, density, and forage production of range plants, and heavy grazing caused them to deteriorate.

Likewise, during recent years conservative stocking on the Jornada Experimental Range, in New Mexico, has increased calf crops from 74 to 83.5 percent and reduced losses from 2 to 1.2 percent. In addition, the range has increased in grazing capacity about 20 percent under conservative stocking.

Inventor Perfects Fiber-Measuring Devices: Seven devices for determining the fineness, shape, length, surface structure, and other characteristics of fibers have been developed by Dr. John I. Hardy, research scientist of the Bureau of Animal Industry, and are adapted to a wide range of agricultural and industrial uses. Knowledge obtained with the various instruments is valuable in the breeding of improved plants and animals. It is useful, too, in the textile industry, cleaning and dyeing operations, manufacture of felt, and even in identification of criminals from telltale bits of clothing, hair, or other fibrous material. Most devices were used first in the study of wool in connection with livestock research. But they soon proved valuable, also, in industries working with mohair, cotton, fur, bristles, paper, leather, cork, silk, and other fibers. One is a holder for determining the fineness of wool fibers. It has a small slot of known size in which fibers are packed to a desired depth and pressed down uniformly by small weights. Excess fibers are cut away by a razor blade, which is part of the device, and the fibers remaining in the slot are counted. The fewer the fibers the coarser they are, and vice versa. The other inventions are equally practical.

Loss of Plant Nutrients by Erosion: Analysis of soils washed from slopes by rains shows that a farmer is not always feeding his own crops when he applies commercial fertilizers to his fields. If he doesn't protect his sloping land against erosion, he is likely to find he is losing his plant nutrients to his neighbor lower down the watershed.

Soil Conservation Service scientists have reported a study of erosion debris made in New York State, to determine the soil and fertilizer elements lost through runoff erosion. Samples of washed soil were taken, immediately after rain, from the bottoms of the slopes of a small watershed where it had washed from 7 farms into and along the creek, along fence rows in bottomlands, and other low places. At the same time, other plow-depth samples were obtained from the soil left on the slopes. Careful analyses showed that all transported soil contained more organic matter than the corresponding soil left on the slope. The average for the 8 deposited soils was 3.7 percent, compared to 2.9 percent for the soil on the slopes.

Seven samples of moved soil contained more potassium than the slope samples, and one contained the same amount. Five samples of deposited material contained more phosphorus than the slope samples, two the same amount, and only one less. Appreciable amounts of magnesium, calcium, and ammonia and nitrate also were found in the deposited soils. Information of this kind, when given to slope farmers, does much to encourage the adoption of conservation practices especially designed to prevent erosion from sloping fields or to build up soil organic matter in fields that have suffered this damage.

Farm Operators' Living Conditions Improve: Between 1940 and 1945, the average net income of U.S. farm operators increased substantially. During the same period, their average level of living increased one-fourth. This is shown by indexes, constructed by Bureau of Agricultural Economics scientists, of farm operator family level of living by counties. The increases were general throughout the U. S. In only a few counties was the level of living lower in 1945 than in 1940. Most of the counties in the upper fifth are located in the heart

of the Corn Belt, the small industrialized States of the northeast seaboard, and California. Nearly all the counties in the lowest fifth are in the Southeast.

New Varieties Boost Grain: In the hard spring wheat regions where new varieties have gradually minimized farmers' losses from rust, yields have been far better as a result. In the past two years farmers have produced 100,000,000 bushels more a year of hard spring wheat because of these improvements. Yields of oats in the principal producing area have gained greatly as a result of wave upon wave of new varieties. The estimated yield has increased by more than 10 percent per acre. There have been similar improvements in barley and rice, and sorghum growing has been revolutionized by varieties adapted to combine harvesting.

Grain Improvement Speeded: The scope of the Federal-State small grain improvement makes necessary many testing stations throughout the country, a factor that has much to do with helping the farmer compete with adversity. There are 80 locations for testing wheat, 90 for oats, 100 for barley, and many for corn, rice, sorghum, etc. The good results of cooperative grain breeding are now so well recognized by farmers that a new variety of proved superiority is usually snapped up as rapidly as streamlined methods can increase the seed.

DDT Controls Powder-Post Beetle in Harvested Bamboo: Dinoderus minutus (F.) is a small bostrichid powder-post beetle that infests many kinds of stored vegetable products in most of the warm parts of the world. In Puerto Rico, it bores into and destroys large quantities of harvested bamboo. Infestation often begins within 24 hours after culms are stored. Where the adult beetles are plentiful, infestation may be imminent during the next few months of drying and curing. Culms of nonresistant species are so badly attacked as to be unusable and some are reduced to a mass of fibers and dust. Experiments at the Federal Experiment Station in Puerto Rico have shown that DDT prevents most of this infestation. The ordinary 5-percent residual strength in kerosene, applied to the trimmed culms immediately after harvest, allows even the most susceptible species to cure with approximately 90 percent less damage than would otherwise occur. As curing increases resistance to beetle attack, the DDT treatment makes possible the marketing of susceptible bamboos for utilization in localities or climates where this insect is not found.

Eradication of Big Sagebrush: Effectively to improve badly deteriorated sagebrush range for livestock grazing, it is frequently necessary first to remove or reduce dense stands of big sagebrush. Research by the Forest Service at the Intermountain Forest and Range Experiment Station, Ogden, Utah, has shown that sagebrush removal not only facilitates reseeding, naturally or artificially, but also enables sheep and cattle to graze more freely. Losses of lambs from predators are sharply reduced. Sagebrush should be removed only where the danger from erosion is not high. Fairly firm soils and slopes under 30 percent are not likely to be damaged if a fairly good stand of grass promptly occupies the area or is established through reseeding.

Methods which uproot, break off, or mash down sagebrush, such as railing, ripping, harrowing, and rolling, are most effective in late summer and early fall when the sagebrush is brittle and the soil dry. Methods which cut or tear up the sagebrush, such as plowing, scraping, and grubbing, are effective almost any time when weather and soil conditions permit operations. These methods should not be used in late fall or winter because the removal may effectively scatter and plant sagebrush seed that ripened during the fall. Eradication by these latter methods should be followed by reseeding, which ordinarily increases grazing capacity from 5 to 10 times.

The use of fire, properly handled, to eradicate sagebrush is the cheapest method. Precautions must be taken to prevent damage to adjacent property, timber, or watersheds. Burning usually gives nearly complete removal. If a good stand of perennial grass prevailed before such controlled burning, it will usually take over the area, if protected from grazing during the following growing season. If a sparse stand of perennial grasses prevailed, burning must be followed immediately by reseeding. Average costs of applying these methods on an experimental basis have ranged from $0.25 per acre for planned burning to $1.32 per acre with equipment such as the wheat-land plow and self-clearing harrow. Seeding costs are in addition.

Water Conservation Practices Compared: Catching water and storing it in the soil is vital for soil conservation in the southern Great Plains. For several years Soil Conservation Service scientists at Guthrie, Okla., tested different cultivation practices and combinations of practices to determine those best suited to areas where rainfall is scanty and droughts may occur any year. The scientists now have conclusive evidence that both plain listing and basin listing greatly reduce run-off water losses when done on the contour. Contour cultivation reduced runoff losses 23 percent in the past 5 years. Although this is an outstanding saving of moisture, observations and trials on the watersheds show that contour cultivation alone is not sufficient to control erosion on slopes over 1.5 percent. Over a 5-year period, a combination of terraces and contour cultivation saved an average of 42½ percent more water than could be held by the old up-and-down slope methods of working cultivated fields. Beginning with the third year after terracing, crop yields were higher with the terracing and contouring.

Future of Western Agriculture: Prospects for further development in the vast area of the 11 Western States is discussed in Long-term Outlook for Western Agriculture, a joint publication of the Bureau of Agricultural Economics and the Bureau of Reclamation. The outstanding fact in western agricultural history is the greatly increased output from only a moderately large acreage. The annual value of agricultural production (in 1926 dollars) rose from about one billion in 1910-14 to about 2-1/4 in 1939-43. The authors of the report see no reason to believe that the upward trend has reached its peak. They estimate that production in 1960 may be 30 to 40 percent above 1940. During the same period, the market for western products is likely to increase 25 to 35 percent while the population of the 11 States is expected to gain about 33 percent to a total of 18½ million.

Penicillin Reduces Losses from Erysipelas in Turkeys: Bureau of Animal Industry experiments indicate that penicillin is highly effective in saving turkeys infected with the swine-erysipelas organism, to which turkeys as well as swine are susceptible. Infection in turkeys usually attacks the flock just before marketing, when the birds are most valuable. The use of penicillin reduced the mortality of infected birds to 10 percent when 100 percent of untreated birds, similarly affected by the disease, died. The drug, suspended in peanut oil, was given in doses of 20,000 units, repeated 4 times a day apart. The experiments disclosed that the best method of treatment was to inject the penicillin into the wattles. This location is preferred since the wattles are readily accessible, are not used for food, and accommodate a large dose of the drug. Another method of giving penicillin was in drinking water, but this proved to be unsatisfactory since only 1 bird in a group of 10 would drink the medicated water. That bird, however, recovered from the infection. The salts of penicillin appear to have a powerful germicidal effect on the disease organisms. The experiments, which are regarded as preliminary, included 222 three-quarter grown turkeys, treated in various ways in groups of 10.

Making Silage From Hay Crop Halves Protein Losses: Dairymen can reduce the size of next winter's protein-feed bill considerably by saving more of the protein in their home-grown forage crops. An enormous amount of protein available in hays and other harvested forages is lost through conventional methods of harvesting and storing the crops. Under humid conditions like those at the Agricultural Research Center, Beltsville, Md., more than a third of the protein in an acre of alfalfa may be lost when the crop is made into field-cured hay, even during ideal haying weather. One way to reduce these losses, and thereby actually put more of the home-grown protein in the cows' mangers in winter, is to make silage from the forage crops instead of curing them in the field for hay. This conclusion is based on experiments by the Bureaus of Dairy Industry and of Plant Industry, Soils, and Agricultural Engineering, which have been under way at Beltsville for several years. Feeding tests with dairy cows showed also that alfalfa silage was slightly better for milk production than the hay made from the same crop at the same time. Where conditions make it difficult for farmers to produce good quality field-cured hay, the difference in favor of the silage would be much greater. Farmers, in humid regions particularly, are urged to consider shifting from hay making to silage making and to plan now for such a shift in operations. The wilting method of making silage is practical and easy to use. Labor and machinery costs per ton of dry matter fed are not materially different in making hay or silage. Making silage would be an effective way to insure a supply of good quality roughage and to reduce expenditures for purchased protein in winter.

Chemical Method for Determining Toxicity of Derris Root: A quick simple method for evaluating the toxicity of derris roots has been devised by the Puerto Rico Experiment Station. The method is based on the absorption of light by the toxic constituent of the roots dissolved in acetone and measured in a spectrophotometer at 360 mu. The transmittance value of total acetone extractives of derris roots is in close agreement with the rotenone equivalent as determined biologically on house flies. Thus the chemical method obviates the necessity of the expensive and time-consuming biological assays formerly necessary to determine the value of derris roots.

Bromegrass Best for Erosion Control: A deep-rooted and nutritious grass is one of the greatest boons to farmers who want to hold their soil and at the same time "grow profit." Smooth brome, originally from Hungary, has been spreading rapidly throughout the Northern States as farmers and stockmen speed the good word about its nutritive values and its ability to withstand drought when most other grasses are dried and dormant. This grass has proved the finest of all erosion control crops.

Grass-root studies by the Soil Conservation Service in West Virginia show conclusively that smooth brome is a deeper rooting grass than four other important northern grasses. In the top 12 to 18 inches of soil, bromegrass showed 101 pounds of roots compared with 30 pounds for orchard grass, 16 for deer tongue, 5 for timothy, and 3 for Kentucky bluegrass. Brome's much-branched, fibrous roots may penetrate the soil 6 feet or more. Its erosion-resisting root system, along with its protein-rich green growth and its adaptability to a large portion of the Northern States, probably is the explanation for the phenomenal increase in smooth brome acreage in the past few years.

Many thousand farmers in soil-conservation districts now use this grass for a soil-conserving plant in rotations, for planting on steep cultivated slopes and in field draws, for buffer strips, for sod flumes and terrace outlets, for headlands around fields, for roadside plantings, and in many other places where conservation plans call for a thick deep sod. Its large quantity of tough roots makes it an excellent ground binder, which stands considerable abuse as well as silting and flooding. When mixed with alfalfa, it has no equal for hay or pasture

Bromegrass has been tested, also, for its ability to improve soil infiltration under frost and frozen soil conditions. In Michigan, hydrologic investigations by SCS revealed that during a storm, when 2.77 inches of rain fell on a brome-alfalfa watershed with a thin layer of frozen soil at the 6-inch level and 2.41 inches fell on an unfrozen woodland, there was more runoff from the woodland than from the brome-alfalfa sod. Neither lost any soil, but one-half inch of clear water ran off the brome-alfalfa and three-fourths inch from the woodland. Corn stubble, the horrible example, lost 1,009 pounds of soil per acre in 1 3/4 inches of run-off. The unusual aspect of the measurements, the hydrologists report, was that the woodland soil was unable to hold permanently as much of the rain as was the brome-alfalfa with its remarkable root system and tremendous moisture-holding capacity.

Slow Nitrogen Fertilizer: A slow-acting nitrogen fertilizer that feeds crops over a long growing period has been developed by soil scientists of the Department of Agriculture. The fertilizer is one of a series of combinations of urea and formaldehyde, known as Uraform. It is produced at present only on a laboratory scale. Results of laboratory and greenhouse tests with the material were recently demonstrated by Dr. K. G. Clark, Jew Yam Yee, and Dr. M. S. Anderson at a Soil and Fertilizer Conference at Plant Industry Station, Beltsville, Md. The results indicate that Uraform is superior to natural organics in supplying nitrogen at a uniform rate over a long growing period. Unlike commercial nitrogen fertilizers now used, Uraform does not leach out of the soil easily. It offers promise as a source of nitrogen for corn, potatoes, and tobacco crops which ordinarily need additional fertilizing after they have been planted. Application of Uraform at planting time would save labor. Its delayed action and long duration would also make it a valuable fertilizer for lawns and other grasses. The tests show that Uraform may be used in mixed fertilizer as well as in separate applications. Because it does not appear to be affected by moisture absorption, Uraform offers possibilities as a conditioner that prevents caking, often a serious problem in mixed fertilizers.

Who Gets the Consumer's Meat Dollar? The way in which the consumer's dollar spent for meat is divided among livestock producers, markets, wholesalers, retailers, and packers is discussed in a report from the Bureau of Agricultural Economics by Knute Bjorka. In 1939, it was estimated, 51 cents of the consumer's dollar was received by livestock producers. Retail distribution took 24 cents, wholesale distribution almost 6, meat packing nearly 15, and marketing slightly more than 4. The report also discusses the methods of reducing costs and improving the efficiency of marketing and processing.

Reseeding Abandoned Lands: Research on range reseeding conducted by the Forest Service in the West has produced specifications and guides by which several types of range lands can now be reseeded to good forage species with reasonable success. Within a few years after reseeding, abandoned crop lands produce many times the forage they produce after abandonment. Left to revegetate naturally, 40 or more years are required for restoration to a good forage cover. It is particularly fortunate, in view of the expansion of dry-land wheat acreage during the second World War, that adaptable species have been determined and economical reseeding methods developed. As the demand for wheat decreases, it is inevitable that large acreages of land, sub-marginal for permanent crop production, will be abandoned. Newly abandoned stubble fields offer nearly ideal conditions for seeding crested wheatgrass and other forage grasses with ordinary farm equipment. Delay in reseeding after abandonment increases the possibilities of infestation by cheatgrass or weeds, which increases costs of reseeding and reduces the chances for success. Prompt restoration to forage production of abandoned areas contributes to greater production of range livestock and their products and reduces

the possibilities of soil blowing and erosion, particularly in the event of prolonged drought.

Fruit and Vegetable Concentration Markets: Since 1925, the concentration markets have been used increasingly by small lot growers in Southeastern States. These markets are the subject of a joint study by the Bureau of Agricultural Economics, Experiment Stations of North Carolina, South Carolina, Georgia, and Alabama and Georgia Extension Service. Relatively low cost of operation is chiefly responsible for the success of these markets. Improved motortruck transportation, dissatisfaction with other kinds of markets, belief that marketing charges are too high, and need for additional outlets also have contributed to their success. In three-fourths of the markets in the survey, at least 90 percent of the products sold came from within 25 miles of the market. The majority of sales were made to resident buyers. The most successful operation methods in the concentration markets are discussed in detail in the study.

Plant Growth-Regulating Chemicals: In recent years plant growth-regulating chemicals, sometimes called hormonelike substances, have proved useful in agriculture in several important ways. It started with the discovery by scientists in Holland and in this country that applications of indoleacetic acid stimulate readier rooting of cuttings ordinarily difficult to root. Wide knowledge has gradually accumulated regarding this and similar chemicals. Much work has been done by scientists at the Plant Industry Station, Beltsville, Md., and by research workers at some State experiment stations. Growth regulators now in use are products of the chemical laboratory and therefore cannot properly be known as hormones, but as hormonelike substances, since they do not occur in nature.

After about 10 years' work by researchers, the uses of these substances in the order of their economic importance are: Weed killers (2,4-D); preventives of preharvest drop of certain varieties of apples and pears (2,4-D and alpha-naphthaleneacetic acid); rooting of cuttings (indole-butyric acid); prevention of sprouting of stored vegetables such as potatoes and root crops, and plants such as rose bushes (ethylnaphthalene acetate); and fertilization of greenhouse tomatoes to increase fruit set--often poor under glass--and to better the yield and speed up ripening (indole-butyric acid). Other responses not yet used commercially but which show promise are: Improving the storage quality of certai varieties of apples especially subject to scald (naphthaleneacetic acid); hastening ripening of fruit, such as bananas, by spraying with 2,4-D; and insuring the setting of numerous, large, well-colored berries on female holly plants by treating the blossoms with naphthaleneacetic acid.

Scientists of the Bureau of Plant Industry, Soils, and Agricultural Engineering have contributed much to the full use of these chemicals, including controlling many broadleaf weeds with 2,4-D, delaying fruit-drop, preventing sprouting in stored vegetables and plants, reducing scald in stored apples, hastening ripening of certain fruits, and hurrying fruiting of holly. The scientists believe it may be possible to combat weeds before the cropping season by treating the soil or manure piles so as to kill weed seeds at the germinating stage or immediately before.

Up to the present this new way of killing weeds has applied only to broadleaf weeds, such as dandelions, plantain, and many others, but not to the grassy ones--crab grass, quack grass, etc. Now investigators at the Station are busy studying new growth regulators, including one found by British scientists, called isopropyl-N-phenyl carbamate (IPC, for short). To some extent it does what 2,4-D doesn't do. Under certain conditions it kills some kinds of grass seedling and lets the broadleafs grow. So far the investigators have made some convincing

demonstrations in the greenhouse with mixtures of sugar beets and quack grass growing in pots.

Most Farm Workers Receive More Than Mere Wages: It has long been a custom for American farmers to furnish their hired laborers with various goods and services in addition to paying them in cash. To determine the extent and importance of these perquisites, a survey was made by the Bureau of Agricultural Economics. It showed that 80 percent of U. S. regular hired hands and 60 percent of the seasonal farm laborers received perquisites. Houses, food products from the farm, and room and meals were the most common types furnished regular workers, while the noon meal was the most common type furnished seasonal workers. Perquisites are about a fourth of the average farmer's wage costs for regular hands, but only about a tenth of his costs for seasonal workers.

Hybrid Vigor in Various Crops: Hybrid corn has given farm productivity a big lift, but it is only a beginning of what hybrid vigor in plants can be made to do for us through increasing the capacity of crop plants to make food, feed, fiber, and industrial raw materials. Hybrid vigor--the geneticists call it heterosis--has been made widely useful in increasing the yield of plants.

An established hybrid crop variety that possesses heterosis or hybrid vigor (such, for example, as the present-day corn and onion hybrids) is the first-generation cross of inbred strains or strains which differ in their genetic composition. These strains are maintained year after year for seed production, as hybrids have no standard independent life. They are artificial in the sense that they could not be kept up on the ordinary farm except by the specialized farmer who grows new seed for a fresh start each spring. There have long been socalled crop hybrids that are not classified as hybrids in the modern sense. These are really the result of selection from the progeny of a cross and produce their own seed. There are still some varietal names that include the word "hybrid," although the varieties are not hybrids in the hybrid-vigor or heterosis sense, simply improved varieties selected from hybrids.

Corn hybrids in the short period of 25 years have gained 15 to 20 percent over open-pollinated varieties and have caused the farming public to expect similar improvements through the utilization of hybrid vigor in other crop plants. Informed scientists say these expectations will undoubtedly be fulfilled with respect to a number of our important crops.

It is relatively simple to produce hybrid seed corn because the wide separation of silks and tassels permits the ready detasseling of plants that produce the usable seed. Most crops other than corn have flowers which not only carry both the male and female elements but also are small and so do not permit simple removal of the male or pollen-bearing structures. The production of hybrid seed of such plants is not economically feasible. However, the scientists have overcome this difficulty in some cases by taking advantage of such peculiarities as male-sterile or self-sterile plants. A male-sterile plant has either no pollen or pollen that does not function, while a self-sterile plant is one whose flowers must be fertilized by pollen other than its own to produce seed. In the hands of plant breeders these factors are highly useful as they can be bred into various strains which can then be used as female parents in the production of hybrid seed for commercial growers.

A few years ago scientists of the Bureau of Plant Industry, Soils and Agricultural Engineering and the California Experiment Station discovered a male-sterile onion. This simplified the crossing and made possible the growing of hybrid seed on a commercial scale. The first hybrid onion, California Hybrid Red No. 1, is now

established in some areas in the West, giving early onion producers from 25 to 50 percent greater yield than they were able to get with the old open-pollinated varieties. Even more important is the fact that the geneticists at the Plant Industry Station, Beltsville, Md., have bred this male-sterility factor into other varieties and types of onions. This means that ultimately growers of all sorts of onions may be able to get hybrid seed and have added vigor in the crop.

The onion, like most plants, has open blossoms from which pollen moves naturally or can be moved from flower to flower with relative ease, an important factor in crossing. In the case of alfalfa the geneticists are using self sterility to produce hybrids in much the same way that inability to produce pollen was used to develop a practical hybrid onion for commercial growing. The small size of the flowers and closeness of the male and female parts are no particular obstacles under such conditions.

In addition to the various kinds of hybrid corn and the hybrid onion, seeds of other hybrids have appeared on the market recently. Among them are tomato, cucumber, and squash--all hybrids possessing hybrid vigor.

The Station scientists are not inclined to make sensational predictions, but they say that the discovery of male-sterile grasses, sorghums, and sugar beets, and the practical use of the hybrids previously mentioned are reasons to believe that there will be more and more crop hybrids, as both public and private plant breeders continue their work.

Wartime Nutrition at High Level: The national food supply furnished civilians with an unusually high level of nutrition during the war, according to a joint study, Nutritive Value of the Per Capita Food Supply, 1909-45, made by the Bureau of Agricultural Economics and the Bureau of Human Nutrition and Home Economics. Although the war-time food supply provided less calories and carbohydrates, the amounts of other dietary essentials were equal to or higher than in any other period since 1909. Increased consumption of almost all foods, particularly of milk, eggs, vegetables, and citrus fruits, plus the enrichment of white flour and bread, accounted for this high level of nutrition.

Farm Costs High--Returns Higher: High production and favorable prices in 1946 boosted the net returns of families operating 14 major types of farms well above their wartime peaks, a study by Ronald W. Jones, of the Bureau of Agricultural Economics, shows. Costs in 1946 were higher too, but took a smaller proportion of gross income than they did in prewar. Gains in net income in recent years were smallest on dairy and cotton farms where production has increased least and cost rates have advanced most.

Dehydrofreezing Process Preserves Foods: A new process of food preservation that combines most of the advantages of dehydration--namely, reduction in weight and volume--with freezing, has attracted much interest among food processors. The process, termed dehydrofreezing, was developed by the Western Regional Research Laboratory of the Bureau of Agricultural and Industrial Chemistry, and involves carrying the product through the first cycle of dehydration, and then freezing. Since the vitamins and flavor are virtually undamaged by this initial dehydration treatment, the product retains the fresh quality, and in some instances, notably boysenberries and apricots among the fruit products investigated, it retains the original shape. In consequence of the weight and volume economies, dehydrofreezing effects savings in packaging materials. The load

on refrigeration systems also is materially reduced. Reconstitution of dehydro-frozen foods is easier than that of dehydrated foods because of the greater moisture content of the former. Implications for the fruit and vegetable industries are lowered transportation, storage, packaging, and refrigeration costs.

Cottonseed Handling with Small Air Pipes: A mechanical system of seed handling with small air pipes, developed by engineers of the Bureau of Plant Industry, Soils, and Agricultural Engineering at the U. S. Cotton Ginning Laboratory, Stoneville, Miss., is now used in more than 500 gins in the Cotton Belt; it keeps cottonseed pure and uncontaminated. More of the small-pipe systems are being installed every year. In operation they consume less than half the power required in older seed handling systems. For handling grains, granular bulk materials, and various kinds of trash, the small-pipe systems are described by the engineers as economical and trouble-free. They enable the cotton producer and ginner to preserve the purity of the cottonseed because the equipment is self-cleaning. They have adequate capacity for moving from 70 to 160 pounds of cottonseed per minute from the gins--as fast as the cotton is ginned.

Light weight, these small-pipe systems are portable and can be used for loading from trucks to railroad cars at inland trackage points and for emptying the cars at seed breeders' treating and delinting plants, where the seed may be carried to storage bins and later moved to grading, sterilizing, and other processes at rates of handling to suit plant capacity. Cottonseed has been successfully handled by them for distances up to 700 feet. Installation costs are very little more than for the larger pipe and fan systems commonly used. The older types operate on 10 to 15 horsepower, but the small pipes require only 3 to 7 horsepower.

Better Home Canning of Low-Acid Foods: Three years of intensive research on household canning methods have enabled the Bureau of Human Nutrition and Home Economics to recommend new and improved processes (temperature and heating times for food in a canner) for home canning of low-acid foods. These foods include meats and practically all vegetables, except tomatoes, commonly canned in home kitchens. Procedures previously recommended were based mainly on industry's research. This work had shown that steam pressure is essential to safeguard low-acid food against botulism. When adapting industrial processes it was customary to lengthen them considerably to provide safety margins, since housewives could not copy industrial methods and precision. Hence excessive processing often made home-canned low-acid foods unattractive and low in vitamins.

In the Bureau's research, more than 4,000 glass jars and tin cans of beef, pork, chicken, and 12 low-acid vegetables were prepared, packed, and processed in home-type steam-pressure canners in the way homemakers do the job. Temperature changes inside jars and cans were recorded by sealed-in termocouples. To verify the amount of heat required to sterilize the foods, some packs were experimentally inoculated with bacteria even more heat-resistant than the botulinus bacillus. According to results of this work, vegetables in pint glass jars, and some in quart glass jars, may be processed at home in 25 to 50 percent less time than was previously recommended. It is necessary to lengthen processing times for a few vegetables, if quart-size glass jars are used. The new processing times for foods home canned in tin are quite similar to those in commercial use. For home-canned meats processing temperature has been set at 240° F. (10 pounds pressure), replacing 250° F. (15 pounds pressure) formerly recommended.

These improved directions offer important advantages to the 20,000 or more American families that annually can some of their own food supply. Using a steam-pressure canner, homemakers may now turn out a product which combines safety with better flavor, texture, and nutritive value than in the past, and at a saving of time and fuel. Since the new processes make safe canning more attractive, there is prospect that more homemakers will adopt the steam-pressure method for low-acid foods, which cannot be safely canned in a boiling water bath, oven, or open kettle. Aside from dubious safety, spoilage due to inadequate processing of home-canned foods has been excessive. In one recent year, spoilage of low-acid vegetables alone due to improper canning methods was estimated at a $1,500,000 loss.

More Eggs from Less Feed: Eggs account for more than half the income from poultry, although the rapid increase of the broiler industry in the last 50 years has been a significant development in poultry keeping, according to T. C. Byerly, poultry specialist of the Bureau of Animal Industry. In general it takes about a pound less feed to produce a dozen eggs than it did 50 years ago. Three average hens nowadays lay as many eggs as four average hens did 50 years ago. An increase in eggs per hen probably is the most important poultry gain during the half century. This is due primarily to the careful work of poultry breeders who have applied skillfully knowledge gained through experience and research in poultry genetics.

Raindrop Erosion: When raindrops strike bare soil, or thin films of water covering it, particles of clay, silt, and sand and bits of fine gravel fly through the air like tiny rockets. This is splash erosion. Much unprotected soil can be moved by splash erosion, depending upon soil type and velocity of raindrops. Experiments carried out by the Soil Conservation Service at Coshocton, Ohio, indicate that 8.25 inches of artificial rainfall, falling at a velocity of 19 feet per second, caused a 1-inch layer of soil to erode and splash away. This seems bad enough, but when the raindrop velocity is increased to 35 feet per second, the erosive action is 10 times as great. Moreover, the impact of raindrops on bare soil breaks down soil aggregates and seals the surface so as to reduce the rate of water infiltration into the soil. Farmers have science on their side when they prefer slow, soaking rains to hard thundershowers. Vegetative cover that breaks the impact of raindrops offers the best known means of preventing splash erosion. The Coshocton studies give added proof of the value of winter cover crops and stubble-mulch practices.

Rapid Method of Detecting Compression Wood: A simple electric-light box was devised by the Forest Products Laboratory of the Forest Service for the quick detection of compression wood, an abnormal type of wood produced on the lower side of leaning softwood trees. Such wood has erratic strength properties, shrinks excessively and unevenly along the grain, and is unusually hard and unsuited for many uses. Only an experienced eye can detect it. The box throws a beam of light through thin cross-sections of wood and thus shows up compression wood even to unskilled workers, because it is much more opaque than normal wood. It should find many uses in shops employing refined construction methods for aircraft, ladders, masts, oars, structural members of buildings, and even boxes, in all of which compression wood is objectionable.

Cotton Gin Improvements: "Mistifiers," which eliminate static electricity generated by movement of dry cotton through a gin and permit ginning of full-weight bales, have been investigated by agricultural engineers of the Bureau of Plant Industry, Soils, and Agricultural Engineering. Static electricity

causes cotton to bunch up, clogs the gin machinery, prevents lint from packing uniformly in the press box, and creates a fire hazard. The engineers found that adding sulfanated oil mist to the lint eliminates the static and permits better, continuous ginning and pressing of the lint into full-weight bales. The "mistifiers" are being tested in 18 commercial gins. New cotton-cleaning systems increasing bale values $8 to $16 each have been devised by the engineers in the past year. Superimposed upon regular ginning equipment, the cleaners remove dirt, leaves, sticks, and other trash that accumulate inordinately in machine-picked cotton.

Introduced Bamboos Valuable: For several years the Department of Agriculture Experiment Station in Puerto Rico introduced various species of bamboo, and in 1935 more extensive work was undertaken in this field. At present 36 species and varieties have been established on the station grounds. Several have been found highly resistant to the bamboo powder-post beetle which often destroys cut culms. As a result of these introductions Puerto Rico now has a split-bamboo fishing rod industry and a bamboo furniture industry, employing over 100 people. It is hoped to duplicate these industries in many small mountain communities of the Island with serious rehabilitation problems. During 1946, 18,062 bamboo offsets were distributed for planting. The Puerto Rico Development Company has set up a purchasing center for buying cured culms of bamboo from local farmers.

Breeding Better Hogs: Faster-growing hogs of superior conformation and greater liveability are resulting from experiments of the Regional Swine Breeding Laboratory, Ames, Iowa, conducted by the Bureau of Animal Industry and 13 State agricultural experiment stations. The research involves carefully planned systems of matings in which inbreeding, signifying the use of closely related parents, has a prominent part. The main purpose of inbreeding is to fix desirable characteristics. Hogmen, using their farms as proving grounds, are cooperating with the scientists by testing boars produced by the various systems of breeding. Thus far, over 500 boars from the various projects have been released to farmers for practical tests of breeding excellence. Five breeds and 3 lines from crossbred foundations are represented in the research. The degree of inbreeding in most of the lines ranges between 25 and 50 percent. Experiment-station data, with reports from farmers, indicate that mating boars from good inbred lines to noninbred sows results in about 100 pounds more weight per litter, when the pigs are 6 months old, than that of litters sired by non-inbred boars of the same breeding as the sows. Crosses involving three inbred lines, all within the same breed, are a promising method of growing still more pork per mating.

Tailoring Tools to Contour: Not long ago, potato farmers in the rolling-hill country of Aroostook County, Maine, were on the horns of a dilemma. If they kept on farming up and down hill, they would eventually lose all their topsoil and be forced out of business. But when they put in terraces and farmed on the contour, they had machinery troubles. Conventional planters, sprayers, and harvesters simply did not produce best results. These Maine farmers had a lot at stake. Theirs is a fine potato county. Aroostook County farms yield an average of 275 bushels of potatoes to the acre. Each harvest around 12 million barrels of spuds are sent to market or put in storage. Fortunately, they could rely on the scientific knowledge of Soil Conservation Service researchers and engineers. In particular, they had the help of John W. Slosser, who spent several years redesigning potato machinery for efficient operation along hillsides.

Take the potato sprayer, for example. The old type multiple-row sprayer, with rigid cross boom, gave trouble over terraces and along fairly steep slopes. The up-hill nozzles were too high; the down-hill nozzles too low. Slosser set to work and came out with a new principle. On his sprayer each boomlet slides along the ground on a metal shoe. Thus the nozzles are always the same height from the ground--the right height for an efficient job. Slosser also rigged up a tank truck that carries 770 gallons of water, meters out the spray chemicals, and then makes a perfect mix.

Then Slosser tackled the multirow planters and diggers--again with happy results. He hinged the working parts of a 2-row pull-type planter to a bar controlled by the soil surface. Not only does this insure proper depth and spacing, but the planter can be operated by one man instead of the two commonly employed. On the potato digger Slosser doubled efficiency by hinging the rear of the digger blade and elevator to follow the ground level. Then he arranged a crank and leveler so that the rear wheels and the separating platform can be leveled for side-hill operation. The majority of Maine potato farmers are now saving their soil and producing excellent crops, though some machinery problems remain to be solved, and are still under study.

Ethyl Alochol Production from Wood Waste: Since construction began of an Oregon plant to produce ethyl alcohol from Douglas-fir wood waste by a laboratory-devised process, the Forest Products Laboratory of the Forest Service, through continuing research, has increased the plant's potential output from 4,000,000 to more than 5,000,000 gallons annually. This research makes possible a continuous process of wood hydrolysis rather than the batch process hitherto used in Germany and elsewhere. The time necessary for hydrolysis has been reduced to one-eighth that used in the German Scholler process, and simultaneously the yield of alcohol per ton of wood has been stepped up by about 10 percent. At the same time better fermentation methods were developed by which both yield and concentration of alcohol from wood sugar are increased. Moreover, it was found that, on the residue remaining in the still after removal of the alcohol, fodder yeast rich in vitamin content could be grown at the rate of 2 pounds of dried yeast per gallon of alcohol produced.

Motor Fuels and Other Products from Agricultural Residues: A process for converting corncobs, sugarcane bagasse, peanut and oat hulls, cottonseed hulls and burs, and flax shives into sugar solutions for fermentation and chemical processing into liquid motor fuels (with several byproducts) has been developed on a laboratory scale by the Northern Regional Research Laboratory of the Bureau of Agricultural and Industrial Chemistry. It is a continuous 2-stage process for converting the cellulose of such materials into a solution of dextrose, and the hemicellulose (principally xylan) into a solution of xylose and furfural, leaving the lignin as an insoluble residue. In the first stage about 95 percent of the xylan is converted by treatment with dilute sulfuric acid into xylose and a small amount of furfural. In the second stage the cellulose is converted into dextrose by a novel procedure that includes impregnation of the dried material with concentrated sulfuric acid at a low temperature. The conversion is accomplished in 1 to 2 percent of the time and with less than 25 percent of the acid required by other known concentrated-acid processes. The xylose can be converted by known chemical processes into furfural, an important material for chemical industries, or, after the small quantity of furfural in the original xylose solution is removed and the solution is neutralized with lime and filtered, the xylose can be recovered in crystalline form or mixed with dextrose and converted by bacterial fermentation into butyl alcohol and acetone.

The dextrose solution, resulting from digestion of the acid-impregnated cellulosic material with water, can be fermented with yeast into ethyl alcohol. Crystallization of the dextrose may offer commercial possibilities. This process was recommended by the Department of Agriculture for further trial on a semiworks scale as a part of the Government program for the development of synthetic liquid fuels from nonpetroleum sources. The research is now moving into semicommercial-scale production at a new plant recently constructed under the Synthetic Liquid Fuels Project at Peoria, Ill. This plant is designed to handle enough agricultural residues to produce at capacity 2,000 pounds of glucose in 10 percent solution, 1,600 pounds of xylose in 15 percent solution, 200 pounds of furfural, and 1,000 pounds of lignin in an 8-hour day. From the fermentable material 500 gallons of alcohol can be made per day. This experimental work will accomplish two purposes. It will show maximum yields of various products from a given tonnage of different agricultural residues, and will provide a basis for computing costs and determining the feasibility of commercial production.

Favorite Tropical Lawn Grass: Since 1936 the Department of Agriculture Experiment Station in Puerto Rico has been experimenting with Zoysia matrella, or Manila grass, for use on tropical lawns. This grass has received publicity in the States as an ideal lawn grass. In Puerto Rico under tropical conditions it has proven superior to such commonly used grasses as Java, Bermuda, centipede, St. Augustine, and carpet. Manila grass has a pleasing, moderately deep shade of green, grows slowly, requires less attention in weeding and mowing, produces a thick mat which feels like a heavy rug under foot, has no serious insects and diseases, withstands drought, and grows well in moderately dense shade. It is tough and withstands considerable foot wear, but is difficult to cut with a hand lawn mower. A rotary-power mower, however, cuts it easily. At present the grass must be propagated by sod blocks, but the station is seeking a seed treatment to induce higher germination. Seed is produced abundantly in Puerto Rico, but little seeding has been reported under most conditions in the United States.

Starfish Meal for Growing Chickens: Starfish, though a serious pest in oyster beds, may be an asset to poultry growers, the Bureau of Animal Industry concludes from a series of tests of starfish meal fed to young growing chickens. Shortages of protein feeds for livestock led research workers to experiment with several materials formerly discarded or poorly utilized by various industries. One was starfish, which oystermen take in quantity in cleaning oyster beds. Whole starfish, when sun dried and ground into meal, contains about 39 percent protein, 19 percent calcium, and smaller quantities of other nutrients including phosphorus. Tests of its suitability for poultry feeding showed that it compares favorably with sardine meal, familiar as an ingredient of poultry feeds. Though a good source of protein, starfish meal gave best results when fed in rather small quantities. Too large an amount supplies an excess of calcium. On the basis of these tests, the investigators advise poultrymen to limit this meal to 3.5 to 5 percent of the diet. Even this limited proportion supplies chicks with considerable protein and calcium enough for their needs.

South Welcomes New Legume: As a cover crop to hold the soil during winter and to increase its fertility, blue lupine has made a tremendous hit with peanut producers in Georgia, Alabama, and Florida. During the war more peanuts were needed for food and oil. This placed a heavy burden on the highly erodible, sandy soils of the Peanut Belt. Alarmed at the possibility of severe land damage, farmers asked the Soil Conservation Service to help them find a suitable winter cover crop to follow the peanut harvest. Blue lupine was the answer. Used as a

soil builder in central European countries for more than two centuries, blue lupine is now flourishing in southern United States. It grows well on soils of low fertility and produces an abundant seed crop. Blue lupine, like many other legumes, has root nodules that extract nitrogen from the air and improve the soil when the lupine is plowed under in the spring. The plant's drawback is that it has an alkaloid poisonous to most livestock. Farmers of Georgia, Alabama, and Florida harvested an estimated 50 million pounds of blue lupine seed during 1946 to use for planting in the fall of 1947. Annual seed production may reach 100 million pounds in 5 years. In the South's Peanut Belt farmers say blue lupine has come to stay.

Hydrogenation of Lignin and Wood: It has been shown from research at the Forest Products Laboratory of the Forest Service that lignin dissolved in organic solvents or suspended in water can be made to react with hydrogen gas at elevated temperatures and pressures in the presence of various metallic catalysts. Among the products of the reaction are several new cyclic alcohols that had never been previously described in the literature. These show promise as plastic solvents, antiknock agents for motor fuel, and toxic agents. By varying the hydrogenation conditions, phenolic compounds which may find use in plastics and complex neutral oils, together with a plasticlike residue, are obtained. Wood waste or chips also can be hydrogenated in aqueous suspension to produce soluble lignin decomposition compounds and a cellulose pulp residue. This is a possible new pulping process that will be studied further by the laboratory. Under more severe hydrogenation conditions the cellulose can be converted to glycerine and sugars. In this case the entire wood is converted to liquid products. All these findings are too new to predict their future application now. Most of the data have been obtained in small bombs and in continuous hydrogenation equipment designed for other hydrogenation reactions. Continuous hydrogenation equipment is being built for further work.

New Type Slatted Floor Hay Drier: Mow curing of hay over a barn drier system using forced air has become popular in some sections of the U. S. and is the generally recommended type of drier installation, particularly in the eastern humid regions. It is of the slatted-floor design, devised by agricultural engineers in cooperative research with the Virginia Experiment Station. More than half the drier systems now being installed are estimated to be of this type as well as half the present total of about 2,000. The slatted floor drier is simple in design. It consists of a tapering central air duct open at the sides on the bottom to allow the air to flow to the slatted floor and up through the hay. The slatted floor can be built of rough lumber and laid by inexperienced carpenters, insuring low-cost construction. The experimental tests have shown that duct-pressure losses in driers of this design, properly operated, are less than half those of the conventional duct systems. Air distribution is better and air flow through the hay is increased.

Worth of Farm Business: How much money is the whole U. S. farm business worth? Economists in the Bureau of Agricultural Economics are bringing together their annual balance sheet of agriculture for 1947. Viewed as a composite business, the balance sheet for last year (January 1, 1946) showed American agriculture was valued at $101,500,000,000, farm real estate was valued at $56,584,000,000, other physical assets at $24,888,000,000, and financial assets of farm operators totaled $20,050,000,000. Owners had an equity in this total amounting to $93,185,000,000, and creditors had an $8,337,000,000 claim on these assets. It was estimated that the net shrinkage in value of farm buildings, machinery, and equipment as a result of low maintenance may have been nearly $800,000,000

for the years 1942-45. The total farm mortgage debt declined by $190,000,000 to $5,081,000 during the year 1945. The mortgage debt declined 23 percent between January 1, 1940, and 1946.

New Method for Quinine Analysis: A simple rapid method of extracting and determining quinine in cinchona bark has been devised at the Department of Agriculture Experiment Station in Puerto Rico. The method has the advantage of requiring small samples of bark (1 gram) and can be used to determine small amounts of quinine; any quinidine present also is measured as quinine. The method may be particularly useful in evaluating young cinchona seedlings for anti-malarial constituents in a breeding and selection program. The method also can be used in assaying samples of cinchona bark for commercial purposes.

Rutin Extracted Commercially from Buckwheat Plants: Rutin is a little known flavonol glucoside occurring in various plants, including tobacco. In work on the industrial utilization of tobacco, the Eastern Regional Research Laboratory of the Bureau of Agricultural and Industrial Chemistry determined the percentage of rutin in different kinds of green and cured tobacco and developed methods for the extraction of rutin from tobacco and other plants. By these methods the Bureau extracted enough rutin from flue-cured tobacco for cooperative research on biological effects of rutin by the Bureau of Animal Industry on its therapeutic value by the Medical School of the University of Pennsylvania.

Rutin was found to be nontoxic to laboratory animals and clinical patients. The clinical tests showed it to be definitely effective in treating a pathological condition known as "increased capillary fragility," which is sometimes associated with high blood pressure and causes minute blood vessels or capillaries to rupture--occasionally in the eye or brain with attendant blindness or apoplexy. Most of the patients treated with rutin showed marked improvement, especially where it was combined with remedies for high blood pressure.

Analysis showed that buckwheat is more promising than any other plant examined as a commercial source of rutin. While the percentage of rutin in buckwheat is highest (about 3 percent on dry weight of plant exclusive of roots) when the plant is in bloom and before any seeds are set, the greatest yield per acre is obtained about 3 weeks later when the plants have made their maximum growth and set all their seed. At this time the yield per acre is $3\frac{1}{2}$ to 4 times as great as at the time of highest concentration in the plant. Most of the rutin is in the leaves, very little is in the stems, and none is in the seeds. Much of the rutin is lost when the plants are dried, especially if dried slowly. Under the best drying conditions more than a third of the rutin is lost.

During the summer of 1945 about 300 pounds of rutin were extracted from green buckwheat plants by 4 drug manufacturers with technical guidance by chemists of the laboratory. This rutin was used by the firms' research staffs and supplied in tablet or capsule form to interested physicians for experimental use.

Approximately 12 pharmaceutical companies planned to manufacture rutin during the 1946 season, with an indicated production of from 10,000 to 20,000 pounds. This quantity is sufficient to treat 200,000 to 400,000 cases for a full year. The higher production figure (20,000 pounds) would require about 4,500 tons of fresh buckwheat plants or an equivalent quantity of dried buckwheat leaf meal.

Better Milk Yields by Housing Cows in Pen Barns: At the Huntley, Mont., field station of the Bureau of Dairy Industry, where both the conventional type of stanchion barn and the pen-type barn are used for housing milk cows, better milk yields have been obtained from the cows housed in pen barns than from those in stanchion barns. In an experiment to compare the merits of the two systems of handling cows in milk, two comparable groups of cows were used. One group was fed a rather liberal grain ration and the other a limited grain ration, each group being housed first in one type of barn and then in the other. All cows were milked 3 times a day. The 7 cows fed the liberal grain ration produced on the average 18,402 pounds of milk and 684 pounds of butterfat (calculated to maturity) when housed in the pen barn. This was 19 percent more milk and 18 percent more butterfat than they produced when kept in the stanchion barn. The 7 cows fed the limited grain ration produced on the average 14,319 pounds of milk and 501 pounds of butterfat (calculated to maturity) when housed in the pen barn. This was 8 percent more milk and 6 percent more butterfat than they produced when kept in the stanchion barn.

Each system has advantages and disadvantages, which vary with local conditions. The pen barn, or loafing barn as it is sometimes called, often consists of an open shed that can be partly or completely closed against severe weather. The cows run loose and get their roughage from mangers or racks inside the barn or outside in the lots. They are milked and fed grain in a separate milking barn. The stanchion barn has a concrete floor and the cows are always confined by rigid stanchions, even while being fed and milked, although they may exercise in an open lot when the weather permits. The pen-barn floor is of earth, and the manure and bedding are allowed to accumulate. The manure can be removed once or twice a year, whereas manure must be removed daily from the stanchion barn. The pen barn requires considerably more bedding, however, and this is an important disadvantage if bedding is scarce or expensive. The cows unquestionably are more comfortable in the pen-type barn, and this probably was the reason for the higher milk production in the pen barn in the Huntley experiment.

Laminated Paper Plastics Containing Lignin: New lignin plastics evolved by the Forest Products Laboratory of the Forest Service and commercial cooperators, and now in commercial production, give strong promise of providing a quantity outlet for much lignin wasted annually by many pulp mills. The plastic consists of paper filled with lignin, which serves as the bonding agent in place of more expensive synthetic resins. For many electrical and decorative applications, it has been found equal to, or better than, more costly plastics.

Scientific Apple Storage: More Pacific Northwest apples in prime condition are becoming available at eastern markets throughout late winter and spring, as growers increasingly adopt handling and storage recommendations of specialists of the Bureau of Plant Industry, Soils, and Agricultural Engineering and the Farm Credit Administration. These recommendations involve a new principle called "reversed air" cooling. Apples of the Delicious variety are particularly sensitive to storage conditions. Research has shown, however, that ripening can be retarded and storage life lengthened by rapid reduction of fruit temperature to 30° - 32° F. Growers following the new practices can make the most effective use of refrigeration.

The new designs and installation specifications for cold-storage houses aim at faster and more uniform fruit cooling by forced circulation of refrigerated air. Large quantities of air, and delivery and return ducts spaced as far apart as possible, increase air velocity and hasten cooling. Reversed air cooling provides for input of cold air or removal of warmed air through the same ducts.

Reversal of the air movement at regular intervals, usually about 3 hours, makes possible the use of colder air for rapid precooling without danger of freezing, as none of the fruit is exposed continuously to the incoming cold air.

Fruit is harvested at optimum maturity and sorted into blocks for early, middle, and late shipment, so that preferential treatment can be given apples to be held longest. The best fruit is put in storage at once, preferably the morning after picking when the night air has removed some of the heat. It should reach storage temperature within a week and be kept there until shipped to market under refrigeration. Apples for late fall or midwinter sale have second place in the cooling schedule. They are brought down to storage temperature less rapidly, but get additional refrigeration later as it can be spared from the late-shipment block. BPISAE specialists recommend that the part of the apple crop of lowest storage quality be packed as received from the orchard and shipped early with little or no cooling in storage.

Plywood Adhesive from Soybean Meal or Corn Gluten: A new waterproof plywood adhesive having considerable binding strength has been developed by the Northern Regional Research Laboratory of the Bureau of Agricultural and Industrial Chemistry. It is made by combining solvent-extracted soybean meal freed of its water-soluble constituents, or corn gluten, with phenolic resin in the intermediate or water-soluble form. A commercial trial demonstrated that excellent plywood could be fabricated with such a glue, which becomes insoluble on setting. A plywood manufacturer made practical use of this discovery and has consumed large quantities of a commercial brand of soybean meal in making waterproof plywood. A manufacturer of soybean meal offered to supply a large amount of the proper quality to companies interested in the use of a soybean-modified, phenolic-resin plywood adhesive. So prospects are good for increased industrial utilization of soybean meal in adhesives. Since the new adhesive costs less than other waterproof adhesives and results in plywood suitable for use as such, or as concrete-pouring forms in building houses and other structures, it should help to reduce construction costs on farms and elsewhere.

New Storage for Potatoes: Potatoes may taste better later in the season, thanks to a new type of storage house developed by engineers of the Bureau of Plant Industry, Soils, and Agricultural Engineering in cooperation with several State experiment stations. The house enables cool air to circulate under and around the potato bins instead of through the mass of potatoes, a method known as shell cooling. The high relative humidity in the bins helps lessen shrinkage and deterioration, but the air outside the bins has somewhat lower relative humidity which reduces damage to the structure. Shrinkage losses of the 10 million bushels of late-crop potatoes now stored each year in improved storages of this type in the U. S. are 1 to 10 percent less than in other types. Shell cooling and other improvements in storage houses are being widely adopted in Maine, Michigan, North Dakota, Nebraska, and Colorado.

Nightshade Berries Removed from Canning Peas: Nightshade is a troublesome weed in the commercial pea-growing areas of Oregon and Washington, where about one-fourth of the Nation's supply of canned peas is packed. Its immature berries, which closely resemble peas, cometimes contaminate mechanically harvested shelled peas because they are not removed by the usual cleaning equipment. A simple, inexpensive method for removing the berries and other foreign material from mechanically shelled green peas has been developed by the Bureau of Agricultural and Industrial Chemistry's Fruit and Vegetable Products Laboratory, Pullman, Wash., in cooperation with the Washington Agricultural Experiment Station and commercial pea canners. This new process is based on the difference in the wetability of shelled peas and nightshade berries.

This difference is enhanced by applying a very small quantity of mineral oil in a preliminary treatment, after which the peas are fed mechanically into the top of a tank containing a foaming emulsion. Properly handled, this mixture permits the nightshade berries, other weed seeds, and debris to float away, while the peas settle to the bottom of the tank where they may be drawn off. Most of the oil is removed from the peas by rinsing, and all but a minute trace is removed in the usual blanching operation before canning. During the 1946 season the cleaning process was in large-scale commercial use at 4 canneries that had installed "in line" machines capable of cleaning from 2 to 4 tons of shelled peas per hour.

High-Frequency Heat for Gluing Wood Products: Methods and equipment for using radio-frequency heating to set glues in wood products have been developed by the Forest Products Laboratory of the Forest Service. It has been demonstrated that high-frequency dielectric heating can be employed advantageously in the mass production of articles which require the use of expensive jigs and other apparatus. The rapidity with which the glue is set--in seconds rather than hours--enables manufacturers to use such apparatus at a much faster rate, thus cutting unit costs of their products. High-frequency heat appears to hold especially great promise in furniture manufacture and production of laminated timbers for land structures and ships.

Master Sample: The Bureau of Agricultural Economics, in cooperation with the Bureau of the Census, has completed the drawing of a "Master Sample" of farms, which is in effect a small replica of all the farms in the United States. Every county containing agricultural enterprises is represented. The sample consists of about 67,000 small sample areas which average about 2.5 square miles in size and contains an average of about 5 farms each. One of the principal features of the Master Sample is its adaptability to various needs. The number of sample areas to be enumerated for any survey may vary widely, depending on the type of survey, the universe to be covered, and the accuracy desired. The sample can be used not only for Nation-wide studies, but for regional, State, or special crop-area studies as well. A further advantage of this sample over other sampling designs is that in clustering the units of observation (farms) by sample areas, considerable savings in survey costs are effected through reduction in travel between farms. This results in a great increase in sampling efficiency per dollar spent.

The first large-scale use of the Master Sample was in connection with the 1945 census of agriculture. It has also been used in connection with field surveys by BAE as well as by other agencies, and materials are being made available to State agricultural experiment stations in connection with their surveys. The materials assembled in the drawing of the sample are very useful and will save much in costs of future samples. These materials consist of: (1) Large-scale highway maps of all counties in the U. S. with information on them useful for sampling; (2) listing sheets showing all villages, towns, and cities having an estimated population of 100 or more; (3) tabulations of farms and dwellings by small geographic areas; (4) transparent "positive" county maps from which an unlimited number of county maps showing the sample areas can be reproduced by the ozalid process; and (5) aerial photographs covering over 90 percent of the sample areas. If additional sample areas are needed for any county or group of counties, these can be readily provided at relatively small cost.

Phenothiazine as Anthelmintic: Phenothiazine is a synthetic organic chemical first prepared in the latter part of the nineteenth century. It is one of the thiazine dyes. Following the discovery and announcement that phenothiazine was effective as an insecticide, its value as an anthelmintic was studied and established in 1938-39 by Harwood, Jerstad, and Swanson, workers of the Bureau of Animal Industry. Experimentation with this drug has been continued to develop the best methods of use. Phenothiazine is now widely recognized throughout the world as a highly effective anthelmintic for the removal of many injurious internal parasites of domestic animals. It is the most valuable single drug so far discovered for combating such parasites. The drug is distributed commercially in powder form and may be administered either in gelatin capsules, in ground feed, in salt, or as a drench, the choice depending usually on the species of animals and preferred method of handling them. For use as an anthelmintic, phenothiazine should be the pure product prepared especially for that purpose.

In 1-ounce doses phenothiazine rids sheep and goats of stomach worms, nodular worms, hookworms, and related pests. Its use prevents the spoiling of the sheep's intestines by nodular worms, thus providing an additional war material for making surgical sutures when they were greatly needed. In suitable doses which vary with the size of animals, phenothiazine is effective in removing several kinds of parasites from swine, cattle, horses, and mules. In very small doses this drug is effective also in removing cecal worms from poultry. These worms transmit blackhead to chickens and turkeys. The extensive use that phenothiazine already has acquired for controlling animal parasites is evident from the quantity--about 3 million pounds--used in the United States in 1944. Recently a mixture of 9 parts salt and 1 part phenothiazine, when made available to sheep, has been found largely to prevent acquisition of the parasite.

Insecticide Dispersing Equipment: Recent development of the more effective insecticides, such as DDT, has made it necessary to develop equipment to disperse these materials properly and economically. As early as 1928 the Bureau of Entomology and Plant Quarantine studied methods for the proper dispersal and adherence of concentrated conventional sprays. Spray mixtures were applied in atomized form so as to get effective coverage with a small volume of liquid. Insecticide formulations tried were 100 times more concentrated than conventional insecticides then in common use. These sprays were applied with various known types of spraying equipment. Considerable information was obtained on atomizing principles, particle size, and adherence.

The Bureau, in cooperation with industry, has recently tested models of power blowers designed to disperse the new insecticides in finely atomized forms. Different types of nozzle assemblies have been developed for atomizing liquid insecticides and for introducing dusts and liquid, either alone or in combination, into air blasts. Tallest shade trees can be effectively covered by this method. Much less spray material is used by this method than by the conventional type equipment used for applying dilute liquid insecticides. The new mist blowers are especially well adapted for treatment of shade and roadside trees and orchards.

Photoperiodism: While working with Maryland Mammoth tobacco prior to 1920, W. W. Garner and H. A. Allard, of the then Bureau of Plant Industry (now Bureau of Plant Industry, Soils, and Agricultural Engineering), discovered that the plants flower only when the daily period of illumination is relatively short--that is, when the days are short and the nights long. When the light periods are long, the plants remain vegetative. Subsequent experiments on

many kinds of plants showed clearly that they differ greatly in growth and flowering, responding with respect to the relative lengths of the daily periods of illumination and darkness to which they are exposed, some conforming to the behavior of Mammoth tobacco, others responding to relatively long illumination periods, and still others being but little affected.

This discovery departed widely from the prevalent theory that mere intensity of illumination was the principal light factor in determining the characteristic growth, flowering, and fruiting of plants. It had great fundamental importance as pure research, and as it developed widespread practical significance. Response to relative length of day and night largely explains changes in behavior where plants are carried from one latitude to another. It is now possible, by conducting experiments under controlled conditions, to tell in advance whether certain varieties of soybeans, peas, onions, timothy, barley, and other plants are adapted to the photoperiodic conditions prevailing in specific localities. Experimental crops can be grown under greenhouse conditions anyway, with supplemental artificial light as needed; if none is adapted to the locality, one or more suitable lines can be bred.

This discovery also has been particularly helpful in selecting soybean varieties that thrive and produce abundant seed for making oil, plastics, and food products in various localities. It enables us to produce our own beet seed domestically instead of importing it as formerly. It enables us to select localities where pyrethrum, a long-day plant, will thrive in the United States, and also to cross plant varieties which would not normally flower at the same time, as in the case of sugarcane varieties. By artificially shortening the daily light period, chrysanthemums and other flowers are now brought to market ahead of their normal season.

Cross-Breeding Experiment with Dairy Cattle: The Bureau of Dairy Industry began this experiment in 1939 at Beltsville (Md.) to explore the cross-breeding of dairy cattle. Few experiments in crossing dairy breeds had been conducted before, especially with animals of known producing ability. All foundation animals in the experiment were of known production or transmitting ability. Production-tested cows of four dairy breeds--Holsteins, Jerseys, Guernseys, and Red Danes--were available, as were also proved sires of the same breeds except Guernseys. Funds for the experiment were available through the Bankhead-Jones Act of 1935.

The experiment differs from the usual pattern of cross-breeding, in that only a limited number of interhybrid matings are being tried. The major plan calls for continuous introduction of new genes (units of inheritance) through the use of proved sires of the respective breeds. Females resulting from the mating of two breeds are being mated to a proved sire of a third breed. The resulting 3-breed females so far have been mated to a proved sire of one of the same breeds as in the first cross, for a second round of the three breeds involved. All cows are milked 3 times a day for 365 days, and bred $4\frac{1}{2}$ months after calving. No culling is practiced and all females are tested for production.

Thirty-two females representing various combinations of the two breeds have completed production records, averaging 12,842 pounds of milk and 592 pounds of butterfat, at the average age of 2 years 2 months. The great majority of these 32 crossbred heifers are better producers than their dams. Some increase was expected because of the high level of production inheritance transmitted [illegible] by careful analysis of

increase, however, turned out to be approximately 20 percent more (on the average) than was expected. This may be the result of hybrid vigor.

Four 3-breed heifers have completed production records, averaging 14,837 pounds of milk and 645 pounds of butterfat, at the average age of 1 year 11 months. So far every 3-breed heifer is better than her 2-breed dam. One of the striking characteristics shown by all the crossbred heifers is their persistency in milk production. In many cases the monthly butterfat production varies less than 10 pounds from the high to the low month.

Copper and Manganese Reserves in Young Animals: Observations have recently been made at the U. S. Plant, Soil, and Nutrition Laboratory at Ithaca, N. Y., on guinea pigs, rabbits, and rats with respect to copper and manganese reserves of the young. Animals are born into the world with a reserve store of copper in their livers. This reserve is usually enough to tide the young over the suckling period in which the intake of copper is inadequate due to the low copper content of milk. Since the copper reserves are depleted during the suckling period, it is necessary in the interest of adequate nutrition to supply some source of available copper during a prolonged period of suckling. As contrasted to copper, the same animals were born with little or no reserves of manganese in their livers. However it appeared that the animals studied obtained enough manganese in the dam's milk to permit manganese to steadily rise in the suckling offspring. Whether or not the dam's milk supplies enough manganese for optimum nutrition of the young remains to be determined.

Cobalt Deficiency in the United States: The U. S. Plant, Soil, and Nutrition Laboratory at Ithaca, N. Y. is making surveys of mineral deficiencies in the U. S. Cobalt deficiency seems to be more widespread than had been previously anticipated. Reports of cobalt deficiency in forage animals have been made from Wisconsin to Maine and along the Coastal Plain to Florida. Deficiency of cobalt in the forage results in a loss of appetite in the animals, some anemia, and a general "wasting away." If the deficiencies are extreme and are not corrected, they result in the eventual death of the animal. The deficiency may be cured by feeding the animal small amounts of cobalt salts. Through a study of the various reports, evidence is accumulating that certain types of soils are more apt to be deficient in cobalt than other types. It is hoped that, through a detailed study of the cobalt content of soils and vegetation in various regions, a generalization as to the type of soil and the amount of cobalt necessary to give best growth of animals may be reached. It is possible that in many areas just sufficient cobalt is present to give fair growth of the animals and actual deficiency symptoms are not recognizable. It may be that additional cobalt in these cases would result in better growth and health of the animals, and it is anticipated that careful laboratory studies of the problem will lead to the correction of these marginal deficiencies, as well as the precise demarcation of the areas where acute deficiencies occur.

Vitamin C Content of Tomatoes: Factors which might influence the vitamin C content of tomato fruits have been studied at the U. S. Plant, Soil, and Nutrition Laboratory at Ithaca, N. Y., for a number of years. The results to date indicate that soil fertilization has little or no influence on the amount of this vitamin in ripe tomato fruits, except that the application of large amounts of nitrogenous fertilizers tends to reduce the vitamin C content. On the other hand, the amount of light received by the fruits while they are ripening apparently has a tremendous influence upon their vitamin C content. Regardless of the amount of illumination which the leaves of the plant receive, tomato fruits which ripen in the shade are low in vitamin C. Shading only the

fruits is as effective in producing a low vitamin C content as shading the whole plant. Conversely, exposing only the fruits to full sunshine is as effective in producing fruits containing large amounts of vitamin C as exposing the whole plant to full sunshine. The wide variations observed in the vitamin C content of tomato fruits may be largely the result of differing degrees of illumination of the fruits during ripening. Part of the varietal differences may be related to this factor and plant breeders may want to keep this in mind in selecting new tomato varieties. The application of nitrogenous fertilizers may reduce the vitamin C content simply by resulting in greater shading of the fruits.

Tropical Kudzu: In cooperation with the Soil Conservation Service the Department of Agriculture Experiment Station in Puerto Rico has been working on new legumes for the Western Hemisphere tropics. Pueraria phaseoloides, locally named tropical kudzu, appears to have all the favorable points which have made kudsu so popular in the Southern States. Ordinary kudzu will not thrive in the tropics, but tropical kudzu, its close relative, thrives well and produces a heavy forage crop. It serves excellently as a soil-erosion plant, and will control erosion on steep hillsides and deep gullies. The protein content of the leaves is high, and the plant is palatable to animals. It grows well together with other grasses, thus improving the quality of fresh cut feed. It has drought resistance, a distinct advantage in Puerto Rico. Interest in this legume has been widespread, and requests for seed have been received from nearly every tropical country of the Western Hemisphere, as well as from the southernmost areas of the U. S.

U. S. DEPARTMENT OF AGRICULTURE

Office of Information
Mr. Harding

No. 6
Revised January 1, 1948
A USDA Document

IMPORTANT RECENT ACHIEVEMENTS OF DEPARTMENT OF AGRICULTURE SCIENTISTS

Shrinkproofing Wool: Extensive investigations made by the Production and Marketing Adm'n. Wool Laboratory on the treatment of wool to reduce or eliminate felting showed that certain chemicals had a pronounced effect in decreasing the shrinkage of wool. More intensive investigations were begun and carried on for about 2 months. The reaction of all materials under test, including wool, showed that fibers of other fabrics could be made equally shrinkproof with the same formula. It was also found possible to carry out the reaction so that wool could be rendered completely shrinkproof, something that had never before been done. Since the test material produces a profound alteration in the basic make-up of the wool fiber, it appears probable that the modified wools, in addition to being shrinkproof, may be proof against moth and mildew also.

Bamboo: Bamboo flowers are decidedly uncommon. They turn up something like once a half century and are usually pale green and relatively inconspicuous. Bamboo seed also is a rare commodity, hence the big grass is normally propagated by dividing old clumps. When the Federal Experiment Station at Mayaguez, P. R., had a good set of bamboo seed in 1945 and 1946, many were used to test methods of storing and planting. Since fruiting and flowering occur only in plants from 20 to 80 years of age, few have had experience in handling the seed. Bamboo seeds resemble oats, do not seem to be long-lived, and, if they must be stored, storage should be dry and cool, but it is best to plant them quickly.

Dye Test for Cotton-fiber Maturity: Chemists at the Southern Regional Research Laboratory are developing a most ingenious quick dye test for maturity in fibers of unprocessed cotton lint in laboratories of dye houses. A mixture of dyes of contrasting colors and different dyeing properties is used. The thick-walled or mature fibers dye one color, the thin-walled fibers, commonly called immature, another. Differentiation is easy.

Women's Fiber Preferences: What women prefer to buy in the way of certain wearing apparels and household textiles, and why, will be found in the report of a Nation-wide survey conducted by the Bureau of Agricultural Economics. The information obtained about the qualities women consider desirable or undesirable in cotton and other fibers — as these features appear in particular items of clothing and household textiles -- supplies at least a partial basis for re-examination of the methods used in the production of fibers and in manufacturing, converting, fabricating, and distributing products made from them. Since market outlets for household and apparel textiles are largely determined by the actions of ultimate consumers, the survey sought and found consumers' preferences with respect to 16 different textile products, also the reasons for their preferences. The findings show for each of the 16 articles the percentage of women who had fiber preferences, the percentage preferring various fibers, the reasons for their preferences, and the qualities that women seek when buying a particular article.

Growth Regulators: These most versatile chemicals, have now come to the aid of tobacco growers. Tobacco farmers have to top the plants at the flowering stage, to get good leaves, and then pinch off suckers growing at the base of the leaves several times during the growing season. Dr. Robert A. Steinberg, Bureau of Plant Industry, Soils, and Agricultural Engineering, has recently found in field tests that synthetic growth-regulating substances in powder or liquid form, can replace this hand sucker pinching; applied once to the cut surface they retard sucker growth. Further trials must be made to be sure the tobacco quality remains unaltered.

It's the Fat in those Oranges: Or at least it's the suspended material in the juice that contains the lipid or fatty fraction, which undergoes changes and produces that off-flavor much processed orange juice develops when stored at room temperature. Filtered juices develop some off-flavor, but not as much as whole juices, and also different in character. Peel oil is responsible for little if any of the off-flavor, though it may sometimes mask it. Juice pressed from peeled fruit developed about as much off-flavor as any other. These and other illuminating facts were developed by researches of A. Laurence Curl and M. K. Veldhuis, of our Citrus Products Station at Winter Haven, Fla.

Growth Factor in Alfalfa: Accumulated evidence from experiments with rabbits strongly suggests the possibility that alfalfa contains a growth factor and also a factor that prevents cirrhosis of the liver. Rabbits developed this ailment when fed a diet of whole milk. When 50 percent of the diet is made up of alfalfa-leaf meal, the liver trouble did not develop. Partial protection was provided when only 10 percent of the diet consisted of alfalfa-leaf meal.

Anti-biotic Produced by Bacteria Affecting Bees may have Medical Value: Department scientists have found that bacteria, causing a disease of bees known as American foulbrood, produce a substance which kills or checks the growth of many other bacteria that come in contact with it. Preliminary laboratory testing in cultures has indicated that this substance works against the bacteria which cause several serious human diseases. While working on the control of the bee disease, which is a serious problem to bee keepers, scientists in the Bureau of Entomology and Plant Quarantine discovered that a bee larva, dead from the disease, caused milk to become clear when dropped into it. Testing in the laboratory indicated that some substance produced by the bacteria themselves acts as an inhibitor to the growth of other bacteria. The scientists extracted this substance and tested it against bacteria which cause human and animal diseases. They have developed a method of eliminating an undesirable toxic material that is present and are now endeavoring to develop quicker and easier ways of producing the antibiotic. The National Institute of Health is now conducting further studies regarding the effect of the substance on bacteria of importance to human health, as an outgrowth of this preliminary work.

Grain Proteins Compared: In recent experiments on the quantity and quality of proteins in a number of major grain foods, the Bureau of Human Nutrition and Home Economics found that rolled oats equaled or surpassed all of the others on both points. Rice ranked with oats as the highest in nutritional quality of its protein, though rice was lowest in the amount of protein present. Rye, whole wheat, barley, and corn followed in the order named in the quality of their proteins. Between hard spring wheat and soft winter wheat no significant difference in quality was found.

Cows Like Wood Molasses: C. R. Lockard of the Southern Forest Experiment Station says that molasses made from cull hardwoods shows promise as an inexpensive supplementary feed for contented cows. The Alexandria Branch of this station has fed the molasses, made at Forest Products Laboratory from wood of mixed species of southern oak. The cows like it in their cottonseed cake -- prefer it even to good range forage. The Mississippi Agricultural Experiment Station is making tests of the molasses' food value. A plant handling 25 cords of cull hardwood daily could produce about a tank car of molasses in that time. Use of cull hardwoods for this purpose would enable owners to turn a profit and would give the southern livestock industry a badly needed source of cheap carbohydrates.

Rubber: What became of our efforts to encourage rubber growing in South America during the War? Dr. E. W. Brandes, who was in charge of USDA rubber investigations, says that the cooperative natural rubber program has emerged from the nursery stage in Brazil, Colombia, Costa Rica, Guatemala, Haiti, Honduras, Mexico, and Peru. About 29,000 acres of field plantings are now established in government demonstration areas, on coffee, banana, and other plantations, and on nearly a thousand small farms. USDA maintains scientists and technicians in various centers to conduct research and train local workers. The return of rubber here as an economic crop became possible by the introduction of clones from high-yielding Hevea trees in the Far East and by development of leaf-blight-control methods. Rubber plantings of 5 to 10 acres will offer a profitable long-term enterprise to small farmers in Latin America and will help build a strong diversified agriculture in the tropics.

Development of a Method of Testing Liquid Roach Sprays: There has previously been no method for satisfactorily evaluating liquid roach insecticides. Entomologists of the Insecticide Division, Livestock Branch, Production and Marketing Administration, have developed a satisfactory method for comparing liquid contact roach sprays with a standard comparison insecticide. This method is based on spraying known volumes of a finely atomized spray on adult male German roaches. It is used in enforcing the provisions of the Federal Insecticide, Fungicide, and Rodenticide Act as they apply to roach insecticides. All roach insecticides should have a toxicity to roaches that will be at least equivalent to the comparison insecticide (OTI). The method is being perfected and is in process of adoption by the insecticide industry.

Penicillin Reduces Losses from Erysipelas in Turkeys: Bureau of Animal Industry experiments indicate that penicillin is highly effective in saving turkeys infected with the swine-erysipelas organism, to which turkeys as well as swine are susceptible. Infection in turkeys usually attacks the flock just before marketing, when the birds are most valuable. The use of penicillin reduced the mortality of infected birds to 10 percent when 100 percent of untreated birds, similarly affected by the disease, died. The drug, suspended in peanut oil, was given in doses of 20,000 units, repeated 4 times a day apart. The experiments disclosed that the best method of treatment was to inject the penicillin into the wattles. This location is preferred since the wattles are readily accessible, are not used for food, and accommodate a large does of the drug. Another method of giving penicillin was in drinking water, but this proved to be unsatisfactory since only 1 bird in a group of 10 would drink the medicated water. That bird, however, recovered from the infection. The salts of penicillin appear to have a powerful germicidal effect on the disease organisms. The experiments which are regarded as preliminary, included 222 three-quarter grown turkeys, treated in various ways in groups of 10.

Heifers on Roughage Alone: Recent experiments by the Bureau of Dairy Industry show that dairy heifers can be grown successfully on roughage alone, after they are about 10 months of age, thereby saving large quantities of grain and considerable expense in raising them to calving age. Heifers are now being raised successfully on less than half the amount of grain, by feeding good-quality roughage at all times, and no grain after they are 10 months of age.

Standard Method for Determining the Ash Content of Wool: The determination of the ash content of scoured wool has been routine procedure for years in the chemical laboratories of the woolen industry. Despite the fact that these determinations are widely made, there has been no standard method set up giving precise details of the test. Recently Production and Marketing Administration's Wool Laboratory, upon investigation of the industry's method, was able to demonstrate what certain processes would give best results, and published a paper recommending a standard method. It is believed that the industry will follow the recommendations set forth in this publication because of its greater accuracy.

Underground Cotton Enemy Controlled with Fumigants: Cotton may be protected from the root knot nematode, a destructive pest in many parts of the Cotton Belt, by fumigating with any one of several of the newer soil fumigants such as D-D, Dowfume N, and Dowfume W. Tests made by the Department of Agriculture at its field station at Sacaton, Ariz., have shown that as little as 6.4 gallons of one of these chemicals checks the pest sufficiently to produce a full crop. Where land is badly infested, according to specialists of the Bureau of Plant Industry, Soils, and Agricultural Engineering, such treatment promises to make the difference, other factors being equal, between a good crop and practically no crop at all. Applying the chemical requires no expensive equipment, as it can be done by merely attaching a small tank to the machine used in preparing the bed in which the seed is planted. The actual cost of the fumigant may be low enough to encourage wide use of it.

Housing Publications: An illustrated manual on the use of wood for prefabricated housing was prepared by the Forest Products Laboratory of the Forest Service for the Housing and Home Finance Agency. Information included was based upon Laboratory research and upon results of a nationwide survey of prefabricated house manufacturers. Subjects covered included basic information on wood, plywood, laminated wood, modified woods, fiberboards, plastics, and sandwich materials; strength of materials; seasoning and storage; machining of wood and other wood-base materials; gluing of wood, plywood, plastics, and sandwich constructions; joints and fastenings; house design; fabrication procedures; and repair techniques. Though nailing is one of the most commonly used methods of fastening for wood, very few data are available on nails or nailing practices. Recognizing that great numbers of houses were to be erected and knowing the advantages that result from the use of good nailing practice in house construction, a bulletin showing the most satisfactory methods of nailing for houses and farm buildings was prepared by the Laboratory for the Housing and Home Finance Agency.

Sugar-coating Wood: A singularly durable coating for wood, highly resistant to wear, hot oils, and heat, has been developed from ordinary table sugar, or sucrose, by P. L. Nichols, Jr., and E. Yanovsky, of the Eastern Regional Research Laboratory. As prepared it is a heavy, light-yellow liquid which, when exposed to air or oxygen, particularly at elevated temperatures, increases in density and viscosity, and finally hardens into an insoluble, infusible,

transparent resin. Properly cured films of it are insoluble in all organic solvents so far tested. The coating possesses high gloss and extreme hardness, yet sufficient flexibility to expand its usefulness. Its transparency suggests use as an adhesive for glass. The coating and impregnation of paper, textiles, and other materials for water and grease proofing and increase of their tensile strength are distinct possibilities. Thus an entire new field of research opens on the industrial utilization of sucrose and its derivatives.

New Plant Food Facts: The scientists at Plant Industry Station, Beltsville, Md., recently entertained some 50 representatives of the fertilizer industry. At the time they disclosed findings about a slow-acting nitrogen fertilizer called Uraform -- so far produced on laboratory scale only -- a combination of urea and formaldehyde, which is superior to natural organics. It slowly parts with its nitrogen over a long growing period. It does not leach out of the soil easily. It seems especially adapted for use with corn, potatoes, and tobacco -- crops which usually need additional fertilizer after planting. Its delayed action gives it good prospects for lawn and turf use. It can be used in mixed fertilizer and is unaffected by moisture absorption. But it must wait awhile, as both its constituents are in short supply just now. Uraform was a mere high light in an all-day conference which provided the visitors with much else of interest.

Cows on Thyroprotein: Experiments in which Bureau of Dairy Industry scientists fed dairy cows tyroprotein indicate that this increases the milk production of the animals -- at least for short periods -- but that such gains are accompanied by large losses in body weight, unless the cows get extra nutrients to sustain both weight and increased milk flow. Furthermore, cows fed thryoprotein have a faster heart rate and generally faster respiration than those on normal rations. Some show abnormal heart beats. Individual cows differ considerably in their response to thyroprotein, but cows fed this substance should also get at least 25 percent more nutrients along with it. Costs vary from cow to cow and from one condition to another, so the economy of this procedure is uncertain.

Guayule Latex: Edwin P. Jones, of the Guayule Emergency Rubber Project, Salinas, Calif., reported recently from the Bureau of Agricultural and Industrial Chemistry on the recovery of rubber latex from guayule shrubs. A maximum of about 70 percent of the rubber present in 3- to 4-year old foliate shrubs was recovered as a latex containing 35-50 percent solids. Continuous processing with better adapted equipment should bring that up to 70-80 percent. The rubber was of excellent quality and compared well with ordinary hevea rubber, though it is slightly inferior for general but superior for certain special uses like sponge rubber, and certain dipped goods requiring high tensile strength and elongation. The process is so far perfected as greatly to facilitate any future investigations of making latex from guayule.

