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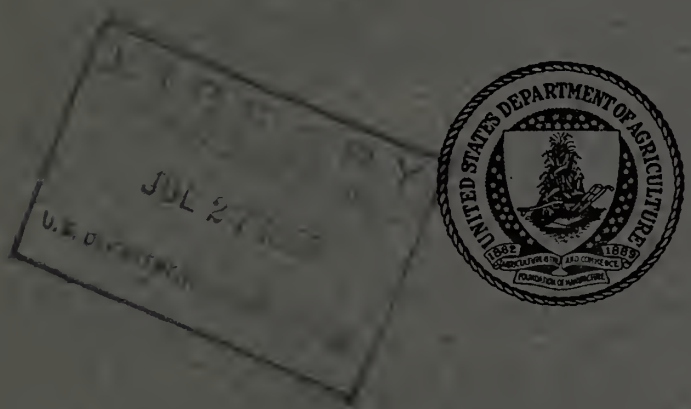

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Contributors

Contributors are on the staff of the Bureau of Agricultural Economics unless otherwise stated

EARL E. HOUSEMAN, statistical consultant, Office of the Chief, is a frequent contributor to this magazine.

SHERMAN E. JOHNSON, Assistant Chief of Bureau, returned in May from his second stay in England within the last few years.

ROY J. BURROUGHS divides his time, in the Division of Agricultural Finance, between farm housing studies and the Balance Sheet of Agriculture. He has been one of the joint authors of the Balance Sheet since its inception.

GEORGE KNUTSON, agricultural statistician for Wyoming, has given varied and valued service both within the Department and outside. FLOYD K. HARMSTON transferred from SCS to BAE a few years ago, then served in the Army for 2 years, and is now on the staff at Cheyenne.

CHARLES F. SARLE is in Turkey on the ECA mission described in his article. Somewhat similar work he performed in Japan was reported in this magazine last year.

GLADYS L. BAKER, agricultural historian, began work in the Department in the program planning division of AAA. Dr. Baker served in the research division of OPA and since her return has been on the history project in connection with the records of World War II.

FORREST E. CLEMENTS heads the Division of Special Surveys from which the results of many research studies of consumer preferences are being published.

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AGRICULTURAL ECONOMICS RESEARCH

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Sampling Methods in Marketing Research

By Earl E. Houseman

Such keen interest was created by the papers presented by this author before the annual meeting of The Association of Southern Agricultural Workers at Biloxi, Mississippi, last February, and before a meeting later that month which was sponsored by the Committee on Experimental Design in the United States Department of Agriculture, that the editors asked for the content of them to give to the readers of this magazine.

"ALTHOUGH THE USE of sampling necessarily introduces certain inaccuracies, owing to sampling errors, the results obtained by sampling are frequently more accurate than those obtained in a complete census or survey. The random sampling errors are always assessable. The other errors to which a survey is subject, such as incompleteness of returns and inaccuracy of information, are liable to be very much more serious in a complete census than in a sample census. Furthermore, the use of sampling greatly facilitates the imposition of additional more detailed checks. Indeed, a complete census can only be properly tested for accuracy by some form of sampling check." This is Frank Yates in his recent excellent book on sampling.[1]

This fact that a sample can be more accurate than a census, under certain conditions, is becoming widely accepted. The explanation is simple. With the exception of rather unusual cases, surveys and censuses are subject to many errors which have little, if anything, to do with the way a sample is selected. The challenging problem is often how to get accurate and useful information from respondents, or how to keep errors due to causes other than sampling at a minimum—not how to design an efficient and adequate sample. There is no implication here that designing a sample is no longer a problem. But the emphasis is on the need for a better sense of proportion as to the probable magnitude of various components of error in survey results. We are all concerned about the costs of surveys, but too often the concern is to get as much data as possible with the funds without sufficient regard for quality, overlooking the simple truth that work of higher quality even with a smaller sample might provide more accurate results. Emphasis on holding down the costs may also lead to use of inefficient sampling designs. As sample size is only one of many factors that influence accuracy, we should attempt to maximize the accuracy for a given amount of money and not to minimize the cost per schedule in order to get as much data as possible. Results of research on sampling methods, over the last 10 years, are helpful in the attempt to achieve maximum accuracy per dollar spent.

A common deficiency of surveys is inadequate clarification and development of the objectives, the hypothesis to be tested, the needs for the data, the definition of the data, the tabulation

[1] YATES, F. SAMPLING METHODS FOR CENSUSES AND SURVEYS. Hafner Publishing Company, New York; Charles Griffin & Company, Ltd., London, 1949. 298 pp.

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plans, and the content of the resulting report. That is, the whole plan of the survey is left in terms which are too nebulous. The end result is a report that lacks unambiguous answers to specific questions or that overlooks certain phases of the problem which should have been stated during the planning of the survey. This is true particularly when working in new areas of study because an adequate formulation of the problem may depend upon advance informal investigation or case studies, followed by the pre-testing of a questionnaire which, incidentally, should be a part of every survey. Adequate advance planning should help to avoid the situation in which a research worker discovers, when involved in the analysis phase of the project, that certain much needed tabulations cannot be made because either the sample or the questionnaire was not properly designed.

Only part of the benefit derived from the application of modern statistical methods is attributable to the statistical design. Much benefit results from better planning, since good planning is essential to successful application of modern statistical methods. Some surveys, however, are centered around the sampling plan *per se* which is expected to carry nearly the whole burden of providing useful and accurate results. In the interest of trying to use good sampling methods, a sampling plan is sometimes chosen prematurely and around it the study is developed. This is putting the cart before the horse. Logically, the objectives should be clarified first. Then the sampling design should be developed as a tool for better accomplishment of these objectives. Actually, the expressed objectives are commonly limited by various factors including feasibility of alternative sampling plans, but the emphasis should be on adapting a sampling design to the objectives, and not vice versa.

The preceding remarks may seem trite to many research workers but they represent ideas which the writer feels are too often overlooked, ignored, or not understood. Attention is now turned to selected recent experiences with the application of modern sampling methods including controlled experiments in stores.

Sampling Retail Grocery Stores

The first illustration involves the application of objective methods of sampling for the purpose of making a study of the problems and possibilities of developing a retail market news service.[2] Briefly, plans for the study called for weekly estimates of the prices of about 125 food items and estimates of the volume of about 40 of these items. The 125 items included canned, frozen, and fresh fruits and vegetables, meats, and dairy and poultry products. As the sample was built mainly with the end in mind of estimating prices and volume of specified items for the city of Baltimore, including suburban areas, the first example is represented by a brief description of the techniques used to obtain a sample of stores for city-wide statistics, in contrast to the next example which relates to experiments in retail stores.

For purposes of sampling, the universe was divided into three parts: Independent stores, chain stores, and stalls in the city markets. This discussion is confined to prices and to the methods of obtaining the sample of independent stores used for weekly reports.

Two possible bases for sampling were weighed: (1) Lists and (2) area sampling through the use of Sanborn or street maps. There were two sources of lists: A newspaper and the Office of the Retail Sales Tax Collector. These lists gave very little information about the characteristics of individual stores. Those on the list from the newspaper were classified into three volume classes and by type of ownership, but according to field checks the list was very inaccurate and the volume classification was very poor. The list from the tax collector's office was no doubt more accurate in the sense of giving correct addresses, but from it grocery stores could not be separated from certain other types of stores, no information on size of store was given, and as the stores on the list could not be easily classified geographically there was no basis for stratification.

It was decided that a preliminary survey of about 400 to 500 stores was advisable using a short questionnaire to obtain information on the characteristics of each store, including size in terms of total dollar volume of business, the type of store, type of ownership, commodities handled, and volume of business done on a credit or delivery basis. Such a sample would provide a good basis for selecting a smaller subsample to be used for

[2] A project under the Research and Marketing Act of 1946 conducted by the Production and Marketing Administration.

weekly reports. If the sample had been wanted for a one-time survey, probably a single-phase sampling plan would have been used instead of the double-phase sampling plan here described. For this quick preliminary survey, the Sanborn maps provided the best basis for sampling.

On the Sanborn maps (which are available for most cities that have more than about 10,000 inhabitants) the buildings within each city block are indicated, together with limited information as to use, structure, and size. It is possible to identify the blocks having retail outlets, but not the type of outlet. In areas that have coverage by Sanborn maps, the Bureau of the Census has, as part of the Master Sample project, a listing of all blocks within which retail outlets are indicated. These lists were used for the territory within Baltimore proper. Blocks containing retail outlets were arrayed in geographical order and every sixth block was selected, which provided a sample of 609 blocks. These blocks were visited and a short questionnaire was completed for each independently owned grocery store, including meat markets, fruit and vegetable stands, and delicatessens, but excluding national chains and stalls in city markets. To check on accuracy of the Sanborn maps, a sample was selected comprising 52 blocks on which no retail stores were indicated. On investigation no stores were found on any of these blocks, so we were satisfied that in this case the Sanborn maps gave an excellent basis for sampling.

In the outlying districts of Baltimore, the Sanborn map coverage was inadequate. This left two alternatives: To select a sample of all blocks from a street map or to select a sample from the newspaper list. It was decided to use the newspaper list because the outlying areas have many dead-end streets and other features which cause difficulty in defining blocks on the map that can be located in the field. This is particularly true of maps that are not up-to-date. Moreover, as the blocks on which retail outlets were located could not be distinguished in the office many sample blocks would be visited on which there were no stores.

A total of 470 independent stores were visited in the preliminary survey. After much discussion on designing the subsample of the 470 stores, it was decided to group them into 36 strata as follows: The stores were first classified into six groups by type: (1) Self service stores, (2) service stores carrying a complete line of commodities (that is, all major commodity groups such as meats, produce, and canned goods), (3) service stores with an incomplete line of commodities, (4) delicatessens, (5) fruit and vegetable specialty stores, and (6) meat markets. The most numerous type—service stores carrying complete lines—was subdivided into three groups on the basis of the percentage of the total dollar volume of business which was done on a credit or delivery basis or on both, as these factors affect price. This gave a total of eight groups which were further stratified as to total dollar volume of business, giving the 36 strata. These strata were made of approximately equal size in terms of total dollar volume of business. Strata comprised of the largest stores contained only three stores each, compared with one stratum which consisted of 39 small stores. One store was selected at random (equal probability) from each stratum. Hence a store's chance of being in the sample was approximately in proportion to its size.

The sample and subsample were so designed primarily for two reasons: (1) For purposes of estimating total volume of sales of the various commodities, the large stores should have a much greater chance of being in the sample. (2) The specifications of data indicated a preference for estimates of a city average price weighted by sales volume, rather than an unweighted price. A simple arithmetic average price from a sample is automatically properly weighted under the following hypothetical situation, taking eggs as an example. If the volume of eggs sold is proportional to total volume of business and the chance of a store being in the sample is proportional to its total volume of business, then a simple unweighted average of the egg prices from the sample stores is automatically an average price weighted by total volume of eggs sold. Exact proportionality from store to store between the sales of a particular commodity and total sales obviously does not exist, but it was hoped that a simple average price from a sample as described above would be close enough to the desired weighted average price so that weighting of the sample prices would not be necessary.

This idea of aiming toward a sample which would automatically give properly weighted prices led to modifications in the sample design which have not yet been pointed out. Prices of meats

in a meat market that handles only meats and which has a business of $2,000 per week should have more weight in an average meat price than do prices of meat in a general grocery store that has a total general business of $2,000 per week. As a result, an exception to having the strata of equal size was made in the case of meat markets, which were one of the eight type-of-store groups. Strata comprised of meat markets were made only about one-third as large as the strata comprised of stores that carry all commodity groups, because it was estimated that meats constitute about one-third of the business of a complete-line store. Thus, a meat market with a business of $2,000 per week had about three times the chance of being in the sample as a complete-line grocery store with a business of $2,000 per week. This type of modification should give a slight improvement in the sample used for estimating both prices of meat and volume of sales. A similar modification in the sample design was made for stores that specialize in fresh produce and for stores that carry an incomplete line of commodities. Such arbitrary decisions affect the statistical efficiency of the sample, but each store had a known probability of being selected, so the sample is a probability sample.

For this sample of 36 independent stores the sampling errors, at the 95-percent probability level applying to differences in price from week to week for five selected commodities, were estimated as follows:

Commodity:	*Sampling error* [1] *(cents)*
Eggs, large grade A	0. 6
New potatoes	. 6
Ground beef	1. 5
Canned green beans	. 5
Canned peaches, 2½	. 8

[1] Sampling errors pertain to estimated differences between weeks for the same stores for a 5-week period beginning June 6, 1948.

Prices for independent stores are combined with prices for chain stores and stalls in public markets. The combined average prices will have lower sampling errors than these just indicated.

Controlled Experiments in Retail Stores

Next, a type of statistical design is indicated which might be useful in a case in which the appropriate approach to a problem might be through a controlled experiment in retail stores. Designs of this type are being used for analogous situations in biological fields.

Let us begin with a case which involves a simpler statistical design than is found with experiments in retail stores. Consider a problem of testing three different kinds of tubes for coring bags of grease wool, the purpose being to learn the best kind for sampling bags of wool when the yield is to be estimated—that is, the ratio of scoured wool to grease wool.

Here are two possible experimental designs, each involving six bags of wool and the taking of six cores from each bag. (1) Divide the six bags at random into three groups of two. In the first group take six cores from each bag with the first tube; in the second group take six cores from each bag with the second tube; and so forth. This design is inefficient in comparing the coring devices because the observed differences among tubes include variability attributable to differences among bags. (2) Take two cores from each bag with each instrument. This design gives a more accurate comparison between the tubes because variations among bags do not influence the observed differences among the tubes.

The problem just presented is over-simplified, but without going into the statistical analysis it gives an illustration of how, through the use of an appropriate design, more accurate information can be obtained with about the same effort, or of how an inappropriate design might fail to provide the information sought.

