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Cotton Production In Missouri

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THIS BULLETIN AT A GLANCE

This Bulletin contains a report of cotton spacing, fertilizer, and variety tests, conducted on the four principal soil types in the Southeast Missouri lowlands that are used extensively for cotton.

From sixteen trials, 2 to 4 plants in the hill with hills 10 to 12 inches apart, produced an average yield of 424 pounds of lint. With single plants in the hills where the hills were spaced 12 inches and 18 inches apart, the acre yields averaged 405 and 377 pounds respectively.

An acre application of 400 pounds of 4-12-4 fertilizer at Hayti and Kennett was the most effective treatment tested on land where black rust does not occur. It gave an average acre increase of 79 pounds of lint at these places. At White Oak, on land where serious damage from black rust is known to occur 14% Kainit applied at 200 and 300 pounds per acre gave marked increases in yield.

The capacity to produce a large yield is the most important characteristic of a variety of cotton for Missouri, but other factors, particularly earliness, are scarcely less important.

Delfos, a dwarf, early prolific, long staple variety was one of the best yielding varieties on rich heavy land. It is especially recommended on soils of this character where a long staple variety is desired.

Trice did not prove superior in the comparison of yields, but the fact that this variety is very hardy in its early growth period and matures very early, marks it as one of the best short staple varieties on land where cotton tends to grow rank and mature late.

Delfos and Trice are very inferior on poor sandy land or even on good land where Black rust and wilt are severe.

Acala and Cleveland led in yield on the fine sandy soils of only moderate fertility.

Express has a wider range of adaptation to the different soil conditions than any other variety tested, but it is very difficult to pick.

Cotton Production in Missouri

B. M. King

The growing of cotton in Missouri is confined to twelve counties located in the southeast lowlands and in the Ozark region along the southern border of the State. For the six-year period from 1924 to 1929, approximately 96% of the crop was produced in seven counties of the southeast lowlands, with 71% of the total produced in only three counties, Dunklin, Pemiscot ,and New Madrid.

The local importance of the cotton crop, can best be realized when we consider that the average value of the lint and seed for the period 1924 to 1929 was approximately $18,000,000 annually and was about equal in value to the oats crop which is grown in every county of the State. Corn, wheat and hay are the only field crops grown in Missouri that exceed cotton in value.

Cotton attained its present importance in Missouri only in recent years. Previous to 1922 the acreage never exceeded 153,000 acres, nor did the total yield exceed 100,000 bales. The crop was of major importance only on the sandy and loamy soils of Pemiscot, Dunklin, and a part of New Madrid counties.

The College of Agriculture maintained an experiment field on the Lintonia sandy soil at Kennett for a number of years for the purpose of conducting experiments with cotton and other adapted crops. The results of the cotton experiments are reported in Circular 122 of this Station in which attention is called to the fact that cotton yields can be increased by fertilizer, crop rotation and the use of superior, adapted varieties.

The widespread interest of farmers in the crop beginning in 1921 was followed by a marked increase in total acreage and production during succeeding years, that raised the average acreage to 401,000 and the average production to 198,800 bales for the six-year period 1924 to 1929. This rapid development of the cotton industry in Missouri carried the crops to inexperienced growers. It carried the crop also to several important soil areas, differing widely in texture, drainage, and other properties related to productivity and crop adaptation, where cotton had never been grown on a large scale.

Naturally many questions arose as to the best methods to use in growing the crop. Some were of a broad general nature pertaining to time and depth of plowing, quality of seed, depth of cultivation, number of cultivations and methods of planting. These could be answered satisfactorily through the simple application of fundamental principles of crop production, or on the basis of experimental data secured at Kennett, or from other experiment fields in nearby states. Others of a more specific nature could be answered only in part for there was little information available upon which the answers could be based. A lack of facilities prevented the investigation of all the important phases of cotton growing, but a series of experiments was started in the spring of 1924 on the most important soil areas to determine the best adapted varieties, kinds and amount of fertilizer to apply, and the proper distance of spacing cotton plants in the row.

LOCATION OF EXPERIMENT FIELDS

Fields on which the cotton experiments have been conducted for three years or more are located near Hayti, Kennett, New Madrid and Wyatt. Each field was selected as representative of a large area of soil dominantly alike in texture, fertility, drainage and other properties affecting productivity. Although all of the soils are of alluvial origin they are extremely variable. Areas that are mostly of a sandy or loamy nature and are generally well drained show numerous smaller areas of heavy, poorly drained soil. In the area of heavy soils, patches of loam and sand occur. Experimental results secured on any given area may or may not be applicable to the variations occurring within it. An outline map of the areas is shown in figure 1.

Area 1.—Tests were conducted on this area near Wyatt. It is composed mostly of Sharkey clay loam and includes (1) the Little River drainage district, an area of heavy soils extending almost from Cape Girardeau to the Arkansas state line, and (2) the heavy soils located in the eastern part of Scott, Mississippi, and New Madrid counties. Poorly drained gray soils and coarse sandy soils very low in fertility occur in this area, but as a whole the land is rich in plant food and is capable of producing abundantly in favorable seasons. Yields of 1500 to 2000 pounds of seed cotton to the acre are not uncommon. Alfalfa can be grown successfully on the best phases of this area if the land is well drained. The tests near Wyatt were made on land far above the average of the area for the production of corn and alfalfa, but not greatly superior to most of the area for cotton.

Area 2.—Experiments were conducted on Area 2 near New Madrid. It is composed of Lintonia fine sandy loam and forms the Sikeston ridge. It is similar to Area 3 in that it is adapted to a wide range of crops, but is less productive. The soil is quite similar in fertility and physical properties, to the sandy soils of Area 4, located on

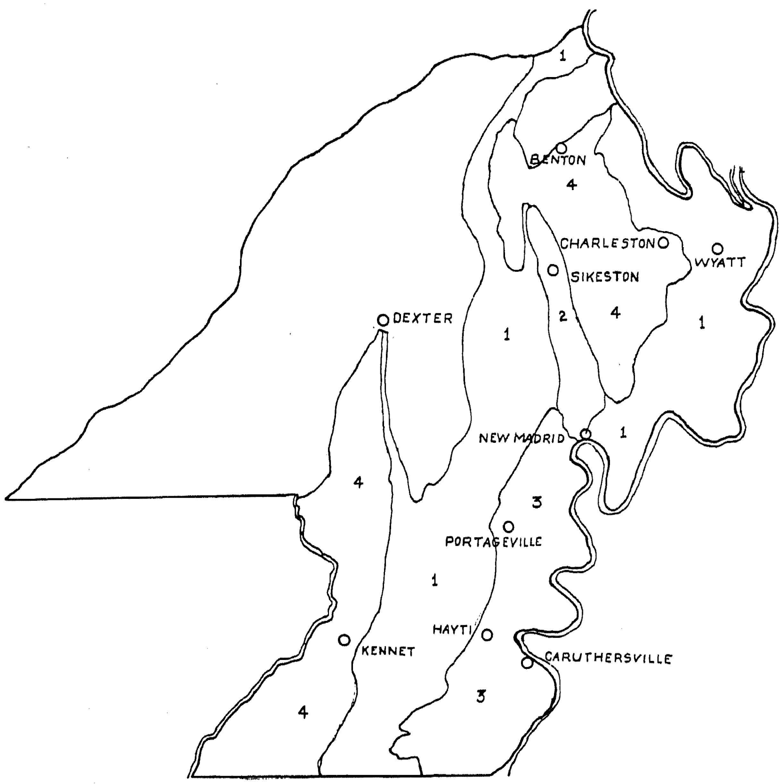

Fig. 1.—This outline map shows roughly the boundaries of the four principal soil areas used extensively for cotton in Missouri.

the southern half of Dunklin ridge, but it is inferior to the Dunklin county soils for cotton as a rule. On the other hand it is apparently superior to those soils for clover, alfalfa and small grain.

Area 3.—Experiments were conducted on Area 3 within about three miles of Hayti. The soil used in 1926 to 1929 inclusive is a little finer in texture and not especially well drained, resembling somewhat the soils of the Sarpy series. Well drained sandy loams, fine sand, loam and silt loam occur most extensively, but sections of poorly drained silty clay loam and clay are common throughout the area. A wide range of crops including alfalfa, clover, corn, small grains and truck crops are adapted to this area, and it is unsurpassed in Missouri for the production of cotton.