Consumer Preferences in Peaches: Consumers made a definite choice on how ripe they wanted their peaches and in what size containers in a test of Colorado box peaches run at St. Paul and Minneapolis. This was brought out in the first report of a project under the Research and Marketing Act. Peaches from the Mesa County producing area were separated into three stages of ripeness tree ripe, firm ripe, and standard or hard ripe. Buyers showed a distinct preference for the firm-ripe fruit, tree-ripe peaches ran second, and the hard-ripes hardly sold at all as long as the others were available. Appearance seemed the determining factor. The firm ripe was bright and fresh-looking, the tree-ripe looked dull, and the hard-ripe appeared green.

This Colorado fruit was shipped in packages of two sizes, first the standard box holding about 60 peaches. When these reached the market, some of the larger boxes were repacked to 2-pound cartons. Both these sizes sold readily. An experiment was tried in prepackaging 6-pound cartons at the shipping point. These did not appeal to the Twin Cities buyers as they were apparently too large for those buyers wanting to use them immediately and too small for those wanting to use them for canning.

During the test, consumers were also questioned to check the effectiveness of the advertising and promotion program the Colorado peach industry has carried on for several years. Evidently these have been effective as the Twin Cities consumers expressed a definite preference for Colorado peaches over those from other areas, especially for canning. This consumer-preference project was carried on by the Cooperative Research and Service Division of the Farm Credit Administration with the Colorado A. and M. College, Fort Collins, and with several private agencies particularly interested in the Colorado peach industry. Fruit observed in the markets and used in the tests was marketed by three shipper members of the Mesa County peach industry.

Wind Erosion Control: Wind erosion specialists of the Soil Conservation Service in the Great Plains have concluded after nearly two decades of study that soil blowing can be prevented in dry years only if precautionary measures are used in the good years as well as in the dry years. At the top of the list is crop-residue management, or stubble-mulching. That means harvesting grain or other crops so as to leave adequate residue in the field and using it effectively as a surface protection to the soil. For example, a good, heavy wheat stubble will protect a field through two windy seasons if it is kept on or near the surface of the ground. Furthermore, it is the method all farmers can use, because it is economical. When used consistently, season after season, it is the most beneficial and practical means thus far known for wind erosion control on cropland. Other measures to help prevent wind erosion include: planting erosion-resistant cover crops when fields require special protection and regulating grazing of stubble, fall grain, or pasture land so that blowing cannot start. Also, by delaying soil preparation, with an eye to the weather, a farmer often can save whole fields from serious blowing. Farmers who neglect these first-line-of-defense measures, along with good water-management practices such as contouring, terracing or strip-cropping, are likely to run into difficulties when the first dry, windy crop year comes along. Their last resort will be emergency tillage such as rough tillage of bare fields, or even furrowing of growing crops; but these extra operations are costly, and they may be hazardous in more ways than one.

Bread-Baking Quality of Wheat: The quality of bread that can be produced from wheat differs widely and depends largely on the quantity and quality of gluten (one of the proteins) in the wheat. These glutenous properties, in turn, depend upon the variety and type of wheat, the climatic and soil conditions under which it is grown, and upon certain other factors, some of which are not fully understood. A quick and simple test that reflects both the quantity and quality of gluten in wheat flour, and hence its potential bread-baking quality, has been developed by the Grain Branch of the Production and Marketing Administration. The test may be performed on flour in about 15 minutes with the simplest of laboratory equipment and, therefore, offers considerable promise after further development as a practical procedure for the purposes of routine wheat inspection. The test consists briefly in measuring the rate of settling of the solid phase of an acidulated suspension of flour in water. The flour used may be ordinary white flour, if available, or a crude grade of white flour that may be more quickly and easily prepared from the original wheat.

Promising New Drug Reported: The new drug, gramacidin, may be as important to surface medication as penicillin is to internal treatment, it is indicated in new research at California Medical School, in collaboration with the USDA Western Regional Research Laboratory, Albany, Calif. A modification of gramacidin, soluble in water, weak enough to cause no toxicity and yet strong enough to kill bacteria, was devised by laboratory workers and tested by California University. In its original form, the new drug proved too toxic for use and destroyed red blood corpuscles, while it was hard to dissolve it in water. There is yet no indication, the California report says, that gramacidin causes severe systemic reactions after repeated use.

Who Gets the Consumer's Bread Dollar? The division of the consumer's bread and cereal dollar among various marketing agencies, including millers and other manufacturers, transportation, wholesalers and retailers, is described in a recent publication of the Bureau of Agricultural Economics. For example, out of the consumer's dollar spent for family flour in the year 1939, farmers received 38.3 cents, country elevators 2.9 cents, terminal elevators 2.5 cents, transportation 13.0 cents, millers 23.8 cents, wholesalers 3.2 cents and retailers 16.3 cents. Similar information is furnished for corn wet-mill products, for various feed products, for rice and for dry edible beans. Means of reducing marketing costs and improving marketing efficiency are discussed.

Significant Discovery: Some years ago a method was found of using artificial insemination on bees. Until then it had been practically impossible to maintain pure lines of honeybees, because queens would mate with any drone. Artificial insemination provided complete breeding control. Now scientists in the Bureau of Entomology and Plant Quarantine, cooperating with those in Louisiana and Wisconsin Experiment Stations, have discovered by accident that unmated queens, when subjected to carbon dioxide gas anesthesia, lay eggs which later hatch into drone bees. This makes possible a rapid production of hybrid strains in which the parentage is absolutely controlled, and hybrid honeybees are thought to be as important to apiarists as hybrid corn to corn growers. The carbon dioxide treatment and development of the standard apparatus and equipment required for artificial fertilization of bees have been worked out by EPQ entomologists. By artificial insemination individual drones selected by the breeder can be used for mating; the carbon dioxide treatment makes possible artificial insemination of an unmated queen even with her own son, if desired. Bee strains high in honey production, especially good for pollinating fruits and other crops, or adapted to particular climates, should result.

Free Air Cools Orange Cars: Shipments of oranges from the warm groves of California in the early winter can now be cooled at low cost, with nature providing the cooling medium -- cold outside air. This cold air, by a simple change in regulations on the opening of vents, becomes available as soon as the East-bound fruit trains move into the mountains. As a result, orange growers of the region where precooling is not available, will save much money, probably at least $25 a car. Growers of navel oranges in central California alone probably can save as much as $200,000 a year. This new development is the result of a series of orange shipping studies begun a few years ago by fruit and vegetable storage and transportation specialists at the Plant Industry Station, Beltsville, Md., and carried on by them, the California Fruit Growers Exchange, and the Southern Pacific and Santa Fe railroads.

They thought it probable that outside air below freezing temperature could be admitted to loads of warm oranges for a considerable time without danger of cold damage. Shipping regulations established by the National Perishable Freight Committee had provided that intake vents on fruit and vegetable refrigerator cars had to be closed when the outside temperature got down as low as 32°F. The experimenters found that the vents could be left open as the trains went over the western mountain ranges unless the outside temperature dropped to 20°, and could be left open as far as Ogden, Utah, where the old limit of 32° could be put in effect for the rest of the trip to Midwest or Eastern markets. The secret is that the fruit contains enough heat from the sunny orchards to warm up the narrow ventilating streams of December and January air for several hundred miles of mountains and plains without risk of freezing the load. As a result, the National Perishable Freight Committee modified its regulations to call for leaving open the intakes on these fruit cars until the outside temperature falls to 25°.

Study of Unidentified Nutrients in Milk: Studies have been under way in the Bureau of Dairy Industry for a number of years to determine what unidentified nutritional factors occur in milk, their role in animal nutrition, their distribution in feeds, methods of supplying them to the growing calf, their sources in the cow, the effect (on the milk) of varying their amounts in the cow's diet, and their physiological properties. Progress to date may be summarized as follows: (1) A still-unidentified nutrient (X) occurs in milk and certain other foods and feeds but does not occur in the cereal grains, in cereal flours or their byproducts, in oil meals, and in certain other foods and feeds; (2) X is essential for normal growth and development, at least in the rat, and promotes fattening as well as growth; (3) X has a very potent effect on the performance of animals receiving lactose in their diet; (4) X has a particularly potent effect on the growth, development, and even the survival of animals fed diets containing high percentages of protein; (5) Preparations of X can be made that are effective in doses of only a few micrograms daily; (6) X may be deficient in the basal rations used in various biological assays for known nutrients; and (7) Serious reproduction failures occur on diets that are apparently adequate in their content of all known nutrients.

Vegetables for Vitamin A: From its nutrition researches, the Bureau of Human Nutrition and Home Economics has stressed a need for caution when current food composition tables are used to show how well various green and yellow vegetables provide for one particular nutritional requirement -- vitamin A. Only part of a vegetable's carotens (yellow-orange pigment that the body can convert into vitamin A) is used by the body. The rest apparently is not freed from the vegetable cells during digestion.

In recent tests to compare the usefulness of vegetables for meeting vitamin A needs, experimental rats have been fed on diets otherwise adequate and depending on cooked kale or cooked carrots for vitamin A. By measuring chemically the carotene in the cooked vegetable, and also measuring growth of the rats receiving carotene in this form in the diet, it has been found in this Bureau's laboratories that only about 60 percent of the carotene in kale and 25 percent of that in carrots is converted by the rat into vitamin A. Previous studies with young adult human beings have shown that the usable carotene differs from vegetable to vegetable. The carotene in peas and spinach, for example, is more completely used than that in carrots. Carrots, however, continue to rate as important sources of vitamin A in diet, because they are naturally so high in carotene.

Wood-Working Wastes for Corrugating Boards: The Forest Products Laboratory of the Forest Service demonstrated that corrugating boards can be made successfully from woodworking wastes such as those from box plants and furniture and veneer mills. The pulps for the boards were made from the three wastes employing two different chemical pulping agents (neutral sulfite and soda ash). There was little difference in properties of the pulp from the two processes. However, the box plant wastes produced the strongest pulps in the highest yield (81 percent of original wood) and the veneer waste the weakest pulp (by roughly 25 percent) in the lowest yield (71 percent). Corrugating boards made from the two types of pulp from the composite waste materials also differed only slightly in strength and further differed little from an experimental board made from commercial straw pulp and from a commercial straw corrugating board. The experimental boards corrugated satisfactorily and showed the same crush resistance in the form of a corrugated fiberboard as commercial straw corrugated fiberboard.

Hornfly Control Now Standard Practice: One of the greatest developments in livestock practices in recent years is spraying cattle with DDT insecticides for hornfly control. This insecticide has materially altered range management and feeder stock practices within just two seasons. Few developments have changed livestock management procedures so quickly. Experiments by the Bureau of Entomology and Plant Quarantine, in cooperation with State and local agencies, during 1945, showed the possibility of controlling hornflies by use of DDT insecticides. These experiments indicated that great losses estimated to exceed $100,000,000 annually, in beef and dairy products probably occurred during outbreaks of these flies. Probably not less than one-fifth of all cattle in this country were treated one or more times with DDT, during the 1947 season, for the control of these flies. Over a million head were sprayed in each of several states alone.

Laboratory Color Measurements Used in Establishing 1947 Cotton Grade Standards: Instruments and methods for measuring color that have been developed by the Color Laboratory of the Cotton Branch, Production and Marketing Administration, were used as a basis for preparing the new Official Cotton Grade Standards which became effective on August 1, 1947. Color is one of the important factors of grade in cotton and the fact that cotton stored under normal atmospheric conditions gradually changes in color has made the problem of maintaining the grade standards constant a difficult one. The Color Laboratory was established to develop or adapt instruments and methods for measuring objectively the various elements of color and to apply these instruments and methods to the measurement of color in samples of cotton. The successful accomplishment of this task has made it possible to measure with precision the color of the various grade standards at the time they are officially accepted. The record of these measurements then makes it possible to prepare subsequent copies of the standards with the precise color of the original standards at the time adopted. In the absence of this technique, the original standards stored over a period of years would gradually change color and become increasingly difficult to use as a basis for classification of currently ginned cotton.

Spinning Quality of Cotton Produced by Cotton-Improvement Groups: The marketing of cotton of the improved varieties that are being produced commercially by groups of farmers organized for cotton quality improvement is being facilitated by a program of fiber and spinning testing conducted by the Cotton Branch of the Production and Marketing Administration. The tests were made in the Department's laboratories as early in the ginning season as possible, and the results are published promptly for distribution to cotton merchants, manufacturers, and others in order to enable them to locate cotton having the fiber characteristics and

spinning performance required for best results in the manufacture of specific types of cotton products. The first report on the 1947 crop was released in November 1947. This report was based on tests made on samples from 86 cotton-improvement areas distributed throughout the entire Cotton Belt. The laboratory tests made include such fiber properties as tensile strength, fineness, maturity, length, and length variability. Tests for processing performance include manufacturing waste, yarn strength and appearance, and tire-cord strength.

Who Gets the Consumer's Milk Dollar: Division of the consumer's dollar spent for fluid milk, butter, American cheese and evaporated milk among various marketing operations and types of marketing expenses is reported by the Bureau of Agricultural Economics. Breakdown of the average consumer's dollar spent for all four products in 1939 shows the farmer receiving 55.9 cents with 5.1 cents for country assembly, 11.3 cents for processing, 1.0 cents for long haul transportation, 4.1 cents for wholesalers, and 22.6 cents for retailing. Analysis of margins for each product points the way to achieving economies in marketing.

Rural-Urban Levels of Living: A recent analysis of differences in the level of living of farm and nonfarm residents shows the farmer, in most respects, to be at a disadvantage. This study by the Bureau of Agricultural Economics is based upon data from the 1945 Agricultural Census, enumerative surveys, and other sources. Rural areas are deficient in the services of doctors, dentists, hospitals, libraries, and schools; and, although rural electrification is advancing rapidly, rural folk are still short on household equipment and conveniences. Only 28 percent of rural homes have running water, 18 percent bathtubs or showers, 58 percent refrigerators or iceboxes, and 46 percent electric irons. Urban homes have from 2 to 5 times higher percentages of these items. In one respect only the rural dweller has an advantage over his city cousin -- he has a more adequate and nutritious diet.

Fresh Fruit and Vegetable Waste in Stores: To take the guesswork out of estimates of food wasted, the Bureau of Agricultural Economics, in cooperation with retail stores, has conducted detailed investigations of waste and spoilage of fresh fruits and vegetables. These investigations are an offshoot of studies on the retailing of prepackaged fruits and vegetables. A preliminary report measures three classes of waste and spoilage losses for each of a wide variety of fresh fruits and vegetables. Losses were measured and compared for both refrigerated and nonrefrigerated display and storage facilities. In the stores keeping records it appears that reduction of waste by use of refrigeration facilities was sufficient to more than pay for the cost of refrigeration.

Protein and Milk Production: Bureau of Dairy Industry has found in recent experiments that cows produced as well in their first lactations when fed less protein than is usually recommended. This seems to make it unnecessary for farmers who have ordinary home-grown grains and good legume hay to purchase protein concentrates. Corn, oats, barley, and such ordinary farm grains mixed together actually give a higher protein concentrate than was fed to cows on the low-protein ration used in the experiments and these grains, fed along with a good grade of legume hay and corn silage, will furnish plenty of protein, so long as the cows get total digestible nutrients at the rate indicated by the Morrison standard. The low-protein ration used provided 0.5 pound of digestible protein for maintenance, plus 1.25 times the protein in the milk.

Potato Program Produces 34 Varieties: The National Potato Breeding Program, centering in the Department of Agriculture, has enlisted the cooperation of the experiment stations in 28 States and in the Territories of Alaska and Hawaii. It has been under way since 1929. As a result of the persistent effort to create high-yielding varieties and-disease resistant and special ones for different areas, now nearly one-third of the certified seed potatoes of the whole country are from varieties developed in the Program.

At least 11 new varieties were named and distributed to growers in 1946. In a recent committee report to the Potato Association of America, published in the American Potato Journal, August 1947, 34 varieties were listed as having been distributed to growers since the program was started. States taking part directly are Arizona, California, Connecticut, Florida, Indiana, Iowa, Louisiana, Maine, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Nebraska, New Jersey, New York, North Carolina, North Dakota, Ohio, Pennsylvania, Rhode Island, South Carolina, Texas, Virginia, Washington, West Virginia, Wisconsin, and Wyoming.

According to the Department plant workers, potato-growing conditions vary widely in different parts of the country, and a new variety that does not prove valuable in one State may have just the combination of qualities needed in another. Most of the breeding for resistance to virus disease is carried on by the Department in cooperation with Maine; on resistance to late blight, with Maine, Cornell and Pennsylvania, and on resistance to scab with thirteen States. Some of the other important disease-resistance problems dealt with in the program are brown rot, ring rot, hopperburn and leaf roll (threatening the well-known Russet Burbank potato in the Northwest).

Adapting Vegetation to Conservation Farming: Soil Conservation Service nurseries are placing emphasis on improving the type of vegetation used in conservation farming. Conducted in cooperation with State and Federal research agencies, their plant observational studies have resulted in the past 14 years in more than two dozen new and better conservation crop plants which now have been brought into general use. They represent outstanding native strains of grasses and legumes, as well as foreign introductions. These new crop plants have special application for soil conservation uses: They are planted for wind-erosion prevention and to stabilize sand dunes. They are used to line waterways and to protect terrace outlets and farm ponds. Some are particularly adapted for planting on steep, eroding hills and embankments. Others have proved excellent for revegetating burned-over woodlands, denuded desert range lands, or poorly drained alkali soils. Many are utilized for orchard and vineyard ground cover, or in soil-building rotations; while others are being rapidly adopted for revegetation of over-grazed range land and abandoned cropland. Some are rapid-growing gully healers, and others make good wildlife field borders.

During 1947, the facilities of the nurseries were used largely for maintaining foundation seed stocks and for quantity production of these newly evaluated conservation crop plants. The total seed production at the nurseries was 422,000 pounds. The seed was distributed to soil conservation districts for seed increase. In the Southeast, 730 five-acre seed blocks of one selected grass were established in soil conservation districts in nine states. Many other species and strains now are being evaluated in the nurseries. Approximately 83 were advanced in the last few years from the initial observational category to the field trial and seed-increase stage. Typical among them are a cold-hardy kudzu and an early-fruiting, cold-resistant lespedeza from China, an extremely drought-resistant, soil-holding grass from South Africa, and a prostrate, compact indigo plant from South America.

Coupled with the plant evaluation studies is the job of incorporating good native grasses into conservation farming. Through careful study of cultural requirements, seeding habits, and methods of harvesting, 18 heretofore undomesticated species have been brought into use in the West, with seed available on the commercial market. They include such important grazing species as blue grama, buffalo grass, western wheatgrass, sand lovegrass and the bluestems. Significantly, out of tests with more than 200 grasses and legumes in range revegetation in the extremely low rainfall sections of the Southwest, only Lehmann lovegrass was found adaptable to these adverse conditions. Similarly, it was found possible to establish Haring grass on range land in the 15-inch rainfall areas in California. It was learned, also, that application of 200 pounds of 16-20-0 fertilizer on annual range in this rainfall zone increased the vegetative cover more than 100 percent.

Adaptation studies of native grasses brought into the nurseries showed that the source of the seed has an important influence on success of the planting. It was evident that most species cannot be moved very far from their point of origin without loss of vigor. Seed increase trials showed that grasses required both for range revegetation and irrigation farming can be grown successfully for seed production under irrigation.

Farmers' Net Worth: Economists in the Bureau of Agricultural Economics in their balance sheet of agriculture for 1947, show that the overall financial condition of farmers improved during the war and continued to improve thereafter. They also point out in what respects the strong financial conditions of U.S. agriculture and improved credit facilities may be expected to add strength to our national economy. Assets of agriculture on January 1, 1947, stood at 111.2 billion dollars, more than double the 53.8 in 1940. Farm debt had decreased from 10 billion dollars in 1940 to 8.4 in 1947. This means that farmers' equities or net worth increased from 43.8 billion dollars in 1940 to 102.8 in 1947. Not only were farmers' equities and total assets increased, but a large proportion of their holdings was in bank deposits, Government bonds, and other financial assets. In 1940 these financial assets were only 9 percent of total assets; by 1947 they had increased to 20 percent of total.

How Our Land is Used: Where is it located? How much is privately owned? How much is publicly owned and administered? And what are some of the problems in managing and using public lands? The answers to these and other questions related to the history, use, and present status of land holdings may be found in 3 recent reports prepared by the Bureau of Agricultural Economics in cooperation with other agencies. War Records Monograph No. 5, Acquisition and Use of Land for Military and War Production Purposes, World War II, gives a factual account of how land was acquired for war, and an analysis of the problems faced in acquiring it. Federal Rural Lands presents current facts on the extent, character, and use of that part of our land which is publicly owned and administered; and on how our public land resources are related to agriculture and to other uses in war and peace. A third publication describes graphically how all our land -- both public and private -- is used; it is a cooperative report of BAE and the Bureau of the Census called "Graphic Summary of Land Utilization in the U.S."

Cotton for Official Staple Length Standards Now Selected on Basis of Fiber Laboratory Tests: Equipment and methods of fiber testing developed in the laboratories of the Cotton Branch, Production and Marketing Administration, are now being used regularly in the selection of cotton for copies of the physical types representing the various staple lengths included in the Official Cotton Standards.

All cottons for use in these types are now subjected to fiber tests for length and length uniformity. The adoption of this practice has increased the precision with which the currently issued types match the original standards. Further studies are being made of the feasibility of developing specifications for the official staple length types to include other measurable physical properties of cotton fibers that affect spinning value.

Progress in Core Sampling of Domestic Wools: In continuation of research in wool shrinkage designed to make the core sampling of wool more accurate and speedier and to reduce its cost, the Wool Laboratory, Livestock Branch, Production and Marketing Administration, has conducted numerous experiments employing a 1-inch tube. These experiments have shown that samples so obtained can be drawn more quickly and with less physical labor than with the larger tubes currently in use. Samples obtained with the new tube are approximately 1/9 to 1/10 the size of those taken with the older type of coring tubes, thus reducing the expense of shipping the samples from 60 to 70 percent. Processing of samples selected by the 1-inch tube in the laboratory is quicker and easier. Subsampling, scouring, calculating, and the subsequent storing of samples are simplified considerably. In addition to the aforementioned advantages, the damage to wool sacks because of coring is considerably reduced. Comparative tests indicate that the accuracy of the 1-inch core samples is at least equal to samples obtained with 2- or 3-inch coring devices, and the cost of obtaining and testing the samples is much less than with the larger instruments.

The Sodium Hydroxide Methods for Determining Vegetable Matter in Wool: Two methods for the determination of vegetable matter in wool have been used. One of these, the transparizing procedure, has some advantages but is subject to personal bias which enters into the visual matching of samples under test with a standard photographic plate. Another method, the hydrogen peroxide - sodium carbonate, is accurate but complicated. The Wool Laboratory, Livestock Branch, Production and Marketing Administration, has recently developed the sodium hydroxide method for the determination of vegetable matter in wool, which is quicker and cheaper and has been adopted as a standard method by that laboratory, by other Federal agencies, and by commercial testing concerns. It consists of adding to a 20-gram sample of wool 400 mls. of boiling 10 percent NaOH, letting the sample stand for 2 or 3 minutes, filtering off the vegetable matter, washing with water, and drying and weighing.

Control of Potato Insects by DDT Increases Yield: Increased potato yields have followed insect control through use of DDT insecticides. Research on DDT formulations developed by the Bureau of Entomology and Plant Quarantine resulted in a saving of more than $300,000 in insecticide cost during 1946 to potato growers in Maine. Entomologists have long considered insects highly destructive to potatoes, but damage of this magnitude had not been suspected. Potato vines customarily die late in August. Heat, drought, or other factors have been considered reasons for this. The potato tuber stops growing when the plant dies. The potato crop thus has been made by middle August under normal culture. It was shown during the 1944 season, through small experiments, that the common potato insects could be controlled with applications of certain DDT preparations. More extensive testing, in 1945, led to the conclusion that this material is suitable for large-scale field use on potatoes.

Manual on Laminated Timbers: A manual was recently completed by the Forest Products Laboratory of the Forest Service on the subject of laminating structural timber products by gluing. The contents of the manual are based on the experience gained over the wartime years and since in the use of glues for building up large laminated beams from relatively thin boards. It covers the properties of glues suitable for laminating, the techniques of laminating, and recommendations for inspecting and testing laminated products.

Farm Housing Aids: As aids to wise planning and sound investment for the farm family that wishes to remodel an old house or build from the ground up, a series of publications on "your farmhouse" is being prepared. This work is shared jointly by the Bureau of Human Nutrition and Home Economics and the Bureau of Plant Industry, Soils, and Agricultural Engineering. Intended for families that must do much of their own planning and construction, the housing specialists' recommendations are presented in readable style with few technical terms and many illustrations. One completed publication gives practical guidance on how to plan remodeling. Experiences of a real farm family in making its old home more comfortable and convenient, inside and out, are used to point up the principles of a sound planning job. A second completed bulletin provides cut-outs to help in developing plans for remodeling or for new construction. Diagrams of standard pieces of furniture and equipment and structural construction, such as closets and stairs, are provided. These are all drawn to scale, so that space may be tested on paper layouts. Also included are sample floor plans for each room in a house, to show convenient arrangements and minimum allowances recommended for space. Additional publications of the series are in press or in preparation.

Success with Range Cattle: Facts and figures on how certain western North Dakota ranchers have organized their ranches and adjusted their operations so as to face good years and bad with long-run success are summarized in a study by the Bureau of Agricultural Economics. The study was made in the belief that the experiences of ranchers who have survived and prospered through the years would assist others in preparing for the inevitable periods of drouth. The bulletin, published by North Dakota Experiment Station and BAE cooperating, is called Range Cattle Production in Western North Dakota.

Easier Farm Debt Load: Economists of the Bureau of Agricultural Economics in cooperation with the Bureau of the Census estimate the farm mortgage debt in the U. S., beginning of 1947, at only a little over half the 1920 debt, and less than half the peak debt of $10,785,621,000 reached in 1923. There has also been a big drop since 1940 in the number of farms mortgaged and in total farmers' mortgage debt. The total owed was $6.6 billion in 1940 and only $4.8 billion in 1947.

Dividing the Nation's Food Purchases: Estimates of the annual national retail value of each of 6 important food groups have been developed and published by the Bureau of Agricultural Economics. These estimates, in conjunction with farm income received from sale of equivalent produce, provide the basis for measuring the national marketing bill for each group of products. Estimates apply to civilian purchases of food sold from American farms. In 1946 the Nation's marketing bill for all groups was 13.5 billion dollars. The 1946 marketing bill for meats was 2.5 billion dollars; for dairy products 2.3; for poultry and eggs 1.0; for bakery and other cereal products 2.2; and for all fruits and vegetables 3.7 billion.

New Insecticides Control Insect Pests in Greenhouses: The development of the gas-propelled aerosol insecticides by entomologists and chemists of the Bureau of Entomology and Plant Quarantine has resulted in an efficacy of insect control in greenhouses heretofore unexcelled. DDT aerosols have been found effective against a number of insect pests in greenhouses. Less than 3½ ounces of DDT aerosol solution have proved sufficient for 1,000 cubic feet of greenhouse space. The use of properly formulated DDT aerosol insecticides has resulted in no injury to plants. However, some greenhouse insects are not affected by DDT aerosols.

Hexaethyl tetraphosphate, in an aerosol preparation, has been found to be effective in the control of many greenhouse insects which are not affected by DDT aerosols. Applications of 1/3 ounce of hexaethyl tetraphosphate aerosol solution in methyl chloride per 1,000 cubic feet have proven satisfactory. Of more than 130 plant species upon which this material has been tried, only tomato and chrysanthemums have been affected adversely. Weekly applications of this material over a period of months in rose houses resulted in vigorous growth free from spider mites and their injury. Rose production increased in some houses as much as 30 percent. This new treatment has been widely adopted by commercial greenhousemen.

Cotton Insulation Introduced: The introduction of cotton as an insulating material has had the attention of the Cotton Branch of Production and Marketing Administration for several years. This new application of flame-repellent principles and determination of the most economically effective densities have opened the way for cotton's use in this field. In its preparation for this use, cotton is slightly fluffed, run through baths of chemical salts, dried, and made into batts or blankets of insulation. Thereafter the cotton will withstand a blowtorch flame of 1800° F. and has a density of about 0.06 pound per board foot. Thicknesses (from 3/4-inch to 4-inch or more) and widths can be varied to meet use requirements. The product has a very high insulating value and is suitable for use in homes, in farm and industrial structures, and in other places where insulation serves a useful purpose. This high quality product, made from the lower grades and shorter staples of cotton, is being manufactured and sold by eight concerns with plants in California, Connecticut, Michigan, New York, North Carolina, Texas, and Wisconsin.

Methods Developed for Predicting Spinning Performance of Cotton from Fiber Test Data: Studies of the relationships of the various properties of cotton fibers to spinning performance and to the quality of products made from cotton, which are being conducted by the Cotton Branch of Production and Marketing Administration have definitely established the relationships between readily measurable properties of cotton fibers and performance in processing. This information has provided a basis for developing formulas whereby it is possible to predict fairly accurately from the results of a few fiber tests made on the raw cotton, the performance of the cotton in processing and quality of the products that may be obtained. The practical implications of this development are farreaching. The use of this information is enabling cotton breeders to expedite the development of improved varieties and strains of cotton having superior spinning performance. Cotton merchants and manufacturers are finding that they can use the formulas developed as a basis for more efficient selection of cotton having the precise characteristics needed for best results in the manufacture of various types of cotton products. In general, the information derived from these studies is facilitating technical progress in the cotton textile industry. The studies and the predicting formulas developed in connection with them are based on the most extensive collection of data on cotton quality now in existence. These data have been accumulated over a period of years in the laboratories of the Cotton Branch.

Calcium for Growing Heifers: Recent work in the Bureau of Dairy Industry shows that rations containing as little as 0.10 to 0.14 percent of calcium in the dry matter are sufficient for normal growth and conception, though this quantity is insufficient for gestation, which requires 0.16 percent. These results indicate that, when heifers are fed the usual farm rations, it is unnecessary to supplement these with calcium from other sources, since farm-grown hays usually contain sufficient calcium to meet all requirements for growth, conception, and gestation.

Large Crate Designs: Although the Forest Products Laboratory of the Forest Service has done extensive work on the strength and design of open crates for relatively small and light articles, no scientific information was available for large open crates designed to carry heavy loads. Recently testing and development work was done which made it possible to provide designs for loads up to 30,000 pounds net. A distinctly new type of construction was evolved employing prefabricated panels in which diagonal braces are placed on both faces of the frame members. The diagonals on one face slope in the opposite direction from those on the other face. This provides stability in each panel, adds to the rigidity of the crate as a whole when the parts are assembled, and increases the capacity of the side and end panels for supporting superimposed loads. Moreover, it makes possible the use of much thinner lumber than is needed in a conventional design. These crates can be made with 30 to 40 percent less lumber than the conventional fully sheathed crates.

Farm Mechanization--Progress and Effect: Technological developments have had a profound effect on American agriculture in the last 100 years. One farm worker in 1945 produced enough agricultural products to support himself and 13½ other persons. In 1920, one farm worker supported himself and 9 others and, in 1820, himself and 3½ others. Each man-hour of farm labor meant 44 percent more gross production in 1945 than in 1917-21. About half the savings in hours per unit of production resulted from mechanization. These and many other developments in the last century due to mechanization are the subject of a new publication of the Bureau of Agricultural Economics. Emphasis is given to the effect of the developments in the last 25 years on the volume of food production, labor requirements, farm employment, and efficiency in production.

Land Values Rise at Slower Rate: Data gathered by land economists of the Bureau of Agricultural Economics show that average farm real estate values, though continuing to rise, rose only 1 percent during the 4 months July to November, 1947, and rose less than for the July-November period in any year since the beginning of World War II. The rise was 3 percent for the same period in 1946. For the year ending November 1, 1947, average values rose 8 percent, compared with a rise of 14 percent for the same period a year earlier. The recent leveling off was particularly evident in South Atlantic and Pacific areas. Average values for the South Atlantic States were unchanged from last July; and for the Pacific States, a decrease of less than one-half percent occurred. Increases of only 1 percent are reported for the Middle Atlantic and East North Central States. Ten States had no change during the last 4-month period. Average values actually decreased 2 percent in California and Florida and 1 percent in Virginia and Michigan.

Tussock Moth Control: The application of DDT sprays from airplanes to 413,469 acres of forest in mountainous country in Idaho, Oregon, and Washington during the period May 22 to July 2, 1947, in the largest forest-insect spraying project of its kind ever undertaken, was a complete success in quickly bringing under control a severe outbreak of the Douglas fir tussock moth. The Bureau of Entomology and Plant Quarantine and the Forest Service, in cooperation with the

States concerned, and with private timber owners, applied 390,881 gallons of DDT solution to the most heavily infested timber. This involved a total of 2,120 flights by small planes as well as large ones of the C-47 and Ford tri-motor type. The spraying was done while the caterpillars were small and before they had caused much defoliation. Results were even better than the entomologists and foresters in charge of the work had dared to hope for. It was almost impossible to find living caterpillars in the treated areas a few days after the spray was applied. Much of the timber already weakened by defoliation in 1946 would have been killed had steps not been taken to prevent defoliation in 1947. This included some 1,518,000,000 board feet of commercial timber in Idaho alone with stumpage value of $4,625,000.

Farm Labor Requirements: Mechanization and other technological advances in farming are resulting in a more even distribution of farm work through the year. Compared with a quarter century ago, the spring work peak has been greatly reduced, the fall peak less so, and there is still almost as much to do in the wintertime. A recent report of the Bureau of Agricultural Economics presents estimates of the man-hour requirements of farm production for each State for the prewar year 1939 and the wartime year 1944. Emphasis is given to the seasonal distribution of labor requirements of crop production, livestock production, and general farm maintenance work. Similar data are shown for the more important crop and livestock enterprises in each State. Factors which account for differences in labor requirements among States are discussed, as are the major factors behind the noteworthy changes in farm labor requirements during the war.

Farming Progress on Reclamation Projects: The Bureau of Agricultural Economics has recently made studies showing the progress in land use and crop production on 12 Federal Reclamation Projects in the Northern Great Plains. The several projects are briefly described. Tabulations show progress made, by projects, in getting land ready and in getting water to the land, years required for projects to reach maximum development and the acreage in cultivation on each project. A record is also given of the several crops grown, yields per acre and value per acre, by projects, each year since the projects were started. The studies are summarized in Trends in Land Use and Crop Production -- 12 Federal Reclamation Projects, Bureau of Agricultural Economics, in cooperation with the Bureau of Reclamation, and South Dakota Agricultural Experiment Station.

Scourable Branding Fluid: For identification purposes, it is the custom of domestic wool growers to place a paint brand on sheep. Reports from producers and woolen manufacturers on commercial branding fluids that have been used for this purpose, indicate that these fluids are not satisfactory, as they either fade out within a year or cause damage to the finished fabric. While it is necessary that sheep be branded on the range to identify them, this custom proves costly to manufacturers, since the brand marks must be removed before the wool can enter the manufacturing processes. The usual method for removing the brand marks is for the wool sorters to slip the encrusted parts from the ends of the staples. Regardless of how carefully this work is done, particles of branding material are overlooked and cause stains or spots in the finished fabric. After considerable experimentation in the Production and Marketing Administration Wool Laboratory, a branding fluid has been developed that has proved in preliminary experiments sufficiently durable to remain legible on the backs of the sheep for a period of a full year yet sufficiently soluble to be removed in the ordinary scouring process. Additional experiments are now under way in cooperation with the Bureau of Animal Industry. The mixture is being

used on sheep at the experiment station at Beltsville, Md., and the U.S. Sheep Experiment Station at Dubois, Idaho. The development of a satisfactory branding fluid such as this promises to be will prove profitable to growers and manufacturers alike.

Herbicides Show Promise in White Pine Blister Rust Control: The use of herbicides, such as 2,4-D, may materially change the procedures employed for the control of white-pine blister rust in some areas. This disease is a serious and devastating threat to the young white pine forest stands in this country. The idea of using herbicidal chemicals in the fight to protect the Nation's white pine forests is not new. Certain chemicals have had limited use for this purpose for nearly 20 years. However, the development of 2,4-D as an herbicide within the past few years now provides, for the first time, an effective treatment that can be used on susceptible Ribes over extensive areas in the sugar pine region.

Within recent months it has been found that some of the varieties of currant and gooseberry, the alternate host plants of the disease, are extremely sensitive to 2,4-D in very low dosages. Field tests have been made with the chemical using light power equipment and small compressed-air spraying devices. One of the latter devices produces a finely divided spray and is sufficiently light in weight to be carried easily upon the back of a man. If further experimental work shows 2,4-D to be effective on some of the more resistant currant and gooseberry varieties, the use of this material may make it possible to kill these plants on a number of Ribes-infested areas with less manpower and at lower cost than by hand pulling.

Volatile Oils in Rosin: A reliable and accurate method for determining the volatile oil content of rosin, which has been developed by the Naval Stores Division, Tobacco Branch, Production and Marketing Administration, will enable processors and industrial consumers to evaluate the suitability of a rosin for their purposes with respect to the content of these oils. The presence of an excessive quantity of volatile oil in rosin -- obtained by steam distillation of the sap from the living pine tree, or by extraction from the dead pine stumpwood -- is objectionable in several of the many industrial processes using rosin as an ingredient. Examples of this, drawn from two major uses, are: Rosin of this type will give low yields in the manufacture of soap and will also cause some difficulties in the production of paper size, especially when used in the Delthirna process. In any manufacturing process where soft and tacky rosin is objectionable, rosin of this type would not be suitable. All rosin will contain some residual oil, the amount depending on plant control and operation during the separation of the turpentine and other volatile products from the rosin by steam distillation. The problem has long been recognized and a standardized procedure for the operation of the old-style copper-kettle still has been established by the Naval Stores Experimental Station, USDA, at Olustee, Fla. This process will produce rosin containing less than the allowable maximum of volatile oils and has been accepted by the industry as good commercial practice. Also, the newer control stills of the type developed by the Station produce fully acceptable rosin. None of the present methods in the literature for determining the volatile oil content of plant materials was found to be suitable for testing rosin. The successful method was developed by modifying the laboratory apparatus used in customary determinations for volatile oils lighter than water, and following a procedure simulating the principle of the operation of a rosin still.

Flaxseed in American Farming: The Bureau of Agricultural Economics has presented an analysis of the place of flaxseed in farmers' plans, past and future. Flaxseed acreage has shifted westward, with notable increases in Minnesota and California. U.S. flaxseed acreage more than doubled in response to emergency demands during World War II. Pronounced shifts in flaxseed production in response to changes in relative prices suggest the need for examining demand prospects and supply factors ahead. The development and use of new flaxseed varieties, higher-yielding and more disease-resistant, may improve the position of flaxseed in competing with other crops. American farmers probably will find it profitable to produce considerably more flaxseed during the next decade than they produced in the 1930's, although output is likely to be below recent emergency levels. A fuller analysis will be found in USDA Technical Bulletin No. 938.

Equipment Developed for Extraction of Foreign Material from Cotton Lint at Gins: A new type of cleaning equipment for use at cotton gins, which removes foreign materials left in the lint after the ginning process, has been developed at the USDA Ginning Laboratory, which is operated jointly by the Cotton Branch of Production and Marketing Administration and the Bureau of Plant Industry, Soils, and Agricultural Engineering of Agricultural Research Administration. The increasing use of mechanical equipment for harvesting the cotton crop and the exercise of less care in hand harvesting, as has been customary during recent years, have intensified the problem of cleaning cotton at gins. The Ginning Laboratory over a period of years has made exhaustive studies of various types and combinations of equipment designed for cleaning seed cotton prior to ginning. These studies have established the limits to which seed cotton can be subjected to cleaning processes without damage to the lint. When it appeared that with the adoption of new methods of harvesting, additional cleaning would be required in order to avoid losses to producers from low grades, research was undertaken to develop equipment for cleaning the lint after its separation from the seed but before it is pressed into the bale. Equipment necessary for this supplementary system of cleaning has been developed in the laboratory and tested in pilot-plant models. The results have been so promising that some of the gin-machinery manufacturers have proceeded with the construction of full-size units for installation in commercial gins, and it is expected that a considerable number of cleaning machines embodying the principles of the equipment designed at the Ginning Laboratory will be in commercial use during the 1948-49 ginning season. In the meantime, it is contemplated that additional research will be done on the laboratory-designed equipment in order to further improve its operating efficiency.

Important Changes in Peanut Production: Recent expansion in peanut production has been accompanied by marked changes in producing areas, technology of production, and use of peanuts, according to a published analysis by the Bureau of Agricultural Economics and the Bureau of Plant Industry, Soils, and Agricultural Engineering. Production has increased more than sixfold during the last 35 years. Most of the increase has come outside the old Virginia-North Carolina peanut area. A large part of the increase has occurred in Coastal Plains and other sandy sections of Georgia, Alabama, Texas, and Oklahoma. Many soil types in these areas are suitable for peanuts, but relative yields and returns vary significantly. On some farms production has become mechanized. In the subhumid areas the use of tractor power and a side-delivery rake for bunching has become common. With these methods, labor requirements per ton of peanuts are about half those usually found in the eastern part of the Belt.

But the range of practices in the eastern areas is also wide. The increasing use of peanut butter has been one of the striking changes in use of peanuts and it now accounts for over half the cleaned and shelled production. These and other developments in recent years are analyzed in the published report, Peanuts in Southern Agriculture. Emphasis is given to production and consumption aspects that should be considered by farmers and others in making future adjustments.

East-West Alfalfa Breeding: The East and the West of the U.S. have come together for improvement in alfalfa production, partly as a result of efforts by the Bureau of Plant Industry, Soils, and Agricultural Engineering. Once largely a western crop because only there does it produce seed abundantly, alfalfa is now grown just as commonly in the eastern States, but from western seed. The peculiar situation as to seed complicated the problem of alfalfa improvement for eastern farms. But now there is organized Federal-State improvement work in which experimental seedling plants are shipped West and seed is shipped East.

To stimulate the improvement work, Federal and State research men organized the Alfalfa Improvement Conference which has members in many States, and in the Canadian provinces. Some of the varieties grown for seed production in the West have been well adapted for feed production in the East, but seed from almost any sort grown in the West sometimes reaches the eastern markets regardless of how well the strain is adapted there. Some varieties, like the Turkistan, do well in the West and not in the East; some, such as Hardigan and Atlantic, do well in both places if the latitude is about the same.

So the associated research men are searching out or creating new strains and testing them for adaptability to both East and West — excepting the deep Southwest where varieties must be adapted for late fall and early spring growth. Selections are made for adaptation and disease-resistance in the East of strains that are to be grown anywhere except the Southwest. New strains are propagated vegetatively in the East where seed isn't produced, and here it is determined whether or not they will do well. At the same time the strain may be under test in the seed region. Selected plants tested in the East are sometimes shipped to the West by plane for quick transplanting.

When good plants (called clones in this work) are found suited to both regions they are used for the production of hybrids and synthetic varieties. Once this long and painstaking program has resulted in a desirable strain, seed grown in the West makes it practical to increase the spread of the improved variety in the East. The fact that the seed is grown far away makes no difference when the variety has proved good in either place. The alfalfa breeders expect the new program will ultimately free eastern and midwest farmers from the risk of getting unadapted alfalfa seed and will provide them with better and better varieties.

Oil Crops in American Farming: Supply and demand conditions for oil crops are discussed by economists of the Bureau of Agricultural Economics in the new USDA Technical Bulletin No. 940. The wartime expansion in oil crops was a remarkable achievement -- combined output of peanuts, flaxseed and soybeans more than doubled while cottonseed decreased only slightly. Before World War II a surplus in the supply of fats and oils had seemed to be approaching. The war changed this situation to one of shortage, resulting mainly from production maladjustments; production of tropical oils, dominant in world trade was greatly reduced; output of whale oil used in European margarine nearly ceased; European production of animal fats became very inadequate. Despite the large increase in the production

in the U.S. and the partial recovery in other countries, world supplies of fats and oils are likely to be short of demand for some time. Long-term consumption of fats and oils both for food and nonfood purposes appears to have been increasing on a per capita basis, especially in the U.S. Population increases together with an upward trend in the level of living will put additional pressure on the limited supplies. U.S. consumption of fats and oils under favorable economic conditions will probably rise further on a per capita basis. On the basis of the estimated population in 1955 this would call for relatively minor adjustments from recent levels of output. Most of the adjustments in acreage will be needed in order to prevent erosion and conserve soils.

Determining Fineness of Wool: There has long been need for a quick and reliable method of determining the fineness of grease wool and wool top. Wool standards are based on microscopic measurements of fibers. This is tedious and time-consuming work, and the process is not adaptable to commercial usage. The Wool Laboratory, Livestock Branch, Production and Marketing Administration, has experimented at great length with several methods of rapid determination of fineness, as follows: Work is being done with a film strip containing examples of known diameter and fiber distributions which are used for the comparison of unknown samples for determining diameter and variability both in grease wool and wool top. The method involves the cross-sectioning of wools and a direct comparison is made in a very short time. When demonstrated at a recent meeting of the American Society for Testing Materials, industry showed unusual interest in its application because of its rapidity. The Bureau of Animal Industry has done preliminary work on this method at Dubois, Idaho, and certain adaptations are being considered for more effective use in the large-scale marketing of wool. This method appears to be the most rapid and probably the most acceptable of any that has been advanced heretofore. The air-pressure method involves the use of a constant source of air that passes through an instrument designed to control the pressure. While a process of this nature had been suggested some years ago, it is only recently that a commercial company has developed an instrument based on that principle. The Wool Laboratory is cooperating with the company in developing methods and procedures for determining fineness of grease wool and top. The air-pressure method will give a quick mean diameter figure which may prove to have certain adaptations for rapid determination of fineness or grade in wools. The cross-section sedimentation method as developed in the wool laboratory consists of cutting subsections of a standard length, mixing in the top portion of a settling column, and then allowing the subsections to settle throughout the sedimentation liquid under the influence of gravity. The large diameter fiber fell most rapidly. Fiber diameter distributions could be obtained in less than 5 minutes.

Cantaloups Armed Against Mildew: In southern California, the most important source of commercial cantaloups, powdery mildew became a limiting factor 25 years ago. The development of varieties resistant to this fungus has been going on ever since with such success as to provide a good basis for a greatly increased market for this melon. In the Imperial Valley, where cantaloups were becoming unprofitable, the Department plant breeders began the search for better strains by searching badly infested fields of Halo's Best to find occasional plants that were little damaged. A few years of testing and selection of plants grown from these produced a strain good enough to brace up the industry until more elaborate methods could turn out a still better one. For convenience they called it No. 50, its number in a test plot.

Then a California specialist found a wild melon from India that was more resistant to powdery mildew than No. 50. This melon looked somewhat like a pumpkin, but it was cross-fertile with cantaloups and not with pumpkins. Except for the resistance, it lacked practically all desirable cantaloup characters.

The resistance in the wild melon proved to be a simple Mendelian character carried by a single gene. The Department of Agriculture and the California breeders crossed this newcomer with susceptible commercial cantaloups and made selections of the better offspring. In a relatively short time they had a still more resistant strain of better quality and higher yields called No. 45. It promptly replaced No. 50 in the Imperial Valley. But nature launched a new mildew attack as concentrated plantings of the new cantaloups were developed in the Valley. A strain of the fungus, rare when the resistant "lopes" got into production, became more and more prevalent each year, again endangering the industry.

Now the problem was more difficult. Apparently there were no ready-made varieties or species resistant to the new fungus strain. Search of mildewed fields revealed no very resistant plants. All that was available was partial resistance in several lines. No. 50 had some; No. 45 had a little, and certain wild melons were found to have resistance different from those. In effect, the scientists, experts in genes and means, took apart the factors in this breeding material and put them together in new and varied combinations. This gene-juggling culminated in the release of three new varieties -- U.S. No. 5, U.S. No. 6, U.S. No. 7 -- all with complex pedigrees and effective combinations of resistance to two races of powdery mildew. They are not immune from the disease, but sufficiently well armed to make it a minor production problem for the present. The research men are getting genes together for still more resistant varieties, and primitive lines of breeding material are maintained as a scientific stockpile with which to defend the industry against any new strain of the fungus that may appear.

Equipment Developed for More Efficient Sampling for Cotton Bales: As a means for providing cotton samples that are truly representative of the bales from which they are taken, and to eliminate damage to the bale package which results from present methods of cutting samples from bales, technologists of the Cotton Branch of Production and Marketing Administration have developed mechanical equipment which automatically samples each bale of cotton as it is being formed at the gin. The average bale of lint cotton contains in the neighborhood of 500 pounds, and it is customarily sampled for classification by cutting each side to remove a portion there. These samples do not always represent the bale contents, unless particular pains have been taken to ensure uniformity of the seed cotton prior to ginning. There have been many complaints from mills of "sandwiched" bales, with poor grade cotton placed in the middle. In such cases, and where there is a difference in quality between the samples taken from the two sides, it has been customary to value the bale on the classification of the lowest grade side. The automatic sampling equipment takes samples of the entire bale periodically throughout the process of ginning, and assembles these into a single package. These individual samples are accumulated in a small press-box and pressed independently to a density approximating that of the parent bale. Because of the intervals at which the portions are taken, this composite sample is much more representative of the over-all bale quality than the two outer portions cut from the sides of the bale under present customary practices. The press-box of the new sampling equipment is so constructed that, after the sample is packaged, it can be conveniently cut into two or more segments to provide such duplicate samples as are required for the purpose of marketing transactions. Since the samples are packaged independently, the necessity for cutting the bagging on the parent bale is eliminated and a much better bale package results. The sampling mechanism is also ideal for use in any gin installation where the bale is put in a final package for shipment direct to mills.

Laboratory Fiber and Spinning Tests Adapted to Meet the Needs of the Cotton Industry: Equipment and methods for testing or measuring the physical properties of cotton fibers, and for small-scale tests of spinning performance, that have been developed or adapted in connection with the research program of the Cotton Branch of Production and Marketing Administration are being used extensively in connection with a testing service conducted by the Cotton Branch under authorization of the Cotton Service Testing Act of 1941. This act was passed in response to the urgent request of commercial cotton breeders and other branches of the cotton industry in order to make available to the industry, on a fee basis, the facilities and techniques that have been developed for evaluating, with fine precision, the various elements of cotton quality that affect spinning value. The testing services provided under the act are being used extensively, particularly by cotton breeders, cotton merchants, and cotton textile manufacturers. Private breeders of cotton varieties which now comprise approximately 90 percent of the U.S. crop are basing their breeding programs on test results obtained from this service. Cotton merchants who supply mill customers having rigid quality requirements are using the testing service to supplement customary commercial classification for grade and staple length in order to supply cotton having the precise characteristics desired. Similarly, cotton manufacturers are using the service as a means for selecting cotton having the characteristics desired for specific uses and also as a basis for improving their processing techniques. The continued expansion of this service is indicated by the fact that November 1947, was the record month for samples tested and fees collected, a total of 4,483 samples having been tested in the four laboratories operated by the Cotton Branch. Fees collected and covered into the U.S. Treasury amounted to $4,733.75. This compares with 2,793 samples tested and $3,807.20 collected during the month of October 1946, which was the previously high month since inauguration of the service in August 1941.

Wartime Changes in Milk Production and Utilization: A substantial increase in the Nation's milk output and marked shifts in utilization at both the farm and processing plant levels took place between 1940 and 1945, according to economists of the Bureau of Agricultural Economics. The 4½ million farmers who milk cows increased milk production from 109.5 to 121.5 billion pounds, a gain of 11 percent. At the same time the 2½ million commercial producers who sell milk and cream increased their deliveries into trade channels by 15 percent. During the latter part of the war, milk production was so vital that the government encouraged it through incentive payments to producers. Sales of whole milk by farmers increased from 53.3 billion pounds in 1940 to 75.5 billion in 1945, a gain of 42 percent. In contrast, the amount of milk skimmed on farms decreased from 33.0 to 24.3 billion pounds, or 26 percent. This shift in type of product sold by farmers served better to meet wartime requirements for consumer dairy products.

Commercial utilization of milk and cream likewise underwent major changes during the war years. Consumption of fluid milk by people in cities and villages between 1940 and 1945 increased by 12.5 billion pounds, a gain of 37 percent. This increase resulted mainly from the sharp rise in consumer incomes. Dairy-manufacturing plants processed about the same amount of milk in 1945 as in 1940, but marked shifts were evident in types of products made. Dairy products utilizing both fat and nonfat solids and suitable for overseas shipment increased substantially. Milk used for cheese in 1945 was 3.3 billion pounds or 41 percent greater than in 1940, and for evaporated milk 2.9 billion pounds or 55 percent more. Dry whole-milk production was stepped up to 7½ times the 1940 level, utilizing about 1.4 billion pounds additional milk. Ice cream production

in 1945 represented 1.4 billion pounds more milk than in 1940, but output was limited by the Government War Food Program to shift milk usage to other products more urgently needed. Plant output of nonfat dry milk solids for human consumption doubled between 1940 and 1945. On the other hand, factory production of butter decreased sharply during the war period and in 1945 utilized about 9.3 billion pounds less milk than in 1940, a decrease of about one-fourth.

New Soil-Moisture Measuring Device: In connection with the work at the San Dimas Watershed Experimental Forest in California, a new type of soil-moisture measuring device has been developed by the Forest Service. A small unit is placed in the soil at any specified depth with wires leading to the surface. An electronic device hooked to the wires determines the soil moisture and the temperature almost instantly. This eliminates much of the work of taking soil samples, weighing and drying them to ascertainsoil moisture. The instrument is this year being tested in other areas of the country under other soil type and climatic conditions. It is expected to help greatly in research work on water conservation and flood control, and should be of value in other phases of agricultural work as well.

This research work has also produced a new type of tensiometer, a device to maintain soil moisture in a block of soil at a predetermined moisture content. Heretofore, workers in plant physiology have been unable to prevent the accumulation of water along the bottoms of the plant conatiners because of the impossibility of naturally breaking the surface tension of the water. This also developed "perched" water tables in the block of soil so the worker could never be certain that the moisture throughout his soil approached that of natural soil. By the use of the new tensiometer the moisture of the soil inside the block can be kept the same as that outside. This device, and the one for electrically measuring soil moisture promise to revolutionize much plant research.

Soluble Sausage Casings from Fruit Wastes: A new pectinate material, made from citrus peel or apple pomace and used as a soluble protective covering for sausage and other meat products, was recently developed by the Bureau of Agricultural and Industrial Chemistry's Western Regional Research Laboratory at Albany, Calif. The method for making this new coating material is simple and easily controlled. A 2 percent dispersion of low-methoxyl pectin is prepared and adjusted to a suitable acidity. A calcium salt is added in a quantity so a calcium pectinate solution will form at about 158° and the material will gel when cooled to 104°. The sausage or other meat product, molded into any desired shape, is dipped in the warm solution for about 3 seconds, after which the liquid coating is dried in a current of air for half an hour to form a strong gelled film coating. Treated products can then be stored in the usual way. If the coated meat product is boiled, the film will dissolve; if fried or roasted, the film, which is tender and edible, may be eaten with the meat.

Progress in Vanilla Research: The Department of Agriculture Experiment Station in Puerto Rico has conducted experiments with vanilla since 1907, when cuttings were introduced from the Florida Experiment Station. The commercial industry began to grow about 1917, when a root rot appeared which has limited production and expansion of the vanilla industry to date. In 1927 a member of this station identified the causal organism as a fusarium root rot. In cooperation with the P. R. Insular Government, investigations since that time have been devoted largely to crossbreeding for varietal resistance and to study of the cultural practices which support vigorous healthy growth. A system of growing vanilla, using lath

shade admitting about 50 percent sunlight, has been devised and shows considerable commercial promise. The first year's flowering and fruiting has exceeded all expectations. One commercial grower has entered into a long-term experiment with the station, testing the method on a commercial scale. Widespread interest has resulted and the experiment is being watched by vanilla growers as the hope for the future of thi new industry.

Inventor Perfects Fiber-Measuring Devices: Seven devices for determining the fineness, shape, length, surface structure, and other characteristics of fibers have been developed by Dr. John I. Hardy, research scientist of the Bureau of Animal Industry, and are adapted to a wide range of agricultural and industrial uses. Knowledge obtained with the various instruments is valuable in the breeding of improved plants and animals. It is useful, too, in the textile industry, cleaning and dyeing operations, manufacture of felt, and even in identification of criminals from telltale bits of clothing, hair, or other fibrous material. Most devices were used first in the study of wool in connection with livestock research. But they soon proved valuable, also, in industries working with mohair, cotton, fur, bristles, paper, leather, cork, silk, and other fibers. One is a holder for determining the fineness of wool fibers. It has a small slot of known size in which fibers are packed to a desired depth and pressed down uniformly by small weights. Excess fibers are cut away by a razor blade, which is part of the device, and the fibers remaining in the slot are counted. The fewer the fibers the coarser they are, and vice versa. The other inventions are equally practical.

Loss of Plant Nutrients by Erosion: Analysis of soils washed from slopes by rains shows that a farmer is not always feeding his own crops when he applies commercial fertilizers to his fields. If he doesn't protect his sloping land against erosion, he is likely to find he is losing his plant nutrients to his neighbor lower down the watershed.

Soil Conservation Service scientists have reported a study of erosion debris made in New York State, to determine the soil and fertilizer elements lost through runoff erosion. Samples of washed soil were taken, immediately after rain, from the bottoms of the slopes of a small watershed where it had washed from 7 farms into and along the creek, along fence rows in bottomlands, and other low places. At the same time, other plow-depth samples were obtained from the soil left on the slopes. Careful analyses showed that all transported soil contained more organic matter than the corresponding soil left on the slope. The average for the 8 deposited soils was 3.7 percent, compared to 2.9 percent for the soil on the slopes.

Seven samples of moved soil contained more potassium than the slope samples, and one contained the same amount. Five samples of deposited material contained more phosphorus than the slope samples, two the same amount, and only one less. Appreciable amounts of magnesium, calcium, and ammonia and nitrate also were found in the deposited soils. Information of this kind, when given to slope farmers, does much to encourage the adoption of conservation practices especially designed to prevent erosion from sloping fields or to build up soil organic matter in fields that have suffered this damage.

Who Gets the Consumer's Meat Dollar: The way in which the consumer's dollar spent for meat is divided among livestock producers, markets, wholesalers, retailers, and packers is discussed in a report from the Bureau of Agricultural Economics by Knute Bjorka. In 1939, it was estimated, 51 cents of the consumer's dollar was received by livestock producers. Retail distribution took 24 cents, wholesale distribution almost 6, meat packing nearly 15, and marketing slightly more than 4. The report also discussed the methods of reducing costs and improving the efficiency of marketing and processing.

Dehydrofreezing Process Preserves Foods: A new process of food preservation that combines most of the advantages of dehydration--namely, reduction in weight and volume--with freezing, has attracted much interest among food processors. The process, termed dehydrofreezing, was developed by the Western Regional Research Laboratory of the Bureau of Agricultural and Industrial Chemistry, and involves carrying the product through the first cycle of dehydration, and then freezing. Since the vitamins and flavor are virtually undamaged by this initial dehydration treatment, the product retains the fresh quality, and in some instances, notably boysenberries and apricots among the fruit products investigated, it retains the original shape. In consequence of the weight and volume economies, dehydrofreezing effects savings in packaging materials. The load on refrigeration systems also is materially reduced. Reconstitution of dehydrofrozen foods is easier than that of dehydrated foods because of the greater moisture content of the former. Implications for the fruit and vegetable industries are lowered transportation, storage, packaging, and refrigeration costs.

More Eggs from Less Feed: Eggs account for more than half the income from poultry, although the rapid increase of the broiler industry in the last 50 years has been a significant development in poultry keeping, according to T. C. Byerly, poultry specialist of the Bureau of Animal Industry. In general it takes about a pound less feed to produce a dozen eggs than it did 50 years ago. Three average hens nowadays lay as many eggs as four average hens did 50 years ago. An increase in eggs per hen probably is the most important poultry gain during the half century. This is due primarily to the careful work of poultry breeders who have applied skillfully knowledge gained through experience and research in poultry genetics.

Breeding Better Hogs: Faster-growing hogs of superior conformation and greater liveability are resulting from experiments of the Regional Swine Breeding Laboratory, Ames, Iowa, conducted by the Bureau of Animal Industry and 13 State agricultural experiment stations. The research involves carefully planned systems of matings in which inbreeding, signifying the use of closely related parents, has a prominent part. The main purpose of inbreeding is to fix desirable characteristics. Hogmen, using their farms as proving grounds, are cooperating with the scientists by testing boars produced by the various systems of breeding. Thus far, over 500 boars from the various projects have been released to farmers for practical tests of breeding excellence. Five breeds and 3 lines from crossbred foundations are represented in the research. The degree of inbreeding in most of the lines ranges between 25 and 50 percent. Experiment-station data, with reports from farmers, indicate that mating boars from good inbred lines to noninbred sows results in about 100 pounds more weight per litter, when the pigs are 6 months old, than that of litters sired by noninbred boars of the same breeding as the sows. Crosses involving three inbred lines, all within the same breed, are a promising method of growing still more pork per mating.

Motor Fuels and Other Products from Agricultural Residues: A process for converting corncobs, sugarcane bagasse, peanut and oat hulls, cottonseed hulls and burs, and flax shives into sugar solutions for fermentation and chemical processing into liquid motor fuels (with several byproducts) has been developed on a laboratory scale by the Northern Regional Research Laboratory of the Bureau of Agricultural and Industrial Chemistry. It is a continuous 2-stage process for converting the cellulose of such materials into a solution of dextrose, and the hemicellulose (principally xylan) into a solution of xylose and furfural, leaving the lignin as an insoluble residue. In the first stage about 95 percent of the xylan is converted by treatment with dilute sulfuric acid into xylose and a small amount of furfural. In the second stage the cellulose is converted into dextrose by a novel procedure that includes impregnation of the dried material with concentrated sulfuric acid at a low temperature. The conversion is accomplished in 1 to 2 percent of the time and with less than 25 percent of the acid required by other known concentrated-acid processes. The xylose can be converted by known chemical processes into furfural, an important material for chemical industries, or, after the small quantity of furfural in the original xylose solution is removed and the solution is neutralized with lime and filtered, the xylose can be recovered in crystalline form or mixed with dextrose and converted by bacterial fermentation into butyl alcohol and acetone.

The dextrose solution, resulting from digestion of the acid-impregnated cellulosic material with water, can be fermented with yeast into ethyl alcohol. Crystallization of the dextrose may offer commercial possibilities. This process was recommended by the Department of Agriculture for further trial on a semiworks scale as a part of the Government program for the development of synthetic liquid fuels from nonpetroleum sources. The research is now moving into semicommercial-scale production at a new plant recently constructed under the Synthetic Liquid Fuels Project at Peoria, Ill. This plant is designed to handle enough agricultural residues to produce at capacity 2,000 pounds of glucose in 10 percent solution, 1,600 pounds of xylose in 15 percent solution, 200 pounds of furfural, and 1,000 pounds of lignin in an 8-hour day. From the fermentable material 500 gallons of alcohol can be made per day. This experimental work will accomplish two purposes. It will show maximum yields of various products from a given tonnage of different agricultural residues, and will provide a basis for computing costs and determining the feasibility of commercial production.

New Type Slatted Floor Hay Drier: Mow curing of hay over a barn drier system using forced air has become popular in some sections of the U.S. and is the generally recommended type of drier installation, particularly in the eastern humid regions. It is of the slatted-floor design, devised by agricultural engineers in cooperative research with the Virginia Experiment Station. More than half the drier systems now being installed are estimated to be of this type as well as half the present total of about 2,000. The slatted floor drier is simple in design. It consists of a tapering central air duct open at the sides on the bottom to allow the air to flow to the slatted floor and up through the hay. The slatted floor can be built of rough lumber and laid by inexperienced carpenters, insuring low-cost construction. The experimental tests have shown that duct-pressure losses in driers of this design, properly operated, are less than half those of the conventional duct systems. Air distribution is better and air flow through the hay is increased.

Plywood Adhesive from Soybean Meal or Corn Gluten: A new waterproof plywood adhesive having considerable binding strength has been developed by the Northern Regional Research Laboratory of the Bureau of Agricultural and Industrial Chemistry. It is made by combining solvent-extracted soybean meal freed of its water-soluble constituents, or corn gluten, with phenolic resin in the intermediate or water-soluble form. A commercial trial demonstrated that excellent plywood could be fabricated with such a glue, which becomes insoluble on setting. A plywood manufacturer made practical use of this discovery and has consumed large quantities of a commercial brand of soybean meal in making waterproof plywood. A manufacturer of soybean meal offered to supply a large amount of the proper quality to companies interested in the use of a soybean-modified, phenolic-resin plywood adhesive. So prospects are good for increased industrial utilization of soybean meal in adhesives. Since the new adhesive costs less than other waterproof adhesives and results in plywood suitable for use as such, or as concrete-pouring forms in building houses and other structures, it should help to reduce construction costs on farms and elsewhere.

Cobalt Deficiency in the United States: The U.S. Plant, Soil, and Nutrition Laboratory at Ithaca, N.Y. is making surveys of mineral deficiencies in the U.S. Cobalt deficiency seems to be more widespread than had been previously anticipated. Reports of cobalt deficiency in forage animals have been made from Wisconsin to Maine and along the Coastal Plain to Florida. Deficiency of cobalt in the forage results in a loss of appetite in the animals, some anemia, and a general "wasting away." If the deficiencies are extreme and are not corrected, they result in the eventual death of the animal. The deficiency may be cured by feeding the animal small amounts of cobalt salts. Through a study of the various reports, evidence is accumulating that certain types of soils are more apt to be deficient in cobalt than other types. It is hoped that, through a detailed study of the cobalt content of soils and vegetation in various regions, a generalization as to the type of soil and the amount of cobalt necessary to give best growth of animals may be reached. It is possible that in many areas just sufficient cobalt is present to give fair growth of the animals and actual deficiency symptoms are not recognizable. It may be that additional cobalt in these cases would result in better growth and health of the animals, and it is anticipated that careful laboratory studies of the problem will lead to the correction of these marginal deficiencies, as well as the precise demarcation of the areas where acute deficiencies occur.

U. S. DEPARTMENT OF AGRICULTURE

Office of Information
Mr. Harding

No. 6
Revised October 1, 1948
A USDA Document

IMPORTANT RECENT ACHIEVEMENTS OF DEPARTMENT OF AGRICULTURE SCIENTISTS

Fiber from Corn Protein: Among the best synthetic fibers from plant proteins is one the chemists have spun from zein, a protein of corn. This fiber was developed by the Bureau of Agricultural and Industrial Chemistry's Northern Regional Research Laboratory at Peoria, Ill. Recently the Laboratory has simplified the process for manufacturing zein fiber and made it suitable for dyeing with the acid dyes ordinarily used for wool. The improved fiber has a dry strength equal to that of wool and a wet strength about half that. Its shrinkage under the severe conditions of acid dyeing is 10 percent or less. One commercial firm is now producing zein fiber experimentally.

What Do Housewives Know About Nutrition? A survey conducted by the Bureau of Agricultural Economics in Richmond, Va., shows that 4 percent of the housewives interviewed had an adequate knowledge of modern nutrition, fewer than half had some knowledge of it, and about half had little or no nutrition information. Lack of adequate nutrition information did not mean that housewives served inadequate diets to their families. About half the women provided at least the minimum number of servings suggested for each food group -- mostly those who had adequate information or some knowledge of nutrition. About 3 out of 4 said they would like additional information. They were more interested in new dishes and new recipes than in nutrition as such. Housewives suggested the two best ways to get women to use nutrition information would be to point out (1) that the foods they should eat are better for health and growth of their children, and (2) that their families are likely to have more energy and live longer if they eat the foods they should. These findings are reported in "Homemaker's Acceptance of Nutrition Information in an Urban Community."

Wood Molasses for Livestock Feed: One of the most promising potential uses for large quantities of low-grade wood and wood wastes is as sugar for industrial chemicals and for livestock feed. Wood-sugar molasses produced at the Forest Products Laboratory at Madison, Wisc., is being tested as a feed for beef cattle, hogs, chickens and sheep. Agricultural experiment stations in Connecticut, Michigan, Wisconsin, Washington, Oregon, Montana, Idaho, Wyoming, Louisiana, and Mississippi are cooperating in the feeding tests. Preliminary feeding experiments have shown that the Laboratory's wood sugar is palatable, and the feeding experiments are being carried a step farther to compare the relative value of molasses from wood to that from other sources. Further Laboratory and pilot-plant research is under way to improve the efficiency of the wood-molasses-making process and to determine whether it can be made profitable under competitive conditions.

New Methods of Merchandising Large Turkeys: Years of improvements in breeding and feeding practices have resulted in the production of an abundance of large, full-breasted, meaty turkeys. The supply of such turkeys has become greater than the quantity users -- hotels, restaurants, and institutions -- can absorb. To aid the industry in disposing of these to home consumers, the Department has been cutting turkeys into various parts, and developing methods for cooking the parts. The results of the study, when completed, should stimulate increased retailing of turkey parts and provide the homemaker with directions for their preparation. The results of work on the cutting and roasting of turkey halves and quarters have been released to the press and to magazine editors in the form of picture stories. When work on disjointed pieces and on turkey steaks is completed, the practical findings of the entire study will be published by the Department in a popular bulletin, directed to homemakers, but of interest to all segments of the turkey industry. This project is being carried on by the Bureau of Human Nutrition and Home Economics, with the cooperation of the Poultry Section of the Bureau of Animal Industry, and the Poultry Branch of the Production and Marketing Administration.

Tropical Fish Used as Test Animals for Evaluating Insecticidal Plants: A quick simple method for biologically assaying insecticidal plants using "guppies" (Lebistes reticulatus) as test animals was developed at the Federal Experiment Station at Mayaguez. This method does not require special equipment or trained personnel as is the case when houseflies or other insects are used as test animals. The toxicity data obtained with "guppies" are in close agreement with those obtained with houseflies and the Mexican bean beetle. The "guppy" is a tropical fish available in large numbers in ponds and ditches. Rearing the fish, when required, is relatively easy.

Farm Fire Losses: Economists in the Bureau of Agricultural Economics have developed a method for estimating farm fire losses. Estimates for 1945, based on Census data and insurance experience, are used as a bench-mark. Losses in 1945 totaled 80 million dollars, and preliminary estimates for 1947 put losses at 99 million dollars. Details are given in a report entitled "Method of Estimating Farm Fire Losses in the United States."

Easter Lilies Now American: The lilies that brighten Easter in the U.S. today are far removed from the lilies of the field. Practically all now come from American farms. Not long ago Japanese Easter lilies filled our markets, but in the past few years American growers have increased their plantings and the American varieties now outrank the Japanese in size of flowers and health of plants. Not only are the American varieties better, but USDA scientists have developed improved methods for storing the bulbs before planting so they will bloom luxuriantly and at just the right time. The sooner cool storage treatment is started after bulb digging the better the behavior of the plants grown from them -- the more flowers and the better their quality. When most bulbs were imported this factor was harder to control.

When the first research was done there was little interest in the development of an American Easter lily bulb industry and the research was discontinued. But 10 years ago conditions had changed and investigations were resumed and expanded with the development of new techniques. Work is under way on the creation of large flowered "tetraploids" resulting from doubling of the chromosome number of the normal Easter lily, which makes larger cells, and this in turn makes larger plants and flowers. This was done by treating the scales of Easter lily bulbs with a drug of a plant origin, colchicine. These new types are not yet available commercially.

Dye Test Shows Maturity of Cotton Fibers: Chemists at the Southern Regional Research Laboratory in New Orleans have developed an ingenious, quick dyeing test which reveals the maturity of fibers in unprocessed cotton lint. It can be used conveniently in research laboratories or in dyeing plants. The test is made with a mixture of red and green dyes having different dyeing properties. The thick-walled or mature fibers dye pink and the thin-walled fibers, generally immature, dye bluish green. Differentiation of cotton on this basis is easy. The test is important because maturity affects cotton's manufacturing and dyeing properties and its suitability for various uses.

Potato Preferences: Housewives want a medium-sized potato with a smooth skin, clean surface, few eyes, and no injuries or blemishes. Most homemakers buy only one all-purpose potato, or an all-purpose potato plus one special-purpose potato, which is usually for baking. Overall, homemakers evaluated quality as the most important factor in their purchases; size was second, price third. The homemakers were also asked about storage problems, what cooking qualities they prefer, and many other questions. "Potato Preferences Among Household Consumers," Miscellaneous Publication No. 667, presents the findings of this survey which was based on a cross-section sample of towns of 2,500 population or over. The survey was conducted by the Bureau of Agricultural Economics.

Milk and Cream Consumption. "Consumption of Milk and Cream in Northeastern Marketing Areas," a report prepared by the Bureau of Agricultural Economics, brings up to date the series on sales and estimated per capita consumption of fluid milk and cream in selected Northeastern markets. As compared with prewar, marked increases in the per capita consumption of fluid milk occurred in all markets included in the study. Equally apparent are substantial declines in fluid cream sales. The greatest percentage increases in per capita consumption of fluid milk between 1940 and 1947 occurred in those markets having low absolute levels of consumption in 1940.

Conservation Practices and Peach Tree Yields: Soil erosion has long been a serious problem in the peach-growing areas of the Southeast. For 9 years the Soil Conservation Service has conducted an intensive research program at Clemson, S.C., and other places in the South to determine the best soil management practices for these orchards. It was largely a matter of cover crops, and how to treat them for control of soil erosion and to obtain good yields from the orchard trees. In 32 tests, continued over 9 years, 2 soil management practices 'led the field'. An average peach tree yield of 8.5 bushels was obtained by using a soybean-Sudan grass cover crop, mowed, as a type of mulching; and a straight grain straw mulch produced 8 bushels per tree. Vetch, the winter legume, was a close third, producing 8 bushels to the tree when used as a cover crop with crop residues left on the surface. When vetch was turned under, however, yields dropped to an average 6.7 bushels per tree. Rye, the winter nonlegume, was least satisfactory of all. It was tried in all ways -- with seedbed preparation only, with 1½ months and with 3 months cultivation, as a cover crop on the surface, and turned under -- but nothing brought yields up to those gained by using the straw, vetch, and the soybean-Sudan grass as mulch. It was concluded that the rye residues reduce peach tree yields as much by tying up nitrogen as vetch increases them by furnishing additional nitrogen, and as straw mulch does by conserving soil moisture for tree growth.

A Monument of Bread: Bread is a monument to the wheat breeders who have answered the world's cry for food. The great increase in yields that brought more than a billion bushels added wheat production over 6 years of the war period is still adding to the country's capacity to fend off hunger. There are three ways to measure the value of wheat varieties: (1) By their performance in experimental tests; (2) by the acreage farmers grow of them once they have been able to get seed; and (3) by their usefulness as parents in producing other superior varieties. A checkup by the Department showed there are 216 wheat varieties grown in this country. Of these, 110 are the result of breeding and selection by State or Federal experiment stations, and in one recent year American farmers grew them on 33,000,000 acres, more than 50 percent of the acreage. A total of 63 other varieties now in use here were brought in from other countries and now grow on about 28 percent of the acreage. Forty-four in the list were developed by private breeders and grow on 22 percent of the total acreage. The biggest factor for both producer and consumer has been the gradual concentration of more resistance to stem rust.

Tobacco: The Crop Reporting Board of the Bureau of Agricultural Economics has recently supplied a continuous series of tobacco statistics by States on acreage, yield per acre, production, price, and value from 1866 through 1945, and by types and classes from 1919 through 1945. The 1946 crop of tobacco brought growers in the U.S. more than a billion dollars, and in recent years tobacco has provided the Federal Government alone an average of more than 950 million dollars a year in revenue. "Tobaccos of the U.S." is the title of the report.

Progress on Proteins: All proteins are composed of a score or more simpler compounds called amino acids, variously combined. Two of these, cystine and methionine, contain sulfur. The generally accepted belief has been that individual proteins of the plant and animal world were unchanging, each one being composed of a constant proportion of certain amino acids fixed by nature. That belief has been overturned by a protein research chemist in the Bureau of Human Nutrition and Home Economics, and currently working on a cooperative investigation by his bureau and the Bureau of Animal Industry. The proteins he analyzed were obtained from eggs laid by hens experimentally fed on rations exactly alike -- except for the quantity and kind of protein. Some were fed a high-protein ration derived from casein, some the same from soybean meal, and the chicks hatched from their eggs were fed identical chick rations. But chicks whose mothers had consumed casein gained weight faster than those whose mothers had eaten soybean meal. Seeking the cause of this, the scientist undertook a biochemical study of the egg-white proteins, centering it on the two amino acids mentioned above. He found that when a hen's feed contains different kinds of proteins, changes can be detected in the proportions of cystine and methionine which help make up the proteins of the egg white. This signal discovery that the composition of proteins is not immutable may help explain the mystery of how varying growth rates are transmitted from hen to chick via the egg.

Entomology Lesson: In order to find out whether an insecticide is safe, effective, and economical our entomologists have to do some pretty intimate work with certain insects. For instance, suppose they want to know whether a material is poisonous to a fly, and the amount required to kill it. How would you go about that? Well, the entomologist first holds his fly captive in a small glass tube under a microscope. He uses a piston at one end of the tube to push the fly against a screen at the other end. Then he dips a tiny loop of fine wire into the insecticide solution, and a very thin film thereof forms across it. This dose can be transferred to any part of the fly at will -- its nose, or at least the organ through which it inhales and which, in unsimple language, is the "thoracic spiracle"; into its mouth; or on its back. The entomologist also has

a highly accurate method of estimating the quantity of insecticide he has in the film on the wire loop. He can measure this to the microgram, of which there are a million in a gram, of which there are about 29 in an ounce. Thus he determine the relative effectiveness of fine or coarse sprays for application as dusts or aerosols, as well as what part of the insect -- nerves, heart, breathing organs - makes it most vulnerable to attack. The method is rapid as well as accurate. Scientists in the Bureau of Entomology and Plant Quarantine, devised this delicat technique.

