THE KNAPP METHOD *of* GROWING COTTON

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Illustrated

GARDEN CITY NEW YORK
DOUBLEDAY, PAGE & COMPANY
1913

TO THE LATE

DR. SEAMAN A. KNAPP

THIS WORK IS DEDICATED IN APPRECIATION OF
HIS GREAT SERVICE TO THE COTTON
FARMERS OF THE SOUTH

PREFACE

In the preparation of this book it has been the aim of the authors to give in concise form a practical treatise on Cotton, instructive to the cotton grower.

The authors desire to express their thanks to the many friends who have assisted them in this work, and especially to the following: Messrs. B. L. Moss, J. A. Evans, and E. C. Ewing in reading the manuscript of certain chapters. In the preparation of this manuscript, we have consulted freely the publications of the State Experiment Stations and the U. S. Department of Agriculture; "Cotton," by Burkett and Poe; "Southern Field Crops," by J. F. Duggar, and "Cyclopedia of Agriculture," Bailey.

In the list of illustrations credit is given in detail to the U. S. Department of Agriculture, and to State Experiment Stations and others that contributed photographs for this volume.

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CHAPTER I

INTRODUCTION

HISTORY OF COTTON

COTTON is the world's greatest fiber crop. History records nothing that compares to it as a cash crop. The cotton crop is extensively grown in but twelve of the Southern States, and exceeds in total value any other crop in the United States, except corn, which is produced in each of the forty-eight states of the Union. The spinners of Europe are much more concerned about the size of the American cotton crop each fall than about the peace of nations. The cotton plant furnishes the raw material for the greatest textile industry of all times. The volume of the export trade it supports is enormous.

Cotton has been known and perhaps used as fiber since the earliest civilization. The important part it was to play in the economic

adjustment of the world's products and finances was not realized until after the American Revolution. Silk, flax, wool, and cotton have always been the staples to furnish mankind with clothing. By reason of the cheapness of production, the ease of manufacture, and the general excellence of the manufactured goods for wearing apparel, cotton is rapidly taking place of the other three materials.

HISTORY

The original home of the cotton plant has not been definitely established by historians, but from the best data at hand was probably the East Indies. Hindoo history, 4,000 years old, speaks of a fiber, evidently cotton, and leads us to believe it was manufactured into fabrics at this early period. Cotton has been known in the countries of southern Europe for several centuries. The early fragmentary history of various countries mention some plant bearing a wool-like fiber, which was undoubtedly cotton. Some species of cotton have been found growing wild in practically all countries lying between the 37th degree of latitude north and south of the equator except the present cotton area

of the United States. Magellan found the Brazilians using cotton for beds and fabrics in 1519.

The first record of its being grown as a fiber in the United States was in 1621, and then only in small quantities. Cotton seed was brought from the Barbadoes to South Carolina in 1680. The first foreign shipment of cotton from this country was from Savannah in 1747 — only three bags. There seems to have been so little grown that no authentic record of the crop was kept until 1791, at which date the entire American crop was 8,889 bales weighing 225 pounds each. The lint had to be separated from the seed by hand, which was a tedious and difficult task.

The cotton gin was invented by Ely Whitney in 1793. The first saw gin was erected in South Carolina in 1795, and from this dates the beginning of an industry which, for rapidity and volume of growth, has no parallel in the world's history.

The total crop of the United States in 1850 was, in round numbers, 2,500,000 bales. In 1860 it reached 4,500,000 bales. Then the Civil War came on and so paralyzed all the

business industries of the South that it took almost two decades to get back to the production of 1860. Since 1880 the increase has been continuous and rapid. The average yearly production, for the twenty-six years ending 1904 was 7,500,000 bales. The average for the past ten years has been 12,300,000 bales. The crop of 1911 was over 16,000,000 bales, the largest of any yet grown. The highest average prices for thirty years have been paid for the last five crops, averaging more than 12,000,000 bales each. The cotton mills of the world now handle more than 15,000,000 bales of cotton annually. Even with this enormous supply, it is claimed that half the people on the globe know nothing of modern-made cotton goods. One statistician has estimated that if all the people in the world used as much cotton goods as the civilized nations, it would take more than 40,000,000 bales to supply the demand. The progress of some of the most populous countries toward higher standards of living will doubtless cause the demand to grow faster than the supply unless there is some readjustment of labor conditions in cotton-producing countries.

The United States has special advantages

for cotton growing that perhaps are possessed by no other country. There exists a peculiar combination of soil and climatic conditions found in no other country, even where situated in the same degrees of latitude. Not all the lands lying between the 37th degrees of north and south latitude will produce cotton successfully. Profitable production of cotton in any country is largely determined by conditions of soil, climate, labor, and management.

America now furnishes about 75 per cent. of the cotton used by European spinners. Egypt, India, and Brazil, in the order named, supply the rest. Several other countries grow limited amounts, but unless better methods are used and a more rapid progress made, these countries will hardly produce more than enough for home consumption. The only chance of an early increase in supply for European spinners must come from Egypt, and under the most favorable conditions the increase from this source must be limited. All other cotton countries except America have found other crops more profitable, and it is hardly probable that they will change to cotton merely to accommodate the spinner.

There are vast possibilities for the extension of the cotton industry in the Southern States. In the strictly cotton-producing states there are 303,000,000 acres of land. Of this not over 100,000,000 have been put into cultivation. In recent years 28 to 36 million acres, or about one third, have been planted to cotton. This is about 9 per cent. of the total area of the cotton states. There are still vast areas available for cotton production.

It would appear from the above figures that the quantity that could be produced might be greatly increased by the utilization of all available lands. There are, however, certain important factors that will limit production. The problem of maintaining soil fertility; the adjustment of the labor problem, now a most serious one; and the increasing population with constantly advancing prices for other farm products will have a tendency to limit the acreage devoted to cotton. Again, it must be remembered that cotton is one of the most tedious and difficult crops to grow and harvest. It will always be hard to get those accustomed to growing other crops less troublesome to adopt cotton farming. This will be the case

so long as present high prices for other products exist. The present practice of growing cotton and buying from the proceeds the necessary supplies to run the farm is seldom profitable.

About one third of the American crop is consumed in the United States, the remainder being exported. The estimated total value of the last two crops, including seed, is $1,000,000,000 each. This is a vast sum of money and should the Southern farmers make up their minds to grow this amount of cotton and in addition all the food supplies for man and teams, a thing that could easily be done, it would be only a question of a few years until the cotton farmers of the United States would be the most prosperous and independent of all men.

Description of Cotton Plant

CHAPTER II

DESCRIPTION OF COTTON PLANT

THE cotton plant belongs to what is known as the mallow family. The okra, hollyhock, althea, some weeds and trees belong to the same family. Cotton is a tropical plant and is found growing wild in most tropical countries. It is an annual in the United States; but after warm winters occasional stalks of the old crop start new growth, indicating the perennial nature of the plant. In this country it is usually a shrub-like plant, ranging from two to seven feet in height. The extent of growth naturally depends on soil, climatic conditions, variety, and general treatment.

A peculiarity of the mallow family is that all plants in it have flowers with five petals with numerous stamens that form a tube about the pistil. There are usually several leaf-like parts below and around the flower. In cotton there

are three of these, which, with the inclosed bud, form what is termed the "square." The leaves are alternate, lobed, with veins all beginning at a common point near the base.

The genus or general subdivision of the family to which cotton belongs is Gossypium. A number of species are classed under this subdivision, but only two of these are of special interest to the American cotton grower. The first, and one of the greatest importance, is Gossypium Hirsutum, which includes all the upland cottons both long and short staples. The second, Gossypium Barbadense, includes all the Sea Island and Egyptian cottons. As indicated above, American upland cotton may be divided into two distinct classes: (1) short staple, and (2) long staple varieties. The chief distinction between the two is in the length and strength of staple. The short staple ranges from three fourths to one and one eighth inches, while the long staple ordinarily runs from one and three sixteenths to one and five eighths inches in length. There are, of course, several intermediate classes. The buying and selling prices of long staple cotton are largely determined by the length of staple; the

highest price, of course, being paid for the longest.

Cotton seed when planted germinate quickly under favorable conditions. The first stage in the growth of the young plant is the formation of a stem and tap root. When the young plant first appears above ground it has two leaves. With warm weather, plenty of plant food, and good treatment the plant develops rapidly. The plant has a central main stem from which are put forth limbs or branches. This stem and the branches are woody in nature and possess considerable strength. The first or base limbs are the largest and in many varieties assume the stalk-like qualities of the parent stem. The other branches decrease in length and size toward the top of the plant. When fully developed the plant usually presents a very symmetrical and pleasing appearance. The main stem and the larger base limbs produce only leaves and smaller sub-branches on which the bolls are found. One peculiarity of the cotton plant is that two limbs start from the axil of each leaf on the main stem. One contains the bolls and the other is barren; frequently, however, only one develops, and

fortunately this one is more often the fruit-bearing branch.

The varieties or plants developing fruit limbs nearest the ground having short joints or nodes are found to reach maturity first; the long-jointed, straggling plants being invariably late in maturing. The stalks and stems are covered with a rather strong, tough bark, usually of a brownish color. This bark contains a coarse fiber, but it has never attained any commercial importance.

Cotton leaves appear alternately on the stem and may vary in size or shape in the same variety and even sometimes on the same stalk. The upland cottons usually have leaves with three lobes, sometimes more. The big boll varieties have large heavy leaves with slight indentations and short lobes. The very small boll varieties have small, light leaves with deeper indentations and sharp, pointed lobes. Sea Island and Egyptian cottons have very deep indentations and slender lobes. There are usually three or more prominent veins in each leaf starting out from a common point at the leaf stem. The leaves and small stems of upland cottons are covered with short hairs

which are not found on the Sea Island varieties.

A small flower stem of varying length appears along the larger branches to support the bolls. The square is the first stage of the fruit. It consists of three bracts or leaves with the inclosed flower bud and appears, on an average, twenty-one days before the bloom opens. The blooms of upland cotton are cream colored the first morning, changing to pink the second day, and fall to the ground the third or fourth day. The flowers open up beautifully early in the morning, but begin to close and change color in the afternoon of the first day. Blooms of other species vary in size and color. The cotton bloom is self fertile. When the bloom drops, it leaves a small pod about the size of a pea which develops, on an average, in from forty-five to fifty days into the full grown boll. This boll is similar in size and shape to a small hen's egg and contains the lint and seed. The boll of upland cottons has four to five divisions, each containing a lock consisting of seed and lint. Each lock has from six to twelve seeds. Sea Island bolls are smaller and contain three or four locks.

The number of bolls may vary from a very few to several hundred to the stalk. The number depends largely on the variety, soil, moisture, and climatic conditions while growing. The number of blooms appearing does not signify how many bolls will reach maturity, as insect pests, excessive rains, dry weather, or lack of fertility may cause a large per cent. to shed. An average of thirty to fifty mature bolls to the stalk over a field with a good stand should give a yield of three quarters to one bale per acre. The size and shape of the boll varies with the varieties, class of soil, and weather conditions. The small boll cottons require from one hundred to one hundred and twenty bolls to make a pound of seed cotton, while some of the large boll varieties require only forty to sixty to the pound. The manner of opening of bolls differs greatly with the varieties; some yield their locks freely, while others open in such a way as to cause the lock to adhere closely. The latter kinds are preferred in a windy country or where the harvesting is not done promptly.

The seed cotton produces about two thirds seed and one third lint or fiber when ginned.

Cutting down the expense of making a cotton crop by harrowing young cotton across the rows. This method stirs the soil, conserves the moisture, kills the weeds and grass, thins the cotton and gives the plants a sturdy growth, reducing the hoe work 100 per cent.

Breaking three acres a day, eight inches deep, with moldboard plow

A weeder in use for early cultivation on light and sandy soils

Five hundred pounds of lint is a bale. A bushel of seed weighs thirty-two pounds. The seed are rich in oil and nitrogen, and are usually worth about one sixth as much as the lint.

Climate and Soils

CHAPTER III

CLIMATE AND SOILS

WHAT is commonly known as the cotton belt of the United States lies below latitude 37 degrees. This embraces the larger part of the following states, viz: Arkansas, Alabama, Florida, Georgia, Louisiana, Mississippi, Oklahoma, North Carolina, South Carolina, Texas, Tennessee, and small portions of Virginia and Missouri. The climatic conditions of this particular region are perhaps more thoroughly adapted to the successful growing of the cultivated varieties of cotton than any other yet known. The summers are long and the temperature relatively high. The average annual rainfall is between forty and fifty inches over the larger part of the cotton territory. Cotton being naturally a tropical plant, it does best in a warm, humid climate; but, on the other hand, can be grown profitably under semi-arid conditions. To reach full development, the

cotton plant must be grown where there are at least six months warm sunshine. The dates of killing frost in spring and fall are every important with the cotton grower. While the picking sometimes extends into the winter months, a killing frost stops all growth and frequently spoils considerable quantities of immature bolls. If the temperature is uniformly high, day and night, the young plant develops rapidly. On the other hand, should there be cold nights or a sudden drop in the temperature, the growth of the young plant is seriously checked and the stand may be so injured that replanting is necessary. The extreme sensitiveness of the cotton plant to cold makes it important that planting be delayed for seasonable weather. There is nothing gained by planting before the ground and air have been sufficiently warmed to insure quick germination; besides, there is danger of losing the choicest seed if planted too soon. With warm weather, good cultivation, and a normal amount of moisture, the plant should reach maximum stalk growth by the first of August. After this the principal business of the plant should be to develop and mature fruit.

The best cotton seasons are the ones during which there is an absence of abnormally heavy rainfall, but where showers and occasional rains are frequent enough to supply moisture for continuous but not excessive growth. Such seasons permit the plant food to be assimilated gradually, and also causes a sufficient setting of early fruit to insure a fair yield. These conditions distribute the bolls in such a manner as to make the plant more symmetrical and give a more extended opening period, resulting in a better grade of lint, especially where pickers are limited during harvest season. A cold, wet spring is unfavorable, interfering with preparation, retarding planting operations, and early cultivation. While such conditions materially lessen the chances for a good yield, the cotton plant is so adaptable to conditions of climate and soil that fair crops have been made when the early outlook was quite gloomy. Frequent heavy rains during June, July, and August, sometimes occur and seriously damage the crop. Such seasons interfere with proper cultivation, promote excessive plant growth at the expense of fruit, and encourage the multiplication of insect pests and fungous diseases that prey upon

cotton. The territory is so extensive, however, that there is wide variation in the weather conditions. Some sections may have favorable conditions, while the opposite may be true of others. No two states have the same weather conditions, and often in the same state there is a wide variation. There is, consequently, little probability of having an ideal season over all the cotton belt the same year. Under the present system and with the large acreage planted, it is doubtful whether an ideal season over the entire cotton area would be best for the industry. Under the most favorable conditions such a large crop might be grown from the present acreage that the price would perhaps be reduced below the cost of production. It will be noted by taking the averages for ten, twenty, and thirty years that the cotton crop will show a more uniform yield per acre than any other American farm crop.

SOILS

Cotton may be planted on almost any well-drained soil in the cotton region. It will be found growing readily on all kinds of soils from the stiff clays to the lightest sands. The

vigor of growth and yields vary widely on different soils. A profitable crop can be produced on almost any class of land, provided suitable plant food is present or is furnished by applications of fertilizers.

The system of cropping practised in the cotton states has so reduced the fertility of some soils that crops cannot be grown on them at a profit. The use of so much of these poor, depleted lands accounts for the low average yields. Some of the cotton lands are naturally poor; and the constant cropping to cotton, without returning enough vegetable matter to retain fertility and protect from washing has made vast areas of once rich soils almost worthless.

On the other hand, there are some extremely rich bottom lands and some newly cleared fields not in bottoms that have too much moisture and plant food for successful cotton raising. These should be devoted to corn, meadows or pastures. If planted to cotton the plant growth is too rank and the fruit will often be scattering. There is also an additional danger of serious damage from the rotting of the bolls, insect depredations, and fungous diseases on these rich lands.

The most satisfactory of all lands for cotton, taking it through a long series of years, is a medium sandy loam with a clay subsoil. The nearest approach to ideal conditions can be maintained on such soil in all seasons. The plant growth in a normal year will neither be too rank nor too small. There is a comparatively small percentage of typical loam soils now in cultivation. Some of the best of these have been cropped with cotton so continuously that much of the plant food has been exhausted and leached out.

The per cent. of sand or clay in soils has an important bearing on both their mechanical texture and production. The texture of the soil means more to the average farmer than its chemical composition. Long experience and practice have taught him to determine the best cotton lands from observing the native growth and the texture of the soil, rather than from chemical knowledge of its contents. The tenant farmer soon learns the fields that are best suited to the crop, and this accounts largely for their continuous cropping in cotton.

About 50 per cent. of all space in soils is occupied by air and water. Sandy soils are

composed of larger particles and naturally are less retentive of water; clay soils are composed of very fine particles and are more retentive of moisture. Under very dry conditions sandy soils do not retain moisture sufficient for cotton; while, on the other hand, clay soils are equally objectionable during wet or rainy periods for the opposite reason. The most reliable cotton lands are therefore loams and sandy loams, well drained, but with sufficient clay to make them retentive enough to insure a uniform moisture supply during the growing season. When such soils have had proper preparation and the early rains have been stored and retained by later shallow and frequent cultivation, the yield may be expected to turn out satisfactorily in all seasons.

The mechanical condition of all soils are greatly improved by keeping them well supplied with vegetable matter.

Cotton Culture

CHAPTER IV

COTTON CULTURE

PREPARATION of Seed Bed.— Where possible to do so, break the land in the early fall or winter. This breaking should be done on most soils before December first.

If an ordinary turning plow is used, break one or two inches deeper than usual, cutting a narrow furrow slice in order to set the furrow on edge to prevent bringing the subsoil to the surface.

The disk breaking plow is especially suited for this fall breaking as it brings but little of the subsoil to the surface. If a disk plow can be secured, use it and go down as deep as possible.

On well-drained lands the fall breaking may be done broadcast. On poorly drained lands it is better to throw up in high beds or ridges in order to give drainage and to thoroughly aerate the soil during the winter.

The object of deep fall plowing is mainly to increase the supply of available plant food and the storage of moisture in the soil. The particles of the soil are separated by this tillage, allowing frost to penetrate deeper and the air and moisture to circulate freely, and the winter rains are stored up for use in the spring and early summer. When the subsoil is first brought to the surface it is a dead inert mass, and the soil particles must be acted on by the oxygen of the air, the frost, and the rains to make plant food available. Every farmer has observed that when a ditch is dug and dirt is thrown out from the bottom nothing will grow on it for several months. The second year the rankest growth is found on this soil. An additional advantage of fall breaking is that it destroys some injurious insects, which pass the winter in the soil. Deep fall plowing is of great value in fields long in cultivation where the plant growth is medium or less. On very rich, moist soils where there is too much available plant food for cotton, a condition that makes an excessive growth of the stalk and a consequent decrease in fruitage, it is best not to do fall breaking. Such lands should be

The disc cultivator — a valuable tool in preparing the seed bed and cultivating the crop

The modern way — ten acres a day

broken shallow in the spring. Deep, light, sandy soils should not be broken in the fall unless covered with a heavy crop of vegetation or where a winter cover crop is to be planted to utilize available plant food and prevent leaching.

