CIR. 434

by Wesley Chaffin
and Henry Dunlavy

COTTON IN OKLAHOMA

EXTENSION SERVICE, A. AND M. COLLEGE
SHAWNEE BROWN, DIRECTOR STILLWATER

Contents

Cotton in Oklahoma

by

WESLEY CHAFFIN and HENRY DUNLAVY*

INTRODUCTION

Cotton was one of the first crops planted by the pioneers in Oklahoma, and the early history of the state shows that cotton growing was a very profitable enterprise. As new lands were broken out and put in cultivation, more cotton was planted, and it soon became the state's leading cash crop.

In 1900, cotton occupied 756,000 acres of land from which 357,000 bales were harvested. The acreage steadily increased until 1925 when 5,396,000 acres were planted. Since 1925 the acreage devoted to cotton has gradually declined until in 1945 only 1,179,000 acres were harvested. Cotton production has declined from the record crop of 1,773,000 bales in 1926 to 285,000 bales in 1945.

Cotton is still the most important cash crop in the southern part of Oklahoma. It ranks second only to wheat in money value in the entire state. A comparison of the acreages and values of the state's three leading cash crops—wheat, cotton, and corn—is shown in the following table:

TABLE 1.—Comparison of Acreage and Value of Cotton, Wheat, and Corn Grown in Oklahoma.

CROP	ACREAGE 1934-43 (10-yr. Avg.)	ACRES		VALUE	
		1944	1945	1944	1945
Wheat	4,044,000	4,773,000	5,432,000	$119,420,000	$104,248,000
Cotton	1,979,000	1,425,000	1,306,000	72,935,000	35,784,000
Corn	1,814,000	1,831,000	1,465,000	37,243,000	30,734,000

The value of cotton seed is sometimes underestimated. Each 1500 pounds of seed cotton will yield approximately 500 pounds of lint, 130 to 140 pounds of oil, 400 pounds of cake or meal, 80 pounds of linters, and 150 pounds of hulls.

The seed is a major source of vegetable oil which is used in the manufacture of shortening, oleomargarine, salad dressings, and other food products. It is also used in the manufacture of soaps. The cake and meal are used to supplement the state's vast grazing areas and to balance the rations of livestock on many farms.

* Respectively, Agronomist, Oklahoma Extension Service; and Agronomist, Oklahoma Agricultural Experiment Station, Stillwater.

WHAT KIND OF COTTON SHOULD OKLAHOMA GROW?

Most farmers are familiar with the combination of cattle characteristics that we call Hereford, and their ability to describe the breed is rarely limited to the white face. The words "variety" and "breed" are often used interchangeably; however, "variety" is usually applied in the case of plants or crops and "breed" in identifying groups of animals.

Too few cotton growers have a thorough understanding of what constitutes a variety of cotton. The knowledge of some is limited to the fact that a given variety has "a good turn out," "a large boll" or is "early maturing."

A full and complete description of a variety of cotton will include such characteristics as (1) yielding ability (of both lint and seed), (2) lint percentage, (3) length, strength, uniformity, fineness and quality of fiber, (4) boll size, (5) earliness, and (6) plant type. All of these characteristics are affected by soil and weather conditions, but distinct varieties will be contrasted by a definite difference in one or more characteristics when grown under similar conditions.

It is easier to describe the **kind** of cotton that should be grown in Oklahoma than to answer the question, "What variety should be grown?" There are a few characteristics that are of paramount importance in a good variety. A distinct variety always differs from another in one or more characteristics, though in others they may be similar.

The kind of cotton that is most desirable to grow in Oklahoma may be described as follows:

(1) It **must** be a high yielder. A good variety is always a high yielder, but a high yielding variety is not always a good one.

(2) Lint percent or gin turnout is not as important as it is often considered. Lint percent is merely the proportion that exists between the weight of lint and the weight of seed. It has no fixed relationship to acre yield or quality of fiber. A high linting cotton costs less **per bale** for picking and ginning, but the producer is more interested in the **net income per acre** than in the income per bale. He is concerned with the number of times he goes to the gin as well as with what he gets when he makes the trip. The lint turnout should be as high as possible without sacrificing yield or quality of fiber.

(3) Length of staple must be considered from the viewpoint of market demand and its relationship to yield and other characters.

(a) Generally speaking, western Oklahoma should grow the kind of cotton that will produce a staple length of 15/16 inch under favorable weather conditions, and of 7/8 inch under dry or otherwise unfavorable conditions. In the eastern part of the state, this range should perhaps be widened to embrace 7/8 to one inch staple.

(b) Tensile strength of Oklahoma cotton should be from 85,000 to 95,000 pounds per square inch of fiber.

(c) A good kind of cotton will produce a uniform length staple from year to year, on good soil and on poor. True, it will be shorter in a dry year, but it will not produce 15/16 cotton one year and 13/16 the next.

(d) Western Oklahoma should produce a rather hard bodied cotton, while the east can profitably grow a finer or more silky fiber.

(e) A good kind of cotton should have that undefinable quality of character. Character in cotton is felt and not described, but it has to do with those attributes that improve the spinning quality of the fiber.

(4) Relatively large boll size is important to the hand picker, but like lint percent it should not be overemphasized. Other characters being equal, a large boll cotton is desirable, but even this rule may change as mechanical harvesting becomes more prevalent. Sometimes the lint of large boll varieties does not stay in the bolls well.

(5) Earliness is a relative term and is often overemphasized. It is impossible, for example, to say that one variety is a week earlier than another. One variety may be 50% harvested early in the season as compared to only 20% for another, but no one would say that the first variety was the best if the first picking weighed 100 lbs, as compared with a like amount for the second variety. Early and rapid blooming is important, and a good rule for earliness is that the variety should start blooming early and continue blooming rapidly.

(6) Plant type is important only because the plant is the framework on which the seed and fiber are borne. A good variety of cotton has been described as one having "the maximum fruitation and minimum plant growth." A variety that produces large branches at the expense of fiber and seed is not desirable. Large spreading, leafy plants are grown at the expense of fruit; they mature late, harbor insects, and are more difficult to destroy at the end of the season.

A BRIEF DESCRIPTION OF VARIETIES

The following table gives a brief description of thirteen varieties of cotton that are commonly grown in Oklahoma. By far the greater portion of the state's cotton acreage is planted to these varieties. The characteristics of yield, fiber length, strength, uniformity and boll size are described in terms of "excellent," "good," "medium" and "low" or "small" (for bolls) and are applied to the range of differences between the high and low varieties. The classifications were determined by analyzing variety test records of the Oklahoma Agricultural Experiment Station. "Excellent" represents the top quarter in the tests, "good" the upper half, "medium" the lower half, "low" or "small" the lower quarter. Lint turnout is given in average lint percent and length of staple in average lengths in thirty-seconds of an inch. In reading staple, 32 means an inch (32/32), and 31.5 would be a staple midway between 31/32 and one inch. It should be realized that these descriptions apply only to the varieties included in the table and that a "low" yielding variety will perhaps have a good yield when compared to some other variety not in the list.