Fresh-Market Vegetable Supplies: Statisticians in the Bureau of Agricultural Economics have undertaken an investigation of the problems of estimating local-market supplies of vegetables for metropolitan areas. The Bureau's present estimates of commercial vegetable production do not cover all of the local-market segment of the Nation's vegetable production. Bench-mark data are also needed on yields per acre, since the U.S. Census reports on vegetables are limited to acreage and value. The project will include studies of various sampling procedures as a basis for improving the forecasts and estimates of vegetable production. A pilot survey was made in Burgen County, N.J., in May 1947. The results of this exploratory work are now available in a preliminary report, "Local Market Vegetable Supplies for the New York Metropolitan Area, Bergen County, New Jersey, 1947." The work will be continued in 1948-49 with comparable surveys for Long Island and Staten Island, N.Y., and for additional counties in northeastern New Jersey.

Educational Aids in Training Egg Graders: One of the main problems in improving the general quality of shell eggs has been the lack of a uniform and accurate interpretation of the quality of the egg as it appears before the candling light in relation to its broken-out appearance. As an educational aid in correcting and improving this condition, color charts and color slides illustrating the candled and broken-out appearance of the four qualities of shell eggs have been printed and distributed. These prints were reproductions of color transparencies made for the Poultry Branch, Production and Marketing Administration, through the cooperation of the Office of Plant and Operations, USDA. Their widespread use by egg graders, handlers, and processors has not only improved the accuracy and uniformity in quality determination, but has resulted in the improvement of shell-egg standards and grades.

Who Gets the Consumer's Shoe Dollar? The spread between the price of hides and skins and prices to consumers for the finished leather products, the charges or costs involved, and the possibilities of reducing them are analyzed in a report by the Bureau of Agricultural Economics, as part of a research project relating to marketing margins and costs of agricultural products. About 86 cents out of every dollar consumers spent for shoes in recent years was accounted for by marketing charges; costs of hides and skins took less than 14 cents. Analysis of the figures for 1939 shows that in that year manufacturers got the largest share of the consumer's dollar, 36.2 cents, and retailers got 35.2 cents. Full title of the report is "Marketing and Manufacturing Margins for Hides and Skins, Leather and Leather Products."

Fire Resistance of Houses: In connection with the work being done to find ways and means to give wood, wood products and wood structures greater safety from fire at reasonable cost, a series of "burn-out" tests were made by the Forest Products Laboratory, Madison, Wis., on a structure representative of a furnished 8-by-12-foot room. Various wall and ceiling materials were tried including interior plywood, insulation board and plaster applied to insulation board lath.

Temperature measurements obtained at various locations in the room revealed that the type of materials used for the walls and ceilings had no significant effect on the rate of temperature rise, indicating that the combustible contents of the room were the principal source of fuel.

More Electrical Appliances on Farms: Farm homes can use many of the electrical appliances that are used in city homes now that electricity is more and more available in rural areas. A survey conducted by the Bureau of Agricultural Economics and reported in "Farm Homes Use Wide Variety of Electrical Appliances" indicates that 43 percent of all U.S. farms have an electric washing machine, 38 percent have electric refrigerators, 27 percent are using electricity as power for water systems, 25 percent have electric vacuum cleaners, 12 percent have electric ranges, 10 percent have electric hot-water heaters, and 7 percent have electric sewing machines. The Pacific Coast States have the largest proportion of farms with electric appliances. It is estimated that 61 percent of all farms had central power station electric service in June 1947. Extension of power lines in rural areas has continued at a rapid pace since then.

Nutrition-wise Cooking: To learn more about good home cooking from a nutritive standpoint, food and nutrition specialists of the Bureau of Human Nutrition and Home Economics systematically cooked family-sized quantities of 20 familiar foods. Vegetables, meats, cereals, and breads were included, and each food was boiled, baked, fried or otherwise prepared by two or more suitable household methods. Before and after cooking, foods were analyzed for content of vitamins sensitive to heat, air, and water, also minerals that escape into cooking water, and the ash and moisture in the food. An important part of the research was standardizing procedures and cooking conditions, so that similar tests can be repeated with the same or other foods, for valid comparisons. An example of the findings is that, while the potato's skin protects nutritive values in cooking, the carrot's skin is unimportant for this purpose. Carrots boiled whole, pared or unpared, keep about 90 percent of their vitamin C.

Jersey-type Sweetpotatoes Flower in Puerto Rico: Sweetpotatoes cultivated in the continental U.S. for decades without flowering have bloomed and seeded normally in Puerto Rico. In breeding experiments being carried on at the Federal Experiment Station there the difficult-to-flower Jersey varieties, Orange Little Stem, Big Stem Jersey, Vineland Bush, and Yellow Jersey have been induced to flower and have set seeds in self-pollinations and in crosses with other varieties. The Jersey-type varieties flower in field plots during the same period as the moist-fleshed varieties (October, November, December, and January) and produce blossoms and seed similar to the latter varieties. The achievement of sexual reproduction in the Jersey varieties will permit a program of hybridization and selection, previously impossible, for the interchange of valuable genetic characteristics among the Jersey varieties, themselves, and also with the group of moist-fleshed varieties. A cooperative project has been worked out between the Federal Experiment Station in Puerto Rico, where the flowering was induced, and the Bureau of Plant Industry, Soils, and Agricultural Engineering for the introduction of sexua seeds to the sweetpotato breeders of the Continental U.S.

Aerial Surveys Aid Forest-Insect Detection: Aerial surveys now in process of development by the Bureau of Entomology and Plant Quarantine are a marked step forward in the field of forest-insect detection. A preliminary aerial survey of 7,750,000 timbered acres in Oregon and Washington was completed in 1947. About 710,000 acres of spruce budworm infestation, 70,000 acres of Douglas-fir tussock moth infestation, and several small outbreaks of other species were mapped, and the general status of the western pine beetle was recorded. All this was done

in about 30 hours of flying time -- less than 2 weeks' work for obtaining information that would have taken a ground crew most of the summer to acquire. The cost was far below that required for earlier ground surveys.

Improvements in Egg Cases and Packing Materials: Shell eggs have increased materially in size during the past 30 years, particularly in length. In 1918, egg measurements taken by the Department showed that about 18 percent of them were over 2 1/4 inches long. Egg measurement studies made in the spring of 1948 show that about 59 percent of the eggs then being shipped were over 2 1/4 inches long. In 1918, egg case fillers were 2 1/4 inches high and standard wooden egg cases were 12 1/2 inches deep. Largely as a result of laboratory and transportation tests made by the Poultry Branch, Production and Marketing Administration, manufacturers have added 1/16 inch to the filler height and are this year increasing the depth of standard wooden egg cases by 1/4 inch. Fiberboard egg cases are now being made at least 12 3/4 inches deep with double thicknesses of material in at least two of the four following parts: Bottoms, ends, sides, and center partitions. These changes in the height of egg cases and fillers and in the strength of fiberboard egg cases will not only better accommodate eggs of the size being shipped today but will better protect eggs during handling, transporting, and storing operations.

Interview Survey of Farm People: The Bureau of Agricultural Economics has developed a procedure for obtaining types of data that, because of their complexity cannot be gotten very satisfactorily by use of mailed inquiries. The procedure involves the selection of a sample of farms throughout the country which are then visited and the desired information obtained by interviewing the farm operators. As there are some 5 1/2 million farms in the U.S. and only some 10,000 can be contacted during one survey the problem of selecting a representative sample is quite intricate. The procedure used by the Bureau of Agricultural Economics is to group the 3,000 counties into about 400 blocks having the same type of farming then selecting one county from each block. This gives a selection of 400 countie and within these counties a random selection is made of areas of land containing about five farms each. Local people who are trained in the details of the work a in interviewing techniques then contact these farms and obtain the information needed. Two such Nation-wide surveys have been made, one in January 1947 and the other in April 1948, and another got under way in September this year. Information is collected on such topics as farm employment and wages, accidents to farm people, marketing channels and transportation methods, and inventories of farm machinery. The data collected are incorporated with related material from other sources and used in preparing the regular reports of the Bureau.

Rebuilding Eroded Soil a Slow Process: What can farmers expect from conservation treatment of their severely eroded cropland? For a decade the Soil Conservation Service has been conducting experiments to find the answer. In Wisconsin the Service's research men have been studying two areas, one severely eroded with only 3 inches of topsoil left, and the other a moderately eroded area with 6 inches of topsoil. They have treated the two areas exactly alike. Both were cropped to a 5-year rotation corn, grain, and 3 years of alfalfa-brome hay. Barn yard manure was applied to corn (8 tons per acre), and the corn also was given lime to maintain a pH of 7.0. Phosphate and potash fertilizers were used on grai to raise the level of fertility to 75 pounds of available phosphorus and 200 pounds of available potassium per acre -- they usually put on 425 pounds per acre of 0-30-34 for this. They removed two crops of hay each year and plowed under the after-growth of hay after the second crop.

Here are some of the results. After 6 years of good treatment, the yields of corn and hay on the severely eroded areas have increased to about the same level as yields on the moderately eroded areas. After 9 years of good treatment, yield of spring barley still shows the effects of the erosion. And, soil and water losses continue to be slightly higher on the severely eroded soil, with the greatest differences occurring when the areas are planted to grain. Thus it is apparent that it takes a long time, and careful study and treatment and considerable expense, to restore eroded soil to true productivity. The moral is that it is best to prevent soil erosion, by using the land according to its capabilities and treating it according to its needs before it loses its productivity.

New-Style Farm Kitchen: A step-saving U-shaped kitchen designed in housing laboratories of the Bureau of Human Nutrition and Home Economics is the first of a group of farm kitchens which the Bureau plans to develop, to help homemakers save time and effort. Other designs will include the broken U, L, broken L, and parallel-wall methods of arranging equipment. When exhibited publicly, the U-shaped kitchen has attracted wide attention and much favorable comment for its smooth production line, and its many convenient features, such as generous counter space handy garbage disposal arrangement planned especially for farm use, pull-out boards that automatically lock into place when pulled out, and effective use of such storage aids as bins, vertical files, revolving corner cupboards. Working drawings of the step-saving U kitchen are available to families through the Regional Plan Exchange Service.

Radioactive Phosphorus in Plant-Fertilizer Research: The employment of radioactive isotopes in soil-fertilizer investigation is very recent, yet the method already gives promise of being an unusually powerful research tool likely to bring about significant changes in crop production and farm management. The work being conducted by the Bureau of Plant Industry, Soils, and Agricultural Engineering in cooperation with the North Carolina, Cornell, Iowa and Colorado Agricultural Experiment Stations with radioactive materials provided by the Atomic Energy Commission from the Oakridge, Tenn., plant has already brought valuable results.

The radioactive phosphate used differs from the ordinary fertilizer phosphate in that it gives off radiations wherever it goes in the soil or throughout the various plant parts -- stems, leaves, blossoms, seeds. In the detector used (Geiger counter) this tracer phosphate, wherever it is, literally rings a bell, revealing its movements and making possible the accurate measurement of the quantity present. Thus it is possible to determine where a plant has obtained the phosphates it has used -- whether from the application of "tagged" radioactive materials or from the store of phosphates already in the soil. This is only a beginning, and other openings for this promising research key are also being explored.

Already the radioactive tracer key has opened doors for the soil and crop scientists and given substantial returns. It has shown them that in a soil with little natural phosphate plants make heavy use of that applied as fertilizer (only 20 percent of the natural but 80 percent of the applied); that in a soil with a medium quantity of natural phosphate plants make moderate use of each (60 percent of the applied and 40 percent of the natural); and that in a soil with a large amount of phosphates already there the plants get 80 percent of what they use from that source and only 12 percent from that applied.

Preliminary experiments with corn, cotton and tobacco indicate differences in the quantity of phosphorus used under similar conditions by the different crops and differences in the rate of use at various stages of growth. However, the investigators consider it far too early to speculate on changes that may result in fertilizer practices. Interesting possibilities are in the offing; such as determining availability of phosphorus in crops plowed under, the best rates and methods of application for the various economic crops, and the nature of different phosphatic materials.

Introduced Bamboos Valuable: For several years the Department of Agriculture Experiment Station in Puerto Rico introduced various species of bamboo, and in 1935 more extensive work was undertaken in this field. At present 36 species and varieties have been established on the station grounds. Several of these have been found highly resistant to the bamboo powder-post beetle which often destroys cut culms. As a result of these introductions there is now established in Puerto Rico a split-bamboo fishing-rod industry and a bamboo furniture industry, employing over 100 people. It is hoped to duplicate these industries in many small mountain communities of the Island where a most serious rehabilitation problem exists. During the past year 18,062 bamboo offsets were distributed for planting. The Puerto Rico Development Co. has set up a purchasing center for buying cured culms of bamboo from local farmers.

New Treatment Increases Peanut Yield: Fine dusting sulfur has long been used to control the potato leafhopper and peanut leaf spot on peanuts in Virginia and North Carolina. Three applications made 3 weeks apart, beginning about July 10 to 15, increased the yield of field-cured peanuts by about 25 percent. Entomologists of the Bureau of Entomology and Plant Quarantine recently found that by adding DDT to the sulfur they obtained an immediate kill of 25 to 30 percent more leafhoppers than when sulfur is used alone, and the residual effect of the DDT keeps injurious numbers of these pests off the treated vines. A mixture containing 1 percent of DDT, 90 percent of sulfur, and 9 percent of an inert materia is now recommended. DDT residues on harvested peanuts have been negligible.

Qualities of Raw Cotton Suitable for Various Cotton Products: Data have been assembled by the Cotton Branch, Production and Marketing Administration, on the qualities of raw cotton suitable for the manufacture of the following important cotton products: Print cloth, sheeting, broadcloth, osnaburg, duck, denim, combed lawns, thread, and knitting yarns. Eventually all the principal cotton products will be included. A preliminary report is being prepared on items for which sufficient material has been accumulated. This project is part of an overall study of cotton market outlets designed to provide information as to: (1) The detailed quality characteristics of cotton most suitable, both from the technological and economic standpoints, for the manufacture of each of the principal products made from cotton; (2) the quantities of cotton of each type and quality required for the cotton products as indicated by present and prospective textile production; (3) the total needs of the textile industry, or the available market outlets, for cotton of each type or quality under present and prospective levels of production; and (4) the adaptability of the different improved varieties or strains of cotton for various end-use products.

The Agricultural Ladder: A general decline in tenure status of agricultural workers between 1880 and 1940 occurred in almost every part of the U.S. In 1940 there were 133 fewer farm owners per 1,000 adult male farm workers over 20 years of age than in 1880, 86 more tenants per 1,000, and 47 more laborers. The traditionally conceived agricultural ladder as it has actually operated did not result in a rising or even a stable proportion of owners among workers in agriculture over the 60-year period. The trends were clearly toward a larger

proportion of tenants and laborers and a decreasing proportion of owners. Social science analysts in the Bureau of Agricultural Economics report these findings on tenure shifts for all States and geographic divisions, based on the censuses of agriculture and population, in "Trends in the Tenure Status of Farm Workers in the U. S. Since 1880." From 1940 to 1947 the proportion of tenant-operated farms was drastically reduced.

Improved Synthetic Rubber Made from Lactic Acid: Scientists of the Bureau of Agricultural and Industrial Chemistry's Eastern Regional Research Laboratory, near Philadelphia, have developed a new synthetic rubber called "Lactoprene EV". The raw material for this substance is lactic acid, which occurs in sour milk and may be produced by fermentation of sugars from various starchy crops. Lactoprene EV has a number of superior qualities, including high resistance to heat, which make it valuable for special industrial uses and as an insulating material. It will stand up under high temperatures better than natural rubber or any of the snythetic rubbers except those known as silicones. This new elastomer, a so-called acrylic rubber, is the most promising of several lactoprenes, or rubber-like substances derived from lactic acid. The lactoprenes are unusual, from the chemist's point of view, because they can be manufactured without butadiene or similar compounds required for most synthetic rubbers. They are also simpler to produce than butadiene rubbers, can be vulcanized without sulfur, are very tough and flexible, and are not easily damaged by oils or oxidation. The Eastern Laboratory has worked out a continuous process for making Lactoprene EV on a commercial scale. One of the large rubber companies, which already has an acrylic rubber of its own on the market, is now producing the Laboratory's rubber experimentally.

Irrigation in the Humid Region: Research in the economy of irrigation in the Eastern States, and economical methods of applying water to crops, has been conducted for several years by the Soil Conservation Service in cooperation with State agricultural experiment stations. Rainfall studies in Georgia show, for example, that although the annual rainfall averages 50 inches, droughts are of such frequency as to warrant the use of supplemental irrigation.

Irrigation of vegetables, pasture, and corn was studied at Athens, Ga. The tomatoes, okra, and pole beans showed increases in total yield of 25 to 73 percent as a result of irrigation. With the tomatoes, however, the benefit from irrigation was apparent only where the soil was treated for control of root-knot nematodes. The irrigated pasture provided more than double the grazing of the unirrigated pasture, measured in animal-grazing days. It yielded 65 percent greater gain in weight of cattle, and 34 percent more air-dry vegetation. The experiments with corn showed an average increase in yield of 23 bushels per acre, or 33 percent, as a result of the irrigation.

The total cost of irrigation in 3 to 7 applications of 1 to 2 inches in depth, with portable pipe and sprinklers, was calculated as $2 to $3 per acre-inch including amortization of investment. A study of rainfall records indicates that, if supplemental irrigation becomes adopted in the humid Southeast, farmers will use an average of 4 irrigations a year on crops that need to be watered at 14-day intervals, and 10 applications a year on those watered at 7-day intervals during the growing season from March to November.

New Head Lettuce: Progress, a new early variety of head lettuce (crisphead), with the great advantage of resistance to tipburn, has just been released by the USDA and the New Jersey Agricultural Experiment Station. The new variety has several advantages in addition to tipburn resistance. It is early maturing, high quality and free of bitterness. The savoyed leaves (curled and wrinkled) are an advantage in giving the variety a compact head as such leaves do not easily slip and loosen. So far tests of the new variety have been limited to the Northeast--New Jersey, New York, Michigan and to some extent in Virginia and North Carolina.

The variety has not been tested in the far West and South but it has shown good prospects in the East and North and is now being tested in other areas. Although most is expected of Progress as a market lettuce, there is a good prospect for it as a home garden lettuce for those gardeners who are willing to go to the bother of starting the plants indoors or in a cold frame, to be transplanted to the garden. It must be grown during the cool season to head well and the soil must have plenty of lime. If the plants are moved to the garden by the time they have 8 to 10 leaves they transplant very well. Most of the seed of Progress harvested this fall (1948) will probably go to commercial growers but in another year plenty of seed should be available from many seedsmen. No seed is available through the USDA.

DDT Controls Powder-Post Beetle in Harvested Bamboo: Dinoderus minutus (F.) is a small bostrichid powder-post beetle that infests many kinds of stored vegetable products in most of the warm parts of the world. In Puerto Rico, it bores into and destroys large quantities of harvested bamboo. Infestation often begins within 24 hours after culms are brought into storage. Wherever the adult beetles are plentiful infestation may continue imminent during the next few months of drying and curing. Culms of nonresistant species are so badly attacked as to be unusable and some are reduced to a mass of fibers and dust. Experiments conducted at the Federal Experiment Station in Puerto Rico have shown that DDT prevents most of this infestation. The ordinary 5-percent residual strength in kerosene applied to the trimmed culms immediately after harvest allows even the most susceptible species to cure with approximately 90 percent less damage than would otherwise occur. As curing increases resistance to beetle attack, the DDT treatment makes possible the marketing of susceptible bamboos for utilization in localities or climates where this insect is not a pest.

Staining Detects Hidden Weevil Infestation in Grain: A simple and practical method for determining hidden weevil infestation in wheat and other grain has been developed by entomologists of the Bureau of Entomology and Plant Quarantine. By soaking grain samples for a few minutes in a stain containing acid fuchsin and then washing them in water, little cherry-red dots appear where the weevils have laid eggs in the kernels. Female weevils puncture the kernels to deposit their eggs and then carefully plug the hole with a jellylike material which hardens and seals the egg puncture and hides the hole. It is this plug which takes up the color of the stain. The test, which can be used on wheat, corn, sorghum, and oats, now enables millers and grain purchasers to determine quickly and easily the percentage of hidden weevil infestation in any lot of grain.

Spinning Tests on 2-Pound Samples of Cotton: Spinning-test procedures for obtaining the strength and appearance grades of carded yarn from 2-pound samples of cotton lint have been developed by cotton technologists in the spinning laboratories of the Cotton Branch, PMA. The procedures are primarily for cotton breeders to permit the spinning testing of their progeny productions one year sooner than was previously possible. By this test the lint is processed throug

standard commercial cotton textile yarn manufacturing machines into one size of long-draft roving, and the roving is spun into the three different numbers of yarn on long-draft spinning frames. Because of the small amount of material used, no waste data are obtained; therefore, the test is not designed to replace the present tests on 5-pounds or larger quantities of lint. It has been added to the service tests available to cotton breeders, cotton merchants, cotton manufacturers, and others who desire to have the spinning quality of a limited amount of cotton tested for a fee under the provisions of the Cotton Service Testing Act of April 7, 1941. It is available from the Branch's spinning laboratories at College Station, Tex., and Clemson, S. C.

Consumption of Fish: Consumption of fishery products ranged from about 8 to 12 pounds per person from 1930 to 1947. Consumption in 1948 is estimated at 11.0 pounds per person, about the same as in 1935-39. In general, fish consumption has been increasing, due principally to technological advances and increased efficiency in the processing and distribution of fish. In the past, consumption of fish was heaviest along the coasts, but with the development of better machinery, new freezing techniques, improved transportation, and more adequate local storage facilities, more fishery products have been sold in inland areas. The study of the supply and distribution of fish was made by economists in the Bureau of Agricultural Economics in cooperation with the Fish and Wildlife Service and represents the first comprehensive and detailed analysis on the subject. "Supply and Distribution of Fishery Products in the Continental U.S., 1930-47," is the title of the article which is published in the July-September National Food Situation.

Fruit Wastes Make Soluble Casings for Sausage: A new pectinate material, made from citrus peel or apple pomace, gives a soluble protective coating to sausage and other meat products. It was developed by the Western Regional Research Laboratory, Bureau of Agricultural and Industrial Chemistry, at Albany, Calif. Making this transparent, edible coating material is quite simple. A solution of "low-methoxyl" pectin is prepared and adjusted to the proper acidity. Calcium salt is added, and the mixture is heated to about 158°F. When cooled to about 104°F. it forms a watery gel. Sausage or other meat molded into any desired shape is dipped into the warm solution for about 3 seconds and then dried for half an hour or so. The pectin forms a thin, strong coating over the product. This holds the meat in shape, makes it less sticky, and helps insure cleanliness in handling. After drying, the meat can be stored as usual. If treated products are boiled the pectinate film dissolves, and if they are fried or roasted the film becomes tender and may be eaten with the meat.

Conservation Methods for Western Grassland: Over the past few years, intensive studies have been made by the Soil Conservation Service to determine how to bring back good grazing in many parts of the Western range country. In some areas the results are promising -- for better grazing, and for dry grassland safe from devastating erosion in the future. In Wyoming, for example, formerly cultivated land, seeded 6 years ago to a good grass, or to a mixture, now produces as much as 105 pounds of lamb gain per acre each year. Untreated native range for the 6-year period averaged only 30 pounds per acre.

A few of the indications developing from this study are: (1) Standard crested wheatgrass is better than Fairway crested wheatgrass. (2) Russian wild rye appears exceptionally outstanding as a summer, fall, or winter grass. (3) Crested wheat is the most productive grass for spring grazing. (4) Western wheatgrass appears best for late spring-summer use instead of as an all spring grass. (5) The grass mixture of crested, western, and Russian wild rye is not as good as the same species in pure stands, from the standpoint of production

and length of season of good, palatable grazing. (6) Buffalo grass mixed with blue grama seriously reduces gains and grazing capacity of the blue grama. (7) Alfalfa mixed with crested wheat has added one-third to the grazing capacity of crested wheat in rows.

Mechanically pitted experimental pastures in Wyoming now carry about a third more sheep per acre, with a little over one-third greater animal gain per acre, and with more than 50 percent more grass left each year as compared with native range that has not been pitted. The pits on pastures treated 6 years ago are still effective in holding water, and the initial change in vegetative composition brought about by the pitting still exists. Between two and three times as many western wheatgrass plants are flourishing on the pitted pastures as on adjoining range that did not have this treatment.

Much Better Potatoes: The 225 years of potato growing in North America have made it today a half-billion-bushel crop in the United States and Canada. As measured by the development of new varieties, improvement was at a high point during the forty years just before 1900, but new breeding methods and organization of research to meet new problems, particularly of disease, have made the 19 years since 1929 the most important period in building up the efficiency of the crop.

Potato breeding was put on a country-wide basis in 1929 with the establishment of the National Potato Breeding Program, carried on by the Bureau of Plant Industry, Soils, and Agricultural Engineering at Beltsville, Md., and cooperating State experiment stations. In this short time the average yield of potatoes in the U. S. has increased from 110 bushels an acre to about 150. Now more than one-third of the certified seed potatoes produced are of the new varieties resulting from the Program -- most of them bearing names of American Indian origin, such as Katahdin, Sebago, Chippewa, Sequoia, Pontiac and many more.

The most recent of these Program potatoes is the variety "Kennebec" with high resistance to late blight, the most destructive disease with which American potato growers and those in many other countries have had to contend, and to other important diseases. In tests it has yielded 675 to 700 bushels to the acre of large, smooth, good cooking tubers. It has demonstrated its suitability for growing in Maine and New York and is considered promising for most of the late potato areas.

There are many varieties of potatoes long considered standard that are excellent yielders and of fine quality but have become less dependable because of low resistance to certain diseases and insects. This has been the chief reason for the painstaking breeding work that has gone into the 25 new varieties. As the best of these varieties become more widely used and as still better ones are produced, the bigger the yields farmers will get and the better potatoes the consumer will have for the table.

A Chemical Method for Determining Toxicity of Derris Root: A quick simple method for evaluating the toxicity of derris roots was devised. The method is based on the absorption of light by the toxic constituent of the roots dissolved in acetone and measured in a spectrophotometer at 360 mu. The transmittance values of total acetone extractives of derris roots is in close agreement with the retonone equivalent as determined biologically on houseflies. Thus the chemical method obviates the necessity of expensive and time-consuming biological assays that were formerly necessary to determine the toxicological value of derris roots. Transmittance values of lonchocarpus root do not correlate with the retonone equivalent as determined biologically.

Low-Pressure Aerosols: Low-pressure aerosols are now finding an important place for household use. The low-pressure aerosols developed by the Bureau of Entomology and Plant Quarantine are included under the patent assigned to the Secretary of Agriculture and formulas proposed for manufacture are reviewed and accepted by the bureau with respect to chemical and physical compatibility, as well as to insecticidal effectiveness. Many of the commercial products contain pyrethrum extract, piperonyl butoxide or oil extractives, DDT, and alkylated naphthalenes, with a mixture of trichlorofluoromethane and dichlorodifluoromethane as the propellent gas. They are packaged in cans that are much lighter and cheaper than the heavy containers required for the high-pressure aerosols.

Economic Aspects of Cotton Ginning Operations: The Cotton Branch, Production and Marketing Administration, is helping cotton ginners achieve maximum operating efficiency as regards cotton quality, and to do so with lowest operating costs. This is being done through a series of area studies of quality and cost of ginning services performed by various types of ginning establishments. A report was recently published on the results of a study in the North Carolina Coastal Plains area. Other reports are being prepared covering conditions in the Yazoo-Mississippi Delta, the Rio Grande Valley and High Plains areas of Texas, and the San Joaquin Valley in California, where intensive studies have been made. In each area, gins were selected to provide a representative cross-section in terms of size and types of equipment, and operating practices. The results show the comparative quality of services performed by, and operating costs of, ginning establishments with ginning and auxiliary equipment of various types and capacities. Evaluations are made of relative returns to cotton producers ginning cotton at various types of ginning establishments, taking into account charges paid for ginning services and quality of services as reflected in prices received for cotton and cottonseed. The studies have produced some highly pertinent findings in regard to the economic aspects of cotton ginning operations that are useful to ginners in making modifications for improvements and to cotton producers in selecting gins that will enable them to realize the maximum return for their product.

25-Year Outlook for Farming: Prospects for American agriculture over the next quarter century are relatively good, according to an analysis made by economists of the Bureau of Agricultural Economics for the House Committee on Agriculture. In the next few years the prices that farmers get for their products and that they pay for the goods they buy are expected to fall below 1947 levels, but demand for farm products is expected to be favorable. Americans are eating about 15 percent more food per person than before the war, and the foreign market will probably continue relatively large for some time. Farmers are in a better position to work out adjustments than they were after World War I. Stocks of staple farm commodities are relatively low and cattle and hog numbers have been reduced. For the longer-run prospect, increasing population and advancing technology make for growth in the U.S. economy. As a result, assuming employment is maintained, we can expect rising real incomes and some increases in per capita consumption of farm products.

Agricultural output is expanding and this trend is expected to contine. Farm population will probably continue to decline, and a trend toward fewer and somewhat larger commercial farms will continue, especially if employment is maintained. The level of living of farm people will continue to increase. In addition to these relatively stable trends, three variable factors will affect the long range prospect for agriculture: Employment, the general price level, and foreign demand. Farm prosperity will depend to a considerable extent upon our ability to maintain a high level of employment and real income and to encourage international trade.

Farm Mechanization: Farmers in the U.S. bought substantially more tractors in 1947 than in any previous year. Farm tractors increased from 1,545,000 on January 1, 1940 to 2,800,000 January 1, 1947, and about 3,150,000 January 1, 1948. In 1948, more than 60 percent of all farm work requiring tractors or work animals will be done with tractor machines and equipment. Specialists in the Bureau of Agricultural Economics have calculated the proportion of several farm jobs that have been done with tractor machines, animal-drawn machines, and by hand methods in 1946. Since 1939 the increased use of tractor power for light jobs like planting and cultivating corn and cotton has been much greater than has the increased use of tractor power for heavy-duty jobs such as plowing, disking, and listing. "Use of Tractor Power, Animal Power, and Hand Methods in Crop Production" is the title of the report.

Animal Units of Livestock Fed:: A new series of estimates of the number of animal units of livestock and poultry fed annually has been developed in the Bureau of Agricultural Economics. Such a measure is needed to compare the feed requirements of livestock with the feed supply. The new series includes all livestock fed in a year rather than only those on hand January 1, and is also computed by States whereas the old series was on a national basis only. An "average" milk cow is the base animal unit in the new study. Three series are presented: (1) Grain-consuming livestock, (2) roughage-consuming livestock, and (3) all livestock. The title of the report is "Animal Units of Livestock Fed Annually 1919-20 to 1946-47."

Flavor of Grapefruit Products Improved: A simple but effective method for making canned grapefruit segments and juice less bitter and generally better tasting has been developed by the Bureau of Agricultural and Industrial Chemistry at its Fruit and Vegetable Products Laboratory in Weslaco, Tex. The process involves preheating the fruit to reduce the amount of oil in the peel. At least three-fourths of Texas grapefruit canners are now using the Laboratory's method, and its value to the industry each season is estimated at $500,000.

Chemical Makes Nicotine Better Bug-killer: For a number of years scientists have been looking for a synergist, or activator, to increase the lethal power of nicotine insecticides. They were not sure, in the beginning, that such a synergist existed. But after trying several hundred compounds, researchers of the Eastern Regional Research Laboratory and of the Bureau of Entomology and Plant Quarantine found that a chemical called phthalonitrile would do the trick in some cases. Putting a little of this substance into an insecticide makes the nicotine two or three times more poisonous to certain plant pests, notably the armyworm, pea aphid, and diamondback moth. Some other insects, unfortunately, are not killed any quicker by the "spiked" nicotine than by the ordinary kind, and it appears that phthalonitrile may not be the last word in nicotine synergists. However, the discovery of its limited activating effect showed that nicotine's killing power can be increased, and chemists and entomologists are continuing their cooperative search for a better synergist.

Wilt-Resistant Sweetpotatoes: Sweetpotatoes collected on Tinian Island by a U.S. soldier in 1946 are likely sometime in the future to supply American farms and gardens with varieties more highly resistant to wilt or stem rot than any now grown in the U.S. His sweetpotatoes were sent to plant introduction specialists of USDA at Beltsville, Md., who grew sprouts from them in a quarantine greenhouse. None of the popular eating varieties of sweetpotatoes in this country possess any appreciable resistance to wilt and until very recently no important varieties of the starchy industrial type had much. But of the three selections sent from Tinian (in the Marianas) one, known for the present as P.I. 153655 has higher resistance to stem rot, even in greenhouse "death beds" loaded with the

fungus, than any other variety tested by the Department. Furthermore, this unusual Tinian sweetpotato gives promise of yielding well, and, in addition to being a valuable breeding parent for improvement of other varieties, it may be valuable "as is" in the production of commercial crops for feed and industrial use. Planting stock is not available for general distribution.

2,4-D Increased Herbicidal Action of Arsenicals and Oil Emulsions: Preliminary experiments conducted at the Federal Experiment Station in Puerto Rico have shown that concentrate 40 + 2,4-D and oil emulsion fortified with Santophen 20 + 2,4-D both suppressed the population of Commelina sp. and Ipomoea sp., broad leaf plants easily eradicated without 2,4-D. The combination sprays also suppressed more weeds than 2,4-D alone. The addition of 2,4-D to concentrate 40 increased its herbicidal action against Bermuda grass by 50 percent. Plots sprayed with concentrate 40 alone were completely covered with weeds, 60 percent Bermuda grass and 40 percent nutgrass (Cyperus rotundus L.). In plots sprayed with 0.10 percent 2,4-D in Concentrate 40 the area was covered with only 40 percent Bermuda grass and 5 percent nutgrass.

Cotton Fiber Fineness Test: Comprehensive studies have been made by cotton technologists of the Cotton Branch, Production and Marketing Administration, on three types of instruments, each of which employs the principle of air-permeability for measuring cotton fiber fineness. Two types of instruments were available from commercial sources and the third type was built in the Branch's own shops from plans furnished by the research department of a cotton textile firm. The results of this study showed that each of the three types gave good results and insofar as fineness determinations alone were concerned were satisfactory for use in the Branch's program of fiber property testing. On the basis of (1) ease of sampling (2) lack of special treatment of the sample before testing, and (3) speed of operation, it was found that the so-called "micronaire cotton fineness tester" was more satisfactory for use than the other two types. Fineness determinations with the use of the micronaire can now be made 30 times faster than was possible with the previous standard method which involved the use of the fiber sorter, the making of an array, and the weighing and counting of large numbers of fibers. Standard procedures have been set up for the use of the micronaire and an instrument has been installed in each of the Branch's four fiber-testing laboratories located respectively at College Station, Tex., Stoneville, Miss., Clemson, S.C., and Washington, D. C. A fineness test using the micronaire has been incorporated in the series of service tests available at a fee to cotton breeders, cotton merchants, cotton manufacturers, and others under the provisions of the Cotton Service Testing Act of April 7, 1941.

Polymyxin Is Promising New Medicine: Discovery of the antibiotic polymyxin, whic may be good for a number of serious human and animal diseases, was first reported in April 1947 by scientists of the Northern Regional Research Laboratory, Peoria, Ill. At about the same time it was discovered independently by two other researc organizations, one in the U.S. and one in England. This new antibiotic has prove highly active experimentally against the microbes causing typhoid, plague, one type of pneumonia, undulant fever, brucellosis, tularemia, and whooping cough. It is now known to be one of a series of similar agents, including the aerosporin obtained from the same bacterium. Polymyxin is produced by a micro-organism used at the Northern Regional Laboratory during the war for making butylene glycol, a source of butadiene for synthetic rubber. Laboratory researchers have recently worked out an improved method for estimating the potency of various polymyxin preparations. They have also made mutations of the original producing bacterium and obtained new strains which produce up to five times more polymyxin.

Canning Costs: An addition to the scanty information on costs of canning vegetables is made possible by analyses by economists in the Bureau of Agricultural Economics of data obtained by the Office of Price Administration in the Northeastern States for 1941. Direct costs account for 85 percent of all costs and the rest is overhead. These percentages vary with the grade of raw material used in computing the cost. The portion of total cost attributed to raw materials averages roughly 30 percent when fancy grade raw material costs are used. "Costs of Canning Selected Vegetables, Northeastern States, 1941" is the title of the report.

Farm Real Estate Values: Farm real estate values continued to increase during the 4 months ended July 1, 1948, according to estimates of economists in the Bureau of Agricultural Economics in "Current Developments in the Farm Real Estate Market." From March to July the index rose 2 percent. Values were 109 percent above the 1935-39 average and 2 percent above the 1920 peak. During the year ended July 1, 1948 the largest gains in land values occurred in the States extending from North Dakota to Texas, with increases ranging from 13 to 15 percent. The volume of voluntary sales during the year ended March 1, 1948 was 15 percent below the record of the previous year but still about double the 1935-39 average.

Drainage Problems: A progress report on "Drainage Problems and Systems of Farming in the Pocomoke River Watershed of Sussex County, Delaware," issued by the Bureau of Agricultural Economics in cooperation with the Soil Conservation Service, is designed to help farmers of that area and of similar areas in thinking through their farming problems and in adjusting to improved drainage as it develops. Estimates for two typical farms indicate that future incomes, on farms that take advantage of the improved drainage, would be adequate to repay the drainage costs and to provide farm families with much better levels of living than would otherwise be the case.

Alta Fescue Doing Well: Grass breeders have reason for satisfaction in the record of alta fescue, a new strain especially useful as pasture, that was picked out from a field of tall fescue twenty-five years ago. Selected by Department workers at the Oregon Agricultural Experiment Station, and developed there into a popular forage in the northwest, it is working its way into favor in many parts of the northern States and may go farther. Last year the production of seed, practically all of it grown in Oregon, Washington, and Idaho, totaled close to 2,500,000 pounds, enough for seeding about 160,000 acres. In addition to 10,000 acres devoted to alta fescue seed production, 49,000 acres was grown for forage in the three States last year.

Stands of this new fescue have surprising persistence. The first seed-increase planting was in 1936 and that plot of one-tenth of an acre is still thriving. The plant sends its roots down 5 feet or more where conditions are most favorable, a characteristic that enables it to keep green in dry weather and to keep growing continuously over a long season. It is adapted to heavy soils and does well even where drainage is poor.

Department grass specialists say alta fescue has possibilities for lawn or turf purposes in parks and playgrounds where durability outranks appearance. It may prove to be a good winter pasture grass for the South and investigations are going on in several States to test it for that purpose.

Heavy Milking Rubber Trees: The great rubber tree of the Amazon Valley, Hevea brasiliensis introduced to the Dutch East Indies on the other side of the world 71 years ago has since become the most economical source of commercial rubber, and has improved as a "milker" at a greater rate than the dairy cow has in those years. It was taken to the Dutch East Indies where it was improved in an environment uncontaminated with the plant's indigenous diseases and insects. The first mature Hevea seedling trees in plantations averaged only about 350 pounds of raw rubber an acre, but through selection and bud grafting some plantations in that part of the world have been built up to an average of 1,500 pounds.

This important increase in yielding capacity is now being obtained by planting Eastern strains of Hevea in Latin American countries, including the original home in the Amazon Valley, where -- with U.S. cooperation -- efforts are being made to develop a rubber industry on the high yield level. Diseases are controlled by top-grafting with resistant strains discovered in the Amazonian jungles.

In the years during which selection and bud grafting were increasing Hevea's rubber yield more than fourfold, the average American dairy cow in about the same time has had her milking capacity raised from an estimated 3,500 pounds a year (1889) to an estimated 5,000 today, a gain of less than 50 percent. (The cow has been domesticated for some thousands of years, of course, and the first strides in improvement of the newly domesticated rubber tree "milker" may be expected to be long.)

Production Units of Livestock: How much grain and other concentrate feeds are required to produce a given quantity of milk, eggs, meat, etc. in the U.S.? Scientists in the Bureau of Agricultural Economics have developed a device for measuring this production. It is called a production unit and is based on the feed concentrates required in producing 4,400 pounds of milk (the 10-year average quantity of milk produced per cow in the U.S.). It does not take into consideration hay, pasture, and other roughage. The production unit is a somewhat more accurate device than the animal unit in calculating feed concentrates needed at the national level and may also be used for quarterly estimates. Animal units can be used in State or regional estimates but on an annual basis only. The report is called "Units of Livestock Production, A Measure of Grain Consumption at the National Level."

Changes in the Poultry Business: Long-time changes in the poultry enterprise are reported by economists of the Bureau of Agricultural Economics in a report entitled "Changes in Farm Production of Chickens and Eggs, 1924-48." Four items stand out among the long-run changes that have developed since 1924 in the farm production of chickens and eggs in the U.S.: (1) The ever-growing relative importance of the Northeast and Lake States regions to the poultry industry and the slight decline of the Pacific region; (2) the rapid progress made in improving the productivity of laying flocks; (3) the gradual increase of the proportion of eggs produced during the early winter season; and (4) a decline in the number of small flocks and an increase in the number of medium and large flocks. A related factor is the high level of domestic consumption of chicken meat and eggs that developed and was maintained late in World War II and in the years immediately following.

Rural vs. Urban Level of Living: Regional variations are presented in Part II of "Differences Between Rural and Urban Levels of Living," a study by social science analysts of the Bureau of Agricultural Economics. Farm families are relatively disadvantaged in regard to housing and modern conveniences. The South ranks below the North and West in each housing item. Farm houses in the West are better supplied with modern conveniences than those in the North, and the disparity

between rural and urban families was less marked in the West than in other parts of the country. Health and medical services are located almost exclusively in cities and towns. The North was the most favored with respect to doctors and dentists, and the West had proportionately more hospital beds. The South had the least in all these services. Educational facilities and expenditures were higher in the North and West than in the South, and rural and urban differences were more pronounced in the South.

Rutin Established as Valuable Drug: A chemist at the Eastern Regional Research Laboratory first had the idea that rutin might be beneficial in the treatment of capillary fragility. Doctors at the University of Pennsylvania Medical School, working in collaboration with the Laboratory, tested this idea and found that rutin did restore weakened capillary blood vessels to normal in a great many cases. This discovery and the medical applications of the new drug which followed constitute one of the most important contributions to the world's health and welfare which chemistry and medicine have made in recent years. Rutin lessens the severity and duration of bleeding in hemophilia, helps to protect people with high blood pressure against apoplexy and retinal hemorrhage, and is valuable for preventing injuries from frostbite. The drug also gives protection from the harmful effects of X-rays. This suggests that it may aid in avoiding damage to human tissues from atomic radiation. The Eastern Laboratory found that green buckwheat plants are an economical source of rutin and developed procedures for extracting and purifying the drug. Recently the Laboratory has worked out improved extraction methods, using hot solvents, which will make rutin production more efficient. At least two of the more than a dozen companies now making rutin commercially have already adopted the new process. Further experiments, on the varieties of buckwheat best suited for rutin manufacture and on methods of harvesting the green plants and converting them to leaf meal, are continuing at the Laboratory.

Crop Disease Forecasting Three Crop Diseases: Plant diseases cause a waste of crops and the farmers' uncertainty as to the coming of disease epidemics causes a waste of money in precautions against possible outbreaks. To provide better guides as to the time and place for precautions against these destructive attacks the USDA, in cooperation with the States, during the past year has been operating a forecasting service. It might be compared to the storm warnings of the Weather Bureau except for the longer time covered in crop disease forecasting. This year (1948) the service, which centers at the Plant Industry Station, Beltsville, Md., and now includes 37 States, is giving special attention to three crop diseases widespread in the eastern half of the country -- late blight of potatoes and tomatoes, blue mold of tobacco, and downy mildew of cucumbers, cantaloups, and watermelons. Plans are to include other important diseases as the service develops.

Regional research is going on to provide information on which to base more accurate predictions of epidemics. With better predictions growers will make plans to fight the diseases when they are most liable to attack, and manufacturers and distributors of spray materials will make them available in the quantities needed. Farmers can help the service by promptly reporting on the appearance of crop diseases to the county agent who informs the State plant pathologists who sends his reports to headquarters where warnings are prepared when justified. When diseases promise to be inactive forecasting will save money, and when they are rampant it will save crops -- which usually means even more money saved to growers who heed the warning. Growers are showing a willingness to base control measures on the forecasts.

Survey of Marketing of West Texas Potatoes: Growers and shippers of West Texas potatoes have experienced considerable difficulty in recent years in finding a profitable commercial market for their product, and it has been necessary for the Department to procure substantial portions of the crop under the mandatory price-support program for potatoes. A survey of the marketing of West Texas potatoes was therefore undertaken by Production and Marketing Administration's Fruit and Vegetable Branch to determine the factors that resulted in the lack of market acceptance of potatoes from this area and to offer suggestions for improving the situation.

The methods by which potatoes were handled in the area were thoroughly investigated and the important markets for West Texas potatoes were visited to determine the reaction to them by receiving dealers. Among the recommendations growing out of the study were the following: (1) That a further study be undertaken to determine the effect of late irrigation on maturity and keeping quality of the crop; (2) that greater care be taken to avoid mechanical injury during harvest; (3) that potatoes not be allowed to lie in the fields in sacks or in the open so long as to permit sun or wind burn; (4) that research be undertaken to determine the factors that cause the poor shape of the White Rose potato since this variety is preferred to some others grown in the area; (5) that efforts be made to improve the general quality of the pack of potatoes sold; (6) that further work be undertaken to determine the effects of refrigeration during transit on the keeping quality of West Texas potatoes.

Sugar Beet Progress: Curly-top-resistant sugar beets, first introduced only 14 years ago, are now grown exclusively in western areas where this disease is the win-or-lose factor. But those so widely grown today are not the 14-year-old U.S. 1 "that gave new hope to farmers and sugar companies," the first product of the USDA plant breeders to make beet growing profitable again.

Following U.S. No. 1, the research men brought out U.S. 34, U.S. 33, U.S. 12, and U.S. 22, which turned out to be especially resistant and productive. As no absolute resistance has been found in all the tens of thousands of plants, combed over in test fields, breeding and selection have been continued. U.S. 22 was the mainstay during the war years, but it has been replaced by U.S. 22/2, which now has taken over those Western fields where the hordes of virus-carrying beet leafhoppers descend annually from their breeding grounds in the weedy range lands to the beet farms in the valleys.

With U.S. 22/2 doing well as the top commercial variety in the curly-top areas, the breeders used it as a source of still better varieties. They grew it under extra heavy exposure and were able to pick several new ones, notably U.S. 22/3 which is now being propagated for commercial growing. Although this one has not yet reached the farmers, it already is a source of other promising strains.

In the 1947 selection field, the plant breeders -- by delaying their plantings and by creating a curly top epidemic -- made the disease exposure so severe as to kill off the old-type beets and some of the earlier improved varieties. Only plants that could take it survived. The original U.S. 22, a fine performer under ordinary curly top exposures, yielded only 6.47 tons to the acre. But U.S. 22/2 gave 10.78 tons and U.S. 22/3 15.85 tons. Two of the very latest yielded well above 16 tons but they have not yet proved themselves for sugar content.

These breeders, by selecting for higher and higher resistance to curly top, have not only brought back farms to a profitable basis and put idled sugar factories back into operation, but the research freed sugar beet farming from independence on European seed. Growers now rely on U.S. grown seed, creating a new western industry.

Farm Inheritance: "Farm Inheritance and Settlement of Estates" is the title of a report on which economists of the Bureau of Agricultural Economics cooperated with other land economists of the Southeast Land Tenure Committee. The area studied was in Montgomery County in southwest Virginia. Making a will can facilitate the transfer of property from generation to generation, although the existence of a will does not necessarily prevent problems from arising in the settlement of estates. Problems arise over the management of life estates devised to widows, the subdivision of farms into uneconomic units, and joint ownership. The same problems as well as additional ones arise when the farmer dies intestate. A will prepared at an early age with the functions of inheritanc in mind and modified from time to time as family conditions and the amount of property change would go a long way toward removing the problems of estate settlement.

Reducing Farm Fire Losses: Farm mutual fire insurance companies have made a major contribution toward reducing heavy farm fire losses, according to findings of a survey conducted by the Bureau of Agricultural Economics in 1947. A majority of these companies made donations or paid fixed fees to regular fire departments so that these departments would answer fire calls for company members. Many companies distributed suggestions on fire prevention to members and a number of other methods were also employed. The data indicate that companies that supported fire protection spent about 1 1/3 cents, and their losses were 11 cents lower, per $1,000 of insurance than the average for companies reporting no such expenditures. "Participation of Farm Mutual Fire Insurance Companies in Rural Fire Protection Programs" is the name of the report.

Possible Effects of Soil Conservation in the North Central States: How would farm land be used and how would the volume of farm products be affected if practices recommended by the Soil Conservation Service were carried out in the North Central States, the greatest food-producing region in the country? In a report on "Possible Effects of Conservational Land Use on Production in the Corn Belt and Lake States" George H. Walter of the Bureau of Agricultural Economics shows, on the basis of these recommendations, that there would be a shift of 24.6 million acres of permanent pasture and idle land into crops and a shift of 24.5 million acres of unsuited land out of cropland use. The adoption of recommended rotations together with shifts in major uses of the open land in farms would bring a 6-percent decrease in the acreage of row crops, a 16-percent decrease in the acreage of small grains, and a 28-percent increase in the acreage of hay and rotation pasture. Yields of grain crops could be increased about 30 percent with moderate quantities of fertilizers, and yields of roughage could be doubled. Because of this added volume of roughage livestock production could be increased 40 percent.

Riboflavin Produced Cheaply by Special Yeast: Feed manufacturers use the growth-promoting vitamin B_2, or riboflavin, in mixing concentrated feeds for hogs, poultry, and other livestock. A yeast organism, found by scientists of the Northern Regional Research Laboratory, Peoria, Ill., now promises to lower the cost of making this vitamin. Experts know the yeast as Ashbya gossypii. Grown in a nutrient solution of wastes from cornstarch and meatpacking plants, it produces the yellowish substance that is riboflavin. This special yeast is a recent addition to the Laboratory's famous collection of more than 5,000 micro-organisms, used mainly in studies of fermentation processes. The collection played an important part during the war in research that boosted our output of penicillin. Commercial manufacturers of vitamins are interested in putting the Laboratory's special riboflavin producer to work in their plants, and some of them have begun experimenting with this organism. Riboflavin is now produced commercially by

both chemical synthesis and fermentation methods. The current price is about $4.25 an ounce. With Ashby gossypii, the Laboratory estimates, this vitamin can be produced for about $1.45 an ounce.

Mechanical Cotton Strippers: Suggestions on how to obtain the best results in the use of the mechanical cotton stripper are presented by research workers of the Texas Agricultural Experiment Station, Texas A & M College, and the Bureau of Agricultural Economics in "Waste in Harvesting Cotton with Mechanical Strippers on the High Plains of Texas, 1947." Important factors in reducing harvesting waste included planting cotton in 40-inch rows or carefully adjusting the stripper to precisely fit the width of the rows, regulating speed of tractor in accordance with amount of cotton on stalk and field conditions, growing storm-resistant cotton, maintaining proper condition of the fields, and skill in operating the machine. The study showed that waste from mechanical stripping on the Texas High Plains is not much greater than from hand-snapping.

Farm Tenure Situation in the Southeast: In the Southeast Region in 1945 the rate of tenancy was the lowest since 1890 and the number of full owners and part owners reached an all-time high. War-related influences accelerated and strengthened trends that were evident during the late 1930's. The rapid rise in farm incomes enabled many tenants to buy farms, and many farmers, especially those on inadequate units, left the land. With fewer people depending on farming for a living the efficiency of labor increased. However, the gains may not be permanent unless nonfarm employment opportunities remain good. These findings are reported in "Farm Tenure Situation in the Southeast," a publication of the Southeast Regional Land Tenure Committee by economists in the Bureau of Agricultural Economics in cooperation with the South Carolina Agricultural Experiment Station of Clemson Agricultural College.

Tests of Antibiotic Subtilin Continue: The Western Regional Research Laboratory, near San Francisco, is continuing its work on the production and evaluation of the antibiotic subtilin. This potentially valuable medicine is being tested by various research organizations. It may prove useful against bovine mastitis, trichomoniasis, Rickettsial infections, tuberculosis, tropical ulcers, and other diseases. Juice from waste asparagus butts was used originally to feed the micro-organism which produces subtilin, but the Laboratory has found recently that a nutrient medium containing sucrose and ammonium citrate is more satisfactory. Further research is being done on methods for increasing yields and reducing the amount of labor required in commercial production of this antibiotic.

Developing Plans for and Promoting the Construction of Efficient Market Facilities: The costs of physical handling in the marketing channel account for a large part of the total marketing bill. The Marketing Facilities Branch of Production and Marketing Administration has conducted research, developed plans, and aided in the promotion of the construction of efficient market facilities in many producing areas and terminal markets for the handling, display, storage, and sale of fruits, vegetables, poultry, eggs, meat, dairy products, and other agricultural commodities. In each locality the types of facilities recommended have been designed to meet the peculiar needs of the area affected, and in every case the facilities recommended would result either in the movement of an increased volume of farm and food products or in a reduction in the cost of distribution, or both. During the past year studies were conducted in 25 localities in 17 States. In each study the inefficiencies of the existing facilities were determined and measured; the amount and kind of new facilities needed were determined; the best location, design, and arrangement of facilities were worked out; the cost of the

proposed facility was estimated; methods of going about the construction and operation of the facility were suggested; and the tangible benefits to each group affected were presented.

The Hired Farm Working Force of 1947: More than 4 million persons worked for cash wages on farms in the U. S. in 1947. The total number of persons in the hired farm working force was about the same in 1947 as in the wartime year of 1945, but there were more young men between the ages of 16 and 35 than in 1945 and fewer women, boys and older men. The majority of hired farm workers in the course of a year are seasonal workers. Only 1,550,000 workers reported that farm labor was their main occupation and of these 346,000 also did some nonfarm work. The average cash wage income in 1947 for all types of farm wage workers, both full-year and part-year workers, was $583. This amount included $408 from farm wages and $175 from nonfarm wages. The annual cash wage income for persons who reported farm labor as their major activity and who did no nonfarm work during the year was $722. For those whose major activity was nonfarm work it amounted to $1,057. These findings are based on an enumerative sample survey made by the Bureau of Agricultural Economics and published under the title of "The Hired Farm Working Force of 1947."

Rise in Farm Population Halted: The postwar increase in the farm population was halted in 1947. Although births to farm residents exceeded deaths by nearly half a million, and nearly a million people moved to farms from towns and cities, more than a million and a half persons moved away from farms in 1947. In contrast with the gain in the number of people on farms during 1945 and 1946, about the same number of people were living on farms in January 1948 as in January 1947. From the low point of 25,190,000 reached in January 1945 at the peak of World War II, the farm population increased by nearly 10 percent to a level of 27,550,000 in January 1947, as demobilized veterans and some civilian migrants returned to farms following the end of the war. These findings are the result of continuing research studies in farm population conducted by the Bureau of Agricultural Economics and are published in "Farm Population Estimates, January 1948."

Grain Futures Markets: "Analysis of Hedging and Other Operations in Grain Futures" is a recent report from the Bureau of Agricultural Economics. These markets provide focal points at which the various factors of demand and supply are brought together to determine or register grain prices. The main purposes of the report are (1) to show the relationships between cash and futures prices of grain; (2) to find out what protection from price changes are afforded; (3) to show gains and losses from transferring hedges and from spreading operations; and (4) to give some indications of the effects of trading in futures on the stability and level of grain prices, on the costs of marketing and on income of producers.

Cotton Research Widens Markets for South's Big Crop: Old King Cotton still reigns supreme as the best all-around textile fiber, in spite of recent remarkable improvements in rayon and other competing materials. But cotton's continued superiority can be ensured only if unusual progress is made in improving cotton products. This is the conclusion of scientists at the Southern Regional Laboratory in New Orleans. Recent Laboratory surveys indicate that cotton can maintain its dominance only if production costs are lowered and if the textile quality of cotton fiber is improved. Researchers at the Laboratory are concentrating on the fiber-improvement part of this problem.

They have worked out various chemical-finishing methods to give cotton more desirable properties, and they have improved cotton-processing machinery. An important phase of the Laboratory's work has been the development of better cotton tire cord. This product was once the most important end use of cotton, but in recent years a large part of the tire-cord market has been supplied by rayon. A constant-tension stretcher for tire cord and a special ply-building machine developed by the Laboratory are being studied by tire manufacturers. These machines produce cotton tire-cord of superior strength and wearing qualities.

An outstanding Laboratory contribution in the field of cotton finishing has been the process called "partial acetylation" for rotproofing and mildewproofing cotton yarn or fabric. Two manufacturers have adopted this process to treat cotton bags used in water-softener systems. Industrial users of cotton for plastic laminates, seedbed covers, electrical insulation, and fishing nets and lines are testing partial acetylation for these products. Other developments at the Laboratory include improved methods for weatherproofing cotton. Chemical treatments have been devised which enable the fabrics used for awnings, tents, tarpaulins, and similar products to resist the effects of light and outdoor exposure while retaining their usual textile qualities.

Less Mystery About Mildew: Pathologists studying powdery mildew of wheat and barley, a bad disease in humid areas, had long wondered why it did no damage to these crops in dry areas even when conditions existed of a kind that developed it in humid areas. They were also puzzled because in humid areas there are epidemics of the disease in cool seasons, in hot seasons, in wet seasons, and in dry seasons. There seemed to be no rhyme nor reason in the evidence.

The evidence had been incomplete. Recently scientists at Plant Industry Station, Beltsville, Md., found experimentally that the amount of this mildew infection that develops in any one season depends not only on weather conditions after the plants become infected, but also -- to a large extent -- on the conditions under which the plants were grown. If the plants in the early stages of growth were subjected to drought on excessive heat or cold, the leaves developed a thicker cuticle than when conditions were more favorable. The fungus, which feeds by sending microscopic tubes into the surface leaf cells, was unable to penetrate this thickened "skin" put on to cut down loss of moisture.

These findings explain why powdery mildew is no problem in dry regions and how in humid regions the climatic conditions of each passing day leave their imprint on the defense mechanism of the plant. A cold spell in early weeks of growth, "may fortify plants against mildew attack later when weather conditions might be favorable for an epidemic." Just as experimenters use mice with standard resistances or susceptibilities to disease, now presumably plant pathologists can provide themselves with properly conditioned plants to use in their tests. So some of the mildew has been taken off the problem.

Farm Land Prices in the Midwest: A recent cooperative study summarizes developments in the farm real estate market in the Midwest during the period 1941-46 and makes comparisons with the World War I period. It also appraises the forces operating in the land market and considers possible implications of recent developments. Particular attention is called to danger spots in the recent situations. The farm real estate market in the North Central States during both world war periods was characterized by a large volume of sales with increasing land prices. The outstanding difference between the two periods was in the financing of farm transfers. The "shoestring" financing and speculation which were common in the World War I land boom were not prevalent during the recent war period. Despite this favorable over-all situation, however, many farms were

transferred with a minimum of down-payments. This was recognized as one of the major "danger spots" in view of uncertainty as to the continuance of the currently high farm income level. It was pointed out that those who have bought land recently with small down-payments will need to reduce their debt obligations rapidly while farm earnings are still high in order to avoid a possible future precarious debt situation. "Farm Land Prices in the Midwest" was prepared by economists of the Bureau of Agricultural Economics in cooperation with the North Central Regional Land Tenure Committee and was published by Michigan State College.

Gum Naval Stores Industry Aided by Research: Producing turpentine and rosin from pine gum, one of the South's oldest industries, has undergone a technological revolution in the last 20 years. The Department's research on naval stores processing, now conducted by the Bureau of Agricultural and Industrial Chemistry, has led to improved steam-distillation methods and establishment of central gum-cleaning plants. Chemical derivatives of turpentine and rosin have found wider uses, and new equipment and techniques have helped pine-gum refineries get increased yields of better quality naval stores products. This has meant higher prices for crude gum and more money in the pockets of "turpentine farmers" in the longleaf and slash pine forests of the South Atlantic and Gulf coasts. There are now some 40,000 of these farmers. About three-fourths of them collect pine gum as a profitable sideline to their regular farming operations. The latest improvement in gum processing, made at the Naval Stores Research Station near Olustee, Fla., is a continuous method for obtaining rosin and turpentine. The new continuous steam still developed by the Station has a number of advantages over the batch-type stills in current use. It requires only one operator instead of the two necessary for present commercial stills, needs only half as much steam, and increases the yield and quality of naval stores products. It is the result of several years' development work and makes possible the kind of efficient processing which the industry has been trying to achieve for a long time. Cleaned gum is fed into the still continuously, and turpentine and rosin are obtained continuously from separate outlets. Industrial processors have shown considerable interest in this new still, which began trial operations in the summer of 1948.

Farm Income: Farmers' cash receipts from marketings during the first 8 months of 1948 totaled 17.9 billion dollars, 4 percent higher than in the same period last year. Receipts from livestock and livestock products were up 10 percent over last year but crop receipts were down about 4 percent. Although prices received and farmers' cash receipts are up a little on the average, the prices they have had to pay and their total production costs are also higher. It seems probable that net income so far this year has been lower than last year for most farmers. Preliminary estimates indicate that the total volume of agricultural production for sale and for consumption in farm households in 1948 will be only a little below last year's record output. The report from the Bureau of Agricultural Economics also gives estimates, by States and commodities, of cash receipts from farm marketings in 1946 and 1947. State estimates of the value of products consumed in farm households where grown are also included.

Improving Retail Merchandising of Fresh Fruits and Vegetables: An important development in the past year in the field of retail merchandising of fresh fruits and vegetables is a program sponsored by the Department in cooperation with the United Fresh Fruit and Vegetable Association. This is in conformity with the provisions of the Research and Marketing Act of 1946, under which a program is being conducted for the training of retailers of fresh fruits and vegetables in merchandising techniques. The need for improvement in this field is evidenced

by the considerable wastage and losses from handling fresh fruits and vegetables in many retail stores, and has long been felt in the industry. Under the Department's program, conducted by the Fruit and Vegetable Branch of Production and Marketing Administration, a contract was entered into in October 1947 with the United Fresh Fruit and Vegetable Association whereby that organization undertook to conduct courses in cities and towns throughout the country, at which retailers and their employees would be instructed how to improve methods of merchandising fresh fruits and vegetables. This 1-day course includes information on methods of trimming green vegetables, caring for fresh produce during the day and overnight, effective display, suggestions for improving sales techniques, and various aspects of receiving, record keeping, and pricing. As of the end of August 1948, over 5,000 retailers and their employees had been trained in classes held in 29 cities and towns. Classes are being opened each month in additional cities.

Debt and Taxes on Farms: The farm-mortgage debt on January 1, 1948 was 4,882 million dollars, an increase of about 104 million dollars or 2.2 percent over a year ago. This rate of increase was slightly higher than between January 1, 1946 and January 1, 1947. The increases in debt during 1946 and 1947 represent a reversal of the downward trend in the farm-mortgage debt which has been in progress since 1923 with but one minor exception in 1928. "Farm-Mortgage Debt Shows a Further Rise in 1947," is the report giving these estimates. Farm real estate taxes per acre averaged about 15 percent higher in 1947 than in 1946, it is reported in "Farm Real Estate Taxes in 1947." This is the fourth consecutive year that the average for the country as a whole has risen. Taxes per $100 of real estate value increased to $0.96 in 1947 after remaining at $0.90 for 2 years. This is the first increase of taxes in relation to real estate values to appear in nearly a decade. Although farm land values continued to rise in 1947, taxes rose relatively more. These findings are a result of studies in the Bureau of Agricultural Economics in the field of agricultural finance.

Managing Farm Finances: USDA publication "Managing Farm Finances," fills a long-felt need for reliable information on financial problems daily confronting farmers. The trend toward larger, more highly specialized family farms presents an increasing volume of financial transactions that the farmer must handle competently if he is to stay in business. In this publication the various problems encountered in investing in the farm are treated in detail, including those concerned with investments in land, in machinery and equipment, and in the home. Considerations in making investments outside the farm are also discussed such as those in stocks, bonds, U.S. Postal Savings, and bank accounts. Information is given on the various kinds of financial safeguards commonly employed by the farmer. These include the building up of financial reserves and the covering of crops, buildings, and equipment with insurance. A brief discussion is given of farmers' problems in purchasing life insurance.

The farmer who needs to borrow money will find useful information regarding sources of credit, as well as the forms in which it is extended to farmers for purchases of land, equipment, or consumer goods. He will gain many useful tips in judging when to use credit to advantage and how to decide what types of repayment contracts are cheapest and best. At one time or another most farmers are parties to a transfer of land with its unfamiliar problems in searching titles, and in executing and in recording deeds and mortgages. Here again helpful information is made available in language easy to understand. Farmers and those who work with farmers will do well to explore the contents of this timely publication.

Grain Proteins Compared: In recent experiments on the quantity and quality of proteins in a number of major grain foods, the Bureau of Human Nutrition and Home Economics found that rolled oats equaled or surpassed all of the others on both points. Rice ranked with oats as the highest in nutritional quality of its protein, though rice was lowest in the amount of protein present. Rye, whole wheat, barley, and corn followed in the order named in the quality of their proteins. Between hard spring wheat and soft winter wheat no significant difference in quality was found.

Penicillin Reduces Losses from Erysipelas in Turkeys: Bureau of Animal Industry experiments indicate that penicillin is highly effective in saving turkeys infected with the swine-erysipelas organism, to which turkeys as well as swine are susceptible. Infection in turkeys usually attacks the flock just before marketing, when the birds are most valuable. The use of penicillin reduced the mortality of infected birds to 10 percent when 100 percent of untreated birds, similarly affected by the disease, died. The drug, suspended in peanut oil, was given in doses of 20,000 units, repeated 4 times a day apart. The experiments disclosed that the best method of treatment was to inject the penicillin into the wattles. This location is preferred since the wattles are readily accessible, are not used for food, and accommodate a large dose of the drug. Another method of giving penicillin was in drinking water, but this proved to be unsatisfactory since only 1 bird in a group of 10 would drink the medicated water. That bird, however, recovered from the infection. The salts of penicillin appear to have a powerful germicidal effect on the disease organisms. The experiments which are regarded as preliminary, included 222 three-quarter grown turkeys, treated in various ways in groups of 10.

Woodworking Wastes for Corrugating Boards: The Forest Products Laboratory of the Forest Service demonstrated that corrugating boards can be made successfully from woodworking wastes such as those from box plants and furniture and veneer mills. The pulps for the boards were made from the three wastes employing two different chemical pulping agents (neutral sulfite and soda ash). There was little difference in properties of the pulp from the two processes. However, the box plant wastes produced the strongest pulps in the highest yield (81 percent of original wood) and the veneer waste the weakest pulp (by roughly 25 percent) in the lowest yield (71 percent). Corrugating boards made from the two types of pulp from the composite waste materials also differed only slightly in strength and further differed little from an experimental board made from commercial straw pulp and from a commercial straw corrugating board. The experimental boards corrugated satisfactorily and showed the same crush resistance in the form of a corrugated fiberboard as commercial straw corrugated fiberboard.

Control of Potato Insects by DDT Increases Yield: Increased potato yields have followed insect control through use of DDT insecticides. Research on DDT formulations developed by the Bureau of Entomology and Plant Quarantine resulted in a saving of more than $300,000 in insecticide cost during 1946 to potato growers in Maine. Entomologists have long considered insects highly destructive to potatoes, but damage of this magnitude had not been suspected. Potato vines customarily die late in August. Heat, drought, or other factors have been considered reasons for this. The potato tuber stops growing when the plant dies. The potato crop thus has been made by middle August under normal culture. It was shown during the 1944 season, through small experiments, that the common potato insects could be controlled with applications of certain DDT preparations. More extensive testing, in 1945, led to the conclusion that this material is suitable for large-scale field use on potatoes.

New Insecticides Control Insect Pests in Greenhouses: The development of the gas-propelled aerosol insecticides by entomologists and chemists of the Bureau of Entomology and Plant Quarantine has resulted in an efficacy of insect control in greenhouses heretofore unexcelled. DDT aerosols have been found effective against a number of insect pests in greenhouses. Less than ½ ounces of DDT aerosol solution have proved sufficient for 1,000 cubic feet of greenhouse space. The use of properly formulated DDT aerosol insecticides has resulted in no injury to plants. However, some greenhouse insects are not affected by DDT aerosols.

Hexaethyl tetraphosphate, in an aerosol preparation, has been found to be effective in the control of many greenhouse insects which are not affected by DDT aerosols. Applications of 1/3 ounce of hexaethyl tetraphosphate aerosol solution in methyl chloride per 1,000 cubic feet have proven satisfactory. Of more than 130 plant species upon which this material has been tried, only tomato and chrysanthemums have been affected adversely. Weekly applications of this material over a period of months in rose houses resulted in vigorous growth free from spider mites and their injury. Rose production increased in some houses as much as 30 percent. This new treatment has been widely adopted by commercial greenhouse men. Dr. Floyd F. Smith received an award from the Society of American Florists and Ornamental Horticulturists for this work.

New Type Slatted Floor Hay Drier: Mow curing of hay over a barn drier system using forced air has become popular in some sections of the U.S. and is the generally recommended type of drier installation, particularly in the eastern humid regions. It is of the slatted-floor design, devised by agricultural engineers in cooperative research with the Virginia Experiment Station. More than half the drier systems now being installed are estimated to be of this type as well as half the present total of about 2,000. The slatted-floor drier is simple in design. It consists of a tapering central air duct open at the sides on the bottom to allow the air to flow to the slatted floor and up through the hay. The slatted floor can be built of rough lumber and laid by inexperienced carpenters, insuring low-cost construction. The experimental tests have shown that duct-pressure losses in driers of this design, properly operated, are less than half those of the conventional duct systems. Air distribution is better and air flow through the hay is increased.

Cobalt Deficiency in the U.S.: The U.S. Plant, Soil, and Nutrition Laboratory at Ithaca, N.Y., is making surveys of mineral deficiencies in the U.S. Cobalt deficiency seems to be more widespread than had been previously anticipated. Reports of cobalt deficiency in forage animals have been made from Wisconsin to Maine and along the Coastal Plain to Florida. Deficiency of cobalt in the forage results in a loss of appetite in the animals, some anemia, and a general "wasting away." If the deficiencies are extreme and are not corrected, they result in the eventual death of the animal. The deficiency may be cured by feeding the animal small amounts of cobalt salts. Through a study of the various reports, evidence is accumulating that certain types of soils are more apt to be deficient in cobalt than other types. It is hoped that, through a detailed study of the cobalt content of soils and vegetation in various regions, a generalization as to the type of soil and the amount of cobalt necessary to give best growth of animals may be reached. It is possible that in many areas just sufficient cobalt is present to give fair growth of the animals and actual deficiency symptoms are not recognizable. It may be that additional cobalt in these cases would result in better growth and health of the animals. It is hoped that careful laboratory studies of the problem will lead to the correction of these marginal deficiencies and precise demarcation of the areas of acute deficiency.

U. S. DEPARTMENT OF AGRICULTURE

Office of Information
Mr. Harding

Document No. 6
Revised March 1, 1949
A USDA Document

IMPORTANT RECENT ACHIEVEMENTS OF DEPARTMENT OF AGRICULTURE SCIENTISTS

Kitchen Utensils -- How Many Needed? A list of 50 items making up a recommended minimum set of kitchen utensils for farm-family use answers an old question. Brides and experienced housekeepers, as well as kitchen cabinet manufacturers and home economics teachers, wanted the information. The Bureau of Human Nutrition and Home Economics got its answer from experiments conducted in 90 households in California, Nebraska, and Rhode Island. Test sets of kitchen utensils were loaned for 3 weeks to the 90 families, who put away their own kitchen utensils for the time. The minimum set of 50 is recommended for reasonable efficiency in getting meals. These 50 were used at least once a week by half or more of the homemakers. Adding 22 more pieces makes a more desirable basic set. These 22 were used at least once a week by 25 percent or more of the homemakers.

Sanded Paint Finish Durable on Plywood: The Forest Products Laboratory, maintained by the Forest Service at Madison, Wis., reports that in test fence studies of Douglasfir and Western hemlock plywood of exterior grade a coating of house paint containing sand lasts much longer, curtails checks, and conceals the checks that do develop better than any ordinary paint coating. The sanded paint finish consisted of one priming coat of high-quality house paint, a second coat of paint in which ordinary builders' sand was sprinkled generously while the paint was still wet, and a third coat of the paint. The sanded paint presents the appearance of stucco or painted cement.

Rabbits Require Essential Fatty Acids: Recent studies at the U.S. Plant, Soil, and Nutrition Laboratory, Ithaca, N. Y., with the experimental feeding of rabbits indicate for the first time that a herbivorous animal may require a dietary source of the so-called "essential fatty acids." In the rabbit, a chronic deficiency of these essential fatty acids may possibly result in liver cirrhosis and retarded growth; an acute deficiency may be manifested by poor growth, an unthrifty appearance because of the loss of hair and absence of a sheen to the hair coat, and a sloughing off of dried skin resembling dandruff flakes. The rabbit appears to have heard about vitamin B_{12}. Current work suggests the possibility that the rabbit under certain dietary conditions requires an unknown vitamin for good growth, and the recently isolated vitamin B_{12} may be this factor.

Wheat, Flour, and Bread Prices: In general, the prices farmers get for their wheat tend to move in the same direction as the retail prices of flour and bread. But in the period January through October 1948, when the national average local market price of wheat dropped 30 percent and the retail price of flour dropped 15, the retail price of bread rose 0.7 percent. Failure of the retail price of bread to respond to the rapid fall in the price of wheat intensified farmer and consumer interest in the cost of marketing certain of our basic farm

products. According to an analysis by the Bureau of Agricultural Economics, a substantial part of the marketing margins for flour and bread is made up of fairly stabilized costs such as salaries and wages, transportation costs, storage, and packaging. On the whole, these costs increase and decrease along with the general level of prices, but to a lesser extent; and they tend to lag behind the general price changes. This makes the marketing charges relatively rigid in comparison with retail prices. As a consequence, the farmer's share of the retail price rises rapidly during periods of inflation and falls rapidly during deflationary periods. A preliminary report based on a study made with funds authorized by the Research and Marketing Act of 1946 is given in "Farm to Retail Margins for White Flour and White Bread."

New Uses for Growth Regulator: Practical new uses for growth-regulating substances, says the Bureau of Plant Industry, Soils, and Agricultural Engineering, are gradually developing as a result of basic research on their effects on plants. For example, studies show that relatively large quantities of growth-regulators tend to slow up the aging of plant cells. This offers promise as a means of prolonging post-harvest freshness and vitamin content in fruits and vegetables. Some phenoxy compounds have a marked effect in slowing up the rate at which post-harvest changes take place in green beans. Pods were treated with varying concentrations of from 50 to 1000 parts per million of the compound. After 17 days the percentage of beans remaining plump and green was greatest at the higher concentrations used. Sixty-six percent of the pods treated with 1000 parts per million of the compound were plump and green, but all the untreated were shriveled. The treated pods also maintained a relatively high level of vitamin C for a longer period than the untreated ones.

Inventor Perfects Fiber-Measuring Devices: Seven devices for determining the fineness, shape, length, surface structure, and other characteristics of fibers were developed by the Bureau of Animal Industry, and are adapted to a wide range of agricultural and industrial uses. One of them actually aids in the detection of criminals. The knowledge obtained with the various instruments is valuable in the breeding of improved plants and animals. It is useful, too, in the textile industry, in cleaning and dyeing operations, in the manufacture of felt, and even in the identification of criminals from tell-tale bits of clothing, hair, or other fibrous material. Most of the devices were used first in the study of wool in connection with livestock research. But they soon proved valuable, also, in industries working with mohair, cotton, fur, bristles, paper, leather, cork, silk, and other fibers. One of the inventions is a holder for determining the fineness of wool fibers. It has a small slot of known size in which fibers are packed to a desired depth and held down to a uniform pressure by small weights. Excess fibers are cut away by a razor blade, which is part of the device, and the fibers remaining in the slot are counted. The fewer the fibers the coarser they are, and vice versa.

How Heavy Should I Feed My Hogs? This is the title of AIS-78, recently published by the Bureau of Agricultural Economics. If a farmer is wondering whether to put an extra 50 pounds gain onto a hog and it will take a month to do it, then his problem is to figure out how much the extra 50 pounds of live hog will be worth, how much it will cost to keep a hog and feed it for an extra month, and how much the price of hogs is likely to change in a month. This 4-page report gives a rough guide that should make the figuring easier.

Light and Nitrogen Requirements of Cinchona: An experiment started in 1946 to determine the nitrogen and light requirements of cinchona plants during the nursery stage was completed during the year. Best results have been obtained with seedlings grown under the higher levels of light, particularly when the nitrogen was also in abundant supply. Seedlings receiving plenty of nitrogen under full and three-quarters light were the most thrifty and developed the better color. The light factor, however, proved to be less important than hitherto believed, provided the plants were supplied with adequate amounts of nitrogen; those given low or medium quantities of nitrogen made significantly less growth, regardless of the light treatment applied. Furthermore, a study of the relationships of nitrogen and phosphorus to the growth and composition of young cinchona seedlings indicated nitrogen to be unquestionably the more important element. Plants deficient in nitrogen contained lower amounts of quinine and total alkaloids than those receiving the full nutrient requirements. Roots of plants deficient in either potassium or magnesium had a relatively low quinine content; in the stems, however, the reverse was true. Deficiencies in potassium were followed by a high magnesium content in the leaves. This work was done at the Federal Experiment Station, Puerto Rico.