Area 4.—Tests were conducted on this area near Kennett and at Bertrand. It includes the Sarpy fine sand in Mississippi, Scott and

New Madrid counties, and the Lintonia fine sand in Dunklin and Stoddard counties. Some of these soils are very low in plant food and organic matter and are subject to drifting or blowing. Soils of this character seldom produce a profitable crop of cotton. If cultivated at all, they should be used to a much greater extent than at present for the production of cowpeas, soybeans, rye or a cover and pasture crop, and truck crops. The better phase of the Lintonia and Sarpy soils is well adapted to cotton production. It is only moderately fertile, but is well drained, easily cultivated, and rarely fails to produce a good crop of cotton. There is a great need for a system of farming on these soils that will improve or at least maintain the organic content. Many farmers particularly in the southern half of Dunklin county plant soybeans in corn for hogging down, or the grain may be harvested and the stalks and soybeans pastured off or turned under. Marked improvements can be noted in the succeeding crop where this practice is followed.

The tests at Kennett in 1926, 1928 and 1929, were made on land representative of the better phase of the sandy area, while in 1924 the land used for the test was average in fertility for this area.

METHOD OF CONDUCTING THE TESTS

The tests were conducted by the College of Agriculture in cooperation with farmers. A representative of the College has supervised the mixing and application of fertilizer, and the planting, thinning, and harvesting of the plots. Seedbed preparation and cultivation have been carried out by the farmers according to instructions, but without direct supervision. This work has nearly always been handled quite satisfactory.

The cotton was planted between April 25 and May 10. This range of dates conforms closely to the most favorable time of planting in Southeast Missouri. Very little replanting was necessary, except in 1924 when most of the seed rotted during a period of cold rainy weather that occurred during the second week of May.

Methods of seedbed preparation, planting, and cultivation which were expected to result in maximum yield were used. None of the methods used, however, was out of the ordinary, but was simply a duplication of those used by many of the better cotton growers of the State.

EXPERIMENTAL RESULTS

Cotton Spacing

The proper spacing of plants on the land is one of the important factors in cotton production. Numerous experiments have been conducted throughout the South to determine the distance that plants should be spaced in the row, and the width of rows that will result in maximum yields. Many of these tests were conducted before the advent of the boll weevil, but soon after it began to spread over the cotton belt a search for means of reducing the damage caused by this insect greatly stimulated investigation along this line. In general it was found that single plants spaced 12 inches apart in 3½ to 4 foot rows

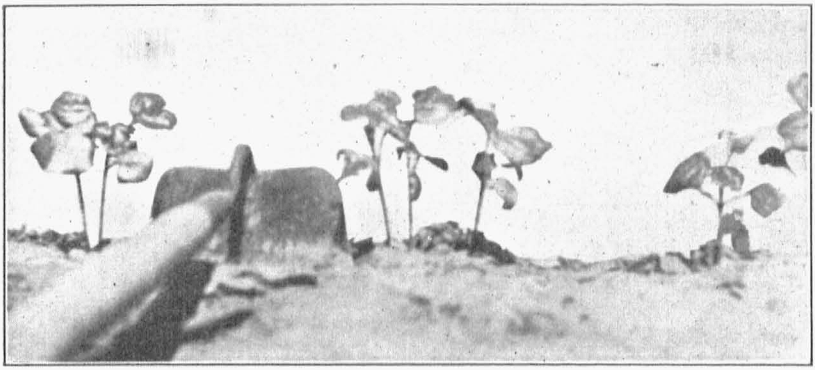

Fig. 2.—A profitable and practical method of thinning cotton is to block out the row with an eight-inch hoe leaving two or three plants in a hill.

gave a higher acre yield as a rule than any other spacing tested. But wider spacing on rich land gave the highest yield in a number of tests. In tests conducted under boll weevil conditions it was found, in a great majority of cases, that plants spaced closer than 12 inches usually gave the best results. But again the results were not consistent, due probably to variation in seasonal conditions, kind of soil, the variety of cotton grown, and weevil infestation.

Unthinned plots have in a few instances given the highest acre yield, but in very dry seasons serious competition may result from this practice. Furthermore, there should be space enough between plants to permit the removal of grass and weeds with a hoe. This requires at least 10 inches or more for a standard size hoe. So from a practical standpoint the problem of spacing is largely to determine the number of plants that should be left in hills 10 or more inches apart.

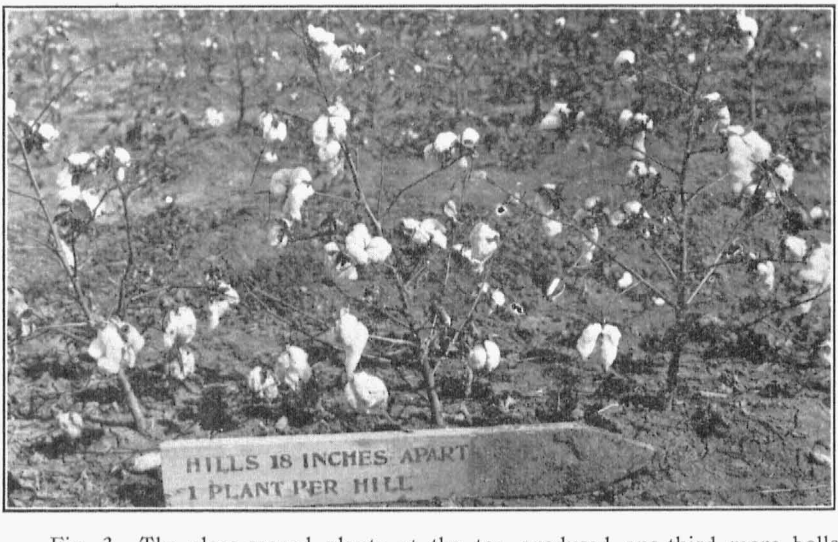

Fig. 3.—The close-spaced plants at the top produced one-third more bolls than the wide-spaced plants at the bottom, covering an equal length of row space. The bolls on the close-spaced plants are set higher on the plants and are less subject to damage from rain than those on the wide-spaced plants.

In width of row tests it has been found that rows 36 to 42 inches wide on medium to poor land, and rows of slightly greater width on very fertile land, will generally give the best results. From a practical standpoint, however, it is probably advisable in most cases to space the rows so as to permit the most efficient and economical cultivation, and govern the number of plants on the land by the spacing in the row.

Although the problem of cotton spacing had been carefully studied in all of the leading cotton States prior to the beginning of the series of tests in 1924, such tests were considered necessary to secure information that would apply specifically to local conditions. The principal soils of Missouri used for cotton production are not strikingly different from the delta soils of other States, but the growing season in Missouri is shorter and the crop is free of boll weevil injury.

A comparison was made of three different spacings of plants in the row, designated for convenience in discussion as (1) close (2 to 4 plants in the hill with hills 10 to 12 inches apart); (2) medium (1 plant in a hill with hills 10 to 12 inches apart); and (3) wide (1 plant in a hill with hills 18 inches apart). Plots of single plants spaced 24 inches apart in the row were included in some of the early tests.

The tests were made in two or more series of three or four plots. The length of rows and number of rows per plot were not always the same for different tests, but six or eight row plots 300 or more feet in length were used if enough land was available.

All of the plots in each test were planted with the same variety at a heavy rate, to insure a stand and permit spacing the plants the desired distance. Except for variation in spacing, cultural practices and varieties were used that were considered conducive to maximum yields.

The plants were thinned as soon as possible after danger from damping off or reduction of the stand by other natural agencies had passed. This was usually during the first half of June and soon after the first pair of true leaves was well developed.

In spacing the plants to the desired distances in the row it was found necessary to use a pole or string placed along the row with distances indicated as a guide for the choppers. Extreme care was exercised thereafter in cultivating and hoeing the cotton to maintain the stand. Plant counts made in sections of the field at picking time indicated that approximately correct stands were secured in every test except at Kennett in 1927. No records were made of the yields in this test.

Results at Wyatt.—The results secured from spacing tests at Wyatt are recorded in Table 1. Express was used in 1924 while Delfos was used in 1925 and 1926. It may be observed from the table that

TABLE 1.—YIELDS SECURED IN SPACING EXPERIMENTS WITH COTTON AT WYATT

Spacing of Plants in Rows	Pounds of Lint per Acre			
	1924	1925	1926	Average
Close—(Hills 10-12 inches, 2 plants per hill)	251	585	613	483
Medium—(Hills 10-12 inches, 1 plant per hill)	285	503	608	465
Wide—(Hills 18 inches, 1 plant per hill)	255	480	540	425

the medium and wide spaced plants produced higher acre yields in 1924 than did the close spaced plants, although medium spacing resulted in a higher yield than wide spacing. The close spaced plants showed a pronounced tendency to grow tall and whip-like at the expense of fruiting.

