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BEHAVIOR OF COTTON PLANTED AT DIFFERENT DATES IN WEEVIL-CONTROL EXPERIMENTS IN TEXAS AND SOUTH CAROLINA

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INTRODUCTION

More information is needed on the growth and fruiting habits of early and late planted cotton in relation to cultural control of the boll weevil. In the season of 1923 comparisons were made of the behavior of early and late plantings in Texas and South Carolina, and differences were shown in the rates of growth and the fruiting habits of the plants.

A more rapid formation of nodes during the seedling stage of the plants was found to occur in the later plantings, resulting in a shorter interval between the date of planting and the appearance of the first floral bud. The fruiting capacity of late-planted cotton was found to equal and in some cases to exceed that of the early-planted cotton. The large number of floral buds produced in later plantings was due to the fact that more nodes were produced on the lower fruiting branches. Also, slightly larger numbers of flowers were recorded on the late-planted cotton, although the early plantings produced a larger number of flowers during the first part of the flowering period.

The experiments were made in three places—San Antonio, Tex., Charleston, S. C., and Gainesville, Fla. The object of having similar tests in three widely separated parts of the Cotton Belt was to secure comparative data of plant development under different soil and climatic conditions. The experiments consisted of side-by-side comparisons of cotton planted on four different dates. An

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interval of 10 days between plantings was used in South Carolina and Florida and 7 days in Texas.

As these experiments were conducted under boll-weevil conditions, measures were taken to protect the early plantings from infestation by overwintered weevils. Uncontrolled infestation in the early plantings would have caused excessive infestation in the adjacent later plantings and would have prevented comparable data being obtained from the different plantings. The method of weevil control was by removal of squares and the application of poison after most of the weevils had emerged from hibernation.

At San Antonio, Tex., it was only necessary to apply pois n to the two later plantings, those of May 5 and May 12, as these plantings had not reached the fruiting stage at the time squares were removed from the early plantings.

A separate late planting was made at San Antonio on May 12 in order to compare the development and fruiting habits of cotton in rows that were left unthinned with rows that were thinned to two plants in a hill with hills 12 inches apart. This comparison showed that plants left in hills had a larger individual fruiting capacity than the unthinned plants, due to the production of more nodes on the fruiting branches. But this difference in the fruiting capacity of individual plants was counterbalanced by the greater number of plants in the unthinned rows. More flowers were recorded from the unthinned cotton, and a marked difference in the rate of flowering occurred during the first half of the flowering period, the unthinned rows producing flowers at almost twice the rate of the rows that were thinned.

No trace of weevil infestation was found in this separate late-planted field until July 8, after the beginning of the flowering period. Thus, it appeared that the planting of May 12 had been late enough to avoid any infestation from overwintered weevils in the season of 1923 at San Antonio.

SOIL, CLIMATIC, AND WEEVIL CONDITIONS AT SAN ANTONIO, TEX.

The United States San Antonio Field Station is located about 5 miles south of the city. The soil on the farm is typical of a large part of the cultivated land in that region and is technically described as Houston clay loam. It is of high natural fertility and is fairly retentive of moisture. The subsoil is a coarse gravel, which affords good drainage but limits the water-storage capacity of the soil.

The annual precipitation is variable, ranging from 13 to nearly 40 inches. The average annual rainfall over a period of 15 years is about 26 inches. Although the precipitation is usually sufficient for cotton production, the distribution is very irregular. Periods of excessive rainfall are frequently followed by protracted periods of hot dry weather which deplete the soil moisture and cause serious injury to crops.

The precipitation during the season of 1923, from January 1 to October 1, was 23.47 inches, which was about 4 inches in excess of the 15-year average for the same period. The heaviest monthly rainfall, 6 inches, was recorded in February. Rains occurring during the winter months are often an important factor in this section, as stored moisture in the soil may enable the plants to continue growth

even when surface moisture becomes deficient. June was very dry, with only 0.55 inch of rain. Precipitation during the growing period of cotton was fairly well distributed, but effective rains fell on only six days between May 30 and September 7.