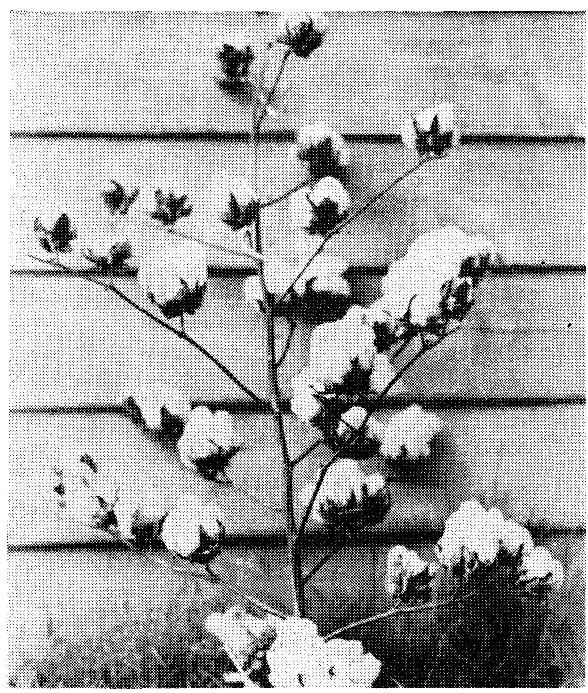

FIGURE 1—A very desirable type of cotton plant. Medium size and comparatively close fruiting habits are especially important in machine harvesting.

TABLE 2.—Description of Thirteen Varieties of Cotton for Oklahoma.

	ACRE YIELD			FIBER CHARACTERISTICS			Boll Size	Lint %
	Lint East	Lint West	Seed State	Average Length	Strength	Uniformity		
Stoneville 62	Ex	Ex	Ex	31.5	Good	Med	Med	36.2
Hi-Bred	Ex	Good	Med	26.8	Good	Med	Med	40.7
Mebane 140	Good	Good	Good	28.9	Ex	Good	Med	37.8
Deltapine	Good	Good	Med	32.3	Med	Low	Small	39.1
Acala 892	Good	Good	Good	31.1	Ex	Good	Good	36.7
Okla. Triumph 92	Good	Med	Good	30.8	Med	Good	Small	35.9
Rowden	Good	Med	Ex	30.8	Good	Med	Good	34.2
Stoneville 2B	Med	Med	Ex	32.7	Good	Low	Med	34.2
Acala 6566-18	Med	Med	Low	30.1	Good	Ex	Small	39.0
Northern Star	Med	Med	Med	32.0	Ex	Good	Good	36.3
Lankart	Med	Good	Med	31.8	Good	Low	Large	36.6
Watson Mebane	Med	Med	Med	30.3	Low	Ex	Large	36.3
Acala 8	Low	Low	Low	33.2	Med	Good	Good	37.2

PERFORMANCE OF VARIETIES IN OKLAHOMA

The Office of Cotton Improvement of the Oklahoma Agricultural Experiment Station has conducted extensive cotton variety tests since 1939. The results of these tests have been analyzed from the standpoint of some of the characteristics listed on pages 4, 5, and the acre value of each of the varieties has been calculated. The tests were conducted in both eastern and western Oklahoma in the years 1942 to 1945, inclusive, and the results are summarized in Table 3, page 9. The data include acre yield of lint and seed, gross acre value, cost of picking and ginning, and net acre value (gross acre value less cost of picking and ginning). The net acre value expresses in one figure the interaction and relationship of all of the characteristics except boll size and tensile strength. For further information in connection with the data presented in Table 3, see Okla. Agri. Exp. Sta. Cir. No. M-157 entitled, "Oklahoma Cotton Variety Tests for 1944-1945."

TABLE 3.—Performance of Varieties in Oklahoma

VARIETY—	Acre Yield LINT		Acre Yield SEED		Total Acre Value LINT & SEED		Total Acre Expense GIN, B & T		Net Value Per Acre	
	East	West	East	West	East	West	East	West	East	West
Stoneville 62	452	353	797	622	109.43	85.44	30.92	24.14	78.51	61.30
Hi-Bred	442	331	644	482	99.02	74.15	27.09	20.28	71.93	53.87
Mebane 140	419	325	689	535	99.10	76.89	27.51	21.35	71.59	55.54
Deltapine	418	325	651	506	99.04	77.00	26.59	20.67	72.45	56.33
Acala 892	416	327	718	564	100.36	78.88	28.10	22.08	72.26	56.80
Okla. Triumph 92	412	294	736	525	100.02	71.37	28.41	20.26	71.61	51.11
Rowden	396	292	762	562	97.50	71.90	28.57	21.08	68.93	50.82
Stoneville 2B	385	309	741	605	94.38	76.00	27.78	22.54	66.60	53.46
Acala 6566-18	383	309	599	483	91.20	73.57	24.43	19.70	66.77	53.87
Northern Star	377	295	662	518	91.20	71.36	25.73	20.13	65.47	51.23
Lankart	373	319	646	553	90.00	76.99	25.24	21.60	64.76	55.39
Watson Mebane	367	297	644	521	89.13	72.13	25.04	20.26	64.09	51.87
Acala 8	337	269	569	454	80.62	64.34	22.46	17.93	58.16	46.41

FIGURE 2—A. Stoneville 2B Cotton. B. Stoneville 62—An improved strain of Stoneville 2B cotton developed at the Oklahoma Experiment Station.

SOIL REQUIREMENTS

Cotton has a rather wide range of adaptation to soil types, but it will usually do best on sandy loam, loam, and silt loam soils. The soils should be well drained and in good physical condition. They should be well supplied with organic matter and at least of medium fertility. Shallow, badly eroded soils and soils of very low fertility are not suited for cotton production. Cotton should be planted on the best land available, considering the needs of other crops.

SEEDBED PREPARATION

Thorough preparation of the seedbed is an important factor in cotton production. A seedbed that is firm, free of weeds, and well supplied with moisture is essential. Methods of preparation vary in different parts of the state and even on different soil types in the same area. The character of the soil, weather conditions, and the kind of equipment available will largely determine the method of seedbed preparation.

Extra time spent in properly preparing the seedbed for cotton will make cultivation easier and will reduce the amount of labor required in producing the crop.

The first step in the preparation of a good seedbed for cotton is the proper handling of the vegetation on the land. If the previous crop was cotton, corn, or grain sorghum, a stalk cutter may be used to cut the stalks before the land is plowed or listed. This is particularly important when plowing or listing is delayed until spring. The finely cut stalks will be easier to incorporate into the soil and will cause less trouble in cultivating the cotton crop.