Turning now to experiments in retail stores, the analogy is that the stores correspond to the bags of wool and the treatments (which might be differences in display, packaging, grading or prices, etc.) correspond to the coring tubes. But from the standpoint of statistical methodology there is at least one major difference: In the case of the wool, we were not particularly concerned with the time element. Then, too, there was an assumption that the taking of two cores from a bag with one coring tube did not appreciably change the characteristics of the contents of the bag for the second tube.

With retail stores, the time element commonly enters the picture in two important ways. (1) Certain trends may take place through time regardless of whether or not a treatment is applied. (2) There may be certain carry-over effects; that is, if treatment B, for example, follows treatment

A in the same store, the results observed for treatment B might be affected by the fact that treatment A preceded it.

In this connection Applebaum and Spears [3] have stated: "Where two or more variables are to be tested simultaneously, a different group of test stores will be required to investigate each variable. In addition, a group of control stores will also be necessary. For example, if the regular price of an item is 10¢ and the problem is to determine what sales results will be achieved at 9¢ and at 2/19¢, then three groups of experimental stores are required to carry out the tests simultaneously—a group for each price, 10¢, 9¢, 2/19¢. The element of time cannot be controlled in any other way."

Actually, there may be other methods of handling the time factor and carry-over effects that will prove to be useful—methods which are more efficient statistically, and at the same time give additional information.

Applebaum and Spears went on to say: "Of course in some experiments the element of time may be a very minor factor in the results, and each variable can be tested by successive steps. Also, in some experiments it is possible to test different variables by criss-crossing the tests between different groups of stores. A word of caution is in order here. The authors' experience indicates that to safeguard the validity of results it may be worth spending the extra money required to set up an additional group of test stores." It appears that the statistical advantages of applying all of the treatments in each store were recognized but that such a design was considered unsafe because of time trends or carry-over effects.

Analogous situations are found in biological fields. A good example is a dairy-cattle feeding experiment, reported by Cochran, Autrey, and Cannon, [4] to ascertain the differences in yield of milk when three rations were used. In an experiment in which each cow receives only one ration, the yield of milk observed for any given ration will depend upon both the producing ability of the animals (which is highly variable among cows) and the ration itself. Variation in producing ability can be partly controlled by an appropriate grouping of the cows, but variability among cows is still an influential contributor to the experimental error. If variability among cows is eliminated from the experimental error by feeding the three rations, successively, to each cow during a single lactation period, it is obvious that carry-over effects and characteristic changes in milk production during the lactation period should be taken into account, which is what the design used by Cochran and his associates did.

Let us examine this design to see what it would be like when used for retail stores—even though the design and the accompanying analysis cannot be fully discussed here. Consider three different treatments: A, B, and C. These three treatments might be three different types of display, three different prices on a particular grade of oranges, or three methods of packaging. Or the treatment might be complex, as, for example, three different price patterns involving several varieties and grades of apples. The effect of the treatments is measured in terms of volume of sales. For the experiment the number of stores should be a multiple of six: Let us assume it is 12. Six groups of stores would be set up so the members of each group would be as much alike as possible. Here is the lay-out for applying the three treatments to the six groups:

Period	Group of stores					
	1	2	3	4	5	6
1	A	B	C	A	B	C
2	B	C	A	C	A	B
3	C	A	B	B	C	A
4	A	B	C	A	B	C

There are six orders in which the treatments are applied which is the minimum number of orders if, during any period, each treatment is to follow every other treatment. (As there might be carry-over effects in the first period from whatever the situation was in each store before the experiment started, perhaps the treatments applied in the first period should be repeated during a fourth period as indicated in the above layout; in that event, the data for the first period might not be used in the analysis.) From the above

[3] Applebaum, William, and Spears, Richard F. controlled experimentation in marketing research. Jour. Marketing. 14 (4): 505–517. Jan. 1950.

[4] Cochran, W. G., Autrey, K. M., and Cannon, C. Y. a double change-over design for dairy cattle feeding experiments. Jour. Dairy Science. 25: 937–951. 1941.

design, estimates of the direct effects of the treatments and the carry-over effects are estimated by the method of least squares. The mathematical solution involves setting up an equation for each period within each group of stores, assuming that the carry-over effects from the first period do not extend into the third period. For example, the equation representing the volume sold during periods 2, 3, and 4 for the first group would be:

$$V_2 = m + p_2 + b + a' + e_{21}$$
$$V_3 = m + p_3 + c + b' + e_{31}$$
$$V_4 = m + p_4 + a + c' + e_{41}$$

where m = average volume sold per store, the p's represent the average effects of the three periods, b, c, and a represent the direct effects of the treatments, a', b', c' represent the carry-over effects, and the e's are the experimental errors.

Actual experience with a few such designs is needed if several questions on technique are to be answered. Is it necessary to repeat the treatments applied in the first period? If the stores in the experiment vary widely in size, should something be done about heterogeneity of variance? Are the effects more nearly multiplicative than additive, suggesting that logarithms of the volumes be used in the analysis? How should the stores be selected?

Assuming that the change-over design is administratively feasible and that using it will meet the objectives of the study, its essential features, compared with setting up a separate group of stores for each treatment plus a control group, include the following.

1. Variation among stores is eliminated from comparisons of the effect of treatments. That is, the same number of stores will provide a more accurate comparison of the treatments. The question of the degree to which accuracy is improved can be estimated from an analysis of data obtained when change-over designs are used; it is unnecessary to use both designs simultaneously.

2. The carry-over effects can be estimated and, if they are important, the direct effects can be adjusted for carry-over effects. In some cases, the information provided on carry-over effects might be important. For example, if a store manager makes a special effort to reduce his stock of a particular commodity, what is the effect of this on his sales the following week?

3. It should not be necessary to have a control group of stores. If a comparison with some standard treatment or practice is desired, the standard treatment can be included in the lay-out as one of the treatments.

Sampling to Estimate Volume

As estimates of volume are frequently attempted with samples that are too small, it may be advisable to include a short discussion of sampling when volume is to be estimated. First, a simple contrast between sampling for prices and sampling for volume is given. Assume that a complete list of stores in some city is available, but that no information for the stores is given. Coefficients of variation, among all stores, pertaining to volume might be as large as 200 to 300 percent per store and higher; whereas the corresponding coefficients of variation for prices might be in the rough neighborhood of 20 to 30 percent. How much larger would a sample have to be if volume is to be estimated with a sampling error of 5 percent than it would have to be if the average price is to be estimated with a sampling error of 5 percent? Assuming a simple random sample, which is the best that could be done in the absence of any information about individual stores, the sample might have to be more than 100 times larger (unless corrections for finite populations come in). In other words, for a sample of a given size the relative sampling errors for estimates of volume could be as much as 10 or more times larger than for prices.

Compared with simple random sampling, available information on individual stores can be used in the sampling design or in the process of estimation to improve the accuracy of the results. In particular, if information is available on size of the store (or whatever the sampling unit is), the accuracy of estimates of volume can often be greatly improved by increasing the sampling rate with the size of the store. The improvement is attributable to both the stratification by size and the varying sampling rate.

There have been several cases in which records were sampled for the purpose of estimating the quantities and prices of selected commodities that move through various marketing channels. Examples are a wholesaler's sales record or a canner's

record of shipments. The quantity of each sale is on the record and information with regard to each transaction is taken from the record, including the quantity of the sale. Instead of taking every *nth* transaction, a simple procedure can often be devised for going through such a file using heavier sampling rates on the larger transactions, which will result in a much more efficient sample for certain purposes. The gain in efficiency differs, of course, from one case to another, but in some cases, as compared with taking every *nth* transaction, a sample only one-fourth as large (or even smaller) might be as accurate if the sampling rates are properly increased as the size of the transaction increases. However, if the objectives call for estimates of the percentage of transactions that fall in various categories, to increase the sampling rate with the increase in the size of the sale would normally result in a loss of statistical efficiency, as compared with taking every *nth* transaction.

The following example will illustrate a few additional points about designing a sample whenever estimates of volume are the objectives. It is taken from a study in the North Central region which, as part of its objectives, included specifications for estimating the quantities of butter sold through various channels by butter manufacturers. For sampling purposes a list of the manufacturing plants and the pounds of butter produced by each, in 1948, were available. Using Minnesota for illustration, the number of plants and the total volume for each of four size groups are shown in table 1.

The sample was designed primarily for use in reaching the objective of making estimates of the volume of butter sold by manufacturers through various channels. For this purpose, how much heavier should the large plants be sampled than the small? If relevant data were available from previous studies, that question could be answered accurately. In the absence of such information, a good plan is to allocate the sample on the basis of volume. Some plants may be large enough to be included in the sample automatically; these are the plants which would come into the sample with certainty if one were selecting a sample of plants with probabilities proportional to their sizes.

To decide which plants to include automatically, the total volume of all plants is divided by the size of sample, which for purposes of this illustration is assumed to be 100. The quotient is about

TABLE 1.—*Allocation of sample butter plants in Minnesota by size of plant*

Size of plant (000)	All plants		Allocation of sample	
	Number	Volume (000,000) pounds	Proportional to number of plants	Proportional to volume
0 to 400	527	105	77	46
400 to 800	106	57	16	25
800 to 1,250	35	35	5	16
1,250+	13	26	2	[1] 13
Total	681	223	100	100

[1] Actually not quite 13 percent of the volume is in this group.

2.2 million pounds; that is, the average plant in a sample of 100 would correspond to about 2.2 million pounds. Hence, if a sample of 100 were allocated on the basis of volume, any plant with more than 2.2 million pounds should be in the sample automatically and one out of two plants, each with 1.1 million pounds, should be selected. In the absence of a better procedure, we could split the difference between 1.1 million pounds and 2.2 million pounds which is roughly three-fourths of the quotient—total volume divided by the sample size. A cut-off point of 1¼ million pounds was used since there were no plants whose production was in that neighborhood. The remainder of the range, 0 to 1¼ million pounds, was divided into three intervals of approximately equal size.

Two allocations of the sample are shown in table 1; one is proportional to number of plants and the other is proportional to volume. Without making a detailed technical analysis of this particular case, the best guess based upon general experience is that the sampling standard errors pertaining to volume will be about 30 to 40 percent less if the sample is in proportion to volume instead of in proportion to number of plants. For estimating the percentage of plants using various outlets (not volume sold through the outlets), statistical efficiency would usually be lost instead of gained by increasing the sampling rate with the increase in size of plant.

This discussion on sampling butter manufacturing plants has been from the viewpoint of estimating totals for all plants and not by groups

of plants. Actually, the sample was not designed as described above, because of the nature of the tabulation plans and information on important factors in addition to size was available for use in stratification. One of those factors was the ability of a plant to switch between the manufacture of butter and of other milk products. Other things being equal, plants with a high degree of flexibility should be sampled at a heavier rate.

Sampling First Buyers of Various Agricultural Commodities

Frequently samples of first buyers of agricultural commodities are needed when no lists are in existence to be used as a basis for sampling. Other than taking steps to develop a list, two methods of obtaining a sample of first buyers are possible. The first is to begin with a sample of producers (growers) and get the names of persons or firms to whom they sell. This might be a practical approach when a sample of producers is being interviewed for reasons other than developing a sample of first buyers. It is clear that a large buyer has a much greater chance than a small buyer of being named by the sample producers and that unweighted averages of data in the buyer's sample are not unbiased statistically. Hence, before beginning the producer and buyer surveys, appropriate questions should be included on both schedules in order that statistically unbiased estimates can be made from the buyer's sample. The sampling theory for this method of sampling the first buyers needs thorough exploration, for the estimating procedures indicated below are results of only a preliminary examination of the problem.

As a specific illustration, consider the problem of estimation for such a sample of first buyers of eggs to obtain information on their marketing practices. Suppose that, for each producer in a random sample, the name of each buyer to whom he sold eggs in a given period and the quantities sold to each can be obtained. Then let y_1, y_2, . . . , y_n be the number of eggs sold to each where n is the number of different buyers to whom the sample producers sold eggs. That is, if three sample producers, for example, sold to buyer No. 1, y_1 would be the total number of eggs sold to buyer No. 1 by these three producers. In this discussion it is assumed that all buyers named by the producers are included in the sample of buyers. If not, it is necessary to modify accordingly the formula given below.

Let $x_1, x_2, \ldots, x_n$ be the total number of eggs bought by the n sample buyers from all producers (including producers not in the sample) as learned from the buyer's schedule. Note that shipped-in eggs or local eggs which might have been bought from some other dealer are not included. The formula given below provides statistically unbiased estimates when the x's be numbers such that, if a census of all producers were taken, y_i would equal x_i. That is, the expected value of $y_i = r\,x_i$ where r is the sampling rate applying to the sample of producers.

Next, let z represent the universe total of a variable which is to be estimated. A statistically unbiased estimate z', of z is given by the following equation.

$$(1) \qquad z' = \frac{1}{r} \sum_{i=1}^{n} \frac{y_i}{x_i} z_i$$

where z_i, for example, is the total number of eggs shell-treated by the i^{th} sample buyer. The quantity $\frac{y_i}{x_i}$ is in effect a weight, so the estimating equation can be rewritten in the form:

$$(2) \qquad z' = \frac{1}{r} \sum_{i=1}^{n} w_i z_i \text{ where } w_i = \frac{y_i}{z_i}.$$

If an estimate of an average per buyer is desired, instead of an estimate of the universe total, we simply compute a weighted average using the w's as weights. That is, $\frac{\Sigma w_i z_i}{\Sigma w_i}$

The answers to some questions might be in the form of a proportion. That is, the question might ask for a percentage, p_i, which is equal to $100\,\frac{z_i}{x_i}$ where x_i, as defined before, is the number of eggs bought by the i^{th} buyer from producers, and z_i, for example, is number of these eggs which are shell treated. To estimate the percentage of all eggs bought direct from producers that are shell treated by first buyers, the percentages, p_i, can be weighted by the y's. Thus $\frac{\Sigma y_i p_i}{\Sigma y_i}$. This weighting is applicable only when p_i is a fractional part or percentage of x_i.