Measured in terms of percentage of the total crop open at the first picking, maturity was delayed at Wyatt in 1924 by close spacing. Only 35 per cent of the total crop was open on the close spaced plants at the time of first picking, while 43 per cent and 40 per cent was open on the medium and wide spacings respectively. The tendency of close spaced plants to grow tall and whip-like at Wyatt was noted again in 1926, but the time of maturity and yield were practically the same for close and medium spacings. For the three year average, close spaced plants produced 18 pounds more lint per acre than medium spaced plants, and 58 pounds more than wide spaced plants.

Results at New Madrid.—Spacing experiments were conducted at New Madrid during the same three seasons that similar tests were made at Wyatt. Varieties of a different character were used on account of the soil difference between the two localities. Cleveland was used at New Madrid in 1924 and Acala was used the remaining two years. The results obtained are reported in Table 2. They are similar to the results secured at Wyatt in that medium and wide spaced plants produced a higher acre yield in 1924 than did the close spaced plants. There was also a pronounced tendency for the latter to grow tall and whip-like as they did at Wyatt. This tendency was noted to a less degree in 1924 and 1926 when close spaced plants led in acre yield.

TABLE 2.—YIELDS SECURED IN SPACING EXPERIMENTS WITH COTTON AT NEW MADRID

Spacing of Plants in Rows	Pounds of Lint per Acre			
	1924	1925	1926	Average
Close—(Hills 10 to 12 inches apart, 2-4 plants per hill)	139	466	473	359
Medium—(Hills 10 to 12 inches apart, 1 plant per hill)	157	418	467	347
Wide—(Hills 18 inches apart, 1 plant per hill)	154	397	451	334

The three year average yield from the different spacings was not greatly different, showing a range of only 25 pounds of lint to the acre. But there was an increase in yield with each increase in the number of plants per acre.

Apparently, time of maturity of the crop was not modified to any significant degree by a difference in spacing. As a three year average 54 per cent, 54 per cent, and 56 per cent of the total crop was open on the close, medium, and wide spacings respectively at the first picking.

TABLE 3.—YIELDS SECURED IN SPACING EXPERIMENTS WITH COTTON AT HAYTI

Spacing	1924	1925	1926	1927	1928	1929	Average
Close—(Hills 10-12 inches apart, 2-4 plants per hill)	437	604	518	307	386	415	444
Medium—(Hills 10-12 inches apart, 1 plant per hill)	367	540	455	338	333	361	399
Wide—(Hills 18 inches apart, 1 plant per hill)	347	493	437	323	316	396	385

Results at Hayti.—Spacing tests were conducted at Hayti during the six year period from 1924 to 1929. The results secured are recorded in Table 3. Except in 1927 the highest acre yields were produced by close spaced plants. Medium spaced plants led in yield that year. Even the wide spaced plants outyielded the close spaced. This complete reversal cannot be attributed to abnormal soil variation for the same land has been used regularly for experiments and has proven to be remarkably uniform for alluvial soil. The growing season of 1927 was unfavorable for cotton, particularly on land not well drained, on account of the excessive amount and poor distribution of rainfall. The close spaced plants grew tall and slender, just as they did at Wyatt and New Madrid in 1924, and very few bolls were produced on the lower half of the plants.

For the six year average the acre yield of close spaced plants exceeded that of the medium spaced by 45 pounds of lint to the acre and the wide spaced by 59 pounds. At the time of the first picking more cotton was open on the close spaced plants, but the percentage of the total crop open was essentially the same for all spacings, amounting to 38 per cent, 36 per cent, and 37 per cent for the close, medium and wide spacings respectively.

Results at Kennett.—During the six year period 1924 to 1929 results were secured from four spacing tests at Kennett. Plant counts in 1925 indicated that the stand was too irregular for reliable results, so the crop was harvested in bulk. In 1927 no spacing test was conducted at Kennett on account of threatening overflows and the land was later planted to corn. The results secured during the remaining four years are recorded in Table 4.

Table 4.—Yields Secured in Spacing Experiments with Cotton at Kennett

Spacings of Plants	Pounds of Lint per Acre				
	1924	1926	1928	1929	Average
Close—(Hills 10-12 inches apart, 2 to 4 plants per hill)	301	515	447	376	409
Medium—(Hills 10-12 inches apart, 1 plant per hill	294	484	470	383	408
Wide—(Hills 18 inches apart, 1 plant per hill)	264	418	400	368	362

In 1924 and 1926 close spaced plants made a higher acre yield than medium spaced, while in 1928 and 1929 the reverse of these results was recorded. For the four year average the close spaced plants yielded only one pound more per acre than did the medium spaced plants. However, it should be emphasized that close spaced plants consistently gave higher yields than the wide spaced plants, the difference amounting to an average of 47 pounds of lint per acre.

Variation in spacing of plants in the row apparently had more effect on time of maturity at Kennett than at Hayti. For the four year average, 41 per cent of the crop was open on the close spaced plants at the time of the first picking, 38 per cent on the medium, and 36 per cent on the wide spaced plants. The difference in these percentages, however, is not large and their significance uncertain.

Summary of Spacing Tests

A total of sixteen trials of the spacing experiments showed that close spaced plants produced an average acre yield of 424 pounds of lint, medium spaced 405 pounds, and wide spaced 377 pounds. Possibly by leaving a greater number of plants in the row than was provided in the close spacing, higher acre yields could have been secured. However, the difference in yield between close and medium spacing averaged only 19 pounds, indicating that further crowding of the plants in the row could not be expected to raise the yield much higher. Furthermore, there was a tendency, under certain conditions, for close spaced plants to grow tall and spindling at the expense of fruiting. Any further crowding of plants would probably have increased this difficulty.

Close spacing has been advocated as a means of increasing earliness. Measured in terms of the average percentage of the total crop open at the time of the first picking, earliness was not increased to any significant degree in these trials by close spacing. Maturity was actually delayed in a few cases. If, however, the relative amounts of cotton harvested at the first picking are used as a measure, earliness was increased, for more pounds of cotton were obtained on an average from close spaced plants at the first picking than from medium or wide spaced plants.

Cotton Fertilizer Tests

Tests were conducted at Wyatt, New Madrid, Hayti and Kennett in 1924, 1925, and 1926 to determine the effect of fertilizer on cotton in which the following kinds, combinations and rates were used.

Sodium nitrate	50 pounds
Sodium nitrate	100 pounds
Superphosphate (16%)	300 pounds
Superphosphate (16%) Sodium nitrate	300 pounds 50 pounds
Superphosphate Potassium chloride	300 pounds 30 pounds
Superphosphate Sodium nitrate Potassium chloride	300 pounds 50 pounds 15 pounds

The combination of 300 pounds of superphosphate and 50 pounds of sodium nitrate were omitted from the test at Wyatt and Hayti. Nitrate alone was omitted at Wyatt except in 1924, when the 100 pound application was made. No results were recorded from the Kennett field in 1926 on account of poor stands.

The tests were made in duplicate 6 or 8 row plots in most cases, although some consisted of a single series. Every third plot in each series was left as a check, thus placing each treated plot next to one with no treatment. Fertilizer was applied and the seed planted at the same operation with a combination one-row planter and fertilizer distributor adjusted in such a manner that the fertilizer was placed an inch or more beneath the seed.

The response to the treatments varied somewhat in different seasons and on different fields in the same season. Sodium nitrate applied alone increased the yield at Kennett. The increase was small, amounting to an average of 14 pounds of lint for the 50-pound application, and 23 pounds for the 100-pound application. In 1926 the yield at New Madrid was decreased by the 100-pound application which caused a rank plant growth and a delay in maturity of the crop. An average of the plots treated with nitrogen alone in all the trials does not differ to any significant degree from the yields of the untreated plots.

As an average of all trials three hundred pounds of superphosphate alone increased the acre yield of lint 37 pounds. The largest average increase from this treatment on any individual field, amounting to 49 pounds of lint per acre, was recorded at New Madrid. The increase in yields from three hundred pounds of superphosphate and 50 pounds of sodium nitrate, applied in combination, did not differ widely from the increases secured from superphosphate alone.