Kenaf Fiber for Sacks: Latin America sells to the U.S. many commodities such as sugar, coffee, and cacao, packaged in jute bags. Fabric for these bags has been supplied from distant India. For several years the Office of Foreign Agricultural Relations has been conducting research with bast fiber crops that might be useful for bags and other purposes for which jute has been utilized. This research work has been conducted cooperatively with the governments of Cuba, Dominican Republic, El Salvador, and Peru. Kenaf (Hibiscus cannabinus) has such seedling vigor that competitive weeds are choked out, can be harvested in 90 days after planting, and yields about a ton of fiber per acre. The fiber which has been produced in Cuba has been sought by U.S. users of raw jute as substitute for short-supply jute. In addition to the agronomic research much progress has been made toward mechanizing the production of kenaf. In drop tests with kenaf and with jute sugar bags filled with raw sugar the jute fabric ruptured when dropped 11 feet while the kenaf fabric did not rupture after repeated drops of 15 feet. Several commercial interests are actively initiating production in these neighbor countries. Not only is such cooperation with the other American Republics helping build an industry of value to the U.S. but also kenaf cultivation fits into the better labor and land use needs of such sugar-producing countries.

Grasshopper Control Improved With New Insecticides: Improved control of grasshoppers is now possible through use of two new organic insecticides, chlordane and toxaphene. Tests conducted by the Bureau of Entomology and Plant Quarantine during 1947 and 1948 have shown sprays, dusts, or baits containing these chemicals to be more effective than the bran-sawdust-sodium fluosilicate bait formerly used. When applied as sprays, chlordane and toxaphene give higher initial kill of the hoppers, and continue to kill over a longer period, than when applied in equal dosages as dusts. These insecticides may be applied with ground dusters or sprayers of various types, or from airplanes. The Bureau recommends that for sprays 1 pound of technical chlordane or 1½ pounds of technical toxaphene be applied per acre. For dusts, the dosages are 1½ pounds of technical chlordane or 2 pounds of technical toxaphene per acre. Somewhat higher dosages may be needed late in the season

on rank vegetation and against full-grown grasshoppers. Baits containing these new insecticides are much more economical than sprays or dusts, and equally effective for use, in sparse range grass, grain stubble, or dry vegetation that is no longer highly attractive to grasshoppers as food. Forage treated with chlordane or toxaphene should not be fed to dairy animals or to animals being finished for slaughter.

Food Requirements of Children: In learning more about the nutritional needs of children, more accurate information is needed about the energy children use. Although the energy used by adults has been studied, little work had been done with children. Cooperating with Columbia University, the Bureau of Human Nutrition and Home Economics has obtained information on the basal metabolism of normal children and the added energy used in 15 physical activities that are part of children's everyday life. Subjects were 38 boys and 39 girls 9 to 11 years of age. The youngsters were studied in such activities as walking, sitting quietly or engaged in eating and writing, standing quietly or working at a blackboard, dressing and undressing. How much energy the children used was measured by using a respiration chamber and other apparatus.

Forest Seeding by Airplane: An experiment in the use of airplanes to sow forest tree seeds was started last year by the Forest Service following the severe 1947 forest fires in Maine. These fires destroyed all tree growth that might have reseeded the forest. Rodents which might eat the seeds had been eliminated and vegetation that would compete with the young tree seedlings had been destroyed. Thus conditions were favorable for the establishment of a new stand of trees from seeds sowed from the air. It was found that the cost of airplane seeding is much less than that either of hand sowing the seeds on the ground or of planting nursery-grown stock.

Cobalt Deficiency and Hay Quality: Clover and alfalfa are good sources of cobalt, an important element in cattle nutrition. Studies at the U. S. Plant, Soil, and Nutrition Laboratory, Ithaca, N. Y., have shown that timothy, the most common grass in mixed hay, is generally a poor source of cobalt, particularly in soils where cobalt is a limiting factor. The clovers and alfalfa, on the other hand, are good sources of cobalt even on soils relatively poor in this element. These forages seem to have unusual abilities for mobilizing this element from the soil. Thus, they will often contain from 2 to 5 times as much cobalt as the best grass growing on the same soil. In a study involving over 300 samples of mixed hays obtained from farms in northeastern New York, the Laboratory found that the cobalt content of the hay was closely related to the legume content. Hays containing 25 percent of legume always contained at least the minimum quantity of cobalt essential for cattle and sheep, hays containing 50 percent always contained ample quantities of cobalt and cobalt-deficiency troubles will not occur under these conditions. Thus, a hay-quality program can be one of the best preventatives of the cobalt problem. In addition, many other benefits are certain to be realized as poverty grass and other weeds give way to the clovers.

Radioactive Materials don't Benefit Crops: In the 1948 growing season experiments with low-level radioactive materials in 14 States and with 18 crops have shown no benefit in yield or quality. The experiments, first under a special 2-year study to be carried on by the USDA and cooperating agricultural experiment stations, were undertaken in March at the request of the Atomic Energy Commission, with funds supplied by it, to determine the effects of radioactivity upon crop growth. The materials used to apply radioactivity to the

various crop plots were a commercial radioactive product and radium. The first was applied at three different rates with 10 replications (repeated 10 times). The other was applied in only one concentration, comparable to the medium concentration of the commercial material, but with the same replication.

The field experiments on the crops indicated were conducted in cooperation with the State agricultural experiment stations are listed below: Arkansas, sweetpotatoes; Georgia, cotton; and soon Illinois, corn, soybeans, oats, and alfalfa; Kentucky, tomatoes; Michigan, navy beans, table beans, and spinach; Mississippi, corn; Montana, potatoes; North Carolina, tobacco and peanuts; Ohio, ladino clover; New York, carrots and potatoes; North Dakota, wheat and barley; Washington, sugar beets, field beans, and wheat; West Virginia, corn. Experiments with tomatoes and turnips were conducted at the Plant Industry Station, Beltsville, Md.

The scientists carrying on the tests say the results this first season indicate strongly the farmer cannot expect increased yields from money invested in radioactive materials, but the investigations will be continued for another year. They caution against confusing this study with the use of radioactive isotopes as tracers in the study of soils, fertilizers, and the nutrition of plants. As a research tool, radioactive isotopes are proving valuable, they say, but they admit they have still to find any evidence that radioactive materials stimulate plant growth.

Penicillin Reduces Losses from Erysipelas in Turkeys: Experiments conducted in the Bureau of Animal Industry indicate that penicillin is highly effective in saving turkeys that have become infected with the swine-erysipelas organism, to which turkeys as well as swine are susceptible. The infection in turkeys usually attacks the flock just before marketing, when the birds are most valuable. Penicillin reduced the mortality of infected birds to 10 percent when all untreated birds, similarly affected by the disease, died. The drug, suspended in peanut oil, was given in 4 doses of 20,000 units, repeated a day apart. The experiments disclosed that the best method of treatment was to inject the penicillin into the wattles. The location is preferred since the wattles are readily accessible, are not used for food, and accommodate a large dose of the drug. The salts of penicillin appear to have a germicidal effect on the organisms that cause the disease. The experiments which are regarded as preliminary included altogether 222 three-quarter-grown turkeys, treated in various ways in groups of 10.

Potato Preferences Among Restaurant and Hotel Buyers: This study is part of a Research and Marketing Administration consumer preference project. It is a personal-interview survey of all hotel and chain-restaurant buyers and a heavy sample cross-section of all individual restaurants in two contrasting cities, New Orleans and Cincinnati. The objectives of the study were planned in cooperation with RMA Advisory Board on Potatoes, the Potato Branch of the Production and Marketing Administration, potato marketing experts in Bureau of Agricultural Economics, and also with the advice of the National Restaurant Association. Interviewing was done in the spring of 1948 and analysis in May and June. The report is scheduled to appear in April 1949. It is expected to be of interest and value to the same industrial and professional groups as the household survey and also to the hotel and restaurant industry.

Bamboo Propagation and Fertilization: Local farmers in Puerto Rico have evinced considerable interest in the planting of bamboo as a cash crop following the purchase of culms by the Puerto Rico Industrial Development Co. and the establishment of bamboo fishing-rod and furniture industries based on utilization of the new species and varieties introduced by the station. Experiments on the fertilization of bamboo have shown this practice to be economically sound; more clumps developed and the average diameters were greater when fertilizer was applied during the early development of the clump. A large part of the expense involved in establishing a bamboo plantation lies in the cost of digging the clumps. Data obtained on the use of dynamite for the larger clumps showed that this method halves the cost as compared with hand-digging. With smaller clumps, dynamiting reduced the man-hours but the total cost remained essentially the same. No damage to the bamboo followed the use of dynamite, clumps that were blasted out sprouting and growing as well as those that were dug by hand. This work was done at the Federal Experiment Station, Puerto Rico.

Developing Plans for and Promoting the Construction of Efficient Market Facilities: The costs of physical handling in the marketing channel account for a large part of the total marketing bill. The Marketing Facilities Branch of Production and Marketing Administration has conducted research, developed plans, and aided in the promotion of the construction of efficient market facilities in many producing areas and terminal markets for the handling, display, storage, and sale of fruits, vegetables, poultry, eggs, meat, dairy products, and other agricultural commodities. In each locality the types of facilities recommended have been designed to meet the peculiar needs of the area affected, and in every case the facilities recommended would result either in the movement of an increased volume of farm and food products or in a reduction in the cost of distribution, or both. During the past year studies were conducted in 27 localities in 18 States. In each study the inefficiencies of the existing facilities were determined and measured; the amount and kind of new facilities needed were determined; the best location, design, and arrangement of facilities were worked out; the cost of the proposed facility was estimated; methods of going about the construction and operation of the facility were suggested; and the tangible benefits to each group affected were presented.

Biology in Soil Conservation: Analyses made by the Soil Conservation Service have disclosed that true conservation on farm land includes various land treatments that conserve soil and water and at the same time encourage wildlife production. As a result, more effective methods have been developed for incorporating such practices as field or woodland border plantings, pond management for fish production, and others, into farm and ranch plans being applied in soil conservation districts. The demand of farmers for these practices based on biological principles has been revealed as much greater than was recognized some years ago when conservation farm planning got under way.

In the Northeast last year the use of hedges increased 83, fishpond management 82, and odd-area management for wildlife 171 percent. In the Upper Mississippi Valley States the application of hedges increased 500, fishpond management 42, and odd-area management 73 percent. Corresponding advances were made in other regions. Use of multiflora rose for hedge fences increased greatly and was extended west and south from the northeastern quarter of the U. S. During

the past year several more such practices were sufficiently developed to warrant preparation and issuance of instruction sheets on them. Among these are: Multiflora rose fences, including machine planting; pond fish identification and management; muskrat and duck marsh development; drainage-ditch and spoil-bank seeding; and aquatic weed control.

Improved Milk Heater: A new-type milk heater capable of heating fresh milk to above-boiling temperatures and producing changes that can be used to advantage in many dairy manufacturing processes has been developed by the Bureau of Dairy Industry. In its present form, the heater can be used as a pasteurizer for small market milk plants or cheese factories where milk is pasteurized by heating to 160-162° F. for about 15 seconds. It can be used to treat milk or other liquids, such as fruit juices, where a continuous flow through the apparatus is desired. It is suitable for sterilizing, pasteurizing, forewarming, and preheating under pressure for spray drying. Its invention is registered under a public service patent.

Fluorescence Microscopy: A new technique has been developed by the Forest Products Laboratory at Madison, Wis., for anatomical study of wood structure by incident-light-fluorescence microscopy. It permits faster examination of relatively large surface areas than by the usual method. Structural details of tissues, including specific types of cells comprising them, show clearly. The method permits observation of tissues in nearly natural conditions, or staining in the block with improved color contrasts.

Breeding High-C Potatoes: Studies at the U. S. Plant, Soil, and Nutrition Laboratory, Ithaca, N.Y., carried out in cooperation with potato studies of the Vegetable Crops Department of Cornell University, indicate that the present average vitamin C content of 7 parts of vitamin C per 100,000 parts of stored potatoes can be increased to at least 15 parts. New varieties can be developed that have all the other desirable characteristics of a marketable potato as well as a high vitamin C content. An increase in the vitamin content thus obtained would be permanent and reproducible from year to year without any further cost to the grower or consumer.

New Sweetpotato Promises Big Yields of Starch: Whitestar, a new sweetpotato developed over the past 10 years by the USDA and 5 southern State agricultural experiment stations, promises good results for industrial purposes and livestock feeding. It was grown from true seed (not the root sprouts) supplied by the Hawaii Agricultural Experiment Station from a Hawaiian variety with the musical name of Laupahoehoe (which rhymes with aloha oe). States cooperating in the research were Alabama, Mississippi, Georgia, Louisiana, and Texas. The selection was tried out in 7 States from 1938 to 1946 to establish its value for commercial growing. The roots have russet-white skin and cream flesh, and are medium to large. The variety was picked out on the basis of composition, yield, and shape (spindle-cylindric to chunky). Whitestar outyields Triumph and often outyields Pelican Processor, two widely grown varieties of the industrial type. It compares favorably with the latter in the acre production of starch in the lower South and does much better than Triumph in this respect. Farther north it does better than either of these. Planting stock of Whitestar has been sent to State experiment stations and some other interested agencies for increase, and supplies for farms are expected to be available by 1950. The Department has no stock for general distribution.

Beef-Cattle Research at Front Royal, Va.: The facilities of the Agriculture Remount Service at Front Royal, Va., are being converted into a station for beef-cattle research. The horse-breeding program at Front Royal has been discontinued. The Department of Agriculture acquired the property, consisting of 4,100 acres of land together with buildings and improvements, July 1, 1948, by transfer from the Department of the Army. The land is well adapted to beef-cattle raising and is representative of a considerable area in Virginia, West Virginia, and other parts of the Appalachian Region. In accordance with previous practice the beef-cattle research to be undertaken at Front Royal will be conducted by the Bureau of Animal Industry in cooperation with the Virginia Agricultural Experiment Station; investigations on pasture utilization and studies on beef-cattle management will be included. The change in type of work is occasioned largely by financial considerations. The officials believe the funds available for the remount service can be used to better advantage if distributed among fewer stations. The change-over at Front Royal from horse breeding to beef-cattle operations required several months and were accompanied by corresponding changes in personnel and equipment.

Study of Egg Quality: Results are now available of an egg-quality study made cooperatively by Production and Marketing Administration, Bureau of Agricultural Economics, and Farm Credit Administration, and 13 agricultural experiment stations of the North Central States. The research was undertaken to determine (1) the quality of eggs marketed by producers, and (2) the extent of the change in quality that occurs in moving eggs from the country assembler to the central assembling plant. It was found that producers are delivering eggs to assembler which, on the average, contain about 60 percent that are A (top) quality, about 12½ percent that are stains and dirties, and about 4 percent that are checks (cracks). It was found also that 12 out of every 100 eggs decline 1 grade, on the average, as the result of adverse holding conditions in country buying stations, the length of time held at these stations, and the careless loading and handling in transportation between the country buying stations and the country assembly plant. The results of this study will provide factual information to educational institutions working with producers and country receivers of eggs in programs to improve the quality of eggs arriving at central assembling plants.

Vanilla Culture and Curing: Experiments at the Federal Experiment Station, Puerto Rico, on the production of vanilla under controlled uniform light and with moisture supplied during drought periods have given outstanding results. The first normal fruiting gave a yield of 1,200 pounds of green vanilla beans per acre, as compared with the 500 pounds per acre ordinarily considered high for Puerto Rico. The vines under all experimental treatments flowered profusely during the year, and the succeeding crop should greatly exceed that of the past season. Growers have shown their approval of the method by investing in the construction of similar types of sheds for the commercial production of vanilla in Puerto Rico. In studies of the nutrient requirements of vanilla, the best growth was obtained when the nitrogen-potassium level was high. Plants receiving low nitrogen appeared chlorotic; potassium had no apparent effect on foliage color, but growth was considerably better under the high-potassium treatments. Experiments in the curing of vanilla showed that the use of infrared heat is neither practical nor desirable; the time required was considerably reduced but the resulting product was poor in aroma and low in vanillin content.

How the Land is Used: The Bureau of Agricultural Economics has recently issued a report on "Inventory of Major Land Uses in the United States." It gives an account of the extent and distribution of the major agricultural land uses and a general analysis of the land use situation in the U.S., showing the latest data available for both land in farms and land outside farms. Information on the acreages of land devoted to the chief purposes provides a comprehensive picture of the use of all land in the U.S., trends in land use, and elements affecting use.

Conservation Practices for Bright Tobacco Land: The Soil Conservation Service has developed and proved a system of low-gradient ridged rows which provide ample drainage and prevent crosswash in the Bright Tobacco Belts of Maryland and North Carolina. The system reduces heavy crop-season erosion and safeguards good yields and high quality of the crop. In addition, cover-crop mixtures, when used on the tobacco land and allowed to grow in the spring to a very late green-manure stage before being turned down, have been shown to be a big help in controlling soil erosion during the critical summer months.

Hay, Hay! Experiments by the Bureau of Dairy Industry with three different methods of harvesting and storing hay crops show that making grass silage or barn-dried hay offers the dairyman two distinct advantages over making field-cured hay. More of the feed nutrients in the original crop can be saved by making either silage or barn-dried hay, and the crop can be harvested with less risk of weather damage. Silage and barn-dried hays, and hay that was cured in the field without rain damage, all produced about the same amount of milk when fed on an equal dry-matter basis along with grain and a small quantity of corn silage. Weather-damaged field-cured hay, on the other hand, was unpalatable and produced less milk than the other forages.

The relative milk production possible on the different forages, based on the dry matter preserved for feeding and on an equal consumption of dry matter per 100 pounds of milk produced, would be as follows: Compared with good-quality field-cured hay, milk production per acre would be 20 percent less for rain-damaged field-cured hay, 8 more for hay dried in the barn without heat, 16 more for hay dried in the barn with supplemental heat, and 12 percent more for silage. Compared with rain-damaged field-cured hay, the possible milk production per acre would be 25 percent more for hay cured in the field without rain damage, 35 more for hay dried in the barn without heat, 45 more for hay dried in the barn with supplemental heat, and 40 percent more for silage. These experiments were in cooperation with the Bureau of Plant Industry, Soils, and Agricultural Engineering.

Who Gets How Much of Your Poultry Dollar? In 1939 the farmer received 65 cents of each dollar spent at retail for poultry and eggs. What happened to the other 35 cents is analyzed in "Marketing Margins and Costs for Poultry and Eggs," recently issued by the Bureau of Agricultural Economics as Technical Bulletin 969. Opportunities for reducing marketing costs are also discussed. Current margins and costs of marketing poultry and eggs are now being studied as part of the program of research under funds authorized by the Research and Marketing Act of 1946.

Economics of Timber Growing: The Forest Service says 9 years' records of a 40-acre tract of pine-hardwoods second growth in Arkansas indicate that the returns rival income from cotton growing on similar land. Operation of this experimental "farm forty" shows the possibilities of timber growing in diversifying southern agriculture. An analysis of the part forests can play in providing employment in the Anthracite Region of Pennsylvania discloses that the development of fully productive forests throughout the region would make possible employment for 30,000 persons in woods work and dependent industries in contrast to the 7,000 employed in 1943.

Outlook for Hops: Acreage of hops has increased in recent years, encouraged by high wartime prices. Nearly all the hops grown are used in the manufacture of beer and ale. Although beer consumption in the U.S. more than doubled between 1935 and 1948, the consumption of hops in the manufacture of beer increased only one-third, as consumers came to prefer beer with a low hop content. "Outlook for Hops From the Pacific Coast" presents an analysis of the situation prepared by the Bureau of Agricultural Economics.

Molybdenum-Caused Cattle Ills: A high molybdenum concentration in soils and forages appears to be responsible for certain nutritional troubles in cattle in California and Florida. Other troubles of unknown origin may be associated with molybdenum and other similar elements. Studies at the U. S. Plant, Soil, and Nutrition Laboratory, Ithaca, N. Y., show that a concentration of 0.08 percent of molybdenum in the moisture-free ration was toxic to rats while 0.04 percent of molybdenum was not. No anemia occurred in the rat at the toxic level but the rate of growth was significantly retarded. Additions of 0.005 percent of lead or 0.01 percent of copper to the ration had no effect on growth either in the presence or absence of toxic quantities of molybdenum. Additions of 0.5 percent of zinc to the ration, without molybdenum, had no appreciable effect on growth of rats. Additions of 0.5 percent of zinc plus 0.08 percent of molybdenum (the toxic level of molybdenum) resulted in greater retardation of growth than was found for molybdenum alone. Thus, the toxic effect of molybdenum was greater in the presence than in the absence of zinc.

Microscope in Lily Breeding: A way of using the microscope to assure better results from greenhouse space has been worked out in USDA experiments in lily breeding. A few hours devoted to 10-minute microscopic examinations may prevent years of unproductive use of greenhouse space, and greatly improve the odds of a venture in lily breeding. Fundamental studies have been made of inheritance in these flowers, including microscopic studies of the chromosomes, the minute structures within the cells that are involved in carrying inherited characteristics. Because lily chromosomes are larger than those of many plants and thus easier to work with under the microscope, laboratory workers are able to pick out various species of lilies by this means, using thin sections of root tips as material. Under the microscope these reveal the chromosomes for identification.

Lilies are peculiar in that they may bear either true hybrid seed--the seed resulting from fertilization of one species by pollen from another, a true union of the characters of the two lilies -- and "apomictic" seed, resulting from a stimulation of seed-bearing by the applied pollen without a true union. The "apomictics" will grow, but they have only the qualities of the mother plant. Before the microsco/ method was found, a lily breeder could not be sure whether a cross was a true hybrid or apomictic without spending 1 to 3 years and using valuable greenhouse space to bring the new cross to bloom

stage. Now by means of the microscope he culls out the unpromising ones at the rate of one examination in 10 minutes. Unless such sampling reveals cells that have a new and mixed pattern, with chromosomes that can be identified as coming from both parents, the seed is not worth the time and expense of growing to maturity.

Accidents to Farmers: Five persons were reported injured during the first 4 months of 1948 for every 100 farms included in a sample survey made by the Bureau of Agricultural Economics. From the survey it is estimated that farm people and farm workers had approximately 275,000 lost-time accidents during the period. Average time lost per accident was about 3 weeks. Medical, dental, and hospital expenses resulting from these accidents averaged just over $40 per person injured, and totaled more than 11 million dollars. Twice as many farm people were injured in falls as in any other type of accident. Three and a half times as many men and boys were injured as women and girls. About 49 percent of all accidents were the result of farm work. Additional details are reported in "Accidents to Farm People and Farm Workers, January-April 1948."

Vegetated Waterways: Several years of research on the use of vegetation as a protective lining for farm waterways have revealed that a short, dense-growing grass is best for lining pond spillways, terrace outlet channels, and natural watercourses. The experimental work was carried out by the Soil Conservation Service at the Stillwater Outdoor Hydraulic Laboratory in cooperation with the Oklahoma Agricultural Experiment Station. The vegetative covers used in the studies included alfalfa, Bermuda grass, blue grama, buffalo grass, weeping lovegrass, and a mixture of tall and short grasses native to Oklahoma. Channel slopes varied from 1 to 10 percent. Results were analyzed from the standpoint of (1) the protection to the soil offered by the vegetation and (2) the channel capacity under the vegetative cover.

The short Bermuda grass was superior to all other covers. Only slight channel erosion was observed even after the linings were subjected to velocities of water flow as high as 12 feet per second for 40-minute periods. A permissible velocity of 8 feet per second for slopes up to 10 percent was recommended for watercourses and channels with short Bermuda grass lining. Alfalfa, weeping lovegrass and the native grass mixture were the least effective in preventing bed erosion. Buffalo and blue grama grasses provided good channel protection under light to moderate velocity, but were unable to withstand prolonged high-velocity flows as well as Bermuda grass. The results of the experiments have been analyzed and presented graphically for use by conservation engineers in designing farm waterways.

Artificial Daylighting for Cotton Grading: Most standards of quality for agricultural products that involve color are applied in daylight and the inspector's or grader's memory of the color as represented in the standards is thus based on daylight illumination. For this reason, grading that involves color judgment is usually done insofar as possible under the best and most constant natural daylight. Usually, this is provided by a large window or skylight reflecting north light, since it is from that direction that natural daylight remains most stable throughout the day. Because it is sometimes necessary or advisable to grade at times or in places that lack good daylight, the Color Laboratory of the Cotton Branch, Production and Marketing Administration, has made extensive studies of various types of artificial daylighting in relation to requirements for cotton classing. As a result of these studies, specifications have been developed for

artificial daylighting installations that will meet the technical and practical requirements for most satisfactory results in the classing of cotton. These specifications are applicable not only to cotton grading, but also to textile color matching and to inspection and grading of other agricultural products. Installations conforming to these specifications are currently being made in the classing rooms of a number of cotton marketing agencies and textile mills. A summary of the results of the studies in this field, including specifications, are reported in Miscellaneous Publication No. 580, entitled "Color Measurement and Its Application to the Grading of Agricultural Products."

New Delicate Test Detects Pasteurization: A reliable and accurate test to determine whether milk and cream have been pasteurized, and whether various manufactured dairy products were made from pasteurized milk, has been developed by investigators in the Bureau of Dairy Industry. Known as the Sanders and Sager phosphatase test, it resulted from research on the chemical nature and activity of the phosphatase enzyme in milk. Although the test was perfected for use on Cheddar cheese during the war, it has been widened in applicability until now it can be applied to practically all dairy products. The Association of Official Agricultural Chemists has adopted the test as the official pasteurization-testing method.

The test is based on the fact that all raw milk contains a phosphatase enzyme which can be destroyed by heat. Pasteurization -- the heating of milk at a temperature a few degrees higher than that required to destroy the most resistant of the pathogenic or disease-producing organisms that may occur in milk -- destroys the enzyme. Hence its absence from milk indicates adequate pasteurization. By using the Sanders and Sager test it is possible to detect a decrease of as little as a single degree Fahrenheit in the pasteurizing temperature. The test will detect, for example, the presence of 1 pound of raw milk in 2,000 pounds of properly pasteurized milk, whether applied to the milk or to products made from it. The enzyme is more concentrated in cream, and the test is capable of detecting raw cream added to properly pasteurized cream in the ratio of 1 to 5,000.

Irrigation Agriculture in the West: Potentialities that lie ahead for the 17 Western States in the expansion of irrigation and in improved utilization of its water resources for irrigation and other purposes are analyzed in "Irrigation Agriculture in the West," Miscellaneous Publication No. 670, prepared in the Bureau of Agricultural Economics. The nature of irrigation agriculture in the West and the factors that have influenced and modified its growth are summarized with a generous use of color maps and charts. Irrigation programs in the West are becoming more and more a problem for Federal agencies because the remaining possibilities will be mostly through multiple-purpose projects that are too costly and complex to be undertaken by private groups or by local public agencies. Irrigation is utilized by more than 80 percent of all farms in many of the counties of the intermountain and arid parts of the West, but many of these farms need additional water, and others would benefit greatly by irrigation.

Acid Spray Gun for Naval Stores Operations: A simple, practical spray gun developed by the Forest Service for the application of acid to stimulate the flow of gum from pine trees will help make the production of naval stores more economical. The new spray gun consists of a noncorrosive plastic nozzle fitted to a flexible plastic bottle that can be squeezed with one hand to

eject the acid. This new device has been well received by laborers and operators alike. It is now available on the market and is gaining wide use by turpentine-gum operators throughout the Naval Stores Belt.

Good Ginning Opens Way to Better Markets: A key that will open more doors to world markets for American cotton is improvement in ginning processes. USDA agricultural engineers say that such improvements are called for today more than ever because of the spread of mechanical harvesting, which, along with mechanization of other field operations, is now considered of the highest importance in reducing production costs to farmers. It works out this way: Mechanical picking brings in cotton with an excess of leaf trash composed of pieces of green leaf (when plants have not been defoliated) or dry leaf trash. Where cotton is harvested with machine strippers it contains an excess of burs, sticks, stems, and dry leaf. So, to hold the fiber quality inherent in the crop and retain the market advantage of lower production costs, ginning must be improved so the cotton will remain as good as it was raised to be. The seed cotton drier and the new cleaning equipment are advances in this direction. Since all of our cotton must be ginned before it enters commerce, and since this processing has so much to do with quality, American ginning must continue improving as it has been in recent years. It has to keep up with the growing mechanization in the fields.

Food Production and Consumption: What adjustments in production and consumption of food products would be necessary in the period ahead to provide better diets and at the same time satisfy tastes and preferences as fully as possible? This is the central question in a study of "Efficient Use of Food Resources in the United States" recently issued by the Bureau of Agricultural Economics as Technical Bulletin No. 963. The report includes discussions of the long-term food problem, food needs for better nutrition, changes in food production, relative efficiency of products as sources of food nutrients, food production and consumption ahead, and future adjustments in food production.

Soybeans: "Soybeans in American Farming," recently published by the Bureau of Agricultural Economics as Technical Bulletin No. 966, presents a general appraisal of the position of soybeans, and evaluates the factors that may influence the future competitive position of this crop in American farming. Estimates are made of the production of soybeans that may be expected with each of three different sets of price relationships for soybeans, as compared with competing crops. These different price relationships represent alternative situations that could develop if demand were the same as/or higher or lower than in the recent past. On balance, the combined supply and demand outlook, under the assumed conditions, suggests a price for soybeans relatively lower than in recent years but above the prewar price. With this situation it is estimated that the production of soybeans would be less than in recent years although about three times as high as in 1935-39.

Frost-Cautious Strawberries: From wild strawberries used as breeding material USDA plant breeders are putting frost-hardiness into berries possessing various other good qualities. The wild ones were found in North Dakota where they had developed through generations of struggle against late spring frosts. Few home gardeners and growers realize how serious frost damage is to the strawberry crop. The South has even more to gain from frost-hardiness than the North.

The first strawberry blossoms to open develop into the first ripe berries, and also into the largest berries the plant will bear in the season. The second lot of flowers develop into intermediate-sized berries. The later flowers -- which are often the only ones to escape frost -- bear still smaller berries. The small and late berries are often about one-third the size of the first comers or the possible first comers.

At Plant Industry Station, Beltsville, Md., a frosty spring in 1947 gave the new hybrids a thorough testing. Frosts in late April and early May destroyed nearly all the blossoms on most strawberries. The new hybrids, however, bore flowers that were injured only slightly by a 23° frost just before May Day. Three out of four of the flowers of one hybrid bore fruit after a severe frost on May 10 which killed every blossom on most varieties. Darrow says: These hardy hybrids are still a long way from being commercial varieties, but they do give us hope that in a few generations more we will have home garden and commercial varieties that will be more frost-hardy than any we have today."

Drainage of Irrigated Lands: Important progress has been made in the California Imperial Valley drainage investigations during the last year. For the past 5 years the Soil Conservation Service has been doing basic research on the Valley's problems, both in the laboratory and in the field. As a result, a tile-spacing and depth formula has now been developed for use by farm-planning technicians in designing conservation drainage for the irrigated land. The new formula is based on such factors as the permeability of the soil, occurence of barrier strata that may interrupt the flow of drainage water to the tile lines, and the quantity of water likely to be handled by the tile system. This development is looked upon as a notable example of applying research findings to field use without delay. Similar investigations are being made in the San Fernando Valley, where a grid of shallow drainage wells has been installed at half-mile intervals for determination of the portions of the Valley needing drainage.

New Techniques in Forest Inventories: The national survey of forest resources of the U.S. is being furthered markedly by technically interpreting aerial photographs of timbered areas and by special sampling methods. Both are new developments on the Forest Survey. Stereoscopic examination of aerial photos furnishes much of the information on the area, volume, size, and location of timber that formerly was obtained by costly ground work. Appropriate classification of timber stands provides the basis for most efficient and lowest-cost field sampling to determine the area and volume of timber within desired accuracy limits. Photos are also basic to low-cost, detailed, forest-type maps. The helicopter has been tried out for mapping forest types. It appears to have good possibilities in inventorying timberlands, particularly areas difficult of access.

Improved Method for Determining Ascorbic Acid: The determination of ascorbic acid in beets and other anthocyanin-containing plant materials presents special problems that have frequently been overlooked by biochemists and nutritionists. Studies at the U. S. Plant, Soil, and Nutrition Laboratory, Ithaca, N. Y., show that if the usual indophenol dye reduction methods for ascorbic acid are used in the presence of anthocyanins higher ascorbic values than expected are obtained. Various anthocyanins isolated in relatively pure form were shown to react with the dye in the same manner as ascorbic acid, but these compounds

did not show antiscorbutic activity for the guinea pig. Analytical methods that prevent interference of anthocyanins in the determination of ascorbic acid have now been developed in this Laboratory.

New Cottons for Southeast: Three Southeastern States -- South Carolina, Georgia, and Florida -- are working with the USDA in developing strains of long-staple cotton which may soon reduce America's need for cotton importation. Already, scientists of the Department and the State Pee Dee Experiment Station, S. C., have developed some new strains which give promise of enabling farmers in the southeastern part of the Cotton Belt to produce more long-staple cotton. At present, the U.S. is importing annually about 100,000 bales of long-staple varieties.

One of the new strains is Sealand 542. Commercial growers in the Southeast who have tried the new strain are said to be well pleased with the results. It has brought as much as 17 cents more per pound than the 15/16-inch cotton. The new strain produces fiber 1-3/8 to 1-7/16 inches, described as fine and strong. Yields were as good as other long-staple cottons in the region. About 1,000 acres of it, which took all available seed, was planted in 1949 in the three States. Also, a 5-acre trial planting was made in New Mexico last spring, following the successful outcome of a small experimental planting in that State. In an effort to increase seed production of Sealand 542, farmers in Barrien County, Ga., have organized a cooperative for the exclusive production of this new variety under conditions to ensure seed purity.

However, the scientists still have two important problems to work out in connection with the new variety. Like all long-staple cottons, the bolls of Sealand 542 are not as fluffy as those of short-staple strains and, therefore, not as easy to pick. Nor does it grade as high. But the plant breeders have tackled these problems. They are making a survey of all the many hybrid lines they have and are making new ones between productive short-staple strains and a new Sealand variety with 1-5/8-inch fiber. Already, they have found a few productive types with fluffy bolls.

Longer Storage Period for Sweetened Condensed Milk: Manufacturers of sweetened condensed milk are interested in lengthening the period they can store this product with a minimum of thickening. Preliminary results from one phase of a long-time study on age-thickening made by the Bureau of Dairy Industry show that a high-temperature, short-time forewarming procedure produces a milk of lower viscosity than the customary forewarming procedure. In one test, milk forewarmed in the usual way to about 180° F. for 10 minutes and manufactured into sweetened condensed milk developed a viscosity 10 times as great as milk forewarmed at 240° for 30 seconds. After 124 days storage at 60° the milk that was forewarmed in the usual way showed a heavy gel structure, whereas the milk prepared by the high-temperature, short-time forewarming treatment had a lower viscosity and flowed smoothly.

Cattle Ranches: "Commercial Family-Operated Cattle Ranches, Intermountain Region, 1930-47, Organization, Costs, and Returns," recently issued by the Bureau of Agricultural Economics, is part of a Nation-wide study on costs and returns on commercial farms and ranches by types and sizes in important farming regions of the U.S. The report deals specifically with the group of cattle ranches that range in size from 50 to 600 head of cattle. In 1947, operators' net cash ranch income averaged $7,246 compared with $2,656 in 1941.

The index of production on cattle ranches rose from 87 in 1937 to a high of 124 in 1943 (1930-44 = 100); in 1947 the index was 104. Total investment averaged $66,606 per ranch in 1947.

122-Billion-Dollar Industry: The assets of agriculture viewed as a single industry totaled 122 billion dollars on January 1, 1948. Physical assets amounted to 100 billion and selected financial assets owned by farm people totaled 22 billion dollars. The rights of operators and landlords in these assets were valued at 113 billion dollars while the claims of creditors were only 9 billion dollars. The assets of agriculture increased from 54 billion dollars in 1940 to 122 billion in 1948. This 68-billion-dollar increase may be accounted for as follows: (1) Inflation of inventory valuations resulting from higher prices, 48 billion; (2) physical increase in inventories, 3 billion; and (3) increase in financial assets, 17 billion dollars. These estimates are published by the Bureau of Agricultural Economics in Miscellaneous Publication No. 672, "The Balance Sheet of Agriculture 1948."

Hail Damage to Soybeans: The damage hailstorms may do to growing crops of soybeans has been studied by research men of the USDA and the Iowa Agricultural Experiment Station by measuring the effects of artificial leaf removal and reduction of the stand by cutting out plants. They found that before the crop came into bloom they could remove up to half the foliage or cut out up to half the plants over the field--comparable to the damage from a fairly severe hailstorm--with little or no reduction in yield. But when the crop had passed bloom stage this simulated hail damage reduced yield; the farther the crop was beyond that stage the greater the reduction.

These tests shed light on the probable effect on yield of damage to the crop from other causes, such as grasshoppers or other leaf-eating insects or diseases that damage leaves. The results should also be helpful in deciding between different cultivation practices. Many farmers do not use the rotary hoe, the spike-tooth harrow, or the weeder on young soybean plants because of the supposed yield-reducing damage. The tests show, however, that there is small risk of loss in using these implements up to the time the plants are 4-5 inches tall. It is even likely that their use would increase yields because of better weed control.

Too Heavy Range Stocking is Poor Economy: At the Manitou Experimental Range maintained by the Forest Service in Colorado, average return for 6 years from a section (640 acres) of bunchgrass range conservatively stocked with cattle amounted to $735 annually. In contrast a similar range area stocked heavily returned an average of only $485 because of lower livestock gains and lesser value of the animals. At the Central Plains Experimental Range, the cumulative effect of range deterioration and inadequate forage after 8 years of heavy stocking showed up in a return of only $1,345 in contrast to $1,807 per section under moderate grazing in the last year. The moderately grazed range improved during the period.

Long-Distance Breeding of Self-Cleaning Sugarcane: Ten years ago USDA plant explorers brought from Burma a wild sugarcane that sheds its lower leaves and leaf sheaths, a discovery of special interest to those in charge of sugar plant investigations of the Bureau of Plant Industry, Soils, and Agricultural Engineering. Most commercial sugarcanes have leaf sheaths that dry out and cling to the cane. If they could incorporate the self-cleaning characteristics in an

improved variety, it would speed up harvesting, particularly by machine. Plans to make the cross at the U. S. Sugar Breeding Station, Canal Point, Fla., could not be carried out because the Burma cane bloomed sparsely and too early for mating with other desirable parent varieties. Crossing was finally brought about in a three-way cooperative project. Working with the Department were Director Arturo Roque of the Puerto Rico Agricultural Experiment Station at Rio Piedras and Dr. Ramos Nunez of the Estacion Agricola Experimental at Palmira-Valle, Colombia.

In July 1947, Director Roque wired PISAE that the wild sugarcane planted at varying elevations at the Rio Piedras station was coming into flower; the Bureau got in touch with Dr. Nunez and learned that three desirable cane varieties at Palmira-Valle were also in flower. The crosses were made by a Department scientist who took a plane to Puerto Rico, collected the pollen, and carried vials of it by refrigerated plane to Colombia. The work was done in less than 4 days. Within 6 weeks the Department had seeds from the cross. These are being used for further crossing to breed new, more easily harvested varieties.

Farm Real Estate Values Advance: Farm real estate values increased 2 percent during the 4 months ending November 1, 1948. The index is 8 percent above a year ago and 113 percent above the 1935-39 average. During the year, values declined only in California and Florida, where low prices for citrus and truck crops tended to depress the farm real estate market. The November 1948 level of land values is now above the 1920 peak in all but 12 States. Although over one-half more farms are changing hands by voluntary sale than before the war, indications are that substantially fewer were sold during the summer and early fall of 1948 than during the same period of 1947. The volume of voluntary sales for the year ending in March 1948 was estimated to be 15 percent below the peak reached the previous year and all available data since March indicate that the downward trend has continued. These estimates by economists of the Bureau of Agricultural Economics are published in "Current Developments in the Farm Real Estate Market."

American Oats Growers Don't Have All Eggs in One Basket: Oats varieties of the U.S. have been contending for supremacy -- notably a variety, Victoria, from South America and one, Bond, from Australia. Victoria, introduced in 1927 and used as a parent in many crosses, has been important because of its resistance to crown rust and the smut diseases. These good points led to increasing yields and improving grain quality in the big oats-growing areas. Perhaps a dozen varieties of this "blood" were well-known to farmers by 1944 when Victoria's fatal weakness showed up in susceptibility to the new helminthosporium disease, now commonly called Victoria blight. All the Victoria varieties fell before it.

In the meantime, Bond, brought in by the USDA in 1929, had been used in various crosses, all now proving to have high resistance where Victoria was weak. By 1947, when the blight was discouraging farmers by the thousands, there were 13 varieties related to Bond -- Clinton, Benton, Cherokee, Bonham, Advance, Shelby, Eaton, Mohawk, Bonda, Mindo, Andrew, Zephyr, and Nemaha. Some of these were already well established, and were then ready to take the place of the Victoria sorts. Other varieties are being developed, especially hardier, disease-resistant, and better adapted varieties for fall seeding in the South. Practically the entire production is now from varieties derived from Bond. The bumper crop of 1948 showed the value of these new varieties in the national economy. This work emphasizes the safety that comes from exploring efficient unrelated strains. Here a choice of varieties may keep a crop from being eliminated by disease.

Mechanical Harvesting of Cotton: "Mechanical Harvesting of Cotton in North Carolina, 1947," a preliminary report issued cooperatively by the North Carolina Agricultural Experiment Station and the Bureau of Agricultural Economics, is part of a larger study of mechanization of cotton and its implications in North Carolina. Harvesting with the mechanical stripper seemed to be about as economical as hand-picking and appeared to have an advantage over hand snapping. Loss in grade due to mechanical stripping is the chief cost, and special ginning equipment is needed to gin cotton harvested by this method. Data on mechanical pickers are not adequate for drawing conclusions but these machines appear to have possibilities if 100 or more bales can be picked per machine during the season. A successful and economical artificial defoliant would aid mechanical harvesting greatly. Greater efficiency in the use of mechanical harvesters may be obtained if the other production practices are carried out with mechanical harvesting in mind. Specific suggestions for using mechanical strippers and pickers are given.

Weeding Sugarcane by Air: Tie weeds in Louisiana sugarcane fields -- mostly red morning glory, cypress vine and button tie vine, the first the worst -- can be controlled by spraying from the air with 2,4-D. Not only has this treatment increased the tonnage of cane but the better-sunned plants accumulate much more sugar. The USDA agronomists who carried on studies in Louisiana say the treatment killed out almost entirely the canopy of climbing weeds. It increased the sugar content as much as 52 pounds to the ton of cane. Another advantage brought out in the experimental plantings, and on commercial plantations where use of 2,4-D has been adopted, is that the absence of the ropelike vines facilitates machine harvesting which in some cases had become impossible. This interference with machine harvesting was particularly noticeable where the cultivation had been by machine and there was no hoeing off of these vines after the crop had been "laid by."

Airplane spraying is strikingly well adapted to these canefields, which are so luxuriant as to make ground operations difficult. When the vines come to the tops of the canes, the killing spray settling on them gets to the roots by transference through the plant, which is one of the peculiarities of the working of 2,4-D. The experimental tests showed that one-half pound to the acre of the amine salt of 2,4-D killed practically all the morning glories (red-flowered) and cypress vine in these fields. Enough of the spray got through the vine canopy to kill even the small weeds of these species that had not yet climbed very far up the sugarcane plants or had not even started to take hold. By keeping up the treatment year after year the land will finally be freed of the morning glory seed, which has quite a reputation for the long time it will remain viable in the ground.

Brushland Plow: One of the most difficult aspects of reseeding deteriorated range lands in the West has been the development of economical methods of removing dense stands of sagebrush from ranges in need of reseeding. The Forest Service has developed a disk plow that now appears to be a solution for this problem. The "brushland plow" combines the best features of several implements. The rugged, heavy frame has unequal size disks attached in pairs. The independent action of each pair of disks enables them to roll over rocks without breaking the plow, thus practically eliminating lost time from breakage, a costly item. During a 3-week trial in Idaho, the brushland plow killed 97 percent of the sagebrush on the test area.

New Reagent for Determining Boron: A new analytical method for boron that has the advantage of greater simplicity than the curcumin method and greater adaptability to colorimetry than the quinalizarin method has been developed for biological materials. The latter method is widely used because it is less subject to interference by other elements and because determination may be made easily and quickly. However, the reagent is not particularly suited for use with a filter photometer or spectrophotometer since there is a considerable overlapping of the absorption bonds of the reacted and unreacted reagent. In the search for a new reagent at the U. S. Plant, Soil, and Nutrition Laboratory, Ithaca, N. Y., over 100 dyes and other organic compounds were tested before 1, 1'-dianthrimide was chosen as being most suitable because of adherence to Beer's law, sensitivity, ease of obtaining pure or of purifying, and reproducibility of results. The work was carried out in cooperation with Dr. Oskar Baudisch, Research Director, Saratoga Springs Commission, who is a world-known authority on the use of organic compounds in colorimetric analysis.

Practices and Costs of Marketing Cotton in Central Spot Cotton Markets: The Cotton Branch of the Production and Marketing Administration has completed a study of practices and costs of marketing cotton in the central spot cotton markets. This study included 5 of the 10 markets designated for spot-market price quotations under the provisions of the Cotton Futures Act. The central spot markets, though relatively few in number, exercise a dominant role in the marketing of the cotton crop of the U. S., since they serve as bases of operation for the raw-cotton merchandising firms who perform or direct the services required in bridging the gap between producers of cotton and the cotton manufacturing industry. The far-flung organization and activities of these central market cotton firms are indicated by the fact that almost one-fourth of the cotton merchandised by the representative firms included in the study was purchased direct from producers and almost one-half was acquired from first buyers located in the country markets in which cotton growers usually sell their product. As a general rule, such purchases include cotton of mixed quality which must be assembled into merchantable lots of even-running quality to meet the requirements of mill customers to whom most of the sales were made direct for forward delivery of the actual cotton. Costs of merchandising cotton by central spot cotton merchants average approximately $9 per bale. Possibilities for improving marketing procedures and reducing costs of marketing were explored and are discussed in detail in the report on this study which has been published under the title "Marketing Practices at Central Spot Cotton Markets."

Colostrum: Colostrum milk, an essential for proper nourishment of new-born calves, can be fed to older calves safely when diluted with warm water in the proportion of 2 parts milk and 1 of water. Colostrum is a highly concentrated feed and provides more nutrients, pound for pound, than whole milk. Bureau of Dairy Industry investigators found that experimental calves at Beltsville showed no difference in average weight at 4 months of age when placed on the same basal ration and fed either 360 pounds of whole milk or 270 of colostrum during the first 60 days. Moreover, the calves fed colostrum showed no greater evidence of scours than those fed whole milk. Colostrum milk is much higher in vitamin A than normal milk and, as was expected, the colostrum-fed calves stored more vitamin A in their bodies during the first 60 days than the calves fed whole milk. The complete utilization of colostrum will channel more whole milk to the markets. It is good practice to apportion each day's supply among all calves in the herd, feeding the diluted colostrum in place of an equal quantity of whole milk.

Farm Tenure: Major trends in farm tenure and in the current tenure pattern are indicated for the Nation and for 4 large regions in the "Graphic Summary of Farm Tenure in the U.S.," a cooperative report issued by the Bureau of the Census and the Bureau of Agricultural Economics. Fewer of the Nation's farms were operated by tenants in 1945 than in any census year since 1890. The number of tenants declined from the all-time high of 2,865,155 in 1935 to 1,858,421 in 1945. Technological improvements, greater opportunities for employment outside farming, and important shifts in demands for farm products have contributed to changes in farm tenure. The number and proportion of people required to produce the Nation's food and natural fibers have declined rapidly. Marked changes have taken place in number of farms in each tenure group, size of farms, farm values, and mortgage indebtedness. Many of these changes were hastened by conditions during World War II. Tenure changes have been decidedly different in various regions.

Changing Fertility Rates: Special tabulations of population data from the 1945 Sample Census of Agriculture provide the basis for computing fertility ratios for the farm population classified according to the economic size of the farm. Findings of a study by the Bureau of Agricultural Economics are presented in a report entitled "Changing Fertility Differentials Among Farm-Operator Families in Relation to Economic Size of Farm." States vary in the relationship between fertility of farm families and economic class, some showing the traditional negative relationship, others showing no clear direction of relationship, and still others showing a positive relationship. Among the last group, selected States showed a greater rise in the birth rate during World War II among high-income farm-operator families than among low-income families.

Sand Love Grass, Selected Native, Just Suits Southern Great Plains: Sand love grass, a native plant that provided part of the ration of the ancient antelope and buffalo, has now demonstrated its superiority for cattle grazing in the Southern Great Plains. Until 10 years ago it received no attention except as an inconspicuous contributor to the original range. Then it was selected out of the wild plants of the range pasture by USDA agronomists because it was found to produce the best gains on cattle. Now sand love grass, according to the field station at Woodward, Okla., has records in the files of the experimenters that prove its high efficiency compared with the mixed native range and some individual grasses, including buffalo grass. It is what the research men describe as "one of the more palatable and nutritious grasses" being used to bring cultivated and abandoned Southern Great Plains farm lands back to good range.

Native range pastures with the highest percentage of sand love grass have consistently produced the highest cattle gains, the investigators report. Cattle prefer sand love grass. A pasture of it grazed by yearling steers produced 30 pounds more of gain per animal and 73 pounds more per acre than native range. It proved better than the famous short grasses blue grama and buffalo in content of phosphorus and had more vitamin A in the spring, summer, and fall. It has the ability of the short grasses to retain half of its high food value when winter-cured in contrast to most grasses which hold only about 25 percent when dormant. This native grass is suitable for sandy areas of the Great Plains from western Nebraska to central and southwestern Texas.

Snow Surveys: The snow surveys and stream-flow forecasts have become an established service to water users of the West. The work is done by the Soil Conservation Service with cooperation of a wide variety of Federal, State, and local agencies. During 1948, approximately 1,000 snow courses were surveyed during the winter and spring months. Results of the surveys were issued in a series of 9 drainage-basin forecasts and were used by farmers as well as municipal, industrial, and recreational associations. During the year considerable progress was made in refining and improving the accuracy of forecasts, expanding the survey network on the Columbia and Missouri River watersheds, and analyzing snow-course data to reduce the length of courses. The value of this work is shown by the fact that the April 1 forecast for the Columbia River basin gave warning of a serious potential flood on that stream. The snow melt was delayed until late May when there were high temperatures and rains, and the melting snow on the Columbia caused one of the worst floods in history.

Shaping Sugar Beets for Easy Pulling: The shape of the sugar beet is more important now that large acreages of this crop are gathered mechanically. USDA scientists are seeking to change the shape so the beets will come away from the loosened soil readily -- either tumbled out by a plow or raised by a gentle lift on the leaves. Sugar beets as grown today are long and pointed and cling in the soil like a nail in a board. Investigators in the Bureau of Plant Industry, Soils, and Agricultural Engineering, working in cooperation with the Colorado Agricultural Experiment Station, have found that the globe- or top-shaped sugar beet root is the most desirable for easy lifting. This shape is common in the red garden, or table beet. This kind of beet is a handy source of breeding material from which to get the factor of better shape worked into sugar beets. Another possible place is in some of the many strains of sugar beets.

At first the plant breeders thought the factors for globe shape in beets might be so closely linked with the factors for low sugar content that the job of getting high sugar and globe shape combined in one beet type might be hopeless. But they have already found this is not so. Instead the factors for white flesh color are associated with the high-sugar factors and that red flesh color is associated with low sugar, but they have now some globe-shaped, white-fleshed beets that are moderately high in sugar. Now the way seems fairly clear for creating a heavy-yielding, white-fleshed, high-sugar beet that can be easily pulled without damage. This seems a reasonable conclusion from experiments with a number of hybrids of sugar beets and red garden beets. It is hard to get the sugar percentage high enough but the hybrids have not proved unsuitable. The next thing is to backcross the best of these to a high-sugar variety, always reselecting for the desired root shape.

An Experiment in Interviewing Nonrespondents to Mail Surveys: The Bureau of Agricultural Economics recently conducted an experiment for determining whether surveys of farm stocks are biased because of nonresponse of some farmers to mail questionnaires. The experiment related to data on grain stocks on farms April 1, 1948. Special schedules containing grain stocks questions comparable with those on the General Crop Schedule, from which present estimates are made, were also mailed to special lists in 25 States. Nonrespondents to both the general crop schedule and the special survey were interviewed in 3 of these States. For each survey, 10 counties per State were drawn so that counties with the largest number of nonrespondents had a greater chance of being selected. Nonrespondents were then selected for interviewing in each of these counties by using a method

of systematic sampling beginning with a random start. It was assumed that the grain stocks data obtained from the interviewed nonrespondents were representative of all nonrespondents. The combined respondent (from mail returns) and nonrespondent indications were generally lower for the particular data covered than the results obtained by mail alone. The general crop schedule list is known to be somewhat selective in that it contains proportionally more of the above-average farmers. Correction of this bias is a part of the analysis of survey results. However, the improvement resulting from the use of the more nearly representative special list was slight, when compared with the selectivity inherent in responses to mail questionnaires. A full report on this experiment appears in Vol. 1, No. 1, Agricultural Economics Research.

Ham and Eggs Scientific Teammates: Confirming practical experience, science has shown why ham and eggs are an efficient and satisfying food combination, the Bureau of Animal Industry finds. Previous experiments had shown that the protein in pork enhanced the value of that in bread eaten with it. Now it appears that the protein of eggs enhances the value of the protein in pork when ham and eggs are eaten together. Thus they supply more nourishment than when either is eaten separately. That, in substance, is the result of a series of tests involving these and other protein foods.

As is customary in nutrition experiments the investigators used, as test animals, young white rats, which digest their food in much the same manner as man. Various steps in the experimental work disclosed the following significant results. Although the protein in dry-cured ham was inferior to that of spray-dried eggs in growth-promoting value, when the diet contained equal parts of ham and egg protein, the growth-promoting value was practically the same as for eggs alone. When the diet contained 2 parts of ham and 1 of egg, the growth-promoting value was somewhat higher than the computed value but lower than the value for eggs alone. These results indicate a moderate supplemental relationship between the two foods.

Other experiments included the addition to the diets of 2 nutritional substances, cystine and methionine, which are sulphur-containing amino acids found in certain proteins. The addition of a fifth of 1 percent of either of these substances increased rat growth still more. As typical of the results, the protein of fresh ham caused an average increase of 111 grams in the weight of rats in 30 days. The corresponding growth from egg white was 126 grams; from ham and egg white together, 128 grams; and from ham and egg white, plus cystine, 144 grams. Results with whole-egg protein were approximately the same as for egg-white protein. Methionine had about the same supplemental value as cystine. The general results of the test provide further evidence of the superiority of carefully selected combinations of foods and food supplements over the same products eaten separately.

A New Fescue in Soil Conservation: Kentucky 31 fescue, or Suiter's grass, is becoming important in the soil and water conservation program, especially in the South. It is a tall, cool-season grass, well adapted to wet lands, and its extensive root system multiplies its values as a soil-holder and helps it to fit into differing soil and moisture conditions.

Discovered in the mountain farm of W. M. Suiter in Menifee County, Ky., this thrifty and nutritious pasture grass really started on its way in 1941. That was when the Soil Conservation Service bought 70 pounds of seed from the Suiter farm and planted it for seed production at the regional soil conservation nursery at Chapel Hill, N. C. They got 165 pounds in the spring of 1943 and kept on planting, at Chapel Hill and other regional nurseries. By 1948 the nurseries had harvested nearly 85,000 pounds of the seed of this valuable forage grass. As seed was produced, it was distributed among farmers in soil conservation districts who were willing to plant at least a 5-acre patch of the new fescue for seed production and observation. Nearly 700 farmers in more than 600 counties participated, and by 1947 there were more than 100,000 acres of the new grass in the 9 Southeastern States alone. The seed harvested in 1948 was sufficient to bring the acreage of Kentucky 31 fescue in the Southeast to about 250,000 acres. And, some farmers as far west as Texas and Arkansas already are growing this grass, while at the same time it is on trial in some of the Corn Belt and Northeastern States.

There is good reason for the rapid spread of this grass. It is suited for pasture in the spring and early summer, and in the fall and on into winter. It can be used very successfully in crop rotations that allow the grass to remain 2 or 3 years. It is excellent for waterways that carry the discharge from terraced fields, and in wet spots not suitable for cultivation, as well as in wet pasture areas where ordinary grasses do not thrive. It is a good seed producer and is relatively easy to harvest directly with an ordinary combine, or with a binder for later threshing. Some of the 5-acre patches in the soil conservation districts produced enough seed the first year to plant 100 to 200 additional acres. Good stands of this grass in the second or third years of growth often produce 400 to 600 pounds of clean seed per acre. This fescue likes plenty of fertilizer, especially nitrogen. Agronomists of the Soil Conservation Service say that when Kentucky 31 fescue is used as pasture, it should always be planted with an adapted legume. Ladino clover, for instance, does very well with it.

Apple Decay Traced to Bruise-Broken Lenticels: Decay damage to apples often starts in bruises made in handling, according to research results of USDA scientists working at Wenatchee, Wash., who report that bruising frequently ruptures the bottoms of the lenticels or breathing pores in the apple skin. Mold spores falling into the opening find opportunity to germinate and send their threads directly into the flesh. Lenticels are practically microscopic openings, but they provide ample space for entrance of the mold spores. The falling in of spores of one mold (Penicillium expansum, most common cause of apple rots) is likened by the investigators to "croquet balls being dropped into craters 25 feet across."

Although lenticels are openings, the undamaged lenticel basin was shown in the experiments not to be a point of serious mold infection in apples, not a natural weakness. Bruising alone is not sufficient to cause rot. There was no decay in test apples that were subjected to bruising but were not dipped in a suspension of mold spores; but where there were bruises and apples were dipped in spores as many as 44 percent of the bruises developed decay. Because the beginnings of these damage spots are on a microscopic scale, the specialists emphasize the importance of small bruises as well as large, any one of which may contain spore-swallowing cracks in the lenticels and sometimes elsewhere. Even if no rots start in the bruises they are still highly undesirable as they produce corky pockets under the skin.

The studies brought out many causes of apple bruises. They are produced in picking, during movement to the packing sheds, and when being washed they may get many more than in all the previous handling. Because of much variation in the design and equipment of apple-packing houses, the investigators are not making specific recommendations for bruise reduction that could apply closely to many of them. They recommend making test runs, preferably with apples on which bruises show up readily, and then making construction and operation changes to reduce damage. Some pickers bruise apples more than others, so checking up on this factor has been found to bring improvement.

Plant Breeders Produce Crops with Comfort Factors: Farmers, thanks to the plant breeders, not only have crop varieties superior to their old ones in yield, quality and disease and insect resistance, but, according to the USDA, they have many that have been made more agreeable to handle. Otherwise good varieties with clinging, gouging beards or itch-inciting hairs have given way in many instances to new ones in which these characteristics have been reduced while the important positive factors have been kept. In fact, the plant breeders show that in many instances these tamed touch-me-nots are much better in yield and quality factors than those they have superseded.

The wheat breeders, who have to their credit scores of new good-quality high-yielding varieties resistant to rusts and smuts, remember a famous old variety, Sonora, introduced into California by the Spanish padres, which has on the glumes a fuzz responsible for a skin irritation farmers came to call Sonora itch. There is still a little Sonora grown, but present varieties of the area are more pleasant to handle and more productive, too. Barley beards, or awns, have long been the bane of farmers harvesting and threshing that crop. Good smooth-awned varieties have been created, but now with the combine for harvesting there is less objection to the rough-awned kinds. But combine harvesters made rice harvesting a more irritating job since the combined grain frequently requires drying and in the process many varieties give off a dust highly irritating to the human skin. As a result, such varieties are becoming unpopular and rice breeders have already produced several new ones without the small hairs of leaf and hull that make up that dust.

Improvements of a similar nature have been brought about in many other crops: A kind of grain sorghum called white durra became unpopular because of irritating hairs that cause "durra itch" and the plant breeders have largely avoided this factor in the improved varieties that have many positive improvements. Many grasses have had obnoxious awns or saw-edged leaves softened and smoothed by the scientists to suit the pleasure of animals and the profit need of farmers. The stipa grasses and Napier-grass are examples. Among the legumes, burclover is an example of a forage crop that has been bred for burs (seedheads) less bothersome. Minute spines have been bred off okra pods in some varieties, making them easier on picker's fingers.

The plant breeders, while making possible better yields of better quality, have brought many comforts to farmers, domestic animals, and consumers. The farmer has often shown that he is willing to sacrifice some economic advantage for the comfort of having a variety free of spines, hairs, spicules, dust, or some other irritant.

Carotene-Rich Forages Help Prevent Vitamin Deficiency: Feeding a supplement of well-cured, leafy-green legume hay in a ration where low-carotene roughages like cereal hay, straw, and corn stover are used is recommended by the Bureau of Animal Industry as for the prevention of anasarca and of other symptoms of vitamin A deficiency. This recommendation is based on observations and experimental work by a group of BAI animal-husbandry specialists who pointed out that the real error in practical feeding, which often leads to symptoms of vitamin A deficiency during the fattening of beef cattle, is not primarily in the use of old corn in the ration. Instead it is in the exclusive use of low-carotene roughages without a supplement of some carotene-rich feed such as well-cured green legume hay of the current year's crop, well-made silage, or green pasture.

For years the condition referred to as "anasarca" has been a factor in the losses among cattle being fattened in the Corn Belt, especially on those farms where large amounts of coarse low-carotene roughages are fed. The symptoms vary in severity from farm to farm. Steers may go off feed for long periods before the appearance of the characteristic swollen legs and briskets which are usually accompanied by varying degrees of stiffness and lameness. Night blindness may also be associated with the condition of generalized edema, and convulsions occur in the most advanced stages. The carcasses of these edematous animals are watery and unfit for use.

Statistics from the Federal Meat Inspection Service show a total of 651 beef carcasses condemned for anasarca in a recent 5-year period. But it is not known how many nor how widespread are the cases of anasarca under practical field conditions since the workers say that more cases develop than slaughter condemnations show. Also some animals may recover before slaughter owing to timely changes in the nature of their ration. Still others die on the farm or become severely injured during convulsions in transit to the slaughterhouse.

It had been determined previously that anasarca was not of bacterial origin but was probably due to some fault in nutrition. One theory was that it was caused by feeding old corn. However, observations made on several Corn Belt farms where the disease was prevalent have been correlated with observations made on experimental cases of anasarca produced by feeding 2 different types of carotene-deficient rations. These showed that anasarca, along with other symptoms of vitamin A deficiency, result from a long-fattening period in dry lot on a ration which may utilize either old corn or new corn fed with a low-carotene roughage such as oat hay or straw. Average yellow corn usually contains no more and often less carotene than a low-grade hay. Hence it is recommended that corn alone should not be depended upon to supply the carotene needed by cattle.

The over-all economic importance of the results of a deficiency of vitamin A in fattening cattle is not calculated. Yet it is indicated that such a deficiency with all its implications is probably quite common in the beef-feeding regions where corn rations are widely used, except on farms where a carotene supplement is provided in some such form as good silage, well-cured green-colored hay, or green pasture.

Forest Land Ownership in Northern Mendocino County, Calif.: This report, prepared in the Bureau of Agricultural Economics, presents the results of a study made to provide information on ownership and use of forest land in connection with the reappraisal of the timber supply by the Forest Service. Data from the study were used in estimating the extent of farm ownership of timber in the Pacific Coast redwood and fir areas in California. Because of public interest, results were used also in developing plans and procedures for a broader study of forest land ownership and use covering California. The Northern Mendocino County area is fairly representative of Northern California in that it contains forest, range, farm, and recreational lands. Despite a large volume of timber in the forest portions of the area the pattern of land ownership and use is so complex as to make difficult effective management of the forest land. Much land is controlled by range livestock farmers, small-scale timber operators, people who own recreation and residence sites, and by nonresidents who own many small scattered tracts. In addition to a description of the land ownership and use pattern the report brings out useful suggestions on future land use and management.

U. S. DEPARTMENT OF AGRICULTURE

Office of Information

Document No. 6
Revised October 1, 1949
A USDA Document

IMPORTANT RECENT ACHIEVEMENTS OF DEPARTMENT OF AGRICULTURE SCIENTISTS

BAMBOO NOT HARMFUL TO SUCCEEDING CROPS:

An experiment designed to determine the effect of bamboo on succeeding crops was completed during the year by the Federal Experiment Station, Office of Experiment Stations, at Mayaguez, P.R. The results indicated that successful cropping practices with all types of crops may be followed immediately in areas previously planted to bamboo. Experiments on bamboo fertilization indicate that the use of ammonium sulfate is highly beneficial; growth and vigor of fertilized clumps was almost double that of the checks. These findings add impetus to the increasing use of bamboo as an important soil-conserving crop in Puerto Rico.

ANTIBIOTIC FROM EGG WHITE:

Studies made by Bureau of Agricultural and Industrial Chemistry researchers on the minor constituents of egg show that some of these substances may possess medicinal value. One such constituent is lysozyme, a bacteria-destroying enzyme in egg albumin. This antibiotic also occurs in human tears and in the saliva of dogs and other animals -- which probably explains to some extent why animals can help to prevent infection by licking their wounds. The method devised by Bureau scientists for isolating lysozyme from egg white is now being used commercially to produce the enzyme for medical-research purposes. This process also makes it feasible to obtain lysozyme from waste egg white remaining in shells discarded at egg-processing plants. The Bureau's Western Regional Research Laboratory at Albany, Calif., is responsible for this development.

MEN'S PREFERENCES AMONG SELECTED CLOTHING ITEMS:

Two-thirds of the owners of business shirts, underwear, and pajamas prefer them made of cotton. Cotton for items of apparel is chosen because it is comfortable to wear and is safely and easily washed. Those who prefer wool choose it for comfort and appearance. Rayon is liked by some because of coolness, pleasant feeling next the skin, and appearance. Apparently, men put comfort above any other factor in choosing wearing apparel. In buying clothing they look for style and particular construction features, correct size and fit, and quality and kind of material. Many men select their own clothing or part of it, but wives select a good deal, especially robes and pajamas. A preliminary report of the findings of research on this subject carried on under the Research and Marketing Act has been issued by the Bureau of Agricultural Economics.

BUYING GUIDE ON MEN'S SUITS:

Many a man on a suit-buying expedition has wished that he knew more about quality and the differences -- visible and hidden -- that make one suit cost more than another. Heretofore, there has been little authoritative guidance, but a consumer buying guide bulletin, "Buying Men's Suits," prepared in the Bureau of Human Nutrition and Home Economics, is designed to help meet the need. The clothing specialists who undertook this work observed suits being manufactured and took them apart for comparative study in the Bureau's clothing laboratories. The illustrated bulletin, printed in the autumn of 1949, points out differences in materials and workmanship to be expected in suits of different grades and their effect on appearance, durability, and fit. The bulletin is expected to prove useful, not only to individuals, but also to teachers, extension workers, and other group leaders.

X = B_{12}:

Research by the Bureau of Dairy Industry has shown that pure crystalline vitamin B_{12}, which is the name commercial chemists gave to the antipernicious anemia factor they isolated from liver in 1948, has the same physiological effects in normal mammals as the unidentified growth factor (nutrient X), which Bureau workers had previously found in milk, skim milk, nonfat milk products, and certain other foods. Unlike pure vitamin B_{12} or liver extracts, however, milk and other food sources of nutrient X are not effective in treating pernicious anemia, probably because of the form in which the factor exists in these foods.

UNKNOWN FACTOR FOR POULTRY GROWTH IDENTIFIED AS VITAMIN B_{12}:

During the past 5 years studies have been conducted by the Bureau of Animal Industry at Beltsville on an "unknown factor" which was required for the early growth and reproduction of poultry. The factor was known to be present in the manure of cows and chickens and in fish meal, fish solubles, and liver. These studies led to the discovery in 1948, that the "unknown" factor was vitamin B_{12}, a bacterial growth factor required for the early growth and reproduction of poultry. The vitamin had already been isolated in a commercial laboratory during the same year. Experimental injection of small amounts of vitamin B_{12} into eggs of hens fed a diet deficient in this vitamin resulted in improved hatchability of eggs and better growth of chicks.

MOTHER NEVER MET FATHER:

The mother of the cow which gave the milk you found on your doorstep this morning may never have met the father of her calf. Despite this, considerable cooperation may have been involved. According to Circular C-133, "Dairy Breeding Cooperatives, Their Development, Practice, and Policies." of the Farm Credit Administration, there were 963 dairy farmers' cooperatives engaged in artificial insemination of dairy cattle on January 1, 1948. All these co-ops had been organized within the previous 10 years, indicating the rapid development of such artificial breeding. About 1,200,000 cows had been artificially inseminated as the result of service extended by these cooperatives prior to 1947. About 7 percent, or 1,750,000 of the Nation's dairy cows, were listed with the co-ops for such service during 1948. Most of the reporting associations were not operating stud farms but obtained semen from other sources, since accumulating enough money to purchase a sufficient number of good bulls presents a serious problem to many newly organized breeding cooperatives. However, 81 bull studs were operated by cooperatives. Among the advantages are lowered costs and improved calves from better sires.

PYRETHRUMLIKE MATERIAL SYNTHESIZED:

Chemists of the Bureau of Entomology and Plant Quarantine, after 15 years of intensive research, found out how to make insectidides containing principles almost identical in structure to those contained in pyrethrum. In laboratory tests, one of the compounds was found to be as toxic to houseflies as the natural flower-produced insecticide. The same desirable quick "knock-down" action of pyrethrum is retained, and the synthetic pyrethrum remains stable for a longer period of time. This discovery may be the first step in the development of ..... a substitute for the imported plant material which has wide importance in the control of certain kinds of insect pests. For additional information consult the Bureau of Entomology and Plant Quarantine.

OBJECTIVES OF THE PLANT EXPLORERS:

"There is always a possibility," says C. O. Erlanson, principal ecologist of the Plant Industry Station, "that someone may find somewhere some plant that may be developed into an entirely new crop that will profitably supply an important demand." He cites several examples of desirable crops that would be welcomed in U.S. economy--an oil-producing plant to yield profitably on lands marginal for present staple crops; a good rubber-yielding plant; for Texas spinach growers, a disease-resistance factor that may be found in Korea where several relatives of the crop are to be found. Highly desirable would be the discovery of some disease-resistance factors to help orange growers if the time comes that a certain citrus disease known elsewhere gets into their groves. "In such a case," he says, "it would be a feat of forehandedness if we could have the resistance before the disease."

GRASS-LINED WATERWAYS AND BURNING

It is better to mow the grass in a vegetation-lined waterway than to burn it off. Tests run at the Stillwater Outdoor Hydraulic Laboratory, Okla., by the Soil Conservation Service, have verified earlier findings that burning off of waterways is an unsafe practice. Observations over a 5-year period on burned channels showed a continuous change taking place in the species of grasses forming the vegetative lining of the waterway. Originally the cover was a pure stand of Bermuda grass with a permissible water-flow velocity of 8 feet per second. After burning, the cover is only one-third Bermuda grass, the balance being miscellaneous annuals and some blue stems. At the same time, the change resulted in a drop in the permissible velocity to 6 feet per second--and a reduction in the efficiency of the waterway.

SMALL-SCALE PEA EXPERIMENTAL VINER

Laborious and time-consuming methods of harvesting crops like peas have been a definite handicap in experimental studies. Commercial pea viners have been in use for a very long time but no adequate small-scale model was ever available. Such a machine has been constructed at the U.S. Plant, Soil, and Nutrition Laboratory and has been used successfully in harvesting this year's crop. The viner has a capacity of about 40 shelled peas per hour and can thrash the peas from a plot of 50 square feet in 4 minutes. Thus, it is practical to design an adequate experiment without the necessity of considering harvesting as a limiting step. Peas were formally harvested by hand labor which took about 6 man-hours per plot of 50 square feet or 90 times as long as by machine. Also less efficient recovery is obtained by use of hand labor. The viner, which can be operated in the field by means of a gasoline motor, makes it possible to conduct vitamin studies where rapid changes in vitamin content and in other characters occur within a few hours during the peak of the quality factors in a crop like peas.

MARKETING STANDARDS FOR SIRIPS, EDIBLE MOLASSES, AND LIQUID SUGAR

The Sugar Branch, Production and Marketing Administration, currently is engaged in a research project the objective of which is the development of permissive grades and standards for cane sirups, edible molasses, and liquid sugar. Adoption of standards on those commodities should permit a much more orderly marketing system for them. Samples of each type of sirup, molasses, and liquid sugar have been analyzed for chemical factors pertinent to the establishment of grades and standards for these products. Also, information has been collected from producers and distributors of cane sirups, edible molasses, refiners' sirups, and liquid sugar relative to (a) the present methods used by each company in establishing classifications of these products as to type; (b) the influence of various factors--such as differences in manufacturing processes, variations of raw materials, and variable market outlets--on the ranges in quality and variations in types of sirup, molasses, or liquid sugar produced; (c) the feasibility of setting up a system of permissive standards for each group of these products; (d) recommendations as to the number of grades which should be established for each of the products under review, and suggestions as to the permitted range in composition of such factors as density, total sugars, ash, and total nonsugar solids content in each grade. Full descriptions of each of the major types of liquid sugar and refiners' sirup on the market have been compiled. Producers of these products have been requested to give the relative importance of each type and to specify the principal classes of users for each type. Tentative specifications are now being drafted and soon will be submitted to the trade for review.

"RICE PREFERENCES AMONG HOUSEHOLD CONSUMERS"

This is the title of a preliminary summary report issued by the Bureau of Agricultural Economics and based on research under the Research and Marketing Act. Homemakers with large families are more likely to use rice than are those with smaller families. Homemakers with high family incomes are more likely to use rice than are those with smaller incomes. The large or medium-sized families, the lower-income families, and those with homemakers who have had fewer years of formal education apparently use rice more frequently than others. Homemakers use rice for a variety of reasons--taste, variety, health, small costs, as a substitute for potatoes, or because it combines well with meats, soup, etc., or contains starch and carbohydrates. Homemakers were about evenly divided as to the merits of quick-cooking rice and a little more than half did not care for brown rice. The purpose of the survey was to help rice growers and the rice industry evaluate domestic consumption with a view to its possible expansion. This is because rice acreage may need to be curtailed as competition increases between our exports and exports from other countries.

PROMISING DISEASE-RESISTANT VANILLA VARIETIES

One of the major limiting factors in vanilla production is a serious root rot disease. To combat this disease, a number of crosses between commercial vanilla and other vanillas resistant to the disease have been made by the Federal Experiment Station, Office of Experiment Stations, at Mayaguez, P. R. During the year, 40 of the most promising hybrids have been transplanted to field conditions where they are under observation for resistance to vanilla root rot and for quality of fruit.

NEW INDUSTRIAL FIBER FROM CORN PROTEIN

A new textile fiber spun from zein, a corn protein, is now in commercial production. It was developed at Peoria, Ill., by the Northern Regional Research Laboratory of the Bureau of Agricultural and Industrial Chemistry. One firm has been making it since May 1948. About 15 percent of the output is used in a well-known brand of men's hats. This zein fiber, blended with other fibers--cotton, wool, rayon--gives fabrics with desirable new qualities for clothing and other uses. It is the best fiber so far developed from a plant protein and is the only such fiber now on the market. This new product from corn is similar to wool in softness and warmth. Like all protein fibers it is somewhat weak when wet, but its dry strength (twice the wet strength) is equal to that of wool.

NEWS ON GOAT'S MILK

The Bureau of Dairy Industry's improved phosphatase test for determining the adequacy of pasteurization in cow's milk, and in dairy products made from cow's milk, has now been modified for use with goat's milk. Although still not as sensitive as the cow's milk test, the goat's milk test is now considered sufficiently sensitive for all practical purposes. A reliable pasteurization test for goat's milk is especially important because of the frequency of brucellosis organisms in the raw milk. In other experiments with goat's milk, the Bureau found that the commercial supply can be extended through the winter by pasteurizing, homogenizing, and freezing the milk, and holding it in frozen storage at temperatures between -17° and -27° C., temperatures which are practical commercially. Goat's milk is produced normally only from March to October.

HOW AMERICA EATS (NEW DATA)

To learn what Americans are eating and what they spend for food, the Bureau of Human Nutrition and Home Economics in the spring of 1948 interviewed almost 1,600 families in 68 cities representing a cross section of urban population. Additional interviews were obtained in Birmingham, Buffalo, Minneapolis-St. Paul, and San Francisco to obtain facts about seasonal and geographic differences in food consumption. It was found that families in the 68 cities were spending an average of 32 percent of their income for food, ranging from 17 percent for families with incomes of $7,500 or more to 48 percent for families with incomes under $2,000. The survey showed that, in the spring of 1948, urban families were buying larger quantities of such foods as milk, meat, eggs, sugars, citrus fruit, and tomatoes, and some of the other vegetables and fruits than were bought in 1942 when the last similar survey was conducted. The 1948 survey was undertaken with funds allotted under the Research and Marketing Act to provide facts useful to farmers, food processors, and market men, and also to nutritionists and others concerned with education for better nutrition. Ten reports on various aspects of the data have thus far been issued.

COTTONSEED BECOME IMPORTANT

Cottonseed, once discarded or destroyed as waste after enough had been set aside for planting, is now an important source of income to cotton farmers. Between 1928 and 1947, states Miscellaneous Report 128 of the Farm Credit Administration, titled a "Working Manual for Cooperative Cottonseed Oil Mill Operators," the farm value of cottonseed increased from a little more than 60 million dollars to more than 400 million dollars. Thirteen cotton growers' cooperatives are now engaged in processing cottonseed with the objective of effecting savings in oil mill operations which can be passed on to their farmer-members. The proportion of

cottonseed processed has shown some increase in recent years. Eighty-eight percent of the total production was used in the manufacture of cottonseed oil, with its byproducts of cottonseed cake and meal, during the three years, 1945-47, as compared to 76 percent in 1929-31.