To estimate, for example, the percentage of first buyers who happen to operate an egg route, the procedure is decided upon by referring to

equation (2) and letting $z_i=1$ for buyers who answer Yes, and equal zero for buyers who answer No. The estimated percentage turns out to be the sum of the w's for buyers who answer Yes, divided by the sum of the w's for all buyers.

A second possible way of sampling first buyers in the absence of a list is the use of area sampling which was recently considered as one of the alternatives for sampling local buyers of cotton. It was reported that within a community all local buyers of cotton can be discovered by inquiring within the community. This suggested an adaptation of area sampling, the sampling units being parts of counties, these parts being probably as large as a minor civil division or larger. Briefly, the designing of the sample might proceed as follows, assuming a uniform sampling rate: First, identify any of the cities or places which are of sufficient importance to be included in the sample automatically. The interviewer would visit these places, develop a list of buyers and apply the overall sampling rate to the list. If, for the remainder of the universe, a sample of counties is to be selected, county statistics on cotton production and perhaps other information, including the knowledge of cotton experts, would be used as a basis for stratification of the counties.

Information available for defining sampling units within the sample counties (or over the whole area included in the universe, if a single stage sample is used) includes statistics by minor civil division, county highway maps, and population figures for the cities and villages. A sample of sampling units is then selected and the buyers who are located within the selected sampling units are in the sample. If space permitted, various modifications of this procedure could be illustrated, including the possibilities of varying the sampling rate with type or size of buyer.

For the sampling of local cotton buyers it seems advisable to travel through the counties and develop a complete list by local inquiry, including information on type and rough estimates of the quantity of cotton bought by each. This would provide a basis for sampling that is similar to that illustrated for the butter manufacturing plants which is important if the tabulation plans include estimates involving quantities of cotton. From a list so developed for all Delta counties in Mississippi, it was estimated that the 2 largest local buyers out of 161 on the list handled roughly 15 percent of the total cotton bought by them all. Buyers of less than 500 bales were not included on the list as they accounted for less than 2 or 3 percent of the cotton. If in a sample of 50, for example, these 2 buyers could be either in or out of the sample by chance, the effect on the sampling error for estimates involving quantities of cotton is clear.

If area sampling were to be used, it should be supplemented with complete coverage of a list of the largest buyers, if reliable estimates of volume were to be obtained. Under the circumstances, if estimates are required for areas as small as the Delta in Mississippi, it appears that effort spent on developing a complete list of the cotton buyers patronized by producers, with estimates of the quantities purchased by each is a good investment. If estimates were wanted for the South as a whole without geographic breakdown, a sample of counties could be selected and lists could be developed within the selected counties. However, all of the relatively few largest buyers probably should be included in the sample even if they were not located in a sample county.

As surveys differ with respect to objectives, to the break-down of data required in the analysis, to the universe covered, and so forth, two samples are seldom designed exactly alike. Frequently, a research worker asks the consulting statistician if his proposed sampling plan is sound without referring to the purpose of the survey in which it is to be used. The statistician who answers the question, without closely examining the objectives, the principal tabulations desired, and the possible alternatives, might be doing himself and the research worker a disservice. A statement made at the beginning of this paper seems worth repeating. The objectives of a survey may be limited by what is feasible in the way of alternative sampling plans, but the emphasis should be on adapting a sampling design to the objectives.

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Agricultural Economics in Great Britain

By Sherman E. Johnson

Carrying out an assignment under the Technical Assistance Program of the Economic Cooperation Administration, Dr. Johnson recently made a survey of agricultural economics research and advisory work in Great Britain. He recognizes that he has seen British agricultural economics with American eyes and that his observations are influenced by his own background and experience in the United States.

INTEREST in economic problems of British agriculture has a long history. The classical economists writing during the Napoleonic era were much concerned with agriculture. They directed their interest toward the technical and economic limitations on increasing the food supply in a period when the population of Britain was largely dependent on home-produced food. Nearly a century later (1896), when British farmers had experienced the full impact of overseas competition, a lectureship in agricultural history and economics was established at the University of Cambridge. That position was filled by visiting lecturers until 1910 when arrangements were made for a permanent lectureship.[1]

Teaching of agricultural economics was not undertaken at most universities until after World War I. It developed rather slowly and does not occupy a prominent place in the agricultural curriculum of most universities even now. Professor A. W. Ashby, appointed to a professorship in agricultural economics at University College, Aberystwyth, Wales, in 1927, developed courses leading to the honors degree in agricultural economics. More recently agricultural economics courses have received emphasis at the universities of Cambridge, Reading, and Leeds. At Oxford University, early attention centered on training of graduate students through participation in research projects, although some lectures were given at the School of Agriculture. Courses are now available at Oxford for both undergraduate and graduate training.

Early Research

Research in the subject had its beginning in the organization of the Agricultural Economics Research Institute at Oxford University in 1913. But the work barely got under way before World War I broke up the organization and a complete reconstitution of the Institute was undertaken in 1919. Dr. C. S. Orwin, the first director, continued in that capacity until his retirement at the end of World War II. As a lecturer in estate management at Southeastern Agricultural College and agent for the Turnor Estates in Lincolnshire, he had been interested in applications of cost accounting to the problems of farm management. Much of the early work of the Institute was devoted to development of agricultural costing. In the later interwar years research was begun on prices and marketing, land reclamation and land tenure, farm labor and other social problems, agricultural policy, and agricultural history.

Research in agricultural economics at other universities was begun largely through establishment of advisory work (extension education) in agricultural economics on a provincial basis. Agricultural advisory specialists were attached to a university or agricultural college located within a particular province, and agricultural economists were appointed to serve as advisers at each provincial university center in the years 1923 to 1926.

The advisory economists found themselves without a background of research on which to build an advisory or educational program. Consequently, they engaged in research studies designed to provide a body of economic information that could be used for advisory work. Some provincial economists turned their attention to cost accounting; others conducted general farm surveys.

Research at the provincial university centers gradually broadened. Many other types of projects were undertaken. Little was done in the field of marketing and prices, however; such studies were carried on directly by the Ministry of Agriculture and Fisheries.

[1] The outline of early development is based largely on AGRICULTURAL ECONOMICS, 1913–38, the 25th Annual Report of the AGRICULTURAL ECONOMICS RESEARCH INSTITUTE, by C. S. ORWIN.

One can summarize the beginning of agricultural economics in Great Britain as an applied science field by saying that although it had early roots in general economics and even in some teaching of agricultural economics, the work got its real start in the years immediately following World War I. At the beginning of World War II a broader view of the field was emerging. But the long war not only prevented further development, it narrowed activities to those immediately useful in the war effort.

Administrative Organization

Financial support of research and advisory work in agricultural economics originates chiefly in the Ministry of Agriculture and Fisheries for England and Wales and the Department of Agriculture for Scotland. These national agencies carry on some research directly, but most of the research is carried out by cooperating universities under a program of grants-in-aid. The Ministry has cooperative agreements under which funds are granted to 9 universities which divide England and Wales into 10 provinces with provincial centers:

1. Department of Agriculture, University of Durham, Kings College, Newcastle-upon-Tyne.
2. Department of Agriculture, The University, Leeds.
3. University of Manchester at Manchester.
4. University of Nottingham, School of Agriculture, at Bonington, Loughborough.
5. University College of Wales at Aberystwyth.
6. University of Bristol, with one center at Bristol and another at Newton Abbott.
7. University of Reading at Reading.
8. University of Cambridge at Cambridge.
9. Wye College, University of London, at Wye.

The Department of Agriculture for Scotland has similar agreements with the North of Scotland College of Agriculture at Aberdeen, the West of Scotland Agricultural College at Glasgow, and the East of Scotland College of Agriculture at Edinburgh. They cover the counties of Scotland.

The agricultural economics staff at each center usually consists of a provincial agricultural economist in charge of the work, a senior agricultural economist as his immediate assistant, 1 or 2 agricultural economists, and 5 to 7 assistant economists. This group is attached to the university. Frequently the senior members do university teaching in addition to research.

In Scotland, the provincial agricultural economists also have responsibility for advisory work (extension). But in England and Wales the National Advisory Service was organized in 1946 as an agency of the Ministry of Agriculture without formal connection with the provincial universities. The agricultural economists were not included in the National Advisory Service because it was believed that they could obtain and analyze economic information more effectively if they remained a part of the university staff. This decision seemed to recognize that the advisory economists had become research workers. Present arrangements do not provide an open channel for the flow of the results of economic research to farmers, but plans are under way to appoint an economic liaison representative to each of the provincial staffs. These men will work with Advisory Service personnel to facilitate getting economic information to farmers in a form they will find useful.

The institute at Oxford is one of several national institutes for research in specific fields of agriculture. It was organized as a research center of national scope to conduct research within the entire field of agricultural economics. Most of the funds for support of the Institute are grants to Oxford University from the Ministry of Agriculture. Several institutes working in other fields, although located at university towns, are organized independently and function separately.

Privately financed activities in agricultural economics include those conducted at the Dartington Hall Economics Department, the Institute of Agrarian Affairs at Oxford, and Nuffield Trust Study of Agricultural Policy at the University of Cambridge. Individual members of teaching staffs in different universities may undertake some research in agricultural economics, but such studies usually are not a part of the activities of the provincial university centers.

Research in Progress

All of the institutions involved in agricultural economics were badly disorganized by the war.

Most of the prewar staff became engaged in war activities and work in agricultural economics was confined to that which could be immediately and directly utilized in the war. The war was followed almost immediately by the trade-gap emergency and in this setting the work in agricultural economics has continued on a restricted basis. Personnel has not been available to fill vacancies and staff members have had to devote much time to request work.

Most of the research now under way at the 13 provincial university centers consists of collection, summarization, and analysis, of farm financial records and enterprise costs. This type of work was developed in cooperation with the Ministry of Agriculture and Fisheries for England and Wales and by the Department of Agriculture for Scotland in the middle 1930's to provide national summaries of changes in farm incomes and costs. It was continued during the war to provide a basis for pricing of farm products. Postwar agricultural legislation calls for an annual review of farm prices and for such revision of price guarantees to farmers as may be needed in view of changes in economic conditions. National summaries of farm financial records and enterprise costs are utilized in the hearings on these annual reviews. The data for these summaries are provided by the provincial university centers under agreements with the Ministry for England and Wales and the Department for Scotland that approximately 50 percent of the funds shall be devoted to collection and analysis of materials that can be used for price reviews and other administrative purposes. It is contemplated, however, that these materials will be utilized for research and advisory purposes within the respective provinces.

From 200 to 430 farm financial records are completed annually at each university center. The number requested from each center by the Ministry or the Department depends upon the estimated need for obtaining a balanced national sample of farms. It is not assumed that the sample gives a cross section of financial results within each province; some sizes and types of farms that are of minor importance will not be represented in a particular province. But the records obtained for the entire country are intended to represent farming returns from British agriculture. About 3,000 records are compiled each year for England and Wales and about 800 for Scotland.

In the work on enterprise costs great emphasis is placed on obtaining detailed costs of producing milk. Cooperating farmers are furnished with forms made up in duplicate sheets, one copy to be returned to the university center. Summaries of the cost of milk production per cow and per gallon of milk are prepared separately for the winter and summer months, and then combined into an annual average. Other cost data are collected for enterprises that are important in a particular province. There is some rotation of requests for cost information by specific enterprises, but the rotation is arranged in such a way that costs for the previous year are available for price reviews from some centers for each of the leading products.

Copies of individual farm financial records and enterprise cost records are supplied to the Ministry by the centers in England and Wales and to the Department by the centers in Scotland. Each record is given a code number; the name of the cooperating farmer is not furnished. Most of the centers make annual summaries of farm financial returns and of enterprise costs which are sent to cooperating farmers, to advisory officers, and to workers at other research institutions.

Each provincial university center has one or more studies under way not directly connected with this record work. There is much current interest in studies of the utilization of labor; three centers have assigned personnel to specialize on such work. Others are planning similar studies. Some enterprise studies are not directly related to costs. Because of shortage of concentrated feedingstuffs there has been great interest in the harvesting of grass to preserve a maximum proportion of the nutrients. Six studies are devoted to grass drying, silage making, and improved methods of hay making. Three studies will provide fairly comprehensive analyses of the problems of an area and suggest needed adjustments in its agriculture. Four studies of hill farming have been organized to measure progress on farms that are taking advantage of special program provisions designed to improve farming in hill areas. Some complete farm-cost records are collected at five centers but only two devote much time to this work.

The Agricultural Economics Research Institute at Oxford has research under way in prices and

marketing, land economics, rural sociology, agricultural policy, and some special studies in farm management.

In addition to the national summaries and analyses in connection with financial records and costs, the economic and statistical staffs at the Ministry of Agriculture and Fisheries in England and Wales and the Department of Agriculture for Scotland make some aggregative estimates of agricultural output and income; prepare summaries and analyze data from the quarterly agricultural census; and carry out other special studies, including some research in marketing.

Research in Relation to Current Problems

If this brief inventory of work in progress is compared with current economic problems in British agriculture there appear to be many unfilled gaps, but it is necessary to view the situation in the light of war and postwar impacts on the British economy. In the United States research institutions have been able, since the war, to reorganize their work in line with peacetime needs. In Britain, however, the continuation of emergency conditions has precluded development of a peacetime research program. But the institutions are now more fully staffed and they can begin to develop a broader program, directed toward solution of problems that will be encountered in the transition to peacetime conditions. The need for closing the trade gap imposes different, and to some extent opposite, impacts on British agriculture than is true in the dollar countries, but it does not remove the necessity for transition adjustments.

These adjustments will be conditioned by the revolutionary changes that have taken place in British agriculture during the war and early postwar years. Plow-up of land formerly in permanent pasture, reclamation of "derelict" land, rapid mechanization, and major shifts in crop and livestock production, are the principal factors of change. At the outbreak of the war, systems of farming probably were in the process of adjustment toward a "best fit" with respect to the land resources and the men and machines that were available, and within the international trade policy prevailing at that time. But many of the wartime and postwar changes are irreversible. Although it would not be possible, nor indeed desirable, to return to prewar systems of farming, guidance is badly needed in the direction of new adjustments. This is partly a question of determining the lines of national policy best suited to the peacetime economic environment and partly of determining the most desirable adjustments, area by area, in view of the changes that have occurred, and within the framework of a national policy for agriculture.