Where land was broken deeply in the fall, rebreak in the spring from three to four weeks before time to plant, and throw in slight beds or ridges the desired width of the cotton rows. This will give sufficient time for the beds to become firm before planting. This spring rebreaking or bedding can be very rapidly and satisfactorily done with a disk cultivator by adjusting the disks so as to throw up a slight bed. Just before planting, freshen and thoroughly pulverize the surface of the beds to a depth from one to one and one half inches.

The cotton plant first throws out its feeding roots in the moist, warm, surface soil, and it is best, therefore, immediately before planting, to use freely the section, disk or some other harrow. Time spent in making a good seed bed in not wasted. Go over the field several times with the harrow if necessary.

Where it is not possible to break the land in

the fall or early winter, break broadcast as early in February or March as soil conditions will permit, as deep or slightly deeper than it has been previously broken.

It is seldom advisable to turn the subsoil in the spring. It is usually too full of water and it is too late for much effective action of the air upon the soil and for the rains to firm the subsoil before planting.

Even where the land is not plowed until spring it is found profitable to rebed before planting. Freshen and thoroughly pulverize the surface of the beds immediately before planting. It is usually better to plant cotton on a firm seed bed. If the land cannot be broken or bedded in the spring in time to become firm by rains, then a heavy drag or roller should be run over the loosely plowed land to firm it before planting. A poor stand often results from planting cotton on a loose bed on account of lack of sufficient moisture to insure germination. It is also difficult to plant seed the proper depth on a loose seed bed.

Whether it is best to plant cotton flat or on beds is a question that is wholly determined by local conditions. On level, well-drained lands

The way to get a deep seed bed. Breaking fourteen inches deep

A terraced field

Method of making broad terrace

flat planting is practicable, and it will be easier to cultivate than where cotton is planted on ridges. Cotton is planted on beds as a precaution against heavy rainfall after planting. Seeds require moisture for germination, but must be kept out of standing water in the soil. Where conditions are such that cotton can be flat planted, it may also be planted in check rows which insures easier and more economical cultivation. Even where cotton is planted on beds or ridges the beds should be dragged down with the harrow so that they have only a slight elevation above the level surface.

In semi-arid sections cotton is frequently planted in the bottom of a freshly opened furrow between beds in order to get the seed into moist soil.

Width of Rows. — The proper spacing of the rows for cotton is important. The general rule for spacing is that the distance between the rows shall be a little more than the height of the plant in average years. Where cotton usually grows two or three feet high, the rows should be from three and one half to four feet apart. Where cotton normally grows three and one half feet high, plant in four foot rows. Where

it grows from four to five feet high, space the rows four and one half to five feet apart. It is better to have the rows a little too wide than too narrow. Air and sunlight are of great importance in pushing the crop to maturity.

Date of Planting. — Cotton should be planted as soon in the spring as danger from frost is past and the soil becomes sufficiently warm to quickly germinate the seed and insure healthy and vigorous growth of the plant. The best time for planting cotton along the Gulf Coast is probably between the dates of March 25th and April 25th. In the central part of the Gulf States planting should be between April 10th and May 1st. In the northern part of the cotton belt planting should be between April 20th and May 15th. The largest part of the cotton crop is planted before the first of May in the central part of the cotton belt, but frequently fields of cotton are planted as late as the middle or last of May and produce good crops. On the rich alluvial lands of the Mississippi Valley, following overflows, cotton sometimes produces a fair crop even when planted late in June. Extra early or extra late planting is not recommended. Extremely early

planting increases the labor of cultivation, and the young, tender plants are frequently injured by the frost. Very late planting lessens the labor of cultivation, but the crop is liable to be cut short in the fall by early frost, which destroys immature bolls.

Cotton Planters. — Where cotton is planted on ridges the most satisfactory planter to use is the one-horse walking planter. There are a number of these planters on the market. The principal features to be desired in a planter are: regular and uniform distribution of the seed, and uniform depth of planting. Some of the planters have adjustments for dropping the seed in hills instead of in continuous drill. With these planters it is often necessary to dampen the seed and roll them in dust, lime or ashes to temporarily paste down the fuzz in order to get regular distribution of the seed.

Seed planted in hills require less work with the hoe in thinning to a stand, but the extra care in preserving the stand about offsets any advantage to be derived by planting in hills.

Depth of Planting. — Cotton should be planted shallow, not over one inch deep, pro-

vided that depth reaches moisture, in which case plants will be up in a few days.

In sections of light rainfall or when planting late in the season, it will be necessary to plant deeper than one inch. More stands of cotton are lost from planting too deep than from planting too shallow.

Amount of Seed Per Acre. — Where seeds are distributed in continuous drill, three pecks of good seed per acre is ample. A stand may be secured with half this amount of seed when planted the proper depth on a good seed bed, but it is an advantage to have more plants on the land than necessary, so that if a few of them are destroyed in the first cultivation the stand will not be injured.

First Cultivation. — Begin the cultivation as soon as the seeds are planted by running once or twice across the rows with a section harrow. When cotton is up to a stand, run diagonally across the rows with a section harrow with the teeth slanted backward at an angle of forty-five degrees. One week later go over the cotton again with the section harrow, diagonally across the rows in the opposite direction. This will destroy a few of the plants, but if three

pecks of good seed per acre have been planted, not enough plants will be destroyed to injure the stand. The weeder is better for this early cultivation than the harrow on very loose soil, and should *always* be used instead of the harrow on sandy soils.

"*Chopping*" *or Thinning.* — This early cultivation with the section harrow or weeder destroys young grass and weeds and leaves the cotton in fine condition for "chopping" or thinning. The common practice of "barring off," leaving the plants on a narrow ridge to save labor in thinning, is unnecessary if the harrow has been used to keep the rows free of weeds and grass. If it should be found necessary to run around the cotton to destroy grass and save labor with the hoe in thinning, this work can be done more satisfactorily with a side harrow than with the turning plow. The turning plow should never be used in cultivation unless the crop has become so foul with weeds and grass that it is impossible to clean it with other implements.

Where planting was rather early it is better to thin twice, leaving two or three times the number of plants needed at the first thinning,

and about three weeks later thin to a stand. Where planting is done toward the latter part of the planting season it is advisable to bring to stand at first thinning.

The distance apart of plants in the drill will depend upon the fertility of the soil. On medium soils where plants grow about three feet tall, leave plants from fifteen to twenty inches apart in the drill. Where cotton normally grows four to four and one half feet tall thin from twenty to twenty-four inches in the drill.

Later Cultivation. — The first cultivation after using the section harrow or weeder, may be given with some form of cultivator. Among the implements used for this cultivation and with which satisfactory results are obtained are the following: the fourteen-inch heel sweep and short bull-tongue point on one-horse Georgia stock; one-horse spring-tooth cultivator; five shovel, one horse cultivator; and the sulky cultivator with short, narrow, diamond point shovel attachments, or with spring-tooth attachments. If the land has become hard and compact from rains since planting, the first cultivations may be rather deep.

This will not be likely to occur, however, if the section harrow has been run as often as recommended. All later cultivation should be shallow. During periods of excessive rains it may be necessary to cultivate deeper to clear the crop of weeds and grass, but after this is done continue the shallow cultivations as before. If the land is clear of stumps the cultivation can be done more economically with a two-horse cultivator that will cultivate the entire row at one trip. Any form of attachment may be used on the sulky cultivator which will give a loose dust mulch about one to two inches deep. If from any cause it is not practicable to use the sulky cultivator, excellent work can be done with a one-horse cultivator or with a one-horse Georgia stock, with broad narrow-winged sweep (heel sweep) if the dirt is allowed to fall loosely over it. Care should be exercised in cultivating cotton not to allow the cultivator to go deep enough to break the feeding roots of the plant. On very rich, moist soils, where cotton has a tendency to grow an excessive stalk with consequent decrease in fruitage, it is often helpful to cultivate deeper than above recommended in order to check the growth of

the plant and encourage fruiting. Usually this should be done early in the season and discontinued when plants begin to set fruit freely. Cultivating every seven to ten days, weather and soil conditions permitting, will be best. This will allow, on an average, seven to nine cultivations. The general practice is to stop cultivation too early. In most sections it will pay to continue cultivation until the crop is practically matured.

Fertilizers for Cotton

CHAPTER V

FERTILIZERS FOR COTTON

COMMERCIAL fertilizers were not used for cotton until about 1860. At this early date wonderful results were attributed to their use in increasing the crops. For several years the increase in the use of them was followed with good results, but after a time the idea began to spread that the stimulating effect gave out and the soils really became poorer. The truth of the matter was that with their continued use and with the clean cultivation, all the vegetable matter and humus became exhausted. A natural consequence was poor land and decreased yields. The alluvial bottoms along the streams and some of the rich uplands will produce profitable cotton crops without the aid of manures of any kind.

Commercial fertilizers, when wisely used, have been profitable to the cotton grower,

but an extravagant and often unintelligent use has been too common.

The one-crop system of the cotton states has been followed until much of the best lands have become unprofitable without the use of artificial plant food. There are vast areas where the natural fertility is too low to produce paying yields without the application of fertilizer. These facts, with the demand for a quick cash crop, the prevalence of the credit system, the indifferent nature of the negro laborer, and the necessity for hastening maturity to avoid insect pests has led up to a general use of commercial fertilizers in recent years. A sort of fertilizer craze has swept over the Atlantic and Gulf States, only that portion of the cotton region west of the Mississippi escaping. The farmers have bought it and used it extravagantly and unwisely, thereby bringing upon themselves and their states a fertilizer debt, much of which is an unnecessary drain upon the resources.

The following figures show the value of commercial fertilizers consumed in cotton states in 1910 based on inspection and tax laws as reported by state officials: North Caro-

Cultivating cotton with a spring-tooth cultivator

Cultivating cotton with a two-horse cultivator

Young cotton plants

lina, $14,368,100; South Carolina, $20,104,305; Georgia, $22,719,760; Florida, $3,523,390; Alabama, $8,200,000; Mississippi, $4,055,540; Tennessee, $1,172,240; Louisiana, $1,820,200; Texas, $860,000.

The above figures represent the value of commercial fertilizers and cotton seed meal used. No report was given of the amount of cottonseed meal used in Alabama, Tennessee, Louisiana, and Texas. The above table does not take into account a large amount of cotton seed and other fertilizing materials of which no official record was kept. While all of this fertilizer was not used for cotton, it was paid for out of the proceeds of the cotton crop.

Until recent fertilizer laws were passed in the states requiring a guaranteed analysis to be stamped on the package, unscrupulous manufacturers and dealers sold much cheap, inferior goods to the farmers at high prices. The law does not prevent making cheap grade fertilizer, but it must be branded so that the purchaser will know just what he is buying. The average farmer wants a cheap grade article notwithstanding the fact that the plant food in a high grade is cheaper and more satisfactory. It is

a matter of record that in the early days of commercial fertilizer the foulest smelling and the most repulsive looking brand was considered most effective. This idea no longer prevails among intelligent farmers. The first thing they look for is the tag showing available elements in each package. But the mass of farmers have not been sufficiently educated along this line. They still buy on credit and consequently take what the dealer offers, regardless of price or grade. We hope this book will be of value in aiding purchasers to buy and use fertilizers with more intelligence and profit in the future.

The chief object in the use of any fertilizer is, of course, increased yield, and to bring this about it must supply available plant food, or make available some of that already tied up in the soil. Usually artificial fertilizers perform both of these offices.

Most soils contain all the elements that enter into the plant growth except three — nitrogen, phosphoric acid, and potash. There is enough potash found in the soils in nearly all the Southern States. This is especially true on the red clays if a proper rotation is followed.

Commercial fertilizers cannot be bought in a pure state, but in combination with other substances which are of no value except to increase the bulk and make it easier to distribute. The farmer should, by all means, know that the value of a fertilizer depends not on gross weight, but on the amount of available plant food contained. No fertilizer should be purchased that does not have the guaranteed analysis printed on the package. The composition is given in percentages, and in each hundred pounds there should be so many pounds of the particular element mentioned.

For example, a fertilizer is offered for sale branded as follows:

Nitrogen	2 per cent.
Water-soluble phosphoric acid	8 per cent.
Citrate-soluble phosphoric acid	2 per cent.
Total available phosphoric acid	10 per cent.
Potash	2 per cent.

Translated into terms of pounds this means that in a sack weighing 100 pounds there are:

2 pounds of nitrogen.
8 pounds of water-soluble phosphoric acid.
2 pounds of citrate-soluble phosphoric acid
10 pounds of available phosphoric acid.
2 pounds of potash.

This gives a total of 14 pounds of plant food in a 100-pound sack. When a ton of such fertilizer is bought, the purchaser receives nitrogen, 40 pounds; water-soluble phosphoric acid, 160 pounds; citrate-soluble phosphoric acid, 40 pounds; potash 40 pounds. Notice that what is called "available" is the sum of the water-soluble and the citrate-soluble phosphoric acid. In this fertilizer we get three things that are of use —2 pounds of nitrogen, 10 pounds of phosphoric acid, and 2 pounds of potash to the 100 pounds.

If cotton seed meal, acid phosphate, and kainit are used to make this fertilizer, it will require the following quantities for one ton of the mixture:

TABLE I.— PROPORTIONS AND VALUE OF COTTON SEED MEAL, ACID PHOSPHATE, AND KAINIT REQUIRED FOR A TON OF FERTILIZER OF A 2–10–2 COMPOSITION

FERTILIZING MATERIAL	POUNDS	VALUE
Cotton seed meal (6.4 per cent. Nitrogen)	625	$ 8.00*
Acid phosphate (16 per cent. available)	1,140	10.00
Kainit (12.5 per cent. potash)	235	2.00
Total	2,000	$20.00

*The value of fertilizing materials is calculated on the basis of 20 cents a pound for nitrogen and 5 cents a pound each for phosphoric acid and potash.

The figures quoted express the actual cost of the materials, so by the time such a fertilizer reaches the farmer it will cost him nearer $25 per ton. The difference between the value of materials and the price the farmer pays represents the cost of mixing, and bagging, and the profits.

It will be found that all materials used in mixing fertilizers vary in the amount of plant food contained in them. Taking acid phosphate for example, we find some running as low as 10 pounds of available phosphoric acid per 100 pounds, while the best grade runs as high as 16 pounds or more per 100 pounds. On this basis, valuing phosphoric acid at 5 cents per pound, the first would cost 50 cents, whereas the latter would cost 80 cents. Even greater differences will be found in the grades of cottonseed meal.

Samples of cotton seed meal can now be found ranging from 3.5 per cent. to 7 per cent. of nitrogen. Basing the values on the nitrogen contained, Table II shows the relative values of cotton seed meal of the different grades. It is assumed that cotton seed meal containing

6.5 per cent. of nitrogen can be bought for $28 per ton.

TABLE II. — VALUES PER TON OF COTTON SEED MEAL OF DIFFERENT GRADES

PER CENT OF NITROGEN	VALUE	PER CENT OF NITROGEN	VALUE	PER CENT OF NITROGEN	VALUE	PER CENT OF NITROGEN	VALUE
6.5	$28.00	6.3	$27.13	6.0	$25.84	5.1	$21.97
6.4	27.67	6.2	26.71	5.6	24.12	3.5	15.07

The average sample of cotton seed meal contains approximately the following percentages of plant food.

Nitrogen	6.4 per cent.
Phosphoric Acid	2.7 per cent.
Potash	1.8 per cent.

A 100-pound sack will therefore contain the following quantities of plant food.

Nitrogen	6.4 pounds
Phosphoric acid	2.7 "
Potash	1.8 "

The results following the use of cottonseed meal indicate that decomposition makes the phosphoric acid in the meal available. In buying materials for mixing fertilizers it is

always economy to use only high-grade goods, even though they cost a little more.

How to Use Commercial Fertilizers. — If fertilizers are used, the following general rule should govern: On rich lands use mainly fertilizers that will stimulate the fruit and not stalk growth. On lighter lands use more of the elements to force growth, combined with others which will mature the fruit. High-grade acid phosphate may be considered a basis for increasing the fruit and hastening the maturity of crops. Even on the richest land it has been demonstrated that a small percentage of nitrogen added to the acid phosphate gives better results.

Nitrogen. — The chief function of nitrogen is to promote plant growth, but it is also of very great importance in the production of fruit. Nitrogen enters largely into the composition of plants, and it follows that everything of vegetable origin is a valuable source of this substance. When vegetable matter is burned the nitrogen is released from its combination, escapes into the atmosphere, and is lost. Hence, it is bad practice to burn off fields and destroy vegetable matter; it is better to turn it

under. The humus in vegetable matter has a value in soil renovation frequently greater than its value as a plant food. The most important sources of nitrogen used in commercial fertilizers are as follows:

TABLE III.—NITROGEN CONTENT OF IMPORTANT FERTILIZER MATERIALS

SOURCE OF NITROGEN	PER CENT	SOURCE OF NITROGEN	PER CENT
Cotton seed meal	6 to 7	Fish scrap	7 to 8
Dried blood	.12 to 14	Sulphate of ammonia	.18 to 20
Tankage	9 to 12	Nitrate of soda	.14 to 16

Phosphoric Acid. — Next in importance as a plant food is phosphoric acid. It is largely required by the plant for growth, but it is absolutely essential in promoting fruitage and is a great factor in hastening the maturity of the crops. The principal commercial sources of phosphoric acid are as follows:

Table IV. — PHOSPHORIC ACID CONTENT OF IMPORTANT FERTILIZER MATERIALS

SOURCE OF PHOSPHORIC ACID	PER CENT	SOURCE OF PHOSPHORIC ACID	PER CENT
Rock phosphate:		Bone meal:	
Dissolved	.12 to 16	Dissolved	.15 to 17
Ground	.24 to 32	Ground	.20 to 22
Thomas slag	.15 to 20		

Potash. — Potash is more directly effective in developing the fruit and adds to the vigor of the plant. It is seldom deficient in soils and especially in the soils of the Gulf States. It is obtained from the following sources:

TABLE V.—POTASH CONTENT OF IMPORTANT FERTILIZER MATERIALS

SOURCE OF POTASH	PER CENT	SOURCE OF POTASH	PER CENT
Kainit	12.5	Sulphate of potash	53
Muriate of potash .	50.0	Wood ashes . . .	5 to 20

It should be understood that the fertilizing content of all the above-named materials are not readily available for the use of the plant. The amounts available should always determine the value of the material. An example to illustrate may be found in acid phosphate. The total content of the ground rock is twice that of dissolved rock, but such a large per cent. of the ground rock is unavailable that it might be cheaper to buy the dissolved rock at twice the price per ton. The same principle applies in a greater or less degree to all the other materials used in making commercial fertilizers.

What Fertilizer to Buy. — Since the elements of plant food already mentioned are required in

different quantities and since the soils vary in their supply, it is well for the farmer to know what his soil and plants need before investing his money in fertilizers. The practical way for the farmer to determine these facts is to observe the growth of the plants on his land. If the plants grow rapidly and make an abundance of leaf and stalk it is evidence of a good supply of nitrogen. If there is not a proportionate amount of fruit it is a sure indication that the soil needs phosphoric acid. On the other hand, if the plant does not have a good color and tends to drop its fruit before it reaches a fair size it indicates that the soil requires potash.