SORGHUM'S FUTURE

Tests of first-generation grain sorghum hybrids indicate that the use of certain hybrid combinations may be expected to give the farmer 40 percent more grain, other factors being equal, than the present commercial varieties. USDA agronomists say satisfactory techniques may be developed in the "not too distant future" for the commercial production of hybrid seed. More research will have to be done, says Dr. J. H. Martin of the Bureau of Plant Industry, Soils, and Agricultural Engineering, before seed of adapted hybrids can be produced economically. But he adds that the prospects of utilizing hybrid vigor in producing grain sorghum are "very bright." Male sterility--ordinarily a serious biological defect--again proves to be the fortunate accident that makes for greater gains. Male-sterile strains of grain sorghum are used as a means of producing the hybrid seed, thus making it probable that production can be on a large enough scale for wide use.

DRAINAGE OF SUGARCANE LAND

Studies to determine the effects of drainage on sugarcane lands in southern Louisiana have been carried out by the Soil Conservation Service in cooperation with the Louisiana Agricultural Experiment Station near Baton Rouge. During 1949, drainage increased the sucrose content of the cane as well as the yield. The average increase in yield amounted to 6.3 tons of cane or 1,650 pounds of sugar per acre. Sucrose was increased from an average of about 9.1 to an average of 11.8.

In grading or "crowning" the land between field ditches, it was found that a crown with a slope of 1 foot per 100 feet is the most satisfactory. The working or grading of the heavy black land when too wet impairs crop yields. Black lands should be worked only when the earth sheds freely from the bulldozer blades. Several experimental areas were graded or crowned with a carry-all scraper and a land leveler such as is used in the irrigated area. This method of precision grading materially reduced the small areas or pockets left in the fields in which water collected and stood after heavy rains, and resulted in increased crop yields. The extra cost of this precision grading averaged about $15 per acre, while the resulting increase in crop value exceeded $50 an acre.

HEAVIER LOADING IN REFRIGERATOR CARS SOMETIMES OFFERS SHIPPING ECONOMIES

Most agricultural perishables shipped in refrigerator cars are relatively light and bulky and utilize only part of the available loading space. Some have not been loaded more heavily in the past because it has been thought that considerable space was needed between the top of the load and the ceiling of the car to permit effective refrigeration, and because in some instances it was erroneously assumed that considerably more damage would result from the heavy load. Recent studies of the Marketing Research Branch, Production and Marketing Administration, have revealed that heavy loads of certain commodities can be used to good advantage in rail transportation without risk of undue damage or ineffective refrigeration. Economies resulting from more efficient utilization of refrigerator cars will produce some important savings for the shippers and railroads. It is estimated, for example, that the savings in transportation cost to the railroads on shipments of 4-layer-high loads of peaches in bushel baskets from Georgia to New York City, as compared with 5-layer-high loads of this commodity would

aggregate approximately $84 per car. The savings in refrigeration costs to peach shippers in this case would amount to $0.05 per package, or $26.40 per car.

TREATMENT MAKES COTTON BAGS INSECT-REPELLENT

Recent studies by the Bureau of Entomology and Plant Quarantine in cooperation with the Bureau of Agricultural and Industrial Chemistry have shown that cotton bags can be made repellent to insects by treatment with insecticides during manufacture. Impregnation of the warp yarns with pyrethrins, or a mixture of pyrethrins and piperonyl butoxide, can be accomplished at the time the yarns are being given the usual sizing treatment prior to weaving. Treated bags protect flour from many insect species which penetrate or deposit their eggs through the fabric of untreated bags. In a series of tests bags of treated cloth admitted no insects during an entire 7-month period. An untreated bag in the same tests became infested with 563 insect pests during the same period.

The quality of flour stored in treated bags is not affected, according to baking tests conducted at Kansas State College. It seems unlikely, from information available, that products packed in insect-repellent bags will be contaminated with the insecticides at the rates and with the methods of application used. Further work is needed, however, to settle this question and to determine the minimum effective dosages.

This treatment may prove of great value in conserving flour and other cereal products, especially in warm countries. Certain phases of this study were carried on under the Research and Marketing Act. Additional information is available in USDA press release 1555-49, and in E-783, issued by the Bureau of Entomology and Plant Quarantine.

CAROTENE FOR VITAMIN DEFICIENCY

Recent studies by specialists of the Bureau of Animal Industry show that feeding a supplement of well-cured, leafy-green legume hay in a ration where low-carotene roughages, like cereal hay, straw, and corn stover, are used, can be recommended for the prevention of anasarca and of other symptoms of vitamin-A deficiency. The real error in practical feeding which often leads to symptoms of vitamin-A deficiency during the fattening of beef cattle is not primarily in the use of old corn in the ration, as some have supposed, but in the exclusive use of low-carotene roughages without a supplement of some carotene-rich feed such as well-cured green legume hay of the current year's crop, well-made silage or green pasture.

For a number of years the condition referred to as "anasarca" has been a factor in the losses among cattle being fattened in the Corn Belt, especially on those farms where large amounts of coarse low-carotene roughages are fed. The symptoms vary in severity from farm to farm. Steers may go off feed for long periods before the appearance of the characteristic swollen legs and brisket which are usually accompanied by varying degrees of stiffness and lameness. Night blindness may also be associated with the condition of generalized edema, and convulsions occur in the most advanced stages. The carcasses of these edematous animals are watery and unfit for use.

NEW MILK-PROTEIN FILAMENT FOR AIR FILTERS AND FURNITURE

During the war, when animal bristles for brushes were hard to get, the Bureau of Agricultural and Industrial Chemistry developed a substitute bristle from casein, a protein of milk, intended particularly for paint brushes. This process for making casein fiber stiff enough for use as bristle, worked out at the Eastern Regional Research Laboratory, has been adapted by an industrial concern to produce a unique "curled casein filament." This springy, fibrous material is dustless, odorless, and may be colored as desired. It is already being used in a new-type carburetor air filter for automobiles, and its unusual resilience makes it suitable for mattress pads and furniture stuffing.

IMPROVED TOMATO HYBRIDS

The Federal Experiment Station of the Office of Experiment Stations, at Mayaguez, P.R., reports that 43 selections from hybrids produced at the station from native and imported tomato varieties produced an average of over 2½ times as much marketable fruit as did standard varieties. The most promising hybrid has been introduced into the Southern Regional Tomato Trials for 1949 in order to evaluate its productivity and disease resistance at a number of locations throughout the southern U.S.

PASTEURIZED VS. RAW-MILK CHEESES

Cheddar cheese manufactured from pasteurized milk in the Bureau of Dairy Industry's laboratories was consistently more uniform and of better quality than cheese made from raw milk, regardless of the original quality of the milk. The pasturized-milk cheeses, like the milk, were much more uniform in quality and other properties than the raw-milk cheeses. The greatest improvement in the quality of the cheese, as a result of pasteurization, occurred when the original milk was of poor quality. The raw-milk cheeses were distinctly inferior to those made from the pasteurized portion of the same lot of milk. The raw-milk cheeses varied greatly in rate of ripening, flavor, and quality, and were definitely inferior to those made from raw milk by the Bureau's modern method.

TURKEY FOR FRYING

Growing turkey broilers to supply fried turkey is a sort of glorified fried chicken is coming forward as a promising poultry specialty. These young turkeys also have been favorably received as small roasters. The breeding of the Beltsville White and Jersey Buff turkeys seems to be an element in the better outlook for turkey broiler growing. A principal point in favor of turkey broiler production is that it takes only about 2.8 pounds of mash and grain feed to produce a pound of turkey meat at broiler age, as compared with 3-3/4 pounds to 4 pounds of feed to a pound of chicken broiler meat.

Offsetting this saving in feed is the somewhat higher cost per poult -- i.e. the young turkey. Indications are, [illegible] that turkey broilers would have to sell about 4 cents a pound more at the broiler stage to make as good a return as chickens. Turkeys reach the broiler or fryer stage about 2 weeks earlier than chickens, and the desirable turkey broiler is larger than the chicken broiler -- 4½ pounds to 7 pounds for turkeys, as compared with 3½ pounds for chickens on a live weight basis.

This finding was made by S. J. Marsden, turkey specialist of the Bureau of Animal Industry. There have been previous attempts to foster turkey broiler production, but the dark-feathered breeds of turkeys grow rather too large to be practical for the purpose, have conspicuous pin feathers, develop practically no finish at fryer age, and the poults generally are higher priced. The Beltsville Whites seem to be about right, and their over-all advantages give them some advantage over the other varieties and strains. They are now produced in commercial quantities.

NEW TEST FOR BREAD-BAKING QUALITY OF WHEAT

In an effort to develop a simple, rapid, and practical method for evaluating wheat in terms of potential bread-baking quality for use in routine wheat inspection, the Grain Branch, Production and Marketing Administration, at its Beltsville laboratories has developed a promising sedimentation test. A crude white flour prepared from the wheat is quickly suspended in water and treated with lactic acid. Under this treatment the gluten particles of the flour become greatly swollen and gradually settle from the suspension. The level to which this swolen gluten will settle in a graduated tube in a definite interval of time depends on both the quantity and the quality of the gluten in the flour, which are the major factors influencing bread-baking quality. Large-scale milling and baking tests performed by three commercial laboratories in cooperation with the Beltsville laboratories on wheat of the 1948 crop show the sedimentation test to be, on the average, fully as reliable as the conventional protein test as an index of bread-baking quality. Research on individual wheat varieties shows that the sedimentation test reflects the inferior gluten quality of wheat varieties known to have inferior bread-baking quality. The sedimentation test is much simpler than the protein test and more practical for the purposes of routine inspection. Sedimentation tests can be completed in about 15 minutes, starting with the original wheat.

MECHANICAL COTTON PICKERS IN THE YAZOO-MISSISSIPPI DELTA

Harvesting of cotton by machine has increased rapidly in this area. Between 600 and 650 mechanical pickers operated here during the 1948 harvest. Use of these machines means a tremendous reduction in man-labor requirements for harvesting. Cost of machine operation per bale was $10.58 in 1945; $19.78 in 1946; and $14.77 in 1947; 111, 87, and 109 bales, respectively, were harvested per picker in these years. In 1947, operating costs per bale for machines harvesting an average of 44 bales were $36.45, and for machines harvesting 138 bales, $16.09. A higher volume per picker is needed for low costs. Considering machine operating costs and losses from field waste and lower grade cotton associated with mechanical picking, total per bale costs were $35.67 in 1947, which is equivalent to a hand-picking rate of $2.42 per 100 pounds of seed cotton. A progress report issued by the Mississippi Agricultural Experiment Station in cooperation with the Bureau of Agricultural Economics reports on this project carried on partly under the Research and Marketing Act.

CO-OP FREEZING PLANTS

There's a fair chance at least part of the frozen foods you eat are processed by farmer cooperatives. Miscellaneous Report 133 of the Farm Credit Administration reports on surveys which indicate that almost one-fifth of all the principal fruits frozen in the U.S. came from cooperative freezing plants. More than 58 million pounds of fruits and vegetables were frozen in such farmer-owned plants

in 1947-48 which is double the amount reported in 1945-46, and represents 17.5 percent of the U.S. total. As your taste may tell you, strawberries were selected over other fruits, those frozen making about 14 million pounds of the over-all figure. Red raspberries and cherries were runners up, with about 10 million pounds of each moving to market from the co-op freezers. All of the increase in such cooperative processed frozen foods was in fruits. Frozen vegetables from co-op plants dropped from 16.4 million pounds in 1946-47 to 6.7 million pounds in 1947-48, reflecting certain difficulties in marketing vegetables processed in this manner.

INSECT CARRIERS OF PHONY PEACH DISEASE

Leafhoppers are known now to spread the serious virus disease causing a condition called "phony peach." The 4 species of leafhoppers that have been found capable of transmitting the disease are general plant feeders. At certain seasons of the year they suck the juices of peach trees. The disease causes dwarfed trees that produce limited numbers of small fruit.

More than a million peach trees in southeastern States have been lost since 1935 because of phony peach disease. There is no known cure for it. The Bureau of Entomology and Plant Quarantine, with cooperating agencies, have inspected orchards and nurseries in affected areas to locate diseased trees. Growers are encouraged then to destroy infected trees, hoping to reduce losses and prevent spread.

A new means of attacking the phony peach problem is being investigated by the Bureau now that insects are known to carry the disease from infected to uninfected trees. Insecticidal treatments are already being tried experimentally to find out if commercial plantings of peach trees in the infected area can be protected. It will take two or more years to determine the results because of the long incubation period of the disease in the tree host. Further details may be obtained from the Bureau of Entomology and Plant Quarantine.

LESPEDEZAS FOR SOIL CONSERVATION

Sericea lespedeza is increasing rapidly as an important crop in soil conservation districts of the Southeast. Its value for cover and soil improvement is now so well known that farmers cooperating with the soil conservation program are harvesting approximately 25,000,000 pounds of seed in 1949. In some work-unit areas of the Soil Conservation Service it has completely filled the legume-hay needs of district cooperators. It is not unusual to find farmers who have several hundred acres of sericea lespedeza for hay and pasture in their contour fields.

In 1936 SCS obtained a few seeds of a superior strain of sericea lespedeza (known only as FC-19248) from the former Arlington Farms of old Bureau of Plant Industry. They planted their small 'find' in their nurseries and increased it, and kept on increasing it to the amount of 200,000 pounds which they distributed among interested farmer growers in the districts. Now the farmers themselves are growing the seed in great amounts. The FC-19248 strain appears to be superior to the ordinary sericea in that it is more leafy and bushy and produces more seed, particularly the first year. It also starts growth a little earlier in the spring. It now is the only strain of sericea lespedeza that is being increased by SCS.

Of course, annual lespedeza still is the most important legume in crop rotations in the Southeast. District conservationists say that the 1949 seed harvest of annual lespedeza will amount to around 225,000,000 pounds in 1949. Kentucky, North Carolina, South Carolina, and Georgia are the heaviest producers of this lespedeza seed.

POTATOES DOING MUCH BETTER

Two bushels of potatoes grow today in the U.S. on the same area as grew 1 bushel 25 years ago. Various factors entered into this increase in yield: Certified seed relatively free of disease; concentration of the crop in areas most favorable to it; effective control of insects; and the development of improved varieties. Dr. Frederick J. Stevenson, potato breeder at the Plant Industry Station, Beltsville, Md., thinks the adoption of improved varieties is one of the most important reasons for the improving production.

Stevenson makes no prediction of developments for the next 25 years, but he offers figures assembled by the Bureau of Agricultural Economics and others which he regards as significant. He points out that the National Potato Breeding Program, carried on by the Plant Industry Station and many State experiment stations, is turning out each year additional new varieties better suited to certain areas. The lists of certified potato seed for 1948 contained 51 varieties, 20 of them old ones brought out during the 50 years preceding 1900 and 31 distributed to growers in the last 17 years. The 20 old potatoes still are represented by more than half of the certified seed sold; the new varieties, nearly all with North American Indian names and with high yield and disease-resistance characters, since 1932 have worked up to 44 percent of the certified seed supply.

The old varieties in the order of their share of certified seed production are: Irish Cobbler, Triumph, White Rose, Russet Burbank, and Green Mountain, followed by a dozen more; tops of the new ones on the same basis are Katahdin, Chippewa, and Sebago, followed by 28 others, many less than 5 years old. Although the new ones are credited with less than half of the certified seed, Katahdin, first issue of the Breeding Program and head of the group, is credited with nearly twice as much seed stock as Irish Cobbler, the leader of the old-timers. Dr. Stevenson says that "the results indicate continuing possibilities in breeding" and "we now have available many characters not yet combined in one variety. Each new combination should give us a new variety more valuable to some of the growers than any we now have."

FROZEN FRUIT SPREADS A POSSIBLE NEW RURAL INDUSTRY

Cold-processed fruit spreads which can be made from berries or various tart fruits are now in limited commercial production on the West Coast. They contain citrus pectin as a gelling agent and are preserved by freezing. Since the process involves no cooking, the spreads retain all the flavor of the fresh fruit. These new food products -- particularly suited for manufacture by cooperative freezing plants -- are a development of the Western Regional Research Laboratory, Bureau of Agricultural and Industrial Chemistry.

EXPERIMENTS WITH CITRONELLA AND LEMON GRASS

Experiments comparing varietal differences and dates of harvesting of citronella grass conducted by the Federal Experiment Station, Office of Experiment Stations, Mayaguez, P.R., indicated that the Java variety consistently outyielded the Guatemala variety. The highest annual yield of oil per acre over a 4-year period was obtained when the grass was cut at medium height. There was no difference in the yields of oil between the West India and Java varieties of lemon grass; the greatest yield of oil per acre per year was obtained when lemon grass was cut at maximum height.

FULL-FLAVORED FROZEN CITRUS PUREES

Lemon and orange purees, made from whole fresh fruit and preserved by freezing, are now on the market in Los Angeles, New York, Washington, and other cities. They give full natural flavor to sherbets, ices, and pies. These smooth and tasty purees, developed by the staff of the Bureau of Agricultural and Industrial Chemistry's Research Laboratory at Pasadena, Calif., provide citrus growers with a promising new outlet, particularly for fruit that is too ripe for shipping, undersized, or has some blemish on the peel.

PROGRESS IN CROSS-BREEDING DAIRY CATTLE

A decade of cross-breeding of dairy cattle by the Bureau of Dairy Industry at Beltsville, Md., continues to show progressive improvement in production. Records are now available for 54 two-breed cows and 41 three-breed cows, including a few four-breed cows and second-cycle three-breed cows. The average production of the 54 two-breed cows, at the average age of 2 years 2 months, was 13,006 pounds of milk and 585 pounds of butterfat. The average production of the 41 three- and four-breed cows, at the average of 2 years 1 month, was 13,465 pounds of milk and 606 pounds of butterfat. The final average is an increase of 3,327 pounds of milk and 164 pounds of butterfat over the average of the purebred foundation cows. These results indicate that a high level of production may be reached in a comparatively short time, and maintained, by using good proved sires regardless of the breed of the cows.

CO-OP PICK-UP SERVICE

Back in 1937 farmers within a 50-mile radius of Minot, N.Dak., were confronted with a tough problem in getting livestock to market. Truckers were reluctant to drive out to a farm to get one steer or one hog. It was often impossible for this reason, reports Farm Credit Administration Miscellaneous Report 132, to assemble truckloads of animals. Livestock usually had to be shipped by rail, 48 hours being required for the 527-mile trip to South St. Paul. The solution came when the farmers and farmer cooperatives serving the area organized the Farmers Union Federated Cooperative Shipping Association of Minot. A charge of 20 cents per mile for pick-ups, regardless of the number of animals, was set up. Three trucks for pick-up purposes have been put into service. Animals are bunched for the long trip to market. On the return journey supplies formerly shipped by rail are truck-hauled to the oil, elevator, and other farm-supply cooperatives serving the area. Federated cooperative has served its members well, with the shipping association filling a need which it seemed could not be met until the neighborly principle of working together was applied.

FARM-MORTGAGE LOANS

The Bureau of Agricultural Economics, in cooperation with the Farm Credit Administration, has collected data showing the amount of farm real estate loans made or recorded by principal lenders. Annual figures cover the years 1910-48 for the U.S. and geographic divisions. In 1948, loans by all lenders amounted to $1,427,045,000, as compared with $1,249,885,000 in 1910. The lowest amount was in 1938 with $723,189,000. Figures include loans made by the Federal land banks, the Federal Farm Mortgage Corporation, the joint-stock land banks, and the Farmers Home Administration; and mortgages recorded by insurance companies, commercial and savings banks; and individuals; and miscellaneous lenders. In 1948, the greatest amount of mortgages--$563,903,000--was recorded by individuals and miscellaneous lenders. Commercial and savings banks were next, with $463,395,000.

FARM-MORTGAGE DEBT RISES

The Bureau of Agricultural Economics says that the increase in farm-mortgage debt amounted to more than 226 million dollars. This is mort than double the increase in 1947. The debt in 1948 stood at 5,108 million dollars. Since January 1, 1946, when it reached a 3-year low, farm-mortgage debt has risen more than 426 million dollars, or 9.1 percent. Only 5 States showed a decline in 1948--Minnesota, North Dakota, South Dakota, Nebraska, and Illinois.

INVENTION OF SIMPLE MEASURING DEVICE SAVES MONEY IN POTATO PRICE-SUPPORT PROGRAM

Surplus potatoes sold by the Commodity Credit Corporation for livestock feed can defeat the whole purpose of the surplus purchase program if they find their way back into normal distribution channels. To avoid this, potatoes sold by CCC for feed have been identified by application of a relatively inexpensive purple dye. Recently, because of requirements of the Food and Drug Act, CCC has begun the use of a very expensive certified color. This necessitated immediate development of a foolproof measuring device to be certain that the costly dye powder would be used in the exact proportions required.

The solution to this problem was found by the Fruit and Vegetable Branch of the Production and Management Administration, through the invention of an ingenious measuring tube constructed of aluminum and containing two precisely measured chambers separated by corks. A vent hole is drilled exactly at the bottom of each chamber so that the chamber can be filled simply by pushing it into the dye powder in the same manner as a grain probe. The hole prevents air-lock and permits the operator to see when the measure is full. The chambers are measured for exactly the quantities of dye necessary for 5 gallons and 10 gallons of solution. The devices are regarded as expendable and one is packed in each 1-pound can of dye so that no matter how large shipments of dye are broken up for use in the field the operator has a measuring device at hand.

It is anticipated that dye wastage will be practically eliminated and that on the average the unit cost of the device will be made up fully by the saving on each carload of potatoes dyed. For the most part, this saving can be multiplied by eight, since each pound of dye will color about eight carloads of potatoes. Additional information may be secured by addressing the Fruit and Vegetable Branch, PMA, Washington 25, D C.

RISE OF THE SUGAR BEET

The high state of efficiency to which the geneticists, agronomists, chemists, engineers, and industrialists have brought the beet sugar industry in the U.S. was signalized in 1948 by the opening of a $5,000,000 sugar factory in the Imperial Valley of California. This valley, of extremely high summer temperatures, was not at first promising as a producer of this cool-weather crop, but a new variety of sugar beet, U.S. 15, has characteristics for successful cropping. U.S. 15, produced by USDA plant breeders and those of the New Mexico Agricultural Experiment Station, is now widely grown in winter plantings of sugar beets in California. Its most noteworthy achievement, according to Dr. G. H. Coons of USDA, has been in the Imperial Valley. Here, he says, with this suitable variety, climate was made to serve the plant by taking the usual growing seasons in reverse. The practice works this way: Seed of the cold-tolerant U.S. 15 is planted in October; plants grow during the cool but practically frost-free winter; roots are ready for harvest in May or early June. Cropping is limited to the cooler months.

Ordinary varieties of sugar beets wouldn't do at all in this revolutionary sugar beet growing system. Because of the onset of colder, slow-growing weather a month or two after planting, such varieties would "bolt," that is, send up flower stalks. When a beet starts to produce flowers and seed, it no longer accumulates sugar--on the contrary, it consumes it. U.S. 15 flowers only in the Pacific Northwest. Hence it is safe for winter plantings in California, and yet it seeds in Oregon.

The sugar beet is a crop that started from scratch less than 200 years ago and was bred scientifically to compete with sugar from the tropics. Several outstanding heritable factors suit U.S. 15 for winter plantings of California. In its early development plant breeders were about ready to drop it, because of its susceptibility to leaf spot. But this disease is not serious in southern California. They then noticed its resistance to early bolting. They had also found it moderately resistant to curly-top, also to rust and mildew, all serious in California. Introduced for commercial planting just 10 years ago, it has become the standby for all winter plantings, a beet that has enabled California sugar beet growers to take advantage of the climate.

SUBSTITUTE INSECTICIDES RECOMMENDED FOR USE ON DAIRY ANIMALS

DDT, found so effective for control of flies by USDA entomologists in 1945, was put into almost universal use within 3 seasons for this purpose by dairymen in the U.S. More than one-fourth of all cattle in this country were treated one or more times with DDT for horn fly control in 1948. Cooperative investigations by entomologists, chemists, and veterinarians have shown that small amounts of DDT appear in the milk of dairy animals that are treated with that insecticide for controlling insects. Even smaller amounts sometimes can be detected in milk following use of DDT in dairy barns for fly control.

When the Food and Drug Administration advised in the spring of 1949 that the presence of DDT in milk would be contrary to the Food, Drug, and Cosmetic Act, the Bureau of Entomology and Plant Quarantine, as a precautionary measure, recommended that DDT no longer be used on dairy cows for insect control nor in dairy barns for fly control. The entomologists recommended that methoxychlor, one of the new chlorinated hydrocarbon insecticides, be substituted for DDT to control insect pests in dairy barns and on dairy cows. The

Food and Drug Administration had indicated that methoxychlor would not be objectionable from the health standpoint, if used according to directions. Pyrethrum and organic thiocyanate space sprays were also recommended for fly control in dairy barns and other buildings where milk is processed.

Lindane, the essentially pure gamma isomer of benzene hexachloride, is effective for controlling flies when it is applied as a residual spray. This insecticide also is now recommended for fly control in dairy establishments. Tests indicate milk will not be contaminated nor its odor affected from its use in this manner. Lindane is not yet recommended for use on dairy cattle for insect control purposes, however. Neither methoxychlor nor lindane, according to USDA entomologists, should be applied to forage which is to be fed to dairy cattle or to animals being finished for slaughter. Additional information is available in USDA press releases 609-49, 689-49, and 1471-49; also in E-762 (revised), issued by the Bureau of Entomology and Plant Quarantine.

EVERGLADES IRRIGATION

Irrigation farmers of the Homestead, Fla., area now are utilizing the results of water-control studies made by the Soil Conservation Service over a period of years. Their irrigation costs are being reduced, and they are losing less fertilizer by leaching. The scientists through experimentation found that, after a period of no rainfall, the virgin soil of the area will absorb only about one-half inch of water before the ground-water table is affected, while scarified soil will absorb from three-fourths of an inch to one inch of water. These results were substantiated by tests on citrus-grove land, where one part of the grove was given a 2-inch irrigation, and an adjacent area a 1-inch irrigation.

Three days after irrigation, the soil in the part of the grove receiving 2 inches of water had no more moisture than the adjacent area which had received 1 inch. It was also found that the area receiving 2 inches of water had lost by leaching about one-third of the nitrate nitrogen available in the soil, while little or no leaching had occurred in the area receiving the 1-inch application. Prior to these findings the general practice followed in the area was to apply 2 inches of water at each irrigation.

Moisture studies show that to maintain an adequate soil-moisture supply in the Rockdale soil of the area during the winter months, the period between irrigations must be shortened as the season progresses. At the beginning of the winter season, applications of 1 inch of irrigation every 12 to 14 days will maintain satisfactory soil-moisture conditions. But during the latter part of the season, 1 inch of water should be applied every 7 days if satisfactory soil-moisture conditions are to be maintained for the growth of the crop.

SOLVENT PROCESSING OF SOYBEANS INCREASES

A survey conducted for the Production and Marketing Administration by the Bureau of the Census shows that soybeans processed by the solvent extraction method increased sharply in the 1947-48 crop year. In solvent extraction the oil is dissolved from thin soybean flakes by a volatile solvent. Less than 1 percent of oil is left in the residual meal. In contrast, 4 to 6 percent of oil remains in the meal in screw- and hydraulic-press operations. A total

of 61 million bushels of soybeans, or 38 percent of the total crush, was processed by the solvent extraction method in 1947-48 as compared with 45 million bushels, or 27 percent of the total crush, in the previous crop year. The screw press accounted for 54 percent of total processing in 1947-48--a decline from 64 percent in the previous year; and the hydraulic press accounted for 8 percent of total processing. Average oil yield was 10.7 pounds per bushel of soybeans in solvent extraction, 8.9 pounds per bushel in screw presses, and 8.5 pounds per bushel in hydraulic presses. Additional solvent-extraction equipment has been installed since 1947-48, and an increasing percentage of the total soybean crush is anticipated for this method in the future.

INDUSTRIAL PRODUCTS FROM PEANUTS

About two-thirds of the South's great peanut crop--a million tons of peanuts a year, grown on some 4 million acres--goes into candy, salted nuts, and peanut butter. The rest is crushed for peanut oil or used as high-protein livestock feed. As a result of research by the Southern Regional Research Laboratory, Bureau of Agricultural and Industrial Chemistry, peanuts now have also a potentially large market as the source of a new raw material for industry--peanut protein. This substance makes good adhesives for book bindings, boxes, plywood, and other products; it can be used for sizing paper, to give it the glossy finish needed for high-quality printing; it is suitable for making cold-water paints; and it has numerous other uses. The Southern Laboratory, located at New Orleans, has developed a new fiber from peanut protein that has outstanding possibilities. Commercial production of all these products depends on getting satisfactory protein from peanuts. The peanut meal or press cake produced by ordinary methods doesn't yield protein suitable for industrial use. Too much oil is normally left in the meal; there is no provision for removing the peanut skins, which contain unwanted coloring matter; and the heat involved in the procedure of steaming the peanuts before crushing "denatures" or damages the protein. The Laboratory has developed a solvent-extraction process for peanuts that overcomes these difficulties. And a method was worked out to get high-quality protein from the oil-free peanut meal obtained by solvent extraction. One new plant in the South, now producing peanut oil and meal by the Laboratory's process, is the first potential producer of peanut protein for industry.

NEW DAIRY FEED CONCENTRATE FROM SOUTHERN CROP BYPRODUCTS

A concentrate dairy mixture consisting entirely of byproducts from southern crops produced as much milk as a standard mixture containing 70 percent of grains, and cost less, in feeding trials conducted in North Carolina and Tennessee by the Bureau of Dairy Industry and the North Carolina Agricultural Experiment Station. The byproduct mixture was made up of dried citrus pulp, dried sweetpotatoes, peanut meal, and cottonseed meal. The standard grain mixture was ground corn and oats, wheat bran, and cottonseed meal. Circular No. 811, entitled "Milk-Production Value of a Concentrate Mixture Composed Entirely of Southern Agricultural Byproducts," is available from the Bureau of Dairy Industry.

NEW METHOD OF DETERMINING THE ROTENONE CONTENT OF DERRIS

A relatively easy test of rotenone-bearing insecticidal plant material is the determination of "total chloroform extractives." However, the true rotenone content of the material could not be predicted from this test heretofore. Careful statistical analyses performed at the Federal Experiment Station,

Office of Experiment Stations, Mayaguez, P.R., on the relationship between rotenone content and total chloroform extractives for given varieties of Derris indicate that there is a constant relationship, probably due to generic factors, and that it apparently is constant for any given variety regardless of location. The establishment of this ratio offers a quick and accurate method of determining rotenone content of Derris where the variety is known.

FARM REAL ESTATE VALUES HIGH IN 1948

According to a report, "The Farm Real Estate Situation, 1947-48 and 1948-49," issued by the Bureau of Agricultural Economics, 1948 was another good year for American farmers. In most States values of farm land reached new highs and farm income continued at near-record levels. By November 1, average values for the country as a whole were 8 percent higher than a year earlier and 113 percent above the 1935-39 average. But since November, values have weakened in the western third of the country. The U.S. Index for March 1949 was 1 percent below last November and only 3 percent higher than a year earlier. This is the smallest annual increase since 1940-41, and the first decline in the national index in 10 years.

FARM MACHINERY

: The Bureau of Agricultural Economics reports that farm inventories of most types of farm machinery were at an all-time high about May 1, 1948. This was brought out by a sample survey of about 12,000 farms in 872 counties. The 5 Corn Belt States lead in mechanization and Iowa leads the Corn Belt and the Nation in this respect. There are exceptions to the general upward trend in numbers of farm machines; for example, combines are replacing grain binders.

WINTER LEGUMES

The Agricultural Conservation Programs Branch of the Production and Marketing Administration reports that State PMA Committees in Alabama, Georgia, and Mississippi studied the effectiveness of the Agricultural Conservation Program in establishing winter legumes for green manure and cover as a measure in farming systems. Observations covered a period of 4 years and almost 10,000 farms. They found that practically all farmers who once started seeding winter legumes continued the practice in subsequent years. Most farmers seeded winter legumes every year after once starting but a very substantial group skipped 1 or 2 years between seedings. It was found that the most frequent reason for reducing acreage was the lack of or negligible amount of financial aid offered under ACP. Weather, time, labor, machinery, and the high price of seed were also important factors while unsatisfactory experience was relatively unimportant.

MILE-A-DAY TRACTOR

Paradoxically, the slowest tractor on record is speeding up one of Soil Conservation Service's tedious but important jobs. It also lowers the cost of transplanting to nursery rows the millions of tree and shrub seedlings grown in seed beds to supply planting stock for windbreaks, gully control, and improvement of farm woodlands. SCS produces 30 to 40 million such seedlings annually in its 28 nurseries located throughout the country.

The creeper tractor was developed at SCS's tree nursery near Zanesville, Ohio. Test of the machine was so successful that a manufacturer has now undertaken production of the "mile-a-day" tractor, as it is called by those who are using it at the Zanesville nursery. To make it, the nursery manager set the engine of his tractor ahead on its frame just enough so that he could introduce an automobile transmission unit into the power line. Then by operating both the regular tractor and the newly added transmission in low gear the machine could move steadily forward at about 10 feet a minute. This is about as fast as skilled workers can feed the tiny trees into the transplanting machine. The tractor hauls 5 transplanting units and permits a driver and 5 plant handlers to get young trees into the nursery transplanting bed at the rate of about 10,000 an hour. Cuts in cost result not only from the speedy planting, but also from the regular row spacing which permits cultivation to reduce hand weeding and hoeing.

Some few tree and shrub species can be transplanted direct from the seedling bed to the field, but most of the trees grown by SCS's nurseries have a much better chance of survival if they are given one to two seasons in a nursery row with special care and the best of conditions. A self-propelled transplanting machine has been in use for years by commercial nurseries, the Forest Service, and SCS, but this new slow-motion tractor is capable of hauling all the transplanters required to fill a nursery bed at one passage. It thus permits substantial savings in producing the millions of trees needed for conservation and for timber production. With 2 of the transplanting outfits traveling at the rate of 1 mile in 8 hours nurserymen were able to do their job of transplanting about 2,300,000 trees in 3 weeks this last spring. Production by SCS of this type of planting stock slumped severely during the war years. It is now getting back into high again, but the supply still represents only about one-third of the amount requested by soil conservation districts for conservation plantings on farm land.

CARROTS IMPROVE IN STORAGE

In tests at the USDA Horticultural Field Station, Cheyenne, Wyo., certain carrot varieties were found to have more carotene than others and some to hold on to it much longer than others--and even to increase it for a time while in storage. Nine varieties were grown, stored in sand in a moist-air root cellar and tested for carotene content every 5 weeks over a period of 30 weeks. Two varieties, Dutch Horn and French Forcing were highest of the lot in carotene at digging time. The first of these had 89.33 milligrams to 100 grams dry weight of carrot: the second had 76.72 to 100. The next highest variety had 65.32 and the rest dropped on down to the lowest, which had 45.10, scarcely more than half as much as the top one.

Almost as important is the fact brought out in the tests that all 9 varieties had a higher content of the vitamin at the end of the 30-week storage period than at the beginning. Nearly all of them lost some carotene from the tenth to the fifteenth week, but practically all of them made it up and more during the next 5 weeks. Dutch Horn, the "A-1" A-vitamin variety in the test of this group of 9, rose from 89.33 to 94.68 in the first 5 weeks of storage, to 106.69 at the end of 10 weeks, dropped to 98.29 at the end of 15 weeks, and then went up to 112.46 at the end of the twentieth week in the root cellar. At the end of the thirtieth week it was up to 115.31. French Forcing, the variety that stood second in carotene, rose in 10 weeks of cellar storage from 76.72 to 104.64, then

in 5 weeks dropped to 97.06. In 5 more weeks its A content was up to 107.99, and in another 5 down to 104.88. By the end of the 30-week test it was down to 95.15, still more than 18 points above the start. Chantenay, another variety, was up to 102.87 points at the end of the 30 weeks but had a lower average of carotene for the storage period. The varieties found to be lower in carotene content, even Long Orange, the lowest, built it up as the best ones did, but they averaged much lower.

The scientists specializing on vegetable storage problems consider these demonstrated carotene gains and the variety differences basis for an important food improvement.

ELECTRONIC SCALE TO WEIGH LIVESTOCK

The development of an electronic scale for weighing livestock at public markets is exciting widespread interest. The device was constructed by a large aircraft instrument company, working under contract with USDA under the Research and Marketing Act; the Livestock Branch, Production and Marketing Administration, supervised the work. The scale permits greater accuracy and speed in weighing than does the conventional scale, and eliminates nearly all possibility of error or incorrect weights. Some stockyard companies already are planning to install it. Undoubtedly it will be applicable to other industries using large-capacity scales.

The new scale measures the weight of livestock through electrical impulses and records pressures electrically. When certain buttons are pressed, it prints automatically the weight, number, and type of animals, names of the weigher and selling agency, and the date and time of weighing. It is so constructed that it is impossible to register anything other than the weight of the load actually on the scale platform.

Dirt accumulations, wear, and corrosion tend to reduce accuracy of the conventional weighbeam-type of scale. Unless it is frequently rebalanced, dirt and manure on the scale platform, rodent interference with the weigh beam, carelessness, or intentional manipulation could result in erroneous weight records. Ordinarily this record can be read only close at hand. The new scale, however, indicates the weight on a large dial, easily readable 10 feet away. It can be rebalanced to allow for accumulations on the platform simply by pushing a button. Superiority over the older type scale more than offsets its greater cost, the Branch believes. The instrument company had to make wide modification of its aircraft scale to adapt it for weighing livestock, and extensive tests and trials at markets to assure dependability and accuracy under all weather conditions.

RESEARCH INCREASES PRODUCTION OF POTATO FLOUR

With a surplus of potatoes in the U.S. and food shortages abroad, it became highly desirable following the war to step up American potato exports, particularly to Europe. But potatoes are about 80 percent water and do not keep well in storage. In their natural form they are generally uneconomical for overseas shipment. One answer to this problem was to convert them to potato flour, which has long been a staple food in Europe. The difficulty here was that our normal capacity for potato-flour production was not big enough to meet the need. It seemed possible that idle equipment available at distilleries and food-processing plants might be put to work making potato flour, but some manufacturers who tried it ran into technical troubles. The Bureau of Agricultural and Industrial Chemistry investigated their equipment--cookers, washers, drum and steam-tube dryers--and developed satisfactory methods for using it to produce flour from potatoes. Bureau

specialists at the Eastern Regional Research Laboratory took their research results to potential flour manufacturers and showed them how to make the equipment they had work properly. Partly as a result of this effort, potato-flour production increased in 1948 to a rate of 150 million pounds a year, about 10 times the country's normal output.

MARGINS FOR MARKETING LIVESTOCK

Margins involved in the marketing of livestock are important to both producers and consumers. Sales of meat animals in 1948 accounted for approximately 30 percent of the total cash farm income in the U.S. From the consumer's standpoint, meat usually accounts for about a fourth of the total expenditure for farm food. Returns received by producers for livestock and prices paid by consumers for meats and meat products are affected by the size of the marketing margins. The Bureau of Agricultural Economics has issued a report, based on research under the Research and Marketing Act which deals with the magnitudes and the general make-up of marketing margins for livestock from farms to slaughter during periods of different price levels.

INTRODUCING FUSARIUM WILT RESISTANCE INTO SWEETPOTATOES

As a part of the Sweetpotato Improvement Project, started last year by the Federal Experiment Station in Puerto Rico, Office of Experiment Stations, in cooperation with the Bureau of Plant Industry, Soils, and Agricultural Engineering, over 2,000 crosses between Jersey and moist-flesh varieties were made during the past season. These crosses provide a method of introducing fusarium wilt resistance into the Jersey types which would be of substantial financial benefit to farmers. This type of breeding work must be done under tropical conditions, since the Jersey-type sweetpotatoes will not flower and cannot be hybridized under continental conditions.

EXCISE TAX ON TRANSPORTATION OF PROPERTY

Enacted in 1942 as wartime revenue measure, the tax on the transportation of property amounts to 3 percent of all freight charges. The tax, as it applies to farm products, results in increasing the prices paid by final consumers and in reducing the prices received by farmers. It bears especially upon farmers who ship their products long distances to markets. The Bureau of Agricultural Economics has issued a report which analyzes the main effects of the tax upon agriculture and agriculture's transportation interests.

RENOVATING UNPRODUCTIVE PASTURES

Research by the Bureau of Dairy Industry shows that renovation of old and unproductive permanent pastures is an excellent method of increasing yields. Over a period of 4 years, renovated pastures at Beltsville, Md., averaged 3,560 pounds of total digestible nutrients per year, or an average of 29 percent more than the 2,765-pound total-digestible-nutrient yield from an unrenovated pasture used for comparison. The renovation process consists of applying manure, lime, and commercial fertilizer; disking thoroughly; and seeding with an approved pasture mixture. A 5-year crop-and-pasture rotation experiment begun at Beltsville several years ago shows that more roughage and more total digestible nutrients can be obtained from this rotation than from permanent pastures. Corn and wheat are

grown the first 2 years, and grasses and legumes the following 3 years. On the average, this rotation has yielded 11 percent more nutrients per acre per year than permanent pasture. Furthermore, the crops in the rotation series provide grazing in early spring and late fall, when pasturage normally is short.

DRYING SUGAR BEETS ENCOURAGES ROT

An odd fact research has brought out about stored sugar beets is that the more they are dried before storing in piles or sheds the more they are subject to rot. The common experience with moisture and decay would likely list this finding as paradoxical. But, according to John O. Gaskill, USDA sugar beet specialist who made the studies, the increase in rotting is logical. It results from the damage drying does to some of the cells of the beets, cracking the walls and making them vulnerable to the attacks of various organisms. The more aggressive break into the sugar-laden cells, followed by hordes of less aggressive camp-follower fungi and bacteria that are just as hungry for sugar.

Gaskill says that in harvesting beets a half hour of drying should be considered reasonable--in fact, hardly to be avoided in ordinary farm practice. This time of drying was used as the check or standard of comparison in the tests he carried on in Colorado in 1948. The beets that had a half-hour wait between uprooting and storing had relatively little storage rot and not much loss of weight in storage. When beets were dried for a day the consequent increase in rotted tissue was striking. At 65° F. after 13 weeks of storage it was almost 32 percent, almost three times as much as in the half-hour test. At 45° F. for 19 weeks rot was 11.4 percent, again nearly three times the check. Dried for 2 days, a condition that is not unusual on farms for at least part of the crop, the losses could be called unbearable--65.6 percent rot after 13 weeks at 65° and 27.3 percent after 19 weeks at 45°. The losses in storage after 4 days drying were so bad as to ruin the beets as a source of sugar--87.5 percent at 65° and 34.2 percent at 45°.

Weight loss resulting from drying used to be the principal deterrent to leaving sugar beets long in the field or pile, but loss from such cause is small compared with the resulting weight loss in storage and especially the loss from rotting during storage. This discovery should save much sugar for millions of tons of sugar beets stored for a few days to a few months is necessary to carrying on the industry with economy and efficiency.

U.S. FOOD CONSUMPTION

Detailed information as to the per capita consumption of all major food commodities in the U.S. is for the first time brought together in a single publication by the Bureau of Agricultural Economics. Part of a project under the Research and Marketing Act includes basic data on supplies and distribution from which the consumption estimates are derived. The years 1909-48 are covered herein. The material will provide a basis for further analysis by the Bureau of the demand for food. During World War II estimates of the per capita consumption of food, together with information on composition of foods, were used to determine the nutritive value of the food supply in this country. They also provided a basis for international comparison with the food supplies and consumption of our principal allies. The methodology involved is here given for the first time.

SIMPLE DYE TEST AIDS COTTON MILLS

Cotton fibers look like very fine hairs. Actually they are tiny hollow tubes. Fibers from immature cotton have thinner walls than those of fully matured cotton. And they behave differently in some cotton-processing operations--for instance, they won't dye the same as mature fibers. Unless they are specially handled, immature fibers tend to cause trouble in cotton mills. A convenient means was needed to aid in segregating bales containing a high proportion of immature cotton. Scientists at the Bureau of Agricultural and Industrial Chemistry's Southern Regional Research Laboratory developed a simple dye test to do this job effectively at little cost. Samples of cotton from the bales are dipped in a special dye mixture; the immature cotton dyes green, the mature cotton red. Many leading mills and cotton brokers now use this test to classify their raw cotton. It makes possible greater operating efficiency and helps the mills to produce cotton textiles of more uniformly high quality.

LONG-LASTING SEED CORN

New facts on conserving the viability of seed corn, a factor of more importance today than ever before, have been brought out recently. Some of these contributions have come from a 13-year series of experiments carried on cooperatively in Ohio by the USDA and the State experiment station. J. D. Sayre, agronomist and physiologist of the two institutions, found 7 conclusions worth special emphasis--for example, "seed corn can be carried over for many years with most of its original vitality by drying it to 5 to 8 percent moisture and storing in airtight containers at a uniform low temperature." When the moisture content was more than 12 percent, seed corn lost viability rapidly. As moisture was reduced, the longer and longer the seed would live especially when kept cool enough. The ordinary room temperature of 70° F. and above is bad for seed corn, but storage at freezing or below was good for it, especially when dry enough.

The experimenters tried storage in which air had been replaced by carbon dioxide, nitrogen, or oxygen, finding that the oxygen reduced longevity and the others had no effect. Sayre concluded that the airtight containers keep seeds viable by preventing ups and downs in moisture content as the humidity of the outside air changes. When the temperature in these containers was kept uniform at 70° F. or below and the moisture down to 5 to 8 percent, seed corn kept viable through the longest experiments--13 years plus--with promise that it could hold on to life much longer than that.

FRESH RED SOUR CHERRIES VS. PROCESSED PRODUCT

Among the observations made in a study of the relationship between the quality of fresh red sour cherries and their processed products, the Fruit and Vegetable Branch, Production and Marketing Administration, reports: In properly frozen cherries, there is little increase in the severity of any defect present in the raw product; there is little change in color intensity, and little equalization of color between cherries. In canned cherries, the bleaching of the product's color can be minimized by decreasing the process in time or temperature or both to the lowest point where sterilization is achieved. Color is also better preserved when sugar is added to the packing medium. Defects, if present, however, are more prominent in the more highly colored cherries produced by either of these methods. Within reasonable limits, the percentage of cherry-red to dark-red cherries does not materially affect the value of either canned or frozen fruit. Prompt handling and quick chilling retard the oxidation of bruised areas.

LINT CLEANER NOW IN COMMERCIAL OPERATION

The new type of lint-cleaning equipment for use at cotton gins, developed at the USDA Ginning Laboratory, which is operated jointly by the Cotton Branch of the Production and Marketing Administration and the Bureau of Plant Industry, Soils, and Agricultural Engineering, has now been field-tested and proven satisfactory. The cleaner is an integral part of the ginning process and receives the ginned lint from the conventional stand where the seed has been separated, and, while the lint is still in the air current, the cleaner removes trash by a combination of centrifugal force, scrubbing action and gravity, assisted by the air currents. After thorough proving-ground tests, no serious operating difficulties have been experienced and it has been proven that the cleaners have the capacity and stamina for constant use in handling the full lint delivery from cotton gins. They have been used effectively on hand-picked, hand-snapped, and machine-picked cotton showing significant grade improvements without injuring the fiber and spinning qualities of the lint. On trashy cotton, the cleaner gave an average of about a grade improvement and benefits ranging from $5 to $10 a bale at current prices. It has been estimated that the operation of the lint cleaner will cost about $1 a bale at gins having a volume of 3,000 bales annually. Public service patents have been applied for and several of the leading gin-machinery manufacturers are now fabricating the cleaners. It is anticipated that about 150 ginning plants will be equipped with these units for the 1949 season and that these plants will probably gin about half a million bales.

BUNCHY-TOP-RESISTANT PAPAYA

Forty-four different varieties of papaya from widely separated locations in the tropical world have been introduced by the Federal Experiment Station, Office of Experiment Stations, Mayaguez, P. R., for testing against the destructive virus disease, bunchy top, which has made papaya introduction virtually impossible in many areas. Valuable genes for fruit size, shape, quality, growth habits, and setting characteristics have been discovered in these stocks. Pathological and breeding investigations are being conducted in an effort to develop strains of papaya resistant to the disease.

MARKETING POTATOES

Farmers in the U.S. produced 5 bumper crops of potatoes in the 5 years from 1943 to 1947 and in 1948 the smallest acreage harvested in nearly 70 years yielded another bumper crop. But per capita consumption of potatoes has been declining and total consumption has not kept up with the growth in population. In a repor called "Problems in Marketing Potatoes: Preliminary Results of Some Recent Research," the Bureau of Agricultural Economics brought together the available information on various phases of the marketing problems that confront the potato industry. The report tells how to reduce losses from shrinkage, waste, and deterioration in quality, and lists ways of reducing other costs of marketing. Demand for potatoes may be increased by finding out the kinds of potatoes consumers want, by improving quality, by better marketing, by stressing the value of potatoes as a food, and by finding uses for cull and surplus potatoes.

MORE NUTRITIOUS COTTONSEED MEAL

Cottonseed provides Southern cotton farmers with a substantial part of their income. The Bureau of Agricultural and Industrial Chemistry devotes considerable effort to research on this commodity--to develop practical solvent-extraction methods for cottonseed; to learn more about the seed's unique pigment glands, which complicate processing; and to improve present methods of converting the seed to oil and meal, using hydraulic and screw-type presses. A new precooking

treatment recommended by the Bureau is now helping cottonseed processors to turn out a meal with higher feed value than that formerly produced. Cottonseed-oil mills normally heat or cook the seed to make it easier to press out the oil. In conventional methods, water is added to the seed before cooking. But the Bureau found, through work at the Southern Regional Research Laboratory in New Orleans, that this practice caused damage to the protein of the cottonseed and made the meal less nutritious as livestock feed. The Laboratory's research showed that in commercial screw-pressing operations little or no water had to be added to the seed before cooking, and that dry cooking gave cottonseed meal of superior feed value. Several cottonseed-processing plants have recently adopted this procedure. —

INVENTION AIDS AIRSTRIP POTATO DRYING

Until last year it was assumed that potatoes could not be dried in airstrips in eastern and southern areas because of the relatively high humidity. However, on the principle that the air over a paved airstrip will be heated sufficiently to cause both a marked decline in relative humidity and rapid thermal circulation, trials of airstrip-drying were made by the Fruit and Vegetable Branch, Production and Marketing Administration, in 3 East Coast and 1 Gulf Coast location late in the summer of 1948 and early in the summer of 1949. The potatoes dried successfully even when rained on repeatedly, and in one case 6 inches of rain in a 4-day period caused no damage other than washing some of the dried cut potatoes off the runway and into the gravel at the side where it was difficult to recover them. An important development was the on-the-spot invention and fabrication of a cutting and spreading machine consisting of a frame, hopper, and cutting disk powered by a gas engine through a modified automobile rear-end. The whole was mounted on casters so that it could be attached to the back or side of any truck. Even on a hand-made basis its cost was only $800 and its output consistently has been 300 to 400 bags per hour, cut and spread in a layer precisely right for rapid and thorough drying.

FLAVOR ESSENCE MAKES TASTIER FRUIT PRODUCTS

When fruits and berries are made into jams, jellies, and other food products, much of their natural flavor is often lost. But manufacturers can now extract the volatile flavor essences from fresh fruits and use them to improve the flavor of their processed fruit products. Practical equipment and methods for recovering and concentrating fruit essences have been developed by the Eastern Regional Research Laboratory of the Bureau of Agricultural and Industrial Chemistry. This process has attracted considerable commercial interest, and a number of companies are planning to produce flavor essence from apples. At least two concerns are also interested in marketing a new apple candy flavored with natural apple-essence concentrate produced by the method developed at the Eastern Laboratory.

RETAILING PREPACKAGED MEATS

A report entitled "Retailing Prepackaged Meats," recently completed by the Marketing Research Branch, Production and Marketing Administration, presents the results of a Nation-wide survey of 97 self-service meat departments located in 80 cities in 27 States and the District of Columbia. Prepackaged meat refers to the retailing of consumer-size meat cuts, wrapped in a moistureproof transparent film, which carries a label showing name of cut, net weight, price per pound, and total value. These packages are displayed in an open-top refrigerated case from which the consumer can help himself and pay for the items when leaving the store. Sixty-five of the stores were operated by 34 chain store companies and 32 stores were independently owned. Meat sales varied from 20 to 34 percent of total store sales. As store sales increased the average number of pounds of

meat handled per man-hour increased from 17 to 29 pounds. The total average labor cost of cutting, wrapping, weighing, and displaying prepackaged meat amounted to 4.3 cents per pound. Discoloration of the prepackaged meat was the major merchandising problem, and to solve it all segments of the meat industry were found to be either carrying on investigations or planning them.

There was little doubt about consumers accepting this new method of retailing meat, as two-thirds of the stores reported that their customers reacted enthusiastically to self-service meat departments and slightly less than one-third of the stores reported their customers as moderately enthusiastic. Only 2 stores reported their self-service meat departments had not been well received. Of the 51 stores converting from a service store to self-service, 46 reported increased sales. The most favorable comments for self-service meat departments were: (1) No waiting in line to be served; (2) better selection of meat items; and (3) the opportunity to purchase to suit household budget. The most unfavorable comments were: (1) Miss personal contact; and (2) prefer to see and have meat freshly cut. The entire survey was based on a questionnaire of 100 questions, the answers to which were collected by personal interviews. The report may be secured from PMA.

FARM-TO-RETAIL-MARGINS FOR LIVESTOCK AND MEAT

This is the title of a report based on research under the Research and Marketing Act and issued by the Bureau of Agricultural Economics. Meat and meat products normally account for approximately a fourth of the cost of all farm food bought by the consumers. But in 1947 and 1948 this proportion was more nearly a third of the total. Important questions of interest to both producers and consumers of meat that are answered in the report are: How is the consumer's dollar spent for meat distributed among producers and marketing agencies? Does that distribution remain the same when prices are low and when they are high? Research shows that the distribution of the consumer's dollar spent for meat differs with different price levels.

QUICK HANDLING HELPS PRESERVE FLAVOR OF FROZEN PEAS

Vegetable canners and freezers want to give their customers a product that tastes fully as good as fresh vegetables right out of the garden. Bureau of Agricultural and Industrial Chemistry researchers have recently aided commercial packers to turn out better tasting frozen green peas. Tests made at the Western Regional Research Laboratory show that a major factor causing loss of flavor or development of off-flavors is delay between harvesting the peas and blanching them prior to freezing. Blanching is a scalding process that halts enzyme activity in the peas and helps to prevent flavor deterioration. By changing field and plant practices according to Bureau recommendations, several producers of frozen peas have cut down the time between vining and blanching, and thus markedly improved the quality of their product.

PREPACKAGING OF WESTERN APPLES AT POINT OF PRODUCTION

During the 1948-49 apple shipping season, apple growers of the Northwest, cooperating with the Marketing Research Branch, Production and Marketing Administration, marketed 70 carlot shipments of Winesap apples in 3-, 4-, and 5-pound transparent film bags. The bags were ventilated and equipped with cardboard leaders which served as convenient carriers. Each consumer package was marked with the packer's trademark. The cost of packaging labor and materials for the prepackaged apples exceeded that required for the standard apple box, although considerable reductions in the cost of labor were found during the season.

Sales observations, as well as opinions which consumers expressed by returning post-card questionnaires included in 90,000 packages of apples, indicated that many enthusiastically accepted the new package. Further study of prepackaged apples is planned for the 1949-50 apple shipping season, and a report showing the progress of work during the past year is in process of preparation.

MECHANIZATION OF THE RICE HARVEST

A progress report with this title, issued by the Arkansas Agricultural Experiment Station in cooperation with the Bureau of Agricultural Economics is a part of a larger study of the mechanization of rice and its implications in Arkansas, carried on partly under the Research and Marketing Act. Since 1940, revolutionary expansion and change have taken place in the rice industry in Arkansas and other rice-producing States. The total acreage of rice in the U.S. was 52 percent larger in 1947 than the average in the prewar period 1937-41. Establishment of artificial driers made possible a rapid shift to the use of combines for harvesting rice. In 1947, more than 50 percent of the rice in Arkansas was harvested by this method. The combine method requires only about 3 hours of labor per acre compared with more than 11 hours per acre with the binder method. Labor and power costs are much less with the combine method, but investments in machinery are greatly increased. The report, which is based on data for the 1947 crop year collected by the survey method from 155 farmers, describes methods and costs of harvesting.

NEW VITAMIN-C COMPOUNDS HELP PRESERVE LARD

To help meat packers retain their markets for lard in the face of competition from vegetable shortenings, the Bureau of Agricultural and Industrial Chemistry has developed methods to make lard keep better. One way this can be done is to treat the lard with levoascorbic acid, otherwise known as vitamin C. This is the antiscurvy vitamin found in citrus fruits and green leafy vegetables. But ordinary vitamin C will not dissolve in lard. So, for the first time, Bureau scientists at the Eastern Regional Research Laboratory successfully prepared compounds containing the vitamin that were soluble in fats and could easily be introduced into the lard. The reason lard becomes rancid is that it combines with oxygen from the air. The preserving action of vitamin C is due to its ability to act as an antioxidant, or reducing agent--that is, it combines chemically with the oxygen in the lard, thus leaving less oxygen available to cause rancidity. One of the new fat-soluble, vitamin-C compounds is levo-ascorbyl palmitate. At least one firm is now producing this substance commercially. Besides their use as lard preservatives, the Bureau's vitamin-C compounds, called ascorbyl esters, also have promising possibilities for the manufacture of pharmaceutical preparations containing vitamin C.

U.S. CONSUMER STANDARDS FOR FRESH PRODUCE

Although wholesale trading in fresh fruits and vegetables on the basis of U.S. standards issued by USDA has been general for a period of 30 or more years, it was only recently that USDA has engaged in research looking to the issuance of consumer or retail standards to aid retailers and consumers in the purchase of their supplies of these products on a quality basis. The first consumer standards issued by USDA became effective for potatoes in December 1947. Since that time standards for fresh spinach leaves, tomatoes, and celery stalks have been promulgated. Investigations have been completed for standards for fresh carrots and they will become official in November of this year. Research also is under way on consumer standards for apples. For additional information address Fruit and Vegetable Branch, Production and Marketing Administration.

U. S. DEPARTMENT OF AGRICULTURE

Office of Information

Document No. 6
Revised April 1, 1950
A USDA Document

IMPORTANT RECENT ACHIEVEMENTS OF DEPARTMENT OF AGRICULTURE SCIENTISTS

VITAMIN D IN BARN-DRIED HAY AND GRASS SILAGE: Recent tests by the Bureau of Dairy Industry showed that barn-dried hays or grass silage, even when cut in an immature stage and stored immediately without exposure to sunlight, provide enough vitamin D under Beltsville conditions to prevent rickets in growing calves. Since winter calves are often raised without exposure to the sun, they must depend on feed for the necessary vitamin D.

CONSUMER DEMAND FOR TURKEY PARTS: Reno, Nev., consumers reacted favorably to the sale of halves, quarters, and smaller parts of fresh turkey, in an experiment under the Research and Marketing Act made from Thanksgiving 1948 to New Year's 1949. The results are believed to indicate an important potential outlet for large turkeys in addition to the usual storage demand for such birds. Trade response was somewhat less enthusiastic than that of consumers. Additional information may be obtained from a report issued by the Nevada Agricultural Experiment Station, the Bureau of Agricultural Economics, and the Production and Marketing Administration.

CITRUS GROWERS CAN COMPARE COSTS: Storm warnings of costs up and prices down during the 1944-45 to 1947-48 crop years were hoisted for citrus growers, packers, and canners in Florida and Texas in a joint study by the University of Florida and Texas A & M and the Farm Credit Administration. Working under funds from the Research and Marketing Act of 1946, these agencies collected and studied the actual costs of canning and packing citrus fruits. The idea was to get information for cooperatives and other packers and canners that would help them analyze and compare their costs with those of the industry in general.

NEW RECOMMENDATIONS FOR USE OF INSECTICIDE LINDANE: Lindane now is recommended by entomologists of the Bureau of Entomology and Plant Quarantine as a spray for the control of the house fly in dairy barns and other places on the farm, for controlling lice on dairy cows, and lice and ticks on other cattle. Used alone, lindane will not control certain tick species for periods longer than a week. When combined with DDT the treatment will control ticks for 2 to 3 weeks. This chemical was recommended for use by USDA scientists for the first time last summer as a residual spray against flies in dairy barns and milk plants.

PURSLANE GIVING WAY: Working in Iowa muckland onion fields, scientists of the USDA and the Iowa Agricultural Experiment Station have found out how to kill purslane, that well-known, sprawling, soft-bodied weed, with a "dinitro" chemical (short for dinitro-ortho secondary-butyl phenol) or a certain sodium compound (sodium pentachlorophenate), put out by herbicide manufacturers under their respective trade names. The experimenters used a sled-borne hood during spraying of the weeds to keep the chemicals off the onion leaves which are subject to local injury. They found that the bulbs were not hurt by the spray. Now cooperating engineers are developing a 4-row hood-sled to be used in more experiments.

OUR FARM OWNERS: Farm land in the U.S. is held mainly by individuals, public agencies, and corporations. In 1945, individuals owned 85 percent of the 1,142 million acres of land in farms. Most of the 5 percent publicly owned were grazing lands in the West and school or tax-reverted State and county lands. Corporations held 6 percent of the farm land, chiefly in the West and South. Our system of ownership has permitted much concentration in the hands of a few, as indicated by the fact that, when the study was made, 3 percent of the owners held 41 percent of the farm land owned by individuals. Additional information may be found in "Farm Land Ownership in the United States," prepared by the Bureau of Agricultural Economics.

SEASONING CONTROL STANDARDS: To aid furniture manufacturers in turning out properly kiln-dried stock, the Forest Products Laboratory, Forest Service, Madison, Wis., has applied statistical quality-control methods by which uniformity of drying can be constantly checked in the factory. Economical sampling methods are combined with simple charts by means of which plant managers know at all times whether their stock is uniformly dried. Hitherto no such methods have been available, and the producer could not be reasonably sure of avoiding losses that result from inadequately dried material. The method has been successfully developed in Wisconsin and North Carolina furniture plants and is being refined and broadened for more general application where seasoning control is essential to satisfactory products.

MILK-PRICING PROBLEMS STUDIED: Some of the problems and methods used in pricing milk under a Federal milk marketing order are analyzed in a report by the Dairy Branch, Production and Marketing Administration, on the basis of a study of "surplus" milk pricing in the Chicago area made under authority of the Research and Marketing Act. What happens when surplus milk is priced too high or too low, the merits of some different bases on which prices might be computed, factors affecting the prices received by milk processing plants for their products, variations in the yields of products among various plants, gross margins received by the plants, and other factors are discussed. Factors that might be included in a formula for computing milk prices are considered. While the report deals entirely with pricing in the Chicago area, the principles and methods discussed are believed to be of interest to anyone directly concerned with milk pricing in other areas.

TREATMENT OF BERRY BOXES REDUCES MOLD GROWTH: In recent years the problem of mold growth on berry boxes (commonly called hallocks) has become a serious one to both growers and processors of berries in the Pacific Northwest. Sound, freshly picked berries put in fungus-infested boxes frequently mold while being transported from the fields to the processing plants. A method for coating berry-picking boxes with wax to prevent or greatly reduce losses from molding or mold contamination of berries between picking and processing was developed by the Western Regional Research Laboratory, Bureau of Agricultural and Industrial Chemistry. This method was favorably received and will be used widely in the future, possibly also in other berry-growing regions.

ASCORBIC ACID IN CANNING PEAS AND TOMATOES: Cooperative work with the Long Island Vegetable Research Station showed that the ascorbic acid content of peas decreased as the peas increased in size. Surprise variety had a higher ascorbic acid content than did Wasatch. Applications of manganese sulfate to the soil did not influence in any way the ascorbic acid content of peas, tomatoes, or rye plants. High nitrogen applications reduced the ascorbic acid content of Marglobe tomatoes but had no effect on the Earliana variety. It is thought that the reduction in ascorbic acid content of tomatoes by heavy nitrogen applications is a result of excessive foliage which shaded the fruit.

FARMING IN ALASKA: Developing a farm from wild land in the Matanuska Valley of Alaska is costly and time-consuming. It requires skill in farming operations, in selecting varieties of crops to grow, and in marketing. Alaska farm products must find their market in Alaska and the extent, location, and performance of this market is a major factor in determining locations, quantities, and kinds of agricultural expansion that can be soundly undertaken. Nevertheless, within the limits currently imposed by physical and economic factors, there are opportunities for judicious expansion of certain types of farming. A progress report of the study of economic aspects of farming in Alaska, with chief attention to the Matanuska Valley, which gives additional information, has been issued by the Bureau of Agricultural Economics.

GRAZING AND SOIL CONSERVATION: It is well known that a good pasture is the best possible safeguard against soil erosion. It is not always recognized, however, that too heavy grazing will quickly damage the erosion-control value of a pasture and at the same time cut down its forage yield. Experiments and field trials by the Soil Conservation Service, in cooperation with the Illinois Agricultural Experiment Station, showed that severely grazed pastures yielded nearly a thousand pounds less good forage than pastures that were grazed moderately with careful consideration for the growth cycle of the plants and protection of the soil. The severely grazed pastures grew about 170 pounds more weeds to the acre than the moderately grazed ones. It also took 51 pounds of forage to put 1 pound of weight on a sheep in the overgrazed pastures--nearly 3 times what it took in the scientifically grazed pasture.

PROTEIN ANALYSIS SHORT CUTS: In the past 5 years protein research chemists of the Bureau of Human Nutrition and Home Economics have sped up food-protein analysis by developing rapid and accurate methods, mainly microbiological, for assaying the 10 so-called essential amino acids. With the slow methods formerly used few food proteins have ever been completely analyzed and data have been insufficient for estimating the amino acid content of diets. With the microtechniques, it is possible to determine a food's content of all amino acids simultaneously in a few days. Simple equipment suffices, and a tiny amount (50 milligrams) of protein-rich material makes an adequate sample for determining all of a food's essential amino acids. A 12-page publication condenses the results of the research for easier reference use. The title--"Methods for Microbiological and Chemical Determinations of Essential Amino Acids in Proteins and Foods." M. P. 696.

TOXAPHENE CONTROLS TICKS: Toxaphene, an insecticide manufactured from resins found in old pine stumps, controls some of the most serious of the insect parasites of livestock, according to entomologists of the Bureau of Entomology and Plant Quarantine. It is of special value in the control of nearly all important species of ticks, which are among the most difficult to control of all livestock parasites. Sprays containing this material will control horn flies nearly as well as sprays containing DDT. One treatment of louse-infested animals will often provide control of these parasites. Toxaphene is now recommended for the control of ticks, lice, horn flies, and sheep ticks on all livestock except dairy cows.

CRANBERRIES BETTER BAGGED AT BOG: Cranberries in cellophane packages sell better. Now USDA announces feasibility of putting them up in the retail bag at the bog or the storage plant, a safe and economical procedure. The results proved it is practical to store the prepackaged berries 4 to 8 weeks without risking excessive spoilage, if the temperature is kept down to 33° or even at 38° F. Berries stored 4 weeks at the lower temperature could be kept at 70° for a week following the cold storage and lose very little from decay, an indication they would stand up well for that length of time while being held in a retail store or in the home of a consumer. The specialists believe most of the crop can be marketed in the small bags opened by the housewife as long as 2 months after filling. Then there can be a few days of grace at room temperature.

NEW SNACK FOOD FROM RICE: "Rice curls," a new snack food prepared from ground rice, have attractive commercial possibilities and offer a new outlet for the Nation's rice crop. Developed by the Bureau of Agricultural and Industrial Chemistry's Western Regional Research Laboratory, rice curls can be served like potato chips, corn chips, or similar foods, with salads, beverages, and appetizers. This new food specialty has excellent flavor, stores and handles well, and can be produced inexpensively from broken grades of rice. The proposed commercial method for making rice curls is simple. Ground rice is mixed with hot water to form a paste which is forced through small round openings in standard extrusion equipment. The resulting "curls" are cut in about 3-inch lengths, fried in vegetable oil, salted, and packaged.

MARKETING PRACTICES AND EGG QUALITY: The more time eggs spend on the road in their journey from the producer to the consumer's breakfast table, the more they deteriorate in quality. This was found in a survey of egg-handling practices on 837 farms in Connecticut, Maine, New York, and Pennsylvania in the summer of 1948; and in an analysis of quality change in 146 lots of eggs sold by poultrymen through wholesale receivers during August of the same year. Greatest deterioration occurred as the eggs moved from the first to the second receiver. Additional information may be found in a report issued by the New York (Cornell) Agricultural Experiment Station, with the States involved in the study, the Bureau of Agricultural Economics, the Farm Credit Administration, and the Production and Marketing Administration cooperating.

THYROPROTEIN TO STIMULATE MILK PRODUCTION: Thyroprotein, a synthetic feeding material known to induce cows to give more milk for a short time, is now on the market in various forms. Some dairymen are feeding it without questioning either the economy of milk production over longer periods or

the ultimate effect on the health of their cows and the offspring. The Bureau of Dairy Industry's results to date indicate some undesirable effects from prolonged feeding of thyroprotein. In previous years, the Bureau reported that first-lactation cows showed a sustained increase in milk production when fed thyroprotein and 25 percent more feed than they would normally require. But during the second, third, and fourth lactations on this feeding schedule, they have shown a progressive decrease in milk production. Cows fed similarly, but with no thyroprotein, usually maintain a relatively constant production during succeeding lactations.

FEED MOLASSES OUTLETS: Possible new outlets for feed molasses and better marketing methods are the subject of a new USDA report. When used as part of a feed ration, molasses is more economical than corn whenever a bushel of corn sells for more than 6½ gallons of molasses. If a small midwestern feed mixer produces as much as 500 tons of feed a year, he can afford to spend $2,500, under present price relationships, to install equipment that can handle molasses. As long as molasses is available in volume at a reasonable price, it is probable that farmer demand for molasses for silage making will increase. Finally, dried molasses has great promise as feed if the cost of this product can be brought down to or below the level of the cost of corn. The study was made by the Sugar Branch, Production and Marketing Administration, under authority of the Research and Marketing Act.

NEW LAMINATING INDUSTRY: Laminated wood construction permitting high ceilings and large clear spans is a comparatively recent development based on fastening boards together with water-resistant glues into structural members of any desired size and of either straight or curved form. The large clear spans, ease of erection, and durability of laminated curved rafters for barns and other farm buildings have proven popular with farmers with the result that a large volume of laminated production is in these products. Unique architectual effects, excellent strength, and unusual fire resistance are qualities that presage the extensive use of this type of member in churches, gymnasiums, assembly rooms, recreation halls, barns, and similar large buildings. The basic design data and specification requirements stem from Forest Products Laboratory research and have led to establishment of an essentially new industry. Write Forest Service for more details.

GUAR, A SOIL-IMPROVING CROP: A rather newcomer to the soil conservation program, particularly in Texas, is guar. The Karnes County Soil Conservation District, with headquarters at Kenedy, Tex., has taken the lead in using guar as a soil-improving crop. Soil Conservation Service nurseries furnished seed for trial plantings. The plantings proved so successful that, in 1948, the district supervisors arranged for 15,000 pounds of seed to be bought and made available for use by the district. That year 2,000 acres were planted following flax harvest. Guar made excellent growth and most of the plantings were stubble-mulched in the fall to condition the soil and were followed by flax. The district farmers harvested over 25,000 pounds of guar seed and used it, plus all the seed that could be bought, for 1949 soil-improvement plantings in surrounding soil conservation districts. Thus widespread use of a good cover and soil-improvement crop was achieved where none was being used before. Guar does well in Texas on both irrigated and dry land, and it is expected to spread rapidly as seed supplies are multiplied.

CO-OP SHARE OF COUNTRY'S FRUITS AND VEGETABLES PROCESSING REPORTED: A good idea of just how much of the country's fruit and vegetable crops are processed by cooperatives--how many salads or main dishes come from a co-op can or package--is contained in the latest survey of cooperative processors for the year 1947-48 by Farm Credit Administration. This Miscellaneous Report 133, "Handbook of Cooperatives Processing Horticultural Products, 1947-48," shows a spotted picture--more volume and a greater percentage of the U. S. total for some crops, the exact reverse over previous years in others. Cooperatives doubled the fruit they froze in 2 years until they handled nearly a fifth of all principal fruits in the 1947-48 season. They handled slightly more canned fruits and vegetables, and they went into a slight reverse in the percentage of frozen vegetables processed. Co-op specialties--olives, wine and brandy, nuts, and dried fruits--continued to rate high in percentage of space on grocers' shelves. Co-ops reported in 1947-48 processing more than a fifth of U. S. wine and brandy, a third of the olives, and over three-fourths of the nuts, and more than a fourth of the dried fruits.

A PHOTOELECTRIC COLORIMETER FOR USE IN MICROANALYSIS: Most of the micronutrient element determinations on plant and animal tissues are made using colorimetric methods. In animal work particularly, the need arose for a photoelectric colorimeter that could be used with small volumes of solution and yet maintain a long light-absorption path, since by this means the size of sample could be considerably reduced. A satisfactory instrument was finally developed after several designs were tested. This colorimeter permits the use of cylindrical horizontal absorption cells of various sizes. Cells with absorption paths from 2 cm. to 10 cm. can be accommodated. Thus, the light beam can be restricted to the extent that a cell holding only 0.4 ml. of solution and giving an absorption path of 10 cm. can be satisfactorily used. The photocell-amplifier combinations are essentially linear in response, stable, and have a high sensitivity. Light sensitivity is such that the colorimeter can be used in the region of 360 mu (cobalt procedure) without resorting to special light sources or over-voltages. A description of this colorimeter has been published in Analytical Chemistry.

FARM MORTGAGE INTEREST CHARGES AND INTEREST RATES 1940-48: From 1946 to 1947, according to Department Circular 821 prepared by the Bureau of Agricultural Economics, interest charges on outstanding farm-mortgage debt increased by 6 million dollars, the first increase since the high point of 1922. In 1947, the total charge amounted to 222 million dollars; in 1922, it was 680 million. Interest rates, however, decreased. On January 1, 1948, rates charged by all lenders averaged 4.6 percent for the country as a whole, compared with 6.4 percent on January 1, 1923. Rates varied, of course, among the major lender groups, and by geographic divisions. They were lowest in the North Central States. Annual figures showing interest charges for the country as a whole and by geographic divisions cover the years 1910-47; those showing interest rates, the years 1910-48. Subsequent reports by BAE showed interest charges continued to increase in 1948 and 1949. For the latter year the total charge aggregated about 242 million dollars. Interest rates, however, have remained relatively stable. The higher charge thus primarily reflects the rising farm-mortgage debt.

EIGHT BREAKFASTS COMPARED: Comparing 8 kinds of American breakfasts USDA scientists have obtained evidence that a breakfast featuring protein-rich food, such as milk and eggs, can do more for the eater's sense of well-being and stave off fatigue hours longer than a morning meal with less protein. Subjects who tested the breakfasts in a study conducted by the Bureau of Human Nutrition and Home Economics consistently reported a sense of well-being when the morning meal contained the larger amounts of protein. Their feelings agreed with the record of their blood-sugar level, physiological indicator of the body's response to different meals used in the study. The favorable feeling of well-being seemed to depend more on the amount and quality of protein in the meal than on the calories from starch, sugar, or fat. Breakfasts studied over a 2-year period consisted of 8 different food combinations--from a single cup of black coffee to a hearty breakfast that included eggs and bacon. Nine women laboratory workers served as subjects.

CHANGES IN AMERICAN FARMING: Record production during the war and postwar years which rose in 1948 to an all-time high was an unprecedented break from previous trends. Changes in farming usually develop very slowly. But agriculture experienced a largely irreversible production revolution during the war years. Causes of this revolution include the forces that had built up the potential production capacity--the progress in mechanization, the greater use of lime and fertilizer, cover crops and other conservation practices, the use of improved varieties, the better balanced feeding of livestock, and the more effective control of insects and disease. A report prepared by the Bureau of Agricultural Economics gives additional information.

BUG CONTROL INCREASES SEED YIELDS OF ALFALFA: Two kinds of insects make the difference between profit and loss in alfalfa seed production, according to scientists in the Bureau of Entomology and Plant Quarantine. Lygus bugs ruin alfalfa seed crops, so the crop must be protected from these insects. They can be controlled by dusting the fields with DDT. If alfalfa isn't pollinated there won't be any seed crop. Pollinating bees make the crop possible. If there aren't enough wild bees to assure pollination, honey bees must be moved into the field to do the job. Research has shown they will pollinate the alfalfa flowers without harm from the insecticide if the DDT applications are stopped when the field starts to bloom. In experiments on the control of lygus bugs where bees were abundant, alfalfa seed production has been increased by as much as 600 percent.

ILLINOIS CO-OP LOCKERS SAVINGS DOWN BECAUSE OF COSTS: The cooperative frozen-food locker business in Illinois showed a slow-down in construction of new plants, expansion of old ones, and in the amount of net savings made during 1948. At the same time, costs continued to mount. This information comes from a detailed study of 101 co-op plants in the State made by the Farm Credit Administration and published as Miscellaneous Report 135, entitled, "Frozen Food Locker Cooperatives in Illinois, 1948." While receipts per locker rented went up $3.37 to average $33.11, costs went up more--$4.55--to average $30.55. Many of the older cooperative locker plants in Illinois are operating very successfully and showing satisfactory savings. However, those that were built in the post-war period of high construction and equipment costs, like many other small businesses, find that their high interest and depreciation costs make it difficult to operate successfully in the present era of increased competition. These plants raise the average costs per plant and lower the average savings per plant for the State.