Maximum temperatures during June, July, and August were comparatively high, and the long periods of hot weather between the few good rains resulted in droughty conditions in spite of the apparently adequate precipitation.

The average monthly maximum and minimum temperatures and the monthly precipitation for the season of 1923 are given in Table 1.

TABLE 1.—*Average minimum and maximum temperatures and monthly precipitation at San Antonio, Tex., from April to September, 1923*

Items of comparison	Jan. to Mar.	Apr.	May	June	July	Aug.	Sept.
Average temperature (° F.):							
Minimum	----------	59.3	64.5	72.4	71.2	72.4	70.7
Maximum	----------	77.6	89.0	95.4	95.3	97.8	89.4
Precipitation (inches):							
1923	9.27	2.93	1.67	.55	3.77	2.50	3.02
Average, 1907 to 1920	3.98	3.11	3.09	1.88	2.12	1.87	2.57

Favorable conditions for the hibernation of boll weevils in the San Antonio district are afforded by scattered areas of undeveloped land covered with mesquite and huisache trees and by large fields of Johnson grass. A heavy infestation from overwintered weevils usually occurs in cotton planted in this section. The first new generation of weevils usually appears before the first of July.

Periods of dry weather often restrict the growth of the plants, and the shed squares are exposed to direct sunlight, so that a natural control of the weevils may result from destruction of the larval and pupal stages in the fallen squares. When heavy rainfalls occur during the early stages of plant growth, excessive vegetative development of the plants results, so that the weevils have more protection even though there is dry weather later in the season. There is slight possibility of effective natural control when the plants grow large and the lanes between rows are shaded so as to protect the infested squares.

In the season of 1923 weevils were first found on May 28. Squares were very small at that time, but by the first week in June numerous punctured squares could be seen in all cotton which had reached the fruiting stage. Dry weather throughout the greater part of May and June retarded the growth of the plants. This small size kept the lanes open between the rows and afforded favorable conditions for natural control of weevils by exposing the fallen squares to direct sunlight. Nevertheless, the weevil infestation increased slowly, until by the first of August there were enough weevils to destroy practically all of the squares.

COMPARISON OF SUCCESSIVE ADJACENT PLANTINGS AT SAN ANTONIO

At San Antonio the successive plantings were made on April 19 and 28 and May 5 and 12. The Lone Star variety was used, the seed having been grown on the experiment farm in 1922. The rows were

200 feet in length and were spaced 4.1 feet apart. The location of this test with relation to other cotton plantings on the experiment farm is shown in Figure 1, and the planting diagram of the test is shown in Figure 2.

Conditions were favorable for the germination of the seed in the first three plantings, and good stands were obtained. Dry weather, following rains which occurred during the last week in April, dried out the soil to a considerable depth, and a stand of about 30 per cent resulted from the planting of May 12, the remainder of the seed lying in the ground until germinated by a rain on May 30. The seedlings produced from the seed that germinated first grew rapidly and produced vigorous plants. The moisture supply in the surface soil was inadequate to support growth of the seeds that germinated late, and most of the resulting seedlings died or remained stunted throughout the season.