Combinations of 300 pounds of superphosphate and 30 pounds of potassium chloride gave average increases for individual fields ranging from 15 pounds at Hayti to 78 pounds at Kennett. The average for all trials showed an increase of 44 pounds of lint to the acre from this treatment. The combination of superphosphate, potassium chloride, and sodium nitrate failed to give an increase in yield over the superphosphate and potassium chloride combination, due probably to the small amount of nitrogen used.

The above mentioned series of fertilizer experiments were discontinued in 1926, and a new series started at Kennett and Hayti in 1928, in which the treatments consisted of 400 pounds of 20 per cent superphosphate to the acre, 400 pounds of 4-12-0, 400 pounds of 0-12-4, and 400 pounds of 4-12-4. The two latter treatments have given the highest average increases up to the present time, amounting to 46 pounds of lint for the 0-12-4, and 79 pounds for the 4-12-4.

That potash is effective in reducing the damage from black rust has been repeatedly demonstrated in fertilizer experiments and demonstrations conducted in Missouri on lands where cotton is normally damaged severely by this disease. In these trials either muriate of potash or kainit was applied alone and in combination with sodium nitrate and superphosphate at a fixed rate. A fertilizer experiment was started near White Oak in 1930, on land where serious damage from rust is known to occur, primarily to determine the effect of varying the rate of application of potash. Applications of 100, 200, and 300 pounds per acre of 14% kainit were made. Kainit was also applied in different combinations, one of which consisted of 200 pounds of 14% kainit and 200 pounds of 4-12-4 fertilizer, while the other consisted of 200 pounds kainit and 200 pounds of 16% superphosphate. The effectiveness of these five treatments in reducing the damage from rust was very striking in late summer. Plants on the untreated plots showed severe injury. There was also considerable rust damage where the 100-pound application of kainit was made. On the two plots where

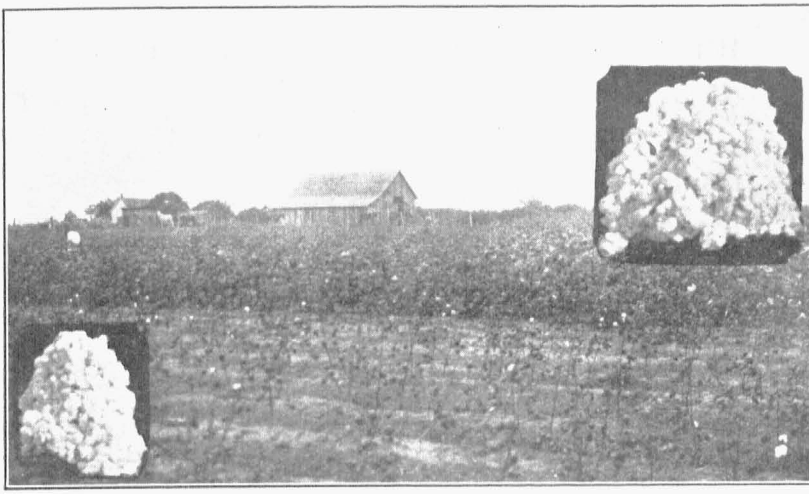

Fig. 4.—Potash fertilizer gives large increases in yield on land where rust injury is severe. The insets show the relative amounts of cotton produced on an untreated plot (foreground) and plot treated with Kainit (background).

heavier applications of kainit alone were used the injury was not severe, although neither of these treatments completely controlled the rust.

The degree to which damage from rust was reduced by the various treatments is best measured in terms of the increase in yield over that of the untreated plots, although all of the increase in yield resulting from a treatment is not necessarily due to the control of rust. Kainit applied at the rate of 100 pounds per acre increased the yield of lint 47 pounds to the acre, while the 200 and 300 pound applications gave increase of 109 and 162 pounds of lint respectively.

The largest increase in yield, amounting to 245 pounds of lint to the acre, was produced by the plot treated with 200 pounds of 4-12-4 fertilizer and 200 pounds of kainit. The yield on this plot was at the rate of 455 pounds of lint to the acre, whereas the yield of the adjacent no-treatment plot was only 210 pounds.

Several factors should be considered in interpreting and applying the results of this experiment with potash fertilizer. In the first place, they are for one year only, and are less reliable than the average of results secured over a period of years. Also they are not applicable to land where cotton is not subject to rather severe damage from rust. This disease is likely to be confused with certain other cotton troubles, especially with red spider injury. A brief description is given of the symptoms of rust on page 31, and a description of the injury caused by the red spider is given on page 30.

COTTON VARIETY TESTS

The choice of the variety of cotton to plant is probably of greater importance in the production of a profitable crop than any other single factor over which the farmer has direct control. Although the capacity to yield well or produce a big crop is the primary factor to consider in making the choice, there are other considerations scarcely less important. Some of these are discussed briefly in the following paragraphs:

Fig. 5.—At least a medium early variety of cotton is required in Missouri. A late maturing variety (as shown at left) will not yield as much cotton of good quality on an average as an early variety (as shown at right).

Earliness.—The growing season in Missouri is relatively short for cotton, so if a variety is to succeed it must mature at least medium early. On rich land where plants tend to grow rank and mature late, an early, dwarf, prolific variety is essential. Under these conditions later maturing varieties may outyield the early ones but the crop is produced so late that only a small part of it can be harvested at a seasonable time and in marketable condition. The remainder is damaged by frost and the fall rains, and picking is often delayed until midwinter and sometimes spring. Under these conditions, it is more frequently "gathered", burrs and all, than picked. Great losses, therefore, occur both in the quantity and quality of the crop. It is sometimes advisable to sacrifice high yielding capacity for earliness, for the variety that opens its crop in time for harvesting before the bolls are damaged by frost or the grade reduced by fall and winter rains, may prove the most profitable over a period of years.

Length of lint.—In choosing between varieties of different staple length a number of factors should be considered. Long staple commands a premium over short staple, but the production, handling and marketing of the crop must be done with more than ordinary skill if the farmer receives any compensation for growing a superior product.

Long staple was once thought to be strictly correlated with lateness, but Delfos, an early variety, and Express, a medium early variety, are long staple varieties (1⅛ inch or longer). Acala produces some crops of 1⅛ inch cotton when grown under optimum conditions, but this variety is best adapted to land not suitable for staple cotton growing. Deep, fertile, well drained soils that will hold enough moisture to insure uniform and rapid development of the crop during the dry summer weather is best for producing long staple.

Varieties that produce a staple ranging from ⅞ of an inch full to 1 3/32 can be successfully grown on all of the various soil types of Southeast Missouri provided they are early. These will include Trice, a variety exceptionally well adapted to rich heavy land, and Acala and Cleveland adapted to lighter land. Staple cotton may be used to an advantage if it is possible to grow, handle, and market it in such a manner that it will command a premium when sold.

There seems to be little justification for growing a large amount of very short staple varieties in Missouri. The average acre yield of the State is 248 pounds of lint, indicating that the land is capable of producing a better product.

Percentage of lint.—Percentage of lint or "gin turnout" is too often used as the sole measure of the value of a variety of cotton. The high linting per cent of Half and Half probably accounts for part of its popularity. There is no objection to a high lint turnout, but the total yield of lint and quality of lint per acre is vastly more important than percentage of lint. Local markets which do not regard quality of cotton but merely total pounds, are the source of much misunderstanding and loss to the producer.

Resistance to storms.—A variety that holds the cotton well during windy, rainy weather is said to be stormproof. Cotton grown in Missouri should show this feature at least to a moderate degree, for a part of the crop is usually exposed to bad weather before it is harvested.

Picking qualities.—The open cotton can be more easily removed from the boll of some varieties than from others. The easiest varieties to pick have large locks that cling together well, making it moved from the boll of some varieties than from others. The easiest and Cleveland are good examples of varieties easily picked.

Some varieties are difficult to pick because the bolls do not open wide enough for the cotton to project well out of the boll. The septs (or partition that separates the boll into compartments) of others are twisted and distorted, holding the locks securely, and in some varieties the boll ends in a sharp point that pricks the fingers in picking. Bolls may open so wide that the locks are not supported and dangle loosely from the boll. In still other cases the locks are held firmly at the base of the boll as though they were glued and tend to pull to pieces when picked. The Express variety has proven to have very poor picking qualities under Missouri conditions, otherwise it is well adapted to a wide range of soil conditions. A few years ago it was widely grown, but has practically disappeared except in mixed seed.

