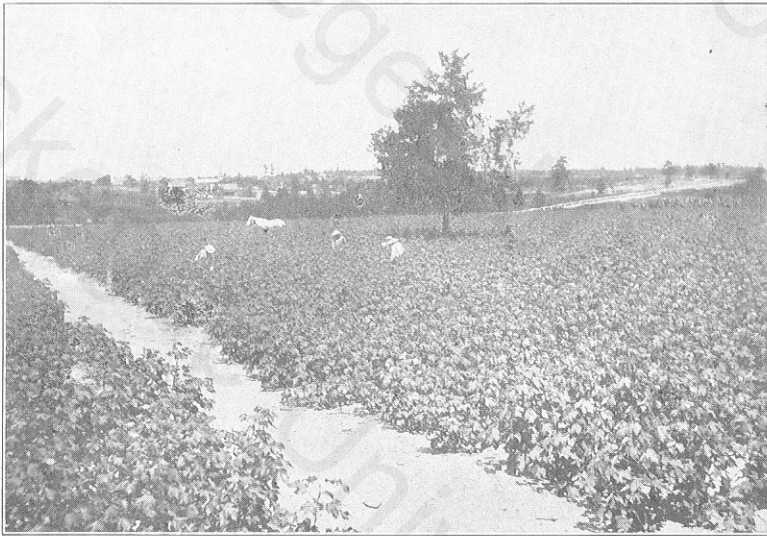


BULLETIN NO. 20

EXPERIMENT STATION
TUSKEGEE NORMAL AND INDUSTRIAL INSTITUTE
TUSKEGEE INSTITUTE, ALABAMA

Cotton Growing FOR Rural Schools



A PROMISING FIELD

By Geo. W. Carver, M. S. Agr.

1911

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Tuskegee Agricultural Experiment Station

Bulletin No. 20 : : : : June, 1911

Cotton Growing for Rural Schools

G. W. GARVER, M. S. Agr., Director

INTRODUCTION

THERE is doubtless no plant more interesting to the casual observer, or more useful economically and more wonderful to the searcher for truth than the cotton plant. It forms the principal products of eight great states of this Union. It also has an ancient history. It is said to have been grown and manufactured into clothing over 2,500 years ago. The early Greek historian, Herodotus, said of the fiber, "that it was of better quality and finer than that of wool."

Cotton cloth has been found in the ancient tombs of the Incas of Peru about the year of 1522. The poetic writers of the Orient called the cloth "webs of woven wind."

From 1500 B. C. until an equal number of years after the beginning of the Christian Era, India was the center of the cotton industry. From India it was introduced into China and Japan, and rapidly spread over Arabia, Africa and Egypt. History states that cotton was growing on the American continent at the time of its discovery by Columbus, and that the first efforts to grow cotton in the United States were made in Virginia about the year 1621. In 1764 eight small bags of cotton were exported to Liverpool from the United States.

The separation of the seed from the lint was a Herculean task, the work being done by hand, four pounds of lint cotton per week being the task required from each head of a family, in addition to the usual field work. At this rate it required one individual a little more than two years to remove the seed from a bale.

It is said by Atkinson that as early as 1742 a French planter of Louisiana by the name of Dubreuil records a machine for the ginning of cotton, but the demand for such a machine being so small, no record of its character has been preserved. The roller gin, in very much the same form as Nearchus, the Admiral of Alexander the Great, was still in use.

In 1790 Dr. Joseph Eve, originally from the Bahamas, but then a resident of Augusta, Ga., made great improvements on this

ancient machine, and adapted it to run by horse or by water power. A correspondent of the American Museum, writing from Charleston, S. C., in July of that year, states "that a gentleman well acquainted with the manufacturing of cotton had already completed and had in operation on the hills of the Santee, near Statesburg, ginning, carding, and other machines driven by water, spinning machines driven by water, and also spinning machines with eighty-five spindles each, with every article necessary for manufacturing cotton."

A machine dating anterior to this year and having a strong resemblance to the above, possessing in fact all the essentials of a modern cotton gin, was exhibited at the Atlanta Exposition in 1882. It came from the neighborhood of Statesburg, but its history could not be ascertained.

In 1793 Eli Whitney petitioned for a patent for the invention of the saw gin. His claims were disputed, and he defended them in the State and Federal courts for nearly a generation, obtaining at last a verdict in his favor.

The first saw gin to be run by water power was erected in 1795 by James Kincaid, near Monticello, in Fairfield County, S. C. Others were put up near Columbia by Wade Hampton, Sr., in 1797, and in the year following he gathered and ginned from 600 acres 600 bales of cotton. Thus the industry grew until the crop of the United States alone amounts to nearly eleven and a half million bales, representing a money value of quite one billion dollars, according to the fluctuation of the market price.

"Of the four great staples for clothing—cotton, silk, wool and flax—cotton has far outstripped all others in consumption. Thus, while fifty years ago only 2,500 bales were manufactured into clothing material, at the present time over 13,000,000 bales are thus used."

Botany of Cotton

The cotton plant belongs to the same botanical order (Malvaceae, or the Mallow family) as the mallow, holly hock, and okra. It is known scientifically by the the generic name *Gossypium*.

Climate

Cotton is indigenous principally to the islands and maritime regions of the tropics, but under cultivation its range has been extended to 40 degrees or more on either side of the equator, or to the isothermal line of 60 degrees F. In this country latitude 37 degrees North about represents the limit of economic growth; or, in other words, a line drawn from Old Point Comfort, Va., through Cairo, Ill., would cover practically the same limit.

Although cotton likes a hot moist atmosphere, it will not thrive where severe drying winds are prevalent.