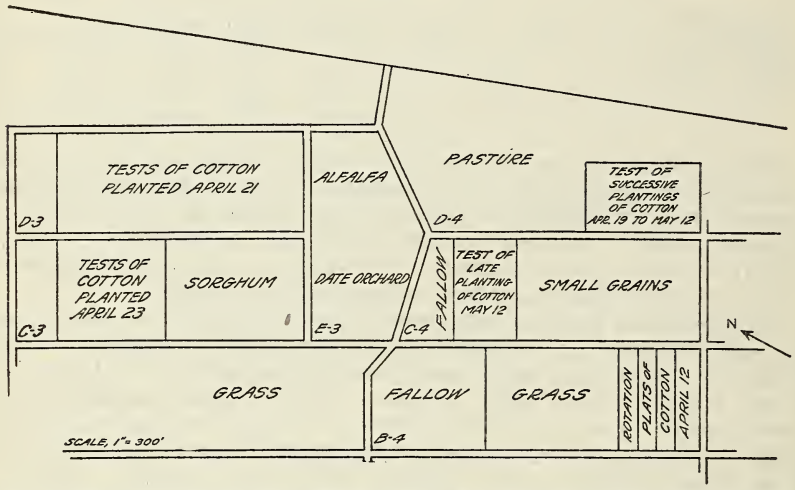


FIG. 1.—Diagram of part of the United States San Antonio Field Station, showing the location of successive plantings and the separate late-planting test of cotton with relation to other cotton plantings

The first three plantings were thinned to two plants in a hill with the hills 12 inches apart. Thinning was done by hand in order to obtain as regular spacing as possible. The fourth planting was not thinned, as the poor stand rendered this unnecessary.

The April 19, April 28, and May 5 plantings were thinned on May 25, June 4, and June 8, respectively. At the time of thinning, the plants in the first two plantings had from five to seven true leaves and averaged about 20 centimeters in height. The plants in the third planting were slightly larger when thinning was done, averaging 22.5 centimeters in height and having from six to eight true leaves.

GROWTH RATE OF SEEDLINGS

In order to compare the rate of development during the seedling stage, the height and number of nodes on 10 representative plants in each planting were recorded when the first floral buds, or squares, appeared. The plants in each planting were examined on June 1 and

at weekly intervals thereafter. While this method did not give the actual date of appearance of the first floral bud on each plant, the beginning of the fruiting stage of the plants may be determined with sufficient accuracy from the first week when the presence of squares was recorded. Table 2 shows the date when squares were first recorded in each planting, together with the average height, number of nodes,[1] and the average number of squares formed.

A more vigorous growth of seedlings in the later plantings is shown by these records. The rate of growth increases with each later planting, the rate of formation of nodes on the axis being more rapid, while the length of the internodes also increases. The faster development of nodes reduces the interval between planting and the appearance of the first squares.

The more rapid formation of nodes on plants of the later plantings probably was due to higher temperatures during the early stages of growth. Seedlings in the later plantings did not encounter cooler weather, which may have checked the growth in earlier plantings.

In comparing the rate of nodal growth of seedlings, the period from germination of the seed to appearance of squares is used. Table 3 gives the date when germination was first noted in each planting, the number of days from germination to the first record of square formation, the average number of axis nodes formed during that period, and the average maximum and minimum temperatures for the same period.

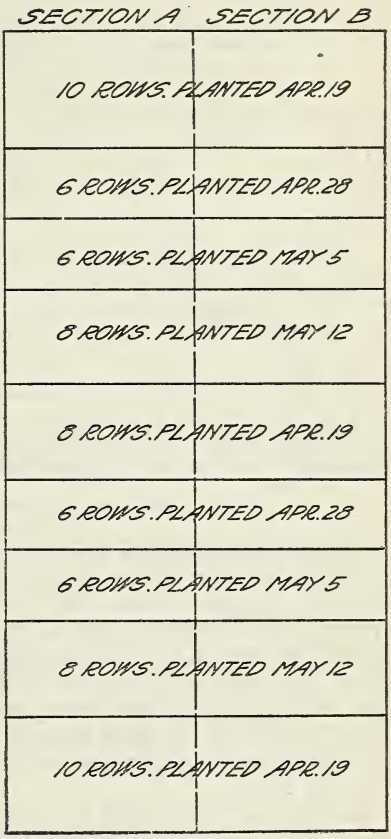


FIG. 2.—Diagram of successive plantings of cotton at San Antonio, Tex.