Size of boll.—As a rule large boll varieties are more storm resistant and more easily picked than those with small bolls. This is very desirable but the choice of a variety on boll size alone would leave out of consideration factors that are vastly more important. All extremely large boll varieties are too late for Missouri, and only a few of the medium or medium large boll kinds are adapted.

Disease Resistance.—Some varieties are more subject to damage from diseases than others. Cotton wilt and black rust are known to occur to some extent in many sandy fields. Where severe attacks of disease are likely to occur, resistant varieties adapted to the locality should be grown.

Variety tests were made in which all of the above factors relating to varietal adaptations were considered. Thirty-seven varieties and strains have been included in one or more tests. Most of these were found to be unadapted to Missouri conditions and were dropped from the tests. Only five varieties have been tested regularly—a small number in the long list of varieties grown in the United States. Many of these so-called varieties are not genuine, but are old standard varieties or mixtures of varieties under a new name.

Some varieties, although well adapted to other sections of the United States, could be safely omitted from the tests because of undesirable vegetative characters and lack of earliness. Missouri requires at least a medium early variety that does not produce an excessive vegetative growth. Only a few varieties and strains were tested that could not be secured directly from a seed dealer who produces his own seed and maintains the service of a well trained plant breeder.

Results at Wyatt.—Variety tests were conducted near Wyatt in 1924, 1925, and 1926. The tests were made in six row plots approximately 400 feet long, repeated two or three times, depending on the amount of land available. The yield of lint cotton obtained from the different varieties is shown in Table 5.

TABLE 5.—YIELDS OF LINT COTTON PRODUCED BY VARIETIES GROWN AT WYATT

Variety	Pounds per Acre			
	1924	1925	1926	Average
Acala (Nunns)	194	686	545	475
Cleveland (Wilson)	157	567	459	394
Delfos 6102	261	596	583	480
Express (Burdette)	216	557	574	449
Trice (Burdette)	258	464	549	424
Half and Half		624		
Trice (Miss. Sta.)		513	670	
D. P. L. No. 4			537	

The yields in 1924 were very low for the extremely fertile land on which the test was made, due to the loss of the first stand and the delay of replanting until the last of May. Relatively late maturing varieties represented by Acala and Cleveland were at a particular disadvantage under such conditions. The total yields were lower than those of early maturing varieties and a much larger per cent of the crop was of a low grade on account of frost damage. Furthermore, the plants were rank and many of the bolls did not open normally, making it difficult to harvest the crop.

In 1925 and 1926 the plots were planted during the later half of April, or about thirty-five days earlier than in 1924, and a good stand of vigorous plants secured within ten days. All of the varieties responded remarkably well to this early start, but the response was greater in Cleveland and Acala than in the other varieties. It was apparent late in the season that the tendency of these varieties to produce late crops on very rich land, a part of which would always be subject to frost damage in the extreme northern edge of the cotton belt, could not be overcome by early planting. This was particularly true of the Cleveland variety.

Half and Half, and Mississippi Station Trice were added in 1925. The former was discarded the next year on account of its short inferior lint. This new strain of Trice, however, proved to be superior to the Burdette Trice on the basis of two years' results.

D. P. L. No. 4 was added to the test in 1926. The capacity of this strain to produce a large crop is evident from the acre yield recorded in Table 1, but the tendency to produce a large vegetative growth and a late crop makes it unsuited to Missouri conditions except possibly on thin sandy land.

Results at New Madrid.—Cotton variety tests were conducted at New Madrid during the same three years as at Wyatt. There is some similarity in the results from the two fields. In 1924 the plots were replanted the latter part of May following a cold rainy period that destroyed the first planting. It will be noted from Table 6 that under these late planting conditions, the early varieties outyielded Acala and Cleveland. The quality of the crop from the former was also much better than from the Acala and Cleveland, for nearly all of it matured before frost.

In 1925 and 1926 when the varieties were planted the first of May and good stands secured, Acala and Cleveland outyielded the early varieties and matured their crop before frost.

TABLE 6.—YIELDS OF LINT COTTON PRODUCED BY VARIETIES GROWN AT NEW MADRID

Variety	Pounds of Lint per Acre			
	1924	1925	1926	Average
Acala 5	225	597	563	462
Cleveland (Wilson)	196	533	607	445
Delfos 6102	228	459	507	398
Express (Burdette)	238	511	465	405
Trice (Burdette)	272	487	488	416
Mebane	105			
Lone Star	97			
Half-Half		596	567	
Acala (local)		601		
Acala (Burdette)		583		
D. P. L. No. 4			443	

Mebane and Lone Star, big boll varieties grown largely in Oklahoma and Texas, were included in the test. The plants were late, rank growing, and very leafy. None of their bolls escaped frost damage.

Acala from three sources was tested in 1925. Very little difference could be noted in the crops, although local seed produced a slightly higher acre yield than the others.

Results at Hayti.—A total of 25 varieties and strains was tested for one or more years at Hayti. Over half of them were found to be very inferior under Missouri conditions. The acre yield of lint of the better kinds and those grown more or less extensively in Missouri are recorded in Table 7. From the column of average it may be noted that Acala produced the highest average yield of lint over a period of years, but it exceeded the other varieties by amounts that

TABLE 7.—YIELDS OF LINT COTTON PRODUCED BY VARIETIES GROWN AT HAYT

Variety	Pounds of Lint per Acre									
	1924	1925	1926	1927	1928	1929	1930	Average 1924-27	1924-29	1924-30
Acala (Nunns)	442	569	579	270	324	350		465	422	
Cleveland (Wilson)	321	577	577	271	307	350	288	437	401	384
Delfos 6102	430	640	485	283	363	282	301	457	412	396
Express (Burdette)	376	551	519	258				426		
Trice (Burdette)	466	534	549	226	329	318	337	444	404	394
Half-Half		590								
Trice (Miss)		530	600	276	359					
Mexican Big Boll				232						
Misdel No. 2					330		311			
Lone Star 65					370	320				
Stoneville No. 1							365			
Rowden 40							287			

have little or no significance. The choice of a variety from this group should therefore be made largely on the basis of factors other than yield. Among these are earliness, length of staple, storm resistance, picking qualities, and size of boll. These factors are described on pages 16 to 18 inclusive.

Varieties for which no average yields are recorded, that showed special promise under Missouri conditions, include Mississippi Station Trice, Lone Star 65 and Stoneville No. 1. During the four year period Mississippi Station Trice was in the test, it outyielded on an average all other varieties but exceeded Delfos, the next highest in yield, by a very small margin.

Stoneville No. 1, a comparatively new strain developed in Mississippi, was tested in Missouri for the first time in 1930. Apparently this strain combines to a satisfactory degree the desirable characteristics of early prolific small boll varieties and the medium large boll kinds without the disadvantages, of either. It is early maturing, dwarfy in growth habit, has large bolls that are easily picked but storm resistant, and a staple length of 1 1/32 to 1 1/8. However, since this variety has been tested for only one season in Missouri, its adaptations to this State are yet unknown, and its use cannot now be generally recommended.

Rowden 40 was also added to the test in 1930. This strain has some excellent characteristics but others make the adaptation of this variety to Missouri appear uncertain, particularly for the fertile soils.

Results at Kennett.—Tests were conducted on soil area 4 near Kennett. The soils of this area are dominantly of a sandy nature and vary widely in fertility. The land used in 1924 is below the average

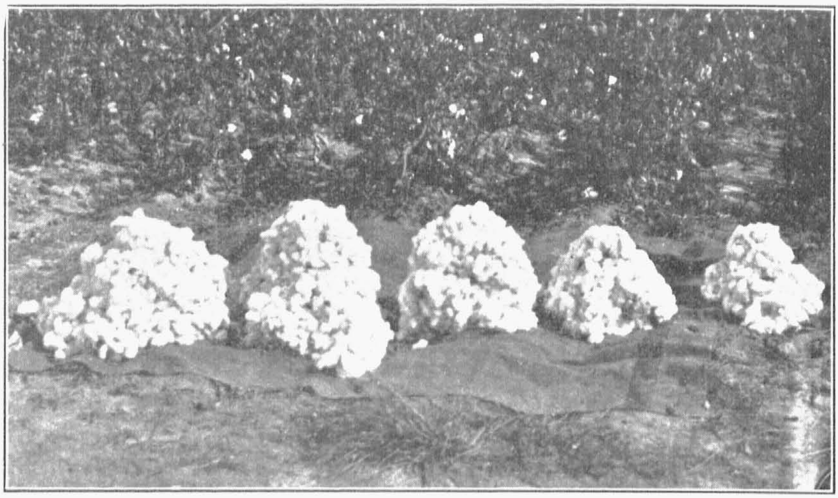

Fig. 6.—Reading from left to right in the picture are shown the relative amounts of Trice, Delfos, Express, Acala, and Cleveland harvested at the first picking.

in fertility, while the remainder of the tests were conducted on land typical of the more productive sandy loam soils used extensively for cotton in Dunklin county.

