Growing Cotton in Arizona

By G. E. Thompson and C. J. Wood

Tucson, Arizona, December, 1919
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Cotton should be cultivated as soon as the plants are through the ground well enough to make the row.
GROWING COTTON IN ARIZONA

By G. E. Thompson and C. J. Wood

TYPES OF COTTON

At the present time two general types of cotton are grown in Arizona—the American Egyptian, represented by the Pima variety, and the short staple, represented by the variety called Mebane's Triumph or Mebane and others more or less similar.

American Egyptian is so called because the original stock, from which our present strains were secured, came from Egypt. We are indebted wholly to the United States Department of Agriculture for the selection and development of the varieties now used in Arizona. Fiber of this cotton is longer and stronger than the fiber of the varieties commonly called short-staple cotton. The bolls are smaller, usually having three locks or parts instead of five, as is the case with short-staple cotton. In general the plants are larger and coarser, and the shape of the leaf is different, making it very easy to distinguish the two general classes under field conditions. The Salt River Valley and the Santa Cruz Valley are growing but one variety of cotton—the Pima variety of American Egyptian. The Yuma Valley and the Upper Gila Valley are growing principally short-staple varieties—Mebane’s Triumph being the most important one at the present time.

The discussions of this bulletin refer primarily to American Egyptian cotton. At the end of the bulletin those particulars in which short-staple cotton differs from long staple are given special mention.

SEED

Great pains to secure the best possible seed should be exercised by all who grow cotton. Seed of an inferior strain will result in a decreased yield and a poor quality of fiber. It is advisable for farmers to buy seed for planting purposes from responsible cotton growers’ associations. At least one of these associations at the present time (and others are preparing to do the same) make it a business through their cotton experts to produce and sell high-quality seed to members of the association. One of the associations now maintains, and the other associations should maintain, a separate gin for handling this cotton. Cotton seed that goes through the regular commercial gins is certain

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to be mixed more or less with inferior seed, and its use will in time result in decreased yields.

Those who have the time and who are especially interested in cotton breeding may find it worthwhile to grow a separate small field of cotton from which seed is selected for the following year's planting. On this special field great care should be taken to rogue out and destroy all plants of undesirable or inferior type and all plants that fail to produce a reasonable number of matured bolls. In addition to this general precaution, the fiber itself should be examined; and if any of the plants have produced fiber that is short and weak, they should be discarded. The seed that is to be used for planting purposes should be fully matured before the first freeze of consequence in the fall. Because early setting and maturing of bolls is very desirable in American Egyptian cotton, it is advisable to select seed from plants that show this character.

The average farmer in Arizona uses twenty-five to thirty-five pounds of seed per acre when planting cotton. Although one-half of this amount will give a sufficient stand if seed is good and soil and weather conditions are ideal, still it is advisable to use the amount indicated and later thin to the proper stand.

LAND ADAPTED TO GROWING COTTON

A rich sandy loam soil, well supplied with humus, is ideal for the growing of cotton. Very light sandy soils as a rule do not produce heavy crops of cotton. Heavy adobe soils are unsatisfactory because of the trouble experienced in securing a good stand, and because of the difficulty of irrigating properly. However, with good care, cotton can be produced upon practically any soil that is suitable for general farming.

PREPARATION OF LAND FOR PLANTING

Thorough preparation of the land for cotton pays, and pays well. Cotton is a cash crop. A good quality of clean, strong fiber brings a better price than fiber that is weak, dirty, or inferior for any other reason. Well-prepared land will produce more fiber, longer fiber, and stronger fiber than poorly prepared land. Cotton from a field that produces a heavy crop is easier to pick and keep clean and free from dirt and trash than cotton with small, poorly opened bolls. If land is to be properly prepared for cotton, the preparation should begin several months before the planting season. Coarse trash or other material on the ground must be chopped fine and plowed under or otherwise
Fig. 2—Good plowing—the first step in preparing a satisfactory seed-bed

Fig. 3—Poor plowing—with such plowing as this it is impossible to prepare a satisfactory seed-bed
put in such shape that it will not interfere with the cultivation of the cotton plants. The ground should be plowed rather deep (7 to 8 inches) as early as possible and allowed to weather till planting time. From five to ten days before planting, the ground should be thoroughly irrigated. This time should be just sufficient to allow the ground to dry out properly and be worked to a good seed-bed. Many farmers make a mistake in the preparation of their cotton land by not having sufficient moisture in the ground before planting. Water should be held on the land long enough to insure its being wet to a depth of four to five feet. Land left rough after plowing takes water better than land that has been disked and harrowed to a smooth surface. Land that has been irrigated when rough, particularly if it is of a heavy adobe type, should be harrowed with a spike-tooth harrow as soon as dry enough to permit of this treatment. This harrowing will save considerable moisture, knock off the tops of large clods, and fill the small depressions. The disk, followed by the spike-tooth harrow when necessary, can be used to work up a satisfactory seed-bed. An ideal seed-bed consists of about two and one-half inches of finely mulched surface soil with a firm and moist soil beneath. It is not advisable to plant cotton and "irrigate it up" because of the difficulty often encountered with the baking of the ground over the sprouting cotton seeds.