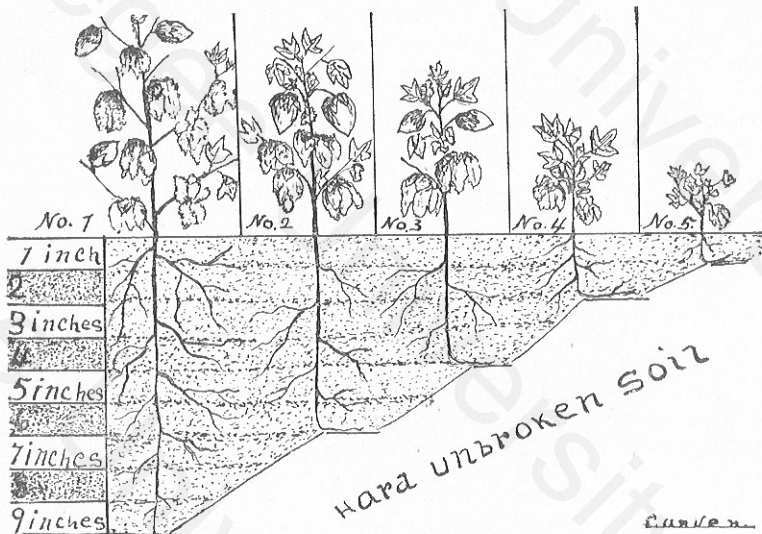
Soils

Climate seems to be of greater importance than soils, as it readily adjusts itself to a great variety of them, such as very sandy, loam, light and heavy clay, peaty, calcareous, or black prairie, and even hog wallow land. Possibly the best type of soil that can be relied upon, to produce a good crop one year with another, is rich, well-drained bottoms where the predominating constituent is clay. Clay loam or medium sandy loam is favored by many.

The presence of iron causes many sands and clays to be red, pink, salmon, striped, spotted, and mottled in proportion to the amount of iron present and its manner of distribution. All things being equal the red soils are naturally richer in plant food than the grey soils as they contain a greater percentage of clay. Such soils can be told by the native forest growth, which will almost always be long-leaved pine and hickory, on the uplands, Southern oak and maple in the bottoms.

Preparation of the Soil

In this it is safe to say that fully two-thirds of our farmers fail—they fail first, because they do not turn (broadcast) their land in the fall just as soon as the crop is off; second, they do not plow deep enough.



The effect of deep and shallow preparation of the soil upon the crop

Advantages

(1) Deep plowing (which should be from eight to ten inches) brings to the surface plant food that the rain and other agencies have carried beyond the reach of the feeding roots of the average farm crop.

(2) If the plowing is properly done in the fall it puts the cotton stalks, leaves, grass, and whatever other accumulations there may be on the surface of the ground underneath, where it will rapidly decay, and the non-available plant food becomes available and the humus (vegetable matter) be in the very best possible condition to perform its most important double duty as an absorbent of the soluble plant food and an improver of the soil's physical condition.

(3) Fall plowing destroys many insects, which deposit their eggs in the stems of weeds, upon leaves, under clods, or just a few inches under the surface, by putting them deep down under the earth, where they drown out or smother. Those which nature intended should be buried deep into the earth for protection, are brought to the surface, where many freeze, others become food for birds, while still others perish by having their natural homes broken up; thus greatly reducing the number of injurious insects. The same can be said of the rusts, smuts, anthracnose, and many other other spot diseases.

(4) Deep fall plowing increases the water-holding capacity of the soil, greatly reducing injurious washing. It also helps to mix the soil by quickly softening the more friable portions and allowing it to percolate into the cracks made by the plowing process.

(5) It permits the wind, water, air, sunlight, earthworms, bacteria, moulds, ferments, and other plant, animal, and mineral agencies to better perform their work of soil building.

Things to Bear in Mind

Since any extreme is more or less dangerous the following should be borne in mind:

(a) That most of Macon County soils are very thin, and have but little or no alluvial layer; therefore the farmers must begin with the subsoil and make out of it an alluvial layer.

(b) That brick or pipe clay soils (such as much of our soils are) must not be broken or worked in any way when too wet, lest its productive power will be more or less injured for two or three years. All preparation or tillage should be done when the soil crumbles the easiest, and does not ball up into a sticky mass when pressed in the hand.

(c) That nine-inch plowing and upward is the end desired, but it must be done gradually on our thinnest soils, unless we have plenty of barnyard manure or its equivalent in vegetable matter, supplemented by the proper commercial fertilizers.

(d) That it will pay you to plow this land real shallow (3 or 4 inches), first, after broadcasting a liberal coating of stable manure, leaves, muck, etc., upon it. Plow this under four inches. Run over it several times with a disc harrow until thoroughly cut up. Spread on another layer of manure as thick as the first; turn four inches deeper, which will make eight inches in all; harrow in the same way. Put the commercial fertilizers in the drill as usual. If this has been thoroughly done a good crop may be expected. This soil can be deepened to advantage a little more next year.

Not only the soil is affected by deep and shallow preparation, but the growth and fruiting power of the plant as well. (See cut which is drawn from an experiment conducted on our own experiment farm.) Some typical wornout soil was selected and divided off into five plots. No. 1 was plowed and thoroughly pulverized by repeated plowings and harrowings until the soil was fine and mellow to a depth of nine inches. Nos. 2, 3, 4, and 5, respectively, in the same way, to depths as indicated, viz., six inches, four inches, two inches, and one inch.

No fertilizer of any kind was used on these plots, the object being to study or demonstrate the exact effect of deep and shallow preparations of the land upon the cotton plant.

The cut needs but little explanation—stalk 1 has splendid root growth, the tap root extending through the nine inches of mellow soil and is abundantly supplied with vigorous laterals, or feeders. This stalk matured twelve bolls.

In No. 2 the tap root strikes the hard ground and turns at six inches; the laterals are noticeably fewer in number, and this stalk matured only six bolls.

No. 3 speaks for itself; the tap root struck hard ground, and turned at four inches; but few laterals are noticeable. Four bolls represented the crop.

The tap root of No. 4 struck hard ground at two inches, and made a desperate struggle to live, but the odds were against it. It could mature only two bolls.

No comments are needed on No. 5. It did well to mature its one little boll.

Fertilization

In addition to a well prepared seed bed, the land must be well fertilized if large crops are expected. By large crops I mean from one to one and one-half, and in favorable localities, two bales per acre. There is an abundance of land in Macon and adjoining counties that can be made to produce two bales of 500 pounds lint per acre.