Perhaps the first and foremost question in British agriculture, as well as throughout the British economy, is the need for economizing on the use of resources in production. Economists at provincial centers are in a strategic position to work on problems of achieving a "best fit" of land, men, and machines, in systems of farming that are likely to be most profitable, by areas, within the national policy; and to develop research materials for advisory work on economic problems.

In analyzing their farm-management data for effective use with farmers they probably will utilize farm budgets and case farm analyses to a greater extent than in the past. With some revisions in procedure, the project dealing with farm financial records will furnish the basic information for this work as well as for the price reviews. The broader research program is likely to include studies of tenure and credit problems, and to revive both national and localized marketing studies.

Balance Sheet of Agriculture—Meaning, Conceptual Limitations, and Uses

By Roy J. Burroughs

Social accounting is so new that only a few specialists are fully aware of the associated conceptual problems or the popular confusions that may result from applying the terminology of accounting for private enterprise to given sectors or to the whole of the national economy. This article endeavors to clarify the meaning, conceptual limitations, and uses, of one of the first products of social accounting, namely, the Balance Sheet of Agriculture.

THE BALANCE SHEET of Agriculture has become a widely quoted and frequently used annual series for the period from 1940.[1] Misuses sometimes arise from a lack of general understanding of its meaning. This article is intended to clarify the meaning, conceptual limitations, and appropriate uses of the Balance Sheet of Agriculture (shortened to BSA hereafter) and to suggest how it may be made more useful.

The misuses of the BSA arise in part from the double purpose that has characterized its preparation and use. On one hand, it has served to represent the financial condition of the whole of agriculture as a single industry; on the other, it includes elements that reflect the financial circumstances of people—of families or households whose members have a connection with agriculture as operators of farms, or as residents of farms, or merely as landlords of leased land. Although it includes more elements than would properly be included in a balance sheet for the industry as such, it is too limited to reflect adequately the aggregate financial circumstances of households living on farms. Nor does it give a clue as to the diversity of financial circumstances of farm firms and of individual households. Some items, for example, United States savings bonds, reveal some of the liquid savings of farm families as a group. It is, therefore, proper to use the BSA to discuss these savings with reference to farm operators and other farm families taken collectively. It is not proper to assume that the individual families with the savings are the same as those with the indebtedness which also is reported. The contrary is more likely to be the case.

As this dual purpose of coverage and use tends to confuse the unwary, it is well at the outset to consider in some detail the meaning and coverage of the BSA.

Definition and Coverage

BSA is an Aggregate

The BSA arrays the aggregate assets and claims of agriculture in the conventional American accounting form: Assets on the left or above, claims on the right or below (table 1). Although it is intended to summarize the financial position of farms and farmers as a consolidated balance sheet would do, it is not a consolidated balance sheet strictly speaking. For a true consolidated balance sheet, separate accounts from each farm firm in the country would be required. But such farm accounts either are lacking or are unavailable so it is necessary to make statistical estimates of each type of item that is entered in the BSA. Also, in a true consolidated balance sheet debts of one farmer to another would cancel out but this is not the case here. It is a global estimate, not a consolidation.

[1] Its first appearance was in the IMPACT OF THE WAR ON THE FINANCIAL STRUCTURE OF AGRICULTURE. Bureau of Agricultural Economics, Sept. 1944 [Processed]: printed as U. S. Department of Agriculture Misc. Pub. No. 567, Aug. 1945. THE BALANCE SHEETS OF AGRICULTURE FOR 1945, 1946, 1947, and 1948 were Misc. Pubs. 558, 583, 620, 642, and 672 respectively. The 1949 Balance Sheet is U. S. Department of Agriculture Information Bulletin 1. Forecasted 1950 figures are reported in address by Sherman E. Johnson, 27th Annual Outlook Conference, U. S. Dept. Agr., November 3, 1949. Since this article was prepared, preliminary data for 1949 Income and the January 1, 1950, Balance Sheet have become available and minor revisions have been made for 1949 (BAE release of Feb. 17, 1950). Final figures are not yet ready. Inasmuch as the data in this article are illustrative only, they are left as originally written.

TABLE 1.—*Comparative balance sheet of agriculture, United States, Jan. 1, 1940, 1945, 1948, and 1949* [1]

Item	1940	1945	1948	1949	Net change 1940–49		Net change 1948–49	
ASSETS								
	Million dollars	*Million dollars*	*Million dollars*	*Million dollars*	*Million dollars*	*Percent*	*Million dollars*	*Percent*
Physical assets:								
Real estate	33, 642	46, 389	62, 813	65, 168	31, 562	+94	2, 355	+4
Non-real estate:								
Livestock	5, 133	9, 012	[2] 13, 384	14, 697	9, 564	+186	1, 313	+10
Machinery and equipment	[2] 3, 118	[2] 6, 114	[2] 9, 069	11, 114	7, 996	+256	2, 045	+23
Crops, stored on and off farms [3]	2, 645	[2] 6, 396	[2] 8, 789	8, 475	5, 830	+220	−314	−4
Household equipment [4]	4, 275	4, 232	5, 415	6, 000	1, 725	+40	585	+11
Financial assets:								
Deposits and currency	3, 900	10, 800	[2] 15, 300	14, 800	10, 900	+279	−500	−3
United States savings bonds	249	[2] 3, 714	[2] 4, 781	5, 024	4, 775	+1, 918	243	+5
Investment in cooperatives	826	1, 264	[2] 1, 858	2, 036	1, 210	+146	178	+10
Total	[2] 53, 788	[2] 87, 921	[2] 121, 409	127, 314	73, 526	+137	5, 905	+5
CLAIMS								
Liabilities:								
Real-estate debt	6, 586	4, 933	4, 882	5, 108	−1, 478	−22	226	+5
Non-real-estate debt:								
To principal institutions								
Excluding loans held or guaranteed by Commodity Credit Corporation	[2] 1, 504	[2] 1, 622	2, 302	2, 714	1, 210	+80	412	+18
Loans held or guaranteed by Commodity Credit Corporation	445	683	[2] 84	1, 152	707	+159	1, 068	+1, 271
To others [5]	1, 500	1, 100	1, 800	2, 200	700	+47	400	+22
Total	[2] 10, 035	[2] 8, 338	[2] 9, 068	11, 174	1, 139	+11	2, 106	+23
Proprietors' equities	[2] 43, 753	[2] 79, 583	[2] 112, 341	116, 140	72, 387	+165	3, 799	+3
Total	[2] 53, 788	[2] 87, 921	[2] 121, 409	127, 314	73, 526	+137	5, 905	+5

[1] The margin of error of the estimates varies with the items.
[2] Revised.
[3] Includes all crops held on farms and crops held in bonded warehouses as security for Commodity Credit Corporation loans. The latter on Jan. 1, 1949, totaled 804.2 million dollars.
[4] Estimated valuation for 1940 plus purchases minus depreciation.
[5] Tentative. Includes individuals, merchants, dealers, and other miscellaneous lenders.

Covers Many Facets of Agriculture

The BSA pictures agriculture as though it were one vast firm. Yet the coverage is not limited to farm enterprises as such. Physical assets like the dwelling, household equipment, the family automobile, and financial assets like bank deposits, that would be appropriate for a balance sheet of farm households, are identified in the BSA with the agricultural industry. Farmers' equities in their own cooperative credit associations and marketing, purchasing, and public service associations are included. United States savings bonds and household equipment of families living on farms are intended to be included whether or not the families make their living from farming. All financial and other assets of farm operators for which data can be obtained are included whether the operators be owners or tenants.

Consistent with the conception of agriculture as a single enterprise or firm, the claims recorded by the BSA include the rights of creditors, owner- and tenant-operators, and landlords. The types of claims held by creditors are diverse. Real estate mortgages represent the largest single type of claim. The non-real-estate debts of farmers reported by institutional lenders often include both operating and personal credit. Included also are the loans held or guaranteed by the Commodity Credit Corporation. In general, except in case of fraud, these loans are without recourse on farmers who often view the transactions as sales of commodities to the Government. Only if prices rise above the loan support

price do farmers have any incentive to pay off the loans to recover possession of the commodities. Besides these claims of institutional lenders are those of noninstitutional lenders—merchants, dealers, professional men, etc. For these, few data exist. All obligations of farm operators are intended to be included but the obligations of farm residents who are not operators are intended to be excluded.

The types of proprietors who hold equities also are diverse. Among the equity holders are landowners such as farming corporations, financial institutions, and governmental bodies, as well as owner- and tenant-operators and nonoperating individual landlords. Indeed, any public land reported in the Census of Agriculture implicitly has a contra value among the proprietary equities reported in the BSA. All levels of government, then, are represented among the proprietors.

In general, the ownership units intended to be covered are those identified in the Census of Agriculture. The Census defines a farm as an area of 3 or more acres in agricultural use operated as a unit. Areas of less than 3 acres are included if they produce $250 or more of agricultural products. The term "agricultural use" covers the usual crop and livestock production and other activities, as apiaries, mushroom cellars, greenhouses, and nurseries, which are less easily recognized as farms. But these nontypical activities have only a minor influence on the real-estate valuations shown in the BSA even though the base value reported by each Census of Agriculture would include these nontypical cases. Moreover, the method of measuring year-to-year changes of real-estate valuation is based only on average per acre prices of typical agricultural land. Public lands used under a lease are included but land used under a grazing permit (specifying merely the number of head of animals to be grazed) is not included in the base figures of the Census. Institutional farms—those of schools, prisons, etc.—are included to the extent of actual agricultural uses. Country estates are included if there is agricultural production. Heretofore, houses and households on farms, even though occupied by nonfarmers, have been classed as "farm." Indications are that, for the 1950 Census, houses rented for cash without land other than yard or garden will be classed as "rural nonfarm" even though they may be situated on real estate that is used for farming.

What, then, is "agriculture" to which the BSA applies? Agriculture is implicitly defined by the BSA not only to be the process of producing plants or animals and their products for sale or farm family use in keeping with the industry concept but also other activities in keeping with the household concept. Activities associated with the household concept are various: Farmers invest in cooperative marketing and credit organizations and in shelter and furniture for the farm family; they provide transportation in the farm truck and the family automobile, and manage the financial resources of the farm family including certain funds and some investments not required in farming.

Valuation in Current Prices

The BSA is set up in terms of current prices in any year. Conceptually it is impossible to express aggregate data of this character in terms of "original cost," "proven investment," or any similar book value that uses historical cost. Such devices may be suitable for private accounting but not for social accounting. Little significance would attach to a sum composed of original investments made over many years by existing owners of farming assets. What is useful is an expression of the aggregate wealth of agriculture as of a given time or in terms of prices of a given period. Individual items of wealth are then additive, and the totals may be added to or compared with data for other sectors of the economy.

Values of the BSA supposedly reflect market prices of items to "willing buyers and willing sellers" for use in a "going concern." The whole of agriculture is personified as a "going concern." Market valuations reflect depreciation, obsolescence, and changing demands for products. Even more important, market valuations reflect changes in the general price level. Neither original cost nor liquidation values are used.

Each asset presents a special problem in valuation. In general, the physical assets are valued at current market prices as reported by the Census and other sources. Census base figures are adjusted from year to year by changes in market prices and quantity. As an exception, for lack of another basis, household equipment is valued in terms of estimated average cost from 1936 to 1940 plus purchases each year since, and minus depreciation during each year. Invest-

ments in cooperatives are valued at book values. Investments in United States savings bonds are at cost-plus accruals. Of course such a liquid asset causes no particular problem of valuation—only a problem of statistical estimating of the amount involved.

Valuation in Constant Prices

The BSA also is expressed in 1940 prices and thus shows the effect of changes from year to year in the quantity of assets apart from changes attributed to prices (table 2). Any other base year might have been chosen for this purpose but 1940 is the last prewar year. It constitutes more nearly a prewar "norm" than any other year. It also is the first year in the annual BSA series. The effect of the conversion of a series of balance sheets to 1940 prices is to obtain a measure of changes in physical quantities that are statistically weighted by the prices of each commodity in the base year. If values of physical assets in constant prices have risen, aggregate physical quantities have risen—granted the use of prices in a base year as statistical weights.

Conceptual Limitations

The foregoing description of the definition and coverage of the BSA has suggested many of the conceptual limitations of the series. These limitations apply to the use of the BSA for presenting the financial situation of the agricultural sector of the economy either as a whole or in segments and for reflecting the situation of the households associated with farms either in the aggregate or with respect to the distribution of individual cases.

Not being considered in this article are the inadequacies associated with the compilation and manipulation of the statistical series of the individual items of the BSA.[2]

[2] See Appendix, IMPACT OF WAR ON FINANCIAL STRUCTURE OF AGRICULTURE, U. S. Dept. Agr. Misc. Pub. 567, Aug. 1945; TOSTLEBE, ALVIN S. ESTIMATE OF SERIES E BOND PURCHASES BY FARMERS. Jour. Amer. Statis. Assoc. Sept. 1945; BURROUGHS, ROY J. THE AGRICULTURAL SEGMENT OF THE NATIONAL BALANCE SHEET, to appear in Volume Twelve by National Conference on Income and Wealth. (In press.)

Ideal Objectives

The aggregate balance sheet is a phase of social accounting—the measurement of national wealth. The individual balance sheets of households or farm enterprises are social statistics of great value in discerning and interpreting details of data that aggregate balance sheets leave concealed.