**PLANTING**

The time of planting cotton will vary somewhat with the kind of soil and with the locality of the State in which the planting is made. Recommendations differ greatly in this regard, but the consensus of opinion of the practical cotton growers is that the best time for planting in an average season is during the last ten days of March and the first ten days of April. Farmers handling sandy types of soil can plant one to two weeks earlier than those handling heavy or adobe types of soil. It pays to plant as soon as the ground is sufficiently warm to insure good germination and thrifty plants. Early plantings when the ground is cold often result in a thin stand and weakened plants; likewise early planting in cold ground, particularly if the days are warm and the nights cold, favors the development of the disease called "sore shin." Late plantings do not allow sufficient time for the plants to set and mature a large crop. The sooner the cotton can be planted after the ground is well warmed and danger of frost is past, the better the average results that will be secured. Cotton should be planted as shallow as possible and still get the seed deep enough into moist ground to insure good germination.
THINNING

The thinning of cotton is a question on which the best cotton growers hold widely differing opinions. We believe that the distance to which cotton plants are to be thinned should be governed largely by the soil. Heavy, rich land will stand thick plantings of cotton. Thin, light land should have cotton spaced relatively far apart. This thin planting, however, should not be carried to such an extreme that the land will not be utilized to its full capacity to produce. With heavy rich ground some cotton growers prefer that the plants be from six to ten inches apart. A few growers will prefer even less space than this. The average cotton grower with typical cotton land of the Salt River Valley will space his cotton from 12 to 18 inches apart in the row, with rows 3¾ feet apart. On thin poor land it may be advisable to increase the spacing to 24 or 30 inches. The purpose of thinning cotton is so to space the plants that they may have light, air, moisture, and plant food in such proportions that they will produce the maximum number of matured bolls per acre. Cotton given too much space is very likely to produce a large, coarse plant, from which the branches may be broken in the fall by heavy winds. Cotton given a reasonable spacing can stand more drying or more severe conditions and still recover than cotton closely spaced. American Egyptian long-staple cotton should be thinned on the sandy light soils when the plants are from four to eight inches high, and on the heavy rich soils when the plants are from eight to twelve inches high. On the extremely rich soils thinning can be delayed till the plants are fourteen to sixteen inches high.

Time of thinning has a great deal to do with the control of vegetative branches. The development of vegetative branches is undesirable in American Egyptian cotton. Early thinning encourages their development while late thinning discourages their development.

CULTIVATION

The cultivation of cotton should begin as soon as the plants are through the ground well enough to mark the row, and be continued every 10 to 15 days till the plants are too large to permit the use of a regular cultivator. Sometimes the cultivation can be continued by the use of a one-horse cultivator, especially in the wider spaced rows and on heavy soils that tend to bake. Early cultivation checks evaporation, warms the soil, and will kill weeds and grass at the stage at which they are most easily destroyed. It will also eliminate much hand work or hoeing. For the most part the early cultivations may be compara-
tively deep and reasonably close to the plant. Late cultivations must be shallow in order to avoid cutting and breaking numerous cotton roots.

IRRIGATION OF COTTON

The proper irrigation of cotton is the most important single item in the profitable growing of the crop. Even though all other conditions are right, if the irrigation is wrong the yields will not be satisfactory. Over-irrigation stimulates plant growth, and to a certain extent prevents the forming of cotton squares and the setting of bolls; while light irrigation encourages the setting of fruit and the dwarfing of the plant, which are highly desirable especially in the earlier stages of growth of American Egyptian cotton. However, this dwarfing of the plant is neither necessary nor desirable on light desert soils deficient in both nitrogen and humus. When a plentiful supply of water is suddenly applied, following a period when the plant has been suffering for water, it will cause a quick stimulation of growth and the plant will shed or drop much of the young fruit already set. It is best to withhold irrigation after planting as long as possible and still keep the plants in a growing condition. Cotton will not be injured by wilting slightly in the middle of the day, provided it fully recovers its fresh appearance by late afternoon or early evening, and provided there is enough moisture deep in the soil to encourage deep root penetration. As long as there is sufficient moisture in the ground to permit transpiration to maintain the leaves in a cool condition during the heat of the day, the plant is not suffering, but when the leaf feels warm to the hand irrigation must be immediately supplied. After cotton begins to bloom the moisture supply should be kept as uniform as possible. Cotton should be kept growing steadily, but excessive growth should be prevented. If examination during the blooming stages shows that the vegetative growth has practically stopped and the cotton is blooming to the top of the plant, water has been withheld too long. In other words, the terminal bud should be kept growing slightly in the lead of the flowers on the fruiting branches.