In southwest Oklahoma the land is usually prepared by listing, and the cotton is planted in lister furrows. On sandy soils which are subject to serious wind or water erosion, listing may be delayed until spring. Land on which erosion is not a serious problem should be listed in the fall or as soon as possible after the previous crop is harvested. It should then be relisted when weed growth starts in the spring or at least 30 days before planting time. A lister planter may be used to plant the seed in furrows of medium depth. If moisture conditions are not favorable, deeper planting may be necessary in order to place the seed in moist soil. When heavy rains come soon after the cotton is planted, soil may be washed into the furrows covering the seed too deeply for germination, or a crust may form which will prevent the emergence of the seedling plants. This can be partially prevented if the cotton is planted in such way as to leave the old lister furrows to serve as water furrows between the cotton rows. In planting cotton, it is sometimes desirable to use small solid sweeps on the planter instead of the regular lister bottoms. In moist soils, the sweeps will open furrows of sufficient depth for planting without completely filling the old lister furrows which remain as water furrows. This will reduce soil washing and will also lessen the amount of water which would otherwise collect in the rows. The chances of getting a stand are often improved where water furrows are used.

Level, or gently rolling soils containing a high percentage of clay and which are not subject to serious erosion, should be plowed in the fall or early winter. The disc or field cultivator or both may then be used for surface tillage to control weed growth, conserve moisture, and prepare a firm, uniform seedbed. The cotton may be planted level or in furrows of medium depth, preferably with water furrows between the rows.

The U. S. Field Station at Lawton conducted extensive studies in methods of seedbed preparation for cotton during the period 1917 to 1930. In these studies fall plowing gave only slightly higher acre yields than spring plowing. This was particularly true when cotton followed cotton, wheat, or cowpeas in the rotation. When cotton followed corn, fall plowing increased the average yield of lint 51 pounds per acre or nearly 21 percent. Listing was less satisfactory than plowing as a method of preparing the land for cotton. As compared with the average yield on fall plowed land, listing showed a loss of 71 pounds of lint cotton per acre. These experiments were conducted on upland soil which is classified as fine sandy loam.

The Oklahoma Experiment Station has conducted experimental work at Stillwater, Lone Grove, Granite, and Heavener on methods of planting cotton. In practically all of the tests level planting gave highest yields while planting in deep lister furrows gave the lowest yields. The results of these tests are shown in Table 4, page 14.

In central and eastern Oklahoma it is a common practice to plant cotton in shallow furrows or on the level. Planting on beds is usually necessary when cotton is planted on poorly drained soils.

Well drained soils which are not subject to severe erosion should be plowed in the fall or as soon as possible after the previous crop is harvested. On land which is subject to severe erosion when not properly protected, plowing may be delayed until late winter, preferably January or early February. Surface tillage to control vegetation, conserve moisture, and prepare a firm seedbed may be done with the disc harrow, field cultivator, or other suitable implements. The planter should be equipped with knife, disc, or sweep furrow openers. It is preferable to make water furrows by using outside sweeps at the time of planting; or, with a cultivator before or after planting.

The land is sometimes plowed in the fall or winter and listed in the spring. Spring listing is particularly adapted to fields having a heavy growth of vegetation which might be difficult to destroy with surface tillage implements. The lister ridges are harrowed or otherwise worked down to shallow beds before planting. The cotton is planted on the low, flat beds leaving the lister furrows to serve as water furrows between the cotton rows.

Heavy bottom soils should usually be plowed in the fall or early winter and listed in the spring in preparation for cotton. The ridges should be harrowed down immediately before planting.

Flat, poorly drained soils may be listed in the fall and relisted in the spring. Listed land dries out more rapidly, warms up sooner, and is in condition for planting at an earlier date. This is a distinct advantage, particularly in weevil infested areas.

TIME OF PLANTING

Cotton may be planted as soon as the soil is warm and the danger of frost is over. It is a common practice to plant in Oklahoma between May 1 and May 15. In the southwestern part of the state, cotton is sometimes planted as late as June 10. Experiments conducted by the Oklahoma Experiment Station to determine the proper time for planting indicate that these dates are satisfactory. The results of the experiments are summarized in Table 4.

TABLE 4.—Yields of Seed Cotton (lbs./acre) for Stated Methods and Dates of Planting.

Method—	Perkins Date	Av. 8 Yrs. 1926-1933	Lone Grove Date	Av. 4 Yrs. 1930-1933	Heavener Date	Av. 3 Yrs. 1931-1933	Granite Date	Av. 8 Yrs. 1926-1933
Level	Apr. 14	800	Apr. 10	596	Apr. 17	320	Apr. 17	667
Ridged		701		573				
Listed		518		556				592
Level	Apr. 22	1101	Apr. 17	470	Apr. 24	294	May 2	918
Ridged		980		602				
Listed		875		517				940
Level	Apr. 29	1108	Apr. 24	652	May 1	312	May 10	901
Ridged		1036		641				
Listed		921		633				782
Level	May 6	1109	May 1	739	May 8	385	May 20	852
Ridged		1076		713				
Listed		1021		695				865
Level	May 13	1277	May 8	714	May 15	370	June 1	919
Ridged		1178		668				
Listed		952		636				783
Level	May 20	1004	May 15	726	May 22	396	June 10	643
Ridged		981		687				
Listed		833		613				565
Level	May 27	793	May 22	568	May 29	285		
Ridged		788		693				
Listed		531		546				
Level	June 3	584	May 29	582	June 5	205		
Ridged		591		629				
Listed		473		533				

At both Stillwater (Perkins) and Lone Grove, May 1 to May 15 plantings have given highest yields. At Heavener, the optimum planting date was April 15 to May 25, and at Granite, May 1 to June 1.

RATE OF PLANTING

The rate of planting cotton seed will vary according to the kind of seed used, method, physical condition of the soil, and weather conditions. Heavy rains sometime cause the soil to become packed after planting and it may take the combined strength of several plants to break the crust and push through the soil. Planting with a hill drop planter is often advantageous. If a harrow is to be used for the first cultivation, thicker planting is advisable to allow for plants which may be destroyed.

It is a common practice in Oklahoma to plant 2 to 4 pecks of seed per acre. In the western part of the state, 2 pecks per acre will usually be sufficient while in the eastern section a higher rate of planting is generally used.

When delinted seed is used, less seed will be required. Only 12 to 15 pounds of mechanically delinted seed or 8 to 10 pounds of acid delinted seed will be needed to plant an acre.