Most of the soils in the South are deficient in both nitrogen and phosphoric acid, and some in potash, so when commercial fertilizers are bought their value depends upon their content of these substances. If the farmer has saved all manures and has grown cowpeas or other legumes abundantly, he will rarely have to buy nitrogen.

For rich soils, or soils where a heavy crop of peas, beans, or clover was grown the previous year, use one part of cotton seed meal and three parts of acid phosphate for cotton. For me-

dium soils use one part of cotton seed meal and two parts of acid phosphate. On thin soils use one part of cotton seed meal and one part of acid phosphate. These proportions are for soils rich in potash, but deficient in nitrogen and phosphoric acid. Experiments have shown that most of the clay soils in the cotton states do not need potash for growing field crops. On soils showing a need of it potash should be added. On some soils experiments have shown that neither acid phosphate nor potash is needed; examples of such soils are found in the black waxy lands of west Alabama, east Mississippi, and Texas, and the stiff alluvial lands of the Mississippi Valley.

On these soils nitrogen and humus seem to be all that is needed. Deep sandy lands such as are found in Florida and along the coastal plains are in many cases deficient in potash, as well as in phosphoric acid and nitrogen. On such soils a complete fertilizer or one containing nitrogen, phosphoric acid, and potash should be used.

Amount of Fertilizer to Use Per Acre. — No definite instructions in regard to the use of fertilizers can be given to fit all conditions and

soils. This question must be settled by tests on individual farms. The following formula will serve as a guide in mixing fertilizers to be used under the conditions mentioned:

TABLE VI.—PROPORTIONS OF FERTILIZER FOR COTTON

	POUNDS OF FERTILIZER PER ACRE			
Fertilizer to be used.	On sandy loam or clay soils when			On deep sandy soil of medium grade.
	Poor	Medium	Rich	
Cotton seed meal	150	100	75	150
Acid phosphate	150	200	225	150
Kainit	—	—	—	150

Where it is found that potash is needed on clay lands, one hundred pounds of kainit or its equivalent in muriate or sulphate of potash may be added.

Where the land has grown a heavy crop of peas or beans the year before, half the amount of cotton seed meal may be used.

On the black waxy lands of Alabama and Mississippi and the stiff alluvial lands of the Mississippi Valley that have been planted to cotton for a long period of years and have become deficient in vegetable matter, 200 to 300 pounds of cotton seed meal or 100 pounds nitrate of soda per acre have given profitable returns.

The amount of fertilizer to use depends on several factors. The cost of the material used in the fertilizer, the value of the land, the need and condition of the soil, and the money value of the crops to be grown must each be considered. The greater the money value the crop represents the larger the quantity of fertilizer that can be used with profit. Large applications of fertilizer never pay on thin, poorly prepared soils. The amount of fertilizer to use is a question of economics as well as of crop culture. With 12-cent cotton the farmer can realize large returns from 600 to 800 pounds per acre on soils in good condition.

Different Forms of Fertilizing Materials. — Elsewhere we have suggested some of the most common sources of nitrogen, phosphoric acid, and potash. In the formula given acid phosphate and cotton seed meal have been used. They are the most commonly known and more generally used. If for any good reason it is desirable to substitute other materials in the mixture, it can be readily done. Simply substitute in proper porportions. Ordinarily nitrate of soda should not be used in making mixed fertilizers. It is better to use it as a top-

dressing for growing crops. Where nitrate of soda is used for cotton, apply it about the time the plant begins to fruit. If more than 100 pounds per acre is used make two applications fifteen days apart.

Methods of Mixing. — The mixing of fertilizers on the farm can be done very satisfactorily by emptying the raw materials on a tight floor of wood or concrete; or if more convenient it may be done on a hard, dirt floor under a shed or outhouse.

It is better not to empty over 400 to 600 pounds at one time, as it can be more readily and thoroughly mixed in small quantities. The mixing can be done with hoes and shovels by turning over two or three times and continuing this process until the desired quantity is ready for use. This method of home mixing is very desirable where the farmer wishes to leave out any element or in any way change the proportion to better suit special conditions.

How to Apply Commercial Fertilizers. — Before applying commercial fertilizers prepare the soil thoroughly. Where 500 pounds of fertilizer or less is used for cotton put it all out in one application in the furrow about ten days

before planting and mix well with the soil. On deep sandy soils it may be best to make two applications; one half at planting and remainder at second cultivation. Where 600 or more pounds per acre are used two applications may be made, one half in the furrow before planting and the remainder as side applications at the second working of the crop. When using 1,000 pounds or more, make two or more applications or broadcast the entire amount before planting.

The depth to which the commercial fertilizer is applied is important. Experiments have shown that about three inches is the proper depth in all except semi-arid regions, where it should be put deeper. It has been a common practice among farmers to apply fertilizers too deep.

The following facts regarding fertilizers should be kept in mind by the cotton farmer:

1. Never allow the waste of barnyard manure.

2. All waste and by-products from the farm should be returned to the land.

3. Rotation of crops is essential for permanent soil building. Legumes and green crops

should be grown liberally and turned under to furnish humus, and keep the soil in good mechanical condition.

4. The greatest benefit to be derived from commercial fertilizers is in combination with farm manures and green crops turned under. A much more liberal application can be made profitable under these conditions.

5. A general and rather liberal use of commercial fertilizer can be recommended if intelligence and good judgment is displayed.

6. Excessive and reckless use of commercial fertilizer should be avoided. Beyond a certain limit profits are much more uncertain.

7. One application on clay soils has been found as satisfactory as more where less than 500 pounds per acre were used. Quickly available substances, such as nitrate of soda, should be applied to growing crops. When large amounts of fertilizer are used, and on special soils, two applications are sometimes more profitable.

8. Where all the benefits from fertilizers are desired the first season, only readily available materials should enter into its composition. For permanent improvement of the soil more

slowly available materials may be used and these are usually cheaper.

9. The effect of fertilizers on crops after the first year depends on season, soil condition, and materials used.

10. Fertilizers give best results when not applied more than two or three inches deep, except when used on dry land, then they should be deeper.

11. Organic nitrogen such as cottonseed meal, dried blood, tankage, and fish scrap have been found preferable in mixed fertilizers where only one early application is made.

12. Potash is not needed on much of the cotton soils as a fertilizer, but kainit has been found greatly beneficial on soils subject to cotton rust.

13. Home mixing is profitable. A better grade of materials can be had, and the mixing can be done to suit special soils or crops.

14. A judicious use of fertilizers will increase yields on any soil. It hastens maturity so that cotton may be grown farther north, and also makes it possible to offset insect damage.

15. Rotation of crops is very beneficial on the cotton farm, especially if all the crops are

fertilized. In this way the benefits from the fertilizers will be cumulative.

16. If nitrogen-gathering crops are grown and manures and waste matter about the farm plowed under and incorporated with the soil, the mechanical condition will be greatly improved and little nitrogen (the most expensive element in fertilizers) will have to be purchased.

17. Where cotton has been grown exclusively on lands for a long period, a complete fertilizer is necessary, but where rotation has been practised only two of the elements and sometimes but one will have to be purchased. The actual field experiments of the individual farmer will be necessary to determine what elements are required. A close study of these problems by the farmer will save money now uselessly squandered on commercial manure.

Improvement of Cotton by Seed Selection

CHAPTER VI

IMPROVEMENT OF COTTON BY SEED SELECTION

THE careful selection of the best seed is a matter of importance to the cotton farmer. It has been a too common practice to plant inferior mixed seed from the gin or oil mill, no attention having been given to seed selection. Tests show conclusively that by selecting the best seed from the most desirable stalks the yield will be from 10 to 20 per cent. more than where gin run seed, even of the same variety, are used. At the present price of cotton the loss to the farmer who plants poor seed will be from $5 to $15 per acre.

Cotton is a plant which is very susceptible to improvement by seed selection, and can be greatly modified in form and habit in a very few successive crops. The bloom is large and open and cross fertilization is constantly taking place by means of insects and other causes. The cotton plant sports easily and

responds quickly to differences in environment, soil, climate, treatment, and fertilization. This is an aid to the farmer if he uses care in selecting his seed, but if no attention is given to seed selection, the plant will show deterioration year after year.

The main points to be considered in improving cotton seed are — variety or type, selection, ginning, and storage. By type is meant the kind of stalk, bolls, lint, and general characteristics. There are but few botanical varieties, but there are a large number of what might be called "Agricultural varieties" and these agricultural varieties have a great many more names than there are recognizable forms. There are a great many varieties that have been developed by the careful work of the most progressive farmers through years of seed selection. Each farmer should decide which type or variety is best suited to his conditions, should grow it exclusively and continue to improve it. In choosing a variety, too little attention is often given to some qualities and too much to others. In making a choice of a variety the following points should be given careful attention and consideration:

adaptability, productiveness, earliness, habit of growth, length and strength of fiber, size of seed, and susceptibility to disease. A desirable type of upland cotton is one having a strong, vigorous, short-jointed stalk with plenty of fruit limbs on the lower half; fruit limbs short-jointed and extending to the outer border of the plant and fruiting to the end; large bolls, storm resisting; a high percentage of lint; medium-size seed; staple at least one and one eighth inches, and strong; plant hardy, early, and prolific.

Simplest Method of Seed Selection. — The simplest method of seed selection is for one careful hand to go ahead of the pickers at the first or second picking and take the best bolls, from near the heart of the stalk, from such plants as nearest approach the type for which the grower is selecting. Store this selected seed cotton in a dry place and wait until the gins are not crowded, then carefully clean the gin, put down a sheet to catch the seed, and run the selected cotton through. Store these seeds in a dry place until it is time for planting. This kind of seed selection will aid in maintaining the excellence and purity

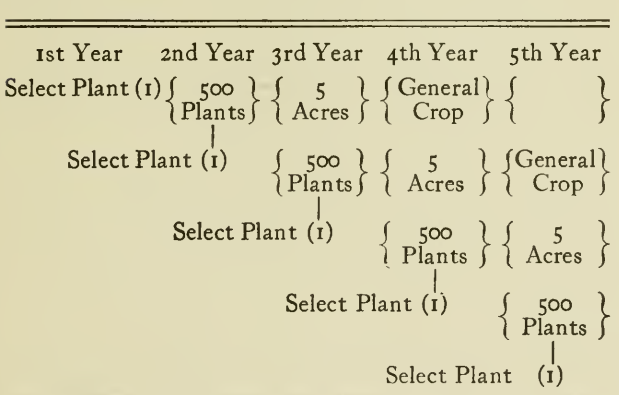
of a good variety and is practicable for farmers who cannot devote much time to cotton breeding.

Plant-to-the-Row Method. — A much better plan and one that should be adopted by the farmer who wants to do careful seed breeding is to have a breeding patch, separated as far as possible from any other cotton to avoid cross fertilization. It will be best to have this breeding patch at least one fourth of a mile from any other cotton. Select a plat of ground for this purpose having uniform character and fertility of soil. From the best field of cotton each year select one hundred stalks, or as many as can be conveniently handled, and gin the cotton from each stalk separately. A specially constructed small gin will be best for this purpose, but if this cannot be had the seed can be planted without ginning.

Lay off the seed patch in rows of equal length and uniform width and plant the seed from each stalk in a separate row. Mark the rows off in checks of equal width and plant the seed in hills. Plants may show marks of excellence due to favorable environments but by keeping the seed from each plant separate,

and planted in separate rows, the good qualities inherited from the parent plant will be easily determined, and it is reasonable to suppose that these plants will transfer their good qualities to their offspring. From the rows showing that the plants have inherited the good qualities of their parent plant, select one hundred plants to be planted in the plant-to-a-row patch the second year. The remainder of the seed from the best stalks in the rows showing the most excellence may be selected and planted in a larger field from which seed can be grown to plant the entire crop the year following.

The following diagram by Webber illustrates seed breeding by the plant-to-a-row method:



Cross Fertilization. — When it is desired to combine the good qualities of two varieties in a single stock, this work can be best accomplished by cross fertilization. It is quite probable that most of the varieties which have been developed from single plants have really originated by means of accidental crossing of different varieties.

While cross fertilization is the surest method for the production of new varieties, it is largely work in the dark, as plants resulting from the crosses may inherit the weak qualities of both parents without showing the good qualities of either. It is often necessary to make a hundred or more crosses before producing a plant showing the desired combinations. Even after a plant has been secured showing the desired qualities the majority of its offspring will not inherit these qualities. After the cross is made and a plant of desired type secured it is then necessary to practise careful seed selection for a number of years before there is much uniformity between the different plants.

While there is much variation between individual plants resulting from a single line

of crossing, still, as a general rule, the character of stalk and the habit of growth in the future plant will be more like the female parent, while the fruit of the plant will be more like the male parent.

It will not be found very difficult to artificially cross fertilize flowers of the cotton plants.

Near sunset select a large, well-developed flower bud that would be open the next morning, and carefully remove the anthers from the flower by means of a small pair of scissors or a sharp, thin bladed knife, using care not to bruise the pistil of the flower. As soon as the anthers are removed tie a paper bag over the mutilated flower to keep out insect visitors.

Next pick out a large, well developed bud on the plant that is to furnish the pollen and tie over the bud a paper bag to keep out the insects. The following morning the pistil will be fully developed and ready to receive pollen. Pull the entire flower that is to furnish the pollen and rub its anthers lightly over the stigma of the flower from which the anthers were removed. Again place the paper bag over the cross pollenated flower and leave

until the young boll is developed, which will be in four or five days. The paper bag should then be removed and the boll carefully labelled with a small tag so that it can be readily identified at harvest time.

Varieties of American Upland Cotton

CHAPTER VII

VARIETIES OF AMERICAN UPLAND COTTON

THE American upland varieties of cotton are commercially divided into two groups — short staple or those having a fiber three fourths to one and one eighth inches in length, and long staple or those having a fiber from one and three sixteenths inches to one and five eighths inches.

Short staple varieties when grown on moist alluvial soils frequently produce a staple slightly longer than one and one eighth inches, but hardly long enough to be classed in the long staple group. This grade of cotton is known commercially as rivers or benders.

Varieties of American Upland Cotton. — There are several hundred so-called varieties of cotton, but a large number of these are practically identical. This multiplication of names has been brought about largely by farmers who secure seed of some standard variety and

after growing it for one or two seasons, give it their own name or some local name for commercial purposes.

Classification of Varieties. — There are several methods of classification of American upland cotton. They may be classified according to conformation of stalk, length of staple, earliness, size of boll, and percentage of lint.

J. F. Duggar, Director of Alabama Experiment Station, Bulletin 140, divides American upland into eight groups. His classification with description of each group is as follows:

(1) Cluster varieties, or Dickson type.

(2) Semi-cluster varieties, or Peerless type.

(3) Rio Grande varieties, or Peterkin type.

(4) The King-like varieties, or King type.

(5) Big Boll varieties, or Truitt type.

(6) Long Limb varieties, or Petit Gulf type.

(7) Intermediate varieties, or various types.

(8) Long Staple Upland varieties, or Allen type.

The lines of demarkation between these groups are not always clear and distinct; one group often merges into another by almost

imperceptible gradations, just as is the case with related varieties.

Below is given a list of the varieties which are included under these several groups, and also a general description of the varieties composing each class. Some varieties are not classified, either because of insufficient data, or more frequently because badly mixed. In cases of a medium degree of impurity, or variation, description has been made of the predominant type.

Group I: Cluster Varieties, or Dickson Type. — The most striking characters are (1) the extreme shortness of the fruit limbs, and (2) the tendency of the bolls to grow in clusters, often two and even three from the same node. The plants are often tall and always slender and normally erect, though often bent down by the weight of bolls growing near the upper end of the main stem. The few base limbs are often long, or there may be no wood limbs, especially when these varieties are closely crowded or grown on poor land. The bolls and seed are usually small, but may be of medium size; the seed are thickly covered with fuzz, which is usually whit-

ish, with little or no brownish or greenish tinge.

As to the time of maturity these varieties must be classed as early, even though they sometimes make a second growth of bolls in the top of the plant which may fail to mature. In earliness they are surpassed by the varieties of the King type (Class IV).

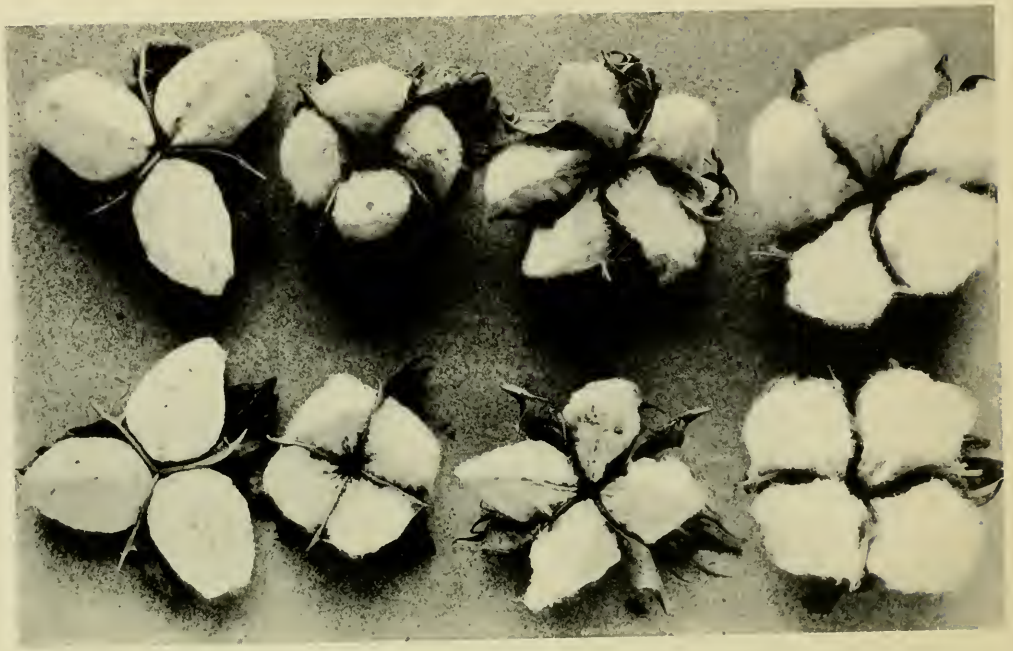
In percentage of lint they are variable, some of them equalling in this respect the Rio Grande group.

Dickson, Jackson (also called Limbless or African), U. S. Dept. Agr., No. 128, and Welborn, belong to this group.

Group II: Semi-cluster Varieties, or Peerless Type. — These varieties have in less marked degree some of the qualities which distinguish Class I, being erect and having bolls borne singly very near together. Along the main stem are short fruit limbs increasing in length toward the bottom of the stem. The two to five base or wood limbs are usually of medium length. In size of bolls and size of seed and percentage of lint there is considerable diversity among these varieties. The seeds are usually well covered with fuzz of many shades,

Cotton bolls

On left, American Upland; in centre, Sea Island; and on right, Indian cotton



Open bolls of cotton .