The results of these tests are shown in Table 8. Unfortunately they do not cover an unbroken succession of seasons. The stands were poor in 1925 and the plots were not harvested and weighed separately. In 1927 no test was conducted on account of excessive rains and threatening overflows at planting time.

Table 8.—Yields of Lint Cotton Produced by Varieties Grown at Kennett

Variety	Pounds of Lint per Acre				
	1924	1926	1928	1929	Average
Acala (Nunns)	264	381	555	435	409
Cleveland (Wilson)	214	490	483	425	403
Delfos 6102	218	387	428	437	367
Express (Burdette)	287	370	432	402	373
Trice (Burdette)	226	337			
Half-Half	258	449			
Rowden	157				
Mebane	141				
Webber 49	235				
D. P. L. No. 4		369			
Lone Star 65			552	503	
Delfos 631			464		

Nine varieties were included in the test in the beginning but five of these were dropped after the second year and others added. Of the varieties tested during the four year period Acala produced the highest acre yield of lint, but exceeded Cleveland only by a small margin. These varieties thrive on the sandy well drained soils of Missouri and mature their bolls early enough to escape frost damage.

Trice proved to be very poorly adapted to the sandy soils and was dropped from the test after the second year. Yields were not only low but the bolls were small and difficult to pick. Also the bolls were set close to the ground and subject to damage from sand beaten onto the open cotton by rains. Trice is also quite susceptible to damage from rust and wilt that occurs widely on the sandy lands of Missouri. Delfos showed the same undesirable features on sandy land as Trice but to a smaller degree. Express is well adapted to sandy land, but is discriminated against by growers and probably justly so, on account of its poor picking qualities.

Seedbed Preparation

On most farms in Missouri where cotton is grown it follows cotton or corn. The old stalks must first be properly disposed of before a good seedbed can be prepared. In too many cases they are raked and burned, and the land robbed of organic matter and plant food that is badly needed. Before the stalks can be turned under in such a way that they will not interfere with further cultural operations, it is usually necessary to cut them into short pieces with a stalk cutter or a heavy disk harrow. After the land is made ready for the plow any one of several methods may be used in preparing the seedbed, but the choice of the method should be governed by a number of factors.

Flat Breaking.—On deep well drained sandy or loam soils that are not subject to drifting or blowing, flat breaking or plowing the land level is sometimes a practical method of preparing the seedbed. All surface organic matter in the form of old stalks, weeds and grass can be thoroughly incorporated into the soil. Consequently, their decay and release of plant food for the following crop hastened. Flat breaking also insures that no unbroken strips will be left in the land to become further compacted and interfere with the root development and cultivation of the crop.

Immediately before planting, the land should be worked down to a smooth seedbed free of weeds and grass, loose and finely pulverized on top but firm underneath. Double disking and harrowing will usually give the desired results. But on sandy land or late plowed land the use of a roller or a heavy disk set so that it will pack the soil may be required to make it firm enough for a good seedbed.

Bedding.—A very large proportion of the land used for cotton in Missouri should be bedded. The beds or ridges promote surface drainage and hasten the warming of the soil in early spring, thus making it favorable for the germination of the seed and the growth of the young plants.

Two general methods of forming the beds or ridges are used: (1) The old row is thrown out by means of a lister forming a new bed in the old middle, (2) bedding with a turning plow. A center furrow is made in the old middle and one or two furrow slices thrown toward it from each side. If only one furrow is plowed on each side it may be necessary to break out the balk with a small lister or solid sweep. Various modifications of this method are used in Missouri but they are not essentially different. Sometimes the land is bedded by one of the above methods and then rebedded shortly before planting time by the same method. This is an effective way of destroying young weeds and grass, but rebedding should be done long enough before planting to allow the land to become firm.

Flat breaking and bedding.—The most effective way to prepare a good seedbed for cotton in Missouri is to plow the land during the fall or early spring. Allow it to stand until about three weeks before planting, then mark it off with some type of marker or a two row planter and ridge or bed it with a lister.

Possibly more labor and expense is involved in this method than in any of the others, but it can be used effectively over a wide range of soil conditions as a means of preparing an ideal seedbed. It is especially recommended for new or heavy soils that are in poor tilth, or land that has a large amount of old stalks or other plant material on its surface. Even on land in a good state of cultivation and free of an abundance of surface organic matter, flat breaking is advisable every second or third year, either for cotton or some other crop in the rotation.

The final step in the preparation of ridged land for planting is to drag the beds down to about half of their initial height. A drag made of a heavy piece of lumber is usually satisfactory for this purpose, but if the ridges are very firm the use of a harrow may be required to loosen the top soil for planting.

Method of Planting

The one row "walking" planter is used most commonly in Missouri for planting cotton. These machines are equipped with a small plow or runner that opens shallow furrows into which the seed are dropped and covered. Some of the planters are equipped with rollers or press wheels that firm the soil on the seeds, giving them a close contact with the soil moisture. By means of a lever, the roller can be so adjusted as to regulate accurately the depth of planting where the land is free of clods and sticks. Two row planters are best for planting on the level and also on ridges that are uniform in height and width if the land is free of trees and stumps.

Carelessness in planting is too often the cause of poor stands. The seed are either planted too deep or too shallow, and fail to produce a good stand. The planter should be held on the center of the bed and not allowed to zigzag from one side of the bed to the other, thus giving rise to a crooked row that is difficult to cultivate without destroying many of the young plants.

Cotton may be checked in the same manner as corn. This practice makes it possible to cross cultivate the crop and reduce hoeing to a minimum, but the plants cannot be spaced close enough together to produce a maximum crop.

Depth of Planting

After cotton is established it is very hardy and will withstand a great variety of adverse conditions, but in its early stages the plants are weak and tender. The seed should not be planted deeper than is necessary to bring them in contact with sufficient moisture for germination. On well prepared land an inch is usually sufficient. Cotton can be safely planted to a greater depth on heavy soils high in organic matter than on sandy or silt loam soils of low organic matter content. Following a rain the sandy or silty soils run together or form a crust that is difficult for the young plants to break through, while the heavy soils will become loose and friable and therefore offer less resistance to the emergence of the plants.

"Leave a few seed showing" is a policy advocated by some Missouri growers. If interpreted to mean that the seed should be planted so shallow that a few will occasionally be left exposed, the practice is not a bad one to follow especially on land that packs or crusts badly.

Planting Rate

Usually cotton is planted in Missouri at the rate of three to five pecks per acre. Even the lower rate would provide too many plants if all the seeds germinated and produced plants, but this never occurs. Some germinate and the young plants die before or soon after they come through the ground. Still others are accidentally destroyed in the early cultivation of the crop. Since the cotton crop in Missouri is particularly subject to damage from cold in early spring, a heavy rate of seeding is to be recommended. Less than a bushel of strong viable seed should never be used for an acre. If the crop is planted before the land is warm enough to promote rapid germination, or if the land tends to crust badly after a rain, the planting rate should be increased to five pecks.

Time of Planting

The seasons in Missouri are relatively short for cotton and the crop should be planted early so as to give it the longest possible growing period. If planted too early, however, the advantage of early planting is lost. The seed may rot because of low temperature, or if they germinate the young plants may die. Even if a stand is finally secured, the germination, emergence, and growth of the young plants is so slow that weeds and grass become established before the crop can be cultivated. Much labor and expense is involved in cleaning the land and many of the young plants are injured or destroyed in the process.