DEPTH OF PLANTING

The depth of planting cotton will depend to a large extent upon the physical condition of the soil and weather conditions which may reasonably be expected following planting. If cotton seed is planted too deep or if a hard crust forms on the surface, the young seedlings may not be strong enough to get out of the ground. The seed should never be planted deeper in the soil than is necessary to place it in contact with sufficient moisture for germination. Very shallow planting, in which part of the seed is left on the surface uncovered, is not advisable. The seed should usually be covered to a depth of one-half to one inch in moist soil. In sandy soil press wheels should be used while in clay soils cover plows are more satisfactory.

CHOPPING

Cotton should be chopped and thinned to the desired stand as soon as it is safe from cold or other adverse conditions. This will generally be when the plants are 4 to 6 inches high and are putting on the third pair of leaves. If chopping is delayed beyond this period, development of the cotton plants is often retarded and the yields reduced.

SPACING

The proper spacing of cotton is determined by the fertility of the soil, the amount of rainfall, and the prevalence of boll weevil infestations.

The spacing should generally be closer on soils of medium to low fertility than on soils of high fertility. Slightly wider spacing may be more satisfactory on fertile bottom soils and on soils in low rainfall areas.

In spacing tests conducted by the U. S. Cotton Field Station at Greenville, Texas, highest yields were obtained on the black lands in that area when the plants were spaced less than 12 inches apart in the row. Several stalks in the hill produced more than one stalk when the hills were more than 12 inches apart. The percentage of lint and the length of lint were apparently not affected by the closer spacing, but the size of the bolls was slightly reduced. These tests indicate that cotton plants are frequently spaced too far apart in the row to obtain maximum yields.

In spacing tests conducted by the Oklahoma Experiment Station near Ardmore, there were only slight differences in yields when hills were spaced at intervals varying from 6 inches to 30 inches. In general, most satisfactory results were obtained from 12- to 24-inch spacings with 2 to 4 plants in the hill. At Chillicothe, Texas, highest yields were obtained when the plants were spaced 18 to 30 inches in the row, although there was very little difference in yield when the spacing varied from 12 to 30 inches.

The fruiting branches on closely spaced plants are short and the crop is produced on the first few nodes of the branches. Consequently, closer spacing promotes the early setting of squares and thus hastens maturity.

Closer spacing is important under boll weevil conditions since it limits vegetative growth, reduces size of plants, and hastens maturity. Small plants make the application of poison more efrective and economical. They also admit more sunlight to the middles between the rows. The immature weevils are thus exposed to the intense heat of the sun on dry, hot soil and are destroyed in large numbers.

In western Oklahoma, cotton should usually be spaced 12 to 24 inches in the row with 2 to 3 stalks in the hill. Also, on fertile bottom soils in the central and eastern sections, spacing the hills 12 to 24 inches in the row with 2 to 3 stalks in the hill is recommended. On soils in this area which are medium to low in fertility, spacing the hills 12 to 18 inches in the row with 2 to 3 stalks in the hill is usually satisfactory.

CULTIVATION

Early cultivation of cotton to destroy weeds and grass, loosen the soil, and conserve moisture is important. Cultivation should begin as soon as the cotton is up to a good stand. A rotary hoe or a light harrow may sometimes be used for one or two early cultivations, particularly if a heavy crust has formed. For this purpose the rotary hoe is usually preferable to the harrow since the latter implement does not work satisfactorily on land where there is a considerable amount of trash or crop residues on or near the surface.

The Oklahoma Experiment Station has recently designed a rotary hoe assembly which is adapted for row cultivation of cotton and other crops. It can be used to break crusts and loosen the soil along both sides of the row and thus aid in getting stands of cotton. The use of this implement after heavy rains may frequently mean the difference between getting a good stand and replanting. It may also be used for one or two early cultivations to loosen the soil and destroy weeds and grass in the row which will reduce the amount of hoeing required.

The first cultivation of cotton is usually done with a disc-sled cultivator or a field cultivator equipped with small sweeps and fenders. This makes it possible to destroy weeds, loosen the soil and throw finely pulverized soil along the row without covering the young plants. The disc-sled cultivator is especially well suited for the cultivation of cotton planted in lister furrows. Immediately after the cotton is chopped it should be cultivated to destroy weeds and throw loose soil into the rows and around the plants. Cotton should be cultivated as often as is necessary to control weeds and conserve moisture. The first cultivation may be deep if necessary to loosen the soil and destroy weed growth, but all subsequent cultivations should be shallow, using care not to cultivate too close to the plants.

There are several different types of cultivators in general use, most of which are satisfactory for cultivating cotton. Timeliness of cultivation and thoroughness with which the job is done are of greater importance than the particular type of cultivator used. Cultivators are usually equipped with sweeps for cultivating cotton as they are more effective than shovels in loosening the soil and destroying weeds. The size and number of sweeps should be such as will cultivate all of the soil between the rows and cover any weeds and grass growing in the rows.

Under boll weevil conditions it is very important to keep the soil in a fine, loose condition and to keep down all weeds and grass which might provide shade or protection for the young weevil in the punctured squares which are on the ground. If the middles are left slightly lower than the rows, there is a tendency for the fallen squares containing young weevil larvae to roll away from the cotton plants and out into the open space between the rows. The heat of the sun in the open middles rapidly dries out the squares and destroys large numbers of immature weevils. This is perhaps the most effective cultural practice in boll weevil control.

FERTILIZERS FOR COTTON

Response from the use of commercial fertilizers in connection with the growth of cotton will depend primarily upon the amount and distribution of rainfall, the fertility and physical condition of the soil, and tillage practices.

Research studies conducted by the Oklahoma Experiment Station indicate that one pound of fertilizer will produce approximately one pound of seed cotton under average conditions in eastern Oklahoma when the rate of application does not exceed 200 pounds an acre.

Some of the sandy and sandy loam soils in central and eastern Oklahoma contain sufficient quantities of nitrogen to produce good cotton stalks but are low to very low in available phosphorus. On these soils an application of 150 to 200 pounds of superphosphate an acre will produce a profitable increase in yield in normal seasons.

When cotton does not produce a vigorous vegetative growth and the plants are not large enough in size to produce high yields, a mixed fertilizer containing nitrogen should be used. A 4-12-4 fertilizer for medium- and fine-textured soils and a 5-10-5 fertilizer for sandy soils applied at the rate of 150 to 200 pounds an acre are recommended.

When cotton is grown on soils which are deficient in potash, the plants are usually affected with leaf rust. On sandy soils in central Oklahoma which are not deficient in potash, an application of 200 pounds an acre of a 4-12-0 fertilizer may be used. In areas where cotton is affected with wilt or with leaf rust, an application of 200 to 300 pounds an acre of a 4-8-12 or 8-8-8 fertilizer is recommended.