The significance of the limitations of the BSA as now constituted may be understood best by reference to ideal objectives for the array of financial data. These may be listed as follows:

Possible Types of Balance Sheets for Agriculture

A. Aggregate balance sheets
  1. Industry of agriculture by
    a. United States total
    b. Geographic groupings
      1. State
      2. Type of farming
      3. Other
    c. Other groupings
      1. Tenure
      2. Size of farm
      3. Gross income
      4. Other characteristics
  2. Households on farms viewed as an aggregate by
    a. United States total
    b. Geographic groupings
    c. Other groupings
      1. Tenure
      2. Net worth classes
      3. Other

B. Distribution of individual farms and households
  1. Individual households by
    a. Net worth
    b. Total assets controlled
    c. Types of assets held
    d. Tenure
    e. Other characteristics
  2. Individual farm enterprises (firms) by
    a. Size of farm
    b. Total assets
    c. Tenure of principal portion of acreage
    d. Significant ratios
    e. Other

TABLE 2.—*Balance sheet of agriculture with physical assets valued at 1940 prices, Jan. 1, 1940, 1945, 1948, and 1949*

Item	1940	1945	1948	1949
ASSETS				
Physical assets (1940 prices):	*Million dollars*	*Million dollars*	*Million dollars*	*Million dollars*
Real estate	33, 642	[1] 33, 642	[1] 33, 642	[1] 33, 642
Non-real estate:				
Livestock	5, 133	5, 606	[2] 4, 913	4, 847
Machinery and equipment	[2] 3, 118	[2] 4, 011	[2] 5, 022	5, 749
Crops, stored on and off farms	2, 645	3, 162	[2] 2, 482	3, 399
Household equipment [3]	4, 275	4, 232	5, 415	6, 000
Financial assets (actual value):				
Deposits and currency	3, 900	10, 800	[2] 15, 300	14, 800
United States savings bonds	249	3, 714	[2] 4, 781	5, 024
Investments in cooperatives	826	1, 264	[2] 1, 858	2, 036
Total	[2] 53, 788	[2] 66, 431	[2] 73, 413	75, 497
CLAIMS				
Liabilities (outstanding amount):				
Real-estate debt	6, 586	4, 933	4, 882	5, 108
Non-real-estate debt:				
To principal institutions:				
Excluding loans held or guaranteed by Commodity Credit Corporation	[2] 1, 504	[2] 1, 622	2, 302	2, 714
Loans held or guaranteed by Commodity Credit Corporation	445	683	[2] 84	1, 152
To others	[2] 1, 500	[2] 1, 100	1, 800	2, 200
Equities (residual balance)	[2] 43, 753	[2] 58, 093	[2] 64, 345	64, 323
Total	[2] 53, 788	[2] 66, 431	[2] 73, 413	75, 497

[1] 1940 valuation of farm land and buildings.
[2] Revised.
[3] Not deflated. Estimated valuation for 1940, plus purchases, minus depreciation.

The first ideal objective according to this listing would be to prepare an aggregate balance sheet for agriculture solely as an industry. Personal and household elements would be eliminated. Having such an aggregate for the country as a whole, it would then be possible to obtain similar aggregate balance sheets for each State, or each type-of-farming area, or for other geographic areas. Then, too, industrial balance sheets in aggregate terms could be prepared for any stratum of the industry such as farms classified according to tenure, size, gross income, or other characteristic.

The next ideal objective would be to prepare an aggregate balance sheet of farm households. One of the intangible assets to be included would be the equity of farm households in farm enterprises. Moreover, financial assets, furnishings, perhaps dwellings located on farms, and all personal assets not heretofore mentioned would be listed as assets of households. Having such an aggregate for the country as a whole, it then might be desirable to obtain aggregate balance sheets for geographic areas and for strata of farm households such as for tenure classes, net worth classes, and other characteristics.

Next, for a complete analysis of the situation of farm peoples, balance sheets of individual households or families are needed. These, if obtained from a sufficient sample, could provide much or all the data for the aggregate balance sheet of agriculture and the aggregate balance sheet of farm households. But a more valuable use for individual balance sheets would be to provide a basis for learning distribution of farm households by such classes as net worth, total assets controlled, types of assets held, tenure, and other characteristics.

Finally, from such individual household balance sheets it might be possible to extract data on individual balance sheets of farm firms, omitting the personal and household elements. Then distributions of farm firms by various financial or other characteristics would be possible.

TABLE 3.—*Percentage distribution of farms by acreage, 1945* [1]

Acreage	Percent	Cumulative	
		Percent down	Percent up
Under 10 acres	10. 1	10. 1	100. 0
10–29 acres	16. 1	26. 2	89. 9
30–49 acres	12. 1	38. 3	73. 8
50–69 acres	8. 1	46. 4	61. 7
70–99 acres	11. 7	58. 1	53. 6
100–139 acres	10. 8	68. 9	41. 9
140–179 acres	9. 7	78. 6	31. 1
180–219 acres	4. 8	83. 4	21. 4
220–259 acres	3. 6	87. 0	16. 6
260–499 acres	8. 1	95. 1	13. 0
500–999 acres	3. 0	98. 0	4. 9
1,000 acres and over	1. 9	100. 0	1. 9

[1] U. S. Bureau of the Census, Census of Agriculture: 1945, Farms and Farm Characteristics by Size of Farm, table C, p. XXXII.

TABLE 4.—*Percentage distribution of farms by value of product, 1944* [1]

Value of product	Percent	Cumulative	
		Percent down	Percent up
$0–$249	9. 5	9. 5	100. 0
$250–$399	7. 4	16. 9	90. 5
$400–$599	8. 8	25. 7	83. 1
$600–$999	13. 3	39. 0	74. 3
$1,000–$1,499	12. 3	51. 3	61. 0
$1,500–$2,499	15. 5	66. 8	48. 7
$2,500–$3,999	12. 7	79. 5	33. 2
$4,000–$5,999	8. 8	88. 3	20. 5
$6,000–$9,999	6. 8	95. 1	11. 7
$10,000–$39,999	4. 5	99. 6	4. 9
$40,000 and over	0. 4	100. 0	0. 4

[1] U. S. Bureau of the Census, Census of Agriculture: 1945, Farms and Farm Characteristics by Value of Products, table C, p. XXIV.

Heterogeneity of Coverage

The conceptual limitations of the BSA as now constituted arise in part from the heterogeneity of coverage: The admixture of farm and household items, the uncertain delimitation of the boundary between farm and nonfarm assets, and the inclusion among the proprietary equity holders of such diverse types as owner- and tenant-operators, nonoperating individual landlords, corporate owners, and governmental units.

The BSA possesses the limitations of an aggregate. Circumstances of individual farmers are not revealed. Some are tenants, others are not. Some have large farms, others have small. Some have large gross farm incomes, others have small. Some are nominally farmers merely because anyone living on a farm, as defined by the Census, is included in the farm population, even though his occupation may not be farming.

Farming enterprises with a very wide range of acreage are included. The percentage distribution of farms by size classes in 1945 was reported by the Census as shown in table 3. The percentage distribution by value of product in 1944 reveals an even greater range (table 4). Some of these "farms" are in fact country estates; others are part-time operations of nonfarm workers; some are units of a multiple farm like a plantation.

Assets Not Necessarily Security for Loans

Another limitation of the aggregate form of the BSA is its implication that any assets shown are security for any debts shown. In fact the farmers owing the debts may be the ones with the least liquid assets. The cash, although at times exceeding the debts, may be entirely unavailable to pay the debts.

BSA Not Representative of Typical Farmer

There is an implication in the BSA that the financial condition of a typical farmer could be obtained by dividing the assets or claims by the number of farms. But of course the presence among the equity holders of owners and tenants, operators and landlords, individuals and corporations, private persons and governments, preclude any such average. Besides the BSA is the aggregate of firms and not of operators or individuals. A single farm may have two or more types of proprietors represented among the equity holders: tenant-operator, individual landlord, and possibly a governmental landlord of leased public land.

Even if the proprietors were all owner-operators, an average obtained by dividing the BSA by the number of farms would not reveal the typical farmer. This is because the distribution of indi-

vidual farmers by financial condition presumably is bimodal; that is, the farmers who owe the bulk of the debts probably are not the ones with the bulk of the financial assets. The farmers owing the bulk of the debts also might control more than average amounts of physical assets. Hence any average of all cases would produce a nontypical and unmeaningful figure. An over-all average can stand for a typical case only when the distribution has a single center of concentration.

The financial status of some proprietary classes with interests in agriculture is more fully represented in the data of the BSA than is the situation of others. The degree of representation varies from item to item. Thus, in the case of bank deposits, all the deposits of farm operators are included and presumably to some extent the deposits of those nonfarm residents who own farms and who draw income therefrom. Whether they are represented would depend on the reporting practice of each sample bank that makes the estimates for no uniform definition of farm deposits has been given.

In principle, data on savings bonds represent ownership by persons living on farms—persons who vary from subsistence farmers in "mountain hollows" to wealthy estate owners on the Hudson River who commute daily to Wall Street. In practice, bonds of the wealthy probably are less fully represented than are those of other income groups because the well-to-do are more likely to buy them in urban financial centers so the purchases would escape inclusion in rural statistics.

The ownership of physical assets is divided among owner- and tenant-operators and their families, resident nonoperating landlords, and nonresident landlords including industrial corporations, financial institutions, and governmental units at all levels. It would be an impracticable statistical chore to report separately the physical assets according to these various claimants. Then would come the determination of gross versus net claims of proprietors since creditors as well as proprietors have rights in the assets.

The liabilities involve further anomalies from the viewpoint of distinguishing the debts of different types of farm households. The mortgage debt is that of all farm owners whether operators or landlords. Farm operators also may owe nonfarm mortgage obligations; such debts are inapplicable to an industrial balance sheet but would be included in the debts of farm households. On the other hand the nonfarm debts of landlords might be included in a balance sheet of farm households if they lived on farms. The question of definition arises, What is a farm household for the purpose involved?

The non-real-estate debts of farm operators, whether or not they arise from farming operations, are intended to be included. Not all such debts can be identified statistically, however. On the other hand, the non-real-estate debts of nonoperator landlords incurred in connection with farming may or may not be reported, depending on whether banks classify such loans as agricultural. If a loan is obtained by such a landlord from a noninstitutional source, it would surely escape inclusion.

These illustrations clearly indicate that the BSA cannot be considered fully representative of the typical commercial farmer. A balance sheet of an industry can suggest only in a very general way, or perhaps indicate with respect to particular items, the financial situation of households that depend on that industry for a living or that use the real estate of that industry as a place of residence.

Variations in Methods of Valuation

The system of valuation varies somewhat from item to item as has been mentioned. This fact reduces the usefulness of the BSA as a balance sheet of an industrial or a household sector of the economy. The methods of evaluating household equipment and investments in cooperatives are departures from the general practice in the BSA of evaluating items on a current market basis. Even the items that are reported in terms of current prices have statistical idiosyncracies that arise from the necessity of using available data of varying quality and coverage.

The conversion of values to a 1940 basis entails individual problems in the case of specific items. Problems of weighting are important. Financial assets and liabilities are left untreated and thus remain on a contract-price basis regardless of changes in the price level.

The main limitation of this device of converting values for a series of years to a base year is the unpredictable effect of changing from base year 1940 to another. Instead of valuing a fixed

basket of commodities at various prices from time to time, the BSA in 1940 prices does the reverse: it values a changing list of commodities at constant prices. Now if the prices are understood to be weights, as well as a common denominator making possible the summation of unlike measures of various commodities, one can compare year-to-year changes in physical amount. Were a different base year than 1940 chosen, the prices used for weights would be different. In some instances the effect of changing base years—and the resulting weights—is to reverse the direction of change. Whether values in constant prices of a given class of assets shall have risen or fallen from 1940 to 1948 may depend on whether 1940 or 1948 is chosen as the base year. Any manipulation of data, such as selecting average prices for a decade as a base, does not avoid this problem of weights; it merely makes the weights more difficult to interpret. But the presence of limitations does not prevent the understanding use of the stabilized balance sheet. The dangers of misuses are merely increased.

Proprietary Equities a Residual

Equities are the difference between assets and liabilities. This residual at any one moment shows the rights of all the different classes of proprietors. It is not the net worth of farmers because many nonfarmers are concerned.

The meaning of changes in the amount of equity from year to year is not readily interpreted. The equity, being a residual, is affected by many types of transactions. The original investment of persons with a proprietary interest in agriculture is reflected. Earned accumulations retained in agriculture or in the form of household or financial assets and losses suffered are reflected. Moreover, each transfer of capital to agriculture from other sectors of the economy, and conversely each withdrawal from agriculture, has an impact on equities. If owner-operators sell to persons who had been nonfarmers, real estate assets in the BSA remain the same. Too, the chances are that machinery and motor equipment will remain on the same or some other farm. But the number of head of livestock may change. Some may be slaughtered. The seller of the farm may retire from farming and withdraw deposits from local banks. The newcomer may bring either more or less deposits than the retiring farmer had. The same is true of United States savings bonds but the methods of deriving this series is such that the amount reported would not be influenced by such two-way exchanges of population between rural and urban areas.

The predominant source of changes in equities of proprietors in recent years has been the write-up of assets, especially of real estate, in keeping with higher prices. Capital gains and losses are not earned income but they affect the balance sheet in much the same way as accumulations or losses from operations. The practical difficulty of distinguishing additions to equity based on the price factor from those based on reinvested earnings has given rise to popular misconceptions of the true meaning of changes in the equities. They are changes on net balance but they arise from a variety of sources.

Bridge Needed Between BSA and Income Data

The difficulty of effecting a reconciliation with data for farm income is a further conceptual limitation of the BSA. An aggregate balance sheet for either the agricultural or the farm household sector of the economy ideally should have identical coverage with income data for the respective sector. The coverage of BSA and income data are somewhat different. Thus the BSA includes United States savings bonds and time deposits but income data do not include interest on these assets. The BSA includes household equipment and motor vehicles but the computations of net income omit from expenses the depreciation on household equipment and half or more of the depreciation on family automobiles.

The BSA includes commodities held under repurchase agreements of the Commodity Credit Corporation with assets while the corresponding loans are classed with debts of farmers. Yet the income data add loan proceeds to cash receipts from farm marketings. The logic of the balance sheet would be to defer the inclusion of these receipts with income until after the loan transaction had been terminated and the commodities sold to the Government. The logic of the income statement would be to exclude the CCC items from both the assets and the claims of the BSA. The latter usually is more realistic though not necessarily so acceptable from a legal viewpoint.