Over a period of years the optimum average date of planting in Missouri is near the first of May. The range in the planting dates, however, extends from about April 20 to May 20. If the weather is favorable early in the spring for warming and drying the soil, cotton may be planted on the deep, fertile, well drained soils soon after April 20 with reasonable degree of safety. Plants grow rank on land of this character and early planting is necessary to avoid damage to the crop in the fall. On the loams, silty loams, and fine sandy soils of moderate fertility and fairly good drainage, cotton should be planted during the first week of May if the land is warm and free of an excess of moisture.

On poor sandy land subject to drifting or blowing, planting should be delayed until May 10 or even later. A stand is difficult to secure and maintain on land of this character if planting is done early. Furthermore, there is little to be gained by early planting, for the plants never make a large growth and mature their crop quickly.

Poorly drained soils usually contain an excess of moisture in early spring. If planted to cotton at all, planting should be delayed until the excess of moisture disappears and the land becomes warm.

Cultivation

The primary purpose of cultivation is the destruction of weeds and grass. Other advantages to be gained from cultivation are the loosening of the soil so that it is properly aerated, plant food is made available, and the land is prepared to absorb the rains. The methods and implements that will best accomplish these purposes should be used.

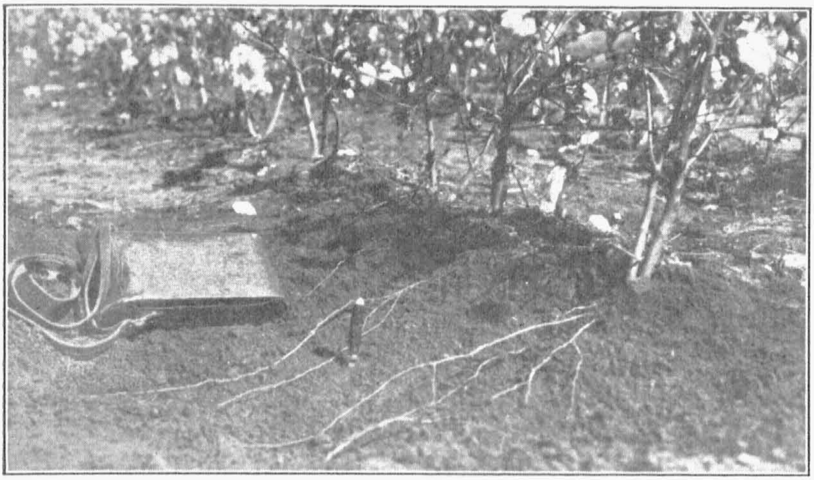

Fig. 7.—Photograph showing the shallow lateral roots of the cotton plant as revealed by the removal of only three inches of the top soil. Deep cultivation after plants are eight or ten inches high will destroy these roots.

Broadcast cultivation with a harrow is sometimes an effective and economical practice when the crop is small. It may be used to destroy young grass and weeds and break the crust after a rain so that the plants can come to the surface. As a rule, the harrow can be used to the best advantage on level planted land, but it also may be used effectively on bedded land if it is run diagonally across the rows and the teeth slanted backward so that too many of the young plants will not be destroyed.

The first row cultivation should be made soon after the plants have come to a good stand. If the seedbed has been well prepared and no heavy rains have fallen to pack the land, the first cultivations may be shallow, although deep cultivation is not harmful to cotton when it is small. The most important feature in early cultivation is to throw enough soil toward the row so that all of the small grass and weeds possible are covered without covering the cotton plants. Too often wide strips are left uncovered in the row where the grass and weds become established and can be later removed only with a hoe.

A cultivator equipped with shovels and fenders, as a rule, is the most effective implement for cultivating young cotton. A spring tooth harrow or a side harrow is also satisfactory under some conditions.

If the crop becomes very foul with weeds the use of scrapers may be necessary. These implements are essentially small turning plows and are used in barring off the rows. The plants are left standing on a narrow sharp ridge, making it comparatively easy to hoe out the grass and thin the plants to the desired stand. As soon as this is done the soil should be thrown back toward the row to support the plants and check the loss of moisture from around the roots.

The first cultivation after thinning may be deep, but later ones should be shallow to avoid injury to the roots of the cotton plants. These later cultivations, however, are primarily for the purpose of destroying weeds and grass and breaking hard crusts formed by packing rains, so should be as deep and frequent as necessary. Cultivators equipped with four or six shovels, or sweeps, are the most satisfactory implements to use if the land is in a good state of cultivation. The sweeps are best where they can be used effectively for they can be set to run at a shallower depth than shovels.

The number of cultivations required to keep the land in good condition and free of weeds varies, but usually four to six are sufficient. Cultivation should be discontinued as soon as most of the bolls are formed or the plants have become so large that they are damaged by the cultivator. Usually this is about the first part of August.

Topping Cotton

Occasional inquiries are made in Missouri as to the merits of topping cotton as a means of checking vegetative growth and stimulating fruiting. It is very doubtful if either would be accomplished. A number of experiments have been conducted in the cotton belt to determine the effect of topping on yield. Increases were recorded in some of the tests, but in a majority of them the yield was actually decreased.

Insect Enemies of Cotton

The cotton plant in its early stages is very tender and delicate. The older plants present a large amount of tender succulent material in the form of young leaves, squares, and bolls. Since cotton is grown where climatic conditions are favorable for insects, naturally many of them attack the crop and cause great losses. The Mexican boll weevil and pink boll worm are the most destructive. Fortunately neither of these is troublesome in Missouri.

Cotton Leaf Worm.—The cotton leaf worm is the most destructive insect that attacks the crop in Missouri and it causes a greater loss in yield and quality than all other insects here. It is a native of Central and South America and probably does not winter here, but each year the moth flies to this country. They are tawny in color and have a wing expanse of about 1½ inches. They lay small green eggs on the under side of the cotton leaf. The eggs hatch in from 3 to 20 days producing small green larvae that vary in color and markings. Some are yellowish green without prominent stripes; others have a black stripe down the back, and a fine yellow stripe. The most characteristic marking of the larvae is four black dots on each segment. The larvae stage lasts 10 days to 3 weeks. The larvae webs itself in the fold of a leaf and there pupates. The pupal stage lasts 1 to 4 weeks, giving rise to the moth, thus completing the life cycle.

The leaf worm makes its appearance in Missouri during midsummer. Conditions are not always favorable for rapid multiplication and in some seasons it does little or no damage except in restricted areas. If, however, conditions are favorable for the rapid development of a succession of generations, the larvae of worms are soon present in great numbers and will attack and strip the cotton plants of their leaves unless brought under control.

Fortunately the cotton leaf worm is easily controlled by dusting the plants with lead arsenate or calcium arsenate. The latter is most commonly used. The poison is sprinkled on the plants in the form of a dust at the rate of 3 to 6 pounds per acre, depending on the size of the plants and the infestation. The poison must be applied when the leaves are wet from dew or rain. The dusting is therefore generally done at night.

There are a number of dusting machines used in applying the poison. The hand gun is the smallest type. It is carried and hand operated by the laborer. It is unsatisfactory except for a very small acreage.

One and two-mule machines equipped with two or three nozzles are satisfactory if properly operated. The one-mule machine is equipped with two nozzles and will cover 15 to 20 acres in a night of operation. The two-mule machine has three nozzles and will cover 30 acres.

The best method of applying the poison from the standpoint of economy is known as the pole-and-bag method. It is also effective if done properly. The laborer rides down the middles, carrying a pole with a muslin bag containing the poison suspended from each end. The laborer, aided by the movement of the animal can agitate the bags so as to cause the poison to shake out fairly regularly and uniformly.

Dusting should be done just as soon as the young larva or worms make their appearance in large numbers. It is too often delayed until after many of the leaves are destroyed. The worms are then killed but the damage to the crop is not repaired.

Some growers claim that an attack of the cotton leaf worm is a decided benefit in maturing late crops and hastening the opening of bolls. Possibly this may be true in rare cases, but too often it is a costly excuse for not poisoning or for planting a late unadapted variety.

Red Spider.—The red spider is neither a spider nor an insect, but a small mite that lives on the leaves of a number of plants including cotton. It is red or reddish brown in color and very small, but can be seen without the aid of a magnifying glass. These small animals attack the under side of the leaves, sucking the juice from them causing them to turn brown and fall off. Injury from the spider is sometimes mistaken for that of rust, the effect on the leaves being similar. The injury from red spider is usually localized, being confined around the edge of the field, although an entire field is sometimes invaded. The spiders spread over the field slowly by crawling from one plant to another.