DRIED CARROTS PRESERVED BY STARCH COATING: Although dehydration of vegetables is not normally a large industry, their commercial production and public consumption are undoubtedly greater now than in previous peacetime periods. Experiments by the Bureau of Agricultural and Industrial Chemistry's Western Regional Research Laboratory, in collaboration with a commercial producer of dried carrots, showed that coating of the product with a 2.5-percent solution of laundry starch, following steam blanching, effectively preserves color, carotene, and organoleptic quality beyond the extent realized with previously used methods, including the application of sulfite. This method of treating carrots before dehydration is simple and readily adapted to the processing plant. The procedure is in commercial use.

HOUSING ECONOMIES: The continued shortage and high cost of housing has prompted the Forest Products Laboratory, Madison, Wis., to direct its research in this field toward developing more efficient construction methods to economize on materials. Thus, walls have been tested with more widely spaced and smaller framing members, and joints with new types of fastenings to improve strength and rigidity. At the same time, greater durability and better service at lower maintenance are being sought in work on preservatives, ventilation requirements, and methods of controlling winter condensation. As a result, attic ventilation of many modern, tightly built houses has been shown to be inadequate, leading to condensation troubles; the need for better vapor barriers has been emphasized; and 2-foot spacing of studs instead of the customary 16-inch spacing has been found adequate with certain types of construction. Much of this work represents the first application of engineering principles ever made to conventional frame-house construction.

RESEARCH PROVIDING BETTER COTTONS: Cottons with new properties promise to lend themselves to many new uses as a result of USDA research. New varieties have improved fiber strength. The shift in breeding objectives from fiber length to fiber strength has resulted from annual laboratory appraisals of cotton-breeding material. These show that strength of cotton yarn depends on three fiber qualities--strength, length, and fineness. The data indicate that increases in fiber length and fineness add to neppiness or imperfections in the yarn and to spinning costs. Increases in fiber strength, however, enhance the use value of the yarn. Heritable fiber strength has been stabilized in a number of new cottons developed at the U.S. Cotton Field Station, Shafter, Calif. They come from hybridization of Acala, the commercial type grown in the Southwest, and Hopi, a primitive cotton cultivated by the Indians.

RICE STORAGE CAPACITY STUDIED: There's a rather critical shortage of public storage capacity for bulk rough rice in two of the main producing States, Louisiana and Texas. This was brought out in studies by the Grain Branch, Production and Marketing Administration, under authority of the Research and Marketing Act. The shortage is causing some headaches for the industry. The problem resulted from a shift in harvesting methods toward use of the combine. Rice from the combine is dried artificially and can be stored in bulk at considerably less cost than by the previous method of storing in sacks. But a large part of the storage capacity still can care only for the sacked rice, which is the product of the older harvesting methods. The study was made as a guide for the industry, to show just what are the needs. It is up to the industry itself to go ahead and provide the type of storage needed, now that it has been advised of those needs and of the economies that can be effected by meeting them.

BIG MILK PROTEIN MOLECULES: By centrifuging milk at high speed for a long time chemists of the Bureau of Dairy Industry have forced out protein in layers corresponding to the size of the protein particles and have calculated the relative sizes. They found that all the particles are extremely large in comparison with the molecules of other common proteins and that at least most of them are composed of a single unit having an apparent molecular weight of about 33 million. This work also showed that the protein is chemically a combination of calcium caseinate and calcium phosphate, apparently in a very definite proportion. There appears to be no free calcium caseinate, free casein, or colloidal calcium phosphate normally in milk. These fundamental facts are of interest in the processing of milk, since, by control of particle size of milk proteins, it should be possible to control the viscosity of milk products and to prevent the separation of milk constituents during processing or storage.

CARE OF LAND SUBJECT TO WIND EROSION: Soil Conservation Service research and technical men have been working for some years to determine the best tillage methods to use with stubble mulching in areas where drought and wind erosion are serious hazards to wheat growing. Seven-year experiments at the Amarillo Conservation Station in the Texas Panhandle have definitely proved the advantages of the subtillage machine where deep, fine-textured, slowly permeable hard-land soil is planted continuously to wheat. Yields 21 percent greater were obtained from subtilled fields than were produced after using the moldboard plow, and 14 percent more than where the one-way plow was used. A 15-percent increase in yield was recorded in favor of the subsurface sweep machine over the one-way plow in a wheat and fallow system. Several types of implements were used in the experiments. The good effects of stubble-mulch tillage with these machines have been accumulative through the 7-year period, the improvement being largely due to a gradually improved physical condition and a better moisture-fertility balance in the soil. Fallowing has also made possible the production and maintenance of a stubble mulch to protect the soil from blowing regardless of the occurrence of periods of subnormal precipitation.

CONSUMERS' TASTE REACTIONS TO BLENDS OF ORANGE AND GRAPEFRUIT JUICE: Experiments made with blends of canned orange and grapefruit juices by the Bureau of Agricultural Economics under the Research and Marketing Act indicate that a majority of consumers were unable to detect taste differences in these experimental blends. The three blends tested were almost equally acceptable to consumers: 40 percent orange to 60 percent grapefruit; 50 percent orange to 50 percent grapefruit; 60 percent orange to 40 percent grapefruit. A slight preference for the 60-40 combination was noted. Of the nonblended canned juices, canned orange juice was the more widely used and was also served more frequently than either canned grapefruit juice or a blend of the two. A report issued by the Bureau gives additional information.

PLANES SPOT POLE BLIGHT OF PINES: Airplane scouting was the opening move last summer (1949) in a fight started by forest pathologists of USDA and the University of Idaho against pole blight of Western white pine, the most valuable tree species of the Northern Rockies. The disease attacks in the relatively young or pole stage (trees 40 to 100 years old). Because of the roughness of the country, specialists used airplanes in place of automobiles

for the preliminary scouting. Western white pine is readily distinguished because of its bluish tinge and the characteristic whorling of its branches (like wheel spokes). The disease also marks the trees distinctly--yellow color, sparse foliage, and shortened terminals. With planes a few men were able to inspect in a few weeks rough areas that would have taken many months or even years on the ground.

PREPACKAGED MEAT INCREASES SALES: Merchandising of prepackaged meats on a self-service basis has its serious problems as well as its advantages. That is brought out in a detailed report on a study of this new merchandising practice, issued by the Marketing and Facilities Research Branch, Production and Marketing Administration. Chief among the problems: Preventing the discoloration of meat on display, developing better prepackaging techniques, and making more efficient use of labor in connection with self-service meat departments. Outstanding advantages of the method include the popularity of self-service meats with most buyers, and increases in meat sales at nearly all the stores that converted from service to self-service. The report goes into costs of prepackaging, methods and materials used, sales volume per foot of display case, relative costs and sales by large and small stores, and numerous other factors. The study was made under authority of the Research and Marketing Act.

NEW USES FOR SOYBEANS: "Gelsoy," a new protein product made from soybean meal, has been developed by the Northern Regional Research Laboratory, Bureau of Agricultural and Industrial Chemistry. Laboratory and practical-use tests indicate that it may find wide use in special food products such as meringues, ice creams, and gels. Laboratory tests also indicate that Gelsoy is suitable for such nonfood uses as an adhesive for sealing cork or paper to metal, for heat-sealing of paper and other packaging units, and for preparing gummed paper, and may possibly be used as a foaming agent in fire-extinguishing preparations. Trial runs by an industrial company have demonstrated that this material is satisfactory for sealing the cork liners in bottle caps. Under a cooperative agreement with a soybean-processing firm, a small-scale plant for the production of Gelsoy has been constructed.

CODIFICATION OF REGIONAL FOREST INVENTORY TECHNIQUES: The national survey of forest resources of the U.S. now going on in 8 large regions, must be controlled and correlated to the extent necessary to make the results fit together nationally. This has been especially necessary because of the new field and office techniques associated with the increasing use of aerial photographs and special sampling methods. To achieve the necessary national correlation, the Forest Service has prepared a "Forest Survey Manual" as a guide in all regions. Its provisions are rigid enough to insure national standardization of basic data but sufficiently pliable to permit adjustment to meet significant regional differences. The intensity of the survey is now varied and controlled regionally by predetermining the number of sample plots that must be measured on the ground, or air photos to obtain a figure for total forest area and volume that is correct within the required limits of accuracy. Air photos are increasingly useful in determining forest area by types, sizes, and kinds of timber, in making rough estimates of volume, and in preparing generalized and detailed forest-type maps. Large-scale strip air photos, such as those produced by the Sonne Camera, have been superficially tested for timber inventory purposes and found to warrant further trial.

BAKERY USE FOR SWEET WHEY: Sweet whey, a dairy byproduct rich in food value but which is often wasted or otherwise utilized inefficiently, can be used successfully in the commercial manufacture of bakery goods. Several bakery products, including rich yellow layer whey-cake, cocoa whey-cookies, oatmeal coconut whey-cookies, yeast raised whey-doughnuts, and whey sweet-dough, have been made and tested experimentally in the Bureau of Dairy Industry's baking laboratory. The principal advantage of using whey in these typical sweet goods is that it makes tenderer cakes, cookies, and doughnuts that keep their softness and good eating qualities longer than similar products made without whey. Also, the milk sugar of the whey aids in the development of a uniform, golden brown crust on the baked goods. Several types of whey are now available for commercial baking purposes. Complete formulas for the use of whey in the bakery products listed above are available from the Bureau of Dairy Industry.

GREENBUG CONTROL NOW POSSIBLE FOR FIRST TIME: For the first time farmers are able to protect their small grain crops of wheat, oats, and barley, from greenbug attack. Applications of parathion developed through research conducted by the Bureau of Entomology and Plant Quarantine in cooperation with State experiment stations, gives excellent control of these plant lice. When temperatures are 75° F. and above, tetraethyl pyrophosphate also gives excellent control. Greenbugs, a species of aphid, have caused huge crop losses in the winter-wheat-growing areas. They have been the cause of some of our greatest losses of small grains in these areas. No control method has been available before. Proper timing of applications, which can be made by airplane or ground equipment, is an essential feature of greenbug control. The insecticides must be applied before the insects have killed many plants in a field. The entomologists point out that these insecticides are extremely poisonous to man and animals, as well as to insects. They caution farmers that the chemicals should be handled with extreme care and only by trained operators.

A PRINCIPLE FOR MAINTAINING STRUCTURE IN CLEAN-CULTIVATED SOILS: The effect of winter protection on the structure and earthworm population of soils in Maryland and two Ohio areas has been determined by Soil Conservation Service research specialists. The specific purpose of the studies was to learn whether the structure of clean-cultivated soil could be maintained by covering the ground over winter, thereby decreasing depth and frequency of freezing, and stimulating the activity of earthworms in making holes to remove excess water during critical freezing periods. The soil structure measurements used were infiltration rates, water stability, and volume of large pores. Results of the experiments were clear-cut, and are proving valuable for cropland conservation. The soil structure and earthworm population were much improved in clean-cultivated land where the ground surface was protected over winter with an insulative cover. Hay mulch was more effective than asphalt roofing paper. Clean-cultivated land, when left bare over winter, had poorer soil structure and lower earthworm populations than land protected by sod. Winter cover had only slight effect on the structure of soil in sod. The principle of winter protection to preserve and improve soil structure of clean-cultivated land is being applied through conservation farm planning, especially on Class I and Class II lands suitable for annual crop production.

LESSENING LETTUCE LOSSES: A test made with 5 carlot shipments of lettuce showed a reduction of almost one-half in breakage of standard "LA crates" which had been bound around the middle with a single strand of wire, as compared with the same kind of crates without wires. The test was part of a Research and Marketing Act project, conducted by the Western Growers Association under supervision of the Production and Marketing Administration, to develop better shipping containers for several fresh vegetables. This was a rather small-scale experiment, and the results cannot be taken us exactly accurate for all shipments. But the work was handled carefully, both kinds of containers were included in each of the test cars, and the comparisons of breakage rates therefore are believed to be of practical value. A machine has been developed to place the wire ties around the crates, at the bulge, as rapidly as crates are packed with the usual type of packing machinery. This research is under the direction of the Marketing and Facilities Research Branch, PMA.

STONEVILLE ADDS COTTON MILLIONS TO FARM INCOME: The establishment of the new U.S. Cotton Ginning Branch Laboratory recently at Mesilla Park, N. Mex., led the Department to review results of the research carried on at the U.S. Cotton Ginning Laboratory at Stoneville, Miss., established in 1930. Mechanical improvements in handling and ginning have added millions to farmers' returns. The seed-cotton-drying process increased values from $2 to $5 a bale, and 3,000 commercial gins now use it. Public service patents make various benefits available free to the public. Among other research findings are: An increase of gin-saw speed and other changes have increased gin capacity 20 percent. Large savings in power have been made from studies that gave ginners improved piping and fans and better methods of operation. Laboratory recommendations for design and maintenance of gin saws are now being followed by all gin manufacturers and many ginners. With improved varieties coming into more general use, the engineers have developed handling equipment to prevent mixing of seed.

LACTOPRENE EV RUBBER FROM MILK SUGAR: An acrylic rubber which is named Lactoprene EV because it can be derived from lactose (milk sugar) has been developed by the Eastern Regional Research Laboratory of the Bureau of Agricultural and Industrial Chemistry. The outstanding properties of this product include long flex life, low permeability to gases, and excellent resistance to deterioration by dry heat, oils, sunlight, ozone, and oxidation. Because Lactoprene EV was so promising as a specialty rubber, a rubber manufacturer began making it on a pilot-plant scale in March 1948. This firm also evaluated the product in comparison with other synthetic rubbers. In September of the same year it announced the commercial production of the new rubber, first under the name "Polyacrylic Ester EV" and later as "Hycar Pa-21." According to trade reports the new rubber is being received favorably and its commercialization is proceeding satisfactorily.

DOES A COW NEED MORE THAN ONE MEAL A DAY?: The rather controversial question of once-a-day versus twice-a-day feeding of dairy cattle was studied by the Bureau of Dairy Industry. The results show that some labor was saved by feeding only once a day but the cows ate less hay and produced less milk than when they were fed twice a day. The experiment was conducted in cooperation with the Montana Agricultural Experiment Station. On twice-a-day feeding the cows at 10 percent more hay and produced 6 percent more

milk, but required 70 percent more labor than on once-a-day feeding. On the basis of the values used in this experiment, the net income from a 20-cow herd above the cost of feed and labor would be $29.51 a day for twice-a-day feeding and $28.37 for once-a-day feeding. The differences in this experiment were small but distinctly in favor of twice-a-day feeding. However, the prices of milk, feed, and labor would be important factors to consider in determining which system of feeding to follow.

VIRGINIA FOREST RESOURCES AND INDUSTRIES: The results of an inventory of Virginia's forests have been reported by the Forest Service. This is part of a Nation-wide Forest Survey of the entire U. S. The inventory provided factual information covering forest area and ownership; timber volume by pine, hemlock, blackgum, sweetgum, oak, yellow-poplar, and other less important species; growth of all timber 5 inches in diameter and larger; depletion of the forest by cutting for commodities; and loss because of insects, fire, and decay. In addition, the primary forest industries such as sawmills and pulp mills were catalogued. Accompanying these data is an interpretative discussion bearing on the general condition of the forests, a comparison of annual growth and depletion, the ownership as divided among private farm and industrial, and public, and the importance of forests in the State's welfare. Pointed out also are significant matters relating to the current productivity of the forest land compared to what it could be under improved forestry. In general, forest land is poorly stocked with trees and produces only one-half to three-fourths of what it is capable. Such information is valuable in making plans to reap more long-time benefit and security from the forests for the State of Virginia and for the Nation.

NEW INSECTICIDES MAKE POSSIBLE NEW COTTON INSECT CONTROL METHODS: New organic insecticides require very small amounts per acre in sprays early in the season to control cotton insect pests effectively, according to research conducted by the Bureau of Entomology and Plant Quarantine in cooperation with the Mississippi Agricultural Experiment Station. Use of these new chemicals in sprays may make possible a shift by many cotton growers in some areas from the old-time insecticide dusting practices. If further research on this problem indicates that liquid applications are as effective as dusts, growers can substitute spraying for dusting, one of the most difficult and expensive of cotton-production practices. Spraying of cotton fields with insecticides might have the following advantages: (1) Spraying would eliminate the time and effort early in the season now required for dusting as a separate operation in areas where injurious pests are so numerous that early season applications are profitable. Sprays can be applied during routine cultivation operations in daylight hours, even in moderately windy weather. (2) Only one-half to 3 gallons of the insecticide per acre in a spray seems to be enough, and even at 3 gallons per acre the cost is less than for equivalent dusts. (3) Early-season control in areas where needed becomes possible at low cost, and this tends to prevent gradual build-up in insect populations and lessens the cost of fighting them during the latter part of the season.

A NATIVE GRASS FOR ERODED SANDY LAND: Sand lovegrass, a native of sandy lands in much of the Great Plains, was almost extinct 10 years ago. Today it is making a remarkable come-back in soil conservation districts where its conservation and grazing values have been called to the attention of farmers and ranchers. Experiments and trials by the Soil Conservation Service have shown this grass to be one of the most palatable and nutritious range plants of the region, and it is now being used extensively for reseeding unproductive and abandoned farm land in the Southern Great Plains States and in the sand hills of Kansas and Nebraska. This lush-growing, fine-stemmed, medium-tall bunchgrass, with its dense growth of soft basal leaves, produces a high yield of excellent forage, and a large quantity of easily harvested seed, which makes it valuable for commercial seed production and enables it to fill out thin stands and eroded areas voluntarily. Reseeded pastures of sand lovegrass produced an average of 422 pounds of live-weight gain per Herford steer annually, and 108 pounds of live-weight gain per acre. This is an advantage of 30 pounds per head and 73 per acre over the range before reseeding. The sand lovegrass also carried 108 more head of cattle per section. A carefully planned seed-production program, and better management of grazing, are the two major factors contributing to the come-back of this valuable native forage plant.

MARKETING FRUITS AND JUICES: The availability in retail stores throughout the country of the major fresh fruits, dried fruits, and fruit juices has been surveyed by the Fruit and Vegetable Branch, Production and Marketing Administration, under authority of the Research and Marketing Act. A series of reports on the findings is keeping the trade advised periodically of the regions where these fruits and their products are kept in stock by most of the stores, and also where only relatively few of the stores are offering them to consumers. Only a small percentage of stores offer some of the products to their customers; for other fruits, the percentages are higher but they vary widely between different regions of the country. The data provide helpful information for producers and suppliers of retail stores in their merchandising efforts. An additional phase of this study has been started recently, in which the amount of sales of several fruits and their products by retail stores will be reported periodically. Through this latter study, producers and the trade can keep informed of the rate of movement of their products into consumption.

COLD-WEATHER CLOVER KILLER: Much of the winterkill of legumes is really a consequence of attack by a cold-weather fungus, Sclerotinia trifoliorum, with the common names crown rot and stem rot. Plant pathologists working at the U.S. Regional Pasture Research Laboratory, State College, Pa., demonstrated that various legumes died as a direct result of its attack. All the perennial and winter annual legumes, but especially alfalfa, Ladino clover, red clover, and Birdsfoot trefoil, are subject to the attack; the summer annual legumes such as lespedeza, soybeans, crotolaria, and alyce clover are not. The pathologists have found a number of physiologic forms of the fungus adapted to the several legumes. It has spread over the East, from Georgia and possibly farther South, up into Canada. Its peculiarities are now quite easy to understand since the scientists learned it is dormant above 80° F. and does practically nothing above 70°. Below 70° down almost to freezing, it spreads vigorously. Knowing the facts has provided the basis for developing resistant strains.

SIRUP FILLING IMPROVES FROZEN APPLE SLICES: The new process for pretreatment of apple slices for freezing by exhaustion of gases from the tissues and filling the voids with sugar sirup, has been made available to processors by the Bureau of Agricultural and Industrial Chemistry's Western Regional Research Laboratory. The most apparent characteristics of sirup-filled slices are their superior flavor and the firmness of slices from relatively soft varieties such as Gravenstein, McIntosh, Cortland, and Rome Beauty. The sirup filling also reduces the tendency of defrosted slices to darken and to lose juice when cooked. Estimates based on the procedures used in experimental studies at the Western Laboratory indicate that costs of a sirup-filling process would be higher than those of conventional processes. It thus appears that the competitive position of sirup-filled slices would depend largely on improved quality. This would favor application of this method to soft varieties wherein the greatest increase in quality could be achieved.

NEW MOSQUITOES RESIST DDT: Strains of mosquitoes that resist DDT occur in Florida. This has been discovered by entomologists of the Bureau of Entomology and Plant Quarantine, working in cooperation with the Armed Services and the State mosquito control organizations. It now takes much greater quantities of the insecticide to kill two marsh-breeding species, Aedes sollicitans and A. taeniorhynchus than just a few years ago. The larvae of both species occur in tide-water overflows and rain pools on and in the vicinity of salt marshes. House flies resistant to DDT were reported several years ago by these same entomologists, and DDT-resistant house flies are found now in many parts of the world. The possibility of insects developing resistance to DDT, or other insecticides, is a subject long recognized by entomologists. Some insects have developed resistance to insecticides used for their control in the past. This is one reason why entomologists continually seek new insecticides, better ways of applying them, and new and more effective ways of controlling insect pests.

NEW DIET FOR DAIRY CALVES: Dairy calves can be raised successfully from birth without any salable whole milk and with limited skim milk, provided the skim milk is supplemented with cod-liver oil or some other source of vitamin A. In experiments at Beltsville, Md., the Bureau of Dairy Industry's calves made satisfactory gains when fed no whole milk at all and only 280 to 460 pounds of skim milk. The calves received colostrum milk the first 3 days and were then changed immediately to skim milk, which was supplemented by vitamin A. Good hay and a high-protein grain ration were given the calves at 10 to 12 days of age, and clean water was kept before the calves at all times. For many years the traditional and orthodox recommendations have been to feed the new-born calf colostrum milk for 2 to 3 days, follow with whole milk for 2 to 4 weeks, gradually substitute skim for the whole milk over a period of a week or 10 days, and then continue feeding skim milk to 6 to 8 months of age. At the rates usually recommended the average calf would be fed about 550 pounds of whole and 2,900 pounds of skim milk.

PLANTING MATERIALS FOR SOIL CONSERVATION: Huge quantities of grass and legume seeds, trees, and other plant materials are needed by farmers and ranchers in carrying out the conservation programs of soil conservation districts. The bulk of this material is being produced through the efforts of private growers--farmers, ranchers, seedsmen and nurserymen. The Soil

Conservation Service encourages private enterprise to increase supplies of such planting stocks by giving technical assistance and, in some instances, by providing small quantities of seed of uncommon species, strains and varieties for increase. A major activity of SCS's 26 nurseries is to increase production of new strains of grasses and legumes that have been proved valuable for soil and water conservation. For example, in the Pacific Coast region, two strains of new and improved plants have been approved for release by cooperating agricultural experiment stations. One of these is the Cucamonga brome, a new self-seeding annual grass especially adapted for control of wind erosion in vineyards in southern California, a rapid-developing, early-maturing grass developed in the SCS nursery in southern California. The other plant, developed in a Washington nursery, is Cascade, a strain of birdsfoot trefoil which is particularly suited for hay and pasture seedings in western Washington and western Oregon. The seed of both of these plants are being increased through the facilities of SCS nurseries until sufficient seed become available in regular trade channels.

SAFFLOWER A NEW OILSEED CROP: Although safflower has been grown in the U.S. since 1899, and probably earlier as a botanical curiosity, it was not until 1925 that its commercial possibilities were explored. In 1942, the Chemurgy Department of the University of Nebraska went seriously to work on it. New varieties were developed and the culture and processing of the crop studied. The greatly improved varieties and the increased plantings in the West encouraged more processors to use it, and in 1949, for the first time, production in this country supported commercial processing operations. Prospects appear to be good for establishment of the crop in American agriculture. In addition to its use as a drying oil in paints, it provides feed for livestock and poultry. Additional information may be obtained from a report on the economic aspects of safflower, issued by the Bureau of Agricultural Economics.

TOO MUCH ROOM BAD FOR SUGAR BEETS: Sugar beet growers bent on getting better yields through changing to thicker or thinner spacing need the Federal-State research results. The USDA and the Utah Agricultural Experiment Station find farmers will do well not to move too far one side or the other. But they warn particularly against too wide spacing, saying, "it is seldom that plant spacing is uniform enough for highest yields--and the wider the spacing (that is, the lower the plant population) the harder the problem is. Beyond a certain point the roots can't reach out far enough to make maximum use of food and moisture." So it seems to the experts it's better to make the mistake of having too many beets than too few. Happy-medium commercial field spacing is about 12 inches between beets in the row and 20 inches between rows. If the farmer can contrive to get a uniform stand over the field, he might have his beets as far apart as 15 inches and rows 22 inches apart, which means 24,000 to 26,000 plants to an acre.

IMPROVED PROCEDURE FOR ANALYZING TUNG FRUIT AIDS INDUSTRY: An improved procedure for sampling and analyzing tung fruit has now been developed to the point where some of the benefits to tung farmers and the tung-oil industry can be cited. Chief among these benefits is the sound basis for trading that is provided by an accurate determination of the oil content of tung fruit. The procedure was developed by the Bureau of Agricultural and Industrial Chemistry's Tung Oil Laboratory, in cooperation with industrial

laboratories. Commercial analysts reported that results are dependable and the Commodity Credit Corporation found it very useful in carrying out the tung program. The American Oil Chemists' Society, whose methods are widely used in the buying and selling of oilseeds, has adopted the procedure tentatively for the analyses of tung fruit, which, of course, means wider acceptance and greater use by industry.

TRAINEES LEARN TO HANDLE FRUITS AND VEGETABLES: Sharp increases in sales and large reductions in spoilage of fresh fruits and vegetables in retail stores are resulting from a series of training classes in handling and merchandising methods, organized under authority of the Research and Marketing Act. The classes are conducted, under contract, by the United Fresh Fruit and Vegetable Association for the Fruit and Vegetable Branch, Production and Marketing Administration. As of March 1, 1950, about 15,000 trainees, including retailers and their employees, had taken the course. They represented 3,193 cities and nearby towns. This program was undertaken to learn just how effective such training could be and what results could be achieved. More than 95 percent of reporting retail stores have been able to increase their sales and reduce spoilage, many of them by very large percentages. The trainees are shown how to prepare the produce for display, how to display it, how to preserve it in good condition overnight, and how to price it and to keep simple records. They learn by doing--actually trimming the vegetables, building displays, and storing the leftovers for the night.

OLD STRAWBERRIES GIVE WAY TO NEW: Of the 5 strawberry varieties that led all the rest in acreage 35 years ago, only 1 is still in that top group today. The variety, Klondike, a very top in 1916 and grown then on 28 percent of the total U.S. strawberry acreage, is now the low berry of the top 5, and found on only 5 percent of the acreage. Of the group of 15 varieties that had more than 80 percent of the acreage in that earlier year only 4 are in a similar list now. The USDA and several of the State experiment stations have had much to do with developing the new and more suitable varieties that now make up most of the present list of commercial varieties: Blakemore (32 percent of the acreage) originated in Maryland in 1923; Marshall (16 percent), on the old list came from Massachusetts; Klonmore (13 percent) came out of Louisiana in 1940; Howard 17 (12 percent) came from Massachusetts, introduced in 1918. In a few more years, according to small-fruit specialists at the Plant Industry Station, Beltsville, Md., we may expect to find big percentages of the acreage devoted to varieties hardly known now if known at all.

COTTONSEED PROCESSING COSTS: Variations in the costs of processing cottonseed at different mills are wide--in most of the categories of costs, some of the mills have costs twice as high as others. In that fact lies the possibility of substantial reductions in the expenses of the higher-cost operators. Those conclusions are drawn by the Fats and Oils Branch, Production and Marketing Administration, from a study of processing costs in the industry made under authority of the Research and Marketing Act. One peculiarity revealed resulted in a general recommendation for cost reduction: It was found that, for the most part, high-cost mills had only one item of cost that was badly out of line on the high side, or at most only a few items. Low-cost mills, on the contrary, generally kept each item at

a reasonable level. The recommendation: Most managers of high-cost mills probably can get their total costs down to a good level by concentrating their efforts on the one item, or the very few, that are out of line. The detailed report on this study is technical and bases its comparisons on percentages of total cost, rather than actual dollars expended for each item of cost.

PRICE SPREADS BETWEEN FARMERS AND CONSUMERS: Retail prices of farm food products reached an all-time high in July 1948 when the retail cost of the family "market basket" was $712. This compares with a prewar 1935-39 average retail cost of $341. By March 1949, the cost had dropped to $647, a decline of $65. In 1948, farmers received an average of 51 cents of each dollar spent by consumers for this market basket, the third year of progressive decline from the all-time high of 54 cents they received in 1945. For cotton products, the farmer's share in 1948 averaged 11.7 cents of each dollar, the lowest since 1940 when the farmer's share was 9.0 cents. The prewar 1935-39 average share was 9.3 and the wartime high 12.8 cents in 1943. The 1928 high of 13.2 cents has not since been reached. The farmer's share of the consumer's dollar spent for tobacco products in 1948 was 17.5 cents, lower than the high of 18.4 cents in 1946. A report issued by the Bureau of Agricultural Economics gives annual figures covering the period 1913-1942 and monthly figures for the years 1943-1949 for a variety of products--54 foods and 3 cotton articles. Current monthly data are reported in the Marketing and Transportation Situation, issued by the Bureau.

COTTON STUDIED IN 10 LEADING FABRICS: A recent report on the specific qualities and quantities of raw cotton used in manufacturing each of 10 major types of cotton fabrics is the product of a 2-year investigation made by the Production and Marketing Administration under the Research and Marketing Act. The fabrics studied were plain print cloth, wide sheeting, narrow sheeting, denim, drill, duck, osnaburg, carded broadcloth, combed broadcloth, and lawn--10 fabrics that ordinarily account for about a third of the raw cotton consumed in this country. Generally, no sharp differentiation was found in the average grade of cotton used in their manufacture. The average staple length, on the other hand, varied materially. Both the grade and the staple length varied considerably among the different mills that make the same type of fabric. Changes in the price of the fabric had little effect on the demand for denim and narrow sheeting, judging by average conditions during the 20-odd years for which data are available, but they affected somewhat the demand for wide sheeting and print cloth. The study was made by the Cotton Branch, PMA.

POTATOES CONVERTED TO IMPORTANT INDUSTRIAL ACID: In the search for new non-food uses for potatoes the Bureau of Agricultural and Industrial Chemistry's Eastern Regional Research Laboratory has developed a method for preparing lactic acid from this agricultural commodity. Lactic acid is used extensively in the tanning, textile, pharmaceutical, and food industries, and is potentially a valuable intermediate for the chemical synthesis of elastomers, plastics, and plasticizers. At present it is manufactured domestically by fermenting sugars and sirups with addition of inorganic and organic nutrients. Washed potatoes were ground, cooked, and treated with enzymes similar in action to barley malt to convert the starch to sugars, which were fermented to lactic acid with no previous separation or purification. The enzymic conversion is not time-consuming, but progresses simultaneously with

the acid fermentation. The results showed that the potato has the carbohydrate, protein, mineral, and other constituents required for the growth of microorganisms, which provides a means for converting surplus and cull potatoes into lactic acid, a valuable industrial chemical.

SYNTHETIC RUBBER FROM TURPENTINE: A new type of high-wuality synthetic rubber, made from a chemical derived from turpentine, has been developed by the Naval Stores Research Division, Bureau of Agricultural and Industrial Chemistry. This achievement, a result of work began during World War II, makes it possible to use turpentine as a supplementary source of synthetic rubber in a national emergency. But the new synthetic as compounded for use in tires is slightly stronger than GR-S rubber, stretches better, and generates less heat under stress. The main ingredient of the new elastomer is isoprene, a compound that forms the basic molecular unit of natural rubber. It is obtained from turpentine by a special process developed by Bureau researchers. Isoprene produced from petroleum is already used in some types of synthetic rubber now produced commercially. The Bureau's method of producing it from turpentine should be a valuable national asset in the event of emergency shortages of petroleum.

PEST APPEASEMENT POOR POLICY: Crop plants that appease attacking nematodes, say USDA scientists, are most liable to damage by them. On the other hand, plants presenting them an uncompromising front suffer little damage. Basis for this belief is found in the reactions of many plants to the rootknot nematode. To the scientists it seems probable that most resistant plants, as well as the susceptible ones, do not prevent the entrance of the parasites into the roots. What makes the great difference in final results is the treatment the pests get once they have entered. Most of them become sedentary once inside. They enter the tender tips and do little moving about, reaching into not more than a few cells from where they lie. If a plant has tough cell walls and makes no effort to make these star boarders welcome, they die out. Among those that put up a hard front are crotalarias (sometimes used as a trap crop), lantanas, marigolds, oats, and wheat. If a female gets into a root where conditions are favorable, she lays eggs in 25 to 30 days; if conditions are less favorable, egg laying is delayed. And if the plant provides little in the way of accommodation, it is likely that few of the females will mature.

NEW DAIRY CATTLE FOR THE SOUTH: The Bureau of Dairy Industry's long-time experiment to develop dairy cattle which are better adapted to southern climatic conditions is now in the second generation. Two calves--one-quarter Jersey and three-quarters Red Sindhi, the latter being a milking strain of Brahman cattle of India--were born at Beltsville, Md., late in 1949. Their sire was a purebred Red Sindhi bull and their dams were first-generation crossbred heifers that were produced by mating Red Sindhi bulls to high-producing Jersey cows in the Bureau's experimental herd. The two calves will be shipped to Jeanerette, La., where efforts are being made to develop breeding methods that will combine the heat-resistant characteristics of the Red Sindhi and the milking qualities of the Jersey and other native breeds. Preliminary results with limited numbers at Beltsville show that the Sindhi-Jersey crosses have more tolerance to sustained high temperatures than Jerseys or Holsteins of the same age. As sufficient numbers of animals carrying Sindhi blood become available, thorough studies will be

made to determine what breeding methods will best combine the heat-resistance characteristics of the Red Sindhi and the milking qualities of the Jersey, Brown Swiss, and Holstein herds. Simultaneously, an effort will be made to determine the physiological secrets of heat tolerance.

TEMPERATURE AFFECTS ON COW'S PRODUCTION: High temperature caused a greater decrease in milk production from dairy cows than low temperature in initial experiments conducted at the Psychroenergetic Laboratory, Columbia, Mo., by cooperating agricultural engineers of USDA and dairy scientists and agricultural engineers of the Missouri Agricultural Experiment Station. The most favorable temperature for the cows appeared to be around 50° F., both for milk production and efficiency of feed, although this might have been different if the initial temperature of the tests had been at some other level than 50°. Findings in the initial experiments will have to be checked many times by additional tests with different cows to be conclusive. The tests at the Missouri station are part of continuing experiments on environmental or housing factors affecting the health and production of animals. They will provide data that the agricultural engineers need for design of better types of animal shelters.

TOPCROP SNAP, A WELL-NAMED BEAN: Few vegetables have received such high praise on introduction as the new snapbean called Topcrop. Developed by USDA, this new bush-type bean won a 1950 gold medal among the All-America selections, being one of only two vegetables to win this coveted award since 1935, and the only snapbean to receive the honor since 1933. Because of disease resistance and other characteristics it is said to be the best variety now available for commercial use in many areas. It is also good for the small garden. It does well under a wide variety of conditions and strong plants will develop even in areas of somewhat adverse weather. Beans are ready to pick in 48 to 50 days. In many States it yields nearly twice as well as present leading varieties such as Tendergreen, Stringless Black Valentine, and Landreth Stringless Greenpod. The committee for All-America selections called it "the highest quality snapbean for the table, for canning, and for freezing." Seed of Topcrop will be available through usual seed sources. The USDA has no seed for sale or general distribution.

LOUISIANA SUGARCANE MARKETING PROBLEMS: Problems in the marketing of Louisiana sugarcane are analyzed in a report issued by the Production and Marketing Administration under the Research and Marketing Act. A major difficulty in the Louisiana sugarcane industry in recent years has been the decline in the amount of sugar taken per ton of cane. The report ascribes part of this decline to imperfections in the old cane purchase contract and to a number of marketing practices that developed during the war, and makes recommendations for improving the situation. Recommendations dealing with trash content are: (1) Sugar mills should not use trash determinations as a competitive weapon in procuring cane; (2) trash-sampling methods would be better if samples were larger and were taken oftener; and (3) the 3-percent tolerance as normal trash should be eliminated in order to encourage growers to market cleaner cane. Other practices frowned on are cross-hauling, cutting more cane than can be delivered quickly, and determining the sucrose content by means of derrick averages.

EXPANDING THE MARKET FOR TREE NUTS: There is a potentially larger market for tree nuts among industrial users of the crop, if suppliers would adopt certain improved practices in marketing the product. The Fruit and Vegetable Branch, Production and Marketing Administration, found this possibility through a study of nut usage by food and confectionery manufacturers. Some of the smaller concerns that use nuts in food products are unable to provide facilities or personnel to hand-pick or process the nuts they buy. If suppliers would be careful to put up a product closely suited to the needs of these smaller concerns, they might sell more. The need for more stable prices for nuts was emphasized by many retail bakers who are unable to keep large inventories; they want assurance of a steady supply at prices that do not vary too much, so that they can use nuts the year around. Wholesale bakers, on the other hand, were not so much concerned with price, but emphasized their need for nuts of consistently high quality the year around. In general, this "exploratory study" points the way to possible expansion of outlets for a crop that, in some of its varieties, has been in heavy supply.

ADJUSTMENTS IN FARMING SYSTEMS: Considerable opportunity exists for profitable adjustments in farming systems in the cotton-producing section of the Southern Piedmont, according to the results of a study of 220 farms made by the North Carolina Agricultural Experiment Station and the Bureau of Agricultural Economics for the 1945 crop year. The adjustments would include greater efficiency in the production of cotton and more effective use of the remaining farm resources. Cotton appears to be the most profitable enterprise on small and medium-sized farms. Poultry offers the best opportunity for supplementing incomes from cotton, although if enough pasture land is available, dairying compares favorably with poultry. On the larger farms, adjustments would depend upon the labor situation. If labor is scarce, dairy, poultry, and small grains-lespedeza may profitably replace cotton. If enough labor is available at customary costs, these less intensive enterprises would be profitable supplements to cotton. Additional information may be obtained from North Carolina Agricultural Experiment Station Technical Bulletin 87.

PIG SENSITIVE ABOUT WEATHER AND WEIGHT: What a pig weighs has much to do with its reactions to various temperatures and feed and water consumption, according to experiments conducted by the USDA and the Calif. Agr'l Experiment Station. One of the objectives of the tests is designs for more efficient barns. The heat and moisture lost from hogs at any temperature must be known if a workable ventilation system is to be designed, for example, as this heat is usually expected to warm the building and move air through it. The tests showed that as the air temperature was increased from 40° F. the body temperature and respiration rate of the experimental pigs increased. Pigs weighing under 150 pounds were more comfortable at a given high temperature than pigs weighing more. Feed consumption of the test animals decreased as the air temperature increased from 40° to 100° F., and it appeared that this decrease was more rapid at the higher levels. The average daily gain also varied with constant changes in air temperature. Hogs weighing 166 to 260 pounds gained most rapidly at about 60° F., while lighter ones weighing 70 to 144 gained most rapidly at about 75° F. The amount of food required to make 100 pounds of gain was at a minimum when the rate of gain was highest.

SEASONAL COSTS AND RETURNS IN PRODUCING EGGS, NEW YORK: A study of seasonal costs and returns was made from records on 172 New York poultry farms for the year 1946-47. Highest profits in producing eggs when pullets were housed in late summer and early fall were in winter, spring, and summer and not in the fall as is often thought. It is possible to organize a poultry farm to take advantage of the seasonal differences in prices of eggs and, as a result, to increase total returns for the year. To do this, chicks should be started in November, and pullets transferred to the laying flock in April. No particular advantage was noted in selling the flock after the winter break in egg prices occurs over that of keeping the flock for the entire year when the pullets are housed in summer and fall. When pullets are housed in spring, the flock may be sold in December or kept for a few more months. A report prepared by the New York (Cornell) Agricultural Experiment Station and the Bureau of Agricultural Economics, partly under the Research and Marketing Act, gives additional information.

MOLD CONTROL FOR PUMP-FED CROPS: A method of fighting water-borne fungus diseases of pump-fed greenhouse crops (in so-called tank agriculture) has been suggested by phytophathologists of Plant Industry Station, Beltsville, Md. Nine chemicals were tried separately in the nutrient solution supplied to tomato plants and a number of ornamentals growing on a non-fertilizing material called haydite. The tests were started as a result of observations made in an experimental chrysanthemum greenhouse where wilt introduced inadvertently on a single plant was spread to all plants in the section through the nutrient solution pumped back and forth between storage tank and growing benches. With nutriculture systems (in which a large tank stores the nutrient solution for extensive plant benches) diseases that attack or enter through the roots can quickly prove disastrous. So far a chemical known as 8-hydroxyquinoline benzoate has given the best results, keeping down the germination of such spores as those of aster wilt fusarium and not interfering noticeably with the growth of tomatoes, gladiolus, lilies, snapdragon, carnations, and others used in the tests.

FARM-RETAIL MARGINS FOR WASHINGTON DELICIOUS APPLES: In 1947-48, a box of apples from an orchard in the State of Washington returned the grower 26 percent of each dollar spent for them by a consumer in a Chicago retail store. From their 26 percent, growers paid costs of production and harvesting, as well as the cost of hauling the apples to the packing plant. Services performed at the packing plant took 24 percent of the dollar; transportation from packing plant to Chicago took 14 percent; marketing functions in Chicago accounted for the remaining 36 percent. Major emphasis of the study was devoted to breaking down the margins for services performed between the harvesting of the apples and their actual shipment to the Chicago market. A considerable degree of variation was shown to exist between the charges made by different members of the industry for performing essentially similar services. A complete report of this study is available in Agricultural Information Bulletin 6, prepared by the Bureau of Agricultural Economics, in cooperation with the State College of Washington, under the Research and Marketing Act.

MECHANICAL HARVESTING OF COTTON IN NORTH CAROLINA: In 1945, the first mechanical cotton picker to operate in North Carolina harvested 170 bales in Robeson County. This still stands as the high mark for one machine during a single harvest season. By 1948, however, approximately 16 additional

pickers and 40 cotton strippers had been bought for use in the State. Wi. mechanical harvesting, man labor requirements both per acre and per bale are greatly reduced. But because of limited use of mechanical harvesters, grade loss, and other factors, in 1948, hand picking at a cost of $3 per 100 pounds of seed cotton was more economical than mechanical harvesting. Unfavorable weather greatly reduced the number of days suitable for mechanical harvesting. A preliminary progress report issued by the North Carolina Agricultural Experiment Station, with the Bureau of Agricultural Economics, from a study supported partly by funds appropriated under the Research and Marketing Act gives additional information. Aids in planning for more efficient use of mechanical harvesters are listed.

STATISTICAL FINDINGS OF SURVEY OF TRANSPORTATION: Thirty years ago farm motortrucks were rare--the 1920 Census reported only 132,000 in the entire country. By 1948 there were nearly 2 million, approximately half of which were 1940 and later models. Greatest increase in proportion of farms owning motortrucks was in the South. Farm trailers were about as numerous as farm motortrucks although a substantial percentage of these are used almost exclusively on farms. Farm automobiles furnish the main source of motive power for the trailers. Farms with hauling equipment are largely 1-truck or 1-trailer farms. Of all farms in the U. S., 53 percent have neither motortrucks nor trailers; 29 have 1 or more trucks; 71 have no trucks; 27 have 1 or more trailers; and 73 percent have no trailers. Nearly half the tonnage of agricultural products moving from farms to initial markets is carried in farm-owned equipment. It is particularly important in moving grain, cotton, fruits, vegetables, and miscellaneous crops from farms. Except in the South, wagon haulage is relatively unimportant and accounts for only 2.5 percent of all commodities moving off farms to initial markets. A report prepared by the Bureau of Agricultural Economics under the Research and Marketing Act gives detailed information.

COMPLEX SOIL LIFE: Soil microbiologists of USDA see a rebirth of interest in the biology of the soil likely due in large measure to the parts bacteria, fungi, algae, bacteriophages, and other small organisms play in crop production. They explain some of the collective accomplishments of these inconspicuous organisms: Providing plants with nutrients in more available form (they are processors); conserving and protecting nutrients for the later use of plants (storehouse watchmen); competing with plants for nutrients (like sparrows in the chicken yard); forming substances that improve tilth (same as in a compost pile); guarding plants against parasites (sheepdog work); and (as may surprise many) promoting the ability of plant roots to absorb nutrients. Products of microbial action have a dissolving effect on minerals in the soil, both those found in organic combinations (vegetable and animal matter) and in inorganic ones (such as the mineral fertilizers). Many microbiologists now believe that, while these organisms are making the nutrients more suitable for absorption by the roots, they also are making the walls of the roots more permeable. There is evidence that they even encase the rootlets so that the plants are not actually in contact with the soil particles at all.

EGG QUALITY IN MARKETING CHANNELS: One out of every three eggs has dropped below Grade A in quality by the time farmers in 13 midwestern States sell their eggs to country stores and other first receivers, according to an investigation conducted recently by the experiment stations of the 13 States

and the USDA under the Research and Marketing Act. More than 2 out of 5 of these eggs are below Grade A about 2 days later when they reach the carlot assembler. Objectives of the study were to learn: (1) The quality of eggs at the time producers delivered them, (2) how much this quality declined between the country buyer and the carlot assembler, and (3) which marketing factors caused the quality decline. The time required to move eggs from the country buyer to the carlot assembler was the most important single factor analyzed. On the way from country buyer to carlot assembler, interior quality deteriorates least when egg quality is high at the time the trip starts, when the trip takes the shortest time, and when case temperatures are kept down. USDA agencies cooperating with the 13 States in the survey were the Poultry Branch of Production and Marketing Administration, the Farm Credit Administration, and the Bureau of Agricultural Economics. A similar report on market-bound eggs in the Northeast is in preparation.

ALFALFA BULLETIN REFLECTS RESEARCH ADVANCES: Even with snail-shaped seed pods, alfalfa gets ahead. Production of alfalfa hay increased 50 percent in the past 10 years. To keep up with the crop and to be somewhat ahead, the Department every now and then issues a revision of the Farmers' Bulletin, Growing Alfalfa. This publication, first issued in 1934 and revised in 1941, has just been re-revised and is out under the original number, F.B. 1722. So far, more than 200,000 copies of all editions have been distributed. Readers of this last edition will find a considerable increase (40 percent) in space devoted to varieties, including a fresh chapter on the new varieties Ranger, Buffalo, Atlantic, Williamsburg, Narragansett, Nemistan, African, and Indian. New advice on inoculation for alfalfa favors the use of commercial cultures because "considerable progress has been made in selecting efficient cultures." The method of inoculating with soil is described as "tedious and a weed scatterer." The strategy against insects has changed noticeably. Present recommendations on the control of the grasshopper, worst insect enemy of alfalfa, emphasize the use of various new chemicals in lieu of poison bait, although better baits with the new poison are described.

"WILL MORE FORAGE PAY?": "Yes, under certain conditions," says the Bureau of Agricultural Economics in a progress report with this title, covering reconnaissance work in northern, southern, and western States, prepared under the Research and Marketing Act. Tentative findings reveal that farmers who have made progress in developing systems of farming that make greater use of forage crops are found in all sections of the country. Investments required to change to these systems vary widely. Additional skills and a higher type of management are generally needed by operators. Production and utilization of more forage are encouraged by current reserves of farm capital; the growing realization that soil resources are exhaustible; State and Federal educational and action programs in the field of conservation; development of new and improved forage crops and the generally high level of prices for feed grains. However, there are retarding factors, some of which are: Greater current returns from competing enterprises; difficulty on some farms in financing the necessary investments; concentration on short-run profits; failure to utilize improved practices in production of high-quality hays and pastures; systems of leasing that are too small for extensive systems of farming; unwillingness of operators of cash-crop farms to acquire the skills and supply the labor needed for livestock farming; and reluctance of farmers to assume unfamiliar risks. Additional data are needed for economic evaluation.

TOBACCO ROAD MARKED BY SHIFTING GENES: Wild tobacco is supplying plant breeders with genes useful in arming the commercial crop against some of the worst diseases that affect it. Department specialists report that the species known as Nicotiana debneyi has high resistance to major diseases but that crossing it with domesticated tobacco has commonly resulted in sterile hybrids--which at first seemed to be the end of this tobacco road. But exploration of the various biological byways has shown that the direction of the cross makes much difference in the fertility of the crosses. When the wild tobacco (N.debneyi) and the domestic tobacco (N.tabacum) were crossed and the latter was the male parent in the original crossing and all the backcrosses, there was increasing sterility in the plants produced, until in the third backcross all of the progeny had sterile pollen. But when the cultivated tobacco was used as the female parent and the same wild one was used as the pollen source the progeny turned out to be fertile. Exactly the same results were obtained both ways of the cross when another wild one, N. megalosiphon, was used with the N. tabacum. By laying this genetic ground work they now are obtaining disease-resistant types that are both stable and fertile.

MOIST FLAXSEED STORED SAFELY AFTER CHEMICAL TREATMENT: Increased production of winter-grown flaxseed in certain areas of Texas during recent years has given the South a foothold on a new oilseed industry. However, the future of this industry which is located in a climate conducive to rapid deterioration of oilseeds appears to depend on successive methods of storing the seed. Oil-mill operators in the flaxseed-producing area who were familiar with the successful application of chemical treatments to prevent the spoilage of cottonseed in storage asked the Bureau of Agricultural and Industrial Chemistry's Southern Regional Research Laboratory to assist in solving the flaxseed-storage problem. Treatment with a mixture of two chemicals (propylene glycol dipropionate and bichloromethylxylene) was found to be as effective in controlling the heating of moist flaxseed without additional handling as was forced ventilation, the method in general use. In comparison with present methods of storage, greatly improved results were obtained when the flaxseed was treated with as little as 10 pounds of the chemicals to a ton of seed and this treatment was supplemented by a moderate amount of forced ventilation. Seeds containing 10 percent of moisture kept for several months under these conditions. Shorter tests with seed of higher moisture content, up to 22 percent, also were successful.

IMPROVED MAPLE-SIRUP COLOR STANDARDS: Permanent colored-glass standards for use in classifying the color of maple sirup, to replace the caramel-glycerine solutions now used in the application of the U. S. standards for grades for this sirup, have been developed as a result of work by the Bureau of Agricultural and Industrial Chemistry's Eastern Regional Research Laboratory and the Production and Marketing Administration. The color of the caramel-glycerine solutions heretofore used is not stable and their use as color standards has not been entirely satisfactory. USDA's three color standards for maple sirup, "light amber," "medium amber," and "dark amber," heretofore represented by the caramel-glycerine solutions, have now been reproduced in permanent amber-colored glass so that no change can take place. A square-type sample bottle for sirup has been adopted by the Department's research workers for use with the glass color standards. The new bottle is inexpensive and easily available, provides a thick layer of sirup that facilitates precise classification and a sample of uniform thickness, which is not possible with the cylindrical bottle.

COST OF HARVESTING CALIFORNIA COTTON WITH MECHANICAL PICKERS: This report is based primarily on data from 5 growers in Kern County and 5 in Fresno, who operated a total of 23 cotton-picking machines which harvested more than 4,500 bales during the 1948 season. The average machine picked the equivalent of 1,500 man-days of hand picking, during the season. Machines were used about equally for the first-picking and the second-picking and for a little of the third-picking. Daily output was the equivalent of 25 to 30 hand workers. Total average cost of harvesting was $2.14 per 100 pounds of seed cotton, distributed as follows: $1.19 for machine picking, $0.43 for value of cotton lost in the field, and $0.52 for loss in grade as compared with what it would have been under hand-picking. In comparison, hand-harvest costs were about $3.25 during the first pick and $3.75 or more per 100 pounds during later pickings. Machine-harvest costs were thus a third or more below the costs of hand harvest. Machine-harvest cost per bale was $29.98; hand-harvest cost was reported to be $45 or more per bale. A report issued by the Agricultural Extension Service of the University of California and the Bureau of Agricultural Economics, partly financed under the Research and Marketing Act, gives additional information.

RESEARCH DOLLARS DIG DEEPER: A new, quick, and sensitive test for the element cobalt devised at the U. S. Plant, Soil, and Nutrition Laboratory at Ithaca is of special interest since it is known now that this element makes up a very small but essential part of the recently discovered vitamin B_{12}. A marvel in the detection of the infinitesimal, the test depends on the reaction of cobalt with nitrosocresol, which gives a brilliant purplish-brown color. In extremely small quantities this cobalt-indicating color cannot be detected by the human eye, yet by use of the colorimeter it can be found when there is only one-thousandth of a microgram of cobalt (and a microgram is a millionth of a gram) in about 5 grams of water. In figures, this bit of cobalt is represented by 0.000000001 of a gram--a very small amount to be detected, but important enough so a cow may be expected to bawl for her cobalt. New fast methods of this type adapted to nutrition studies are a response to the demand for more and more (and more exact) information on the complicated relationships among soils, plants, animals, and human beings. Using the older methods in vogue up to 1935 chemists always separated out an element (usually in the form of a compound) by a whole series of operations that took much time, say 2 days, for a few determinations. Now, in such a laboratory as this one, the taxpayer's research dollar does more.

NEW STRAW-PULPING PROCESS: The Northern Regional Research Laboratory, Peoria, Ill., announces a revolutionary new mechanochemical method of pulping straw for the manufacture of fine straw pulp, blending with wood or other pulps to produce fine and specialty papers, or making 9-point corrugating board. It involves simultaneous mechanical and chemical action on the straw during pulping, can be carried on with equipment available in most paper mills, and produces a high yield of light-colored pulp with shorter cooking that does not require high pressures. The new process has been tried in commercial units and proved feasible. It has attracted much attention because it might replace methods now used and also reduce the cost of fine paper pulps from wheat straw to a figure competitive with that of softwood sulfite pulps. Procure further information from Bureau of Agricultural and Industrial Chemistry.

U. S. DEPARTMENT OF AGRICULTURE

Office of Information

Document No. 6
Revised October 1, 1950
A USDA Document

IMPORTANT RECENT ACHIEVEMENTS OF DEPARTMENT OF AGRICULTURE SCIENTISTS

RURAL HEALTH COOPERATIVES: The experience of 48 of the 101 rural health cooperatives of record up to mid-1949 are given in a joint publication of the Farm Credit Administration and the Public Health Service, "Rural Health Cooperatives," (FCA Bulletin 60 and P.H.S. Bulletin 308). These cooperatives have encountered many problems in their organization and operations. How they tackled such obstacles as financing, building membership and community support, medical opposition, personnel, and costs of operation, are discussed. Their records show the willingness of local people to devote a great deal of time, effort, and cash to safeguarding family and community health. Other groups planning to form health cooperatives should benefit from their experience.

WOOL SITUATION APPRAISED: The U. S. has the resources for a one-third increase in sheep production and there is a ready demand for the lambs and wool that this added production would provide. This is the conclusion reached in a report, "Domestic Wool Requirements and Sources of Supply," made by the Production and Marketing Administration and the Bureau of Agricultural Economics, under authority of the Research and Marketing Act (hereinafter abbreviated RMA). The report presents a comprehensive economic analysis of the sheep and wool industry in this country, civilian and military wool needs and the extent to which these are supplied by domestic wools, the relative advantages of domestic and imported wools, long-time trends of sheep and wool production and factors affecting them, the place of sheep in the U. S. agricultural economy, and their relation to the utilization of public lands in the West which are important in sheep raising.

PACKAGING CRANBERRIES: Consumers, retailers, and wholesalers prefer cranberries prepackaged in handy, attractive transparent 1-pound containers. This information from a study made with RMA funds by the Farm Credit Administration is published in its Miscellaneous Report 138, "Prepackaging Cranberries Cooperatively." The cost is only a few cents more per quarter-barrel unit to package cranberries in transparent film than in bulk. Two types of packaging machines are used--one fills ready-made bags, and the other makes and fills the bags simultaneously. The latter is well adapted for high volume output. Another type of package, the window-carton box, gives less visibility to this naturally colorful and attractive product, but has the advantage for small shippers that it can be filled by hand.

THE MORE RURAL THE COUNTY, THE LOWER THE LEVEL OF LIVING: As a general rule, the larger the proportion of farm people in a county, the fewer the modern services and conveniences that are likely to be available to them. And, in general, the farther farmers live from the city, the lower their level of living is likely to be. A study by the Bureau of Agricultural Economics shows to what extent the needs of farm families with respect to health, education, household facilities, and living conditions generally were met in the 3,071 counties of the U. S. More details of the study will be found in the BAE report, "Trends in Rural and Urban Levels of Living," AIB No. 11.

MAKING COTTON FABRICS DIRT-RESISTANT: Housewives may soon lighten their washday work by the use of a simple, inexpensive compound called CMC (actually carboxymethyl cellulose) in their laundry rinse water to make cotton clothing and other cotton goods harder to soil and easier to clean. The new treatment resulted from a research project at the Institute of Textile Technology, Charlottesville, Va., sponsored by the Agricultural Research Administration. The compound makes cotton fabrics more resistant to soiling and permits them to be laundered clean with less soap than would ordinarily be required. It is added to the final rinse water. It is a low-cost cellulose derivative that already has a variety of industrial applications. It appears to coat cotton fibers with a smooth film that keeps dirt from making close contact with the fabric, which then soils less readily and cleans more easily on subsequent washings.

NEW FOODS FROM SWEETPOTATOES LIKED: Three new foods made largely from sweetpotatoes appear to be acceptable to a large proportion of U. S. consumers according to Nation-wide surveys made by the Alabama Agricultural Experiment Station, in cooperation with the Bureau of Agricultural Economics. These products are known as Alayam Breakfast Food, the Alayam Snack, and Alayam Brittle Candy. Additional information on each will be found in three separate publications issued by the Alabama Polytechnic Institute at Auburn. Studies, financed with RMA funds, were made in an effort to bolster the declining consumption of sweetpotatoes, the Nation-wide drop having been from 26 pounds per person in 1909 to only 14 in 1949.

NEW INDUSTRIAL CROPS: Several new industrial crops loom on the horizon as a result of research by scientists in the Agricultural Research Administration--gayules, safflower, castor-beans, and sesame. Industrial interests have been turning generally to science to find and develop plant materials to meet specific needs. With better understanding of these needs, plant explorers are resurveying the world for plants of potential industrial value. Safflower and sesame are two promising new oil crops. Safflower is adapted to the wheat areas of the Western Plains and sesame to cotton areas of the deep South. Seed of high-oil varieties of safflower was available for planting more than 100,000 acres this spring. The development of nonshattering, high-yielding varieties of sesame is far enough along that the first seed may be offered to farmers within a few years. New hybrid varieties of gayule yield 70 percent more rubber than the best of those available during the war, and a planting of the new type yields successive cuttings at 2-year intervals as does alfalfa. Production and processing techniques are now being perfected. Encouraging work also is under way on canaigre, guar, kenaf, and several other industrial crops of considerable potentiality.

HYBRID COTTON: Complex triple-hybrid cottons have been developed by Agricultural Research Administration plant breeders using American wild, Asiatic, and cultivated upland cottons. They promise eventually to be big factors in helping cotton maintain its competitive position among synthetic fibers. Some of them produce fibers 75 percent stronger than those of most commercial upland varieties. All are really different in potential use properties from any now being produced. Increased fiber strength is essential to increasing yarn strength which, in turn, is essential if cotton is to compete favorably with synthetics. These new hybrids are still in the experimental stage.

FARMERS LIKE STRIP CROPPING: In the Northeastern States, laying out cropping strips with both edges on the contour and planting from both edges toward the middle has become an established practice in every Soil Conservation District. The only exceptions are where drainage is a problem, as in potato areas, or on tobacco land where ridge-row cultivation is required and on farms where topography is too irregular for contouring. Farmers of these States requested Soil Conservation Service technicians to plan 100,000 more acres of strip cropping for them last year than in the preceding year. Even where land-use-capability surveys indicate that contouring alone is sufficient for good care of the land, farmers prefer strip cropping. The contour strips are as easy to lay out as contours, and they have the advantage of being easier to maintain. And, in addition, the strip boundaries serve as a guide for staying on the contour in plowing and other cultural operations without the necessity of laying out contours every time the land is plowed. In the Southeast, the most important recent improvement in strip cropping is the inclusion of grass in the strip rotations. Contact Soil Conservation Service for further information.

FERTILITY OF GRASS SEED DEPENDS ON HARVESTTIME: Guinea grass and its varieties are important sources of forage in Puerto Rico. Recent investigations at the Federal Experiment Station at Mayaguez have shown seeds of this grass which are shed early in the season are poorly filled and have very low germination. Most of the viable seed are recovered if the start of seed collection is delayed until 10 to 14 days after the pollen is shed. This information is particularly important in commercial seed harvest because the delay allows more of the late seed to reach maturity without significant loss of early-maturing viable seed.

TO CONSERVE IRRIGATION WATER: In studies to determine water requirements for economical and efficient irrigation in the West, the Soil Conservation Service has discovered serious water losses through use of unlined irrigation ditches. It is estimated that there are 125,000 miles of irrigation canals and laterals in the West. Of these ditches less than 5 percent are lined. It has been found that the seepage losses in these unlined canals is between 35 and 40 percent of the total flow. Great emphasis is now being placed on installation of low-cost, effective, and durable canal linings. Some of the findings of the studies, which are being carried out as a cooperative endeavor in Utah and Colorado, are summarized as follows: Earth linings must be protected with nonerosive coverings; earth materials which have to be compacted to secure low permeability are not satisfactory for lining canals; butyl-coated fabrics used as membranes must be protected against mechanical injury; seepage losses from canals are greater through the sides than through the bottoms; all types of concrete and shotcrete hold up well; there appears to be no need for reinforcement in concrete canal linings.

REDWOOD BARK INSULATION: The thick bark on mature redwood trees constitutes a major problem of utilization. Various means of using this bark were investigated at the Forest Products Laboratory, Madison, Wis. One of the most promising was a form of thermal insulation for houses. To make this blanket-type insulation, crude redwood bark fiber was sprayed with a resin glue so that the fibers were bonded together in a loose fashion to form a blanket of very low density. Besides its possibilities for use as insulation, the material gives promise as cushioning for packaging of fragile articles for shipment. Write the Laboratory for more details.

CUSHIONING MATERIALS ANALYZED FOR PACKAGING: Cushioning materials are essential in the packaging of many complex and fragile machines, instruments, and other products that are shipped from factory to user. Without adequate cushioing, such products are easily damaged by the shocks of transit. The Forest Products Laboratory, Forest Service, Madison, Wis., has established basic rules for cushioning of products whose weight and fragility are known. Some 40 cushioning materials have been classified as to shock-absorbing power, so that the thickness of cushioning needed can be specified for a given piece of machinery or other product. This development represents a further step in the Laboratory's container research aimed at more precisely engineered packaging. The Laboratory can supply additional information on this subject.

CUTTING MARKETING COSTS BY SIMPLIFYING CONTAINERS: There is opportunity for considerable savings in marketing costs through a reduction in the number of sizes, shapes, and types of containers for fresh fruits and vegetables. That conclusion is reached by the Fruit and Vegetable Branch of Production and Marketing Administration on the basis of an RMA study of the great variety of containers now in use. PMA has issued a Farmers' Bulletin, "Containers in Common Use for Fresh Fruits and Vegetables," containing pictures and descriptions of a large number of the containers now used. Potential advantages of a reduction in the number of types include reduction of marketing costs, economies in handling the produce, fairer competition, better accounting, and more informative market news reports.

COFFEE AND 'ROOSTER'S EYE': "Rooster's Eye" is the name of a serious leaf disease of coffee occurring in many parts of Central and South America. (In Spansih it's known as ojo de gallo.) By damaging the leaves it reduces yields and often kills coffee trees. Considerable success in controlling the disease is being chalked up by pathologists of the Office of Foreign Agricultural Relations stationed at the Inter-American Institude of Agricultural Sciences, Costa Rica. They discovered that the disease is carried from leaf to leaf and tree to tree by falling rain spattering the heavy disease spores. They tried stripping off all leaves at the beginning of the wet season, so that trees would put out new non-infected leaves. The defoliation practice worked, apparently checking the disease and also not hurting the trees. Defoliation in the prescribed manner is now being recommended as a practice in all infected areas throughout the coffee-growing region.

MORE CHOCOLATE FROM ECUADOR: More of Ecuador's high-grade chocolate for the U.S. sweet tooth can be expected to emerge from the cooperative assistance being given by USDA to help restore Ecuador's ailing cacao industry. The U.S. once obtained some of its best cocoa and chocolate from Ecuador, but diseases--especially witches' broom and pod rot--spread throughout the plantations and drastically reduced quality and output. Now, after 4 years of cooperative effort, scientists of the Office of Foreign Agricultural Relations and Ecuador's Ministry of Agriculture believe they're on the road to successfully restoring the industry. At the tropical substation of Ecuador's Estacion Experimental Agricola, they have been testing cacao clones gathered from far and wide, and finally have narrowed the research down to a few carefully selected clones that appear to have considerable disease resistance and at the same time promise good yield. The selected clones are being propagated at the station, and are being distributed to cooperating Ecuadoran farmers to see how they do as commercial plantings.

ULTRAVIOLET LIGHT INCREASES EGG PRODUCTION: Scientists of the Agricultural Research Administration have demonstrated that hens exposed to bactericidal light (the very short rays of ultraviolet light) produce 10 to 19 percent more eggs per bird than hens mainted under the same conditions and on the same diet, normal vitamin D supplies included, but not exposed to ultraviolet radiation. Indications of this increase were found while tests were being made of this invisible light (ultraviolet) as a bacteria-killer with the object of reducing the number of air-borne bacteria in the hen house. Then for 5 consecutive years hens were tested in a specially constructed underground house from which all natural light could be excluded. It was demonstrated conclusively that neither the number of bacteria in the poultry house nor the vitamin D content of the light rays is involved in increasing egg production. The exact properties of the ultraviolet radiation causing the increased egg production have not yet been identified.

VARIATIONS IN EGG GRADES CLASSIFIED: The various State and Federal egg grades and standards used in this country are classified in a new report issued by the Production and Marketing Administration under RMA authority. The standards for eggs now in use vary considerably. Forty States have provided for egg grades in their legislation; the use of grades is voluntary in 17 of the States and required in 23. Another 6 States have laws regulating the sale of eggs, but have not prmulgated grades or standards. The remaining 2 States have no laws, grades, or standards regulating the sale of eggs. The report analyzes the variations in the State regulations with regard to standards for interior quality, provisions for candling, terms designating size and weight classes, and labeling of fresh, storage, out-of-State, and foreign eggs.

BIG VARIATION IN PRICES FARMERS GET FOR EGGS: In 1949 prices received for eggs by farmers in the North Central States varied as much as 15 cents a dozen when sold to different types of buyers. Eggs they sold to hatcheries and direct to consumers brought the highest prices. Additional services were required of farmers by the outlets paying the higher prices. This made farmers' costs higher, but it only partly explains the variation. Fuller information can be had from the Bureau of Agricultural Economics. Goal of the study, made by BAE in cooperation with State experiment stations, Production and Marketing Administration, and the Farm Credit Administration, with RMA funds, was to help farmers find more efficient egg-marketing practices and to improve the quality of eggs furnished to consumers.

QUALITY LOSS IN COLD-STORAGE AND NONSTORAGE EGGS ABOUT THE SAME: When their interior quality is approximately the same, eggs removed from cold storage and eggs that have not been in cold storage lose quality at about the same rate. This was indicated in studies made under RMA authority to test the widely held opinion that cold-storage eggs lose quality faster than eggs that have not been in cold storage. Groups of both cold-storage and non-storage eggs, of comparable quality, were examined after being held at various temperature levels for various periods. This examination included candling, as well as determination of broken-out score and other measurements of quality made after the eggs were broken out. Decreases in interior quality were found to be similar for the two kinds of eggs at each temperature level and after each holding period. When held at the same temperature and for the same time, both kinds of eggs tended to lose weight at approximately the same rate. This work was done jointly by the Bureau of Animal Industry and the Production and Marketing Administration.

PROGRESS ON KENAF FIBER: Western Hemisphere defense requirements are focusing new attention on the soft fiber, kenaf, now being grown experimentally in Cuba and several other Latin American countries as a substitute for jute. Cooperative research on the project has been going on since 1943 by the Departments of Agriculture of Cuba, the Dominican Republic, El Salvador, Peru, and the U.S. Jute comes from the Far East and is used in making burlap and sacking for packaging many agricultural products; it has many industrial uses as well. The fiber plant, kenaf, is a fast-growing substitute that replaces jute in every respect. The research to date has successfully shown how to grow kenaf in this hemisphere, and the project is now placing emphasis on developing mechanical techniques--both to reduce the tedious hand labor in the field, and to speed up and make more economical the extraction of fiber from the kenaf stalks.

HENEQUEN LEAF SPOT CONTROL: Imported henequen fiber is the source of binder twine for U.S. farms. It's significant, therefore, that in 1949 the U.S. was able to buy almost 3 times as much henequen fiber from El Salvador in Central America as it had the year before. A good part of the reason lies in the work of the Office of Foreign Agricultural Relations, through staff members stationed at the joint agricultural station of FAR and the Salvadoran Ministry of Agriculture. A principal project is the control of black leaf-spot disease of henequen, a disease that takes a high toll of fiber harvest. The workers found that through a new technique of heavier harvesting, growers were able to salvage more than a million pounds of fiber that otherwise would have been lost to the disease.

RICE IMPORTANT TO HOMEMAKERS: About 9 out of 10 U.S. families use rice and over half serve it 4 to 15 or more times each month. Whether or not people use rice appears to have little connection with age, educational level, or size of community; but frequent users generally have larger families or families with lower incomes than the less frequent users. Further information will be found in "Rice Preferences Among Household Consumers," issued by the Bureau of Agricultural Economics. The RMA Rice Advisory Committee recommended the survey in an effort to help rice growers and the rice industry to expand domestic consumption of rice. Rice production in the U. S. was greatly expanded during the war years when rice trade with the Orient was cut off. Since World War II, exports have declined and this country has been faced with rice surpluses.

RICE-FARM OPERATIONS STUDIED FOR BETTER RETURNS TO FARMERS: A study made by the Arkansas Agricultural Experiment Station in cooperation with the Bureau of Agricultural Economics indicates what crop-rotation systems and what type of harvesting machines are apt to be most profitable to rice growers in that State. With 1947 price relationships, returns to the farmer are likely to be higher with a rice-soybean rotation system than with any of 5 other systems used. But the individual rice farmer is advised to select the supplemental crops best adapted to his particular land. Alternative rotation systems appraised, in addition to that of rice and soybeans, were rice-oats-lespedeza; rice-oats-lespedeza-soybeans; rice-oats; rice-oats-lespedeza-beef cattle; and rice-lespedeza. On a typical small rice farm with 260 acres of cropland using a rice-oats-lespedeza rotation, a comparison of harvesting methods indicated that the returns to the farmer using a self-propelled combine would be nearly $2,000 higher than if he harvested by binder. The calculation was based on 1947 prices. This study was financed in part with RMA funds. Fuller information will be found in "Comparison of Farming Systems for Small Rice Farms in Arkansas."

WHEAT IMPROVEMENT IN ECUADOR: U.S. policy is to help other countries improve their agriculture by sharing techniques and "know-how." In Ecuador an important cooperative project between USDA and the Ecuadoran Ministry of Agriculture is the improvement of local food crops. In the highlands of Ecuador, this project has included wheat. More than 3,000 varieties have been tested in the search for rust-resistance and high-yielding characteristics. One variety, Frontana, has stood out above all others. Not only does it resist rust successfully but also it has outyielded native varieties by as much as 50 percent. Seed is now being distributed on an experimental basis to Ecuador's highland farmers, and it is expected that the research findings will have value for the wheat growers of the U. S. as well.

MORE ORANGES BEING HAULED BY TRUCK: Trucks and boats hauled a larger share of Florida orange shipments to 9 leading markets in 1949 than in 1948, and railroads a smaller share. The shift from rail transportation to trucks and boats in 1949 resulted in railroads hauling about 2,800 fewer carloads of oranges than in 1948 to the 9 markets included in an RMA study by the Bureau of Agricultural Economics. Fuller information can be had from BAE.

CITRUS FRUIT DURING WORLD WAR II: The demand for citrus fruits that developed soon after the U. S. entered World War II changed the citrus economy from a status of surplus production and low prices to one of inadequate supplies and sharply rising prices. To help solve such problems the Government introduced special programs, regulations, and actions. A study was undertaken by the Bureau of Agricultural Economics to collect, organize, and preserve the basic records of wartime administration. Important wartime distribution orders and price regulations relating to citrus were listed in chronological order, giving effective date and provision of, or action taken under, regulation or order. For further information procure from BAE Agriculture Monograph No. 3.

WHOLESALE DISTRIBUTION OF CITRUS FRUITS IN FIVE TERMINAL MARKETS: Too many stops between the shipping point and the retail store can result in high costs of wholesaling citrus. Each loading and unloading adds to the cost as it results in a duplication of services and functions. Results of a survey of five markets--New York, Chicago, Cleveland, Kansas City, Indianpolis--made by the Cooperative Research and Service Division, Farm Credit Administration, are available as Miscellaneous Report 139. Costs of wholesale services for all citrus fruits in these markets ranged from below 20 cents to more than 80 cents a box with an average of 41 cents for California oranges, 51 cents for Florida and Texas oranges, 42 cents for grapefruit, and 68 cents for lemons. The report concludes that replacing antiquated markets with modern ones, including direct rail unloading into wholesale stores, in four of the markets would help reduce costs.

WOULD BUY MORE CITRUS AT CHEAPER PRICE: A survey on RMA funds conducted by the Bureau of Agricultural Economics in Louisville and in Nelson County, Ky., indicates that about half of the consumers there were getting all the citrus products they wanted. Of those who were not, 2 out of 3 said they would use more if the products were less expensive. The most popular fresh citrus items were oranges and lemons; most popular canned product, orange juice. Some kind of citrus had been used, at one time or

another, by 99 percent of the households in the areas studied. In rural Nelson County, relatively more households in the higher income and educated groups used the various citrus products and used them oftener than did the low-income and poorly educated groups. Income or education levels had little or no relation to the use of citrus products in the city of Louisville. Persons interested in building up markets for citrus fruit may get fuller details from the published report "Citrus Preferences Among Household Consumers in Louisville and in Nelson County, Kentucky."

FROZEN JUICES GROWING IN IMPORTANCE TO CONSUMERS: The development of frozen concentrated juices has affected the demand relationships between frozen juices, fresh oranges, and canned single-strength juice. Data obtained so far in RMA studies sponsored by the Bureau of Agricultural Economics in cooperation with Production and Marketing Administration indicate a large increase in the use of the frozen juices. On the basis of fresh-orange equivalent, the relative importance of frozen orange juice as a percentage of total household orange purchases has increased from 5 in the first quarter of 1949 to 19 percent in the first quarter of 1950. The proportion of purchases of oranges in the form of canned single-strength juice dropped from 32 to 25 percent during the same period while fresh orange purchases dropped from 62 to 56 percent. Data on consumer buying practices are obtained under contract by a nationally known private research agency. Participating fruit industry groups pay for one-half the cost of the study; remainder is from RMA funds. Further details will be found in the BAE-PMA publication "Regional Distribution and Types of Stores Where Consumers Buy Selected Fresh Fruits, Canned and Frozen Juices, and Dried Fruits--January-March 1950, with Comparisons."

MEAT-TYPE HOG: Agricultural Research Administration scientists are fast moving towards an improved meat-type hog. The old market-type hog furnishes meat for 2 persons and fat for 3; the new type furnishes meat and fat in more equal quantities and more preferred cuts like ham, bacon, and loin. This at the same time helps the farmer solve his excess-lard problem and gives consumers leaner pork. By use of the Danish Landrace breed ARA has now produced 6 lines of hogs that come close to the established ideal of 226 pounds at market age and 50 percent of that weight in preferred cuts--5 to 6 percent above the average for market hogs of today.

BEEF BREEDING: Beef-cattle breeding work of the Agricultural Research Administration at Miles City, Mont., has produced calves that attain the required market weight of 900 pounds at 15 months of age instead of the average 18 months. A close relationship has been found between the kind of calves a young bull produces and the characteristics of his brothers and sisters, and this clue saves much time in beef-cattle breeding.

FARMER'S SHARE LARGER WHEN MEAT IS HIGH: An RMA study of meat marketing indicates that the farmer's share of the consumer's meat dollar is relatively large when meat prices are high. A report on farm-to-retail margins for livestock and meat compares the distribution of the consumer's meat dollar when prices are at different levels and discusses some of the more important cost factors in marketing. In 1932, when the average retail price of meat was 20 cents a pound, the total marketing margin was 66 percent of the consumer's dollar, leaving only 34 percent for the farmer. In 1939, when the price of meat averaged 24.4 cents, the marketing margin was 52.5 percent, leaving 47.5 percent for the farmer; and in

1947, when the retail price was 55.4 cents, the marketing margin was 36 percent of the consumer's dollar, leaving 64 percent for the farmer. Additional information may be found in Bureau of Agricultural Economics report, "Farm-to-Retail Margins for Livestock and Meat."

WHEN MACHINES PAY IN SUGAR-BEET FIELDS: Sugar-beet mechanization compared with hand methods is the basis of a recent RMA study by the Colorado Agricultural Experiment Station and the Bureau of Agricultural Economics. On some farms in the Colorado area studied mechanical blocking prior to hand blocking, enabled hand workers to cover nearly twice the acreage per day as when blocking and thinning were done by hand. Mechanical harvesters harvested 25 percent more acreage per day than the average hand-topping crew and required only about half as much labor. The acreage of sugar beets required to justify ownership of a mechanical harvester depends on the relative cost of the machine and of contract labor, the yield of beets harvested, and the length of life of the harvester. With 1947-48 cost rates and with 10 years assumed as the life of the machine, a farmer with 20 acres or more of 13-ton beets could harvest them cheapest mechanically. If the yield remained the same, but the expected life of a mechanical sugar-beet harvester were only 5 years instead of 10 as assumed for these 1947-48 costs, the acreage required to justify the ownership of a mechanical harvester would be about 26 or 27 acres. Full details of the study will be found in the Colorado A&M college Bulletin 411-A, "The Economics of Sugar-Beet Mechanization."