On the left, 1st, Egyptian cotton; 2d, Asiatic cotton; 3d, American Upland long staple; 4th, American Upland big boll stormproof cotton

whitish, greenish, or brownish. Most of these varieties are early or medium, but some that belong in both the semi-cluster and big boll groups are late in maturing. The following varieties are included in the semi-cluster group: Barnett, Berryhill, Blue Ribbon (L. S.), Cummings, Defiance, Dongola (B. B.), Featherstone, Garrard, Haralson (B. B.), Hardin, Hawkins, Herndon, Hilliard, Lealand, McCall, Minor, Montclare (B. B.), Norris, Peerless, Pullnot, Rogers (B. B.), Sterling, Tyler, and Woodfin.

Group III: Rio Grande Varieties, or Peterkin Type. — The characters which most distinctly mark this class are:

(1) The large proportion of lint, usually 35 per cent. or more, of the weight of seed cotton, and

(2) Seeds of which many are bare of fuzz, except at the tip end, or so scantily covered with fuzz that the dark seed hull shows through.

The plants are well branched, and usually, on upland soils, of medium size. On many plants the stems and branches are of a deep red color. The bolls are small to medium and the seeds are quite small. In time of

maturing these varieties are usually neither very early nor extremely late.

The varieties included in this group are conveniently divided into two sub-groups according to the presence or absence of naked, smooth seed. The following Rio Grande varieties have a considerable proportion of naked seed: Ansom Cream, Bates, Braddy, Brannon, Cameron, Carolina Queen, Champion, Combination, Crossland, Dixie Wilt-Resistant, Moss, Parker, Peterkin, Pinkerton, Ptomey, Shine Black Seed, Sistrunk, Texas Oak, Texas Wood, Victor, and Wise.

Rio Grande varieties having practically no naked seed, but having many seeds so scantily clothed with fuzz that the dark seed coat shows through, giving a brown color, are the following:

Berryhill, Borden, Dearing, (probably) Eureka Favorite, (probably) Gregg, Layton, Park's Own, Speight, and (probably) Toole.

Group IV: King-Like Varieties, or King Type. — The varieties of this group are the earliest of American cottons. The plants are usually small but may be of medium size. The limbs are numerous and the fruit limbs

are rather long in proportion to the height of plant. The fruit limbs are often crooked at the joints, reminding one of the crooked twigs of a black jack oak. The base limbs are short and sometimes replaced by fruit limbs bearing a number of bolls on each. King is essentially a short-jointed, compact plant with an abundance of slender, rather crooked limbs. The bolls of this group are small; the seeds are usually small and thickly covered with fuzz which is usually brownish, with an occasional seed showing a greenish tint. The percentage of lint is usually 33 to 35, and sometimes higher. King and its synonyms have on many blooms a red spot near the base of the inner portion of each petal. The varieties of this group are: Dozier, Grier, Golddust, Hodge, King, Simpkins, Lowry, Mascot, Missonary, and probably Shine Early.

Group V: Big Boll Varieties or Truitt Types. — The character which especially distinguishes this class is the large size of bolls, of which only 45 to 68 are required to yield a pound of seed cotton. Other specially notable qualities are late maturity and vigorous growth of stalk. The seeds are large or very

large, and covered with a thick fuzz, generally brownish white or whitish, a part of the seed of many of these varieties being covered with a deep green fuzz. The per cent. of lint often runs rather low and is usually between 31 and 35. The bolls are not closely clustered; in some varieties the upper limbs are so short as to give the top of the plant the erect, slender appearance which is common among semi-cluster varieties. In typical plants the base limbs are of short or medium length, the number of fruit limbs and bolls relatively few, and the main stem is rather short. However, a number of varieties are included here that have all or many of their plants of the semi-cluster form.

The following varieties belong in this group: Alex. Allen, Anderson, Bancroft, Banks, Berry, Bohemian, Cheise, Christopher, Cleveland, Cliett, Cook Improved, Coppedge, Culpepper, Diamond, Double Header, Dongola, Drake (Ala.), Duncan, Ellis, Grayson, Gunn, Haralson, Hunnicutt Big Boll, Hutchinson, Jones, Langford, Lee, Maddox, Montclare, Mortgage Lifter, Ozier Big Boll, Reliable, Rogers, Rowden, Ruralist, Russell, Scogin,

Sewell, Schley, Smith Improved, Smith Standard, Southern Wonder, Spearman, Strickland, Tatum, Texas Bur, Texas Storm Proof, Thrash, Todd, Triumph, Truitt, Webber-Russell, Whitten, and Wyche.

Group VI: Long Limb Upland Varieties, Petit Gulf Type. — The varieties in this class grow to large size and have long limbs and long joints, the plants presenting a straggling appearance or want of compactness. The bolls and seeds are both of medium to large size, the latter covered with fuzz of various shades. The per cent. of lint is usually low. The long limb form is usually accompanied by unproductiveness on average upland soil.

The following varieties are included in this group: Hagaman, Louisiana, Peeler, Petit Gulf, and probably Red Leaf.

Group VII: Intermediate Varieties or Various Types. — This group is here added to the scheme of classification published by the writer in 1899, primarily to include varieties having limbs a little too long to bring them within the semi-cluster class. It is also made to include a few other varieties that are inter-

mediate between any two of the other seven groups.

To this division are assigned, Breden, Boyd, Edgeworth, Eureka, Excelsior, Gold Standard, Hunnicutt (J. B.), Lewis, Meredith, Roby, Rosser, (probably) Shine Early, Sprueill, (possibly) Toole, Tucker, and Webber-Russell.

Group VIII: Long Staple Varieties, or Allen Type. — The length of staple is the distinguishing characteristics. The lint usually measures $1\frac{1}{4}$ to $1\frac{1}{2}$ inches in length. An almost invariable accompaniment to great length of staple is a low proportion of lint.

The plants grow to large size, have limbs of great length, and usually present a straggling appearance, though in some varieties only the base limbs are long, the upper limbs bearing a number of bolls close to the main stem, and giving the upper portion of the plant the appearance of great prolificacy.

The bolls are not very large, but are long, usually slender, tapering to a sharp point. Most of these long staple varieties are late in maturing a crop.

The seeds are mostly of medium to large size, usually densely covered with fuzz, from which

Varieties of cotton

Big boll group: Truitt variety
The King-like, or Early group: Shine variety
Cluster group: Jackson limbless variety
Semi-cluster group: Hawkins variety

Varieties of cotton

Sea Island
Rio Grande Group: Peterkin variety

Upland long-staple group: Allen variety
A stalk showing desirable type of Upland cotton

all trace of green is absent, the color being almost pure white, or in some varieties of a brownish tint. In some varieties the seeds are bare. In the long staple group are included:

Allen Long Staple, Allen Hybrid Long Staple, Black Rattler, Blue Ribbon, Cobweb, Cook Long Staple, Colthorp, Davis, Florodora, Gholson, Griffin, Keno, Laclede, Ozier Long Staple, Simms, Sunflower, and Wonderful.

Relative Value of Varieties. — The relative value of the different varieties can be determined only by the number of dollars per acre each will bring. Each section of the cotton growing belt should secure varieties specially adapted to the particular conditions by which they are to be surrounded. W. R. Perkins, of the Mississippi Experiment Station, in a test of sixteen well-known varieties, under the same conditions and with the same cultivation found the difference in value per acre of the best over the poorest was $19.25 one year, and $26.81 another year. This wide range of values would certainly indicate that ascertaining the proper variety to be grown was necessary for success. A variety may succeed well in one locality and when transferred to another section and planted

on a different soil may not maintain its good qualities. Some varieties are more liable to suffer from insects than others; some are more susceptible to certain diseases than others; some produce fairly well under almost any condition while others produce well under favorable conditions, but fail miserably on unfavorable soils or with unfavorable climatic conditions. Some of the long staple varieties which produce a long, strong, silky fiber on moist rich alluvial river bottom soil, fail to produce as good quality of lint or as satisfactory yield per acre when planted on high dry uplands.

The yield of lint per acre of long staple cotton on the same land and with the same treatment will be from 30 to 40 per cent. less than short cotton. Long staple cotton is more expensive to harvest on account of the size and shape of boll, making it harder to pick and requires more care and expense in ginning. For the farmer to be justified in growing long staple cotton he should receive at least a premium of 40 per cent. over the price of short cotton. In other words, when short cotton is selling at ten cents per

pound long staple cotton will have to sell for about fourteen cents per pound for the farmer to realize as much per acre from it.

On lands suitable, the big boll cottons are preferable for the following reasons: The plants are stronger and more vigorous, it is much easier to harvest, and not so liable to damage from rain or storm when harvesting is delayed.

In purchasing seed of the chosen variety attention should be given to the care that has been exercised in seed selection by the grower and not to advertisements of extra large yields. It is also best to procure seeds that were grown near by, if possible, as they are already acclimated and adapted to local conditions.

The following varieties of small boll early short staple cottons have taken high rank in yield of lint per acre at experiment stations in recent years:

Toole Trice
Simpkins Hawkins
King

The following big boll short staple cottons

have taken high rank in yield of lint per acre:

Triumph	Russell
Cleveland	Cook's Improved
Truitt	

Triumph, Cleveland, and Cook's Improved are medium early, Truitt and Russell are late maturing.

The following long staple cottons have taken high rank:

Columbia	Griffin
Hartwell	Allen
Sunflower	

Sea Island Cotton. — Sea Island cotton is a native of the West Indies and Central America and is grown only in a limited area in South Carolina, Georgia, and Florida, and off-lying islands. It is seldom profitable when grown more than one hundred or one hundred and twenty-five miles from the seacoast.

The plant grows rather tall, has long, slender branches, leaves with long slender lobes, the bolls are small, slender and sharp pointed having usually only three locks, and the fiber

American Upland cotton

Leaves: flower opening creamy white in the morning, closing and changing to rose pink in the afternoon; unopened bolls; mature open bolls with cotton ready for picking

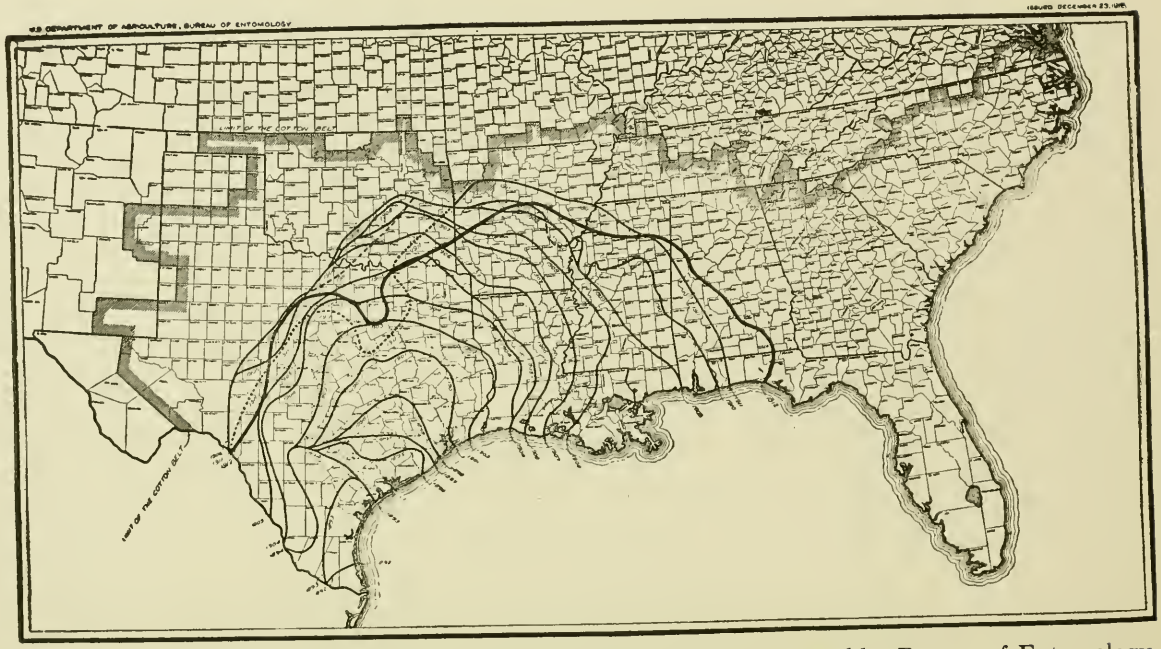
Cotton boll with anthracnose

Root-knot on cotton plant

is fine and silky, ranging from $1\frac{1}{2}$ to 2 inches in length.

Sea Island cotton produces the finest staple of any cotton grown and is used to manufacture thread and the most expensive cotton fabrics.

Some Cotton Diseases and Insect Pests With Suggestions for Their Control



Map showing spread of cotton boll weevil from 1892 to 1912. (Prepared by Bureau of Entomology, U. S. Department of Agriculture.)

The line for each year was determined by field examinations by agents of the Bureau of Entomology, and in certain cases by the entomologists of the states concerned. The heaviest line indicates the limit of the territory infested at the end of the season of 1912

CHAPTER VIII

SOME COTTON DISEASES AND INSECT PESTS WITH SUGGESTIONS FOR THEIR CONTROL

THE cotton plant is subject to more diseases and insect enemies than any of the farm crops of the South. This is to some extent due to the delicate nature of the plant in its early life. It is also partly due to the fact that cotton has been forced to adapt itself to more or less artificial conditions; it is naturally a tropical plant. While cotton has its origin in tropical climates, it is very largely grown commercially in semi-tropical countries, and under entirely changed conditions. It is probably better for the average cotton producer that the cotton plant has its enemies, for with nothing to check its growth and production the supply would be largely in excess of demand.

Anthracnose or Pink Boll Rot. — This is a fungus which causes the bolls to rot and is more or less prevalent in all parts of the cotton

belt. No variety of cotton is entirely free from this disease, but some varieties are more subject to it than others.

This disease first appears on the bolls as very small, dark spots, which enlarge and become somewhat sunken in the centres, which are pink or reddish brown.

The disease is spread by spores formed on the diseased areas and is carried over winter in infected seed and possibly in old cotton plants. Anthracnose is worse in wet than in dry seasons. By giving the cotton plenty of space to let in sunlight and air the disease will be less prevalent.

It is claimed by some farmers and investigators that deep breaking the land in the fall completely burying all old cotton plants has a tendency to lessen the damage from this disease.

In selecting seed be careful to avoid selecting from plants affected by anthracnose.

Cotton Wilt. — This is a fungous disease which attacks the roots and stems of the plant. It enters the roots from the soil and plugs up the water carrying vessels of the roots and stems.

A young cotton plant dying from wilt

A typical plant of Dillon wilt-resistant cotton

This disease first makes its outward appearance in a cotton field by a sudden wilting of the leaves which turn yellow and fall without apparent reason.

An examination of the roots of a freshly wilted plant that has been attacked by the wilt fungus always shows a blackened condition of the inner wood of the root or stem.

So far as known cotton and okra are the only plants the cotton wilt fungus lives on as a parasite.

This disease cannot be controlled by the application of potash as some farmers suppose.

The wilt fungus lives in the soil and is spread by the plow, by drainage water, by cattle, by manure, and other means of carrying the spores from one place to another. No direct proof is available that this disease has been spread by planting seed from infected fields, but many cases have been reported which indicate that the disease may be spread in this way.

In every field attacked by wilt there will be found a few plants not affected by the disease. By selecting seed from these plants a strain of cotton may be secured practically immune

to the disease. Another means suggested for the control of this disease is by practising crop rotation, using in the rotation crops that are not affected by the wilt fungus and the nematode worm — a very small worm which attacks the roots of plants causing root knot. It is claimed that the attack of this worm on the cotton roots makes it easier for the wilt germ to enter. The plants that may be used in a rotation to free the land of wilt are: corn, wheat, oats, rye, iron cowpea, Brabham cowpea, velvet bean, beggar weed, and grasses.

The United States Department of Agriculture has developed two varieties of cotton which show great resistance to wilt, viz., Dixie and Dillon.

Cotton Rust. — Cotton "rust" first makes an outward appearance by a mottled yellowish color of the leaves in dry weather or a sudden blackening and shedding of the foliage in wet weather. This disease is probably due to a poor mechanical condition of the soil and the lack of some plant food element, usually potash. Soils affected with rust are greatly benefited by turning into them heavy crops of vegetable matter, and by a rather liberal application of potash.

The Cotton Boll-Worm. — Perhaps the earliest insect to do serious damage to the cotton crop was the boll-worm. It also attacks the corn and tomato plant. It is known in corn as the common ear-worm, getting its name from the fact that the moth, laying the eggs, deposits them on the silk of the young ear of the corn. Here they hatch out and go into the ear and feed on the tip end grains as they reach the roasting ear stage.

The cotton boll-worm is a large green to dark brown worm that destroys the partially grown cotton bolls by eating into them.

They will invariably attack corn if in reach before going to cotton. The best way to combat this enemy in the cotton plant is to use corn as a catch crop for them. When corn is used for a catch crop, several plantings should be made so that it will give the worm something to feed on continually, without resorting to the cotton patch. This may be done by planting a few rows of corn around the cotton patch, or if preferred, two or three rows may be planted at intervals through the fields. Some good may be done by the use of poison. For poison to be effective it should be applied

several times during the season. The poison generally used for this purpose is dry Paris-green, which is sprinkled over the plants, preferably in the early morning while the dew is still on them. The boll-worm never attacks nor injures cotton except in the bloom and small boll.

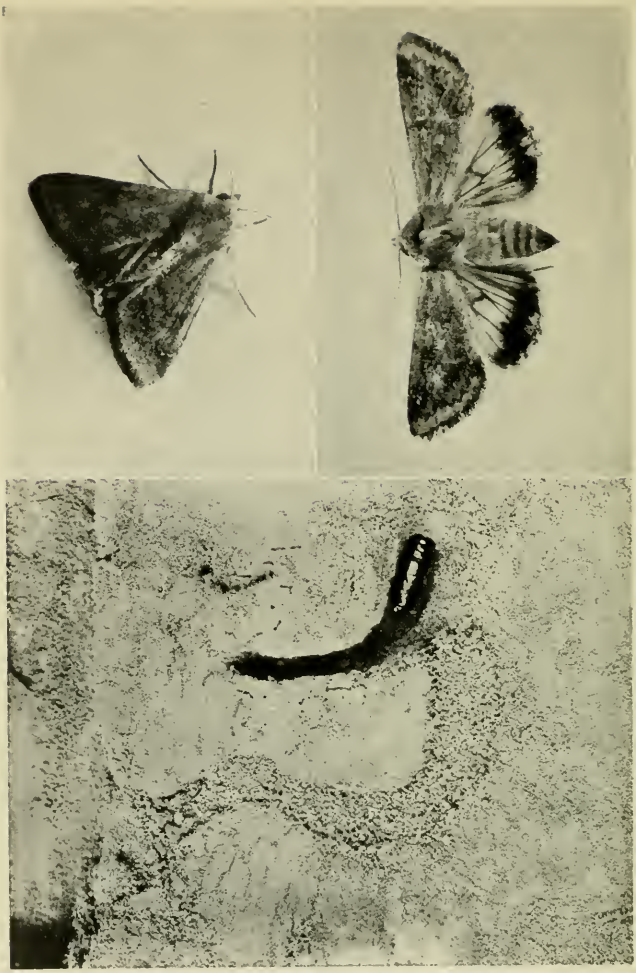
A single moth may lay as many as one thousand eggs. The eggs are laid on all parts of the plant, but especially on the leaves. After the worm hatches it feeds on the tender leaves until strong enough to cut into a boll. Each worm will destroy the contents of one or more bolls. When full grown the worm drops to the ground, and burrows two or three inches below the surface, where it remains until it emerges as a full grown moth. There will usually be from four to five generations in a season.