TABLE 2.—*Average development of 10 cotton plants at the beginning of the fruiting stage as grown in successive plantings at San Antonio on four different dates*

Date planted, 1923	Squares first recorded	Number of days from planting	Height of plants (centimeters)	Number of nodes on main stalk	Average number of squares
Apr. 19	June 1	43	21.5	6.5	2.2
Apr. 28	June 8	41	23.4	7.1	2.8
May 5	do	34	22.6	6.2	1.9
May 12	June 15	34	24.4	5.9	1.7

[1] All records of the number of nodes on the main stalk are exclusive of the cotyledon node.

TABLE 3.—*Relation of temperature to the development of cotton plants as grown in successive plantings at San Antonio on four different dates*

[The temperatures shown (° F.) cover the period from the date of seed germination to the first appearance of squares]

Date planted, 1923	Date of germination	Number of days to squaring	Number of nodes formed	Average number of days per node	Average temperature	
					Minimum	Maximum
Apr. 19	Apr. 25	37	6.5	5.7	64.4	88.5
Apr. 28	May 4	35	7.1	4.9	66.5	90.8
May 5	May 12	27	6.2	4.4	68.6	92.3
May 12	May 20	26	5.9	4.4	70.7	94.0

It will be noted that the interval between the development of successive nodes decreases when higher temperatures occur during the period from germination to the appearance of squares. The average rate of nodal development during the seedling stage of the April 19 planting was 5.7 days. During this period the average minimum temperature was 64.4° and the average maximum 88.5° F. The May 12 planting averaged 4.4 days per node during the seedling stage of the plants, the average minimum and maximum temperatures having been 70.7° and 94° F., respectively.

DAMAGE BY OVERWINTERED WEEVILS

The extent of weevil infestation in the successive plantings of cotton was determined on June 5 by recording the numbers and percentages of squares that had been attacked by weevils. On June 5 squares were present only on the April 19 planting. Even on this there were only a few large squares, and it was necessary to examine about 200 plants in order to find 100 squares that were regarded as over 10 days old. Records of growth of squares have indicated that a period of about 10 days elapses between the time when a square is first visible and the time when it has reached sufficient size to harbor a weevil larva.[2]

In block 1 of the April 19 planting, which was located on the south side of the field, 45 per cent of the squares were punctured by weevils. Block 2, in the center of the field, had 20 per cent of the squares punctured, and block 3, on the north side of the field, had 15 per cent of punctured squares.

The heavier infestation in block 1 may have been due to the fact that the field adjoined a Johnson grass pasture on the south. A large part of the weevil emergence probably occurred from this pasture, and a large number of the weevils would doubtless remain in the first cotton where squares were found.

STRIPPING OF FLORAL BUDS OR "SQUARES"

Squares were removed on June 12 from the first and second plantings, and the entire field was poisoned with calcium arsenate. At that time the squares on the third and fourth plantings were below the size for stripping, so that it was necessary only to apply poison.

[2] Martin, R. D., W. W. Ballard, and D. M. Simpson. Growth of fruiting parts in cotton plants. *In* Jour. Agr. Research, v. 25, p. 202. 1923.

No squares were removed that were less than 10 days old, at which time the involucre of the square was about three-eighths of an inch in length. It was found to be impossible to remove squares smaller than this without breaking the tips of the fruiting branches or injuring the terminal buds of the plants. Records were obtained of the number of squares picked from four rows in the April 19 and April 28 plantings. The number of plants to the row and the number of squares removed from each row are given in Table 4.

TABLE 4.—*Number of squares removed on June 12 from cotton plants of the first and second plantings in rows 200 feet long at San Antonio*

Date planted, 1923	Number of plants to the row	Number of squares removed	Average number of squares to the plant	Date planted, 1923	Number of plants to the row	Number of squares removed	Average number of squares to the plant
Apr. 19	392	787	2.0	Apr. 28	300	128	0.4
	375	803	2.1		261	146	.6
	403	823	2.0		285	114	.4
	387	734	1.9		334	193	.6

An average of two squares removed from each plant corresponds to the amount of stripping reported in experiments with the stripping method in Florida.[3] A difference of nine days in the planting date of the first and second plantings resulted in only one-fourth as many squares being removed from the second planting as from the first. In plantings which were deferred until May 5 and May 12 there was no necessity of square removal to avoid infestation by overwintered weevils.