TOXAPHENE IN LATIN AMERICA: Toxaphene, a relatively new insecticide that is proving of high agricultural value in the U. S., is showing equal promise in the control of parasites of cattle in the tropical lowlands of Latin America. The experimental work is being done cooperatively by the Office of Foreign Agricultural Relations and the Governments of Nicaragua and Ecuador. In Nicaragua, preliminary tests indicate that cattle ticks and the torsalo fly, the country's two worst livestock pests, can be effectively reduced by spraying with toxaphene, and that cattle gain appreciably more weight as a result. In Ecuador, tests indicate good control of ticks and further tests are being made to determine effectiveness against the torsalo fly.

2,4-D DOES NOT AFFECT SUGAR CONTENT OF SUGARCANE: Several reports have appeared in trade journals which claimed that spraying sugarcane foliage with 2,4-D prior to harvest significantly increased the sugar content of the cane. A recent well-replicated experiment conducted by the Federal Experiment Station, Mayaguez, Puerto Rico, showed that the sugar content of cane harvested 11 and 25 days after being sprayed with the ethyl ester of 2,4-D was the same as that in untreated cane.

THE MOVEMENT OF SODIUM 2,4-D IN THE SOIL: A recent report from the Federal Experiment Station, Mayaguez, Puerto Rico, showed that sodium trichloroacetate (TCA) moved downward in the soil in direct relationship to the amount of rainfall following its application. A similar study with sodium 2,4-D showed that regardless of the amount of rainfall applied, the sodium 2,4-D failed to move past the first 1/2 to 1 inch of soil in either wet or dry soil. It is suggested that this may be due to a chemical reaction in which the soluble soldium 2,4-D is changed to insoluble calcium 2,4-D or/and absorption by the soil particles.

NEW DUO-KERF SAW DEVELOPED: A new and improved type of saw has been developed as an outgrowth of basic research at the Forest Products Laboratory on exactly what takes place when the teeth of a circular or band saw cut into a log. A new, duo-kerf principle in saw tooth design is involved. Tests made thus far indicate that the use of this principle reduces the power required for sawing by 20 to 25 percent, produces a smoother surface and hence less shaving loss, and permits the use of a thinner saw, thereby reducing the waste in sawdust. More details are obtainable from the Forest Products Laboratory, Madison, Wis.

POULTRY AND VITAMIN B_{12}: Agricultural Research Administration's search for new sources of vitamin B_{12} led to the discovery that the new antibiotic aureomycin was a growth stimulant. Poultry scientists added aureomycin and a derivative of phenylarsonic acid to basal diets of yellow corn, soybean meal, and vitamin B_{12}, and produced from 10 to 15 percent greater gains in chicks than when they fed the same basal diet fortified with the vitamin B_{12} alone. Preliminary results of feeding the 3 substances indicated that 3-pound broilers might be produced in 10 weeks on $2\frac{1}{2}$ pounds of feed per pound of gain. Without the antibiotic, broilers at 10 weeks weighed 2-3/4 pounds and required 3 pounds of feed for each pound of gain.

RESEARCH AIDS BROILER PRODUCERS: An RMA study of the marketing of broilers which has been conducted by the Arkansas Agricultural Experiment Station in cooperation with the Bureau of Agricultural Economics shows that northern markets prefer broilers of heavier weights whereas southern markets prefer broilers of lighter weights. By studying current prices and market activity, producers can choose the more profitable alternative of selling broilers at light weights in southern markets or feeding to heavier weights for northern markets. Buyers who processed some broilers and sold others alive paid about 1 cent per pound more than live haulers, and buyers who processed their entire volume paid about 1/3 cent per pound more than live haulers. A report of this study is contained in a bulletin of the Arkansas Station entitled, "Market Area for Northwest Arkansas Live Broilers," Report Series 16.

TOTAL ALKALOIDS AND QUININE IN CINCHONA TREES: Total alkaloids and quinine content of cinchona trees grown in the Caribbean National Forest by the Federal Experiment Station, Mayaguez, Puerto Rico, did not vary appreciably or consistently from one year to another in the age range of 3 to 6 years, a fact in agreement with the data from Java for trees of corresponding ages. There was a tendency for quinine and other alkaloids in the trunk bark to be somewhat lower in the smaller trees than in the taller ones but in general the vigor of the trees as measured by height did not have a marked effect on the percentage of these constituents. When the quinine and total alkaloids were high in one part of a tree they were also high in others and vice versa. The roots and lower trunk bark contained the highest percentage of alkaloids and the upper trunk bark, side branches and trunk wood contained the lowest.

INSURANCE HANDBOOK FOR FARMERS: Types of insurance protection for the farmer against various accidents for which he may be held liable are explained in Farmers Bulletin No. 2016, from the Bureau of Agricultural Economics. This is a sort of insurance handbook for farmers giving the principles and uses of all kinds of insurance in which they might be

interested--fire, windstorm, crop and hail, liability, and life. The section on liability insurance includes such items as automobile and truck insurance, farmer's comprehensive personal liability, and employer's liability policies. The bulletin leads off with a list of questions which enable the farmer to check up on his insurance to be sure whether he is safely covered.

PLANT GROWTH REGULATORS: Agricultural Research Administration scientists are beginning to recognize the widespread advantages the newly developed plant growth regulators have. Selective weed killing is the most important use so far developed. But plant growth regulators can be used to induce rooting in cuttings that are hard to root; to produce heavier sets of fruit on greenhouse tomatoes; to hasten the ripening of certain fruits; to prevent potatoes from sprouting in storage; to eliminate storage losses in apples due to scab; and to increase the nutritional and mineral content as well as improve the keeping quality of certain fresh vegetables.

SPOILAGE IN MARKETING OF TOMATOES EMPHASIZED: Spoilage from the vine to consumer plays a large part in the marketing costs for South Carolina tomatoes, according to information given in Bulletin 383, "Physical Losses, Marketing Costs and Prices of Fresh Tomatoes," recently published by the South Carolina Experiment Station in cooperation with the Bureau of Agricultural Economics. Only 57 pounds of the original 100 pounds on the vine ever reached the consumer's hands. Tomatoes produced last year in Beaufort County, S. C., and marketed through repack plants in Jacksonville, Fla., were sampled at each stage of marketing to determine the physical losses involved between the time mature tomatoes were ready to harvest and the time they were sold at retail. This was an RMA project.

MARKETING CHARGES AND SPOILAGE TAKE BIG PART OF THE CONSUMER'S TOMATO DOLLAR: South Carolina tomato producers marketing their crop in the New York area received 31.3 cents of the consumer's dollar spent for these tomatoes in June 1948. Marketing charges accounted for the other 68.7 cents of the tomato dollars. Of the 68.7 cents, grading, packing, and assembly took 12.4; intermarket transportation, 8.9; cost of first sale in the market, 8.1; and retail and wholesale margins, 39.3 cents. The retail and wholesale margins include charges for ripening and repacking. Waste and spoilage caused by decay cracks, insect damage, and bruises were found to be one of the most costly items in the ripening and repacking of green-ripe South Carolina tomatoes. Additional information will be found in the report, "Marketing South Carolina Tomatoes in New York City," of this RMA study made jointly by the South Carolina Agricultural Experiment Station and the Bureau of Agricultural Economics.

TRENDS IN FARM COSTS AND RETURNS SHOWN: Farmers and prospective farmers are able to visualize the ups and downs of production costs and net returns to farmers (average on selected types of farming) by studying farm management publications issued by the Bureau of Agricultural Economics. The latest in the costs-and-returns series is called "Farm Costs and Returns, 1949 with Comparisons," and provides cost-and-income figures on commercial family-operated farms in 7 major U. S. farming regions. Charts trace the ups and downs since 1930 for 15 types of farms; tables give figures related to the different types of farms for the years 1946, 1947, 1948, 1949, and for the 1937-41 average.

COUNTRY BANK DEPOSITS DECLINE LAST YEAR: Deposits of banks turned downward last year in agricultural counties that contain the smaller trading centers but increased in counties that contain the major and secondary centers. In counties with the major trade and financial centers, deposits increased about 3 percent, in counties with secondary trade and financial centers, the increase was 2.3 percent. In contrast, agricultural counties showed a decrease in deposits of nearly 4 percent. One of the causes is the lower level of agricultural income in relation to other income together with a high rate of spending for plentiful farm machinery and other items. Get further information from the Bureau of Agricultural Economics.

SIZE DISTRIBUTION OF FARM OPERATORS' INCOME: As a supplement to the available data on aggregate farm income and expenses of farm operators in the United States, the Bureau of Agricultural Economics has completed an RMA project to indicate how that income was distributed in 1946. This involved the adjustment of data obtained by survey methods to account for the under-reporting of income prevalent in such surveys. The estimates indicated that most of the unreported income was in the upper-income groups. In addition, this research provided the first detailed measurement of the sources and amounts of off-farm income received by farm operators. Details will be found in the publication entitled "The Size Distribution of Farm Operators' Income in 1946 on Farms in the Upper Piedmont of Georgia," Georgia Agricultural Experiment Station Bulletin 263. RMA studies of a similar nature have been made by BAE and experiment stations in eastern Iowa, and in northwestern Washington State, and joint studies are under way in eastern Washington, southwestern Kansas, east Tennessee Valley of Tennessee, north central North Dakota, and the Clay Hills area of Mississippi.

MEMBERS' KNOWLEDGE AND ATTITUDES--CALAVO GROWERS OF CALIFORNIA: Personal interviews with 107 members of Calavo, a cooperative marketing avocados, found the attitude of 62 percent very favorable toward their co-op, 33 percent favorable, and 5 percent indifferent or critical. The survey, made by the Cooperative Research and Service Division, Farm Credit Administration, found that those "indifferent or critical" lacked knowledge of their co-op. However, 41 percent of the very favorable were also below the median with respect to knowledge of their co-op's operations. Members with the largest number of avocado trees had on the average not only more knowledge of Calavo but also a more favorable attitude.

NEW PULPING PROCESS DISCOVERED: A new process for pulping hardwoods was discovered at the Forest Products Laboratory, Madison, Wis., and, in mill-scale trial runs, container-board papers were produced that compared favorably with the regular commercial output of the mill. The process offers distinct advantages, being simpler, less costly, and more efficient from the standpoint of raw-material conversion than older chemical pulping processes. Essentially the process consists of soaking hardwood chips --aspen was used in the mill tests--in a cold caustic soda solution and then putting the softened chips through a grinder. Up to 95 percent of the total wood is thereby transformed into pulp, as compared to 50 to 75 percent with older chemical processes. Waste and chemical effluent are practically eliminated. Additional information on the process is obtainable from the Laboratory.

OKLAHOMA FARMERS CANNOT AFFORD TO STORE CASH GRAIN ON FARMS: The average Oklahoma farmer loses by storing cash grain on the farm--even in buildings he now owns--when elevator storage is available. He can store 3 bushels of grain in an elevator for what it costs to store 1 bushel on his farm. This information, collected from 73 elevator managers and 201 farmers in Oklahoma by the Farm Credit Administration in cooperation with Oklahoma A&M College on RMA Funds, is published as FCA Bulletin 58, "Where and How Much Cash Grain Storage for Oklahoma Farmers." The per-bushel average cost of farm storage was 22.2 cents, based on the use of 41 percent of available capacity and average length of 172 days stored, compared with 7 cents for elevator storage. If no charge were made for facilities, the cost of storing grain on the farm was 11.4 cents. From the viewpoint of the most favorable long-time operating-cost position regular elevator storage should be available to meet only average expected requirements over many years. Cost of empty bins in all but bumper-crop years more than outweighs advantages of having enough storage standing by at all times.

CROP ROTATIONS IN SOIL CONSERVATION FARMING: Crop-rotation improvements are continually being called for in Soil Conservation Districts throughout the country. The Soil Conservation Service, through years of research and experience on farmland, has proved that rotations, when used alone, generally are inadequate for effective erosion control. They must be used with other good erosion-control treatments, according to climates, soils, and crops grown. Terracing and water diversions are needed for handling excess rainfall. Strip cropping, contouring including row structures and systems of row grades, stubble mulching, winter cover crops, drainage, water spreading, pest control--these are some of the other important practices required to meet the varied needs throughout the country. In Missouri, where an adequate combination of conservation methods was employed, soil conditioning by proper crop sequence and management has reduced erosion under row crops by nearly 80 percent over a 9-year period. At the same time the efficiency of fertilizers was increased so that, with the samd applications, corn yields were 38 percent higher. In Iowa, corn grown each year for 19 years yielded only 23.3 bushels per acre as compared with 97.3 bushels per acre in a corn-oats-meadow rotation. Rotation studies on Maryland tobacco land brought to light an important effect of a rotation. The tobacco land, which had been in grass-legume sod for several years, showed remarkable resistance to drought and gave high yields. In the New Jersey trucking area, it has been shown that the development of effective soil conservation practices depend largely on proper rotations to replace continuous row crops. Complete land rest for 1 year in 4 gave greater 4-year yield averages than without the rest. And growing corn in a rotation with a sod crop reduced soil losses 64, and water losses 67 percent; yield increased 46 percent.

INSECT CONTROL: A full program of research has been undertaken by the Agricultural Research Administration to find more effective methods of controlling the more than 600 species of insects that are of primary economic importance to agriculture. One great need is to reduce farm operating costs in such work. Farmers often hesitate to spray or dust fields for insect or disease control because the cost is high as compared with the moderate yield increase to be expected. Efforts are now being made to overcome this obstacle by combining several practices in one operation and to develop machines and attachments that will cultivate, apply fertilizer, and spray for weeds and/or insects at the same time.

BIOASSAY FOR DDT: The widespread use of the insecticide, DDT, has brought about the problems of residue in milk and other foods. Chemists at the Federal Experiment Station, Mayaguez, Puerto Rico, have developed a biological method in which small tropical fish (guppies) are used as the test animal for determining small residual amounts of DDT on fruits and vegetables. Whole fresh tomatoes and beans were sprayed with several concentrations of wettable 50 percent DDT powder. After standing for 1 hour the treated fruits were extracted with acetone and the extracts tested on the fish. The results showed good recoveries for all concentrations in both vegetables with an error within limits of biological methods. Amounts of DDT as small as 0.025 p.p.m. were detected by the method.

IOWA CREAMERIES NEED BETTER MARKET INFORMATION: Iowa creameries need more complete market information to market butter most efficiently. Lack of this information makes it impossible for them to determine prices and price conditions in advance of sales. A recent RMA study "Butter Pricing by Iowa Creameries" has been issued by Farm Credit Administration as Circular C-136. Other conclusions reached are that written sales agreements can be helpful to both creameries and dealers; creameries can operate with less capital investment and marketing risks by shipping regularly on a particular day each week; some creameries should increase local sales; and the creameries should produce butter of the kind the consumer wants rather than relying solely on the judgment of technicians grading butter.

MILK HANDLED IN MEMPHIS AT LOW COST: A steady growth in the volume of business of Memphis, Tenn., milk distributors and a policy on the part of leading milk distributors of maintaining narrow margins to protect and reinforce their position in the trade channel has contributed to the relatively low cost of distributing milk in the Memphis market. Seven Memphis milk dealers had an average profit of a little over one-tenth of a cent (0.13) per quart, equivalent to a return of 5 percent on investment in 1948. Further information regarding findings from this RMA study is contained in the Bureau of Agricultural Economics publication entitled, "Cost and Margins of Milk Distributors in Memphis in 1948."

NEW MANUAL ON SMALL SAWMILL OPERATIONS: In most U. S. forest regions the small sawmill has largely supplanted the big stationary operations of an earlier day. The changing economics of logging and milling have brought this about; smaller, more widely scattered stands of trees make big-scale mill operations unprofitable in many places where small mills can flourish. For more than 2 decades the Forest Products Laboratory, Madison, Wis., has conducted investigations aimed at making small mills more efficient, in order to reduce the heavy timber losses that result from poor harvesting and cutting practices. Results of this work have been summarized in a new manual on small sawmill operation--the first comprehensive publication of its kind ever made available to small sawmill operators as a whole. The basic objective of the manual is to help operators do a more efficient milling job, so that fuller economic use will be made of available timber stands and losses due to miscut logs and lumber will be reduced. Write the Laboratory for more details.

ACCELERATED KILN DRYING: The Forest Service has shown that to increase the efficiency of lumber dry kilns it is necessary to modify drying schedules so that the drying time can be reduced without increasing the seasoning degrade. Dry kilns with adequate forced-air circulation and good

control of temperature and relative humidity can be operated to take advantage of faster drying schedules. This is particularly true where hardwoods are being kiln dried either after partial air drying or green from the saw. Accelerated schedules for these woods involve lowering the relative humidity sooner than most recommended schedules call for and then dropping the relative humidity rather quickly to relatively low values. Studies have shown that relative humidity control is very important for the initial stages of drying green lumber to prevent surface checking and end checking. It has been shown, for example, that by using the accelerated schedule, 1¼-inch northern red oak can be dried in 28 days as compared to 45 days by standard schedules, a saving of 17 days. It is also significant that the stock dried by the faster schedule was more check-free than the boards dried by the standard schedule. The Forest Products Laboratory, Madison, Wis., can supply further details on the accelerated drying schedules.

COTTONSEED SUPPLY AREAS STUDIED: Sharp changes in the production of cottonseed in the various producing areas were analyzed in a new report made following an RMA study by the Production and Marketing Administration. The information should be of much value to operators of cottonseed crushing mills as a guide in expanding or reducing their capacity. The report covers the downward trend of cottonseed production during the two decades ending in 1947 and the sharp upturn in 1948 through 1949. During these years increases or decreases of more than 50 percent occurred in some sections of the Cotton Belt. The report is entitled "Cottonseed Supply Areas."

WIDE VARIATIONS FOUND IN COST OF PROCESSING COTTONSEED: Variations in operating practices and costs among cottonseed processing mills are so wide that there is tremendous opportunity for a high-cost mill--or any mill with certain high costs--to improve its practices. In most of the cost categories, there are some mills whose costs are more than double those of others. These findings are included in a report on an RMA study of processing methods and practices in the industry in relation to costs, made by the Production and Marketing Administration. The study permits one mill to measure, for example, the percentage that its plant repair cost is of its total cost in comparison with the average for other mills. The report also makes comparisons for such items as current, fixed, and general costs; labor, power, heat, and lights, reapirs, and minor operating costs; cost of cottonseed; salaries, office and administrative costs, depreciation, taxes, licenses, insurance, travel, and other indirect costs.

DAIRY CATTLE: Proved-sire-breeding work has been improving the milk-producing ability of our dairy herds for a long while. This work led logically to artificial-breeding organizations which extended the use of the most desirable sires to many more herds. Meanwhile Brahman cattle (particularly the Red Sindhi strain) are being crossed on Jerseys and other domestic dairy breeds in an effort to develop better dairy cattle for the South. Tests indicate that the crossbreds are able to withstand high temperatures better than the domestic breeds. Better feeding also improves milk production, and it is even possible to improve certain nutritive properties of milk by proper feeding, particularly the vitamin A content. Good information is now at hand on the requirements of dairy cattle for calcium,

protein, and carotene, and how these requirements may best be met in practical feeding. A recent very important discovery of the Bureau of Dairy Industry is that milk is a rich source of vitamin B_{12}; research is now under way to find out how the cow obtains this vitamin.

POLLINATING AGENT FOR HEVEA TREE IDENTIFIED: The natural pollinating agent or agents for the rubber tree (Hevea) have not been identified although the problem has received considerable attention in the past. Studies conducted at the Federal Experiment Station, Mayaguez, Puerto Rico, indicate that at least two different species of insects are pollinating agents of Hevea under local conditions. These are thrips and one or more species of midges. Both were found carrying pollen but the midges are believed to be the more effective pollinators because of the larger number of pollen grains they deposited on the stigma. Also judging by the rather limited capacity of the thrips for sustained flight a larger portion of the cross-pollination is probably accomplished by the midges.

COORDINATING TRANSPORTATION IMPROVES MARKETING AND PURCHASING FOR MINNESOTA COOPERATIVES: This Farm Credit Administration (FCA) study shows that coordinating transportation, marketing, and purchasing activities of 128 member farmer cooperatives by Northern Cooperatives, Inc., Wadena, Minn., has resulted in both economy and service to its member associations and in turn to their farmer patrons. Through its transportation pick-up and assembly service the small shipper gets the benefit of lower carload or truckload rates. Through the marketing service, the member co-ops are able to reach more diversified markets than they could individually. Through the purchasing, the lower unit prices on farm and creamery supplies by carlot buying are reflected to its patrons. The report, published as FCA Bulletin 57, also gives suggestions for cooperatives in other areas interested in setting up a similar service.

MORE WATER FROM FORESTED WATERSHED: In the Delaware River Basin, to which New York has turned for relief from its water shortage, preliminary investigations of tributary drainages by the Forest Service have already brought to light marked differences in the yield and distribution of streamflow between heavily and lightly forested watersheds. The Upper Lehigh River watershed--90 percent forested--yields more water per square mile and fluctuates less between the extremes of high and low flow than the closely similar upper Lackawaxen basin, which is only 38 percent forested. The discharge of the Lehigh is clearer than the Lackawaxen's. The heavy surface run-off and attendent soil losses from the Lackawaxen basin during early spring snow-melt or rainfall is attributable to the deep, firm frost that is found in the soil of pastures and overgrazed woodlands. By contrast, well-forested areas in both Lehigh and Lackawaxen basins exhibited no deep, firm freezing, and no surface run-off or erosion. The unfrozen soils permitted the water to infiltrate, thereby delaying its movement into the streams. These investigations show how essential it is to pay close attention to watershed conditions in planning for the water supply requirements of municipal and industrial areas.

FREIGHT RATES RISE AND PRICES TO FARMERS DECLINE AFTER BOTH WARS: During both world wars when prices received by farmers were rising rapidly freight rates rose more slowly than did prices. But when freight rates finally go

up, they tend to stay up, even after commodity prices decline. During 1948 and 1949, for instances, prices of farm products declined while freight rates rose. This is part of the price-cost squeeze which farmers have to face when prices of what they have to sell fall faster than the cost of production and marketing. More information on this RMA study may be secured from the Bureau of Agricultural Economics.

LOW PRICES TO FARMERS FOR APPLES DON'T ALWAYS MEAN LOW PRICE TO CONSUMER: A recently completed RMA study of the marketing of western apples indicates that the grower's share of the consumer's dollar spent for Washington Delicious apples in Chicago was 15.7 cents in December 1947, 35.4 cents in December 1948, and 7.3 cents in December 1949. Variations in "on-tree" prices for Washington Delicious apples were not reflected in proportionate changes in Chicago retail prices for the fruit during October, November, and December of the 1947, 1948, and 1949 seasons. Analysis of data supplementing the 1947-48 study of farm-to-retail margins for Washington apples shows that, in certain instances, spreads between prices received by the grower and prices paid by consumers narrowed when farm prices rose and widened when they declined. Additional information can be procured from Bureau of Agricultural Economics.

PER CAPITA FOOD DATA: Detailed information on the U.S. per capita consumption of all major food commodities is brought together for the first time in a publication issued by the Bureau of Agricultural Economics. Included in the report are basic data on supplies and distribution from which the consumption estimates are derived. The 196-page report, with numerous charts and tables, is the result of a special RMA study and is called "Consumption of Food in the United States, 1909-48." It represents a part of the work which BAE is doing on the analysis of the supply and demand for food in this country. As parts of the work are completed in the future they will be made public in order that specialists in Federal and local government agencies, private industry, and colleges may study the changes in the domestic food supplies and demand; and that farmers and the food industry may improve their incomes by quicker adjustments in production and distribution as consumer demand at any particular time might indicate.

CO-OP FEED-MILL AND RETAIL STORE COSTS VARY WIDELY: Feed-mill managers can compare their costs of operation with mills operating under similar conditions by using the operating statements given in Farm Credit Administration Bulletin 56, "Operating Costs of Selected Cooperative Feed Mills and Distributors." Although the source of information for this RMA study was cooperative mills, the results can be applied to other mills as well. Total expense per ton for 26 cooperative feed mills studied showed a wide range from $3.03 to $13.19 a ton. Feed handled in a year ranged from 705 to 218,253 tons. Operating expenses of 21 retail feed stores showed an even wider range from $0.58 to $9.47 a ton. Volume for the stores varied from 996 to 13,840 tons. Mill plan and equipment, types of feed and proportions of each manufactured, amount and kind of service rendered, management, quality of labor and wage rates, and the relation of volume manufactured to the capacity of mill enter into the wide range in costs per ton. Large-scale operation, modern equipment and mill arrangement, and steady operation at about plant capacity were typical of the low-cost mills.

MISSOURI VALLEY PRODUCTION MAY BE STEPPED UP BY $160 MILLION ANNUALLY: The program for water and land development in the Missouri River Basin, generally known as the Pick-Sloan plan, would result in the creation of about 19,000 new farms and would boost agricultural production in the basin substantially. Crop and pasture production would be increased by about 160 million dollars annually (1939-44 prices) if proposed new and supplemental irrigation is completed. Over 5 million acres of land not now irrigated may be brought under irrigation in the Basin and 2 million more may get supplemental water during the next 35 years. Additional information may be had from the Bureau of Agricultural Economics report "Changes in Crop Production Anticipated from Proposed Irrigation and Reservoir Development in the Missouri River Basin," which analyzes and interprets tentative estimates prepared by the Army Corps of Engineers and the Bureau of Reclamation which planned the over-all program. The report does not include estimates of the increased agricultural production that may be expected from the Missouri Basin Comprehensive Agricultural Program proposed by the USDA to supplement the Pick-Sloan plan.

INTEGRATED APPROACH: The integrated approach to crop production was used to crack the problem of low corn yields in the South--the best combination of germ plasm, amount and timing of fertilization, closeness of spacing, cultivation methods, and other cultural practices. Using such a combination approach, over 55,000 farmers in 7 States have produced an average corn yield of 70 bushels per acre, over 8,000 have exceeded 100 per acre, and a few yields of more than 200 bushels have been obtained. Average corn yields in the same area were 60 percent higher in 1949 than before this combination approach was made, even though a comparitively small percentage of the farmers utilized it. The same principle applies to other crops in other areas. In irrigation research in the West, where water as well as other factors can be controlled, exceptional corn yields are becoming commonplace--as high as 206 bushels per acre, with grain sorghum yields running as high as 174 bushels, oats 114, barley up to 91 bushels, potatoes up to 648 bushels, sugar beets as high as 40 tons, and alfalfa yields as high as 10 tons to the acre. It has definitely been found that maximum benefits from fertilizers can be realized only when all other production factors are in proper balance. Procure additional information from Agricultural Research Administration.

IN CLOVER: Ladino clover moved into the Southeast only after it was found that this legume could not be grazed in the same manner as white clover or lespedeza, and that it also requires liberal application of fertilizer. Its use is now spreading rapidly, because research has shown that, when properly managed, it produces returns equivalent to corn yields of 60 to 90 bushels per acre. Pasture also enables livestock to do most of the harvesting work themselves, and Ladino can be grown on land too wet for corn in the East and too hilly in the West. It is proving excellent for all classes of livestock and poultry. Another major legume-crop advancement is the recent discovery of reseeding types of crimson clover. The reseeding characteristic holds enormous potentials for increasing the efficiency of forage production from annual legumes and eliminating the annual costs of seed and the expenses of seedbed preparation in the establishment of winter pastures. Furthermore, volunteering legumes germinate when moisture and temperature are most favorable, insuring a better

stand and often becoming established earlier than when the crop is planted. At Tifton, Ga., a new volunteering type of sweetclover is under test. If this reseeding characteristic can be built into a wide variety of annual legumes adapted to the Southeast, it will go far to reduce the costs of pasture establishment. Procure additional information from Agricultural Research Administration.

SALVAGING SEED FOR EROSION-CONTROL PLANTINGS: The hammer-milling of seed-bearing hay now has become an established practice in Oklahoma, Texas, Louisiana, and Arkansas. The practice was developed several years ago by the Nursery Division, Soil Conservation Service, for processing the seed of some of the trashy grasses badly needed for planting eroded lands of this region. Hammer-milling processes the seed of these grasses to a high degree of purity, and is especially valuable for King Ranch Bluestem and closely related species such as Angleton and Caucasian Bluestems. When combined, only 20 to 30 percent of the seed of these grasses is deposited in the seed bin, the remainder being lost in the tailings. By the new method, the tailings are caught on a canvas or in a sled pulled behind the combine, and the material thus salvaged is run through a hammer-mill and cut into small pieces that can readily pass through the trashy seed planter or can be easily sacked for shipment and handling. The hammer-mill practice has been generally adopted by Soil Conservation Districts and Land Utilization Projects of the region as a cheap, satisfactory means of processing seed harvested for their local use. Almost any type of hammer-mill commonly used on farms and ranches can be used to process the seed-hay, and it does away with the need for other cleaning equipment such as scalpers and standard cleaners. The Land Utilization Project of the SCS near Decatur, Texas, processed by hammer-milling 46,500 pounds of Little Bluestem seed material for erosion control planting in 1950. The Service's San Antonio nursery processed in this manner 3,900 pounds of King Ranch Bluestem material, most of which was used in flood-control operations for mulch-seeding the earthen faces of various types of detention dams.

HYBRID VIGOR: Better understanding of hybrid vigor and the initial success with corn have stimulated intensive studies with other crops by scientists of the Agricultural Research Administration. The discovery of male sterility in certain species such as sugar beets, onions, and grain sorghums, has opened the way to further crop hybridization. One hybrid sugar-beet variety resistant to leaf spot has already been introduced in the more eastern sugar beet districts. Hybrid varieties suited to other districts appear highly promising. Hybrid onions are being produced commerically, and substantial quantities of seed should be available in 1951; here hybrid vigor expresses itself in increased yields up to 50 percent, improved disease resistance, unusual uniformity in size, and sharp specialization as to region and climate. Hybrid grain sorghums are a definite possibility. Plant breeders are now working to put hybrid vigor and disease resistance in combine-type sorghums. Tobacco breeders also have developed male-sterile strains, but these have so far been of little value because of close parental relationship of our domestic tobaccos. Now that germ plasm is available from wild tobacco in wide variety, the breeders hope to develop new species that can be crossed with present commercial varieties in the effort to capture hybrid vigor. Barley breeders

succeeded in back-crossing male sterility into their parent lines, but so far have not found an economical way to produce seed. Hybrid alfalfas have been developed but do not appear as promising so far as new synthetic varieties produced by a complex series of cross breeding.

WE'RE LEARNING HOW NOT TO HAVE ANOTHER DUST BOWL: Notable progress has been made recently in perfecting and extending the principles of stubble-mulch farming, most important single practice for control of wind erosion on cultivated land in Great Plains areas. The Soil Conservation Service reports that in the eastern Nebraska area, bienial sweet clover has been included in the stubble mulch system with good success. This legume supplies a large quantity of residue for soil protection while providing plenty of available nitrogen for the oncoming crop. It can be subtilled after either 1 or 2 years of growth. Following 2 years of sweet clover, corn yield increased 20.8 bushels, wheat 9.7 bushels, and oats 34.4 bushels per acre, on subtilled land, over rotations not including legumes. In the area around Hastings, Nebr., hairy vetch and partridge peas have been found to do well on sandy soils where legumes are essential because of the low nitrogen content. In these areas a new type of stalk shredder has been developed which promises to improve corn borer control on stubble mulched land. At Amarillo, Tex., a subtillage machine has been developed which operates well on hard-land soils. In this area stubble-mulch practices are of paramount importance in controlling wind erosion. In most years stubble-mulch land in the Southern High Plains produces better yields of wheat than similar areas prepared with a one-way plow. Around St. Anthony, Idaho, the past 10-year average yield of wheat shows that subble-mulch practices which keep the crop residue on or near the surface gave better yields than burning off the stubble. Likewise, a 7-year test in northern Montana gave a wheat yield advantage with stubble-mulch over stubble burning. These findings definitely indicate that the widely established practice of burning stubble prior to summer fallow operations does not increase yields of wheat. Utilization of all available plant residue is essential in order to keep up a good level of production as well as to control erosion.

GRASS CROPS: The Agricultural Research Administration is conducting research on a whole series of grasses and legumes destined to improve our pastures. A new foundation seed program is under way to make adequate seed supplies of all new varieties available. Of vital interest is research work on grasses adapted to the Great Plains and designed to help livestock maintain gains during the winter months. Strains of western wheat grass and Texas blue grass that will do well on the light soils of the Southern Plains are now under test. Prospects are encouraging also for developing a legume that can be used on the Northern Plains in combination with grasses to improve forage on the native range and also build the soil. Coastal Bermuda grass, the product of a planned breeding program, is far superior to common Bermuda and has produced nearly twice as much beef per acre in trials at Tifton, Ga. Production of Coastal Bermuda was boosted from 1 to an average of 8 tons per acre by applying 400 pounds of nitrogen, and the protein content of the hay was nearly doubled--in some cuttings it exceed 18 percent. This is of major importance for protein feeds from the bag are very expensive. An improved variety of lespedeza resistant to nematodes is on the way. Our present varieties of

reseeding crimson clover and of Kentucky 31 tall fescue came from seed stocks on farms where they developed naturally. In Mississippi there is being developed an interspecies hybrid of Dallis grass resistant to ergot, high-yielding and very palatable. The use of Dallis grass has been limited because, when it seeds in pasture, its seed heads are full of ergot, which is poisonous to livestock. Since domestic seed is almost all ergot-contaminated, Dallis grass seed must be imported. But a resistant factor from another species has been incorporated into a commercial strain through a cross made possible by maintaining the proper temperatures and controlling the day length of both parent plants to make them flower simultaneously. Seven ergot-resistant plants have been produced, and seed from them may provide a foundation stock for ergot-resistant Dallis grass in the years ahead.

U. S. DEPARTMENT OF AGRICULTURE

Office of Information

Document No. 6
Revised April 1, 1951
A USDA Document

IMPORTANT RECENT ACHIEVEMENTS OF DEPARTMENT OF AGRICULTURE SCIENTISTS

RESEARCH RETURNS: A Bureau of Plant Industry, Soils, and Agricultural Engineering scientist points out that the annual cost of Federal research in cereal crops is only one-third of a cent per acre cultivated. The money spent on all Federal and State research in soil science and agronomy amounts to only 17 cents for each $100 of the total farm value of the cereal crops. From this modest investment have come the use of corn hybrids boosting annual harvests by 750 million bushels per year, improved wheat varieties that have increased output 200 million bushels per year, and new rice varieties that are enhancing growers' incomes by 25 million dollars annually.

IMPROVED GROCERY CHECK-OUT COUNTERS: Two new grocery check-out counters, the "Redi-chek" and "Simplex," which save time and cost in checking out orders in self-service food stores, have been developed by USDA in cooperation with a national grocery chain under an RMA* project. A public-service patent covering the counters has been applied for. The Simplex is recommended for use in stores where customer traffic keeps at a fairly even pace throughout the week. The Redi-chek is adaptable to any size store, but it is particularly suited to one with peak-volume periods during the week. More details are available in the Production and Marketing Administration report, "The Check-out Operation in Retail Self-Service Food Stores."

MORE COFFEE FROM CENTRAL AMERICA: USDA scientists, working in Central America in connection with the Point Four program of technical collaboration, are continuing to find evidence that coffee production is an "underdeveloped industry" and can be greatly improved. They believe that Guatemala, in only a few years, could triple its production of coffee by adopting two proven recommendations: Propagate new nurseries only from seed from selected high-yielding coffee trees, and adapt "strip-cropping" methods to coffee culture, planting the trees in hedgerows with the wide spaces between the hedgerows planted to tall legumes. (It has been demonstrated that this "strip-cropping" method eliminates need for the time-honored practice of growing coffee trees in the shade of taller trees.) The USDA scientists in Guatemala report that "Coffee yield at substation Chocola in 1950 from the new unshaded triple hedge system of close planting from unselected Bourbon coffee plants only 3 years from seed was 759 pounds per acre, compared with yield on an average coffee farm from mature shaded trees of 6 years or more in age of only 350 to 500 pounds per acre." Other USDA scientists, assigned to projects in El Salvador, are similarly contributing to future coffee yields. They have found, for example, that the mulching of coffee trees to add nutrients and conserve moisture can increase yields by as much as 50 percent. Detailed information on this development is available from the Department's Office of Foreign Agricultural Relations.

*Herein RMA is used as an abbreviation for the Research and Marketing Act of 1946.

HOW THEY MEASURE PREFERENCES FOR CANNED ORANGE JUICES: By means of certain taste experiments, the Bureau of Agricultural Economics, in cooperation with the Florida Citrus Commission and the Florida Citrus Experiment Station, have worked out a highly technical research method which, it is hoped, will make it easier for research workers to do a good job in determining consumer preferences for varied sorts of canned orange juices (juices of different consistencies or Brix-acid content). Juices of different Brix-acid content were used, and by means of a series of taste tests, it was discovered that a selected group of nonprofessional tasters could distinguish one juice from another, so far as Brix-acid strength is concerned, only within certain rather wide limits. "Ability to Discriminate and Preferences in Regard to Canned Orange Juices that Vary in Brix-Acid Ratio" is the title of the report prepared by BAE on this RMA study.

HIGH-SOLIDS, LOW-FAT BEVERAGE MILK: As part of a Research and Marketing Act project to increase the utilization of milk, particularly nonfat milk solids, the Bureau of Dairy Industry has developed a high-solids low-fat beverage milk. It contains about 11 percent of nonfat solids and 1 to 1½ of butterfat, as contrasted to 9 percent nonfat solids and 4 of butterfat in regular whole milk. Palatability tests conducted by BDI have shown that this high-solids milk is pleasing to the taste. In the course of these studies the dairy researchers observed that skim milk has a higher curd tension, and therefore may be less digestible, than whole milk. When they heated skim milk to 180° F., there was a rapid drop in curd tension as the holding time increased, and it practically disappeared when the milk was held for 30 minutes at that temperature. This milk did not have an objectionable cooked flavor when heated to above-normal pasteurization temperatures.

NEW TABLES OF FOOD VALUES: A basic reference volume for nutrition workers throughout the country is "Composition of Foods...Raw, Processed, Prepared," issued recently by the Bureau of Human Nutrition and Home Economics. This new publication, Handbook 8 in the Department of Agriculture series, brings data on nutritive values up-to-date and includes foods and features not found in previous editions of the Bureau's food-composition tables. For the first time in one of its publications, the Bureau has added to the data on foods in the raw state information about the nutritive values of frozen foods and cooked foods. About 750 food items are listed--from dried almonds to brewer's yeast. Nutrients cited include 3 minerals and 5 vitamins. Information for each food is given three ways--in terms of a 100-gram edible portion of the food; in terms of 1 pound of the food as brought into the house; and in terms of a common household unit of the food as it is prepared for serving. Since its beginning in 1923 the Bureau of Human Nutrition and Home Economics has gathered and published food composition data. Dietitians, physicians, textbook writers, and others who calculate diets for the well and the sick rely on these data as source material.

HYBRIDS RESISTANT TO EUROPEAN CORN BORER: Borer-resistant hybrids, report U. S. corn breeders, are already in use in the eastern Corn Belt where the insect has been long prevalent. In Ohio, in 1950, more than 1 million acres was planted to hybrids with some borer resistance. In the recently invaded western part of the Belt, resistant hybrids are now being developed.

NEW HIGH-FLAVORED MAPLE SIRUP: A process for giving maple sirup intensified maple flavor and color has been devised by the Eastern Regional Research Laboratory, Bureau of Agricultural and Industrial Chemistry. It requires only heating under atmospheric pressure at elevated temperatures. Commercial maple sirup is boiled until enough water has been removed to raise the boiling point to between 240° and 250°F. The thickened sirup is held at this temperature for 3 hours for "Fancy" grade sirup and a shorter time for the lower grades, but further loss of water during this boiling period is prevented by using a tight lid fitted with a reflux condenser. When cooking is completed, as much water is added as was lost by evaporation. The sirup becomes darker and develops a maple flavor that is at least four times as strong as that of the original sirup. One part of this high-flavored sirup diluted with 3 parts of cane-sugar sirup makes a maple-sirup blend with a flavor that is scarcely distinguishable from that of the original maple sirup. The process offers a means for preparing low-cost, full-flavored sirup blends of high quality. It should provide an expanded market for maple sirup and should solve the problem of utilizing the grades of maple sirup that are in surplus. Additional information can be secured from the Eastern Regional Research Laboratory, Chestnut Hill Station, Philadelphia, Pa.

NEW WINTER VEGETABLE MADE AVAILABLE BY INSECT CONTROL: A new method for keeping ears of sweet corn free of corn earworms was announced recently by entomologists of the Bureau of Entomology and Plant Quarantine. Until now, the corn earworm has prevented the profitable production of sweet corn in many localities, especially the deep South. Such infested corn cannot be sold. Spray applications of an emulsion containing DDT, mineral oil, and water, to silks and husks of developing ears at the right time kills the worms before they attack and ruin the corn. Two or three applications are necessary--one when silks first appear, the others at 2-day intervals.

GUIDE FOR TEACHING FARMER COOPERATION: Vocational agriculture teachers and veterans' instructors should find helpful Circular E-34 "Guide for Teaching Farmer Cooperation," issued by the Farm Credit Administration. This 34-page circular covers five teaching units: Determining the place of farmer cooperatives in the community, State, and Nation; determining the need for farmer cooperatives in the community; affiliating with existing cooperatives and organizations of cooperatives; organizing a farmer cooperative; and operating, managing, and participating in farmer cooperatives.

RATE OF HEAT PENETRATION IN WOOD: Research at the Forest Service's Forest Products Laboratory, Madison, Wis., on heat conductivity and on the rate of temperature change in wood has made available to manufacturers important basic information relating to the heating of wood from hot-press gluing operations, preservative treatments, veneer cutting, and other processing work. This information is comparable with that available for metals and other structural materials, and contributes to basic engineering and processing knowledge. The Laboratory can supply additional information on this subject.

CUTS IN FRUIT AND VEGETABLE HANDLING COSTS: Ways by which fresh fruit and vegetable distributors can reduce the cost of handling produce, through better use of equipment, are explained in an illustrated report which has been issued by the Production and Marketing Administration. The report is entitled, "How Fresh Fruit and Vegetable Distributors Can Get More Out of Their Materials Handling Equipment." Reductions in certain handling costs of 20 to 80 percent are possible with improved methods explained in the report, which also shows better methods of using hand trucks, skids, pallets, and other materials-handling equipment that distributors may already own. The study on which the report is based is part of a larger RMA project covering the handling of many kinds of packages of farm and food products in stores and warehouses.

FROZEN APPLE-JUICE CONCENTRATE: Development work on the production of frozen apple-juice concentrate is being carried out at the Bureau of Agricultural and Industrial Chemistry's Western Regional Research Laboratory. Concentrates have been prepared by three different methods, each of which appears to be technically suitable for commercial use. These methods are as follows: (1) Vacuum concentration to sixfold, followed by dilution with fresh juice to produce a fourfold concentrate. This is similar to the method currently in use for commercial preparation of frozen-orange concentrate. (2) Removal and concentration of the volatile flavor constituents (essence), vacuum concentration of the stripped residue to slightly over fourfold, and final addition of the essence to the concentrate. (3) Preparation of essence as in (2), concentration of stripped residue to sixfold, and addition of essence and fresh juice to produce a fourfold concentrate. Concentrates prepared by methods (2) and (3) were of excellent quality, being superior in flavor and aroma to those prepared by method (1). On the basis of available data, methods (2) and (3) appear equally suitable for commercial use. Additional information can be obtained from the Western Regional Research Laboratory, Albany, Calif.

TALL FESCUE IN CONSERVATION ROTATIONS: Field studies in Georgia by the Soil Conservation Service have proved that a $2\frac{1}{2}$-year-old sod of Kentucky 31 fescue grass can be turned under without difficulty with a tractor-drawn disk plow, and a very mellow seedbed obtained. Disk harrowing was unsuccessful, as it killed out this valuable perennial grass. Since this fescue succeeds on improved upland soils, it can play an important role as a grass or grass-legume base for conservation rotations and at the same time supply pasturage, hay, and seed crops.

ELEVATION AFFECTS TOXICITY OF INSECTICIDAL PLANTS: The data obtained in a recent experiment carried out by the Federal Experiment Station in Mayaguez, P. R., showed that differences in elevation and the variation in temperature and other environmental factors that accompany it have a marked influence on the survival and growth of insecticidal plants. Some varieties grew better at the lower elevations and others seemed better adapted to the higher elevations and cooler temperatures, but as the elevation increased there was a marked reduction in the percentage of all insecticidal constituents in the roots of all varieties under test, regardless of the vigor of the plants.

HOG-CHOLERA VIRUS VARIANT: A variant form of hog cholera virus never before recognized was found in the Midwest during the fiscal year 1950. Early during the summer of 1949, the Bureau of Animal Industry received reports that many hogs were dying following the simultaneous anti-hog-cholera serum and hog-cholera virus treatment. Extensive field investigations and laboratory tests were made showing that the virus was different from, or was a variant of, the regular hog-cholera virus. However, protection against the variant was afforded by using large doses of serum, at least 50-percent greater than normal doses.

WASTE AND COSTS REDUCED BY USE OF SOFTWOOD CUT-STOCK: By gathering information on the possible use of small-size wood, called "cut-stock," the Forest Products Laboratory, Madison, Wis., assists sawmills to salvage short-length material and wood-using factories to make use of it at savings. Cut-stock can be used in such products as agricultural equipment, prefabricated and precut houses, auto trailers, furniture, and household goods. More details are obtainable from the Laboratory.

GROWTH-REGULATING CHEMICALS: Screening tests by the Bureau of Plant Industry, Soils, and Agricultural Engineering for plant growth-regulating activity indicate that 100 of the 539 compounds tested during the past year are sufficiently active to warrant further study. This has become a productive field of agricultural inquiry.

NEW GENES IMPORTED: Much germ plasm continues to move through the Division of Plant Exploration and Introduction, Bureau of Plant Industry, Soils, and Agricultural Engineering. In 1950, more than 9,300 introductions came from 40 countries, and 8,000 items were sent to 65 countries. Introduced germ plasm is a primary source of genes for plant improvement.

SUPERIOR DETERGENT FROM CORN SUGAR: A synthetic detergent and wetting agent having excellent soil-removing properties has been prepared at the Northern Regional Research Laboratory, Bureau of Agricultural and Industrial Chemistry, from gluconic acid, a product of the fermentation of corn sugar, and fatty amines derived from low-grade, inedible fats and oils. By proper chemical combination of these substances, a product has been made that is considerably more efficient than the synthetic detergents now being marketed, which utilize relatively scarce benzene as a raw material. The detergent derived from corn sugar can be produced at a cost comparable to that of the popular brands of synthetic cleaning agents of which an estimated 800 million pounds were produced in the U. S. in 1948. The commercial application of this development would utilize millions of pounds of corn sugar and low-grade fats annually. More information on this study may be secured from the Northern Regional Research Laboratory, Peoria, Ill.

MARKETING AMERICAN CHEESE: A study by the Bureau of Agricultural Economics indicates that, during 1948 and 1949, marketing agencies received about 42 cents of the consumer's dollar spent for natural American cheese. The cheese factory received about 5 cents of the dollar, the cheese assembler 2 cents, the wholesaler 5 cents, and the retailer nearly 30 cents. For processed American cheese and cheese food, marketing agencies received about 34 cents, and for cheese spread, about 80 cents of the consumer's dollar.

NEW JOB FOR BEES: A new productive job has been found for bees and a potential profit for bee owners who have the skill to manage the bees in the new job. Apple pollen loses its power to "germinate" within a relatively short time, even when dried and kept in ordinary cold storage. It is, however, easy to collect practically pure apple pollen from bees working in an apple orchard and returning to a hive within the orchard. An ingenious trap of two pieces of coarse-mesh screen set at the entrance to the hive brushes off part of the load of pollen a bee brings back, and these pellets fall into a cup beneath the trap. Entomologists of the Bureau of Entomology and Plant Quarantine rob bees in this way, then deep-freeze the freshly gathered pollen. The pollen germinates well when thawed. Stored pollen is thus available for commercial use. Apple breeders may find such storage very valuable. Pollen of a late-season apple variety can be used in making a cross with a variety that blooms early in the spring. In case of bad weather at blossom time the stored pollen might help in saving a crop.

NEW METHODS OF CONCENTRATING WHEY: The Bureau of Dairy Industry has developed two inexpensive methods for concentrating whey in small cheese factories that are unequipped with a vacuum pan. In one, whey is concentrated to about 20-percent-solids content by means of a submerged combustion unit. Air and natural gas are mixed in the correct ratio, and the mixture supplied to the burner at a suitable pressure to maintain combustion under the surface of the whey. One cubic foot of methane gas will evaporate 0.69 pound of water. The resulting condensed whey is strongly caramelized in color, odor, and flavor, and therefore is suitable only for animal feed. In the other method, whey is concentrated by spraying it into a cone through which heated air is forced. The dairy scientists found they obtained the best results by heating the whey to above 212° F. Concentrating the whey continuously to about 33-percent-solids content results in a product comparing favorably with whey condensed under vacuum. This was an RMA project.

STATE TRUCK-WEIGHT LIMITS STILL VARY: Extensive information as to State regulations of truck sizes, weights, taxes, etc. is set forth in the RMA report of the Bureau of Agricultural Economics, "Interstate Barriers to Truck Transportation." The lack of uniformity in truck-weight limits is still a major problem in interstate transportation, although State regulations affecting interstate trucks are generally more liberal than before World War II.

NEW COTTON CLEANER: A flow-through lint-cotton cleaner developed by engineers and cotton technologists of the Department, using Bankhead-Jones funds, has proved so satisfactory to the industry that it is now in use in nearly 1,500 commercial gins. The device provides for rough-harvested cotton "consistent and significant grade improvements."

HAM AND EGGS FROM THE JUNGLE: USDA scientists stationed in Guatemala, in connection with the Point Four program of technical assistance, are successfully demonstrating that ham and eggs can come from the jungle. Neither swine nor poultry industries existed in Guatemala until very recently. Now both are established and promise to become thriving industries in the years ahead. Balanced rations made up of cheap local feedstuffs, plus improved management practices, are the cornerstone of the new industries. Even cull bananas can be utilized in the new hog rations which enable Guatemalan farmers to produce a high-grade pork with the same feed efficiency as U. S. farmers. Likewise, the new poultry rations effectively utilize local tropical products, some of them directly from the jungle. Numerous poultry farms, some of commercial size, have been started in Guatemala in the last 2 years, utilizing the "know-how" that grew out of technical cooperation between the two countries. While this means more poultry business in Guatemala, it also means more business for the U. S.--for a substantial increase has taken place in Guatemala's imports of baby chicks, incubators, brooders, vaccines, medicines, and vitamin feed concentrates. Further information is available from the Department's Office of Foreign Agricultural Relations.

POULTRY FARMERS GET MORE OF FOOD TRADE: Improved and more efficient practices in producing chickens and eggs during the last 20 years, together with certain demand factors, have made it possible for poultry producers to compete favorably with producers of beef, pork, and other livestock products. Total production of chickens and eggs increased by 50 percent, about 10 percent more than the rise in output of other livestock products. The prices poultry farmers received for chicken meat and eggs did not rise as much as did the prices farmers got for other livestock products. The rapid advance in "know-how" enabled poultry farmers to capture a larger share of the food trade than they previously had. (They did this with a relatively lower price rise than that of their competitors.) Results of a study by the Bureau of Agricultural Economics of these developments is covered in Technical Bulletin 1018.

OHIO EGG AND POULTRY CO-OPS: Cooperarive poultry- and egg-marketing associations have been adapted to meet the needs of poultry producers in Ohio according to a study made by the Cooperative Research and Service Division, Farm Credit Administration, published as Bulletin 59 "Cooperative Marketing of Eggs and Poultry in Ohio." Although the cooperatives studied were all in Ohio, the results of the study may have some application in other States. The present Ohio egg and poultry cooperatives evolved from experience with earlier marketing cooperatives and were organized after surveys showed the need for them. The large flock owners, with outputs big enough to justify better outlets, pioneered the field. Their experience later enabled producers with small flocks to join or to form successful cooperatives.

BETTER QUALITY CHICKEN MEAT: Inspection and grading of dressed poultry at both processing plants and retail stores was the main feature of an RMA project conducted in one important poultry-producing area to help improve the quality of fresh poultry offered to consumers. Both the extent and the source of quality loss after the birds left the producer's hands were investigated. The producer, however, was found to be responsbble for most of the downgrading or grade loss. Of the broilers, fryers, roasters, and meat and

egg hens graded after dressing in processing plants, 53 to 80 percent downgrading to B and C qualities was attributable to producers, and 13 to 32 percent was attributable to processors. Seventy-seven to 85 percent of the chickens were graded at A quality depending on the kind of meat. Of the grade B meats displayed in retail food stores broilers showed the highest proportion or 67 percent, of defects attributable to production. For other meats the bulk of the defects was due to processing. The study also indicated that the quality of dry-packed fryers was superior to those ice-packed; and the quality of roasters and meat hens was superior to that of broilers and fryers. The study was conducted in Los Angeles on a cooperative basis between the Bureau of Agricultural Economics, the Production and Marketing Administration, and the University of California. A summary of results was published in California Agriculture, February 1951.

REDUCING SHRINKAGE TO CUT MARKETING COST OF POULTRY: An RMA study conducted by the University of Connecticut in cooperation with the Bureau of Agricultural Economics combines a study of shrinkage in shipments to the New York market with an experimental study of the relationship of shrinkage to time and distance traveled. Poultry shipped from Connecticut farms to the New York live market shrank about 4.2 percent. Factors considered were: Distance to market, breed or strain of bird, type of ration fed during the growing period and in transit, age and size of bird at time of shipment and care in handling, temperature and humidity while loading and hauling the birds. In the controlled experiment shrinkage varied as much as 17 percent by the different methods of handling.

ARKANSAS BROILER-PRODUCERS MARKETING PRACTICES: Farmers selling White Plymouth Rock broilers in the Northwest Arkansas broiler area in 1948 and 1949 received higher average prices than farmers in the area who produced other breeds or crosses, according to a joint report by the Arkansas Agricultural Experiment Station and the Bureau of Agricultural Economics. Farmers selling broilers at weights between 2.6 and 2.9 pounds received slightly better average prices than those selling at lower and higher weights. There were no apparent differences between prices for large and small flocks. Prices in the Arkansas area were closely associated with prices in other broiler producing areas. The results are published in "Marketing Practices of Northwest Arkansas Broiler Producers," Arkansas Agricultural Experiment Station, Bulletin No. 503.

COSTS AND MARGINS IN MARKETING EGGS: In 1948, about 33.5 cents of the consumer dollar paid in Eastern cities for eggs produced in the Midwest went to the marketing system. About 11.4 cents of the margin went to the Midwestern central assembler, about 12.3 to the Eastern wholesaler, and 8.5 to the Eastern retailer. These results are based on a study by the Wisconsin Agricultural Experiment Station in cooperation with the Bureau of Agricultural Economics and are reported in "Marketing Eggs in the Lake States," Research Bulletin 168, July 1950, University of Wisconsin. Another part of the same study published in a separate report indicates that freight costs in moving eggs from producer to consumer are less important than expected; more improtant in the marketing costs are losses due to breakage, losses due to downgrading, and costs of regrading. See the BAE report "Marketing Margins on One Shipment of Wisconsin Eggs to an Eastern City . . ."

COTTON FARMERS SAVE WITH NEW-TYPE FERTILIZER: Production costs have been reduced on many Mississippi Delta cotton farms by using anhydrous ammonia (compressed synthetic ammonia gas) as a nitrogen fertilizer. One 400-acre farm, for example, saved about $400 a year by using fertilizer in this form. It is handled in tanks and applied to the soil by special machines. The saving is more pronounced on larger farms because they can make more efficient use of the tanks and heavy equipment for applying this new type of fertilizer. This information comes from an RMA study made by the Bureau of Agricultural Economics and the Mississippi Agricultural Experiment Station. Ask for the report called "An Economic Appraisal of Anhydrous Ammonia As a Nitrogenous Fertilizer."

WEED CONTROL IN COTTON: Excellent control of weeds in cotton by a combination of chemical and mechanical treatments has been obtained by researchers of the Bureau of Plant Industry, Soils, and Agricultural Engineering and the Mississippi Agricultural Experiment Station. Best returns in cotton yields and quality came from a combination of 3 herbicidal oil treatments followed by 5 flamings. The oil treatments were made 13, 20, and 29 days after the cotton plants came up. These, plus the 5 flamings, gave practically complete control of pigweed and morning-glories, and reduced crabgrass to only 17 plants per 100 feet of row. The treatments required fewer than 4 man-hours of labor to apply and cost $15.10 per acre. Costs include materials, labor, and equipment depreciation. Less effective standard cultivation and hoeing required nearly 55 man-hours per acre and cost $17.51. The yield and quality of the cotton from these two methods of weed control are about the same.

COTTON COSTS CUT WITH MECHANICAL PICKERS: Use of the mechanical cotton picker is cutting the harvesting costs for many cotton farmers in the San Joaquin Valley of California, according to an RMA study conducted jointly by the Bureau of Agricultural Economics and the California Agricultural Experiment Station. Varying conditions such as yield per acre, acreage to be harvested, success with defoliation, and maximum use of machines caused machine picking to be more costly in some areas than in others. For details see the report, "Economics of Mechanical Cotton Harvesting in the San Joaquin Valley," published by the California Agricultural Experiment Station. Other joint reports on improving cotton-production practices include "Cotton Growing in Southwestern Oklahoma" and "Cotton Growing in Southeastern Oklahoma," both published by the Oklahoma Agricultural Experiment Station; and "Cotton Production Practices and Requirements in South Carolina," published by the South Carolina Agricultural Experiment Station.

NEW COTTON-OPENING MACHINE FOR TEXTILE MILLS: An improved machine of radically new design for opening and fluffing baled cotton to make it clean easier and spin better has been developed at the Southern Regional Research Laboratory, Bureau of Agricultural and Industrial Chemistry. The expansion of mechanical harvesting of cotton makes it more urgent than ever to improve methods of cleaning lint at cotton mills, since machine-picked cotton contains more trash than does hand-picked cotton. The new industrial-size opener is simple and economical to build. Although this machine requires only 50 square feet of floor space it can handle 4 bales (about 2,000 pounds) of cotton per hour, which is considered exceptionally good for a machine of such small size. Within 1 month after publication of engineering details in September 1950, specifications for the industrial-size machine were supplied, on request, to more

than 40 textile mills and to 7 machinery manufacturers. The principle of the opener is covered by U.S. Patent No. 2,363,793, which is available for license from the Secretary of Agriculture on a royalty-free, nonexclusive basis. Further information may be obtained from the Southern Regional Research Laboratory, New Orleans.

STORAGE EFFECTS ON COTTON: High-grade cotton deteriorates more during prolonged storage than does low-grade cotton. This finding, with regard to cotton stored for 17 years in USDA laboratories in Washington, D. C., is covered in a report, "Effect of Exposure and Storage on Color and Other Factors of Quality in Raw Cotton," made by the Cotton Branch, Production and Marketing Administration. The study on which the report is based traces back to 1933 when research was begun to determine changes in cotton color caused by field exposure and by frost, changes in the same variety of cotton grown at different locations in different years, and to determine the effect of exposure to light, heat, and short and long-time storage. Samples from the 1933 study were remeasured to form the basis of the present report, which also reveals that the 17-year-old cotton samples showed no significant loss of fiber strength.

HONEYDEW ON COTTON DETECTED BY CHEMICAL TEST: A simple chemical test has been developed by scientists of the Bureau of Agricultural and Industrial Chemistry's Southern Regional Research Laboratory to detect the presence of honeydew on cotton. Honeydew is the partially digested sap excreted by aphids, a form of lice which feeds upon the cotton plant during its growth. Cotton contaminated with honeydew is difficult to process at the mill, because the fibers cling to the equipment, forming a sticky mass which must be removed, at frequent intervals. The manufacturing operation is slowed and mill owners are caused excessive and needless expense. It is not always possible to detect honeydewed cotton by looking at it. Southern Laboratory workers found that a test based on the reaction of alpha-naphthol with soluble carbohydrates was the most practical to apply. This chemical reagent will develop a dark wine-red or purple-red color in water extracts of honeydewed cotton, whereas in extracts of clean raw cotton it will develop only a pale or violet color. The test is simple and can be used by untrained persons. The Southern Regional Research Laboratory, New Orleans, La., can supply details on this test.

STRONG COTTONS: New cotton hybrids, developed by Bureau of Plant Industry, Soils, and Agricultural Engineering breeders, have superior yarn strength. Lint from interspecies hybrids gave yarn strengths about 50 percent above commercial cottons of the same staple length. More breeding work is needed, however, to bring up yields of the strong-fiber strains.

COTTON, LEADING MATERIAL USED IN FINISHING AUTO INTERIORS: Over three-fifths of the materials used in finishing the interiors of 1950 closed-model automobiles was cotton, a recent Bureau of Agricultural Economics survey shows. The cotton so used amounted to about 197 million pounds, nearly 400 thousand bales. Other materials were foam rubber, 12 percent; and wool, 10 percent. BAE got the information through the cooperation of automobile manufactures throughout the country. Such services as the Automobile Manufacturers Association, the National Association of Wool Manufacturers, and the National Cotton Council cooperated in planning the study. Materials used in tops for convertibles were cotton, 45 percent; rayon, 3 percent; and latex, 52 percent.

COTTON FABRICS MADE EASIER TO LAUNDER: A simple treatment that makes cotton clothes harder to soil and easier to launder may soon lighten the washday work of housewives and aid commercial laundries. This new soil-resistant treatment is a result of research at the Institute of Textile Technology, Charlottesville, Va., on an RMA contract project supervised by the Bureau of Agricultural and Industrial Chemistry's Southern Regional Research Laboratory. The process consists of simply adding a small amount of a commercial compound (carboxymethyl cellulose), having the trade name CMC, to the final rinse water each time cotton goods are washed. The effect on the finish is much like that of ordinary starch, but CMC can be applied in quantities that later prevent soiling and make the cloth clean easily without making the fabric noticeably stiff. The application in effective amounts--3 level tablespoonfuls of CMC per gallon of rinse water--does not change the feel of the fabrics. CMC has been used as a thickner for textile printing pastes, as a detergent-builder, and as a sizing agent. A keen interest is being shown by the laundry trade in the use of CMC for soil resistance, and the product may soon be made available in small quantities for household use. The Southern Regional Research Laboratory, New Orleans, La., can furnish further information on this treatment.

INSTITUTIONAL FOOD PLANS: Working out the principles of good nutrition is one job of the Bureau of Human Nutrition and Home Economics. But, since you can't eat principles, a job of no less importance is translating principles of good nutrition into food plans--combinations of foods that will provide good nutrition. Recently released by the Bureau are two new plans for institutional meals. They were worked out after a preparatory study of food-consumption patterns and special problems in management. They are based on food quantities for 10 persons for 1 month; from this basic unit plans may be developed for institutions both large and small. Although the plans are designed primarily for institutions such as children's homes and dormitories, in which food needs are normal and fairly constant, they are also of use to restaurants and others serving in quantities. One food plan is keyed to a low-cost food budget--the other to a moderate-cost food budget. Within the framework of the plans, considerable variety can be obtained to avoid the monotony that so often characterizes institutional food.

LESS BRUCELLOSIS: During the fiscal year 1950 there was a drop in the rate of infection of cattle with brucellosis from 4.0 percent, as reported a year ago, to 3.5 percent of all cattle in the U. S. More than 70 percent of the 208,000 reactors were removed for immediate slaughter. Many of those held in herds, however, were to be disposed of for slaughter in from 6 to 12 months.

TCA CONTROLS GRASSES IN NEWLY PLANTED SUGARCANE: The results of a recent experiment conducted at the Federal Experiment Station, Mayaguez, P. R., indicate that TCA (sodium trichloracetate) at the rate of 100 pounds of 60-percent-acid equivalent will kill or hold in check most of the grass weeds in sugarcane fields. The broadleaf weeds that develop before the cane closes over can be easily controlled with 2,4-D sprays. The sugarcane in the treated plots germinated and developed normally even in plots where it was planted immediately after treatment.

ORGANIC RESIDUES FOR TOBACCO LAND: At Beltsville, Md., good progress has been made in the study of heavy organic residues for tobacco land, in experiments conducted by the Soil Conservation Service. When turned under about one month later than normally, winter covers of wheat, rye, or ryegrass mixed with vetch, have provided a large volume of organic material which improves the physical properties of the soil and gives added resistance to erosion and leaching on tobacco land. For example, 4 months after plowing, a mixture of rye and vetch brought a 15-percent reduction in volume weight of the soil. Tobacco yields and values have been improved by winter covers. During the 1948 season, the vetch and nonlegume covers, turned under at the usual date, yielded 322 pounds more tobacco, worth $145 more per acre, than land without winter covers. Subsequently, late turning of these same covers has further increased the yield by 92 pounds and the crop value by $69 per acre.

FARM CROP DRIERS FOR DRYING LUMBER: Tests conducted by the Forest Service have shown that by circulating the heated air from a crop drier through the lumber in a simple shed-type structure, drying can be accomplished quickly and without serious degrade. The lack of suitable drying facilities has long been a handicap to the greater use of farm-grown timbers by farmers. Write the Forest Products Laboratory, Madison, Wis., for more details.

SUGARCANE MARKETING IN PUERTO RICO: Although present sugarcane-marketing practices in Puerto Rico are desirable in many respects, certain changes would increase marketing efficiency and provide similar treatment for all growers and all processors, according to a report entitled "The Marketing of Sugarcane in Puerto Rico," based on an RMA study made by the Production and Marketing Administration. A uniform method of payment by processors to growers of cane is recommended because of the many variations in payments now in practice. Two transportation practices are singled out as increasing marketing costs: The excessively long hauls and cross hauls of cane that sometimes occur, and the excessive transportation allowances that processors sometimes make to growers as a means of obtaining cane.

NEW SUGAR BEET: A new Federal-State variety of sugar beet is resistant to both black root and leaf spot, two of the most serious sugar-beet diseases in the humid area. In tests in Minnesota it withstood exposure to black root under conditions so extreme that susceptible varieties failed completely.

LOCKER PLANTS HAVE 80 MILLION CUBIC FEET OF ZERO STORAGE: An estimated 80 million cubic feet of gross storage for perishable food at zero temperature is dispersed at widely scattered points over the country through the 11,600 locker plants now in operation. A survey with RMA funds recently completed by the Farm Credit Administration, in cooperation with the Bureau of Agricultural Economics, published as Miscellaneous Report 146, shows these plants have space equivalent to nearly half the commercial sharp-freeze storage space in the U.S. on January 1, 1950, the date the space was reported. In addition to furnishing an excellent method of processing, freezing and storing meats, poultry, and fruits and vegetables for farmers, these plants also provide urban locker patrons, home unit owners, local retail stores, restaurants and institutions with many of these same services. Some plants also act as distributors for commercial frozen foods produced outside the local area.

PREDICTING MILK-PRODUCING ABILITY OF HEIFERS: Preliminary studies by the Bureau of Dairy Industry show that there are significant correlations between body measurements of calves or heifers and their subsequent milk-producing ability. About 29 body measurements are used as indicators of body form, and they have been made at 3, 6, and 12 months of age on both Holsteins and Jerseys. Studies of the Holstein data show highly significant correlations between most of the 29 measurements made at 3 to 6 months of age and the animals/highest subsequent record of milk production. But for Jerseys, not more than 1 or 2 measurements made at these ages were highly significant of future producing ability. For Holsteins, 70 percent of the 29 measurements made at 12 months of age were highly significant of subsequent producing ability; whereas, for Jerseys, only 10 percent of the measurements of this age were highly significant.

NEW INSECTICIDE IN ROOTS OF COMMON WEED: A potent new insecticidal chemical was found recently in the roots of a common native perennial weed by insecticidal chemists of the Bureau of Entomology and Plant Quarantine. Early experimental trials with the chemical, derived by extracting the active principle from plants of the genus Heliopsis, (commonly called "ox-eye,") showed it appreciably more toxic to houseflies than pyrethrum, the standard of comparison. The effect of the chemical on insects other than the housefly, what it may do to man or animals, plants or soils, or how difficult it may be to obtain from the natural weed source, or to manufacture, remain to be explored. There are a number of species of Heliopsis in this country, all native to the U.S. Three of them tested for insecticidal activity so far indicate the most powerful comes from scabra.

FROZEN JUICES PLEASE CONSUMERS: The development of frozen concentrated juices has affected the demand for fresh oranges and other forms of juices. Frozen concentrated orange juice is fast growing in importance to consumers. On the basis of fresh-orange equivalent, it has continued to increase in importance during the last year. As a percentage of total household purchases, the relative importance of the frozen concentrated juice has increased from 21 percent in the fourth quarter of 1949 to 30 in the fourth quarter of 1950. The proportion of purchases of oranges in the form of canned single strength juice dropped from 25 to 21 percent during the same period while fresh orange purchases dropped form 54 to 49 percent. Purchases of frozen concentrated orange juice appear to have substantially increased total consumer purchases of orange products during the summer months when fresh oranges are normally in short supply. Data on consumer buying practices are obtained under contract by a nationally known private research agency with funds provided by fruit-industry groups and the RMA. Further details will be found in the Bureau of Agricultural Economics--Production and Marketing Administration publication "Consumer Fruit and Juice Purchases, October-December 1950."

BETTER SOYBEANS: Heavy-yielding, high-oil-content soybeans have been developed by Federal and State plant breeders for most of the Soybean Belt. Blackhawk, for the northern part of the area, was introduced in 1951. Most other areas have been furnished comparable varieties during the past decade, generally increasing yields by 20 percent and oil content by 10 percent.

THINNING APPLES: About 20,000 acres of Pacific-Northwest apple orchards were thinned in 1950 by using de-nitro spray at blossom time, as worked out by State and Federal horticulturists. In tests with Golden Delicious, chemical thinning increased yields by 6 boxes per tree, about 15 percent, at a cost only one-sixth as much as hand thinning.

GRASS-LEGUME COMBINATIONS HELP CERTAIN SOIL TYPES: A recently completed study of several grass-legume mixtures growing on different soil types at the Federal Experiment Station at Mayaguez, P. R., showed that certain combinations like Merker grass and trailing indigo and Merker grass and tropical kudzu were highly productive when grown on fertile lowland soils, but when these combinations were grown on upland red clay soils both the grass and legume made poor growth. The grass grown alone on the upland soil produced a much higher yield of forage than the mixture, whereas on the lowland soil the reverse was true.

RESEEDING RANGE LAND: Equipment for range reseeding, with a carefully worked-out seeding procedure, is rapidly gaining the approval of ranchers in the West. The cultipacker-seeder and the pitting plow, developed by the Soil Conservation Service, are the machines being used to best advantage. Recently the pitting plow has been further modified to make larger and better pits, grouped in an improved pattern. The modification was accomplished by cutting approximately one-half of the disk away. The cut-off units are then replaced on the line shaft, rotated one-half turn from each preceding disk, and the alternate disks replaced with small spacer washers. By using a 26-inch disk-harrow plow, set at 65° from the direction of travel, a set of pits slightly in excess of 10 feet in width can be made. Such an assembly, with the cultipacker-seeder, can seed solidly at a cost of $2.50 an acre, including seed at the rate of one-half pound per acre and costing $3 per pound. Benefits from this reseeding procedure have varied between a threefold and tenfold increase in perennial grass, with a twofold to fivefold increase in forage by the end of the second year. At the same time, smaller shrubs such as mesquite, catclaw, and burroweed can be successfully and economically thinned out by this reseeding method.

DIISOPROPYL DIXANTHOGEN HELPS TCA KILL WEEDS: TCA (sodium trichloroacetate) is an effective grass killer but to eradicate some species of grasses relatively large quantities of the material are needed. Recent experiments performed at the Federal Experiment Station at Mayaguez, P. R., indicate that the addition of small amounts of Diisopropyl Dixanthogen increases the effectiveness of TCA as well as reducing the quantity of TCA needed for good results. For example, it was found that 30 pounds per acre of TCA plus 8 pounds of Diisopropyl Dixanthogen was more effective than 60 pounds of TCA alone, and that 60 pounds of TCA plus 8 pounds of Diisopropyl Dixanthogen was more effective than 100 pounds of TCA alone.

FOREST FIRES: In most of the U.S. the weather varies so much from year to year that no two seasons bring exactly the same danger of forest fires. For that reason, forest fire control agencies find it risky to take credit for a smaller number of fires one year as compared to another. Recently a Forest Service research team at the Southeastern Forest Experiment Station, Asheville, N. C., worked out a method of computing the normal number of fires that should be expected during a season. This normal number of computed from the

fire-danger ratings taken daily during the season. The computed figure for the first time gives a consistent basis of comparison regardless of weather conditions. It permits a better check on the effect of special measures to reduce forest fires, such as educational campaigns, closure of hazard areas to the public, intensified law enforcement, etc.

DAIRY-HERD-IMPROVEMENT PROGRAM AT PEAK: Milk-production records received and tabulated by the Bureau of Dairy Industry show that the dairy-herd-improvement program is now at an all-time peak of activity. On January 1, 1950, 1,973 associations were testing 40,100 herds, or a total of 1,088,872 cows. Analysis of incoming records show that high-producing cows convert feed into milk and butterfat more efficiently and profitably than low-producing cows. DHIA cows that averaged 8,907 pounds of milk per cow per year consumed $1.75 worth of feed for each 100 pounds of milk they produced, whereas the cows that averaged 5,041 pounds of milk consumed $2.60 worth of feed for each 100 pounds of milk they produced. BDI received 471,721 production records suitable for proving sires in 1950, or about 1,900 records for each working day during the year. A high-speed electronic punch-card calculating machine is now used for processing the constantly increasing number of these lactation records.

FRUIT-ESSENCE PRODUCTION EXPANDING: With the passage of a Federal law in 1949 to permit the manufacture, under specified conditions, of fruit essences "without the payment of the $9.00 per gallon tax "formerly imposed, the commercial adoption of the Bureau of Agricultural and Industrial Chemistry's Eastern Regional Research Laboratory's process for the recovery of volatile flavoring constituents from fruit juices has greatly expanded. About 50 firms have installed essence-recovery units. The process has been adopted by industry to produce on a commercial scale essences from apples, grapes, cherries, peaches, blackberries, strawberries, pineapples, and apricots. All of these essences have been made commercially. Apple and grape essence is being sold either in combination with the concentrated juice or separately. In addition, industry has produced on an experimental scale essences from oranges, tomatoes, maple sirup, raspberries, Damson plums, and quinces. Apple processors have reported promising results on the recovery of essence from apple peels and cores. Fruit essences are now being used commercially in the preparation of carbonated and noncarbonated beverages, flavoring extracts, candy, and frozen concentrated grape juice. The Eastern Regional Research Laboratory, Chestnut Hill Station, Philadelphia, Pa., can supply further details.

LEAFHOPPER CARRIES WESTERN-X DISEASE: A leafhopper has been shown by entomologists of the Bureau of Entomology and Plant Quarantine and cooperating States, to carry the virus that causes western-X disease of peach trees. This is the third time within the last few years that scientists have proved leafhoppers to be carriers of important virus diseases of trees. They showed that 4 species of leafhoppers carry phony peach in southern States, and that another leafhopper spreads phloem necrosis of elm trees.

TILLAGE AND SOIL CONSERVATION: Different methods of preparing a seedbed for corn have been studied for the past 6 years on 54 fields in western Iowa. Results to date indicate that the lister can be used more effectively and advantageously by farmers in western Iowa. Corn yields with listing are about equal to those obtained from plowing. Listed corn responds well to fertilizer, and it is easier to control weeds on listed corn than on plowed and surface-planted corn. Studies at the Soil Conservation Experimental Farm in Page County showed that contour listing was twice as effective as contour surface-planting in reducing run-off and erosion. Other studies at the Agricultural Engineering Farm at Ames showed savings from 30 to 50 percent in the time and power required to plant corn by listing in comparison with plowing and subsurface tilling.

FOREST FIRE DAMAGE: A comprehensive study of the damage caused by fire on brush-covered watershed lands in southern California has recently been completed by the Forest Service. Detailed tables were prepared showing the damage that could be expected from fire in each subdrainage on the four National Forests in southern California. Most of the damage is to property downstream from the burn, and results from floods and erosion. Such damage may range as high as $700 per acre of burn. Damages per acre increase rapidly with the size of the burn. Direct damages, such as destruction of property by fire, ranged from zero to $1,500 an acre. These data provide a sound economic basis to guide investment in and distribution of fire-control equipment and facilities. The most intensive protection can be provided for the areas of highest damage potential. The study also provided the first basis for actually evaluating fire damages to watersheds. Although such damage had long been recognized, there was no definite basis for appraising it.

EDUCATIONAL PRACTICES OF FARMERS' COOPERATIVES: Farmers' cooperatives use at least a dozen major educational devices to build and maintain good relations with their members and the public, according to a study of 237 leading associations recently completed by the Farm Credit Administration in cooperation with the American Institute of Cooperation. Results were published as Farm Credit Administration Miscellaneous Report 140, entitled "Educational Practices of Farmer Cooperatives." These farmer organizations reported annual meetings and personal contacts about equally important in this job. Ranking next were monthly publications, local discussion groups, circular letters, and periodical reports. Following, these were radio programs, all family programs, cooperative Future Farmers of America and 4-H Club projects, and educational exhibits.

TRACTOR TIRES: Engineers of Bureau of Plant Industry, Soils, and Agricultural Engineering, working with industry, found weighted and air-filled tractor tires outpull water-filled tires in normally dry sand and loam soils common to Southern States. Lug height of tires was found important on the same soils. Low lugs were superior to high ones in sand; slightly better in loam. High and low lugs were on a par in clay soil. Rim width had little effect on efficiency.