Barnyard manure is the very best fertilizer known for cotton, and, on an average our soils will require from 15 to 20 tons per acre. This should be spread over the land and plowed under. Where the soils do not wash and are not leachy, the manure can be spread and

plowed under in the fall; otherwise spread and plow under in the spring.

The following formulas, based upon co-operative experimental work, have been found most beneficial by Prof. Duggar, of the Alabama Experiment Station (Bul. No. 107). The writer has used a number of them on the Tuskegee Station, and found them very satisfactory. On our very light, sandy soils I have added to advantage 100 pounds of cotton seed meal, 75 pounds of acid phosphate, and 80 pounds of kainit to the formula already given, making a total of 675 pounds to the acre. I also found that during wet springs, it was better to divide the fertilizer, and put only half of it down when planting, and the other half just before the plants begin to form squares. This is easily and quickly done with a fertilizer distributor.

Formulae

(Alabama Experiment Station, Bul. 107)

For the Calcareous clay loams of north Alabama:

From 80 to 120 pounds of cotton seed meal per acre.

From 160 to 240 pounds of acid phosphate per acre.

Approximately equalling 2.3 per cent. nitrogen, 2.8 per cent. ammonia, 9.3 per cent. available phosphoric, and 0.6 per cent. potash.

For the sandy soils of Eastern and Central part of the state:

From 80 to 120 pounds of cotton seed meal per acre.

From 40 to 60 pounds of kainit per acre.

From 160 to 240 pounds of acid phosphate per acre.

Approximately equalling 2 per cent. nitrogen, 2.3 per cent. ammonia, 8.0 per cent. available phosphoric acid, and 2.3 per cent. potash.

For the level lands of the Southern long leaf pine region:

From 60 to 120 pounds of cotton seed meal per acre.

From 120 to 240 pounds of acid phosphate per acre.

From 60 to 80 pounds of kainit per acre.

From 240 to 440 pounds per acre.

Approximately equalling 1.9 per cent. nitrogen, 2.3 per cent. ammonia, 7.6 per cent. available phosphoric acid, 2.8 per cent. potash.

For any well-drained soil in any part of the state on which cotton is known to be especially liable to black rust:

From 120 to 160 pounds of cotton seed meal per acre.

From 80 to 120 pounds of phosphoric acid per acre.

From 80 to 120 pounds of kainit per acre.

From 280 to 400 pounds per acre.

Approximately equalling 3.0 per cent. nitrogen, 3.6 per cent. ammonia, 4.8 per cent. available phosphoric acid, and 4.3 per cent. potash.

Selection of the Seed

Too much stress cannot be laid upon this point, as good seed is equivalent to one-half the crop, all other things being equal. (a) The single stalk method has proven the most desirable with me; e. g., every cotton grower has observed that, regardless of how pure his seed may be or what variety it represents, there are always some stalks more vigorous, larger in boll, and are more desirable plants from every point of view. These are the kind from which to save seed. (b) Have these ginned separately. (c) Spread them out and remove all small, lop-sided, and otherwise inferior seed. This may seem to be a great deal of trouble, but you will be gratified at the result. Some growers dampen the seed and roll them in ashes. In this way the small, faulty ones can be easily and quickly removed. (d) Always select the lowest and earliest maturing bolls, if they are well developed. If injured or are inferior in any way select the next set of bolls; but never save the top crop when it is possible to do otherwise, as the vitality of the plant has been greatly exhausted, and therefore the seed will be low in vitality, which is likely to result in a poor stand, weak, diseased plants, and a poor quality of fiber.

Planting

Here no set rule can be laid down, as the latitude and season govern that. In this county (Macon) the universal rule is to begin planting on the 15th of April and continue well up in May, and even June plantings have frequently done well.

Planting Distance and Thinning

In the preparation of the soil for planting, there is a wide difference of opinion—some bed up; others do not, and often both methods bring equally good results. By bedding up I mean the throwing of two furrows together, much the same as making ridges or beds for sweet potatoes. My experience has been this: that in light, sandy soils, planting in the water furrows, or a mere suggestion of a bed, is decidedly preferable, but a well defined bed is best in heavy, cold, wet soils.

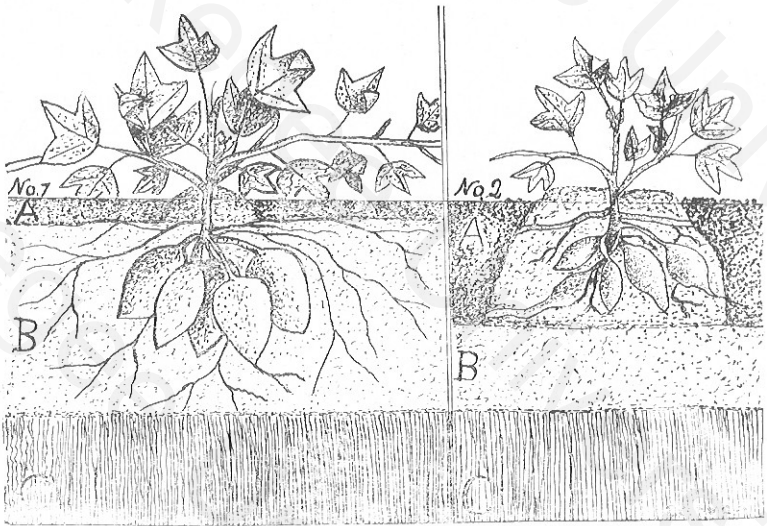
The average width of rows ranges from three and a half to four feet, with the plants thinned to a stand by chopping out with a hoe to a distance of eight or twelve inches. Large-growing sorts should be fourteen and sixteen inches in the drill, leaving in each case from one to two stalks, not more. Some growers who have a reputation for producing large yields of cotton, recommend that the ground be heavily manured, the rows from four to seven feet wide, and the plants from one to three feet in the drill, and carefully thinned out to one stalk.