Cotton does not respond profitably to fertilizer treatment when grown on eroded or shallow soils with dense clay subsoils or in regions which receive limited rainfall. Some of the sandy soils in western Oklahoma are deficient in available phosphorus, but since soil moisture is usually the first limiting factor in plant development a profitable response from fertilizer applied on these soils can be expected only when the rainfall is above the average during the growing season.

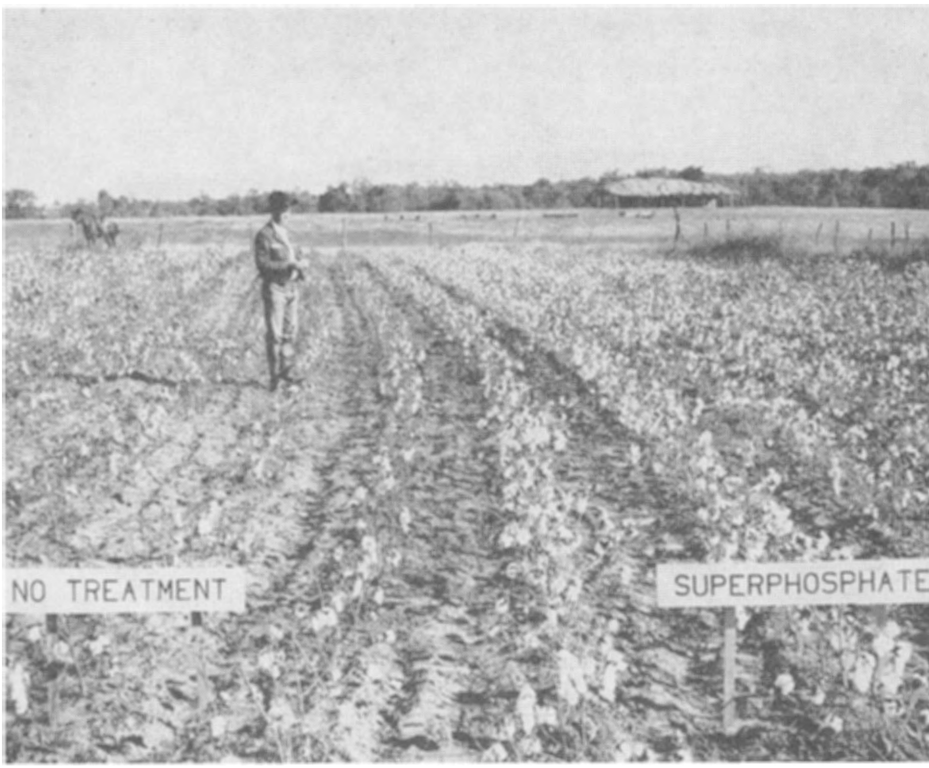

FIGURE 3—Effect of Superphosphate on Cotton.

The unfertilized plot at the left produced 233 pounds of seed cotton an acre. Superphosphate (45% P_2O_5) applied at the rate of 100 pounds an acre produced 645 pounds of seed cotton per acre on the plot at the right. (Oklahoma Experiment Station Bulletin No. B-279, "Commercial Fertilizers for Oklahoma Crops".)

ROTATIONS FOR COTTON

Cotton should be grown in rotation with a legume crop to maintain a good supply of organic matter and nitrogen and to keep the soil in good physical condition. Rotation of crops will also aid in controlling insects and plant diseases and will reduce soil losses due to erosion.

When cotton or other clean tilled crops are grown continuously on sloping land, serious losses of soil are likely to occur. In experiments conducted at the Red Plains Conservation Experiment Station at Guthrie from 1930 to 1941, inclusive, the soil loss on land farmed to cotton continuously was 4.4 times greater than on land in a 3-year rotation of cotton, wheat, and sweet clover. Crops differ widely in erosion resistance. Land in wheat lost only 1.59 tons of soil annually, and sweet clover reduced the loss to less than one-half ton of soil a year. Land grown to cotton continuously lost 16.06 tons of soil annually compared to an average loss of 3.64 tons for the rotation.

Cotton should be grown in a balanced system of farming and should be considered as only one of several sources of cash income. This can be accomplished by setting up a regular rotation for each field on the farm. The crops included in the rotation may vary in different fields depending upon soil conditions.

For convenience in planning suggested rotation systems, the cotton producing section of the state may be divided into three regions as follows: (1) Southwest, (2) South Central, and (3) Eastern and Southeastern.

Region 1—Southwest

On deep, well drained bottom soils a rotation of alfalfa and cotton is quite satisfactory. The alfalfa will usually produce profitable yields for several years, after which it may be followed by cotton three or four years. The alfalfa serves as a cash crop and provides legume hay for feed. It also adds organic matter and nitrogen to the soil.

On bottom land where alfalfa is not grown, a rotation consisting of oats or barley and sweet clover the first year, sweet clover the second year, and cotton two years would make an excellent cropping plan for maintaining soil fertility. If annual sweet clover is used, the rotation might consist of sweet clover one year and cotton two years.

On sandy soils a three-year rotation of cotton, sorghums, and cowpeas is suggested. Cotton is the main cash crop for sandy soils, the sorghums provide feed, and cowpeas will add organic matter and nitrogen to the soil if the vines are turned under. Golden mungbeans may be substituted for cowpeas in this rotation if desired.

On sandy soils which are well supplied with lime and phosphorus a three-year rotation consisting of cotton, sorghums, and annual sweet clover may be used.

Where cotton is grown on deep, permeable upland soils a rotation consisting of oats or barley and sweet clover the first year, sweet clover the second year, and cotton two years is recommended. In drilling the oats or barley it may be necessary to leave three holes in the drill box open and close two in order to provide more moisture and sunlight for the development and growth of the young sweet clover plants.

Region 2—South Central

Many of the soils in south central Oklahoma are highly susceptible to erosion when planted continuously to cotton or other clean cultivated crops. The control of erosion, the application of lime and phosphate fertilizer on mineral-deficient soils and the use of adapted legumes in the cropping system are essential in improving soil fertility and increasing cotton yields in this area. Suggested rotations for sandy soils and for medium- and fine-textured soils are as follows:

Sandy Soils

(1) First Year — Oats, Sweet Clover
Second Year — Sweet Clover
Third Year — Corn or Sorghum
Fourth Year — Cotton

(2) First Year — Peanuts, (Rye seeded in fall)
Second Year — Rye, followed by Sorghum
Third Year — Cowpeas, followed by Vetch
Fourth Year — Vetch, followed by Cotton (Vetch turned under)

(3) First Year — Cotton, (Vetch seeded in fall)
Second Year — Vetch, Peanuts, (Rye)
Third Year — Rye, Cotton (Rye pastured off)

Medium- and Fine-Textured Soils (Soils containing a high percent of clay)

(1) First Year — Oats, Sweet Clover
Second Year — Sweet Clover
Third Year — Corn or Sorghum
Fourth Year — Cotton