The boll-worm passes the winter in the ground in the pupa stage. Many of these insects can be destroyed by breaking the land deep in the fall or early winter.

The Cotton Caterpillar. — This is one of the earliest insect enemies of cotton in the United States. It is sometimes known as the "web-

A field of Upland cotton in South Carolina destroyed by wilt

Wilt-resistant Dillon cotton on adjoining land badly infected with wilt



Moths of cotton boll-worm

Pupa of boll-worm in its underground burrow

worm," or "army-worm." It appears almost every year to a limited extent. It has proven disastrous to the cotton crop only a few times in the United States. Its ravages do not extend over a very considerable amount of territory during any one season.

There are four stages in the life of the cotton worm: the egg, the larva, the pupa, and the adult. The adult cotton worm is a brownish yellow or grayish colored moth, the wings of which expand from one and one eighth to one and one half inches. The moth deposits its eggs on the under side of the leaf of the plant, where it hatches out in very hot weather in about three days.

The worm or larva feeds upon the leaves of the plant, and when very numerous will attack the squares and the outer surface of the bolls and even the twigs. It has been known to destroy a whole field in a few days and then move to another field in such numbers as to derive the name of "army-worm."

The cotton leaf worm or caterpillar transforms to the pupal stage on the cotton plant. The beginning of this stage is known as "webbing up." The time required from the hatching out

of the larva or worm to the "webbing up" or pupal stage is about fifteen days. Usually the caterpillar spins a crude web or cocoon using a portion of the leaf for the purpose, but in many cases no web whatever is formed, and the naked pupa hangs from the cotton plant by means of a thread spun by the caterpillar. The time required from the "webbing up" to the hatching out of the moth is in very hot weather from seven to ten days. The complete life cycle from eggs to moth will be completed in hot weather in from three to four weeks. A single moth lays from four to six hundred eggs in a week or ten days and then dies.

From the fact that the worm feeds on the foliage of the plant, it may be effectively controlled by the use of poisons; Paris-green, arsenate of lead, London purple, or any of the arsenical poisons may be used for this purpose. The most common method of poisoning is by applying Paris-green mixed with one or two parts of flour or lime.

The most practical method of application is the one commonly adopted, of sacks attached to the ends of poles and carried on horseback

Stages and work of the cotton worm or cotton caterpillar

Cotton plant attacked by boll weevil

a, Hanging dry square infested by weevil larva; *b*, flared square, with weevil punctures; *c*, cotton boll, sectioned, showing attacking weevil and weevil larva in its cell

through the fields. Take a pole about one foot longer than the width between the cotton rows, and six inches from each end of the pole attach a sack or bag containing the poison. Cheesecloth will be found a satisfactory material for making the sacks. By the above method one hand on horseback can poison two rows at a time and cover twenty acres a day. The poison should be applied at the first appearance of the worm. It is best to make the application early in the day when the leaves are moist with dew. If the poison is applied on a calm day there will be less loss from the poison drifting to the ground.

The Cotton Boll Weevil. — The most destructive of all insects that have attacked the cotton plant is the boll weevil, which has only been in the United States for the past seventeen or eighteen years. It has rapidly spread each year since its first appearance and is destined within the next decade to cover the entire cotton-producing part of the United States. The ravages of this enemy are so great that the total production of some counties has been reduced to less than 10 per cent. of the normal production. However, a few years' experience

with it has overcome the ravages to some degree in most sections, and in some cases the farmers have almost reached the original production.

The cotton boll weevil is a member of the beetle family. In size it varies from one eighth to three eighths inches in length and the breadth of its body is about one third its length. The color varies from a light yellowish brown to a chocolate brown.

The members of the group of insects to which the boll weevil belongs are characterized by having part of the head in front of the eyes greatly extended to form a long slender snout. The snout of the boll weevil is slightly curved and is about one half as long as from the head to the tip of the body. The distinguishing feature of the cotton boll weevil is two tooth-like projections on inner side of the fore-legs, at the lower end of the thigh, the inner or one nearest the body being longer than the other. There are four stages in the life of the weevil, the egg, the larva, the pupa, and adult weevil.

Three of these stages, egg, larva, and pupa are passed inside the cotton square or boll. The egg is deposited by the female weevil in a cavity formed by eating into a square or boll.

From the egg there hatches in a few days a small, white footless grub or worm which begins to feed, making a larger place for itself as it grows. During the course of its growth the grub or larva sheds its skin and the pupa appears. In this stage it is inactive and takes no food. In a few days the pupa sheds its skin and the full-grown weevil appears and in two or three days eats its way out of the square or boll and about one week later is ready to start another generation.

The time required from the laying of the egg to the emergence from the square or boll of the full-grown weevil is from fifteen to twenty-five days, depending on the season—the shorter time being required during very warm weather.

In the extreme southern part of cotton belt there will be as many as five generations of weevils in one season. In the central part of the cotton belt there will be from three to four generations.

The weevil is a very prolific insect, each female weevil laying during a lifetime about one hundred and forty eggs, so during a season it is estimated that one pair of weevils may have,

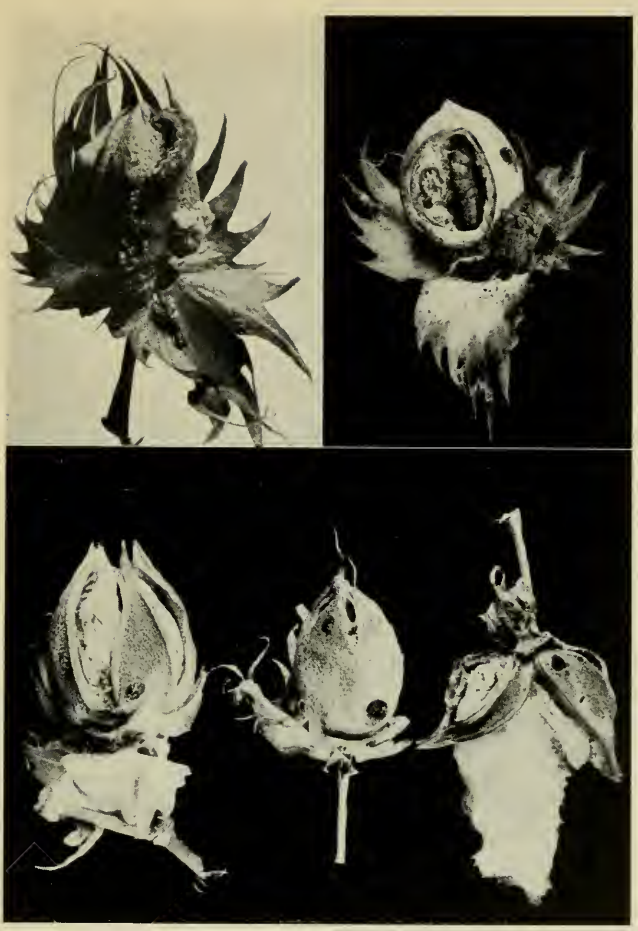
under favorable conditions, a living offspring of two hundred and fifty thousand.

The weevil feeds by sucking out the juices from the inner portion of the plant, which makes it impossible to use poisons effectively in its control, as is done with insects which feed upon the foliage of the plant. This renders the weevil very difficult of control.

The only way of combating the ravages of this insect is by using all means possible to hold the weevils in check and by practising better cultural methods in producing the crop. There are at present no known methods of completely destroying the weevil, so it will most likely be a factor in all future cotton production in the United States.

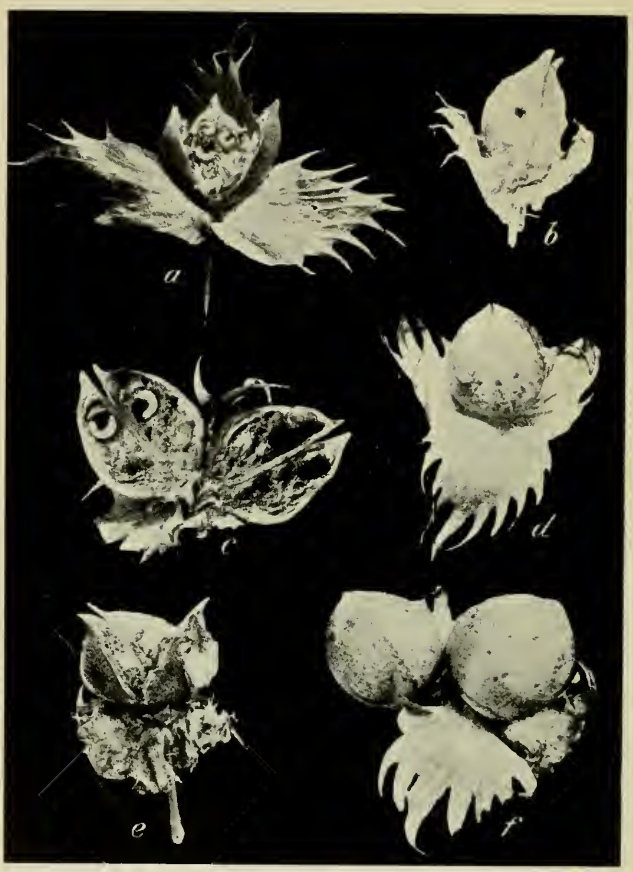
The Bureau of Entomology, U. S. Department of Agriculture, has established the following facts regarding the life history of the weevil which are important in outlining methods for its control:

1. The cotton boll weevil feeds upon nothing but cotton.
2. It goes into winter quarters mainly in or near the field of its depredations.



Cotton boll-worm on outside and inside of cotton boll

Partly opened cotton bolls showing effects of boll-worm damage



Injury by boll-weevil to bolls

a, Three larvæ in boll; *b*, emergence hole in dry unopened boll; *c*, two larvæ in boll; *d*, weevils puncturing boll; *e*, opened boll with two locks injured by weevil; *f*, large bolls severely punctured

3. That a comparatively small per cent. of the total weevils survive the winter and emerge in the spring.
4. That the overwintered weevil feeds upon the terminal bud of the young cotton plants until the forms or squares develop, then the female deposits her eggs in the squares exclusively at first, but later may deposit them in the bolls.
5. That the life of the adult weevil, when supplied with food, is about seventy days. If deprived of food it lives only six or seven days except in hibernation.
6. For a period after emergence from winter quarters it is comparatively sluggish and while feeding upon the cotton plant may be picked or poisoned.
7. The weevils remain in the field where they appear in the early spring until they become very numerous. Their principal period of migration is in the fall.

Based upon these life habits of the weevil Dr. S. A. Knapp, Bureau Plant Industry, U. S.

Department of Agriculture, outlined the following plan for the production of cotton under weevil conditions:

(1) Under boll-weevil infestation the fields selected for cultivation should be well drained, because a successful crop will then depend upon the possibility of cultivating them at the proper time. The poorly drained lands should be devoted to other crops. They have always been an uncertain factor in cotton production. It is not the intention to state that well-drained alluvial lands should not be planted to cotton.

(2) The early destruction of the cotton stalks before frost and the burning of all rubbish in and about the infested field are imperative.

(3) Break the field deep as early in the fall as possible with an implement that does not bring too much of the subsoil to the surface. Some winter cover crop should be grown if practicable; if not, harrow occasionally during the winter. Before planting, thoroughly pulverize the soil and make the best seed bed possible.

(4) Care must be taken to secure seed of an early-maturing variety and of the highest

vitality — not necessarily a small-boll variety, for on uplands we have been more successful with some large-boll varieties.

(5) Plant reasonably early. Planting should be delayed until all danger from frost is past and the soil is warm enough to produce rapid germination and growth.

(6) The use of the section harrow before planting and after planting, and again just as soon as the plants are well up, is advised.

(7) Use intensive, shallow cultivation of the crops and never lay by the cotton till picking commences. Late cultivation is very important.

(8) In case it is evident that a large number of weevils have been overwintered, it is advisable to hand-pick the early appearing weevils from the buds of young cotton plants before squares begin to form.

(9) As soon as the weevil commences to work, as evidenced by the punctured squares attach a pole or brush to the handles of the cultivator so as to knock the squares off. Most of them will fall of their own accord in a few days after they are punctured.

(10) Persistently pick up and burn the fallen squares.

This battle against the weevil is in two divisions:

The first division of the work consists in reducing the number of weevils just as much as possible so that a crop can be made.

The second division is to push the cotton plant to maturity as fast as possible and by extra cultivation and fertilization cause it to put no more forms or squares than it can mature, so that what the weevil takes is only a surplus — of no consideration in making the crop.

The burning of the stalks is very destructive to the weevils in the field, but its value depends considerably on when and how it is done. It must be done early and before frost. Demonstrations have been made showing that it caused the destruction of as many as 97 per cent. of the weevils if done early and properly, but if delayed it might allow as many as 45 per cent. to escape.

There are several methods of destroying the stalks. First, every third or fifth row may be allowed to stand and the rows on each side uprooted and thrown against it. Second, all the stalks may be cut and thrown into piles of convenient size. In either case, some of

Effects of boll-weevil attack on leaf and squares

a, Cotton leaf much fed upon by adult weevils; *b*, square with two egg punctures; *c*, flared square with many feeding punctures; *d*, square prevented from blooming by puncture; *e*, bloom injured by feeding puncture; *f*, poor blooms caused by feeding punctures.

Poisoning cotton by pole and bag method
Poisoning cotton by use of spray pump

the adult weevils will collect in the windrows or piles and be destroyed when the stalks are burned.

Another plan practised is to turn cattle in the fields to eat the foliage and immature bolls. This plan, however, should not be followed except by those farmers who can turn in enough cattle to completely clean up the field in a week's time.

The object in destroying the stalks is a twofold one: (1) To deprive the adult weevil of food and breeding places; (2) to kill the vast numbers of weevil eggs, larvæ, and pupæ contained in the squares and immature bolls at this time. To make this destruction complete, the stalks should be burned as soon as possible after being cut and piled. As soon as the foliage will burn readily fire should be applied, although the main stem and branches may not yet be dry enough to burn. All rubbish in and about the field should also be burned and the field immediately broken.

If this single instruction to destroy all cotton stalks in the fall while still green could be carried out by every grower, it would practically solve the weevil problem. The difficulty is

that only part of the growers follow the plan. It requires early maturing cottons and rapid gathering to get the crop out in time to do this work to the best advantage.

If delay is made until after a heavy frost and a large number of the weevils have escaped from the field, either to hibernate or to go elsewhere then to cut and burn stalks may be of little value, and the better practice is to thoroughly cut the stalks and plow them under.

It is seldom practicable for farmers in the northern portion of the cotton belt to cut and burn stalks early enough to be of value.

The next most important work in eliminating the weevils is in the spring, when the cotton plants begin to put on squares and the infesting weevil punctures them. The grower should take note of this and immediately attach a pole to the handles of the cultivator so as to knock the bush and hasten the falling off of the squares, and then the squares must be carefully picked up and burned. In one sense this picking up of squares goes to the root of the matter more than early fall destruction of the stalk, because in the fall destruction only a small percentage of the weevils would live

through the winter anyway, while we can rest assured that practically every square not picked up and destroyed, at least in cloudy weather, will result in furnishing a boll weevil to infest the crop. We know of hundreds of instances where fields were located in the best situation for weevil depredation, on bottom lands surrounded by heavy timber, with a rank growth of cotton and no previous preparation or burning of the stalks or destruction of the rubbish, and yet by picking up the squares and intensive cultivation a large crop of cotton was made. If care is taken that every punctured square is destroyed, a whole generation of weevils will be wiped out in two or three weeks. The old weevils will die and we can go right on making the crop. Of course, in sections where there is very slight rainfall and on sandy upland soils anywhere during periods of dry and very hot weather, dependence may be placed on the heat to kill the weevil larvæ in the squares.

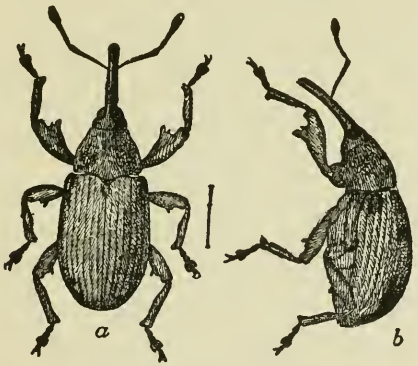
It will seldom be safe to depend on this on alluvial soils and never on any kind of soil except under the conditions of drought and heat above noted.

We therefore wish to emphasize the two points, the early destruction of the stalks in the fall and the picking up and burning of the squares, as of primary importance in making a successful crop of cotton. The early destruction of stalks in the fall has a double advantage. It not only kills a vast number of the weevils, but it destroys all their supply of food so that such as are not killed by fire mostly perish for lack of food before winter.

The crop must be worked regularly and the period of cultivation extended until the early maturing bolls begin opening. It has been found by actual experience that a profitable crop may be made under the heaviest infestation of the boll weevil if the weather is fairly seasonable, that is, if there is not too much rain. It is utterly impossible for the farmer to make a profitable crop of cotton with the boll weevil present under the old system of farming. The system of farming has been materially changed in every section where the weevil has yet appeared. The people have been forced to abandon the all-cotton system and to adopt the method that will enable them to produce all of the home supplies. The first few years have

usually brought about a demoralization of conditions, which almost ruins business in the community. After the third year, the people begin to adapt themselves to the changed conditions and it is frequently the case that in four or five years after the weevil has entered a section the people are in really better financial condition in every respect than they were before the weevil came.

Other Cotton Insect Enemies. — Other insect enemies of the cotton plant are the red spider, the plant louse or aphis, and the cut worm. The damage from these is never very serious and is always confined to local territory.



COTTON BOLL WEEVIL

a. Beetle from above; *b.* same, from side (five times natural size). Note the two tooth-like projections on the inner side of first joint of the front legs.

Harvesting and Marketing Cotton

CHAPTER IX

HARVESTING AND MARKETING COTTON

UNDER harvesting comes cotton picking, ginning, and baling. Picking is the most expensive item in the production of the crop. No machine has yet been perfected that will satisfactorily do this work, and it must necessarily be performed by hand. The prices for picking cotton range from thirty-five cents to a dollar per hundred pounds of seed cotton, varying with the localities and the season in which the picking is done. Hence, the cost of picking a bale of 1500 pounds of seed cotton ranges from $5.25 to $15. Picking begins usually in the latter part of August and extends to the first of December, and in some instances to the first of January. At least three pickings should be made to gather crop in the best condition. The heaviest picking comes in October. One man can cultivate from twenty to thirty acres of cotton very readily, but it

will take four to five good pickers to gather the crop fast enough to keep it from being damaged by the weather. An experienced picker can pick from 150 to 200 pounds per day. The average, however, is much less than this. Under favorable conditions and with some special inducements, a few pickers have gone as high as four or five hundred pounds a day.