Prior to fruiting the desirable method is to give as little water as possible, forcing roots to penetrate deeply for soil moisture stored prior to planting. The system changes after the fruiting begins, and the purpose then is to maintain a thrifty and uniform though not rank growth.

PICKING

In Arizona, cotton picking is usually begun during the last half of September. It does not pay to begin picking until sufficient cotton
is open to allow the gathering of 500 to 700 pounds of seed cotton per acre at the first picking. In nearly all cases it will be advisable to pick the fields two or three times before the gathering of the crop is complete. Care should be taken in picking to see that no dirt, leaves, sticks, or other trash gets mixed with the fiber. It is extremely difficult to separate the dirt from the fiber in a roller gin, and dirty cotton always brings a low price. With short-staple cotton, leaves and other trash can be separated to a considerable extent. Saw gins are used with short-staple cotton.

VOLUNTEERING OR RATOONING

The volunteering or ratooning of cotton for two or three years in succession from the same planting was practiced in Egypt a good many years ago, but has been abandoned there. It has been tried in this

Fig. 4—Volunteer cotton (the 1919 crop from 1917 planting). Volunteering cotton does not pay

State with varying results. The practice is to be condemned for several reasons. In many seasons the volunteer stand of cotton is insufficient to produce a maximum yield. Usually the fiber produced from volunteer cotton is shorter and weaker than the fiber produced from cotton planted each year. In addition to these difficulties, the practice of volunteering cotton favors the increase of injurious insect pests and the development of troublesome cotton diseases. The practice has much to condemn it and very little to favor it. It is only under the most extreme or unusual conditions that the volunteering of cotton will pay.
Topping

The topping of cotton, or the pinching or cutting off the terminal buds, has been advocated and practiced by many as a means of preventing excessive plant growth and as a means of stimulating the formation of bolls. The results secured from this practice have been conflicting. In some cases, particularly on heavy rich ground, reports state that the practice has been profitable. Up to the present time no reports have been received showing that the practice is profitable on medium or thin lands. Properly grown cotton plants should not require topping. Uncontrollable conditions, such as a high water table or excessive rains, may make topping desirable. If topping is to be practiced at all, it is recommended that it be delayed until about the middle of August. Early topping, instead of checking plant growth, may stimulate the production of vegetative branches if growing conditions are favorable, while late topping ought to further the development of bolls already set.

Fertilizing Cotton

Considerable interest has developed in the last two years in the fertilizing of cotton. For the most part the desert soils in Arizona are deficient in nitrogen, and it is possible that on such soils nitrogen fertilizers may prove beneficial. Experience indicates that desert land that has been plowed and irrigated a number of times and brought into a condition of good tilth will produce better cotton than similar land that has received but little cultivation. This is shown by the fact that the second crop of cotton on desert soil is often better than the first crop. On old lands that have grown legumes for a number of years, if any fertilizer proves profitable, it will be one containing phosphorus. Nitrogen fertilizers probably will not pay on such lands. It is not advised that farmers buy phosphorus fertilizers or any other fertilizers on an extensive scale until they have first tried them on small plots in their own fields. Applications of 200 to 500 pounds of acid phosphate per acre at the time the cotton is planted promise to give beneficial results; yet several farmers who have made small tests failed to note appreciable benefits, and tests on the Salt River Valley Experiment Station have so far failed to give increases in yield.

During the last year many questions have been asked regarding the advisability of planting cowpeas in the growing cotton for the purpose of increasing the available nitrogen. This recommendation has usually been to the effect that the cowpeas should be planted about thirty days after the cotton is planted, and then destroyed about the
time the cowpeas are coming into full bloom. A more practical method is to plant the cowpeas at the time the cotton is planted, as this avoids the necessity of special irrigation to bring up the cowpeas. It is claimed that the planting of cowpeas in this way has a beneficial effect upon the growing cotton. In handling the cowpeas in this manner, it has been customary to plant two rows of cotton and the third row of cowpeas. We do not have accurate or conclusive information regarding the benefit of planting cowpeas with cotton. There is considerable evidence to prove that a legume crop may have beneficial effects upon a companion crop, but whether it will pay in the case of cotton remains to be proven. If cotton is planted in this manner, it should be considered an experiment and an accurate comparison should be made with the common methods of planting.