Barring Off

This operation is generally done with a one-horse turning plow, the object being to clear weeds and grass from the side beds. Many claim that it aids in the chopping—this is not my experience, however—after you get used to it. It comes awkward at first.

Chopping

The first hand hoeing or thinning out of the plants to a stand, is called chopping. The time of chopping varies with the conditions of the soil and the size of the plants. When the first true leaf appears, chopping should begin, and it should end not later than the fifth or sixth well-developed leaf.



Cultivation

There is such a wide difference of opinion in the matter of cultivation that one hesitates to put himself on record. These facts, however, are prominent, and in whatever way they can be secured will be acceptable.

If the best results are to be had, all weeds and grass must be kept down; the loss of water must be saved by frequent and shallow cultivation; the surface roots should be injured just as little as possible, the result of which Cut 2 plainly shows.

This cut was made from an experiment conducted at the same time of No. 1, in our experiment field. However, one was conducted on cotton, but we felt that the sweet potatoe plot illustrated

the point better, as the roots could be more plainly seen, therefore we used it instead.

In this cut we show a hill of potatoes from plots one and two. No. 1 shows a mulch of very fine soil produced by two-inch cultivation, which is so essential in our light, sandy soils, which are naturally very thirsty. Note that the feeding roots are not disturbed and that they extend down nine inches to the water-bearing sub-soil. Here we see a vigorous growth of vine, splendid root power, and a good yield of fine large potatoes.

In plot 2 we did as many farmers do—cultivate deep, went down five and six inches, cutting the feeding roots and greatly reducing the yield of potatoes.

Aside from the above this was significant: that despite the very dry season, plot 1 grew and flourished throughout the entire season and did not seem to suffer for want of water, while No. 2 suffered greatly, losing most of its leaves.

Exactly the same was true of the cotton plots—the dust mulch preserved the water, undisturbed the feeding roots, and the plants held their leaves and continued to grow, bloom, and set bolls until frost. Neither leaves nor bolls were seriously affected by the A. thraenose, rust or other spot diseases.

Another important point for the farmer to keep in mind is the fact that all plant foods in the soil are rendered non-available or worthless to the plant unless there is sufficient water in the soil to properly dissolve and distribute them. Hence in the thirsty soils it is doubly necessary that the cultivation be done in such a manner as to save the water. (See cut 2.)

Cotton is a typical, taprooted plant, made to go deep into the soil for both water and plant food; but the many decades of soil skimming, poor seed selection and bad cultivation, have dwarfed both root and top and produced a plant that has lost much of its original characteristics. It has been so lowered in vitality that the roots, stems, leaves, and bolls are all subject to a large number of destructive diseases.

Aside from the tap root going deep in the ground of well prepared soils, it throws out numerous laterals, often four and five feet in length, the largest of which as a rule are just below the surface of the ground; hence the wisdom of shallow cultivation.

From Growth to Maturity

The following interesting data has been compiled from several sources:

(a) That it requires from 14 to 18 days after cotton has been planted to come up to a stand, and longer if the conditions are unfavorable, to germination. However, none comes up after 30 days.

(b) That it requires from 120 to 157 days from planting to the first open boll.

Picking

This is the period that causes the cotton grower the greatest anxiety, as he knows the prices are governed very largely by the time and manner in which the crop is harvested, as this determines its classification and grade.

Ginning

The removal of the seed from the lint is called ginning, and is done now almost universally by public gins, although on many large plantations they own their own ginning and baling machinery.

Baling

This operation consists in putting the lint (linters as they are generally called) into convenient packages for handling, shipping, storing, etc. The size of bales vary greatly, as follows: Upland square bale, uncompressed, or just as it comes from the baling machine—dimensions, 54 by 36 by 27 inches; weight, 500 pounds; density, 16 1-2 pounds per cubic foot. Before shipping long distances it undergoes another and more powerful pressing known as the compress, which changes the dimensions thus: dimensions, 54 by 20 by 27 inches; weight, 500 pounds; density, 30 pounds per cubic foot.

Indian Bale

Dimensions: 48 by 22 by 17 inches; weight, 400 pounds; density, 38 1-2 pounds per cubic foot.

Sea Island Bale

The Sea Island Bale is rather variable in shape, usually cylindrical (called round), but often put up in large baglike pouches. Dimensions: 80 by 32 inches in diameter; weight, 390 pounds.

NOTE—The upland bale, or short, stapled cotton is nearly or quite surrounded by coarse burlap or still coarser jute bagging, followed by six or eight heavy bands of hoops called iron ties.

Grading and Marketing

There are probably no factors in connection with cotton more important than those which determine its grade. Indeed almost every operation connected with it, from the selection of the seed to the harvest, helps to fix the grade. A cotton grader proceeds thus:

He looks for uniformity in the length of the staple by pulling it between the thumb and fingers until there are no uneven fibers. They are then measured by a rule. In doing this he notes whether much or little is pulled out, which indicates its unevenness. Cotton mill machinery must be set to a certain length of staple. If too short great waste is the result, in addition to there being fuzzy-looking yarn. If long and short fibers are mixed and the

machine set for the short, the long ones are broken, which makes the yarn weak, besides giving it a fuzzy appearance. All such cotton will not bring the highest market price.

CAUSES—Poor seed, bad preparation of the soil, insufficient fertilizers, late planting, poor cultivation, etc.

Immature Cotton

Cotton growers divide their pickings into three divisions known as "crops;" viz., the first bolls to open, are called bottom crop, the second, the middle crop, and the third, the top crop. The bottom and middle crops are nearly always the choicest staple, the top crop the poorest, as it is frequently immature. Such should be kept ginned, and sold separately, as it lowers the price of it all when mixed with the bottom and middle crops. Bolls of cotton picked before they are well open and those that do not open before frost, usually contain a large number of unripe fibers.

Foreign Impurities

Another important factor in determining the grade of cotton is its freedom from foreign impurities, such as leaf, boll, husk, stalk, seed, and sand impurities. These can all be reduced to the minimum if the proper care is exercised in picking and handling.