Articulation of the BSA with income data is not readily achieved because many transactions that affect the BSA do not affect estimates of income and the data that are available are not sufficient to fill the gap. In the absence of a system that would account for all money transactions, reconciliation is impossible. Of course some data are available. Net changes in debt position during an accounting period can be ascertained within certain limits. Capital gains and losses resulting from price fluctuations can be estimated directly with the use of price indexes. Outlays of machinery and motor vehicles are partly reflected in the net-income figures, and estimates can be obtained from the outlays not so included. Payments of Federal income taxes are estimated each year but less is known about State income taxes. Estimates are available for at least a part of the nonfarm income received by farmers but the estimates are based on very limited data. Available estimates for outlays on building materials and construction labor likewise are based on too few data.

Data for many other transactions are seldom available in sufficient degree to explain those changes in the BSA that are not accounted for by existing data. Estimates of the amounts of cash payments and cash receipts in the case of many investment transactions, such as the purchase and sale of farms and of nonfarm properties by farmers, and for the most part transfers of goods by those moving to farms or those moving away from farms, are not available. Nor are expenditures on consumption goods known. Some capital transactions do not involve cash; rather they involve transfers of other goods and even more often affect the claims; but such deals usually escape statistical reporting.

Thus a bridge is needed to articulate the BSA and the income statements for agriculture. This bridge is an accounting for money flows and other capital transactions. Some work has been done on money flows by Morris A. Copeland and associates of the Board of Governors of the Federal Reserve System and Cornell University under the sponsorship of the National Bureau of Economic Research but much pioneer work remains.

What the Balance Sheet of Agriculture Does

The BSA is a tool for social accounting. It contributes to the measurement of the status and changes in the agricultural sector of the economy. It contributes to an understanding of the interrelationships of the agricultural and nonagricultural activities of the economy. It covers in part the farm portion of the household sector of the economy.

Measures Over-all Changes in Agriculture

Those interested in agriculture as a whole can look to the BSA to give a measure of the wealth represented by agricultural assets and the values of the rights of various claimants—creditors and proprietors—to that wealth. By comparing a balance sheet of one period with that of another some aspects of the extent of capital formation or reduction can be ascertained. Thus by reducing the comparative balance sheets to constant prices of a base year, an idea may be gained of whether the capital changes are the consequence of accumulations or disappearance of real goods or merely changes that result from rising or falling prices in which the items of the balance sheet are measured. Changes in dollar terms are given and changes in real terms are suggested.

The BSA may be used in connection with other data to suggest the relation of debts to the real products required for their repayment. The purchasing power of financial assets and changes therein often are of real significance, especially when financial circumstances of farm households are being considered.

Shows Changes in Relative Importance of Asset and Claim Items

The relative importance of the items in the balance sheet is readily indicated by the BSA. How does real estate compare in value with livestock, machinery, or other assets? How does real-estate mortgage debt compare with non-real-estate debt? How does it compare with the value of real estate? How do liabilities compare with equities? How is the relative importance of the different items changing from year to year? Do the changes signify a trend associated with improvements in technology or merely those associated with the "dance of the dollar?" Is there any evidence of capital savings as well as labor savings in the trend of technology? These and many other questions of interpretation can be raised by the BSA and, if related to other pertinent information, often can be answered.

Permits Comparisons with Rest of Economy

Besides giving cross-sectional pictures of agriculture at various points of time, the BSA provides a means of comparing agriculture with other segments or with the whole of the national economy. When business men meet they ask, "How are you doing?" They mean: Is the business earning a favorable return? Are assets increasing more rapidly than liabilities? Are a sufficient part of the assets in liquid form? Business consultants, economists, and Government administrators, ask similar questions of the economy as a whole and of its industrial sectors. Data of the balance sheet and income statement help to provide answers.

The National Conference on Income and Wealth, sponsored by the National Bureau of Economic Research and representing many business, college, and governmental economists, is working toward the development of a national balance sheet. Similar undertakings are being made in other countries. Sector balance sheets for industries, governments, and households must first be available for consolidation before a national balance sheet is made. When this has been done the BSA may be used for studies of inter-sector claims and for comparisons of changes in agriculture with changes in other parts of the economy. The direction of the inter-sector balance of payments also may be suggested. Together with data on income and transactions, money flows within agriculture and between agriculture and other parts of the economy, can be more readily traced.

Offers Improved Understanding of Economic Order

End product of such an analysis should be: An improved understanding of how our economic system is operating; a knowledge of its weak points; a recognition of the danger signals which if heeded may prevent economic distress of individuals or avoid general depression; a judgment concerning the results of efforts to stabilize the economy; a conclusion concerning whether price supports are keeping the agricultural investment intact in a period of falling employment; and how much capital formation or reduction is resulting from efforts to increase output. These and many related issues must be analyzed by those who are concerned with the operations of our economic system. The BSA is one aid in such an analysis.

How To Make the BSA More Useful

The Balance Sheet of Agriculture would serve more purposes and would be more readily understood if two collateral fields of research were more fully developed. One, already discussed, is that pertaining to money and capital transactions which are not covered by existing estimates. The other is the preparation of balance sheets for different sectors of agriculture in which data for agriculture as an industry are clearly separated in principle from data for farm households.

Two types of sector research are possible.[3] One would provide aggregate balance sheets of agriculture or of households, as the case may be, by geographic areas as the one Cox and Waite have prepared for the State of Minnesota.[4] The other type would provide distributions (on one hand of farm firms and on the other of households of farm operators) according to size of investment, net worth, financial assets, ratios of one item to another, and other elements of financial status according to tenure, location, etc. Such a study is now in progress in the State of Virginia where the Virginia Polytechnic Institute, the Federal Reserve Bank of Richmond, and the Virginia Bankers Association, are surveying farm operators.

An extension of such studies to other States and to various types-of-farming areas would provide data for more detailed interpretation than is now possible with the Balance Sheet of Agriculture alone. The BSA would become far more meaningful if the variations, which the aggregate data fail to reveal, were fully analyzed. The composition of the Balance Sheet of Agriculture is as important as the global estimate that is now available.

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[3] Both types of studies could be based on a single survey.

[4] Cox, Rex W. and Waite, Warren C. financial structure of minnesota agriculture. Minn. Agr. Expt. Sta. Bul. 402. March 1949.

Statistical Improvements in Turkey

By Charles F. Sarle

Sound statistics are basic to the effective operation of any industry. This article tells of improvements which the Turkish Government is making in its statistics on agriculture through the use of techniques that have been demonstrated in the United States.

TURKEY is scheduled to have a modern crop and livestock reporting service. Preceding its development will be the taking of a census of population, agriculture, and manufacturing. The Central Statistical Office of Turkey will be responsible for the census of population and agriculture, which will be taken this fall and it expects to take a census of manufacturing and business in early 1951.

The United States is providing a three-man statistical mission to assist in getting this work under way. The experience will provide our statisticians with a valuable opportunity to test the effectiveness of modern sampling techniques under unusual conditions.

Under present plans a probability sample survey with specially trained interviewers will be made at the time the agricultural census is taken, to obtain at least a partial measure of the bias that is inherent in any agricultural census taken by village headmen in a rural culture that has actually changed very little, psychologically speaking, in hundreds of years. The last agricultural census in Turkey, made in 1927, was accompanied by a country-wide sample survey that showed an average understatement of 27 percent in the figures obtained by village headmen. This sample survey was made under the direction of a Belgian consulting statistician employed by the Turkish Government of that time. Most of the techniques of modern sampling were employed, except that the sample was not selected on the basis of probability—a method that has become common practice in the United States, in India, and in Japan during this decade.

A sample of 8,000 out of about 40,000 villages was selected, utilizing stratification and a higher sampling rate in the areas where agricultural production was most important. Within each sample village six sample households were selected. The households within the sample villages were stratified on the basis of their economic status and two households were selected from each of the three strata. The data obtained by the survey interviewers were compared with the census data obtained from the same sample households by the village headmen. The average understatement of 27 percent was ascertained in this way.

Making that sample survey was a remarkable achievement, in view of the time and conditions when it was made—more than 20 years ago when only a very small percentage of the villages of Turkey had elementary schools of any kind. (Today, about 43 percent of the villages have elementary schools.) Even in the United States, at that time, only a few statisticians were showing interest in modern sampling methods.

Census Methods Used in Turkey

Turkey had a population census in 1927, in 1935, and each fifth year since. The population census of 1927 had one serious weakness. The sex ratio of males to females for the younger or military-age group was much lower than for the other age groups, indicating a serious underenumeration of males of military age. The country had rather recently passed through two wars: through World War I, as an active belligerent, and the Turkish Revolution of the early 1920's when after several years of fighting, the Greek Army of invasion was driven out.

Two interesting controls are used in taking a population census in Turkey. Before each quinquennial population census, all doorways or entrances of buildings that open upon a public thoroughfare are given numbers by the local authorities. If a given building has more than one entrance on this thoroughfare, it is given a letter as well as a number. For example, if a building has three entrances, they are numbered, say 19A, 19B, and 19C. The population census is

taken on a Sunday and all persons are required to stay within the places where they live until the census is completed, when a signal is given. Everyone can then go about his business as usual. Anyone who will have to be away from home must get a permit from the local police and wear an arm band on the day the census is taken. No enumerators are hired as the taking of the census in a regular duty of the local officials.

This spring and summer the numbering of doorways throughout Turkey will be brought up to date. In taking the population census next October a household questionnaire will be used rather than the individual questionnaire that was used previously.

Agricultural Statistics in Turkey

Those who attempt to use the agricultural statistics of Turkey generally recognize that the present agricultural statistical service is wholly inadequate to meet the needs of the expanding national economy of that country. An imposing array of agricultural statistics in great geographical detail are now published by the Central Statistical Office, but they have not been made available until about 2 years after the crops to which they apply have been harvested. This delay was inevitable under the methods of compilation used thus far. Each of the 497 county agricultural agents, most of whom are graduates of secondary agricultural schools, had to estimate the area and production of crops for each of the villages in his county, or *illce*. On the average, there are about 70 villages per county and few of the county agents have an allowance for travel within the county. These village data were tabulated at the agricultural office of the respective province, and were eventually forwarded to the Agricultural Section of the Central Statistical Office in Ankara, the capital. The Agricultural Section consists of one statistician and a few clerks, and it handles a multitude of agricultural data from various sources. Eventually the data from the county agents and other sources are prepared in rather elaborate geographic detail for publication. An abstract of the compilation is now published in English.

Preparing for the New Census

The Central Statistical Office has made excellent progress in preparing for the 1950 agricultural census. In 1948 a country-wide survey was made of all villages and towns. The respondent was the village headman and his staff, all of whom are elected annually by the villagers at what in New England would be called a town meeting. Questions concerning the economic life of the village as a whole were in the questionnaire, including several global questions concerning land use, such as area of land in field crops, in vegetable crops, orchards, and vineyards; extent of hayland, pasture, and range. The number of livestock kept was also asked. These data have been entered on punched cards, and can be used when the 1950 agricultural census is planned.

Last year, under the able leadership of the Director of the Central Statistical Office, a much more intensive country-wide village survey was made. The questionnaire included questions concerning the area of the individual crops within the village, the numbers of fruit and nut trees, grapevines, and olive trees; and the numbers of different kinds of livestock. Fourteen teams of two persons each were trained and then assigned for 3 months to the 14 districts into which the 63 provinces had been grouped. The military department furnished jeeps for the transportation of these teams and for their later use in their respective districts. These teams conducted training schools for the county agricultural agents, who in turn called in the village headmen and instructed them in the use of the agricultural questionnaire. The county agents saw that the village headmen went over the filled questionnaires critically and returned them. The teams traveled extensively in their districts, supervising and assisting both the county agents and the village headmen.

Data collected in this fashion for the village are subject to understatement bias. One village headman told a supervisor who asked about the accuracy of the data submitted, "If I reported all of the area and production of crops in this village as I know it to be, someone would kill my donkey some night." But these data by villages will be valuable in the planning of the census. They will be especially useful in designing the sample for the survey that is to parallel this census.

Probability Sampling Already Tried

A country-wide probability sample survey of 166 villages with subsampling of households within

the sample villages, was made in the fall of 1949. Data thus obtained will be valuable in connection with designing the sample of the parallel surveys. A statistician from India was employed by the Central Statistical Office from August to November in 1949. He designed the sample, using modern principles of probability sampling. An internal statistical analysis of the data from this survey yet to be made will show the comparative variance for households within villages and between villages, and this will make it possible to allocate survey resources much more efficiently than would otherwise be possible. For example, if the variance is high within villages and low between villages, a smaller sample of villages will be used with a higher rate of sampling of households within villages. But if the reverse is true, a larger sample of villages with a lower sampling rate within villages will be used.

During a 5-week stay in Turkey last fall the writer selected 10 qualified trainees to come to this country for intensive training of 6 to 9 months. Two of these were for work on agricultural census and crop and livestock estimating methods, 2 were for work on sampling, 1 each for work on the population census, the census of manufacturing and business, the collection of information on labor statistics and family budgets, and collection of information on national income, and 1 each to work on economic planning, and machine methods and sample expansions. Three of these trainees arrived last January. Incidentally, 3 of the 10 trainees are women.

At the request of the Director of the Central Statistical Office the writer also prepared, while in Turkey last fall, a report that analyzed briefly the needs of the Turkish economy for current and reliable agricultural statistics and that made specific recommendations regarding the organization and functions of a modern agricultural statistical service for Turkey. It is this service that will now be developed for that country.

Problems in Sampling a Heterogeneous Agriculture

By George Knutson and Floyd K. Harmston

Sampling for agricultural items having low frequencies of occurrence or a very sporadic geographical distribution, which is characteristic of the agriculture in the West, involves several special problems. One of these is the delineation of areas which will be useful as a basis for stratification for selecting samples and for analytical purposes. The authors give their views on the classification of agriculture with reference to Wyoming particularly.