ANGULAR LEAF SPOT

Fortunately there are not many cotton diseases of serious consequence in Arizona at the present time. Probably the disease that has caused heaviest losses is one that farmers have observed but little, even though it may be present to a considerable degree. This is a disease called Angular Leaf Spot or Black Arm Disease of cotton. This disease attacks the plant in all stages of its growth, appearing on the younger plants as small dark angular spots on the leaves. Later the disease attacks the stems and fruit, showing as darkened, shrunkken spots. Control measures are still in the experimental stage, but there is evidence that control, at least in the seedling stage, can be effected by careful treatment of the seed before planting. If treatment of seed to control this disease is attempted, the following is recommended.

BICHLORIDE OF MERCURY TREATMENT FOR ANGULAR LEAF SPOT

Dissolve one ounce of bichloride of mercury in a small quantity of hot water, then mix into seven and one-half gallons of water. Dip the seed into this solution, stirring to make sure that it is thoroughly wet and allow to soak for one hour. Spread the seed out and dry thoroughly before putting into sacks.

Do not dip more than three lots of seed into the same solution, as each lot of seed weakens the solution.

Bichloride of mercury is a poison, and the solution should be destroyed in order that people or animals may not drink it by mistake.

Bichloride of mercury corrodes metal and solutions of it must not be placed in metal utensils. Wooden or earthenware vessels should be used.
COTTON ANTHRACNOSE

Cotton Anthracnose is a disease that has caused great loss in the south, but little if any in Arizona. Importation of cotton seed should be avoided, as this disease is carried on or within the seeds. No satisfactory methods of controlling this disease are known.

ROOT ROT

Root rot of cotton is a disease and lives over in the ground from year to year. The only practical known method of control on infected soil is to grow for at least two years in succession some crop not affected by root rot. Such crops are corn, the various varieties of sorghum, and the small grains, such as wheat, barley, etc. Alfalfa and certain other tap-rooted plants are subject to root rot and must not be grown when attempting to rid the ground of this disease. Since certain weeds may be affected by root rot, deep plowing and clean cultivation are recommended as control measures.

INSECT PESTS

Due largely to the strict quarantine that has been maintained, cotton boll weevil, pink boll worms, and many other troublesome insect pests of cotton have been kept out of Arizona. It is urged that every farmer within the State use his influence to help enforce this quarantine. If insect troubles of any kind are encountered, notify at once the Experiment Station at Tucson, or the State Entomologist's office at Phoenix. A complete discussion of cotton insect pests will be found in Bulletin 87 of this Station, which may be had on application.

COTTON IN ARIZONA AGRICULTURE

At the present time (1919) cotton is the most important cash crop in Arizona. It is unlikely that the present high price of cotton will be maintained indefinitely and farmers should bear in mind that any system of agriculture that is to be permanently successful must be well balanced. Cotton should not be grown to such an extent that other crops or livestock are reduced below a safe amount or number. It should be the aim of every good farmer to maintain the soil at all times in a high state of fertility and to this end an intelligently planned crop rotation must be followed.

SHORT-STAPLE COTTON

Short-staple cotton will mature in a shorter growing season than
American Egyptian cotton and therefore can be grown further north
and at higher elevations. The soil requirements and the preparation
of the seed-bed should be the same for the two classes of cotton.

Because of its shorter growing season short-staple cotton can be
planted one to three weeks later than American Egyptian. A smaller
amount of seed is required per acre—fifteen to twenty-five pounds being
sufficient.

The thinning of short-staple cotton should be done when the plants
are four to six inches high, and the plants are usually spaced from six-
teen to twenty-four inches in the row, with rows three and one-half
feet apart. With very rich soils, both the spacing between the plants
in the row and the distance between rows is increased.

The general principles applying to the irrigation and cultivation
of American Egyptian cotton apply to short-staple cotton.

**SUMMARY**

In growing cotton, good seed is extremely important.
A rich sandy loam soil, well supplied with humus, is ideal.
Early, deep plowing and thoroughly prepared of the land are
necessary.

The seed-bed should be wet to a depth of four to five feet.
Plant early, but not until the ground is sufficiently warm to in-
sure good germination and thrifty plants.

The character of the land should govern the rate of thinning.
Cultivation should begin as soon as the plants are through the
ground well enough to mark the row.

Proper irrigation is the most important single item in the growing
of cotton.
After planting, withhold irrigation as long as possible.
Prevent excessive growth.
The terminal bud should be kept growing slightly in the lead of
the flowers on the fruiting branches.
In picking, keep the cotton clean.
Volunteering cotton does not pay.
Report trouble with disease or insect pests to the Agricultural
Experiment Station, or the State Entomologist.
Do not allow the soil to become depleted; practice crop rotation;
maintain a balanced agriculture.