Color

This probably affects the price as much as any other one thing. Some local buyers go altogether on color, the highest grade being a creamy white.

Tinges, Stains, Etc.

Cotton that has tufts in it that are off color, such as pink, green, yellow, etc., is called tinged. When the color is very deep and general throughout, it is classed as stained. Both conditions originate practically from the same source; viz., immature bolls, juices from crushed seed, water dripping from the leaves of the stalk, frosted cotton, cotton that has been put into large piles and allowed to sweat and mildew—all these materially reduce the price.

American Classification

The classification of cotton is both variable and a little too technical for a work of this kind; so therefore I will start with No. 1, strict good middling, as very few bales ever go beyond this. This high grade is secured by thorough preparation of the soil, well selected seed, proper fertilizers, cultivation, and picking before it rains upon it. It must be free from tinges, stains, dirt, trash, or foreign matter of any kind. This type brings the highest market price.

No. 2—Good Middling. This type usually contains a little foreign matter such as trash, leaves, sun-bleached, etc. This will bring a few points less than No. 1, according to the extent of the defects.

No. 3—Middling. Contains a little more trash and other foreign matter than No. 2 and will bring less money.

No. 4—Middling, tinged. In addition to having some foreign matter this sample contains discolored spots, stains, etc. It will bring less in the market than No. 3.

No. 5—Low Middling. This sample has been handled improperly from start to finish and contains all the tinges, stains, mildews, etc., besides leaves, trash, and other foreign matter. This will bring less money than No. 4.

Fraudulently Packed Cotton

There are many ways in which cotton may be fraudulently packed. A few of the most prominent are these: water packed bales, bales containing an excess of dirt, sand, trash, sticks, stones, good cotton on the outside and poor, damaged cotton on the inside in such a manner as to not be detected without boring or opening the bale. Mixed cotton of the above characters are classified according to the lowest grade in the bale. Twenty-eight pounds, including bands and bagging, is considered the legal and maximum tare on a bale of cotton.

Diseases of Cotton

There are only a few diseases in Alabama at present which cause much loss. The most prominent are these:

Sore Shin or Damping Off

One of the most troublesome diseases of young seedlings, attacking the plants in the crook before the two seed leaves appear and often after the second and third true leaf appears. It is especially destructive in cold, wet seasons. The disease seems to attack the plant just below the surface of the ground, causing it to rot off.

Remedies

Bar off to dry out the land and chop to a thick stand as soon as possible in order to let in air and sunlight, which are the two chief essentials in stopping this trouble. Also good healthy seed and properly prepared soil are very important factors in its control.

Cotton Wilt (Black Root)

This is a very troublesome disease, and often large areas of cotton are destroyed by it. It attacks the plant at almost any stage of its growth, from the tiny seedling to the plant with mature and opening bolls. Its presence is first noticed by the drooping or wilting of the leaves, which advances rapidly until the whole plant usually

dies. If the root is cut off or split it will show a greater or less number of black streaks running through them and extending up into the stem.

Remedies

- (a) Plant only strong, vigorous seed free from the disease.
- (b) Prepare the ground; fertilize and cultivate well, to make plants as vigorous as possible, and hence more resistant.
- (c) Plant corn, sorghum, sugar-cane, potatoes, etc., in all land that wilts cotton badly, but do not plant cow peas, watermelons, beans, etc., on this same land, as the wilt of these plants seem to be clearly related to the cotton wilt.
- (d) Plant wilt proof varieties such as Jackson's Wilt Resisting, the Dixie, Carver's Improved, etc.
- (e) In fertilizing use one-fifth more potash (kainit) to the acre than your formula calls for.

Leaf-Spot Disease—Rust, Etc.

There are a large number of leaf-spot diseases known by the common name of rust. All these cause premature shedding of the leaves, which greatly injures the crop.

Remedies

Good seed, well prepared and well fertilized soil, thorough and frequent cultivation, will usually reduce the above diseases to a minimum.

Insects

In this section there are but few insects that trouble the cotton grower. Among those that do slight damage more or less every year the following are the most prominent:

Cotton Worm, or Cotton Caterpillar

This insect is familiar to nearly every cotton grower. It is a slender, bluish-green worm, with black spots and often with black stripes down the back. It often defoliates whole fields of cotton, but so far, in this section, they have come so late that many cotton growers regarded them more beneficial than otherwise.

Remedy

When necessary a spray of Paris Green will effectually destroy them.

The Cotton Boll Worm

In this insect we have possibly one of the most troublesome of insects. The cotton boll worm, the corn ear worm, and the tomato fruit worm are all one and the same thing. It is often found feeding upon squash, cow peas, okra, pumpkins, beans, tobacco, gladiolus,

geraniums, mignonnette, and a number of other cultivated crops. In appearance it is similar to the cotton worm, except possibly a little darker in color, and crawls with a looping movement.

Remedy

Up to date the most effective remedy is the trap crop. Experience has proven that if corn is planted at the proper time and in the proper way but little damage will be done to the cotton by the worms. An early variety of sweet corn is usually selected, and five rows planted for every twenty-five of cotton. Where large fields are planted another method is to plant strips on either side of the field; thus for every five acres of corn, plant 50 acres of cotton, or for every five acres of corn, alternate with 75 or 100 acres of cotton.

Plant Lice

Sometimes these minute insects cause some alarm, but where the soil has been properly prepared, fertilized, and stirred frequently to give the plant vigor there need be no cause for alarm; these insects will soon disappear; their appearance is almost invariably the sign of a weak, impoverished plant. Raise the vitality of the plant and lice as a rule will disappear.

Mexican Boll Weevil

While it is true that the above insect is not in this county, it is nevertheless in the state, and is moving this way rapidly; so therefore we think it wise to call attention to the best methods of control up to date.

The weevils vary greatly as to both color and size. In color they range from a light ashen gray to a dark brown, and vary in length from $\frac{1}{8}$ to $\frac{1}{3}$ of an inch.