The average time required for finding and removing squares was 48 minutes per row in the April 19 planting and 22 minutes per row in the planting of April 28, the length of rows being 200 feet. On this basis the time required to strip an acre was estimated at 41 hours for the first planting and 19 hours for the second. At the rate of four days per acre, or even two days, the labor requirement for square stripping is considerable.

Only 2 weevils were found in squares removed from the two blocks of the second planting, while 96 weevils were caught in the three blocks of the first planting. The fact that so few weevils were caught in the second planting is probably due to the smaller number of large squares on the later plants. Weevils which are feeding on the floral bud inside the involucre of large squares are more likely to be caught.

A hundred squares from each row in the April 19 and April 28 plantings were examined, in order to determine the percentage of squares that had been punctured. The records of punctured squares in each block of the first planting gave the following average percentages of infestation: Block 1, 23; block 2, 14; block 3, 12. The first block of the second planting had 9.7 per cent and the second block had 6.5 per cent of the squares punctured.

Calcium arsenate in dry-dust form was applied to the entire field immediately following the removal of squares from the first two

[3] Smith, G. D. A preliminary report upon an improved method of controlling the boll weevil. Fla. Agr. Exp. Sta. Bul. 165, 72 p., illus. 1922.

plantings. A hand gun was used in dusting the plants, the poison being applied at the rate of about 8 pounds per acre. It remained on the plants until June 17, when most of it was washed off by a light rain. No further poisoning was attempted during the remainder of the season.

A comparison of the development of plants in the four plantings was made on June 15, three days after squares had been removed and poison applied. Data on the height of plants, the number of nodes on the main stalk, the total number of squares that had been formed to June 15, and the actual number of squares on the plants are presented in Table 5.

TABLE 5.—*Development of cotton plants, showing the average number of squares formed on each plant on June 15 as grown in successive plantings at San Antonio on four different dates*

Date planted, 1923	Height (centimeters)	Number of nodes	Average number of squares on plants	
			Formed to June 15	Remaining on June 15
Apr. 19	28.6	11.2	10.6	5.9
Apr. 28	28.0	9.2	6.5	5.1
May 5	27.8	8.6	5.7	5.4
May 12	24.3	5.9	1.7	1.7

The difference between the total number of squares that had been formed by June 15 and the number actually on the plants at that date represents the loss through square removal and shedding. Considerable shedding of very small squares occurred in the April 19 planting, practically all of the squares formed prior to June 1 having been shed by June 8.

WEEVIL INFESTATION AFTER STRIPPING SQUARES

Although the young squares on the first three plantings had developed within a week after stripping and poisoning to a size which would render them susceptible to weevil injury, no indication of infestation was detected for another week, or until June 25. Three small areas of infested plants were observed on that date in widely separated parts of the field.

The absence of weevil infestation for a period of nearly two weeks after stripping and poisoning indicates that the control measures had practically exterminated the weevils present in the field on June 12. It is probable that the slight infestation which was first noted on June 25 resulted from weevils that had emerged from early-punctured squares. Some of the squares on the first planting which had been punctured during the first week in June were shed before the plants were stripped. Some of the squares which had been shed previous to stripping might have been missed by laborers.

Several scattered points of infestation appeared within a few days after the first trace of weevil damage was noted, most of these points occurring in the first planting. Infestation increased slowly, and by the middle of July evidence of weevil injury could be found throughout the field.

Although the field became reinfested with weevils after square removal and poisoning, the degree of infestation was much less than in untreated early-planted fields on other parts of the experiment farm. Possibly a more effective control might have been obtained if the measures had been applied earlier than June 12, as fewer infested squares would have been shed before the square-stripping operation.