(2) First Year — Cotton
Second Year — Oats, (Alfalfa seeded in fall)
Third Year — Alfalfa (3-4 years)
Fourth Year — Corn (2 years)

(3) First Year — Cotton, (Vetch seeded in fall)
Second Year — Vetch, Followed by Sorghum or summer legume crop for feed.
Third Year — Corn

Region 3—Eastern and Southeastern

On well drained bottom lands and stream terraces where the soils are deep and permeable, a rotation consisting of oats, alfalfa, corn, and cotton may be used. The oats will be harvested in May or early June, and the land can be plowed immediately for fall seeding of alfalfa. The alfalfa will be left on the land as long as it maintains a good stand. Following the alfalfa, two crops of corn may be grown. The corn may be followed by cotton for two years. Other suggested rotations are as follows:

(1) First Year — Cotton (to be fertilized)
Second Year — Oats with lespedeza, or
Oats, followed by cowpeas or mungbeans
Third Year — Corn with cowpeas (alternate row effect)

(2) First Year — Oats, Sweet Clover
Second Year — Sweet Clover, (fall Spinach or Beans)
Third Year — Cotton

(3) First Year— Cotton, (Vetch planted in fall)
Second Year — Vetch, followed by a Sorghum or summer legume crop for feed.
Third Year — Corn

Upland Soils

Most of the upland soils in this region will require the use of lime and phosphate fertilizer for the successful growth of sweet clover, vetch, and other lime-loving legumes.

(1) First Year — Oats with lespedeza, or
Oats, followed by cowpeas or mungbeans
Second Year — Corn interplanted with cowpeas
Third Year — Cotton

(2) First Year — Oats, Sweet Clover
Second Year — Sweet Clover
Third Year — Corn
Fourth Year — Cotton

SEED TREATMENT

When cotton seed is planted, the young seedling plants may be attacked by plant diseases, which cause rotting of the seed and injury to young plants before or soon after emergence. These diseases are caused by parasitic fungi which live on the seed and in the soil. The planting of infested seed, or the planting of clean seed in infested soil often results in poor germination, thin stands, and weak plants.

Treating with chemical dusts gives the cotton seed and young seedlings some protection against these soil and seed-borne diseases. It often improves germination and produces a more uniform stand of healthy, vigorous plants. This is particularly true when poor growing conditions such as a cold, wet period follows planting. Under such conditions, seed treatment may sometimes mean the difference between getting a good stand and replanting.

The chemical dusts commonly used for treatment of cotton seed are New Improved Ceresan and 2% Ceresan. These chemicals can usually be purchased at local seed stores. The dusts are used at the rate of 1 to 1½ ounces of New Improved Ceresan or 2 to 3 ounces of 2% Ceresan per bushel of seed. The dust may be applied with a homemade revolving barrel treater. Directions for making and using the treater can be obtained from the county agent. Commercially operated seed cleaning and treating machines are available in many sections of the state.

Cotton seed treatment is rapidly becoming a regular practice in Oklahoma, and a high percentage of the cotton acreage each year is planted with treated seed. The cost of seed treatment is only a few cents an acre. It may be considered as a low-cost form of insurance that minimizes the hazards of getting a stand under unfavorable weather conditions.

CAUTION: New Improved Ceresan and 2% Ceresan are mercury dusts and are very poisonous to livestock and human beings. A dust mask or handkerchief should be worn over the nose to avoid inhaling the dust while treating seed with these chemicals. Handling dusted seed with bare hands may cause a skin irritation or burning. The hands and face should be thoroughly washed as soon as the seed dusting is completed. If more seed is treated than is needed for planting, it should be put in bags, labeled, and held over for planting the following year. It should not be fed to livestock nor crushed for oil.

DELINTING COTTON SEED

Cotton seed may be mechanically delinted by the use of specially constructed delinting machines. The delinted seed is more easily graded, plants more uniformly, and germinates more quickly than ordinary seed. Mechanical delinting does not destroy disease germs on the seed nor protect it from those which are in the soil; therefore, it does not eliminate the need for seed treatment. Delinted seed is more easily treated than fuzzy seed and less chemical is required. A moderate degree of delinting followed by seed treatment is recommended as a good practice to improve the physical condition of planting seed. Very heavy delinting may result in cutting and breaking the seed coats so that germination of the seed will be seriously injured. Under these conditions chemical treatment may do more harm than good.

Chemical delinting of planting seed removes all of the linters. It destroys the germs of diseases which are carried on the lint and the seed coats. The seed can be planted more easily and less seed is required. Chemically delinted seed should be dusted to give further protection against soil-borne diseases.

COTTON DISEASES

Cotton is affected by several diseases which cause serious losses each year. The most destructive of these diseases are Cotton Root Rot, Wilt, Bacterial Blight or Angular Leaf Spot, and Seedling Blight.

Cotton Root Rot

Cotton root rot is found in Oklahoma in the two tiers of counties extending along the Red River. It constitutes a serious problem in growing cotton and legume crops in this area.

The disease is characterized by widespread dying of plants from July onward. The roots of affected plants are shrunken and decayed and the plants are easily pulled out of the soil. The main roots are covered with fine, brownish colored strands by which the disease is readily identified.

Cotton root rot usually occurs in well defined areas or patches in the field. These patches of dead plants vary from a few square yards to an acre or more in size.

In addition to cotton, the disease attacks alfalfa, sweet clover, and most summer legumes. Winter legumes, such as vetch and Austrian winter peas, are not seriously affected, since the disease is active only in hot summer weather.

Root rot is caused by a fungus which is known to live many years in the soil. Where soil is infested, cotton or other susceptible summer crops should not be grown oftener than once in four years. A four-year rotation consisting of cotton 1 year, and grain crops 3 years may be used to control the disease. During the three years when crops other than cotton are grown, weed growth should be controlled as many weeds are susceptible to root rot and will serve as carriers of the disease to succeeding cotton crops. Winter legumes may be grown if they are harvested or plowed under by early June. An abundant supply of active organic matter in the soil tends to reduce root rot damage. Seed treatment is not effective in the control of the disease.

Cotton Wilt

Wilt is another destructive disease of cotton commonly found in east central Oklahoma and occasionally on acid soils in other parts of the state. Like root rot, wilt kills plants from midsummer onward. Plants affected with wilt are usually scattered through the field rather than in well defined areas as in the case of root rot. The roots of plants killed by wilt are not decayed. Wilt may be easily recognized by the characteristic brown or dark color of the wood when the bark of the tap root, stem or main branches is removed.

Cotton wilt is caused by a fungus which remains in the soil for long periods of time. It attacks only cotton and okra. It is found mainly in acid soils that are deficient in potash.