If the presence of the spiders is detected before they spread over a large area, an outbreak may be prevented by burning all infested plants. If the infestation becomes widespread the only means of control is to spray the plants. Several sprays are satisfactory, but they must be applied with extreme care for the poison must reach the under side of the leaf if it is to be effective. Lime-sulphur, kerosene emulsion, and potassium sulphide are used. Finely powdered sulphur dusted on the plants in such a way that it come sin contact with the lower side of the leaf is also a good control measure.

Cotton Aphis.—The cotton aphis is most commonly known as the cotton louse, a small greenish or greenish black insect that attacks the leaves of the plants soon after they come through the ground causing them to curl and sometimes die. The damage is greatest in early spring when the weather is cool and plant growth slow.

The aphis can be controlled by dusting the plants with black leaf 40 or spraying with nicotine sulphate. The use of control measures is generally impractical, but the damage may be reduced to a minimum by (1) not planting too early; (2) using a heavy rate of seeding of good seed; (3) the use of cultural practices that will promote rapid growth of the plants, and (4) the careful selection of the best plants at the time of thinning.

Other cotton insects that attack the crop and do more or less damage include wire worms, cut worms, cotton boll worm, grasshoppers and a great variety of sucking bugs. None of these are of widespread importance in the State, and are seldom found locally in numbers that justify the use of direct control measures.

Cotton Diseases

Black rust, wilt, root knot, anthracnose and sore shin are the most destructive cotton diseases occurring in Missouri.

Black rust, commonly known simply as rust or leaf blight, does more damage than any of the other diseases. It occurs most abundantly on poor sandy soils, and is very serious in swales and other shallow depressions that were submerged or saturated with water most of the time before the land was drained artificially. It is by no means confined to these low lying areas, however. The affected plants grow

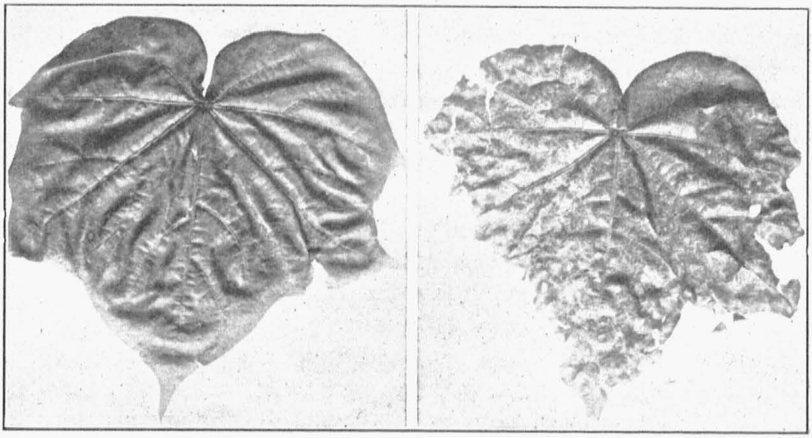

Fig. 8.—The cotton leaf shown on the left is healthy. The one on the right was damaged by black rust.

slowly. The leaves first develop a pale green color. Later, yellow and reddish brown or bronze colored spots appear, giving them a mottled appearance. The spots gradually enlarge, becoming darker. Finally, the leaves are reduced to black, curled masses with little of their normal appearance, and fall to the ground. Many of the young bolls are shed. Those that remain on the plants fail to develop properly and either fail to open or produce a poor quality of lint.

Black rust, unlike many other plant diseases, is not caused by an organism of any kind, but is due to improper conditions of the soil. Among these are, (1) a deficiency of potash; (2) low organic matter content, and (3) poor drainage. The growing of legumes and plowing them under or grazing the crop and applying manure will aid in building up the organic matter content. The use of potash fertilizer is the most effective known method of controlling rust in Missouri. Two hundred pounds of 14 per cent kainit is adequate on land where rust damage is moderate. Where the damage is severe the rate should be increased to at least 300 pounds per acre. On a number of potash fertilizer tests conducted on the land where rust is severe, the difference in yield between treated and untreated plots was the difference between a good crop and practically no crop.

Cotton Wilt in Missouri is confined largely to the sandy soils in Dunklin and Pemiscot where cotton has been the principal crop for many years. Not all of the sandy soils are infested, but it is known to occur at least in small spots on many fields. No survey or careful observations have been made to determine the extent of the damage caused by wilt, but it is probably greater than is commonly supposed. In fact, it is difficult if not impossible to determine the exact damage caused by wilt, for many infected plants show little or no evidence of the disease even though their yield is reduced.

Cotton wilt is easily recognized if the symptoms of the disease are well known. If the leaves begin to wilt and shed without any apparent reason, especially in sandy land, wilt is likely to be the cause. Other characteristic symptoms of wilt are the dwarfing of the main stem and shortening of the internodes. One or more relatively long basal limb is usually present. If the main stem of a freshly wilted plant is broken off near the ground and shows any black or brown discoloration inside, the trouble is almost sure to be due to wilt.

Wilt is very difficult to control. Fungicides, commercial fertilizers, and lime have not given satisfactory results. Barnyard manure, and legume crops plowed under have proven beneficial in some cases. Also nitrate of soda has been found helpful in Mississippi on land where the disease was not very severe.

Time of planting and cultural methods are of little or no importance in wilt control. The fungus that causes wilt can live for a long time, and it is practically impossible to destroy by crop rotation. Rotations that include cotton about every 8 or 10 years reduce the wilt but do not eradicate it. However, root knot, a disease commonly associated with wilt and increasing its severity, is controlled by crop rotation.

The most practical method of controlling or avoiding wilt is to plant wilt resistant varieties and rotate the crop to control root knot, the disease which increases the severity of wilt.

Very early varieties, such as Trice and Delfos, that are best for the short seasons of Missouri are very susceptible to wilt. This may account for the poor performance of these varieties on sandy land. Cleveland is more or less resistant to wilt and is known to be adapted to the soils of Missouri where wilt occurs most abundantly. There are a number of varieties of cotton grown in the South that are highly resistant to wilt, but their adaptation to Missouri conditions has not been determined.

Root Knot occurs most commonly on sandy soils and is closely associated with wilt. It is caused by small eelworms or nematodes that enter the root and live there causing numerous irregular shaped knots or galls varying in size from a small shot to a quail's egg. The nematodes may be spread from one field to another by any agency that will transfer the soil. Drainage water is the most important, but there are many other ways.

Root knot is best controlled by crop rotation and the frequent use of crops that are largely or entirely immune. Crops that are well adapted to Missouri and also immune to root knot are corn, oats, wheat, rye, sorghums, all hay grasses, and peanuts. Crops most severely attacked are soybeans, cowpeas (except Iron and Brabham), potatoes, tobacco, and watermelon.

Anthracnose is widely distributed and results in a great loss every year. However, the amount of the loss varies from year to year and in different localities in the same year.

The disease affects all parts of the cotton plant except possibly the roots of old plants. The greatest damage is done to young plants and immature bolls. If infected seed are planted, the fungus attacks the young seedlings and may prevent further growth. Some of the "damping-off" of young plants that occurs in cool weather and is so well known by many growers, is caused by anthracnose.

The most characteristic symptom of anthracnose is the pink or gray spots found on immature bolls. These enlarge, become darker in color, finally destroying part or all of the boll. The injury to bolls is most severe in Missouri on deep fertile land that produces rank late maturing plants. The injury is increased by excessive rains in late summer. The most effective means of controlling anthracnose is to use disease free seed, rotate crops, and fall plow the land. The use of dwarf varieties of cotton on rich land is also to be recommended as a means of reducing the damage from this disease.

Sore-shin is well known by the cotton growers of the State. This disease causes considerable damage during cold, wet periods in early spring by killing or stunting the young plants, often making it necessary to replant. The characteristic symptom of the disease is the presence of dark reddish brown cankers on the stems of the small plants near the surface of the soil. In severe cases the cankers become so enlarged that they weaken the plant, causing it to fall over and die. Many plants, however, that are not too severely affected, will recover on the arrival of warm dry weather, and outgrow the injury.

Sore-shin is caused by a fungus that lives in the soil. No satisfactory methods of controlling it are known. But the damage which it causes can be partially avoided by using practices that will start the young plants off quickly into a strong vigorous growth. A heavy rate of planting is also to be recommended to provide enough plants so that the loss of a few will not ruin the stand.

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