The Mexican boll weevil is the most destructive and, therefore, is the most dreaded of all cotton insects. These little pests do their damage by puncturing the very small squares into which they deposit their eggs. The best authorities agree on the following as the best methods of control, bearing in mind that the system has two objects in view; viz., 1st, to reduce the number of weevils, and second, to hasten early maturity:

1. The destruction of the weevils in the fall by burning all rubbish and material in and about the field which might serve for hibernating quarters of the weevils.
2. Breaking (plowing) the soil as deep as conditions will allow.
3. The shallow winter cultivation of the soil if no cover crop is used.
4. Delaying the planting until the soil and temperature are warm enough to make it safe.
5. The planting of early-maturing varieties of cotton.
6. The more judicious use of fertilizers.

7. Leaving more space between the rows, and on ordinary uplands, having greater distance between plants in the row than is usually allowed.

8. The use of the section harrow before and after planting and on the young cotton.

9. Intensive shallow cultivation.

10. Agitation of the stalks by means of brush attached to the cultivator.

11. Picking up and burning the squares that fall, under weevil conditions, especially during the first thirty or forty days of infestation.

12. Controlling the growth of the plant if excessive by deep and close cultivation.

13. Better selection of the seed.

14. The rotation of crops and the use of legumes, peas, beans, clovers, vetches, etc.

In addition to the above, local conditions will suggest to the wide-awake farmer numerous valuable remedies.

Products from a Ton of Cotton Seed

The cotton grower feels quite pleased when his cotton "thirds" itself as he calls it; that is, if it yields him one-third lint to two-thirds seed; or in other words, if he has 1,500 lbs. of seed cotton he expects a 500-pound bale of lint. The seed are carried through a series of interesting processes, and the following products made.

Beginning with a ton (2,000 lbs.) of seed, we get the following:

- LINTERS, 20 lbs., the result of re-ginning the seed;
- MEATS, 1,089 lbs., the kernels after the hulls have been removed.
- CAKE, 800 lbs., what is left after the oil has been pressed out of the ground-up meats. This cake is afterwards ground up very fine (to about the consistency of corn meal), and it forms a valuable stock food and fertilizer, adding much nitrogen to the soil and furnishing a high protein ration for the animal.
- CRUDE OIL, 289 lbs.; brown in color, with some sediment, and it is the result of pressing the oils from the meats. From this crude oil a pretty amber oil is made, known as summer yellow. This is refined again and becomes winter yellow. Cotton seed stearin is made at this point. The winter yellow oil is again refined and becomes a pale, yellow olive oil, colored salad oil, with a fine nutty flavor. This oil is refined again and becomes a pure white oil known as summer white.
- During the refining processes lard, cottolene, mineral oil, soap stock, and soaps are made.
- HULLS, 891 lbs. These are valuable as a cattle food. High grade paper is made from the fiber. The soft inner coat is called bran and is valuable as a cattle food. Dye stuffs are sometimes extracted from the hulls. The hulls are then burned and the ashes sold as a fertilizer.

Manufacturing

The making of cloth is simply an improvement over that of our grandmothers by the introduction of improved machinery to do the carding, spinning, weaving, bleaching and dyeing. The carding and making of the rolls by hand, the buzzing and sighing of the old spinning wheel, the clack of the cumbersome old loom, together with the multi-colored stains on the hands, all bespoke the cost of a garment. But now all this is most effectively done by machinery. Power manufacturing of cotton began almost simultaneously with the invention of the steam engine.

Hargrave's spinning Jenny, invented in 1764 and patented in 1770; Arkwright's water frame, invented in 1769, with improvements in 1775; Crompton's mule, so-called because it combined the principles of both the above, and patented in 1779—these antedated the introduction of Watt's steam engine, in 1769, which was improved in 1781, and was first applied to the production of cotton yarn in 1785. In the same year Dr. Cartwright invented the power loom and thus completed the group of fundamental inventions of which all spinning and weaving machinery is but an adaptation and a series of improvements.

The invention and evolution of the carding machine into the almost perfect mechanism of today, covers nearly the whole of the nineteenth century. The first important improvement was made in 1823.

The principle of the revolving flat in 1834, improved in 1857, and about 1880 became in the hands of Messrs. Ashworth, was substantially the carding machine of the present day. The carding machine was invented in 1851 by Mr. Josue Meilmann.

Miscellaneous Information

The estimated number of pounds of cotton produced in Alabama in 1908 was 643,700,335, valued at \$59,477,911; plus 599,722 tons of seed, valued at \$9,587,461, making a total value of \$69,065,372 for the state, against 6,300,472,552 lbs. of upland cotton, having a value of \$582,163,664; plus 35,399,659 lbs. of Sea Island cotton, valued \$6,651,164, with a production of 5,903,838 tons of seed valued at \$92,416,128, making a grand total of \$681,230,956 for the United States.

Macon County produced in the above year 31,519 500-pound bales.

Variety	Length of Staple		
	Maximum Inches	Minimum Inches	Average Inches
Sea Island.....	1.80	1.41	1.61
New Orleans.....	1.16	88	1.02
Texas.....	1.12	87	1.00
Upland.....	1.06	81	.92
Egyptian.....	1.52	1.30	1.41
Brazilian.....	1.31	1.03	1.17

How to Collect an Exhibit

Every school room is incomplete and cannot give the most approved and up-to-date instruction without an exhibit with which to illustrate the subjects taught. The following is an interesting and valuable exhibit of cotton, which may be had in any school room:

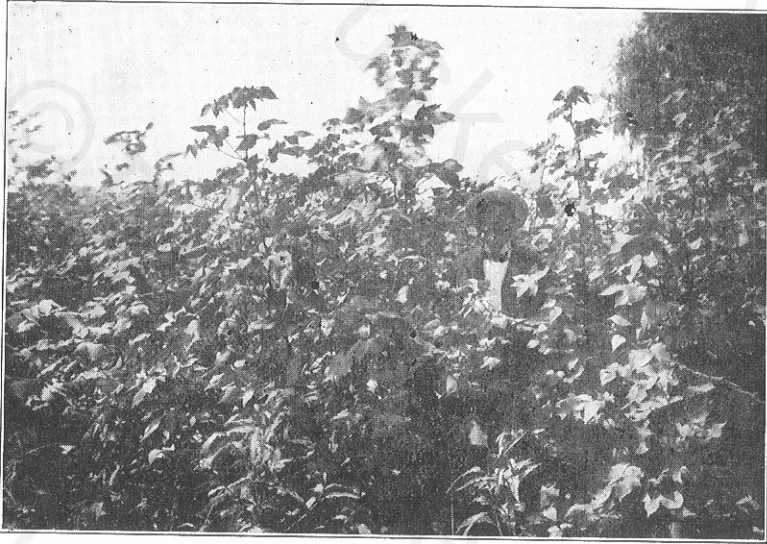
(1) An Exhibit of the American Classification

Take neat pasteboard boxes, say 12 inches long, 10 inches wide, and 2 inches deep; follow directions, beginning with the highest type and ending with the lowest. Do not mix the types, e. g., do not put middling and middling tinged in the same box, but have a separate box for each one. Take a bunch of cotton lint about the size of your fist or larger of the desired type; keep folding until it is very smooth, neat, and until it assumes the shape of a small "corn dodger;" place in the box neatly; continue until full—a box the above size should hold six little dodgers. Label and put away for use. Continue until all the types have been put up.

A pretty and interesting way to exhibit the staple is to gently pick, comb, and pull out as shown in cut. They can then be mounted on black, blue or some dark paper by sticking with a little glue, muscilage, or paste.

Products from the oil mill and gin may be collected as follows: Put the same in suitable bottles, boxes, etc., seed, bran, hulls, meats, cake, meal, oil, etc. A sample of fuzzy seed and smooth seed will be interesting; likewise the different colors of seed, well selected seed, and poorly selected seed. A great variety of stalks can enrich the collection, such as well-fruited, poorly fruited cluster types, limbless, etc.

The above are by no means all the things that will suggest themselves to the wide-awake teacher and interested pupils; there are many more.



A Field of Carver's Improved Cotton

Improvement of Cotton

Science has proved that it is not a difficult matter to improve all farm crops in both quantity and quality. Should we apply the trifling increase of one grain to the ear of corn, or one kernel to the bushel of wheat or oats, the aggregate crops of the country would give an increase as follows:

Corn, 5,200,000, at 40 cts., \$2,080,000, wheat, 15,000,000 bushels at 60 cts., \$9,000,000, oats, 20,000,000 bushels at 30 cts., \$6,000,000 equaling a money value of \$17,080,000.

Should cotton growers add the trifling sum of five pounds of lint to the acre, it would mean for—

Alabama, 16,010,675 pounds, or in round numbers, 32,021 five-hundred-pound bales; Georgia, 17,574,195 pounds, or in round numbers, 35,149 five-hundred-pound bales; Virginia, 128,620 pounds, or in round numbers, 257 five-hundred-pound bales; Indian Territory, 2,210,325 pounds, or in round numbers, 4,420 five-hundred-pound bales; North Carolina, 5,035,100 pounds, or in round numbers 10,070 five-hundred-pound bales; South Carolina, 10,370,405 pounds, or in round numbers, 20,740 five-hundred pound bales; Florida, 1,109,145 pounds, or in round numbers, 2,218 five-hundred-bales, Tennessee, 3,115,685 pounds, or in round numbers, 6,231 five-hundred-pound bales; Kentucky, 11,980 pounds, or in round numbers, 23 five-hun-

dred-pound bales; Arkansas, 9,209,265 pounds, or in round numbers, 16,418 five-hundred-pound bales; Louisiana, 6,881,270 pounds, or in round numbers, 13,762 five-hundred-pound bales, Missouri, 227,980 pounds, or in round numbers, 455 five-hundred-pound bales; Mississippi, 14,489,600 pounds, or in round numbers, 29,975 five-hundred-pound bales, Texas, 34,801,835 pounds, or in round numbers, 69,603 five-hundred-pound bales, or in round numbers, the enormous sum of 120,176,090 pounds, or 240,352 bales.

The methods of improvements are practically the same as that of corn, although the immediate effect of pollen is not seen the first year. Much effective work can be done in the way of cotton improvement by:

(1) Thoroughly preparing the grounds so that the roots may easily penetrate to the depth of eight or nine inches, as it is absolutely essential that the plants be well rooted if a heavy crop is expected.

(2) In addition to a thoroughly prepared seed bed, the land must be well fertilized, as this enables the plant to make its maximum growth and resist to a very large extent the attacks of insects and fungus diseases, as the weaker the plant, the more likely to, and the greater will be, the virulence of the attacks from these pests.

In addition to carefully selected seed (see seed selection and cultivation).

(3) **CULTIVATION**—Many farmers do not appreciate the great value of correct cultivation as a factor in the improvement and maintenance of a high standard as it relates to the particular crop. As stated elsewhere in this bulletin, it is very essential that a good deep seed bed be prepared and followed by shallow cultivation.

Improvement by Crossing

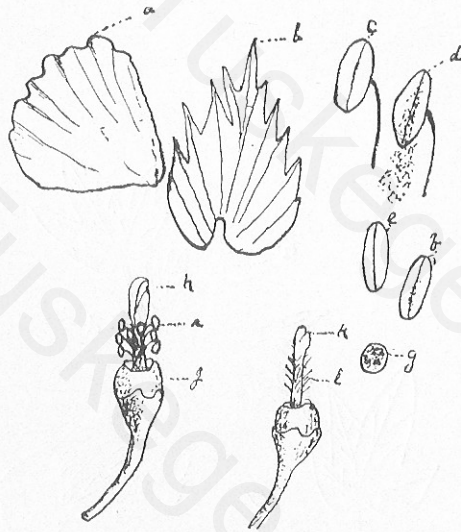
While this requires more knowledge and care, it is not beyond the reach of the average farmer. In this method the blossoms of the plant figure most conspicuously. In examining a cotton flower we find that it contains the following familiar parts. (See cut 1.)