IT HAS LONG BEEN the practice of agricultural statisticians to work with samples that were aimed at getting a cross-section of all farms in a State. Such a procedure is satisfactory when all farms in the universe are fairly similar with respect to the characteristics to be estimated from the sample. But when the agriculture in a State is heterogeneous a general-purpose sample of farms does not yield results of the required precision for sporadically distributed items, unless a prohibitively high sampling rate is used.

So far, the commonly used method for working with problems of heterogeneity has been the classification of areas by districts. Geographical districting has been used in the Department's work in agricultural estimates for a long time, in an attempt to bring "like" agricultural areas into the same subuniverse. These areas follow county lines. The method has a certain degree of merit. Recently, area interview surveys have utilized type-of-farming maps in allocating sampling areas; this amounts to districting into strata the parts of which are not necessarily geographically contiguous.

The problems of heterogeneity, however, are not completely solved by any such simple procedure. State statisticians, particularly those in the West, have lamented the lack of research on them. There seems to be a tendency to select the most homogeneous areas for use in sampling re-

search, thus relegating the nonhomogeneous to a background position, perhaps for future study. The establishment of the West of 100 Meridian Project gave hope, but this was discontinued before ground work was thoroughly laid.

What is there about agriculture in the less homogeneous parts of the country that poses such puzzling problems? Because we are familiar with it, the farming and ranching of Wyoming is here considered.

Agriculture is carried on in Wyoming at elevations ranging from 3,000 to 10,000 feet, or higher. This, in itself, is a problem. Abrupt and decided changes in elevation occur in many parts of the State, and they are responsible for similar changes in ecology. Crops are raised on elevations as high as 8,000 feet and pasture and meadows lie even higher. Rainfall varies from about 20 inches on plains and high mountains to 6 inches in the desert. Topography varies from rolling hills, through rough and broken country, to mountain crags. Stream valleys, some wide and some narrow, are numerous, with intermittent draws. The physical geography of Wyoming is probably the factor of the most heterogeneity.

The agriculture of this State should be classified into several universes and subuniverses. Some of this classification can be made on a geographical basis but most of it cannot. Four types of farming and ranching are carried on in some counties.

There are two major categories of cropland—irrigated and dry. Some land is subirrigated, and this requires special treatment and cropping practices. Yields derived are comparable with those from irrigated land, but for the sake of simplicity these two major categories are considered.

Irrigated land may be readily subclassified into (1) hay meadows and pastures of high elevation and (2) elevations that are relatively low, with diversified farming. The hay meadows are found in all parts of the State and are fairly homogeneous in character. Diversified farming is carried on in many parts of the State but there are wide differences between these parts.

For the sake of statistical analysis, it is always well to consider the following subdivisions by kind of projects when thinking about Wyoming's irrigated land: (*a*) North Platte River valley (Districts 4 and 5), (*b*) Laramie County, pump irrigation (District 5), (*c*) Wind River and Big Horn basin (District 1), (*d*) Sheridan and Johnson Counties (District 2), (*e*) Wheatland Flats (District 5), (*f*) Uinta County (District 3), (*g*) Star Valley (District 3), (*h*) Jackson Hole (District 3), (*i*) Eden (Sweetwater County—District 4), and (*j*) several very small and minor areas scattered throughout the State. Each subdivision has distinct characteristics that are not shared by any other. Each must have individual consideration and analysis in estimation procedure.

The dry-land areas may be subdivided into (*a*) hayland, (*b*) general cropland—wheat, barley, oats, corn, potatoes, beans, and other crops, and (*c*) range and pasture lands. The dry hayland, mostly limited to the Eastern Plains, is fairly homogeneous. The cropland occurs in two types of area—the eastern plains and the mountain foothills and mountain valleys. The crops grown in dry land may be categoried into those grown in all areas and those grown in specialized areas. The small grains predominate in all dry-land areas. Potatoes (commercially grown), beans, and safflower, are produced in certain small areas. Corn is grown in the plains area only.

There are four kinds of ranching enterprises: (*a*) cattle ranching, (*b*) sheep ranching, (*c*) cattle-and-sheep ranching, and (*d*) the dude ranches. Cattle ranchers operate on the plains and in the mountains. The plains rancher depends upon year-round grazing, with or without supplemental feed; the mountain rancher grazes his livestock on the forest reserves in summer, uses the pastures or the irrigated meadows in spring and fall, and feeds hay, oilmeal cake, or other concentrate in winter. The sheep rancher of western Wyoming usually has winter range in the Red Desert area (with some supplemental feeding), ranges his livestock in the foothills in fall and spring, and uses the high mountain pastures in summer. The combination cattle-and-sheep ranchers are found in all parts of the State and may have any combination of range, pasture, and feeding. The dude ranchers are in the mountain areas; they raise mostly horses, cattle, and hay. With so much diversity in the State the statistician is hard put to obtain any kind of sample that will contribute to a reasonable estimation of the truth.

Possible Approach

As a possible approach to a solution, a separation of the total cropland universe into dry land and

irrigated land has long been advocated. This would be a definite break with the theory of districting, since both types occur in the same areas and are widely dispersed. But the need is urgent. The statistician needs this break-down in his sampling and analysis and there is an insistent demand for the development of separate estimates on these two subuniverses in Wyoming, particularly. Such information is essential to the effectiveness of present crop estimation and crop experimental work, and to economic studies regarding the Missouri Basin and other conservation projects in Wyoming.

To treat irrigated and nonirrigated farming and ranching as two distinct universes is the pressing need in this field at present. It would require research to establish bench marks and these would require not only analysis but contact work to keep abreast of changes within these universes. Other such "type" classifications, which would strengthen the agricultural statistician's position and effectiveness, should be attempted. This is particularly true in regard to sampling for livestock numbers. Such factors as drought, prices, and wages, affect the different types of the ranching enterprise differently. Information regarding the shifting from cattle to sheep or vice versa, changes in sizes of ranches, and similar factors, is needed when agricultural estimates are made. As several types occur in the same area, districting does not bring the needed results.

Certain solutions are here suggested in the absence of research which might develop a method far superior to stratification as a solution to the problems of heterogeneity. We submit that these problems are not small and are in definite need of solution. Apparently, they cannot be solved with methods that are derived from work with regard to areas that have more homogeneous agriculture.

The Gist of It

Limiting our consideration of the problem to the Western States, we arrive at these conclusions:

1. Heterogeneity is the most complex of the problems within the region with which the statistician is faced.

A. Widely divergent elevations and phenological phenomena lead to equally divergent ecology and farming or ranching practices.

B. The presence or absence of irrigation water on cropland is responsible for widely differing practices, yields, etc. The source of water supply (reservoirs, direct flow, pump, and subirrigation) and the amount of water available affect areas differently.

C. The livestock ranching industry is not homogeneous but consists of several unlike types. Each type is fairly homogeneous within itself.

2. Present practices are inadequate to cope with the problem.

A. Districting is a help but is far from a solution because different types of farming and ranching often occur in the same area.

3. The use of "type" classification, without regard to political boundaries or geographical proximity, offers a possible solution to parts of the problem.

A. A break-down between irrigated and nonirrigated cropland is acutely needed. To establish and maintain this would require additional work and expense.

4. Research and experimentation dealing with problems of heterogeneity seem essential to future progress in the field of crop estimates.

With demands for greater precision and detail in agricultural statistics, solutions of these problems become absolutely necessary if we are to do the thoroughly effective sampling that is basic to satisfactory results.

Book Reviews

Wartime Economic Planning in Agriculture. By Bela Gold. Columbia University Press, New York, 1949. 594 pages.

THE PROBLEM of increasing the efficiency of economic planning as an instrument of governmental policy, is the author's primary concern. He believes that planning by the national government is necessary in a highly industrialized society to give the electorate an opportunity to take part in making basic economic decisions which would otherwise be made by "an increasingly centralized business group."

The author does not attempt to define planning, noting that most studies of planning are "heavily dominated by theoretical speculation," but undertakes a reexamination of current conceptions in the light of actual planning operations of a governmental agency. However, his more general discussion of planning and his evaluation of its success in agriculture seem based on a broad interpretation of the role of planning which includes arriving at broad policy decisions as well as formulating operating plans for their execution.

The bulk of the book is devoted to a critical analysis of the governmental policies and programs concerned with the management of agricultural resources during the period of the Second World War and a discussion of the factors responsible for the "shortcomings in agricultural mobilization." Agricultural policies and their results are measured against maximization of exports of essential foodstuffs during the period of hostilities and in the immediate postwar period which the author lists as an objective of agricultural mobilization, second only to the provision of sufficient food to safeguard the health of the civilian population and to meet the requirements of the armed forces. As agriculture represented only one segment of the economy to be mobilized, an additional measure of mobilization success was that of minimizing agriculture's demands on scarce productive and distributive resources. As measured by these yardsticks all sectors of agricultural mobilization policies were found to have serious shortcomings and to have been influenced more by political expediency than by mobilization needs.

In his statistical analysis of performance in agricultural production and distribution, Dr. Gold selected 1940 as the base year "to focus as sharply as possible on distinctive consequences of wartime measures rather than on differences between wartime conditions and those which obtained during a recent prewar period of comparable length."

Based largely on a statistical analysis of performance as measured against the goals of maximizing agricultural production, increasing exports, and minimizing agriculture's use of scarce resources, he analyzes needs, plans, and performance including: (1) Agricultural production, (2) utilization of land and livestock resources, (3) agricultural manpower, (4) fertilizers, and (5) other resources, including agricultural credit. Statistical analysis, including 50 general tables, is bolstered by statements of governmental officials given in testimony before congressional committees and in interviews with the author.

The following summary statement on agricultural production and more specific comments on production goals are illustrative of the sharpness of his criticism of all sectors of agricultural mobilization: "In short, the pattern of wartime increases in agricultural production, showing gains by almost all groups with little regard for their relative essentiality or nutritional efficiency, bore fewer aspects of an orderly mobilization of scarce resources than of a pell-mell response to the removal of long-standing production restrictions combined with a general price boom."

Using wartime production-capacity studies the author estimated that agricultural production could have been expanded and altered to provide, as compared with 1940 production levels, a supply of food measured in nutrients sufficient to provide more than 150 million people with ration supplements that would raise their consumption levels

to minimum standards. Production goals were publicized by the Government as the official definition of agricultural output objectives but the basis for their determination was never clearly defined. The apparently reasonable progress made in attaining goals may have served to restrain public pressure for the intensification of mobilization. The author concludes that, in general, goals fell "within the range encompassed by 'feasible' potentials" and noted a progressive shrinking of goal levels throughout the war.

As the issues discussed are controversial, it may be expected that many readers will disagree with some of the assumptions and conclusions with respect to the role of planning and the success or failure of agricultural mobilization. In any event, the author has contributed a comprehensive and challenging analysis.

Gladys L. Baker

Surveys, Polls and Samples: Practical Procedures. By Mildred B. Parten. Harper and Brothers, New York, 1950. 624 pages.

HERE IS A BOOK to be welcomed not only by all professionals engaged in survey research but also by clients of survey organizations. It can also provide a basis for evaluation to persons who may have administrative, consultative, or other contacts with projects involving survey methods.

There is a large body of literature on survey techniques but until the appearance of this book, it has been chiefly in the form of scattered papers published in a variety of journals. Dr. Parten's work brings together for the first time a comprehensive treatment of all phases of the survey process from the original delineation of objectives to the preparation of the final report. It contains a bibliographic reference list of monumental proportions comprising more than a thousand titles. This will probably be one of the most useful sections for the professional surveyor. The book will almost certainly be adopted as a text in those colleges which offer academic course work in survey research for at present there is nothing that can take its place. Nevertheless, as this is not a handbook or manual of procedure, in formal college work it will need to be supplemented by lectures and discussion seminars.

It opens with an historical account of the development of survey methods and the uses of such research. There are long, detailed chapters on the administrative organization necessary to successful survey practice, construction of questionnaires, interviewing, and sampling. These are followed by equally comprehensive treatments of the coding and tabulation process, sources of bias, evaluation of the findings, and preparation of the report. Although the work is largely descriptive, the author occasionally ventures on a comparative evaluation of different methods. This is especially the case in her discussion of judgment or quota sampling versus probability sampling, and mail surveys contrasted with those done by personal interviews.

Naturally in a work of this scope, there are certain omissions or subjects on which the author apparently had out-dated or incomplete information. Thus at least two other survey organizations, besides the one to which most frequent reference is made, are certainly its peer in the matter of interviewing methodology; unquestionably its superior in sampling techniques. But such criticisms seem merely carping when one considers the magnitude of the job Dr. Parten has accomplished. Her book should be in the reference library of every public or private agency which utilizes survey methods. She has performed a task which badly needed to be done and has performed it well.

Dr. Parten received her degree at the University of Minnesota, was a Fellow at the London School of Economics, and was at the Yale Institute of Human Relations. Her 20 years' experience in the field of social surveys includes work for the United States Department of Labor and various institutions and communities. Both Dr. Parten and her publishers are to be congratulated on satisfying a long-standing need in the field of applied social science and economic research.

Forrest E. Clements

Selected Recent Research Publications in Agricultural Economics Issued by the Bureau of Agricultural Economics and Cooperatively by the State Colleges[1]

AHRENDES, E. R., and DOLL, R. J. ALTERNATIVE USES OF EXCESS WHEAT ACREAGE WITH EMPHASIS ON THE USE OF WHEAT FOR FEED. Kans. Agr. Expt. Sta. Agr. Econ. Rept. 39, 39 pp., illus. Manhattan. December 1949 (RMA report. BAE cooperating).

Attempts to analyze some alternative uses of surplus wheat acreage in a hard winter wheat area, to learn whether more wheat could be economically utilized as livestock feed, and to point out necessary adjustments.

BIRKHEAD, JAMES W. METHODS OF HARVESTING GRASS SILAGE IN NORTHEASTERN PENNSYLVANIA (A PRELIMINARY REPORT) Bur. Agr. Econ. F. M. 75, 32 pp. Washington, D. C. February 1950.