PLANT GROWTH DURING THE FRUITING PERIOD

Records of the nodal growth of the cotton plants, the rate of flowering, and the extent of boll shedding were obtained from each of the four plantings. Comparisons of the rate of formation of internodes were obtained from 10 representative plants in each planting, while the flower counts and boll sheds were recorded from 50-foot sections of rows.

The records of plant development following the appearance of squares were obtained from diagrams of the same plants which were used in comparing the rate of growth during the seedling stages. These diagrams were made at weekly intervals throughout the period of fruiting of the plants, the final records having been made on August 11, after growth had practically ceased.

A comparison of the rate of formation of internodes on plants in the successive plantings is shown in Table 6, which gives the average number of nodes on 10 plants of each planting on the date when squares were first recorded and 14, 28, and 56 days later. As the first squares were recorded on different dates, it should be noted that the nodal development of the plants in each planting is compared during similar stages of growth and not on the same dates.

TABLE 6.—*Development of nodes on the main stalk during the fruiting stage of cotton plants grown in successive plantings at San Antonio on four different dates*

Date of planting, 1923	Squares first recorded	Number of nodes at stated intervals after first appearance of squares								
		Average	14-day interval		28-day interval		56-day interval		Total increase	Probable error
			Actual	Increase	Actual	Increase	Actual	Increase		
Apr. 19	June 1	6.5	11.2	4.7	14.8	3.6	18.6	3.8	12.1	±0.15
Apr. 28	June 8	7.0	11.5	4.5	14.9	3.4	18.2	3.3	11.2	± .22
May 5	do	6.2	10.9	4.7	14.2	3.3	16.9	2.7	10.7	± .37
May 12	June 15	5.9	11.8	5.9	15.1	3.3	18.9	3.8	13.0	± .22

The average number of nodes produced on the main stalk during the first period of 14 days after the appearance of squares was 4.7, 4.5, and 4.7 nodes, respectively, on plants of the first three plantings. The planting of May 12, however, formed 5.9 nodes during this period. During the second period of 14 days the rate of formation of nodes was much slower, the increase in number of nodes having been 3.6, 3.4, 3.3, and 3.3, respectively. The final period comprised 28 days, but the increase in number of nodes was only 3.8, 3.3, 2.7, and 3.8, or about the same as during the preceding period of 14 days. The total number of nodes formed during the entire period of 56 days after the appearance of the first squares was 12.1 nodes on plants

of the April 19 planting, 11.2 nodes on the April 28 planting, 10.7 nodes on the May 5 planting, and 13 nodes on the May 12 planting.

In order to show the number of nodes on plants in the different plantings on the same dates, the weekly records of nodal development are graphically presented in Figure 3. These curves show that the nodal development of the first three plantings was nearly parallel throughout the period following the appearance of squares until August 11. The May 12 planting, however, produced nodes more rapidly throughout this period. From June 1 until August 11, a period of 71 days, the April 19 planting produced 13.1 nodes. From June 8 until August 11, a period of 64 days, the April 28 and May 5 plantings produced 11.1 and 11 nodes, respectively. From June 15 to August 11, a period of 57 days, the May 12 planting produced 13 nodes. The average number of days per node for each planting was 5.42, 5. 77, 5.82, and 4.38 days, respectively.

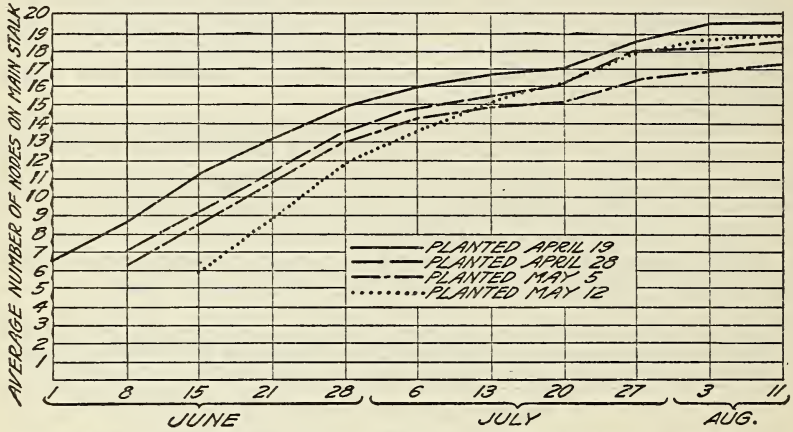


FIG. 3.—Average number of nodes on the main stalks of cotton plants at weekly intervals following the appearance of squares at San Antonio, Tex.