(1) A group of three leaf-like bracts commonly designated as squares.

(2) The yellow petals or flower leaves.

(3) A column rising from the center of the flower, which is composed of two parts and which can be easily seen.

These two parts are the only ones in which we are interested; we will therefore explain their functions in detail. In examining this column we find that it tapers somewhat from the base until about midway, where it splits up into a sort of brush-like form.



G. W. Carver:

(a) petal; (b) bract; (c) stamen with anther unopened; (d) stamen with anther open and issuing its pollen; (e-f) anthers without filaments just ready to burst; (g) a single pollen grain (h) stigma or part of the pistil which receives the pollen; (i) filaments with stamens attached surrounding the pistil; (j) ovaries, where the seeds are produced; (k) shows the flower with stamens removed, ready to cover, and each little thread carries upon its end a little bag filled with a yellow powder known as pollen. Rising from the center of this mass is another larger and longer thread-like body with a slightly twisted and club-shaped end. This is the pistil, or the female part of the flower, and when fructified (the act of placing the pollen upon the end of the pistil) produces seed. Bees, wasps, several species of flies and a great many other insects, seeking honey, fructify the pistil by going from flower to flower gathering both the honey and the pollen, the latter sticking to their hairy bodies and clinging to the pistil of any flower touched. Many valuable crosses are made in this way, but are lost in the overwhelming lot of undesirable mongrels or share the same fate as the other seed in the hands of the feeder or in the crafts of the manufacturer. For the above reasons men have learned that it is an easy matter to do this work by—

1st. Selecting the parents; i.e., the plants to bear seed and the plants from which pollen is desired. These must be strong, vigorous, and possess as nearly as possible the character of the ideal plant you wish to produce.

2nd. Remove all the flowers or buds from the mother plant except those you wish to use (cross). Just before the flower opens (see cut 2) cut the yellow petals away with a pair of scissors and remove the little pollen sacks in the same way, being careful not to injure the pistil.



G.W. CARVER

Explanatory

(Buds and blossoms frequently appear above the flowers pollinated; these should be promptly removed at the points (d-e); (e) is the pistil ready to cover).

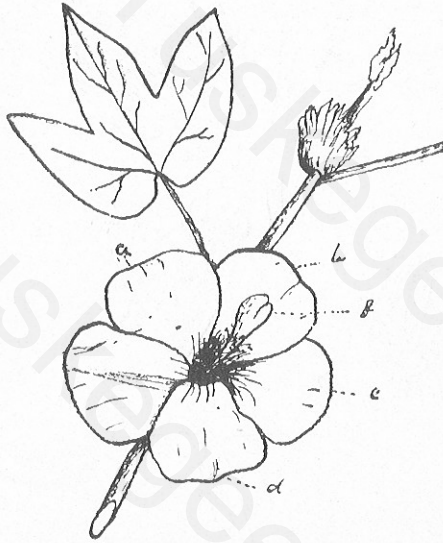
A half dozen flowers is enough to leave on one plant. Cover the whole plant at once with a piece of mosquito netting, or small sacks may be put over the individual flowers. This is to keep insects from them. (See cut 3.)



Explanatory

(c) represents a paper bag properly placed over the pistil before and after the pollen is applied; (a) developing young boll; (b) an easy method of labeling.

3rd. Gather your flowers from which you expect pollen at the same time and put in a shady place, free from insects, where they will open in a few hours. (See cut 4.)

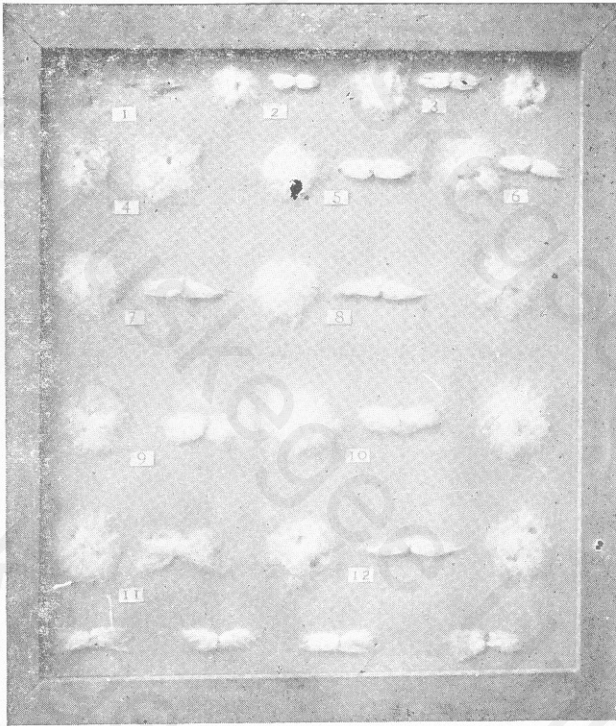


G.W. Carver

Explanatory

(Cut No. 4 shows a flower fully opened. It should never be used for crossing, as it is highly probable that pollen-bearing insects have already fructified it.)

As soon as the pollen sacks burst, clip the yellow petals off (merely for convenience) and apply the pollen by rubbing the same gently over the pistil of the mother plant until it is thoroughly covered with it. Continue until all the pistils have been fructified; return the mosquito netting for a few days, when it may be safely taken off altogether. The seed which result therefrom should be carefully saved by hand and planted the next year, observing the same rules as recommended for selection, and the same in the matter of fertilization and culture. (See cut 5.)



Explanatory

(1-2-3) represent the longest and best of our short-stapled varieties; (4) parent plants to the left, Russell's Big Boll-staminate (male) parent; to the right, Sea Island, pistilate (female) parent; (5-6) represent the best of the first generation of crosses; (7-8) the second generation; (9-10-11,12) the third generation including the four unnumbered ones below.

While this is not intended as an exhaustive treatise on the improvement of cotton, I trust enough has been said to guide and encourage every farmer to make a choice of one or the other of the methods set forth; if so, the crop will greatly increase in quality and quantity without any increase in the acreage planted.