Most northeastern grass silage will continue to be made from the early cutting of hay when weather is usually not good for curing hay. Substitution of mechanical power for man labor is expected to continue. Further investigation is recommended as to influence of grass silage on farm incomes, land use, and on the yields of crops.

BURLINGAME, BURT B., and BAILEY, WARREN R. COST OF HARVESTING COTTON WITH MECHANICAL PICKERS, CALIFORNIA—1948. Calif. Agr. Ext. Serv. and U. S. Bur. Agr. Econ. 15 pp. Berkeley. January 1950.

In 1948, the total cost of harvesting cotton on the average of all pickings was $2.14 per 100 lbs. of seed cotton, compared with $3.25 for hand picked during the first pick and $3.75 or more during later pickings.

CHILDRESS, RUSSELL L. GRADE QUALITIES OF POTATOES IN RETAIL STORES, NEW YORK CITY, 1948. N. Y. (Cornell) Agr. Expt. Sta. Dept. Agr. Econ. A. E. 707, 120 pp. Ithaca. March 1950. (RMA report.)

Data obtained from a survey of 1,214 retail outlets showed more than a fifth of the total quantity of potatoes to contain grade defects.

CHILDRESS, RUSSELL L. HOW MRS. CONSUMER BUYS POTATOES IN NEW YORK CITY. N. Y. (Cornell) Agr. Expt. Sta. A. E. 719, 15 pp., illus. Ithaca. January 1950. (RMA report.)

Summary of a fuller report to be issued as A. E. 707. In a survey November 15-December 17, 1948, *internal* as well as *external* defects were studied.

CROWE, GRADY B., and HAMMOND, JOHN M. POSSIBLE LAND USE ALTERNATIVES YAZOO-MISSISSIPPI DELTA. 29 pp. Delta Council, Stoneville, Miss.

A series of farm budgets for use by farmers and agricultural workers in planning short-term farm adjustments for the period immediately ahead.

EARLE, WENDELL. MARKETING PRACTICES AND EGG QUALITY 1948–49. N. Y. (Cornell) Agr. Expt. Sta. Bul. 858, 23 pp. Ithaca. February 1950. (Northeast Regional Publication 3, RMA report.) [Printed.]

Results of a survey of management and egg-handling practices on a sample of northeastern farms, August and November 1948, and February and May 1949. Differences in level of quality of eggs at the farm were explained by (1) number of times gathered; (2) whether males were with the laying flock; (3) whether layers were confined; (4) temperature; and (5) humidity.

FLAGG, GRACE L., and LONGMORE, T. WILSON. TRENDS IN RURAL AND URBAN LEVELS OF LIVING. U. S. Dept. Agr. Agr. Info. Bul. 11, 75 pp., illus. December 1949.

Analyzes significant rural trends in selected level-of-living items for the United States and the nine geographic regions. Meant to accompany two previous reports in which rural-urban differences for the United States and major regions are analyzed.

GERALD, JOHN O. FARM-TO-RETAIL MARGINS FOR MARKETING WESTERN TURKEYS. U. S. Dept. Agr. Agr. Info. Bul. 5, 12 pp., illus. December 1949. (RMA report.)

Turkey producers in western States must depend partly upon other areas for markets. In recent periods, more than 80 percent of the marketings from farms in Utah went to eastern and midwestern markets as did some turkeys from Oregon and Washington. Margins for retailing hens were about the same in New York, Chicago, and San Francisco; margins for toms were wider in all three cities. Retailing accounted for more than 20 percent of all marketing charges for toms and 40 percent for hens.

HERRMANN, LOUIS F., and WHATLEY, THOMAS J. COSTS AND MARGINS OF MILK DISTRIBUTORS IN MEMPHIS, TENNESSEE IN 1948. 30 pp., illus. Bur. Agr. Econ. and Tenn. Agr. Expt. Sta. Washington, D. C. 1950. (RMA report.)

Costs of milk distribution by seven Memphis milk distributors are given. Differences reflect variations in operating efficiency and nature of services.

HOLE, ERLING, and BONDURANT, JOHN H. FARMING IN THE BLUEGRASS AREA OF KENTUCKY: OPERATIONS, COSTS, AND RETURNS, 1930–48. Ky. Agr. Expt. Sta. Bul. 544, 51 pp., illus. Lexington. December 1949. (BAE cooperating.)

Measures shifts from year to year and over longer periods in production, and changes in size of farm, farm tenure, investment, land use, farm practices, production efficiency, methods of production, mechanization, use of labor, prices, costs, and returns on commercial family-operated tobacco-livestock farms.

JENNINGS, R. D. A LOOK AT THE PROTEIN SITUATION FOR LIVESTOCK. 13 pp. Bur. Agr. Econ. March 1950.

[1] Printed reports are indicated as such. All others are processed. State publications may be obtained from the issuing agencies of the respective States.

Brings to date a processed report, published in 1946: "The Deficit in Protein for Livestock." Gives four available measures for increasing protein content of our feed supply: (1) increasing acreage and yield of good hay and pasture; (2) planting more soybeans and other oilseeds; (3) expanding the use of urea; and (4) greater use of animal-protein feeds now fed to cattle.

KEARL, C. D. SEASONAL COSTS AND RETURNS IN PRODUCING EGGS, NEW YORK, 1946–47. Cornell Agr. Expt. Sta. A. E. 713, 25 pp., illus. Ithaca, N. Y. January 1950 (BAE cooperating.)

Results of study based on records on 172 New York poultry farms for 1946–47. Highest profits in producing eggs when pullets were housed in later summer and early fall were in winter, spring, and summer, not in fall. Poultry farms can be organized to take advantage of the seasonal differences in prices of eggs.

LAGRONE, WILLIAM F. COTTON GROWING IN EASTERN OKLAHOMA. A COMPARISON OF PRESENT METHODS AND RECOMMENDED PRACTICES. Okla. Agr. Expt. Sta. Bul. B–345, 31 pp., illus. Stillwater. February 1950. (BAE cooperating.) [Printed.]

In general, farmers in the area were close to experiment station recommendations in regard to variety, rate of seeding, and method of planting and spacing but far short in fertilization and insect control.

METZLER, WILLIAM H., and SAYIN, AFIFE F. THE AGRICULTURAL LABOR FORCE IN THE SAN JOAQUIN VALLEY, CALIFORNIA: CHARACTERISTICS, EMPLOYMENT, MOBILITY, 1948. 73 pp., illus. Bur. Agr. Econ. and Univ. Calif., Inst. Indus. Relations. Washington, D. C. February 1950.

Heaviest demand in San Joaquin Valley is for harvest labor on perishable crops during 3 or 4 fall months. Harvest over, 80 percent of the workers are not needed for several months. Estimated demand—110,000 hired workers at the peak in October; 20,000 to 25,000 in March.

MORGAN, Q. M., WILLIAMSON, M. N., Jr., and ROGERS, RALPH H. PRACTICES ON FLAX-PRODUCING FARMS IN TEXAS, 1949. Tex. Agr. Expt. Sta. Misc. Pub. 41, 13 pp. College Station, Tex. January 1950. (BAE cooperating.)

In 1949, an estimated 360,000 acres of flax were planted in Texas; 20,000 in 1939. The report analyzes the production practices in the principal producing areas; practices for cotton and combine-type sorghum are included.

O'DONNELL, P. E. CONSUMPTION OF FLUID MILK AND CREAM IN NORTHEASTERN MARKETING AREAS. 33 pp. Bur. Agr. Econ. March 1950. (RMA report.)

The sixth in a series begun in 1941 in response to widespread interest in the northeast in accurate data on consumption of fluid milk and cream. It reports quantities of milk classified for pricing purposes as class I or class II milk.

ROTH, ARTHUR H., Jr. RANCH ORGANIZATION IN THE NORTHERN GREAT PLAINS, 1930–48. THE ORGANIZATION OF COMMERCIAL FAMILY-OPERATED CATTLE AND SHEEP RANCHES (A PRELIMINARY REPORT). 21 pp., illus. Bur. Agr. Econ. and Mont. Agr. Expt. Sta. Washington, D. C. February 1950.

Gives data on ranch organization-control and use of land, and numbers of livestock for a period including drought, depression, war, and postwar years, as well as changes from uncontrolled to controlled use of public range and shifts in use of mechanical equipment.

SUTHERLAND, J. GWYN, and BROOKS, JAMES H. MECHANICAL HARVESTING OF COTTON IN NORTH CAROLINA. N. C. Agr. Expt. Sta. Dept. Agr. Econ. Prog. Rept. (Prelim.) Info. Ser. 22, illus. State College Station, Raleigh. January 1950. (BAE cooperating. RMA rept.)

Mechanical harvesting effects large reductions in per acre and per bale man-labor requirements in cotton production. But in 1948, hand picking was more economical than mechanical, because of limited use of mechanical harvesters, grade loss, and other factors. When hand picking was $4 per 100 pounds and more than 33 acres were mechanically stripped or more than 93 acres were mechanically picked, hand picking was less economical.

THARP, MAX M. FARM LAND OWNERSHIP IN THE SOUTHEAST. S. C. Agr. Expt. Sta. Bul. 378, 62 pp., illus. Clemson. June 1949. (Publication 4, Southeast Regional Land Tenure Committee. Agr. Expt. Stas. of Ala., Fla., Ga., N. C., S. C., Tenn., and Va., in coop. with Farm Found., and BAE.)

Intended to fill the gap in tenure information for the Southeast as to individual ownership and operation of farms.

UNITED STATES BUREAU OF AGRICULTURAL ECONOMICS. CITRUS PREFERENCES AMONG HOUSEHOLD CONSUMERS IN LOUISVILLE AND IN NELSON COUNTY, KENTUCKY. U. S. Dept. Agr. Agr. Info. Bul. 2, 91 pp. January 1950. (RMA report.)

Practically every householder interviewed used some citrus product. Most popular fresh items were oranges and lemons; most popular canned product was orange juice. Analyzes such factors as taste, health, habit, expense, and availability.

UNITED STATES BUREAU OF AGRICULTURAL ECONOMICS. GENERALIZED TYPES OF FARMING IN THE UNITED STATES; INCLUDING A LIST OF COUNTIES IN TYPE-OF-FARMING REGIONS AND SUBREGIONS. U. S. Dept. Agr. Agr. Info. Bul. 3, 35 pp., illus. February 1950. [Printed.]

Refinement of State type-of-farming areas has reached a stage when reexamination of generalized types of farming is needed: (1) to give an up-to-date view of farming in the United States by types; and (2) to provide basis for summarizing statistics reported by civil divisions, on a more regionalized pattern than is possible with State type-of-farming areas.

WILLIAMSON, M. N., Jr., and ROGERS, RALPH H. COTTON PRODUCTION PRACTICES IN THE HIGH PLAINS AREA, 1947. Tex. Agr. Expt. Sta. 14 pp. College Station. February 1950. (U. S. Dept. Agr. cooperating.) [Printed.]

No other area in this country produces cotton at as low cost per acre. Some advantage of this is lost because of the relatively low grade and short staples of the lint grown. Possibilities for changes in production practices are listed

WILLIAMSON, M. N., JR., and ROGERS, RALPH H. ECONOMICS OF COTTON HARVESTING. TEXAS HIGH PLAINS, 1948 SEASON. Tex. Agr. Expt. Sta. Prog. Rept. 1200, 10 pp. College Station. December 1949. (BAE cooperating.)

Gives cost and performance of mechanical cotton strippers on dry-land and irrigated farms; quantity of seed cotton lost when harvested by machine strippers; and effect of method of harvesting on grade of cotton and net returns.

Statistical Compilations

KIMBALL, E. SMITH, SMITH, PAUL W., and MOORE, ROBERT. FARM PRODUCTION, DISPOSITION, CASH RECEIPTS AND GROSS INCOME, CHICKENS AND EGGS, 1948–49. CHICKENS ON FARMS, JANUARY 1, 1949–1950, BY STATES. 16 pp. Bur. Agr. Econ. April 1950.

RUSH, J. F., and TAYLOR, J. SAM. ACREAGE, PRODUCTION AND VALUE OF COMMERCIAL VEGETABLE CROPS IN SOUTH CAROLINA, 1918–49. S. C. Agr. Expt. Sta. Cir. 76, 39 pp., illus. January 1950.

UNITED STATES BUREAU OF AGRICULTURAL ECONOMICS. ANIMAL UNITS OF LIVESTOCK FED ANNUALLY, 1947–48 TO 1949–50. Sup. to F. M. 64 revised. 9 pp. Washington, D. C. March 1950.

UNITED STATES BUREAU OF AGRICULTURAL ECONOMICS. FARM COSTS AND RETURNS, 1949 WITH COMPARISONS, COMMERCIAL FAMILY-OPERATED FARMS IN 7 MAJOR FARMING REGIONS. Bur. Agr. Econ. F. M. 78, 17 pp., illus. May 1950.

UNITED STATES BUREAU OF AGRICULTURAL ECONOMICS. FARM PRODUCTION, DISPOSITION, AND INCOME FROM MILK, 1948–49. 13 pp. Washington, D. C. April 1950.

UNITED STATES BUREAU OF AGRICULTURAL ECONOMICS. FARM PRODUCTION, FARM DISPOSITION, AND VALUE OF PRINCIPAL CROPS, 1948–49, BY STATES. 41 pp. Washington, D. C. May 1950.

UNITED STATES BUREAU OF AGRICULTURAL ECONOMICS. FEED STATISTICS, INCLUDING WHEAT-RYE-RICE. U. S. Dept. Agr. Statis. Bul. 85, 92 pp. December 1949. [Printed]

UNITED STATES BUREAU OF AGRICULTURAL ECONOMICS. MEAT ANIMALS—FARM PRODUCTION AND INCOME, 1948–49. Bur. Agr. Econ. 8 pp. Washington, D. C. April 1950.

WILSON, JOHN L., and GRENIER, OVIDE E. INTERSTATE MOVEMENT OF DAIRY CATTLE, 11 NORTHEASTERN STATES, 1949. Bur. Agr. Econ. 9 pp. March 1950.

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