Cotton is seldom gathered under the most favorable conditions. It should be picked as soon as enough bolls open to justify going over the field. From three to five bolls per stalk make a fairly good picking. If the crop is kept up with closely and never allowed to take the weather, the standard of the grades is much higher and commands better prices. Frequently, faulty, yellow locks, or dirty cotton is picked and thrown in with the good. A few bolls of this damaged cotton will injure the grade of the entire bale and lessen the value from one half to one and one half cents per pound. Cotton should not be picked when too green as the lint continues to grow and mature until the seed have fully dried out. Cotton that is blown out on the ground and damaged by dirt, if picked should be put in separate

bags and ginned separately. This will insure not getting mixed cotton in the bales. The exercise of more care in this direction would result in an annual saving of many thousands of dollars to the farmers of the South. Until recent years the common practice was to pick almost the entire crop and store it in the house for several weeks and haul it to the gin after the rush of picking season was over. In many respects this custom was a good one from the fact that it allowed the cotton to ripen up and become thoroughly dry, thus improving the staple. It is true that there is some loss in the weight of the seed, but this is more than made up by the increased price from the improved quality of the cotton.

There have been many machines patented for the mechanical harvesting of the cotton crop, none of which have as yet been entirely satisfactory. It is possible that a machine may be perfected that will harvest the crop on fields favorably situated; but on small farms and rough lands it is doubtful whether it will be practicable to ever use mechanical contrivances for gathering the crop. A light machine, of moderate cost, adjustable to small

farm conditions, would go far toward solving the harvesting problem. With a successful mechanical picker the cotton acreage could be enormously increased and the whole system placed on a changed economic basis.

Ginning. — The second process in harvesting cotton is the ginning or separation of the lint from the seed. In the early days of cotton ginning in this country this was done by hand, a man separating from the seed about one pound of lint per day. The cotton gin was invented in 1792 and since then has been so perfected as to entirely revolutionize the cotton industry and make it one of the greatest in the world. The modern seventy-saw gin stand will gin from ten to fifteen bales a day. In big ginneries several stands are connected, all arranged for conveying the lint to the same press. The lint is carried by conveyors from the gin stand to the press, where it is packed into bales, varying in weight from 300 to 600 pounds. The average commercial bale is rated at 500 pounds.

These big plants take care of the crop for a considerable territory. The saw gin is used for the short and medium staple cottons.

When long staple cotton is ginned on the saw gin it should be run at a low speed, not over 300 to 400 revolutions a minute. It is a very common practice to run a gin too fast and to injure the staple of any kind of cotton. This is especially true in the busy season, when the ginning plants are more or less crowded. For ginning very long staples, such as Sea Island, what is known as a roller gin is used. This is done to prevent cutting the fiber, which may occur with the saw gin.

Before shipment to distant markets, the bale is compressed to one half its size. The round bale is compressed at the gin. The square bales are covered with what is known as bagging, which is made of jute in most cases and is usually a very poor covering. The bale is bound by six steel ties. The average American cotton bale presents a very ragged appearance. Some sections are using better coverings for their cotton bales, and especially is this true where the round bale press is used. The round bale is a much neater package, and is completely protected from damage by handling, dirt, or weather. The farmer should demand a better wrapping for

his cotton, requiring the ginner to completely cover the bale. The round bale is perhaps the most satisfactory way of putting up cotton. This method has never been popular for various reasons: mainly from the fact that there is so much money invested in the old style press and compress that it is difficult for the round bale companies to compete with the old concerns. Thousands of dollars can be saved for the cotton states by a better method of packing, wrapping, and handling the crop.

Much loss is sustained by allowing the bales to be exposed to the weather after ginning. The cotton bale, when exposed to the weather, absorbs moisture, and the outer edges of the bales will become discolored and the grade injured The poor covering now used on the American cotton bale is usually torn off by rough handling before reaching the mills. This allows the outside of the bale to become dirty, thus lowering the grade of the outer portion of the bale.

Marketing. — The common practice on the small farm is to haul the cotton bales directly to the warehouse or small town market and sell to the local merchant. This system, perhaps,

has some advantages, but there is much room for improvement. There should be some uniform system of grading and storing cotton in warehouses until a sufficient amount is collected to justify the large buyer to classify and bid on the entire lot. The average farmer and local merchant know but little about grading cotton, consequently, nearly all the cotton in smaller markets is sold at about the same price, regardless of staple or grade.

The following table shows the official classification of cotton grades established by the Bureau of Plant Industry, U. S. Department of Agriculture, with the approximate difference in value per pound between grades:

Middling fair	1c above middling
Strict good middling	$\frac{3}{4}$c " "
Good middling	$\frac{9}{16}$c " "
Strict middling	$\frac{1}{4}$c " "
Middling	Basis
Strict low middling	$\frac{1}{4}$c below middling
Low middling	$\frac{1}{2}$ to $\frac{5}{8}$c " "
Strict good ordinary	$\frac{7}{8}$ to 1c " "
Good ordinary	$1\frac{3}{16}$ to $1\frac{5}{16}$c " "

Mr. D. E. Earle, expert in cotton grading, U. S. Department of Agriculture, in an address

before the South Carolina Farmers' Institute, spoke as follows about the work of cotton standardization of the department:

"The official cotton grades have met with the approval of most of the Southern cotton exchanges and have been formally adopted at the following places:

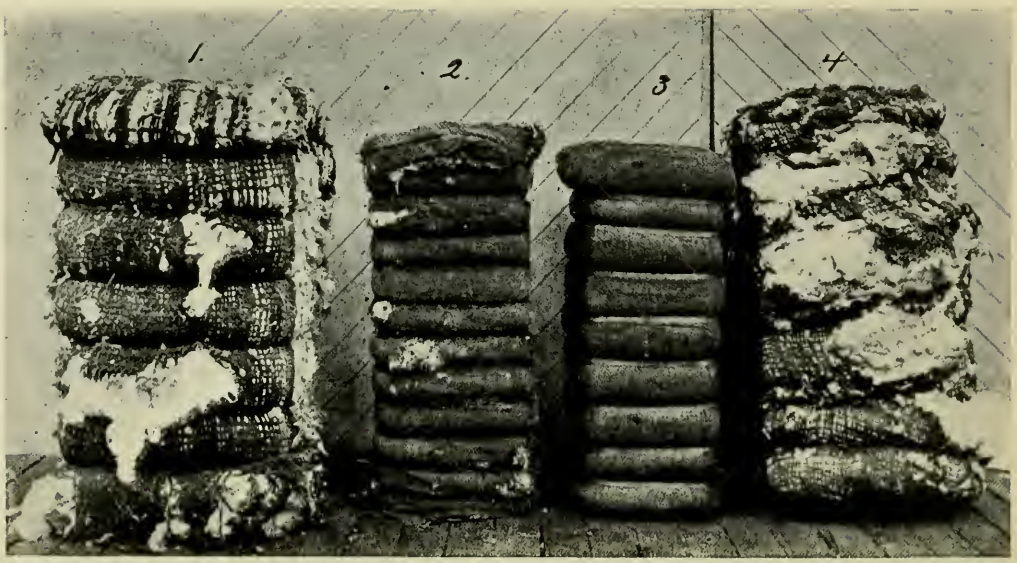
"New Orleans, Memphis, St. Louis, Little Rock, Natchez, Mobile, Macon, Galveston, and Charleston.

"The New England, the Texas, and also the Southern Cotton Buyers' Association have agreed to make the official grades the basis of their operations.

"For any grower who desires the grades and feels that he cannot afford a complete set, the Department has arranged to fill orders for any three grades. Low middling, middling, and good middling, for instance, usually cover the bulk of the crop and for white cotton these three boxes would indicate the grade fairly close.

"The price of the nine official cotton grades has been reduced from $30 to $25, and the price of the fractional sets have been reduced to $9 that is, $3 per box or grade."

1. A farmer comparing his cotton with the Government standard grades in a Farmers' Union warehouse
2. Round bales showing (in centre) method of opening.
3. Gin-compressed bales on a Mississippi plantation ready for shipment to Germany



1, Gin-box; 2, Egyptian; 3, gin-compressed; 4, recompressed cotton bales

If some working system of warehouses could be organized and maintained on a business basis, it would perhaps be the most economical way of handling the cotton crop. Managers of these houses could collect and classify cotton and sell direct to the large buyer. This would enable the manufacturer to pay more on an average for cotton, since he is thus assured of getting large quantities of a product uniform in grade.

The custom of holding cotton for a better price, in the meantime leaving it out of doors and unprotected, is not profitable. The actual damage to the cotton is often greater than any increase in price that may be obtained.

The old custom of marketing the cotton crop through the commission merchants has almost been discontinued. This method always placed the farmer at the mercy of the buyer, and by the time commission, storage, insurance, and other fixed charges were deducted, less was realized for the cotton than if it had been sold in the local market.

In some places the farmers market their cotton by selling in the seed to the public ginner,

instead of having the crop ginned at so much cash per bale. The usual cash price for ginning and covering in recent years has ranged from $2.50 to $3.50 per bale. Selling seed cotton is a bad practice from the farmer's standpoint. It puts the farmer at a disadvantage since the price is based on a certain grade, and no allowance is made for advance in prices or for premiums on better grades.

A mutual agreement on some improved method of marketing the cotton crop would be beneficial alike to producer and spinner. Such a system would tend to prevent violent fluctuation in prices. This reform can only be brought about by a closer understanding between grower and spinner. The multiplicity of middlemen has become an immense burden, not only in the cotton business but in the handling of all farm crops.

In the past the entire crop has been thrown upon the market in three or four months, when it should have been distributed throughout the year. The high price of cotton in recent years has bettered the financial condition of the Southern cotton grower to such an extent that in the future the crop can be held and

marketed through the year. This should result in a more equitable adjustment of values between all parties concerned, and at the same time eliminate the drain in the form of fixed charges that exist under the present system.

Cost of Cotton Production

CHAPTER X

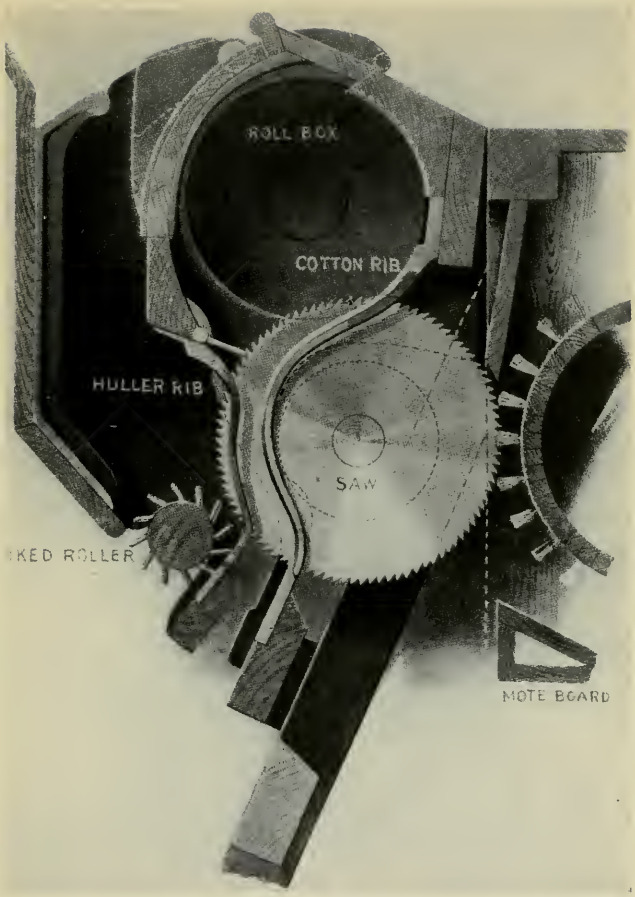
COST OF COTTON PRODUCTION

ONE of the hardest problems for the cotton farmer to solve with any degree of accuracy is cost of production. There are so many factors to be dealt with which are beyond man's control that no real basis for estimating the cost of the year's operations can be made. In nearly every other business there are some known quantities upon which to base calculations. To the farmer nothing is absolutely sure, especially is this true with the cotton farmer. Climatic conditions perhaps mean more to him than to any one. The returns for his year's labor must of necessity depend upon the caprice of the rain, the wind, the frost or the depredation of numerous insect pests. Any one or all of these may in a very short period turn a flattering prospect for a bountiful crop into almost a complete failure.

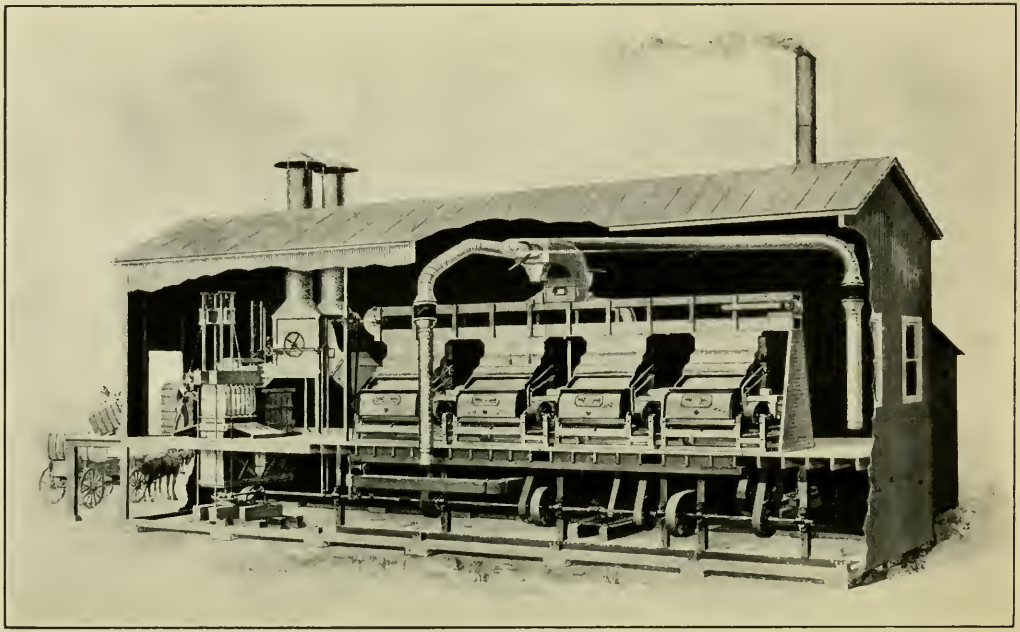
We may take the statistics showing total

production of the cotton or the yield per acre for a series of years and the variations or fluctuations will be quite noticeable. These rather wide differences are due largely to causes over which the farmer has no control. The same general plan of crop management on the same land with the same amount of fertilizer, teams, and labor may have been used each year and still the yields vary a great deal. The total crop production on the same acreage with practically the same expenses frequently varies as much as 25 per cent. in two successive seasons. These extreme fluctuations make a wide margin between the cost of production and the selling price necessary for the farmer to come out with an average profit in the crop. The elements of uncertainty which enter into the production of every crop, make it impossible to estimate the cost.

The business man or the manufacturer can figure with some degree of certainty as to what his running expenses will be. He can also make a pretty close estimate of what the output of his factory or business will reach during the year. It often happens that the manufacturer knows just what he is to receive for his



Transverse section of a cotton gin



Section from a ginnery showing box press and gin stands

products before they are made. At all events there is not the degree of uncertainty about it that the farmer has to meet.

We have mentioned some of the natural causes or climatic conditions which may cause wide variations in yields and profits, but the farmer himself must be taken into account as one of the greatest factors. One man can manage his cotton farm so as to make handsome profit, while another under the same natural surroundings, but with a less degree of business ability, agricultural knowledge, or industry, would produce the crop at a net loss.

To get out of cotton farming under the new order of things more than a mere existence a man must use brains and incessant industry along with his physical labor. The days of profitable farming along the old trodden paths are numbered. By this we do not mean that there is no place for cotton on the small farm, for, if properly managed, there is a possibility of greater profits than on the larger farms. The ordinary methods followed on both the one-horse and the larger farms must give way to more up-to-date management. Under a different system two horses can be used profit-

ably where one has been deemed sufficient before. The plan of crops can be changed so as to furnish labor for team and help for a longer period than where cotton alone is grown. At the same time the better teams and implements will easily double the yield which would give as much cotton as before, and allow half the land for other purposes.

To break the land properly, to do the hauling and cultivation at least expense, two horses or mules are necessary on any farm. The all-cotton system of farming was never really successful under any conditions. Statistics from any section of the cotton territory, whether taken for the present or fifty years ago, will show that the only farmer who had money to lend and supplies to furnish the entire farm was the man who did not grow all cotton. The actual time devoted to making and gathering the crop on an all-cotton farm is not more than six months. This leaves hands and teams practically idle for the other six months. The expenses for subsistence for both labor and teams for this idle period must be about the same that it is for the other six months, but unless there is some profitable labor furnished

them during this time, this additional expense must necessarily be taken from the proceeds of the cotton crop. Such management as this accounts for the higher cost of cotton production. Under a better planned system just as much cotton can be grown and, besides, all the foodstuff necessary for the labor and the teams.

Cotton farmers often claim that it is more economical to grow cotton exclusively and buy all the supplies for the farm. Practical experience and close observations and inquiry into the subject do not confirm the correctness of their claims. Even at the rather phenomenally high price of cotton for the past few years, the man who actually grew it made little clear profit unless he also grew his supplies. The landlord who furnished the land at high rentals and supplied his tenants at enormous credit prices, no doubt gets big profit from the all-cotton method, especially in the good years. The small farmer and tenant has not nor will he ever be able to get much more than a poor living out of cotton farming, when he buys everything else used on the farm from the proceeds of the crop. It is difficult for a man who has been accustomed to figure expenses,

incomes, and profits in an ordinary business to realize why the same methods of accounting cannot be applied to farm operations. The elements of risk and uncertainty met on the farm due to natural causes over which man has little control, but which so greatly effects expenses and yields, are lost sight of in making calculations. Here is where so many who know nothing of the practical side of farming are led into trouble. Certain fixed expenses and the climatic changes are left out of the calculations.

The following is given as an example which serves to illustrate the differences in good and poor farming. The first column represents results from good farming on fair land with good teams and tools, allowing a yield of 1,500 pounds seed cotton per acre. The second column is the results from ordinary farming on average cotton lands with insufficient teams and tools. Yield per acre 600 pounds of seed cotton:

	Good	Poor
Chopping stalks	$ .50	$ .50
Breaking land	1.00	1.50
Harrowing	.50	.50
Opening furrows and distributing fertilizer	.50	1.00
Bedding and harrowing for planting	.75	1.50

	Good	Poor
Planting	.25	.75
Chopping and hoeing	1.00	1.50
Cultivation	5.00	4.50
Fertilizer	4.00	3.00
Seed (for planting)	.50	.25
Picking	9.00	3.60
Ginning and baling	3.00	1.20
Hauling to gin and to market	$ 1.50	$ .60
Rent of land	5.00	3.00
	$32.50	$23.40
Less value of seed @ $18 per ton.	9.00	3.60
	$23.50	$19.80
Sale of lint @ 10 cents	$50.00	$20.00
Net profit	26.50	.20
Cost per pound	.047	.099

These figures do not allow anything for wear and tear on teams and implements nor is there anything accounted for supervision. There are several other legitimate expenses which must be made which would add to the total cost. Unless the labor and teams are profitably employed during the period when they are not needed for the cotton crop the cost of subsistence must be added as an additional item. Some of the items might be reduced by exceptional management. For instance, the fertil-

izers can be reduced by a saving of farm manures and rotation of crops. The cost of food and farm supplies could possibly be reduced, if grown intelligently on the farm. A fair profit may be expected under average conditions where the crop is produced upon a cash basis and where a reasonable degree of knowledge is used in producing it.