Several varieties of cotton which are resistant to wilt have been developed. Of the varieties that are resistant to the disease none are adapted in Oklahoma except Stoneville and Rowden which show some resistance. The use of a wilt-resistant variety together with a fertilizer containing a high percentage of potash will usually give satisfactory control.

On soils where the disease is severe, an application of 200 to 300 pounds an acre of a 4-8-12 or 8-8-8 fertilizer is recommended.

Bacterial Blight

Bacterial blight (angular leaf spot) occurs in all parts of the state where cotton is grown. It attacks both the leaves and bolls of cotton plants. Bacterial blight is characterized by the presence of numerous, small, angular-shaped spots on the leaves. When the leaves are heavily infected, they may wither and fall. Affected spots on the bolls are round instead of angular-shaped. Blight germs cause only slight rotting of the bolls, but they make openings in the bolls through which mold fungi can enter and discolor or rot the lint.

The bacteria which cause bacterial blight are carried mainly on the seed, although to a limited extent they can overwinter in the soil. The disease cannot be completely eliminated, but it can be controlled to some extent by seed treatment combined with a good system of crop rotation.

Seedling Blight

Seedling blight is a disease which attacks young seedling cotton plants, resulting in poor stands and weak plants. Many of the affected seedlings either fail to emerge or wither and die soon after they break through the soil. The disease is caused by parasitic fungi which are on the seed or in the soil. It is most prevalent in cold, wet seasons.

The injury caused by seedling blight can largely be prevented by suitable seed treatment. (See page 22)

INSECT CONTROL

The control of insects is one of the most important factors in cotton production. It is said that insects destroy one bale for every seven bales harvested. This means that on the average cotton yields are reduced approximately 15% as a result of insect damages.

The boll weevil is by far the most injurious cotton insect in Oklahoma. The recommended cultural practices for weevil control should be followed in areas where this insect occurs in large numbers. When weevils appear in the cotton fields, examination should be made each day. If the weevil population starts increasing rapidly, the cotton should be dusted even though the percentage of infestation may be very small.

Other insects including the army worm, cotton leaf worm, and flea hopper also frequently cause serious damage to the cotton crop. For more complete information on the control of the boll weevil and other cotton insects, see Oklahoma Extension Circular No. 430, "Cotton Insect Control."

MECHANICAL CHOPPING OF COTTON

Hand chopping of cotton is an operation requiring a large amount of labor. Several types of mechanical choppers have been designed and are in limited use at the present time. These machines include the flame chopper, the Dixie Chopper and the Finklea Chopper. The flame chopper consists of a wheel on which are mounted five open-end metal boxes. As the machine is drawn along the cotton row, the open-end metal boxes protect the plants to be left and the remaining plants, together with weeds and grass, are destroyed by flaming. The Dixie Mechanical Chopper has a series of blades attached in a circular arrangement and the Finklea Chopper has a revolving wheel with knives attached. As the machines are drawn along the cotton rows, the revolving blades or knives remove the excess plants along with weeds and grass.

Mechanical chopping of cotton will be most successful in fields where the cotton plants are up to a uniformly good stand and where the surface of the land is reasonably smooth. The surface of the land should also be free of trash and large weeds.

FLAME CULTIVATION OF COTTON

Flame cultivation is perhaps the latest contribution toward complete mechanization in cotton production. The first successful demonstration and use of this machine was in 1943.

The flame cultivator is a new piece of farm equipment that destroys young weeds and grass in the row by the quick application of intensely hot flames. Burners are mounted on a frame back of the tractor in a staggered pattern so that flames are applied to the row from each side. Two burners flame one row.

Flame cultivation can begin approximately two to three weeks after chopping and thinning, or when the stalks of the plants are about 3/16 inch in diameter. From the time the cotton plants are up until flaming begins, cultivation should be done with the tillage implements which are commonly used for that purpose.

When flame cultivation is used it is not necessary to throw dirt to the plants along the row. Flaming of the rows and cultivation of the middles with sweeps can be done at the same time.

HARVESTING

The spinning quality of cotton is defined in terms of grade and staple. Grade is determined by color, cleanliness, and the condition of the cotton with respect to smoothness and preparation. Staple refers to the length of the fibers.

The grade of cotton is influenced mainly by weather conditions to which the open cotton is subjected in the field before picking, and to a lesser degree by the quality of ginning and the variety grown. It is well known that open cotton deteriorates rapidly in the field and that practically all of the last cotton harvested in the season is of low grade. Each year many thousands of bales of cotton are damaged due to delayed harvesting.

Gin operators with modern machinery and equipment can do much toward cleaning cotton, but there is a distinct limit to what they can accomplish. The gin cannot restore the "bloom" inherent in unweathered cotton; nor can it remove the dirt, trash, stains and spots that are sometimes in the cotton as it comes from the field.

Cotton should be harvested as soon as it is open to avoid weather damage. Picking should be done when the lint is dry. If it becomes necessary to pick while the cotton is damp, it should be spread out to dry immediately. Seed cotton should be hauled to the gin loose in the wagon or truck bed. Many bales have been lowered in grade by tramping or packing which is sometimes done to get a few hundred pounds more on the load. Seed cotton of good quality should not be mixed with cotton of inferior quality.

DEFOLIATION

Defoliation, or the removal of leaves, of cotton is a new practice that offers great promise to Oklahoma cotton growers. Everyone who has observed cotton over a period of years has seen fields of large cotton plants in the fall on which the bolls were mature and ready to open, but which did not open because of the lack of sunshine. The opening of a boll of cotton is essentially a drying out process, and if sunlight is excluded, the boll does not open. Under these conditions the bolls remain green and do not open until frost defoliates the plants. A high percentage of the bolls often rot.

It has been found that an application of a chemical defoliant to cotton plants will remove the leaves. This defoliation, like that of frost, soon results in all mature bolls opening. The defoliant is applied with a regular cotton dusting machine. The plants must be damp when the chemical is applied. It is believed that the bulk of the Oklahoma cotton crop can, each year, be defoliated at least two weeks before the average frost date and that by the use of mechanical harvesters, the crop can be gathered before excessive weather damage to the fiber occurs.

MACHINE HARVESTING OF COTTON

Machines for harvesting cotton have recently been developed and the mechanical harvesting of this crop is now possible. Cotton machine harvesters are still in the developmental stage, but several different types are already on the market and are available in limited numbers.

The two types of mechanical cotton harvesters are classified as pickers and strippers. The strippers are further divided into the finger and roller types.

The picker is mounted on a tractor and harvests the cotton by means of vertical revolving drums equipped with rotating spindles having numerous small barbs which remove the lint from the bolls. The cotton is removed from the spindles by a rubber doffer and conveyed by air to a storage basket mounted on the machine.