BETTER GRASS FOR THE SOUTH: Dallis grass, the most important perennial summer pasture grass in the South, has been limited in usefulness, says Bureau of Plant Industry, Soils, and Agricultural Engineering, because of susceptibility to ergot, a fungus, and consequent danger of poisoning to livestock. Through control of temperature and light during flowering, hybrids were obtained in cooperation with the Mississippi Agricultural Experiment Station. There were 7 ergot-immune hybrids among several thousand plants in the third generation following crossing. Seedlings from these are being studied to establish an ergot-immune variety.

PASTURE RENOVATION: Pasture-improvement studies at Beltsville, Md., by the Bureau of Dairy Industry and the Bureau of Plant Industry, Soils, and Agricultural Engineering, indicate that renovation should be repeated about 4 years after the original renovation. Plant population counts made each fall for the past 5 years on the same pastures show a progressive decrease in legume content and an increase in grass and weed content, so that, in this respect, the renovated pastures are now similar to the unrenovated pastures used for comparison purposes. This shift in botanical compositon will lower the protein content of the forage. It was concluded that renovation should be repeated soon after the fourth year, to prevent unfavorable changes in the botanical composition of the pasture and a dropping off in total yield thereafter.

PASTURE PROFITS: More forage was produced from Kentucky bluegrass and alfalfa-bromegrass pastures during 4 years in rotations than during 6 years in permanent pasture, in Federal-State tests in Wisconsin. In addition to the forage there were on the credit side a crop of corn and one of oats.

CROP-FEEDING INCREASES: Use of chemical fertilizers on farms, says the Bureau of Plant Industry, Soils, and Agricultural Engineering, has increased 2½-fold in 10 years and now accounts for more than one-fifth of the total U.S. food production. Advances have resulted largely from fertilizer and soil-management research.

WASTE FEATHERS BECOME FERTILIZER: Experiments have revealed a practical process for treating waste feathers that yields a product having apparent commercial value, and a commercial test has substantiated the findings of laboratory trials. Whole, unwashed, wet feathers are treated with steam under moderate pressure in a closed vessel equipped with an agitator. While the wet-feather mass is being agitated, it is cooked with steam under a pressure of 40 pounds for 1 hour or under a pressure of 60 pounds for 40 minutes. Then the product is dried, ground, and bagged. In this condition it is practically odorless and can be satisfactorily stored or shipped. This feather product finds a ready market as an organic-nitrogen-containing fertilizer material. It contains 12 to 15 percent nitrogen, about 1 percent of which is water-soluble and therefore immediately available to plants. The remainder is slowly released in the soil. The Western Regional Research Laboratory, Albany, Calif., can furnish further information on this subject.

NEW SCREWWORM REMEDY: A new treatment for the control of screwworms, (the maggot stage of a parasitic fly that lays its eggs on wounds of any warm-blooded animal, including man,) the most destructive livestock insect pest in Southern States, is now available. The new remedy was developed by entomologists of the Bureau of Entomology and Plant Quarantine, is known as EQ 335/1 known to stockmen for the past decade as the most effective of all remedies for screwworm control. The new remedy contains lindane, a powerful new insecticide. It is applied to wounds with a small paint brush, and kills the maggots deep in the wound, young maggots as they hatch from the eggs, and flies attracted to wounds to feed or lay eggs. Screwworm Remedy, and replaces the Department's EQ 62,

MOLD AMYLASE PRODUCES ALCOHOL: Ethyl alcohol can now be made from cereal grains or other starchy materials by a new process that departs from the traditional use of malt for converting the starches to fermentable sugars. The new process, developed at the Northern Regional Research Laboratory, Bureau of Agricultural and Industrial Chemistry, employes a mold product, fungal amylase, as the converting agent. One industrial alcohol plant is making extensive tests of the process. Very favorable results are being obtained. One large distillery has used the process experimentally in the production of beverage alcohol. The alcohol produced appears to be satisfactory in quality, and the company expects to utilize the fungal amylase process in one of its plants in the near future. Additional information may be procured from the Northern Regional Research Laboratory, Peoria, Ill. The process was tested by Production and Marketing Administration which found that a plant using 12,000 bushels of grain daily could save more than $1,000 in each day's operations by using the new process. A full report of these tests will be found in "Methods and Costs of Producing Alcohol from Grain by the Fungal Amylase Process on a Commercial Scale," available from Production and Marketing Administration.

EVALUATING NEW HERBICIDES: A method for rapid statistical evaluation of new herbicides has been devised by physiologists at the Federal Experiment Station in Mayaguez, P. R. A small area consisting of a relatively pure stand of a weed species is divided into 3' x 3' plots arranged in a latin-square design. The test solutions are sprayed within a plywood frame 18 inches high around each plot to prevent spray drift to adjacent plots. The stand data are taken by placing in the center of each plot a frame 24" x 24," divided into 36 compartments of 4" x 4" each. Every compartment which contains one or more green plants is given a value of 1. The control plots have a theoretical value of 36. The results are then analyzed statistically. A number of chemicals or formulations can be evaluated in a short time under field conditions where the results are of more practical significance than those obtained in greenhouse or laboratory tests. Small quantities of chemicals are used and the design of the experiment reduces variations due to soil heterogenity, moisture and other environmental factors.

UPLAND PASTURE DEVELOPMENT: Trials by the Soil Conservation Service over several years now indicate that long-season grazing can be economically produced on eroded and abandoned hillside land in the Southern Peidmont. A farmer may start with a few common cows and a beef bull, build up a sizable breeding herd of grade beef cattle, and at the same time pay the expenses of

pasture development through sales of steer calves plus increases in herd inventory. The methods recommended for pasture development include the use of deep-rooted perennial summer legumes, moderately well fertilized, to first recondition the eroded soil, followed by overplantings of oats, winter legumes, and grasses. In effect, these methods make it possible to reclaim for productive use much of the idle land in the Southern Peidmont and do so on a "pay-as-you-go" plan.

FERTILIZER PLACEMENT: In USDA-Michigan tests, onion yields were tripled by placing fertilizer 3 inches below the seed instead of broadcasting. Carrot yields, in cooperative tests with New York State, were reduced 15 percent because of injury to the carrot seed and seedling roots from the same fertilizer placement. These cases illustrate the need for placement according to the crop's peculiar requirements.

WOOD PRESERVATION: Forest pathologists of Bureau of Plant Industry, Soils, and Agricultural Engineering find that decay of stored pulpwood may be delayed by small amounts of flourides applied as a spray to the peeled wood. Studies in the South indicate these chemicals stimulate a relatively harmless mold which has an antibiotic effect on the decay fungi and makes the wood much more permeable to various fluids, an important factor in applying treatments. The studies in the pulp industry are being continued and the possible application of these effects to other fields is being explored.

WHITE-POCKET LUMBER: Much overmature Douglas-fir timber in the Pacific Northwest is infected with a fungus called white pocket which causes a pitting in the wood. This fungus is halted when the lumber is cut and seasoned. The Forest Products Laboratory, Madison, Wis., determined the usefulness of white pocket lumber for construction purposes, especially in housing, as an aid in salvaging it. It was found to be entirely satisfactory for house parts like sheathing, subflooring, and roof boards, and for decorative material in panels and cabinet work where high strength is not essential. Properly selected, it was found suitable for structural parts like studding and joists. As a result of this work white pocket material is already finding a market. More details can be obtained from the Laboratory.

VITAMIN BUILDERS: Findings at the U.S. Plant, Soil, and Nutrition Laboratory, Ithaca, N. Y., indicate the amount of light during growth is the most important factor in determining the ascorbic acid (vitamin C) content of leafy vegetables and tomatoes, while storage conditions are of more importance in determining the ascorbic acid content of potato tubers.

CHEMICAL CLEARS MESQUITE: Aerial sprays of a new chemical (2,4,5-T) can be used to kill mesquite, according to plant scientists of Bureau of Plant Industry, Soils, and Agricultural Engineering and the Texas Agricultural Experiment Station. It offers a mass method for fighting mesquite in the less arid sections of the range country at comparatively low cost. It is believed also to hold clues to control methods for the pest in other environmental conditions where it thrives, and for other species of brush that are not affected by either 2,4,5-T or the better known weed killer, 2,4-D.

TROPICAL KUDZU FOR SOIL PROTECTION: This legume, so important in the soil conservation program in Puerto Rico, is showing great promise for pasture or cut forage, and as green manure in crop sequences or under banana or plantain trees. Wide acceptance by farmers has been revealed by a survey in Puerto Rico's soil conservation districts, where the Soil Conservation Service's research information is put to immediate use. In experiments by the Rio Pidras Soil Conservation Experimental project, kudzu-molasses grass mixture, under rotational grazing, gave a yield through 1 year of 9 tons of palatable forage containing over 1 ton of crude protein. Cut-grass feeding was eliminated and protein in the concentrate was reduced, but milk production remained constant or increased. Heifer gains increased on good pasture of this type. Excellent soil protection is provided by the properly grazed kudzu and grass.

MARKET FOR VEGETABLE PROTEIN MATERIALS IN INDUSTRIAL USES: A survey of industrial uses of vegetable protein materials and of prices of competing materials indicates the feeling on the part of industry that a fivefold rise from 1949 levels is possible in the use of vegetable oilseed proteins. The survey was conducted by a private research organization under an RMA contract with the Bureau of Agricultural Economics, and the Bureau of Agricultural and Industrial Chemistry. It indicates future expansion in several areas, particularly in the use of regenerated protein fiber as a replacement or supplement to synthetic fibers and in the use of protein materials for paper coating and adhesives.

ALLYL SUCROSE: The new product, allyl sucrose, which was developed as the result of cooperative research by the Bureau of Agricultural and Industrial Chemistry's Eastern Regional Research Laboratory and the Sugar Research Foundation, shows considerable promise for commercial use as a protective coating material and as a modifier for drying and semidrying oils. It is prepared by treating sucrose (ordinary sugar) with allyl chloride (a product of the petroleum-refining industry) in the presence of caustic soda. For use as a coating material, a solution of allyl sucrose is partially polymerized by passing air or oxygen through it at elevated temperatures, after which the solution can be applied by spraying or brushing. Allyl sucrose is compatible with drying oils, and, when added to drying or semidrying oils, it decreases the time required for "drying," thus serving to improve the drying quality of the oil. It has been produced on a pilot-plant scale, and samples have been furnished to a number of industries for evaluation in various applications. More information may be secured from the Eastern Regional Research Laboratory, Chestnut Hill Station, Philadelphia, Pa.

ROUGH HANDLING DAMAGES POTATOES: Because of rough handling, external damage to potatoes nearly doubles between the shipping point and the retail store. This conclusion is reached in a report of an RMA study by Production and Marketing Administration and the New York (Cornell) Agricultural Experiment Station, entitled, "Deterioration of Long Island Potatoes in Marketing Channels," and based on a study of deterioration during the distribution of Long Island potatoes marketed in New York City and vicinity. In more than 350 samples followed from shipping points to the retail stores the average amount of external damage was found to be 7.8 percent by weight at shipping point, 11.7 percent at the wholesale level, and 13.4 percent at retail stores. Practically all of the deterioration was caused by increased cuts and bruises.

MEASURING IGNITION OF WOOD: Better knowledge of fire behavior is being gained through research by the Forest Service. At the California Forest and Range Experiment Station, Berkeley, Calif., laboratory tests that permitted precise measurement of the heating and ignition of small wood cylinders demonstrated that twigs and branch wood ignited at a temperature of 650° F. when heated rapidly. But if the material were first reduced to charcoal, it would continue to glow and could reignite at 450° F. For safe extinction of fire, therefore, forest fire control measures must aim at reducing the temperature of all fuels below 450°. The tests showed too that ignition slowed up significantly as size of the stick of wood was increased, so long as the temperature to which the sticks are exposed is between 800° and 1,000° F. Within this range, the time required was 20 to 44 seconds. At temperatures of 1,300° F. or more all sizes of fuel wood burst into flame simultaneously within 5 seconds. Increased moisture content of the wood also slowed up ignition very significantly. Such facts are important to an understanding of forest fire behavior, and so to more skillful and effective fire fighting.

STEP TOWARD EXPLAINING DISEASE RESISTANCE: Progress in explaining the differences in tobacco plants resistant and nonresistant to certain fungi is reported by a physiologist of Bureau of Plant Industry, Soils, and Agricultural Engineering. He has found well-known amino acids are factors associated with the destroying fungus. (Amino acids form the proteins in living organisms of all sorts, low and high, plant and animal.) Several of the more than 20 known amino acids were found to be more toxic to the susceptible tobaccos than to the resistant varieties. One acid is lethal to the seedlings in dilutions as weak as 5 parts per million. When several of the amino acids were tried out in weak solutions on the seedling roots, with no disease organisms present, the strains known to be susceptible were in most cases the very ones the acid solution could weaken.

POTATO COPPER SAVER: The Kennebec, a new potato variety, with such good characteristics as high yield, cooking quality, and wide geographic adaptability, has that rare factor of high resistance to late blight. Its special disease resistance makes unnecessary the heavy spraying with copper-containing spray that is the only thing that makes it possible for some varieties to produce a crop--for example, the Green Mountain variety. At present about 50 million pounds of copper sulfate is used each year in spraying potatoes against late blight. In that quantity there is approximately 20 million pounds of actual copper.

QUICK GLUTEN-CONTENT TEST FOR WHEAT: A rapid and simple sedimentation test of quality and quantity of gluten in wheat--the bread-baking qualities of the grain--has been developed in an RMA study by the Grain Branch, Production and Marketing Administration, with the cooperation of the Bureau of Plant Industry, Soils, and Agricultural Engineering, and various cereal and flour-mill laboratories under contract with USDA. Findings in the study are covered in a report entitled "Measuring Bread-Baking Quality of Wheat." The new sedimentation test was checked against milling and baking tests made on wheat from the 1947, 1948, and 1949 crops, and covered the classes hard red winter,

hard red spring, and white wheat. Because of the simple equipment required, the new test can be used at places and under conditions where experimental milling and baking tests and the farinograph test are impracticable, and can be conducted by persons untrained in chemistry. The test has limitations, however. It should not be used to compare flours of different grades. It is not always a ready means of comparing flours produced by different experimental or commercial mills because various flours may show differences in granulation and possibly other physical differences.

RIGHT LEGUME BACTERIA: When a farmer inoculates his legume seeds with the right bacteria, he may be said to be starting a "chain reaction," according to Bureau of Plant Industry, Soils, and Agricultural Engineering scientists. When legume seeds are so inoculated--an essential requirement--it means more nitrogen for the legume plants, more nitrogen for grass plants growing with the legumes and for crop plants following the legumes, more protein yield per acre, better grazing and better hay. In calling attention to inoculation as a means of increasing production a USDA bacteriologist says that today special inoculants are available for the following legumes commonly sown in the spring: For alfalfa and sweet clover; for red, white and alsike clover, all three of which use the same strains equally well; for peas grown for all purposes. Soybeans are usually inoculated with mixed strains of soybean bacteria because some varieties prefer one and some another of this group of organisms.

PREVENTING SUGAR SEPARATION IN FROZEN-FRUIT SPREADS: Recent research has revealed the cause of, and a remedy for, the separation of sucrose hydrate crystals, a phenomenon that has hindered commercial production of cold-pressed, frozen-fruit spreads. These jellylike spreads are made from fresh fruits by a process that requires no heating and, in consequence, retains the natural flavor, color, and aroma of fresh fruit. The difficulty has been that sometimes, during freezing storage, unattractive white masses of sugar crystals (sucrose hydrate) form and grow, and the desirable texture of the spread is gradually lost. Sucrose hydrates are also found occasionally in ordinary frozen fruits. Although these sugar crystals are harmless, their appearance suggests mold and makes the product unmarketable. Experiments have shown that a combination of hermetically sealed containers, avoidance of contamination with sucrose hydrate crystals, and 30-percent replacement of the normal sucrose requirement with invert sugar is effective for preventing undesirable crystal formation in the frozen spreads. In experiments with sucrose sirups, held at minus 10° C., sucrose hydrate growth was found to be reduced (even though the sirup was "seeded" with fine crystals) when part of the total sugar was replaced by corn sirups, levulose, maltose, or invert sugar. Since these modifications do not increase cost or difficulty in processing to a significant extent, they can be adopted easily as preventive measures. Further information may be secured from the Western Regional Research Laboratory, Albany, Calif.

NEW STUDY FACILITATES ADJUSTMENTS ON FAMILY FARMS: A recent study by the Bureau of Agricultural Economics describes and analyzes the major kinds and sizes of farms in the United States. The more realistic classification, and better knowledge of what our farms are like, as found in the report, will

make it easier for economists to work on the problems of production efficiency in Agriculture. Especially important are the problems of adjustment on small-scale and small family farms, farms which have been largely bypassed in the process of mechanization. Gross production per worker on these small farms is only about a fourth to a half of that on medium commercial-family farms. And production both per acre and per unit of livestock has been found to be lower on these small farms than on medium and larger farms. The bulletin, (T.B. 1019) "Sizes of Farms in the U. S.," points out that more than a fourth of the nearly 6 million farms are part-time and residential or nominal units. Only 4.3 million are "regular farming units" that actually are farmed for a living, rather than used for a residence or for supplementary income. Although producing a substantial proportion of the farm products, the large-scale farms are not numerous, only about 100,000; and they are concentrated in certain areas and in particular types of production.

CHICAGO BAKERS FAVOR DEHYDRO-FROZEN FRUITS: About two-thirds of the commercial bakers and half the institutional bakers in Chicago expressed a favorable attitude toward the use of dehydro-frozen fruits for baking. This indicates a potential market for the dehydro-frozen fruits developed by the Western Regional Research Laboratory in an attempt to more nearly meet the needs of the baking industry. The storage and transportation advantages as well as the baking characteristics of the experimentally developed dehydro-frozen fruits appeared generally attractive to the Chicago bakers. These findings are from an RMA survey made by the Bureau of Agricultural Economics.

U. S. DEPARTMENT OF AGRICULTURE

Office of Information

Document No. 6
Revised Nov. 15, 1951
A USDA Document

IMPORTANT RECENT ACHIEVEMENTS OF DEPARTMENT OF AGRICULTURE SCIENTISTS

INCREASED OUTPUT PER MAN-HOUR ON FARMS: Agricultural technology has made possible outstanding gains in productivity of farm labor. Compared with 40 years ago, a man-hour of farm labor now produces 200 percent more food grains, 100 percent more feed grains, 75 percent more fruits and tree nuts, 50 percent more truck crops and cotton, about 50 percent more milk and poultry products--in short, twice as much farm output for human use. Gains in productivity of farm labor have not been uniform among geographic divisions, or among the crop and livestock enterprises. The increase in crop production per hour has resulted from both a decrease in man-hours per acre and a rise in production of crops per acre. Mechanization has been the chief factor in cutting man-hours per acre. Increases in production of milk per cow, of eggs per hen, and per livestock breeding unit, in general, have contributed significantly to the increase in livestock production per man-hour. Prospects are excellent in most parts of the farm economy for further gains in labor productivity. These and other findings are reported on in Technical Bulletin 1020, "Gains in Productivity of Farm Labor," issued by the Bureau of Agricultural Economics.

GROWTH REGULATORS INCREASE CACAO YIELDS IN COLOMBIA: USDA and Colombian scientists, working together under the Point IV program of technical cooperation, have successfully demonstrated that the use of two new hormones will increase cacao tree fruit-setting by two or three times. These materials are the sodioum salt of naphthalene acetic acid and para-chloro-phenoxy acetic acid. They are applied to the blossoms in the form of sprays in concentrations of 25-to-50 parts per million. Futhermore, it was found that a second application of these materials three weeks later greatly reduced a physiological disorder known as "Cherille Wilt." These two applications are sufficient for the crop. (At the time of this report the effects upon total bean production had not been determined.)

PROGRESS ON KENAF, JUTE SUBSTITUTE: Burlap fiber is now being produced on an industrial scale in the Western Hemisphere. This beginning of a new industry is the outgrowth of cooperative agricultural research between scientists of USDA and Cuba, the Dominican Republic, El Salvador, and Peru, initiated in 1943. Kenaf is a soft-fiber plant capable of replacing jute in every respect. The research to date has successfully shown how to grow kenaf in this hemisphere, and the project is now placing emphasis on developing mechanical techniques--to speed up and make more economical the extraction of fiber from the kenaf stalks. Until now, commercial production of kenaf has been largely confined to Cuba. This year it will be grown in commercial proportions in other countries of Latin America and in Florida.

POTATO RESISTANTANCE: Cherokee, first potato variety with high resistance to late blight and scab, has been released by the Department and the Indiana and Iowa Agricultural Experiment Stations. It is promising for Middle Western Soils now so badly infested with scab.

PETROLEUM OPERATIONS OF FARMER COOPERATIVES: (Circular C-139. FCA) This report tells what farmer cooperatives are doing to help keep a million farmers supplied with petroleum to power and lubricate their equipment and machinery. It discusses in some detail their work along five lines -- retail distribution, wholesale purchasing and distribution, refining and manufacturing, production and purchasing of crude oil, and transportation operations. It gives early development, volume, investment, benefits, and problems and possible improvment of these various activities among other things.

SURGICAL SPONGE FROM STARCH: Extensive clinical tests by physicians have demonstrated that a sponge-like product made from starch has unusual value as a hemostatic and therapeutic agent. Several pharmaceutical concerns are now making plans for starch-sponge production. The manufacturing process is based on the fact that a starch paste containing about 7 percent of cooked starch can be given a sponge-like form by relatively slow freezing, at temperatures between 28 degrees and 3 degrees Fahrenheit, followed by thawing. Starch sponge has a number of qualities that make it effedtive in the control of bleeding. Its most important property is that it is absorbed by body tissues. Thus, starch sponge impregnated with drugs, such as sulfathiazole, can be left in wounds to supply prolonged medication. This is a development of the Bureau of Agricultural and Industrial Chemistry's Northern Regional Research Laboratory at Peoria, Illinois.

WINTER COVER CROPS: In parts of the country having long growing seasons with relatively mild winters, cover crops can be used to give winter protection to the land, provide organic material, and aid in improving the soil's physical properties. Studies by the Soil Conservation Service point out two important precautions: (1) Cover crops which are seeded too late and with too low a state of soil fertility may fail to benefit either the soil or the succeeding crop; and (2) various cover crops might be effective in providing winter protection to the soil, yet their effects on the succeeding crop might be different. For example, a 6-year average in New Jersey has shown that sweet corn yields about 40 percent more following a ryegrass-vetch winter cover crop compared to ryegrass alone. In North Carolina, studies have shown that seedbed preparation for winter cover crops may cause erosion if poor stands and growth result. Late seeding, low fertility and fall droughts are outstanding causes of poor cover crop stands. In Alabama good progress is being made with self-seeding winter legume cover crops which promise to reduce the need for frequent seeding.

NEW SNAPBEANS AND LOWER COSTS: Probability that mechanical harvesting of snapbeans will soon be here has attracted the attention of growers, processors, and breeders to the possibilities in new varieties, and lower labor costs, says the Bureau of Plant Industry, Soils, and Agricultural Engineering. Some canners rate snapbeans as the canning vegetable with high harvest costs. There seems little doubt that a mechanical picker will be in commercial use before long. The strictly bush-type snapbean with the right characteristics of plant and pod, although not such a heavy producer as the pole type, may drive out the latter as a commercial crop because of lower labor costs. Snapbean production for fresh market and for canning and freezing has doubled in the past 20 years. But if new machines and new varieties can be developed, W. J. Zaumeyer, bean specialist, believes even this production will be increased.

LEARNING MORE ABOUT WIND EROSION: The portable wind tunnel has greatly aided wind erosion research in Great Plains areas. The Soil Conservation Service uses the wind tunnel to determine the effectiveness of conservation farming practices applied to farm land. It has been found that soils are more susceptible to wind erosion in the spring than in the fall owing to breakdown of clod structure and residues during winter. In Texas and Nebraska the wind tunnel studies showed that the stubble mulch system is more effective in controlling erosion on wheat land than any other cultural practice. Wheat land that was fall plowed following the wheat crop eroded at the rate of 60,000 pounds of soil per acre during the spring of 1950, while soil loss from a portion of the same land under stubble mulch tillage was only 280 pounds per acre. Studies in Kansas of the influence of row direction with respect to wind erosion proved that soil losses are about 3 times as great where the wind blows in the same direction as the rows as when it blows across them. The wind tunnel experiments also showed that land cropped continuously to sorghum is approximately twice as erodible as sorghum land in a rotation of sorghum-fallow-wheat.

TWIN CALVES AID IN CONTINUOUS GROWTH EXPERIMENTS: One pair of identical twin beef calves, used in nutrition studies, will yield data equivalent to that obtainable with 40 less closely related animals. The Bureau of Animal Industry is using identical beef calves to find the answer to the problem of supplying sufficient feed to keep young stock in thrifty condition during the winter or when feed is scarce. Under such conditions, young animals spend months in a semi-starved condition, perhaps even losing weight. This failure to keep young animals growing results in financial losses to the producers. Results of the first year's study shows that calves fed on a maintenance ration during their period of growth have picked up rapidly when put on full feed. In fact they have made gains that were nearly equal to gains of their identical twins on full feed during the growing period and did so economically. But these results are preliminary and must be verified by similar feeding studies before they can be taken as conclusive.

FARM STORAGE COSTS FOR SOYBEAN: Principal factors causing variations in the cost of loans on farm-stored soybeans are the source and size of the loan. This finding is made in a report relating to three of the principal cash costs incurred in storing soybeans, made by the Fats and Oils Branch of the Production and Marketing Administration under the Research and Marketing Act. These costs are interest for the use of credit, insurance against risk, and taxes. Additional phases of the study of farm storage of soybeans -- economic effects of the changes in quality during storage and types and costs of farm-storage structures and equipment--will be reported on when they are completed. Copies of the report, "Cash Costs of Farm Storage in Marketing Soybeans" are available.

CONSUMER FACTS: To help teachers, writers, and others who give consumers information on food, the Bureau of Human Nutrition and Home Economics has begun a new series of reference bulletins on individual foods. Heretofore, consumer educators have found it time-consuming to get such information together. Assembled in each bulletin is reliable information from many sources--including agencies of the Department--on nutritive value of the food, food value for money spent in comparison with other foods, seasonal supplies and sources, retail price trends, marketing operations and costs, selection, and use in family meals. The first two bulletins in this series deal with tomatoes and peaches.

CITRUS PACKINGHOUSE COSTS IN CALIFORNIA: (FCA Circular C-138) The Farm Credit Administration analyzed the costs of packing at 31 orange packing cooperatives in California. Findings revealed that packinghouses with volume over 600,000 boxes had a total costs of 83 cents. The cost increased as volume decreased with those packing under 200,000 boxes having a cost of 94 cents. The various factors affecting costs including use of machinery are discussed.

CANNED DATES: Pasteurized canned dates, which retain the color and other qualities of fresh dates, are a new food product now on the market as a result of research by the Fruit and Vegetable Chemistry Laboratory of the Bureau of Agricultural and Industrial Chemistry at Pasadena, California. In packing these dates, nitrogen is used to replace oxygen in the container. This process prevents the darkening that is characteristic of dates packaged by ordinary methods.

CHICKENS AND EGGS--INTERREGIONAL COMPETITION: Why has the poultry industry expanded so rapidly in particular areas in recent years? In the past, production of poultry and eggs has been widely dispersed, with some tendency toward producing nearer the market than nearer the production resources. Technology works partly toward a continuation of dispersal, but perhaps more toward concentration. Poultry production varies in size of enterprise and type of farm from region to region. Both demand and supply conditions are significant but supply conditions may be relatively more influential in shaping the future map of the production of chickens and eggs. The availability of labor, together with comparisons between its alternative uses, appears to be one of the principal determinants of location. The geographic pattern that may evolve will depend in part on developments in alternative enterprises. See Technical Bulletin 1031, "Interregional Competition in the Production of Chickens and Eggs," issued by the Bureau of Agricultural Economics.

NEW WINTER VEGETABLE MADE AVAILABLE BY INSECT CONTROL: A new method for keeping ears of sweet corn free of corn earworms was announced recently by entomologists of the Bureau of Entomology and Plant Quarantine. Until now, the corn earworm has prevented the profitable production of sweet corn in many localities, especially the deep South. Such infested corn cannot be sold. Spray applications of an emulsion containing DDT, mineral oil, and water, to silks and husks of developing ears at the right time kills the worms before they attack and ruin the corn. Two or three applications are necessary— one when silks first appear, the others at 2-day intervals.

LOW-COST VENEER FLOORING: The Forest Products Laboratory of the Forest Service at Madison, Wis., reports a method of drying veneer to produce flexible, flat sheets of low shrinking and swelling properties. This makes possible a new approach to using wood finish floors directly on concrete slabs, which are becoming increasingly popular in low-cost basementless houses. The veneer is dried, green from the lathe, in a hot press equipped with special cauls that grip it sufficiently to eliminate virtually all lateral shrinkage during drying. Subsequent swelling and shrinking are also less than normal. The hot platens dry 1/8 inch veneer in about 10 minutes, or more rapidly than conventional veneer dryers. One face of the veneer remains smooth and takes on a natural dull gloss during the drying process so that little if any further finishing is necessary other than conventional floor sealer. Strip flooring of 1/8-inch veneer has been laid as an office floor in mastic directly on concrete to determine characteristics and performance under constant use.

CHANGES IN FREIGHT RATES FOR FARM PRODUCTS: Railroad rates on agricultural as well as nonagricultural commodities have risen substantially over the last 40 years. The increases were approved by the Interstate Commerce Commission, acting under certain legislative and judicial pronouncements. Apparently the chief factor considered by the Commission in the rate-making decisions has been the need for adequate earnings by the carriers. Another element has been the ability of shippers to pay rates, although this has generally been applied by the I.C.C. only as modifying the adequacy of earnings principle. The relatively depressed condition of agriculture between the two world wars, chiefly because of its effect upon shippers' ability to pay, has substantially affected rate decisions with respect to agricultural commodities. Until 1946, the I.C.C. exempted agricultural commodities from some general rate advances or imposed smaller increases upon them. Since 1946, farm products have not received preferential treatment. Further details are presented in "Chief Factors Underlying General Changes in Rail Freight Rates," a study made by the Bureau of Agricultural Economics with RMA funds.

IMPORTANT NEW PLANT SOURCE OF HORMONES: Tomatidine, a substance isolated by Bureau of Agricultural and Industrial Chemistry researchers from tomato plants, promises to be a readily available and perhaps inexpensive source of the medically important sex hormones progesterone and testosterone. Investigations by the National Institutes of Health, undertaken at the Bureau's suggestion, show that these hormones can be synthesized from tomatidine by relatively simple procedures. Work on this constituent of tomato plants (which the Bureau also found has antibiotic properties) began in 1945. Characterization of the purified extract as a steroidal secondary amine indicated that it might be a possible source of various hormones, including cortisone. Synthesis of the sex hormones from tomatidine by the National Instituties of Health followed as part of the general program of cooperative research on development of plant precursors of cortisone and other hormones. This investigation was conducted by the Bureau of Agricultural and Industrial Chemistry's Biologically Active Chemical Compounds Division at the Agricultural Research Center, Beltsville, Maryland.

PATRONS APPRAISE COOPERATIVE RELATIONS: (FCA Circular C-140) This FCA report is based on a case study of the views of 2,750 patrons of Southern States Cooperative, Inc., Richmond, Va., to provide a guide to cooperatives in general on such activities. It summarizes patron's suggestions on 14 commonly used means of providing information and various suggestions they made on other services available from the cooperative.

PRUNING FOR CLEAR LUMBER: The Forest Service reports that artificially pruned Douglas-fir trees begin to produce clear lumber in about one-tenth the time required by trees on which the lower branches are left to die and drop off naturally. This was found in pruning investigations by the Forest Products Laboratory in the Pacific Northwest. Branch stubs persist as knots for as long as a century in unpruned trees, whereas artifically pruned branches of second-growth trees 30 to 50 years old healed over in about 10 years and from then on clear lumber was formed. The investigation uncovered no evidence that pruning left wounds that were infected by decay fungi. Fast-growing trees, as would be expected, healed over more rapidly than slow-growing ones.

DEVELOPMENT OF SUPERIOR BROILER CHICKENS: In an attempt to meet the demand of the broiler industry for better conformation and more rapid growth in young chickens, a new variety of Cornish chicken, known as the Silver Cornish, has been developed by the Bureau of Animal Industry, at Beltsville by crossing Brooksville Columbians with Dark Cornish, mating the crossbred progeny among themselves and selecting for desirable utility qualities and for silver or Columbian feather pattern. The Silver Cornish at 10 weeks of age had an average breast angle of 57 degrees in 1949 and 58 degrees in 1950. Measurement of the breast angles of Dark Cornish at the same age showed 61 and 62 degrees for the two years. The corresponding figure for New Hampshires in 1950 was 53 degrees. Under range conditions in 1950, the average weights at 10 weeks of age were as follows: Silver Cornish 2.38 pounds, New Hampshires, 2.35 pounds, and Dark Cornish, 2.06 pounds.

MECHANICAL DISPENSERS BOOST FROZEN ORANGE JUICE SALES: The widespread serving of reconstituted frozen concentrated orange juice by certain units of the public feeding industry such as drug-store fountains and snack bars has created a need for more effective means of dispensing the juice in a sanitary manner while preserving the natural qualities of the product. A study to determine the effects of the use of mechanical counter-type machines on sales volume and preservation of the qualities of such juices has been made by the Production and Marketing Administration USDA under the Research and Marketing Act. Cooperating were the Bureau of Agricultural Economics, the Florida Citrus Commission, drug and food chain stores, citrus products distributors, and mechanical dispenser manufacturers. Use of mechanical dispensers, it was found, increased sales, improved service, and proved generally more efficient then the practice of dispensing juice from jugs. The report, "Merchandising Reconstituted Frozen Concentrated Orange Juice Through the Use of Mechanical Dispensers" is available from PMA.

SNOW SURVEYS: Measurements of snow cover at the end of the 1951 snow season were made by the Soil Conservation Service on 1,151 snow courses laid out on the high watersheds of the 12 Western States and British Columbia in Canada. Under direction of 8 snow survey project leaders, 852 part-time snow surveyors traveled a total of 39,000 miles by snowshoe, ski, oversnow vehicle, or aircraft to make more than 46,000 individual measurements of the water content of the snow cover. Based on these measurements and the relationships between the snow cover and runoff which have been established for the major watersheds, water supply forecasts were made at 260 stations. In addition, more than 18,000 copies of the various forecasts were issued to agricultural, power, industrial, municipal, and recreational water users, and to those charged with forecasting flood stages.

CHEMICALS ON THE FARM: Chemicals go a long way in offsetting farm labor shortage and increasing yields during the emergency, says Dr. Robert M. Salter, former chief of the Bureau of Plant Industry, Soils, and Agricultural Engineering. He says "research has developed a wide range of new uses for them. In 1945 the use of chemicals for weed control was small. Last year U. S. farmers applied herbicides to 30 million acres of cropland. Equally spectacular progress has been made in sect control and the application of chemical fertilizers. One of the most significant current developments is the use of preemergence sprays that kill weed seedlings during germination."

ORDINARY FEEDS CONTAIN ENOUGH RIBOFLAVIN FOR PIGS: One of the most important vitamins for efficient growth of pigs, vitamin B_2, or riboflavin, is usually available in suffieient amounts in ordinary feeds, such as farm-grown grains and forages, according to recent studies conducted by the Bureau of Animal Industry. Even pigs raised in a dry lot (without pasture) will get enough riboflavin in a good normal ration to supply the needs for maximum growth. In fact it was necessary in these tests to use hominy grits in place of yellow corn meal and reduce the quantity of alfalfa meal to get a ration low in riboflavin. The pigs fed on the mixture containing hominy grits required more feed to produce a pound of gain than similar pigs fed normal rations. They had poor appetites, rough hair coats, and rough skin that was sometimes coated with secretions from skin glands. The effects of the riboflavin on growth was especially noticeable during the first 10 weeks.

PRACTICES OF COMMERCIAL MIXED-FEED MANUFACTURERS: A study of "Inventory and Hedging Policies of Commercial Mixed-Feed Manufacturers in the United States" has been made by the Production and Marketing Administration and the Bureau of Agricultural Economics in cooperation with Agricultural Experiment Stations of Illinois, Oregon, Pennsylvania, Tennessee and Texas. Over-all price risks of feed manufacturers resulting from the accumulation of ingredient inventories in excess of immediate needs were moderate, according to the report. However, for some ingredients the risks were found to be seasonally large. Relatively large stocks of soybean meal, fish meal, and alfalfa meal were accumulated by manufacturers who assumed a large proportion of the seasonal price risks on each of these commodities and the speculative profits and losses on them tend to be disturbing factors in the mixed feed industry, it was stated. "Development of a broad, well-conducted futures markets for soybean meal, fish meal, and alfalfa meal would contribute to stability in the mixed-feed industry," it was found. Copies of the report, titled as above, are available.

LOOM ATTACHMENT FOR WEAVING DENSE COTTON FABRICS: Cotton processing specialists have perfected a device for standard looms that permits the weaving of extra-dense cotton fabrics. Textile manufacturers are showing an active interest in both the loom attachment itself and the "high-pickage" fabrics produced with it. These fabrics have many more filling threads per inch than the usual closely woven cotton goods. They appear especially promising for use in cotton goods designed to resist wind and rain, such as outer clothing, tents and tarpaulins—all important items for the armed forces. This is a development of the Bureau of Agricultural and Industrial Chemistry's Southern Regional Research Laboratory at New Orleans, Louisiana.

UP-TO-DATE HOME FREEZING: Freezing specialists of the Bureau of Human Nutrition and Home Economics have translated results of recent experiments in their laboratories the country over, into dependable, up-to-date directions for freezing fruits and vegetables at home. These directions are available in "Home Freezing of Fruits and Vegetables," Home and Garden Bulletin No. 10. For the homemaker who is eager to freeze more foods in more ways, this bulletin has the answers. Directions are given for freezing 35 fruits and 37 vegetables, and some of them in a variety of forms. To help the homemaker do a good job, the bulletin also gives planning pointers, tables of approximate yield of frozen food from fresh fruits and vegetables, descriptions of types of containers and their uses, and directions for loading the freezer.

CONSUMERS PREFER BLEND OF FROZEN CONCENTRATED APPLE JUICES: The Bureau of Agricultural Economics recently undertook a survey to determine which of several frozen concentrated apple juices developed by the USDA Western Regional Laboratory and the Washington State Apple Commission will be most popular among consumers. The over-all project is primarily concerned with increasing utilization of Delicious apples of grades not suitable for marketing as fresh fruit because of lack of red color. The first part of the survey, reported on in "Consumer Preferences for Selected Frozen Concentrated Apple Juices," indicates that the most preferred concentrate was the blend of 50 percent Delicious apples, 20 percent Winesap, 20 percent Jonathan, and 10 percent Rome Beauty at 0.4 percent acidity. The straight Delicious at 0.4 percent acidity was the one preferred next. The least preferred was the straight Delicious at 0.2 percent acidity, although young people under 20 preferred this type to the others. * * * Market tests of the most preferred blend were conducted in Modesto, California and Tyler, Texas. Among the homemakers who knew about this product about 20 percent had bought it. It was found that nearly 7 out of 10 of those who bought the product made repeat purchases and about 4 out of 10 made as amny as four or more separate purchases during the 10-week market test period. Principal use was as a breakfast juice or a between-meal snack. Those who used this product liked it and the reason mentioned most frequently was its "full-bodied," "real apple" flavor. These latter results are reported on in "Consumer Reaction to Frozen Concentrated Apple Juice in Modesto, California and Tyler, Texas."

SMALL POULTRY DRESSING PLANTS: Small local poultry dressing plants are recommended as a method of making dressed poultry more readily available in the producing areas and in and around towns and smaller cities, according to a report of the Farm Credit Administration made with Research and Marketing Act funds. It is published as FCA Miscellaneous Report 147, "Plans and Operations of Farm and Small Commercial Poultry Dressing Plants." These small plants not only help to increase the per capita soncumption of poultry, it stated, but also help to prevent price-depressing gluts on the large key poultry markets. Three suggested floor plans are shown. Photographs of actual operations at the plants studied are included as well as several drawings of details of equipment.

LEAFHOPPER CARRIES WESTERN-X DISEASE: A leafhopper has been shown by entomologists of the Bureau of Entomology and Plant Quarantine and cooperating States, to carry the virus that causes western-X disease of peach trees. This is the third time within the last few years that scientisits have proved leafhoppers to be carriers of important virus diseases of trees. They showed that 4 species of leafhoppers carry phony peach in southern States, and that another leafhopper spreads phloem necrosis of elm trees.

NEW PINE HYBRIDS: Among the pine hybrids developed at the Institute of Forest Genetics maintained by the Forest Service in California are: a cross between Jeffrey and Coulter pines that is resistant to attack by the pine reproduction weevil that has wiped out previous pine plantings in California brushfields; a cross between eastern white and Himalayan pines that has already shown degree of resistance to white pine blister rust; and a cross between Digger and Torrey pines that may be valuable in dry, hot situations if it combines the good growth habit of Torrey with the fast growth and drought resistance of Digger.

UPRIGHT LOADING CUTS CANTALOUP LOSSES: Substantial savings in container breakage, melon damage, and loading capacity have been found to result from loading cantaloup crates upright instead of in the conventional lengthwise method in rail shipments. The study was made under RMA contract by USDA with a non-profit organization of vegetable and melon growers and shippers of California and Arizona, and with the cooperation of railroads and a wooden container organization. In fifteen pairs of transcontinental test shipments, in which one car of containers was loaded upright, accompanied by a second car loaded in the conventional lengthwise manner, breakage of containers in the on-end loads averaged only one-third that in cars in which crates were loaded lengthwise. Bruising of melons in upright loads was found to be less than half as great as in cars using the common method of loading. Loading upright gave a capacity of 312 crates per car as compared with 288 crates loaded lengthwise. The interim report in this study, "Reduction of Cantaloup Loss and Damage in Rail Transportation Through Use of the Upright Loading Method," may be obtained from the Production and Marketing Administration, USDA.

MORE DURABLE TERRACES: Imrpovements continue to be made in the planning and application of terraces for soil and water conservation. Probably the greatest improvement is a revised concept of water disposal in planning terraced fields. The newer method used by Soil Conservation Service technicians consists of placing outlets in accordance with the drainage pattern of the field, establishing vegetation for protection of outlets before the terraces are constructed, and cresting the terraces on ridges between outlets. In fields planned in this manner the terraces are more durable and easier to maintain. little or no erosion occurs on outlets, as they are well protected. The rows, which are laid parallet to the terraces, drain in one direction, thereby preventing washout across rows. There are fewer point rows in such a system.

ANTIBIOTICS SPEED GROWTH OF UNTHRIFTY PIGS: The new antibiotic-containing feed supplements are much more effective in transforming runts into healthy pigs than they are in speeding up the growth of normal animals. This finding was the result of controlled feeding experiments conducted by the Bureau of Animal Industry. Growth rate was increased nearly 100 percent when antibiotics were added to the diet of weak unthrifty pigs, but the increase in healthy pigs was no more than 10 to 20 percent. In some instances, normal pigs showed no effect at all from the compounds. This new development in feeding has moved to the farm surprisingly fast. Farmers have been quick to adopt the use of antibiotics and are reporting excellent results from feeding the supplements to growing-fattening hogs and breeding stock under average farm conditions. The cause of the marked reaction of unthrifty pigs to antibiotics has not been definitely determined.

SEEK QUICKIE FORAGE STRAINS: Early establishment of forage crop seedlings get attention at the Department's Pasture Laboratory, State College, Pa. Dr. Angus A. Hanson of the Laboratory sees great differences in this regard between species, but finds advantage in picking out superior plants within species. He says research men already know there are such within-species differences in ability to withstand short periods of drought, not yet field demonstrated. "But," he says, "capacity to develop a root system rapidly in early growth would have a marked effect on drought resistance and stand." Hanson notes that plant's tolerance to low light intensity is especially important in forage mixtures with tall, shading plants. Here significant differences exist among Ladino clover plants.

FEDERAL-STATE EGG GRADING PROVES PROFITABLE FOR FARMERS: Ohio farmers when paid for eggs according to quality, as measured by official grades, make an extra effort to produce better eggs according to a Farm Credit Administration study. Egg handlers in the States using the official grading service increased their percentage of eggs marketed in the top grades in 5 years from 55.6 percent to 71.6 percent. The study, conducted with funds provided by the Research and Marketing Act, is published as FCA Miscellanrous Report 153, "Some Effects of Marketing Eggs in Ohio According to Official Grades." Other benefits were that farmers selling to buyers using the official grading service increased their egg production more than those selling elsewhere, they produced larger eggs, and received higher prices.

KNIT GOODS MARKET FOR COTTON: At the present time and in the forseeable future knit goods afford a sizable and stable outlet for raw cotton of relatively high grade and medium staple lengths. This is reported in a study of "Market Outlets for Cotton in Knit Goods," by the Cotton Branch, Production and Marketing Administration, under the Research and Marketing Act. The report is a segment of a broader study designed to determine market outlets for raw cotton in each of the principal cotton textile products. A previous report has been made on some woven fabrics and other types of fabrics are to be covered in later reports. Copies of the report are available.

FROTH-FLOTATION CLEANING OF SWEET CORN: The Bureau of Agricultural and Industrial Chemistry's froth-flotation process for removing nightshade berries and other contaminants from vined green peas, which was successfully adapted for cleaning lima and soy beans, has proved highly efficient also in the cleaning of cut sweet corn for canning. In this process the corn itself acts as a foaming agent, making the addition of oil or detergent to the water cleaning bath unnecessary. Damaged kernels, corn-ear worms, and other foreign material are effectively floated off with the foam, leaving the whole corn kernels clean and uncontaminated. Several canning plants are now using this process for corn. This is a development of the Bureau's Fruit and Vegetable Products Laboratory at Prosser, Washington, and the Western Regional Research Laboratory at Albany, California, in cooperation with the corn-canning industry.

CROP-HAIL INSURANCE: When crop prospects are average or better, crop-hail insurance is especially useful in protecting prospective net income. "Hail Insurance on Growing Crops" issued by the BAE as Agriculture Information Bulletin 56 deals with the types of contracts for crop-hail insurance that may be obtained, settlement of losses, and other important provisions of the contracts. A discussion of how crop-hail insurance may be used along with Federal all-risk insurance is included.

POTATO SAVES COPPER: The Kennebec potato--with high yield, cooking quality, and wide adaptability--has high resistance to late blight which makes unnecessary the heavy spraying with cooper-containing spray, the only protection that permits some varieties to produce a crop--for example, the Green Mountain variety. About 50 million pounds of copper sulphate has been used each year against late blight, that quantity containg nearly 20 million pounds of actual copper.

PROGRESS AGAINST BAFFLING X-DISEASE OF CATTLE: Scientists have produced X-disease of cattle experimentally but as yet the agent that actually causes the disease has not been determined. This conclusion was the substance of discussions at a recent conference of research workers from 13 State agricultural experiment stations who are cooperating with the Bureau of Animal Industry. All previous efforts to reproduce X-disease (also known as hyperkeratosis) were futile although it has spread to 37 States. X-disease is being studied under a special R&M project. Active work is under way in 10 States, New York, Pennsylvania, Tennessee, Georgia, Texas, Nebraska, Indiana, Illinois, Alabama, and Colorado. The other six are Michigan, Kansas, North Dakota, New Jersey, Connecticut, and Montana. During 1951 identical symptoms and characteristic changes in the skin and some internal organs, as are found in field cases of X-disease, were produced under controlled experimental conditions with several different materials. In natural cases there is often failure of appetite, depression, loss of condition, watering of the eyes, slobbering, and a progressive hardening and wrinkling of the skin due to increased horny material, or keratin, hence the name "hyperkeratosis." From the evidence now available, no specific compound or feed has been found that consistently produces it. Only single lots of the materials used have produced the disease symptoms.

GOOD ROTATIONS PAY OFF: Extensive studies by the Soil Conservation Service in all parts of the country have shown that a crop rotation should aid in overcoming such difficulties as crust formation, soil compaction, development of plow-pan, poor internal drainage, and excessive runoff and erosion. A good rotation, supported by the tillage practices to prevent soil losses, is considered the most effective method for maintaining cultivated soils in a physical state favorable to good crop yields. Many studies support these conclusions. For example, in the New Jersey truck crop area, an adapted rotation over 4 years brought a 33 percent increase in tomato yield, and a 46 percent increase in sweet corn, over continuous cropping. This rotation land lost only 38 percent as much soil and 24 percent as much water as the continuously cropped land. In Idaho, wheat yields and protein content were substantially increased by rotations containing legumes and legume-grass mixtures. In a 20-year test in Iowa, the 1950 yield of corn, in a corn-oats-hay rotation, was 115 bushels an acre as compared with only 22 bushels for continuous cultivation. On highly erodible sloping land in Wisconsin, rotations proved ineffective for control of erosion, thus confirming the opinion that livestock farming should be developed for such areas, using mostly sod crops, with stubble-mulch practices where grain is grown.

THINNING SPEEDS TIMBER GROWTH: Studies by the Forest Service in second-growth stands of Douglas-fir in the Pacific Northwest ranging in age from about 25 to over 100 years are showing that thinning always speeds up the production of large-size trees and that it may increase over-all volume growth as well. Twelve years after thinning, total growth in a stand thinned at age 38 years was 13 percent greater than in an unthinned stand, even though the thinned stand had 25 percent less growing stock. Careful attention to logging techniques makes the thinnings pay their own way even in stands as young as 27 years. Thinnings from a 50-year old stand have yielded substantial profits.

AGRICULTURAL FREIGHT RATES: Elimination of passenger trains operated at a direct deficit would benefit freight shippers, and should, at the same time, result in a substantial improvement in passenger earnings. This finding is set forth in a study, "Factors Affecting Freight Rates on Agricultural Commodities; The Railroad Passenger Deficit," undertaken by the Production and Marketing Administration, USDA, under the Research and Marketing Act of 1946. The study shows that the (railroad) passenger service deficit, as determined by the Interstate Commerce Commission, may be substantially reduced or eliminated in its entirety. It stressed that this does not mean that entire segments of railroads should be abandoned, but applies only to individual passenger trains operated at a direct deficit. "Sound economic principle supports the elimination of passenger trains operated at a direct deficit," the report concludes. "Normally, private enterprise will not produce any service unless it yields revenue covering costs. The railroads, however, are able to continue deficit passenger services because the costs of passenger operations, in large part, are recovered from the users of freight services." Copies are available.

FOR CONTROL OF EVERGLADES CANAL WEEDS: Investigations on the flow of water in the Florida Everglades drainage channels show that not only hyacinths but other aquatic plants menace the arterial canals of the area. Original studies showed that a heavy growth of hyacinths caused a loss of about one-half the flow in the canals. The past year's measurements reveal, however, that underwater mosses are the worst type of aquatic growth yet encountered in blocking flow. The main offender is the submerged weed, Najas guadelupensis (Spreng.) Morong, which infests a majority of drainage canals in south Florida. The weed has plant roots at the bottom of the canal, and they produce long floating strands of dense growth. Measurements show that the flow in the canals with such growth is reduced to a tenth or less of the flow that occurs when the canal is clear of vegetation. Experiments with various aromatic petroleum oils and solvents indicate that such a substance might furnish an economic means of controlling submerged weed growths in drainage channels. Such experiments are being carried out by the Soil Conservation Service and the Central and Southern Florida Flood Control District.

NEW RESIN-ACID DERIVATIVE: Through chemical treatment of cleaned pine gum, the Bureau of Agricultural and Industrial Chemistry's Naval Stores Research Division has developed a new resin-acid derivative, maleo-pimaric acid, which has several potential uses. It has been found particularly valuable in the production of synthetic resins and emulsifying agents, and as a special component of plastics. This compound is expected to be in large scale commercial production soon.

WIDE ROWS FOR CORN-WHEAT SEQUENCE: Plant scientists of the Department and the Ohio State Agricultural Experiment Station have worked out a new pattern for growing corn, wheat, and meadow crops in sequence. It is adapted especially to conditions in the East. . . and to the use of small tractor (as well as horse drawn) wheat seeding equipment. In cooperative Ohio-USDA experiments, G. H. Stringfield and L. E. Thatcher found that 60-inch rows between the corn and the use of a full-season hybrid will yield fully as much corn on good land during a favorable season as an early hybrid in 40-inch spaced rows. The 60-inch spacing permits the seeding of wheat with small tractor machinery between the standing rows of unharvested corn at the ideal time. Then the corn may be picked with a mechanical harvester when fully dry.

CO-OP FERTILIZER PLANTS IN NORTH CENTRAL STATES: Cooperative fertilizer is furnished North Central States by 23 cooperative fertilizer plants which in 1949 manufactured 518,816 short tons of fertilizers, an increase of about 31 percent over the 1948 production, according to a Research and Marketing Act sutdy conducted by the Farm Credit Administration. Results were published as FCA Miscellaneous Report 149, "Economic Aspects of Transportation Affecting a Cooperative Fertilizer Program in the North Central States." Regional purchasing cooperatives accounted for about one-seventh of the fertilizer materials shipped to North Central States in 1949. Three-fourths of the shipments included high analysis fertilizer mixtures and one-fourth was made up of separate fertilizer materials exclusive of rock phosphate.

FOR DESIGN OF UPSTREAM FLOOD CONTROL STRUCTURES: Sedimentation studies have been made by the Soil Conservation Service to determine the correct design of structures in connection with the Department's flood control action program in the Little Sioux watershed in western Iowa. Sedimentation surveys of the 30 small reservoirs showed variations in rates of watershed sediment production ranging from 440 tons to 110,900 tons per square mile annually. Analysis of the sedimentation information, coupled with climatic factors, provided the basis for a formula now being used for design of small dams and reservoirs throughout the watershed. It eliminates under-design and premature loss in efficiency of the structures. A similar study is in progress in the Tallahatchie and Yazoo watersheds of northern Mississippi. During the past year, sedimentation and watershed surveys were completed on 23 reservoirs in this basin.

REGIONAL DISTRIBUTION OF POPULATION IN 1975: The Bureau of Agricultural Economics and the Bureau of the Census have joined in developing population projections to 1975 for each of the major geographical regions of the United States. The interest of agricultural economists in such projections stems primarily from their concern over future demands for products of farms. "Projections of Regional Distribution of the Population of the United States to 1975" reviews the background of regional population projections in the United States, describes in some detail a relatively simple method of projecting the regional distribution of the population by age and sex, and presents projections of population prepared by this method for each of the 9 major geographical devisions to the year 1975 and projections of age-sex distribution of the population of the 4 major geographic regions to 1960.

COW MUST PRODUCE WELL TO BE PROFITABLE: Analysis by the Bureau of Dairy Industry of records of production and feed consumption for 900,000 cows in dairy-herd-improvement-association herds in 1950 showed that a cow that produces only 200 pounds of butterfat a year seldom makes a profit for her owner, regardless of production costs and milk prices. Cows that averaged 200 pounds of butterfat consumed $119 worth of feed and returned $108 over feed costs. Under the long-standing rule that the cost of feed represents only half the total cost of keeping a cow, these cows did not pay their way by about $11. The Bureau showed that in most areas a cow should produce more than 200 pounds of butter fat a year to make a profit for her owner. As the average production level increased, the relationship of net income over feed cost became more favorable. For instance, the average butterfat production for all DHIA cows in 1950 was 370 pounds. These cows consumed $147 worth of feed and returned $212 over feed cost to their owners, a net income of $65 per cow. Cows that averaged 600 pounds of butterfat in 1950 consumed $196 worth of feed and returned $435 over feed cost, a net income of $239 per cow.

PREPACKAGING APPLES AT POINT OF SHIPMENT ECONOMICALLY FEASIBLE: A detailed study of prepackaging apples at point of shipment was carried out during 1949 and 1950 under RMA contract between a state apple advertising commission and USDA. The project was supervised by the Production and Marketing Administration, USDA, and had the cooperation of the Washington Agricultural Experiment Station, State College of Washington, growers and shippers organizations, container companies, which furnished experimental quantities of supplies and equipment, railroads, and retail store organizations. The research uncovered a number of ways of reducing costs of prepackaging through reductions in cost of materials, through development of new packaging techniques and through demonstrating savings in merchandising prepackaged apples. Preliminary investigations indicated that consumer acceptance of prepackaged apples was very good. Details are available in Agricultural Information Bulletin No. 29, "Prepackaging Apples at Point of Production."

VITAMIN B_{12} PRODUCTION: Vitamin B_{12}, or the "animal-protein factor," is an essential ingredient of mixed feeds for livestock. The Bureau of Agricultural and Industrial Chemistry has discovered several microorganisms that produce this vitamin and has determined optimum conditions for their growth to obtain good yields. One organism isolated by, and a fermentation procedure developed by, the Western Regional Research Laboratory, Albany, California, have been furnished to a plant on the West Coast, which uses them in commercial production of vitamin B_{12} from blackstrap molasses. The Northern Regional Research Laboratory at Peoria, Illinois has isolated another organism and developed a method for its production of vitamin B_{12}, using various grain byproducts in the culture media. This development is also in commercial operation.

NEW INSECTICIDE IN ROOTS OF COMMON WEED: A potent new insecticidal chemical was found recently in the roots of a common native perennial weed by insecticidal chemists of the Bureau of Entomology and Plant Quarantine. Early experimental trials with the chemical, derived by extracting the active principle from plants of the genus Heliopsis, (commonly called "ox-eye",) showed it appreciably more toxic to houseflies than pyrethrum, the standard of comparison The effect of the chemical on insects other than the housefly, what it may do to man or animals, plants or soils, or how difficult it may be to obtain from the natural weed source, or to manufacture, remain to be explored. There are a number of species of Heliopsis in this country, all native to the U. S. Three of them tested for insecticidal activity so far indicate the most powerful comes from scabra.

LEGUMES NEED RIGHT BACTERIA: When a farmer inoculates his legume seeds with the right bacteria, he is starting a "chain reaction," according to Department scientists. When legume seeds are so inoculated . . . an essential requirement . . . it mean more nitrogen for the legume plants, more nitrogen for grass plants growing with the legumes and for crop plants following the legumes, more protein yield per acre, better grazing and better hay. Dr. Lewis W. Erdman, bacteriologist of the Department, says that today special inoculants are available for the following legumes commonly sown in the spring: (1) alfalfa and sweet clover; (2) red, white and alsike clover, all three of which use the same strains equally well; (3) peas grown for all purposes; (4) soybeans usually inoculated with mixed strains of soybean bacteria because some varieties prefer one and some another.

TRUCK VS. RAIL TRANSPORTATION OF AGRICULTURAL COMMODITIES: Motortrucks predominate in the handling of poultry and its products, and of milk, and most types of livestock going to leading markets. Almost all of the receipts of live poultry at principal markets in 1950 arrived by truck; only 1 percent came by rail. For shell eggs, milk, hogs, cattle, and calves, and dressed poultry, the proportion hauled by truck was more than 70 percent. At the other extreme are cheese and oranges; railroads handled two-thirds of the total in 1950. The differences in the proportions hauled by truck and rail may be explained partly and sometimes chiefly by distance of markets from supply areas. The shorter the distance, the greater generally is the advantage of highway transportation, especially in costs; the longer the distance, the greater the advantage by rail. But other factors, such as superior speed and less damage, were also important for some commodities. The proportion of traffic carried by truck rose between 1939 and 1950, although the trend was reversed during World War II because of scarcities of motor vehicles, parts, fuel, etc. For further details see "Transportation of Selected Agricultural Commodities to Leading Markets by Rail and Motortruck, 1039-50," a study made under authority of the Research and Marketing Act, by the Bureau of Agricultural Economics.

WORTHWHILE USES FOR PEAR WASTE: The Bureau of Agricultural and Industrial Chemistry is making a multi-pronged attack on the problem of converting pear-cannery waste from an acute disposal problem to an asset. Considerable progress has been made recently in this research. In Oregon, the Bureau has worked with a farmer cooperative in packing more than 1,400 cases of pears in syrup prepared from pear-waste juice. In California, cooperative research with a canners' organization demonstrated the commercial feasibility of a process for manufacturing molasses and dry pomace from the waste. These byproducts can be used for livestock feed. The results are cooperative developments of the Western Regional Research Laboratory at Albany, California, and the Fruit and Vegetable Products Laboratory at Prosser, Washington.

ANTIBIOTICS AID GROWTH OF CHICKENS AND TURKEYS—Aureomycin, bacitracin, penicillin, and terramycin are being used commercially to stimulate growth of chickens and turkeys. Studies conducted by the Bureau of Animal Industry show that they do not improve egg production or hatchability when fed to breeding birds. Their maximum effect on weight of young birds is observed at 6 to 8 weeks of age, but there is still a significant effect at the ages that chicken and turkey broilers are marketed. In one experiment the average live weights of 14-week old Beltsville Small White turkeys fed diets without and with aureomycin were as follows: with 20 percent protein 2387 and 2580 grams, with 23 percent protein 2606 and 2604 grams, with 26 percent protein 2966 and 3004 grams and with 29 percent protein 2957 and 3088 grams. The basal diet was a good turkey starting mash containing 5 percent each of meat and fish meals. The level of aureomycin was 9 grams per ton.

FRIENDLY FUNGUS: Forest pathologists of the Department have reduced decay of stored fence posts and pulpwood by a "friend vs. foe" fungus method. After spraying peeled southern pine with ammonium and sodium fluoride, Ralph M. Lindgren of the Division of Forest Pathology reports that these chemicals apparently stimulate the growth of a "relatively harmless" mold (actually an antibioltic fungus—one that fights another form of life.) This fungus prevents the establishment of the decay fungi and makes the wood more permeable to oil and water solutions and therefore may aid in its preservation.

EGG STORAGE FINDINGS: Eggs placed in storage early in the season decline less in quality than those stored late in the season, according to a study of "Changes in Egg Quality During Storage" made by the Production and Marketing Administration under the Research and Marketing Act of 1946 with the assistance of Cornell University. The study was based on changes in the level of quality in 104 lots of eggs held in storage; 82 lots in midwestern warehouses and 22 in eastern warehouses. The studies indicated that early storage of eggs may generally be more profitable than later storage. Another conclusion reached was that low quality eggs, if stored should be stored early in the season rather than late, and held for a shorter period than high quality eggs. Copies of the report, titled as above, are available.

BOXBOARD FROM STRAW USEFUL FOR WIRE-BOUND CONTAINERS: Experiments in cooperation with industrial firms demonstrated that the low-grade wood veneer used in making wire-bound shipping containers can be replaced satisfactorily with panels of an improved straw boxboard having the exposed edges protected with sheet metal. In this use, straw boxboard could replace much of the 1.5 billion square feet of wood veneer needed annually for wire-bound boxes and, at the same time, provide a use for about 500,000 tons of surplus wheat straw. In performance tests by an industrial research laboratory, wire-bound boxes made from the improved straw boxboard according to the standard design and containing loads of 100 to 200 pounds withstood dropping and rough handling as well as the boxes made from like thickness of wood veneer. The improved straw boxboard was developed by the Bureau of Agricultural and Industrial Chemistry's Northern Regional Research Laboratory at Peoria, Ill.

NEW JOB FOR BEES! A new productive job has been found for bees and a potential profit for bee owners who have the skill to manage the bees in the new job. Apple pollen loses its power to "germinate" within a relatively short time, even when dried and kept in ordinary cold storage. It is, however, easy to collect practically pure apple pollen from bees working in an apple orchard and returning to a hive within the orchard. An ingenious trap of two pieces of coarse-mesh screen set at the entrance to the hive brushes off part of the load of pollen a bee brings back, and these pellets fall into a cup beneath the trap. Entomologists of the Bureau of Entomology and Plant Quarantine rob bees in this way, then deep-freeze the freshly gathered pollen. The pollen germinates well when thawed. Stored pollen is thus available for commercial use. Apple breeders may find such storage very valuable. Pollen of a late-season apple variety can be used in making a cross with a variety that blooms early in the spring. In case of bad weather at blossom time the stored pollen might help in saving a crop.

SUGAR BEETS THAT KEEP: Probability that beet sugar factories can operate longer in spite of the shorter digging period that has come with mechanical harvesting, is an incidental result of recent research. Spoilage in the big piles of sugar beets and the consequent reduction in sugar yield, with a loss of $10,000,000 a year, says Dr. G. H. Coons of the Plant Industry Station, had become a No. 1 problem. Its solution demanded either more factories or larger ones, or sugar beets slower to heat and burn up their sugar, or handling methods that would keep down the temperature. Since new factories or expanded ones require critical steel and labor, it is fortunate, says Coons, Progress has been made in handling sugar beets in storage and that research promises varieties better adapted to holding.

CLIP SPINACH AND STRIP KALE: A study of the Norfolk, Va., production area for spinach, kale and collards has revealed that demand for clipped spinach and stripped kale is increasing. The RMA study, made by the Production Marketing Administration and Bureau of Agricultural Economics with the cooperation of growers and shippers and wholesalers and prepackers in sales markets, is titled: "Problems and Practices in Marketing Norfolk Spinach, Kale, and Collards." Other findings: Field stripping of or clipping kale and spinach is recommended to reduce labor and container costs, while machine harvesting would save even more labor. Growers and shippers of spinach will find it more profitable to give greater emphasis to quality and less to quantity. Production of medium-sized kale and collards should be stressed. This could be obtained by closer planting without unduly reducing yields. Copies of the report are available.

FARMERS' MARKETING AND PURCHASING COOPERATIVES IN PUERTO RICO 1948-49: Although it is difficult for Puerto Rican farmers to improve their financial condition because of the handicaps of small farms and low income, this study of the Farm Credit Administration, shows that the nearly 13,000 active members of the 12 farmer associations on the Island have benefited financially from their cooperative marketing and purchasing activities. It is published as FCA Miscellaneous Report 152. Conclusions reached are that greater benefits for more farmers are possible through the development of new processing services for farm crops, and manufacturing services for certain farm supplies.

ALFALFA DRYING: Stabilization of the carotene content of alfalfa is a problem of great importance. The use of an oil spray as a carrier for the antioxidant is being studied. The main problem is still unsolved, but the tests with oil yielded a most interesting contribution to alfalfa dehydration. Oil spraying was found to keep down dust, with resultant advantages from the health and fire-hazard standpoints. Therefore, alfalfa dehydrators are rapidly adopting the oil-spray procedure. This is an accomplishment of the Bureau of Agricultural and Industrial Chemistry's Western Regional Research Laboratory at Albany, California.

TCA GAINING AS A WEED GRASS KILLER: The chemical TCA (sodium salt of trichloroacetic acid) has not only proved itself a worthy foe of perennial weedy grasses in extensive field trials, but also is showing promise against grasses in certain TCA-tolerant crops, such as sugar beets and table beets, flax, alfalfa, and other legume crops, according to a report by the Department. It says if definite treatment practices and dates can be established by future research, TCA will become one of the farmers' most dependable killers of grass weeds such as quackgrass, Johnson grass and Bermuda grass. TCA does its damage as it comes in contact with perennial weed roots. Contact with aboveground foliage has little effect on the weed, as the poison is not transferred from the foliage to the roots. Much of TCA's success, therefore depends on leaching of the chemical down through the soil to root level. This means the poison should be applied at a time of year when soil moisture conditions or rainfall can be counted on to leach it.

CO-OP FRUIT AND VEGETABLE PROCESSING: An economic analysis of the sales of cooperatives processing fruits and vegetables by the Farm Credit Administration shows that about 45 percent of their sales were to wholesale grocers, 27 percent to chain stores and super markets, and the remaining 28 percent to independent retailers, Government, other processors, and other buyers. The study made with Research and Marketing Act funds is published as FCA Miscellaneous Report 151, "Marketing Canned Fruits and Vegetables Processed by Cooperatives, 1948-49." A major portion of the canned fruits and vegetables, except citrus, was marketed under buyers' labels. The cooperatives used brokers rather generally indistributing their products.

CALCIUM CARBONATE-STARCH MIXTURE FOR CANDY MOLDS: Starch has long been used to make molds for casting certain types of candy, and candymakers have had difficulty in combating the consequent serious dust-explosion hazard in candy plants. Now the Bureau of Agricultural and Industrial Chemistry's research has shown that mixing food-grade calcium carbonate with the starch makes it safer for candy molds. The Food and Drug Administration has indicated no objection to the use of calcium carbonate in the amounts required. This compound can help in maintaining high standards of sanitation in candy plants, and it will reduce the danger of starch-dust explosions, which should result in lower insurance rates for candy manufacturers. The candy industry is currently much interested in this development, and early commercial adoption of the finding appears likely. This is a development of the Bureau's Agricultural Chemical Research Division working in cooperation with the National Confectioners' Association.

BETTER OLEIC ACID FOR INDUSTRIAL USES: A process for the economical production of high-purity oleic acid from inedible animal fats has been adopted commercially after being developed through the pilot-plant stage in the laboratory. This improved technical grade of oleic acid has important uses as a raw material for manufacturing industrial chemical products such as plastics, resins, lubricants, detergents, and plasticizers. This is a development of the Bureau of Agricultural and Industrial Chemistry's Eastern Regional Research Laboratory at Philadelphia, Penn.

PROVED SIRES IN ARTIFICIAL-BREEDING: Dairy cattle breeding associations provide an effective means for making the fullest use of the outstanding sires they develop. Artificial-breeding associations now operate in 47 States, Alaska, and Puerto Rico, and increasing numbers of herds and cows are getting better sire service. There were 1,653 artificial-breeding units operating on January 1, 1951, with an enrollment of 467,224 herds and 4,077,706 cows. The associations own or lease 2,102 bulls, or about 1 bull for 1,940 cows. About 30 percent of these bulls, or 634, were proved with DHIA production records. Their daughters had an average butterfat production of 459 pounds, as compared with 419 pounds for the dams of the daughters. It is estimated that about 3½ million cows, or about 15 percent of all the milk cows in the United States, will be bred artificially in 1951. In a few of the leading dairy States, approximately 25 percent of the milk cows will be bred artificially.

BULL-LOANING PROGRAM: As an integral part of its proved-sire breeding experiment at Beltsville, the Bureau of Dairy Industry loans young bulls for service and proving in cooperators' herds. The "proof" obtained on the young bulls gives a final measure of the production inheritance that has been developed in the Beltsville herds through the continuous use of proved sires, and at the same time a high percentage of the bulls improve the cooperators' herds. During the year, 20 Holstein bulls and 5 Jersey bulls from Beltsville were proved in outside herds (with records made under DHIA conditions.) Of the 20 Holstein bulls, 80 percent sired daughters that averaged better than their dams in milk production, and 70 percent improved butterfat production. The 274 daughters of the 20 bulls averaged 13,679 pounds of milk and 481 pounds of butterfat, an increase over the dams of 603 pounds of milk and 24 pounds of butterfat. Four of the Jersey bulls, or 80 percent, sired daughters that averaged better than the dams in both milk and butterfat production. The 69 daughters of the 5 bulls averaged 7,993 pounds of milk and 461 pounds of butterfat, an increase over the dams of 405 pounds of milk and 41.5 pounds of butterfat. At the end of the year, 147 Beltsville-bred bulls were being proved in cooperators' herds; 64 of them were in artificial-breeding associations, 30 were in institutional herds, and 53 in individual cooperators' herds

HOT WEATHER FIRES ARE WORST TREE KILLERS: A small forest fire in hot weather does much more killing of young trees than a fire of the same intensity in cool weather. Just why this is true has been determined through laboratory tests by Forest Service research men at the Southeastern Forest Experiment Station, Asheville, N. C. It was demonstrated that the protoplasm of living cells of woody plants go through irreversible changes at a temperature of 140 degrees F. which results in their death. When air temperatures are at 90 degrees F., much more of the living tissue is heated to this lethal temperature or above than when air temperatures are at 50 degrees F. Critical internal temperatures for living tissues of woody plants are nearly identical to those of other more delicate plants. Woody plants, however, are better protected by an insulating layer of corky bark or bud scales. Protection from lethal temperatures increases rapidly as the corky layer increases in thickness with age. This knowledge of the importance of internal temperature of living plant tissue helps to explain the great variations that occur in the damage fires do in southern pine stands. The information is being put to use in two ways; (1) to improve estimates of damage from wild fires; (2) to identify the proper conditions under which controlled fire can be used to accomplish a desired purpose with minimum damage to living trees on the area.

SUPERFLAVORED MAPLE SIRUP: A practical method has been devised by the Bureau of Agricultural and Industrial Chemistry's Eastern Regional Research Laboratory to increase the flavor of maple sirup four to six times without altering i its characteristic taste quality. This high-flavored maple sirup can be used in the preparation of economical blends that are practically indistinguishable in taste from pure maple sirup. A Farm Bureau cooperative in one State and a large maple grower are now producing this new maple product, and a number of other companies have indicated their intention to do so. High-flavored maple sirup offers the possibility of widely extended markets for this farm-produced food product.

RESEARCH EFFECT ON SOYBEANS: Last year, says Dr. M. B. Weiss of the Department's Bureau of Plant Industry, Soils, and Agricultural Engineering, was the biggest year on record for soybeans in the United States, with 15,000,000 planted acres (all but 2,000,000 harvested for grain) and a total production of 287,000,000 bushels. Discussing the potentialities of new varieties for various localities, Dr. Weiss said that the areas for which no specific varieties have been released are now very limited. "In the North Central area, a conservative estimate is that new varieties have increased yields by 20 percent and average oil content by 10 percent. In the South both these percentages are even higher and for the same reason. Production in these two areas is likely to continue to increase particularly as a result of better varieties. Recent experiments on the date of planting in the Mississippi Delta Region, where the crop was put in from early April to late June, showed more economical production in fields planted after May 1. The plants came up quicker, grew faster and competed better with weeds, shaded ground earlier and reduced the cultivation need."

RANGE RESEEDING: The Forest Service reports that several of the wheatgrasses, including crested, intermediate, pubescent (stiffhair) and tall wheatgrass, as well as Russian wildrye and smooth and meadow brome, have proven especially useful in reseeding depleted ranges in Colorado's ponderosa pine land. Generally the openings and parks, some of which are abandoned crop lands, now support enough low-value vegetation to provide strong competition to seeded grasses, but furnish very little forage. This competition must be substantially and economically reduced. Disk-type plows are well suited for this. Planting with conventional grain drill has assured uniform distribution and places the seed so that it can be covered at the ½ to 1 inch optimum depth. For the lower ponderosa pine zone, planting in March or early April or in late September to November are the least hazardous seasons. In the upper zone where precipitation is greater and success more certain, September and early October is the best time. The grazing capacity of many of the one-half million acres in need of reseeding in the ponderosa pine type can be made to yield a ton of range forage which will support a cow for a month on each acre, where before seeding from 20 to 100 acres were required. Information on range reseeding can be obtained from the Rocky Mountain Forest and Range Experiment Station at Fort Collins, Colorado.

LEGUME BACTERIA VARY: On legume crops, U. S. Department of Agriculture and State scientists find that individual nodules vary as much as above-ground plants. Nodules reveal all degrees of efficiency in nitrogen fixation. Bacteria in one nodule may be high fixers; in another nearby they may be low; in the next medium. Some of the tight little groups may fix no nitrogen at all--may be parasitic, living rent free and even taking nourishment from the plant. At the Plant Industry Station of the Department such strain variation among nodule bacteria has been found for all legumes studied. A legume breeder's new strain may need a more effective nitrogen fixer. The bacteriologists know where to look and feel pretty sure of finding it. On the other hand, the breeders feel just as sure that now and then they'll create new strains of legumes that can make good use of some of the bacteria that have never been helpful.

MILK CONTAINS VITAMIN B_{12} : Results from seven experiments by the Bureau of Dairy Industry to determine the vitamin B_{12} activity of milk, as indicated by the rat-growth method of assay, show that average raw milk contains the equivalent of about 5 micrograms of vitamin B_{12} per liter. A sample of spray-dried whole milk (3.3 percent fat content before drying) was found to contain the equivalent of about 38 micrograms of vitamin B_{12} per kilogram, indicating there was no destruction of vitamin B_{12} activity in the drying process. Other findings from these experiments were as follows: There was no significant difference in the vitamin B_{12} activity of raw milk from Jerseys and Holsteins, either when the cows were on barn feeds or on pasture. Storage of raw milk in a household-type refrigerator for 1 to 3 days caused no significant change in vitamin B_{12} potency. No destruction of vitamin B_{12} activity was found when milk was pasteurized, either by the holding method or the flash method. In fact, the potency of pasteurized milk tended to be slightly greater than that of the original raw milk.

NEMATODES HIT GARDENS: It pays home gardeners to watch for damage by nematodes, the Department finds. This applies especially south of pennsylvania, Ohio, Missouri, and below that line on to the West. Hard winters keep numbers low in the North. The rootknot nematode, most common one in gardens, causes knotlike galls, often quite large on the bigger roots, and, on the smaller, showing up like beads. Such swellings as these on the roots of tomato plants; or beets and carrots that are rough and knotty instead of smooth; or cucumber and squash roots short, rough, and thick instead of long, slender, and smooth--indicate rootknot nematodes. There are two ways of control; The quick one, relatively expensive, is fumigating the soil with dichloropropene or ethylene dibromide, now available at hardware and feed and seed stores. The slow method is to divide the garden into two equal parts and alternate the growing of garden crops with a crop such as crotalaria, a legume with roots on which this nematode cannot reproduce.

UTILIZING SAGEBRUSH-GRASS RANGE: Much of the sagebrush-grass range of the West is especially well adapted to spring and fall grazing by sheep. A 25-year study in Idaho recently completed by the Forest Service shows that such range in good condition can be maintained under relatively heavy stocking (43 sheep-days per acre) when grazed only in the fall. Spring grazing each year coupled with lighter use in the fall, although totalling only about 70 percent of heavy fall use, lowered the range condition from good to poor. Recurrent spring use decreased the production of the valuable grasses and forbs (weeds) and favored the increase of undesirable shrubs which in turn made much of the herbage unavailable to the sheep. Range in poor condition will improve only slowly if it is continually grazed in the spring at even a light stocking rate.