Equipment in Teams and Tools for Cotton Farms

CHAPTER XI

EQUIPMENT IN TEAMS AND TOOLS FOR COTTON FARMS

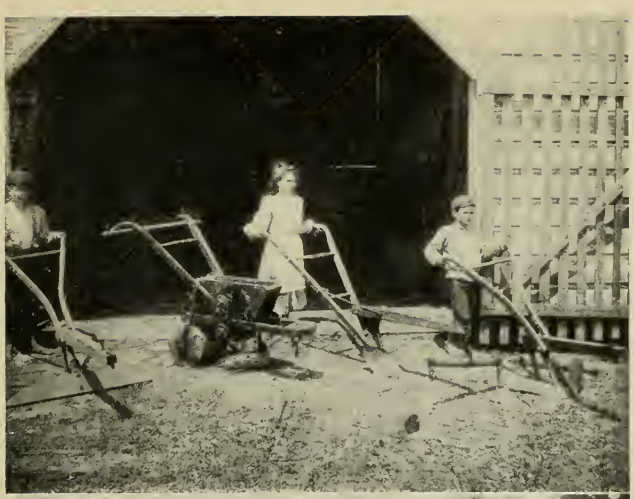
LABOR-SAVING machinery plays an important part in the economy of production of any crop. As liberal an assortment of labor-saving tools is required in cotton farming as in any other type of farming. The principal difference in the equipment for a large or a small cotton farm, under the old one crop system, was mainly in the number of tools rather than in the kind. The cotton farmer has been slow in bringing to his aid labor-saving implements in the production of crops. This has been partly due to the fact that such a large per cent. of farm labor in the cotton belt was uneducated and unskilled in the use of machinery, and partly due to the fact that one man, under the one crop system of cotton farming, could, with one horse and with small one-horse plows or cultivators, produce as

much cotton as three or four laborers could harvest.

On a 160-acre cotton farm, where one third of the area is devoted to corn and two thirds to cotton, the ordinary equipment in the past has consisted mainly of the one-horse, seven-inch moldboard plow; the small Georgia plow stock with sweep and shovel attachments; a one-horse cotton planter; the 14-tooth V-shaped harrow, and the hoe. The entire equipment for a 160-acre farm, under the old system, has been about as follows:

8 mules	@	$150.00 =	$1,200
8 7-inch moldboard plows	@	7.00 =	56
8 1-horse plow stocks, with sweep and shovel attachments	@	4.00 =	32
8 V-shaped spiketooth harrows	@	4.00 =	32
4 1-horse cotton planters	@	5.00 =	20
24 hoes	@	.50 =	12
1 farm wagon	@		60
1 set of double wagon harness			30
8 sets single plow harness	@	5.00 =	40
1 set of repair tools			10
Total			$1,492

The cotton farmer is beginning to diversify his crops and is rapidly discarding light mules and one-horse implements for heavier teams



Ordinary equipment of implements on a one-horse cotton farm

Ordinary equipment of implements on a two-horse cotton farm

Up-to-date equipment for a cotton farm

and improved farm machinery. The two, three, and four horse breaking plows, the sulky cultivator, disk harrow, section harrow, the weeder and the mower are fast coming into use on the cotton farms.

The mule has been the principal work animal on the cotton farm in the past. In recent years many progressive farmers have substituted heavy draft mares in the place of mules and have found them just as satisfactory as the mule except for the very rough work. These mares will do any ordinary farm work and will raise a valuable colt each year.

The necessary equipment in teams and tools for a 160-acre cotton farm, where one fourth of the area is devoted to pasture, one fourth to cotton, one fourth to corn and one fourth to small grain and hay, is as follows:

2 mules	@$200 =	$ 400
4 mares	@ 200 =	800
1 farm wagon		60
1 mower and rake		60
2 combination planters	@ 15 =	30
3 12-inch moldboard plows	@ 12 =	36
1 24-inch disk breaking plow		35
1 20-inch 8 disk, disk harrow		25
2 riding sulky cultivators	@ 35 =	70

1 section harrow			$ 25
4 springtooth cultivators	@	5 =	20
2 one-horse, 5-shovel, cultivators	@	12 =	24
1 set of repair tools			25
Extra small tools			25
1 reaper and binder			150
3 sets double harness	@	30 =	90
1 manure spreader			125
Total			$2,000

Dr. S. A. Knapp, of the U. S. Department of Agriculture, estimated that there is a possible increase of 300 per cent. in the productive power of the farm laborer in the average Southern state by the use of more and better teams and farm machinery.

Cotton By-Products

CHAPTER XII

COTTON BY-PRODUCTS

SCARCELY more than a quarter of a century ago cotton seed, the chief by-product of the cotton crop, was considered worthless except for planting purposes. A common practice among the ginners and large planters was to dump the seed into waste places, into the streams or anywhere to get them out of the way. Contamination of the water supply in the streams and the odor given off by the decomposition of the seed became a nuisance, and in some places steps were taken by the health authorities to prescribe the manner of disposing of them. The planters as well as the country in general little realized the immense value of the seed as a fertilizer and stock feed.

History of the Oil Mill. — The first manufacture of cotton seed products on a commercial scale did not begin in the United States but in England where no cotton is grown. In

1870 that country had an annual crush of about 200,000 tons and was leading the world in the manufacture of cotton seed products. All of this supply had to be shipped across the ocean and there was much loss from the seed heating and decomposing in transit; so it was not long before it was found necessary to move the manufacturing industry nearer to the field of production.

The increased uses made of the seed products and the difficulty of getting the seed to the foreign mills in good shape led to the establishment of a great milling industry in the United States. The annual consumption by American oil mills is now more than 4,000,000 tons. The first cotton seed oil mills were built in the United States in 1840. As late as 1860 there were only seven. In 1910 this number had been increased to 841. The number of laborers employed in oil mills increased from 12,600 in 1899 to more than 22,000 in 1910. The total value of the seed delivered at the mills in 1910 was about $142,710,000, an increase of more than $100,000,000 over 1899. In 1910 the average cost per ton of seed was $27.40, more than $2\frac{1}{3}$ times that of 1899. The total

value of the products manufactured from the seed in 1910 amounted to $152,710,000 as compared with $46,100,000 in 1899. This large rise in value was brought about by the increased consumption of mill products, and is shared by every state which grows cotton. The value of the products manufactured from a ton of seed in 1899 was $17.75 and that of 1910 was $32.50. The total value of oil mill products in 1910 was as follows: oil, $80,430,000; meal and cake, $44,660,000; hull, $11,370,000; and linters, $6,250,000.

There has been considerable fluctuation in the price of seed from the beginning. This is due largely to the fluctuations in the price of the articles with which the products come in competition. For instance, the price of oil is effected quickly by fluctuations in the prices of such articles as hog lard, soap, and olive oil; the price of meal, cake, and hulls is governed largely by the fluctuations in the price of fertilizer and foodstuff materials with which they come in competition. The price of linters, another by-product of the seed, is governed by the same conditions.

Products of a Ton of Seed. — There are al-

together over fifty useful products made from cotton seed. The following gives the average quantity of the chief products from a ton of seed, with a list of articles made from each:

1. Linters	30 pounds	Batting, stuffing, hats, ropes, twines, carpets, cellulose, paper, and explosives
2. Hulls	840 pounds	Feed, fertilizer, paper, and stuffing
3. Cake or meal	730 pounds	Feed, fertilizer
4. Oil (crude)	280 pounds	Soap stock, lard, cottolene, butter, salad oil, olive oil, miners' oil, lubricating oil and paints

Uses of Cotton Seed Oil. — There was for a long time considerable prejudice against the use of cotton seed oils in food products. This has now been largely overcome, and we find them used extensively in the manufacture of compound lard and cottolene; compound butter and cooking oils; in the manufacture of compound olive oil; and, in fact, nearly all compound oils now used in this country are composed largely of cotton seed oil. The cheaper grades are used largely in making soap, washing powder, glycerine, candles, and other necessaries which

require a low grade of oil. Some of the oil is also used for medicinal purposes, illuminating, lubricating, packing fish, and to some extent for the manufacture of oils for paint.

Uses of Meal and Cake. — The chief use of cake and meal are for fertilizers and stock feed. The following table shows the value of high-grade seed meal as a fertilizer:

FERTILIZING VALUE OF A TON OF SEED

128 lbs. nitrogen @ 20 cents	$25.60
54 lbs. phosphoric acid @ 5 cents	2.70
36 lbs. potash @ 5 cents	1.80
Total value	$30.10

In 1910 South Carolina used 140,000 tons of cotton seed meal for fertilizer; Georgia 91,000 tons, North Carolina 70,000 tons and Mississippi 56,000; and other states in smaller quantities. The feed value of cotton seed meal and cake for fattening stock and furnishing a concentrated ration to dairy cows is more than for fertilizer.

The United States Secretary of Agriculture, Hon. James Wilson, was asked a few years ago if he thought that the Southern farm lands could be made to produce as much as the rich,

high-priced lands of the Central West. He said: "Why, of course. What is the hindrance? But the Southern farmer must quit sending his cotton seed meal over the world to enrich other lands. He must use the rich fertilizer himself." It is deplorable that the Southern farmer has allowed the larger part of this valuable fertilizing and feed product to be shipped from its native territory to other sections of the United States and to Europe. The full feed value may be derived from cotton seed products and at the same time, if the manures from the stock are returned to the soil, from 70 to 90 per cent. of the fertilizing value may be retained on the farm. The combined feed and fertilizing value of a ton of high-grade cotton seed meal when fed to animals and the manure carefully saved and returned to the land is about $50; when used alone as feed or a fertilizer its value is about $30. The farmer sustains a tremendous loss when he fails to get both the feed and fertilizing value from cotton seed meal. When the Southern farmer appreciates the importance of feeding the meal and returning the manure to the land, the South will become one of the greatest stock-raising countries in the world.

Southern farmers should keep enough stock to consume all the cotton seed meal on the farm, but it will be years before they can accumulate enough stock to do this. At present some meal is fed to dairy cows and animals in the nearby towns, but comparatively little of it goes back to the farm except what is used directly in the form of fertilizer. Cotton seed meal is one of the most satisfactory forms of nitrogen that can be used in making mixed fertilizers for the common farm crops. It is not only rich in nitrogen but contains considerable quantities of phosphoric acid and potash. The fertilizing elements in cotton seed meal are slowly available, a quality which makes it desirable for such crops as have a long growing period. Unless the cotton farmer has enough stock to consume his meal, it will pay better to use it as a fertilizer than to send it away to enrich other sections.

Hulls. — Hulls are used for feed, paper, fertilizers and packing, but of recent years almost the entire supply has been utilized as a stock feed at prices ranging from $3 to $10 per ton. In addition to the outside covering of the cotton seed, the hulls contain small

portions of kernels or hearts which add to their feeding value. Their feeding value is about that of cheap grass hay or half that of good grass hay.

Linters. — The linters or the short fiber that is taken from the seed in the first process of manufacture is used in making low grades of rope, twine, wrappings, and various other articles requiring a cheap grade of cotton.

Other than a few minor improvements there has been no changes in oil mill machinery for the past twenty-five years. The linters are removed more closely, and several gallons more oil per ton are obtained than formerly.

Soil Improvement on Cotton Farms

CHAPTER XIII

SOIL IMPROVEMENT ON COTTON FARMS

CAUSES of Depleted Soils on Cotton Farms.—Good farm lands are now, and have always been, the greatest asset of any state or nation. The rapidly increasing population and the higher standard of civilization now spreading over all countries will make this problem of good lands a more important one in the future.

Any system of farming that reduces the fertility of the soil or decreases its crop-producing capacity is not only unnecessary but results in ultimate failure. Extensive investigation and experiments under varied conditions have fully demonstrated that lands farmed properly can be improved and their producing capacity greatly increased. There is no valid excuse for wornout farm lands, and where they are found it is the fault of the man or his system and not of the land.

The problem of soil fertility and how to maintain it has been a very vital one to all nations. The earliest agricultural literature mentions the use of manures and other refuse to make the soil more productive. In all the old countries the question of keeping up the soil fertility has been successfully met. This is evidenced by their being able to feed from the same lands the constantly increasing population. There are lands in some of the European countries that are producing, after more than one thousand years of cultivation, larger crops than ever before. The density of the population and the lack of room for expansion make it necessary to conserve all the resources, and especially that of the soil.

In America there has been a very different situation. With a sparse rural population and a seemingly unlimited expanse of fertile virgin soil, the question of caring for or conserving the soil was lost sight of for a long time. It was not until recently that the constantly decreasing yield per acre of our soils was seriously considered. While the abuse of farm lands, idle fields, and tenantless homes are noticeable all over the country, these are

even more marked in the cotton states. In no country or in any age has there been such a system of soil robbing as that practised on the Southern farm. The washed and barren hillsides are the first things to attract the attention of all travellers both foreign and native. Natural causes are, of course, partly responsible for these conditions. The mild, open winters, accompanied by frequent heavy rainfalls, with the naturally sandy loose soil, make washing easy. The principal causes are, however, shallow breaking and the system of clean culture practised in cotton farming. With little humus in the soil to absorb the water and hold the particles together, erosion is the natural result. Farther north, where the soil is stiffer and the rainfall lighter, and with a more diversified system of cropping, soils do not wash so badly. Here also the surface soils are frozen for several months which makes washing impossible for a large part of the year.

In the early days of commercial cotton growing, when fertile lands were abundant and cheap and with slave labor to produce the crop it was considered more profitable to clear new fields when the old ones became

exhausted than to preserve the fertility of the soil. The logical result of such a system was the wearing out of the most desirable lands.

Any system of cropping which does not return to the land the larger part of all that is grown on it, either in the shape of manure from live stock or by turning under the green crops, will soon result in unproductive soils. In some places, cotton has been grown on the same land for generations. This soil was evidently very fertile in the beginning or it would be so exhausted by now that it would not produce profitable crops.

Dr. B. T. Galloway, Chief of the Bureau of Plant Industry, once said, after visiting the Cotton States, that "When the Southern farmer learned to diversify and feed his soil by returning to it what it produced, a system of land robbing would give way to a system of land building."

If only the lint were sold from the cotton farm, less fertility would be removed by it than any other crop known. By returning the seeds or their equivalent in manure or fertilizer, with all the other parts of the plant, there should be little soil deterioration from cotton farming.

Five hundred pounds of lint cotton removes less than two pounds of nitrogen, about one half pound of phosphoric acid, and two and one half pounds of potash. The seed from a bale of cotton, approximately half a ton, contains thirty-one pounds of nitrogen, thirteen pounds of phosphoric acid, and twelve pounds of potash. At prevailing prices the seed from each bale of cotton grown removes more than $7 worth of plant food from the soil. When the farmer sells his seed without returning their equivalent in some other form of fertilizer he robs his land. It has been claimed by many of the best farmers, and with good reason, that the rapid deterioration of soils in the cotton States began with the construction of the oil mill. Before the day of the oil mill cotton seed were either fed to stock or used as fertilizer. Since the introduction of the oil mill nearly all the seed are sold. The prices received are frequently below the actual fertilizing value, and the money received is seldom spent for plant food to be returned to the soil.

Before the oil mills came, the cotton seed were used as fertilizer for corn and it was a rare thing to know of a good farmer who bought

corn to run his farm. The high prices paid for seed in recent years have, to a large extent, robbed the farms of this important fertilizer, and much of the money received for the cotton crop has gone to buy corn and other foodstuff.

Analyses show that a ton of meal contains about as much plant food as two tons of raw seed; but the feeding value of a ton of cotton seed is equal to 1,400 pounds of meal. These facts should be considered when selling seed or exchanging them for meal.

Methods of Restoring Soil Fertility. — Under the system of all cotton farming the lands have greatly deteriorated. The following methods are suggested for restoring and maintaining soil fertility on cotton farms:

1. Terrace hill lands to prevent washing, and drain swamp lands.
2. Grow leguminous crops and winter cover crops to fill the soil with humus and check erosion.
3. Adopt a systematic rotation of crops.
4. Keep live stock to consume all grain and forage crops and return the manure to the land.

Drainage. — The first problem in soil building on cotton farms is to check erosion on the hill land and drain the swamp land. On hill lands broad bed terraces are recommended. On bottom and wet lands, tile drainage, or some other effective method of ridding the soil of surplus water should be adopted. Before any ditching, terracing or tiling is done, all gullies and rough places should be filled up and the land put in fair condition. This will make the work much easier and more effective.

Before permanent terraces are built, grow one or two heavy crops of peas, or some other green crop which can be plowed under to add humus to the soil. This will help to take care of part of the surplus water.

Broad embankment terraces of a width of fifteen feet, with a gradual fall of from four to six inches per one hundred feet, will carry the surplus water away gradually, allowing much of it to be taken up by the soil. These wide terraces will permit the growing of crops on all the land. When cultivated crops are planted, lay

off the rows parallel with the terrace, running the first rows on top of the terrace and allowing short rows to come in the centre or on one side. The terrace bank should be made high enough in the beginning to avoid any possibility of overflowing or breaking while it is new and unsettled. The distance between the terraces can be determined by the lay of the land. Shorter distances will be necessary on steep lands and much wider space can be left on moderately rolling lands. The general rule is to allow a three-foot perpendicular fall between terraces. Before starting terraces see that there is a good outlet for the water.

The laying out of terraces is a very simple matter, and can be done by almost any farmer with a little preliminary instruction. The implements used need not be expensive. A farm level can be bought for $12 or $15, or one that will answer the purpose can be made for $2 by buying a carpenter's level and attaching it to a frame made of light wood. More physical labor will be required to operate the home-made level, but good work can be done with it.

On bottom lands and some rolling hill lands, tile drainage is the best method for taking care of the water. This eliminates all ditch banks and other obstructions.

Green Manure Crops. — The next important step in soil building is to get more humus or vegetable matter incorporated in the soil. Undoubtedly the quickest and most effective way of doing this is by means of growing leguminous crops. If quick results are desired, the whole of the crop should be turned under. This, perhaps, would be advisable for the first year, under any circumstances. The best crops for this purpose are cowpeas, soy beans, velvet beans, and, on land where they will grow, some of the clovers. The cowpeas will grow on almost any land in the Cotton Belt. The velvet bean can be grown anywhere in the Gulf States. The soy bean will be more beneficial perhaps in some places on account of the diseases that affect the pea. Lespedeza, bur clover, and crimson clover can be grown on nearly all soils in the South. An application of lime will be helpful to the clovers on nearly all soils.