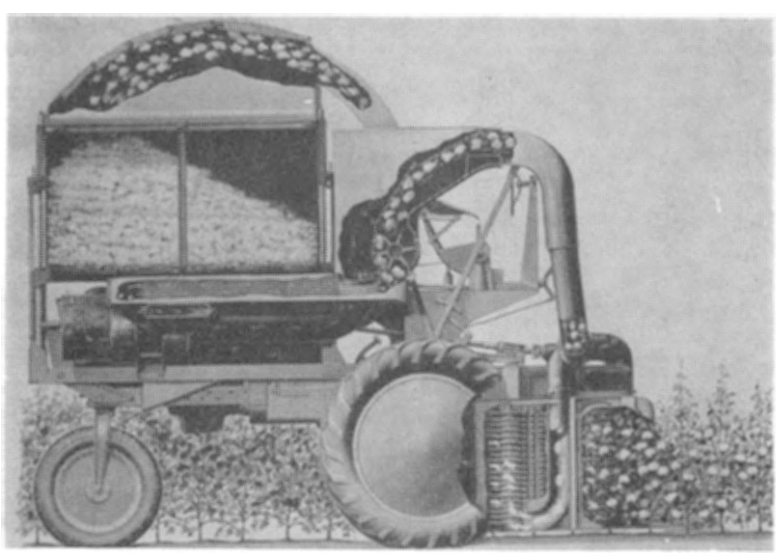

FIGURE 4—Cutaway view showing picker type of cotton harvester.

The strippers range from the simple homemade sled to the more complicated roller type machine. The strippers remove the bolls by passing the plants between fingers which are spaced approximately one inch apart. The roller type strippers remove the bolls by passing the plant between two rollers or between a roller and a stationary bar. Some of the strippers are equipped with bur extractors and modified cleaners.

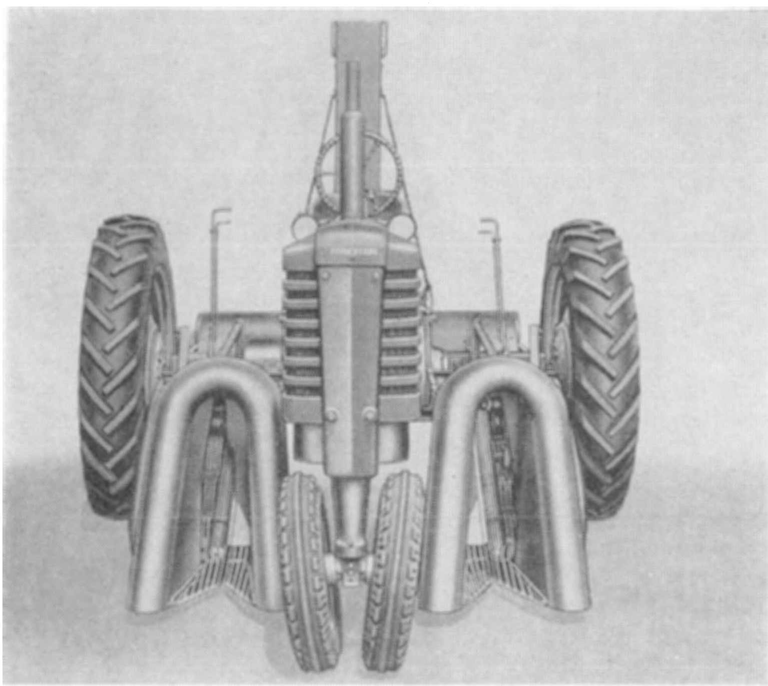

FIGURE 5—Stripper type of cotton harvester.

A converted grain combine has also been successfully used in harvesting cotton. In converting this machine, the cutter bar is replaced by V-shaped iron stripper fingers. The fingers are approximately 30 inches long and are spaced about one inch apart. They are placed in the same position as the guards. A doffer wheel or cylinder is installed at the base of the stripper fingers to throw the cotton back on the conveyor. A slatted conveyor is substituted for the canvas to allow more of the dirt and trash to be separated from the cotton. The cylinder speed is reduced to about one-half that used in threshing grain and all except four of the bars are removed. Since there are many grain combines in the state, and since they can be so easily converted into cotton harvesters, this machine offers the possibility of practical and economical harvesting of cotton.

The mechanical picker may be used to harvest open bolls of cotton without material damage to unopened bolls. The strippers remove all of the bolls from the plants. For this reason, strippers are used only at the end of the season when all bolls are open.

The Oklahoma Experiment Station made some studies in 1945 to determine the practicability of machine harvesting of cotton. In these studies, it was found that machine harvested cotton had slightly better gin turnout than cotton pulled by hand; however, in grade and length of staple, the two methods gave approximately the same results.

The Texas Experiment Station has found that cotton harvested with a roller type stripper is as satisfactory for manufacturing purposes as hand snapped cotton.

Machine harvesting reduces the amount of labor required in harvesting cotton and greatly lowers the total cost of producing the crop. Labor accounts for about half the average cost of producing a bale of cotton. Assuming that the average person can pick 200 pounds of seed cotton in one day, it will require 7.5 days of hand labor to pick a 500-pound bale. In Texas where cotton was yielding approximately one-half bale per acre, a 2-row tractor-mounted cotton stripper harvested nearly a bale of cotton in one hour. In the studies made by the Oklahoma Experiment Station, machine harvesting cost $24.82 less per bale than hand harvesting.

With any type of mechanical harvester, it is necessary for the cotton plants to pass between the picking or stripping units. Relatively close spacing and even distribution of plants in the row contribute to efficiency in machine operation. Plants of medium size and with comparatively close fruiting habits are especially important in machine harvesting. Large, spreading plants with excessive vegetative growth make machine operation more difficult and increase the amount of waste in harvesting.

The Delta region in Mississippi has the greatest amount of mechanized harvesting in the United States, and it is reported that the practice is expanding as rapidly as machines become available. From that section it is reported that machine harvested cotton averages 1.4 grades below hand picked cotton.

It is believed that the cotton growing conditions in Oklahoma are better adapted to mechanical harvesting than those of the Delta region and that in the future a large portion of the crop will be harvested in this way. It is true that hand pickers **can** harvest a higher grade of cotton than can be harvested with machines, but it is also well known that pickers often fail to pick the crop properly. The average season's grade of Oklahoma cotton should be materially raised through mechanical harvesting since the crop can be harvested earlier in the season. Late harvesting always results in lower grades. By planting varieties which are adapted to machine harvesting, defoliating the crop as soon as it is mature, and harvesting early, it is believed that good cotton can be harvested as cheaply in Oklahoma as in any other section of the Cotton Belt.

Cooperative Extension Work in Agriculture and Home Economics,
Extension Service, Oklahoma A. and M., and U. S. Department
of Agriculture Cooperating. Acts of Congress of
May 8 and June 30, 1914.
20247