By growing legume crops in the summer, turning them under in the fall, and following with a crop of oats, rye, crimson or bur clover as a winter cover crop, the land will be fully protected throughout the year, and if all these crops are turned under the original fertility will be rapidly restored. After one or two years of this treatment the land may be turned over to the regular crops of cotton and corn. Of course, this is not specially applicable to soils that are already in fairly good condition.

Crop Rotations. — Rotation of crops is the safest and surest way of maintaining soil fertility. On every farm a systematic crop rotation should be adopted. This rotation will have to be planned to suit the conditions and the location of the farm. What would be good for one farm might not be the best for another, even in the same neighborhood. A few suggestive rotations are given, so that the farmer may have an idea of what is meant by systematic crop rotation.

Following are suggested outlines of two,

three, and four year rotations for cotton farms. The legume crops to be used with these rotations will vary in different sections and on different soils:

TWO-YEAR ROTATION

FIELD NO. 1	FIELD NO. 2
(*1st year*) Corn and cowpeas. Bur clover as winter cover crop	(*1st year*) Cotton. Bur clover as winter cover crop
(*2d year*) Cotton. Bur clover as winter cover crop	(*2d year*) Corn and cowpeas. Bur clover as winter cover crop

Bur clover can be seeded on the cotton land from August 15th to October 15th, depending on the latitude. Seed should be sown in the bur. The clover will mature seed in the spring in time to prepare the land for corn. It will not be necessary to reseed this land the following fall. The land for cotton will have to be broken in the spring before the bur clover seeds, but there will usually be enough seed remaining in the soil from the past year to get a good stand of clover after the cotton.

Crimson clover is the best of all cover crops where the soil has been inoculated. If crimson has not been grown on the farm before, only a small area should be planted at first, and it should be inoculated by securing soil from a

THREE-YEAR ROTATION

FIELD NO. 1	FIELD NO. 2	FIELD NO. 3
(*1st year*) Cotton. Rye or crimson clover as winter cover crop	(*1st year*) Corn and peas	(*1st year*) Oats and peas
(*2d year*) Corn and peas	(*2d year*) Oats and peas	(*2d year*) Cotton. Rye or crimson clover as winter cover crop
(*3d year*) Oats and peas	(*3d year*) Cotton. Rye or crimson clover as winter cover crop	(*3d year*) Corn and peas

crimson clover field and scattering it over the land, at the rate of from 300 to 500 pounds per acre at the time of seeding. If soil cannot be secured from a crimson clover field, fairly satisfactory inoculation may be obtained from the nitro-culture bacteria which are prepared by the U. S. Dept. of Agriculture, and also by some of the leading seed houses. Unless the soil has been inoculated, it will be best to plant the cotton lands to rye for a winter cover crop.

Lespedeza will make an excellent hay crop on good land in nearly all parts of the South.

FOUR-YEAR ROTATION

FIELD NO. 1	FIELD NO. 2	FIELD NO. 3	FIELD NO. 4
(*1st year*) Cotton. Rye or crimson clover as winter cover crop	(*1st year*) Corn and peas	(*1st year*) Oats and lespedeza	(*1st year*) Lespedeza
(*2d year*) Corn and peas	(*2d year*) Oats and lespedeza	(*2d year*) Lespedeza	(*2d year*) Cotton. Rye or crimson clover as winter cover crop
(*3d year*) Oats and lespedeza	(*3d year*) Lespedeza	(*3d year*) Cotton. Rye or crimson clover as winter cover crop	(*3d year*) Corn and peas
(*4th year*) Lespedeza	(*4th year*) Cotton. Rye or crimson clover as cover crop	(*4th year*) Corn and peas	(*4th year*) Oats and lespedeza

Lespedeza does not make sufficient growth on poor land to justify planting it as a hay crop. It should be sown the last of February or the first of March on the oat land. Run over the land after sowing seed with a dragtooth harrow, the teeth slanted backward at an angle of 45 degrees. One cutting of hay can be se-

cured and the lespedeza will reseed itself, and one cutting can be secured the following year. Lespedeza is a most excellent plant for improving the soil. In sections where it cannot be grown other crops can be substituted in the rotation.

The above outlines of crop rotations are offered only as suggestions. Each farmer can, with a little study, plan a system best suited to his conditions.

Farm Manures. — The last but by no means the least important factor to be considered in building up the land and maintaining fertility is that of farm manures. The practical and experimental results in the best farming countries have proven that soil fertility cannot be most economically maintained without the use of live stock. The keeping of sufficient live stock will allow the farmer to get two values for the heavier rough food products grown. He may first get the full feed value through the animal, and second the manure which can be returned to the land. The neglect in preserving and increasing the supply of farm manures has been a great drain on the American farm, especially in cotton-growing

sections. The chief difference between barnyard manure and other vegetable matter is that in the process of passing through the animal the fertilizing elements are made more available for absorption in plant growth.

From 75 to 90 per cent. of the fertilizing value of the crop is left after it passes through the animal. Through neglect in caring for manures about the farm much of their fertility is lost. The Cornell University Experiment Station found that as much as 50 per cent. of the plant food constituents in manure was lost by leaching and unnecessary fermentation. The best plan for utilizing manures, where it can be done, is to haul and spread on the land regularly as it accumulates. Where there is no land available, and it is not practicable to do this at all seasons, some suitable shed or house should be provided that will thoroughly protect it from rain or exposure. One of the best plans for accumulating manures in stables or barns is to let it remain and be trampled by the stock. Always supply plenty of bedding to absorb all the liquids. This treatment will not only take up the moisture but the continued trampling of the animal will exclude all air,

so that the accumulation may go on without injury to its quality until a convenient time to remove and spread it on the land.

One can readily see that a large quantity of valuable fertilizer could be accumulated during the year with a limited number of animals when taken into consideration that each grown horse produces about 12,000 pounds and each cow about 20,000 pounds per year. When the straw and other litter is added to this the amount is largely increased. The actual plant food contained in one ton of barnyard manure is worth at least $2.50, and it is safe to say that the farmer will derive nearly $4 worth of good from it. It not only furnishes $2.50 worth of plant food but greatly improves the mechanical condition of the soil and multiplies beneficial bacteria.

Some farmers prefer composting their manures, but this, except in rare instances, is an additional expense without adding very much to the actual value of the manure. For special farming the compost heap has been found beneficial and may be made somewhat as follows:

Locate the compost heap in an old shed; or build a shed, with any kind of cheap material

1. Crimson clover in central Alabama, sown October first, in cotton middles after first picking of cotton. Clover in full bloom April fifteenth

2. Corn and velvet beans. The velvet bean is a great forage and soil improving crop on the cotton farms of the Gulf Coast country

A yield of two and one half bales per acre by the use of good seed and modern methods of culture

for a roof. Spread on the ground a layer of stable manure 8 by 10 feet, six inches deep. Over this spread one hundred pounds of acid phosphate or ground phosphate rock. The ground phosphate rock answers about as well as the acid phosphate and costs about half as much. Continue these layers until all the manure is used up or until the pile has become conveniently high. To these layers might be added straw, leaves, mold, or other litter, adding one hundred pounds of ground phosphate rock to each ton of material used. Be sure to wet all thoroughly. When the heap is completed cover it about four inches deep with good loam, or with forest mold, to prevent evaporation of the ammonia and other elements. This should remain in the heap for several weeks, thoroughly mixing when cutting down, and before hauling to the field for application.

The judicious use of commercial fertilizers in combination with barnyard manure and green crops will aid in soil building, and will be found profitable in the increased production of crops.

With the best methods of conserving the

soil, and the best methods of tillage, the yield of all crops on the average cotton farm could be more than doubled. The average small yield of the cotton farm compared with what it might be is a heavy tax to pay for ignorance and careless management. How long shall we continue such methods? This is a question that must be answered, not only for our own good, but for posterity.

Outlook for the Cotton Industry

CHAPTER XIV

OUTLOOK FOR THE COTTON INDUSTRY

SOME apprehension has been expressed concerning the future of the cotton industry in the United States. The high prices of recent years and the demoralizing and destructive effects on the crop in some sections by the boll weevil, have created uneasiness in the minds of the spinners. It is only natural that the spinner should desire a sufficient supply of cotton at moderate prices. Several European countries have spent large sums of money in efforts to grow cotton in their colonial possessions that they might become independent of the American crop. They employed high salaried experts and expended millions of dollars; but so far have been unable to produce cotton of the desired standard and in competition with the American crop.

The Southern States have had a monopoly of cotton production, and it is probable that

they will continue to enjoy this distinction. The Mexican cotton boll weevil threatened the industry but, after two decades of experience with this most destructive of all cotton pests, it has been demonstrated that cotton can still be grown profitably in the presence of the weevil. In fact, the crop has constantly increased during the past five years with more than half the cotton-producing territory infested. While there is little doubt that this troublesome pest will invade every field where cotton is grown, it is believed that it will become less destructive in the northern part of the Cotton Belt. It is also probable that natural enemies of the weevil and better cultural methods will reduce the damage in sections already infested. It is doubtful, however, whether any territory once infested will ever be entirely rid of the weevil, though the danger of serious damage may be reduced except in years of unfavorable climatic conditions.

There is little reason to believe that the United States will lose its supremacy in the production of cotton with their rich lands, not only adapted to cotton but to the greatest

variety of useful farm crops; their magnificent forests of timber for building purposes; the great deposits of oil, coal, iron, phosphates, lime, and other minerals; with almost unlimited water power; and with a mild and healthful climate; but instead, every reason to believe there will be expansion and growth.

Mr. Edward Atkinson, a large American spinner, after trying cotton imported from various foreign countries, stated that none of them were satisfactory and that no other country has a climate so peculiarly adapted to the growing of cotton as ours. He finally concluded that the South would perhaps have the monopoly for a long time. In his opinion only one section, which is situated in South America, could ever compete with the United States in growing the best grades of upland cotton.

The English Government recently appointed a commission to investigate the possibilities of cotton production in Africa, and they reported in part as follows:

"All efforts to raise cotton successfully elsewhere than in the southern part of the

United States have failed. This is the home of the cotton plant, and if it will grow and fruit elsewhere to the extent that the staple will have a substantial commercial value, the fact is yet to be demonstrated. It was experimented with under different suns during and after the American Civil War and all the experiments failed. Providence has given the Southern farmer the monopoly of the indispensable cotton crop and he need not take fright when the price soars and there are heard threats of turning Africa, Egypt, and other countries into cotton fields, and making them furnish the world's supply."

The rapidity with which the industry has grown in this country can be realized when we note that the total crop of the South thirty years ago was only four million bales; twenty years ago it was six million bales; ten years ago it was eight million bales, and the past three crops have averaged nearly fourteen million bales. Notwithstanding these three extraordinary crops, the average price per pound paid for them has been greater than at any time in thirty years. A world-wide move-

ment toward a higher civilization and higher standards of living has largely increased the demand for cotton. It has been estimated that of the more than fifteen hundred million people on the earth, only one third are well clothed, one half are partly clothed, and the remainder go without clothing. Something like forty-two million bales would be necessary to clothe all of the people of the world as we are clothed. This fact indicates the immense room for expansion in cotton production. It is believed that the South can increase the cotton crop as rapidly as the world's demand grows. When we consider that in the cotton states but one acre in seventeen is devoted to cotton, and only one acre in eleven in the cotton counties, there seems to be good reason for this belief. The average yield per acre is now less than two hundred pounds of lint cotton; but some of the best farmers average from their entire farms from five hundred to eight hundred pounds per acre. This would indicate the possibility of immensely increasing the crop, even were there no increase in acreage.

The low yields in the South may be largely ascribed to the use of poor seed, run down,

depleted soils, and inefficient and inadequate teams and tools. The use of good seed alone has been known to increase the crop from 30 to 50 per cent., and it is conservative to assume that with the adoption of the latest methods in scientific farming the yields on the lands already devoted to cotton would be doubled.

The acute problem confronting the Southern farmer to-day is the necessity of caring for his lands. This can be done by keeping live stock and rotating crops, and at the same time producing as much cotton as formerly on only half the acreage. Under such a system all of the supplies will be grown at home, and the cotton will be a surplus cash crop. The outlook is very hopeful to the close observer.

Mr. Arthur W. Page, editor of the *World's Work*, in an article analyzing present conditions in the Southern States, said: "We are in sight of the time when the cotton grower in the old slave states will become the most prosperous tiller on the earth."

The late Alfred B. Shepperson, author of "Cotton Facts," in an address entitled, "The Sources of Cotton Supply," before the New York University a few years ago, went into

details as to the future outlook and used the following in his closing paragraphs:

"I am as thoroughly convinced of the utter futility of the attempts being made to grow cotton in the new fields of production as I am of the capacity of our Southern States to readily meet the increasing requirements of the spinners of Europe and America. Our European friends would do well to possess their souls in patience, and stop squandering their money in visionary schemes. Blessed with temperature, rainfall, better adapted to the successful culture of cotton than any other country, and with an abundance of land to meet every possible requirement for expansion of acreage, the United States will undoubtedly maintain in the future its present supremacy in the cotton production of the world."

The Supply and Distribution of Cotton

CHAPTER XV

THE SUPPLY AND DISTRIBUTION OF COTTON

THE total supply of cotton in the United States at the end of 1911 was 17,896,226 bales. This represents cotton held over from a previous crop, and 229,268 bales imported from various other countries. This is the largest supply this country has ever accumulated.

The following table shows the production and distribution of the cotton crop of the United States from 1855 to 1911:

TABLE VII. — TOTAL CROP, EXPORT, AND DOMESTIC CONSUMPTION OF UNITED STATES COTTON CROP FOR SPECIAL YEARS

YEAR	TOTAL COMMERCIAL CROP	TOTAL EXPORT	TAKING NORTHERN MILLS	TAKING SOUTHERN MILLS
1855.....	3,665,557	2,702,863	633,000	138,000
1860.....	3,849,469	615,032	650,000	193,000
1865.....	2,269,216	1,301,146	541,000	127,000
1870.....	4,024,527	2,922,257	1,072,000	91,000
1875.....	4,302,818	3,037,650	1,220,000	134,000
1880.....	6,356,998	4,451,495	1,713,000	225,000
1885.....	6,369,341	4,200,651	1,781,000	381,000
1890.....	8,562,089	5,580,319	2,027,000	613,000

YEAR	TOTAL COMMERCIAL CROP	TOTAL EXPORT	TAKING NORTHERN MILLS	TAKING SOUTHERN MILLS
1895.....	7,146,779	4,761,505	1,605,000	900,000
1900.....	10,266,527	6,806,572	1,904,000	1,583,000
1905.....	10,804,556	6,975,494	2,335,000	2,292,000
1906.....	13,595,498	8,825,236	2,510,000	2,495,000
1907.....	11,375,461	7,779,508	1,885,000	2,079,000
1908.....	13,587,306	8,889,724	2,688,000	2,555,000
1909.....	10,315,382	6,491,843	2,012,000	2,244,000
1910.....	12,005,688	8,008,195	1,994,000	2,307,000
1911.....	16,250,276	10,681,332	2,619,000	2,772,000

TABLE VIII.—COTTON ACREAGE HARVESTED, PRODUCTION AND YIELD LINT PER ACRE AND PRICE IN THE UNITED STATES, FOR SELECTED YEARS, 1879-1911

YEAR	TOTAL ACREAGE U. S.	TOTAL CROP BALES	YIELD LINT PER ACRE	PRICE CENTS PER POUND
1911	36,045,000	16,109,349	210	9.7
1910	32,403,000	11,965,962	175	14.7
1909	32,044,000	10,386,209	165	14.3
1908	32,444,000	13,432,131	195	9.2
1907	31,311,000	11,325,882	175	11.5
1906	31,374,000	13,305,265	205	10.0
1905	26,117,153	10,725,602	205	10.9
1904	30,053,739	13,697,310	215	8.7
1903	28,016,893	10,015,721	175	12.2
1902	27,114,103	10,784,473	195	8.2
1901	27,220,414	9,748,546	195	8.1
1900	25,758,139	10,245,602	205	9.3
1899	24,275,101	9,507,786	220	7.6
1898	24,967,295	11,189,205	240	4.9
1897	24,319,584	10,897,857	235	5.6
1896	23,273,209	8,532,705	195	7.3
1895	20,184,808	7,161,094	175	8.2
1894	123,687,950	9,901,251	205	5.9
1893	9,525,000	7,493,000	190	7.5
1889	20,175,270	7,472,511	185	8.4
1884	17,439,612	5,682,000	163	10.5
1879	14,480,019	5,755,359	195	12.0

World's Production of Cotton (U. S. Census).— Cotton can be grown over a wide area of the earth's surface, but its profitable production is limited to certain well-defined sections. For some countries satisfactory data regarding the production of cotton are not available. The following table, showing production by countries, from 1907 to 1911 inclusive, is believed to approximate the facts.

TABLE IX. — PRODUCTION OF COTTON FOR MILL CONSUMPTION, BY COUNTRIES, 1907 TO 1911

COUNTRY	COTTON PRODUCTION (BALES OF 500 POUNDS NET)				
	1911	1910	1909	1908	1907
Total	22,297,000	18,711,000	16,777,000	19,636,000	16,512,000
U. S.....	15,546,000	11,483,000	9,863,000	13,002,000	10,882,000
British India...	2,514,000	3,082,000	3,774,000	2,953,000	2,498,000
Egypt	1,450,000	1,506,000	911,000	1,275,000	1,296,000
Russia....	1,200,000	900,000	720,000	846,000	620,000
China.....	625,000	775,000	600,000	600,000	426,000
Brazil.....	320,000	310,000	360,000	425,000	370,000
Peru.....	128,000	128,000	107,000	80,000	55,000
Turkey ...	124,000	105,000	32,000	80,000	80,000
Mexico. ..	100,000	135,000	125,000	140,000	70,000
Persia	80,000	92,000	90,000	50,000	50,000
All other countries	210,000	195,000	195,000	185,000	165,000

The average production for mill consumption during the five years shown in the table was 18,787,000 bales, or 3,510,000 bales less than

the production of 1911. In addition to the amounts shown in the table, large quantities of the fiber are produced in some countries and consumed in the homes of the people, without entering commercial channels; but the amount of such cotton cannot be estimated with any degree of accuracy.

Proportion of total consumption, by countries (year ending August 31, 1912).

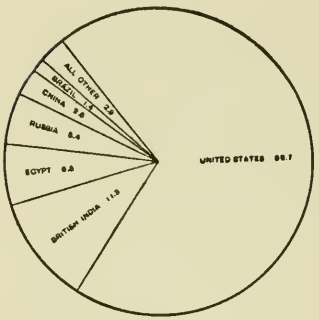


Diagram I

Diagram II

The relative importance of the several cotton-producing countries is graphically presented in Diagram I. Of the total production of commercial cotton in 1911, the United States contributed 69.7 per cent.; British India, 11.3 per cent.; Egypt, 6.5 per cent.; and Russia, 5.4 per cent.

The relative importance of the several countries in the consumption of cotton is shown in Diagram II.

Supplement

SUPPLEMENT

There are many agencies now organized for the purpose of giving practical and scientific information to the farmer in helping him solve his problems. Among these are the State Agricultural Colleges and Experiment Stations, the Industrial and Agricultural Agents employed by the railroads, the U. S. Department of Agriculture through its Demonstration Agents and other employees, and the Editors of Agricultural Papers.

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