Each node produced on the main stalk after the beginning of the fruiting stage of the plants represents the formation of a fruiting branch. Thus, the May 12 planting produced the same number of fruiting branches in 15 days less time than was required by the April 19 planting.

Figure 4 gives the average height of 10 plants in each planting at weekly intervals from June 1 until August 11. While the height of plants is a factor of less importance than the nodal development, it will be of interest as showing the relative size of plants in each planting. The more vigorous growth of plants in the later plantings is shown in these curves. On July 13 the plants of the May 12 planting were the largest, with the May 5, April 28, and April 19 plantings following in the order named. Although the plants in the April 19 planting maintained a larger number of nodes throughout the season, after the middle of July they were the smallest. The difference in the size of representative plants in each planting is shown in Plates I and II.

This tendency toward the development of larger plants in later plantings is to be expected, especially on the heavier types of Texas

soils, when the moisture supply is plentiful. In the present experiment the late-planted cotton made considerably more vegetative growth than that planted early, in spite of drought conditions. The larger growth of the late-planted cotton resulted from the development of longer internodes on the main stalk and on the fruiting branches. Although the plants grew taller they had fewer nodes, as shown in Figure 3.

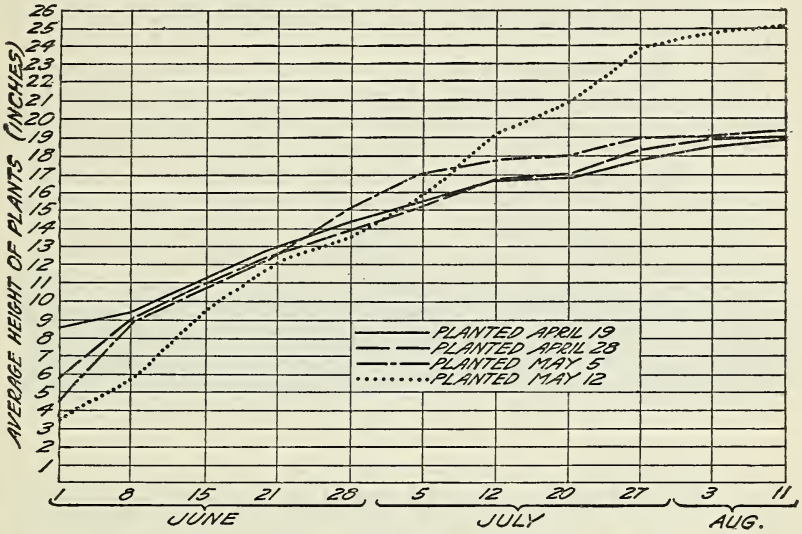


FIG. 4.—Growth in height of cotton plants at San Antonio, Tex.

PRODUCTION OF FLORAL BUDS

The fruiting capacity of a cotton plant is determined principally by the number of fruiting branches formed on the main stalk and the number of internodes formed on the fruiting branches. The plants in the successive plantings at San Antonio were small and formed few squares on secondary fruiting branches, and these are not included in comparisons of the fruiting capacity of plants.

The average number of squares formed on 10 plants in each of the four plantings is given in Table 7. The numbers of squares were recorded at 2-week intervals throughout the fruiting stage of the plants, the final record on August 11 representing the total number of squares formed on the plants.

TABLE 7.—*Average number of squares recorded at 2-week intervals on cotton plants grown in successive plantings at San Antonio on four different dates*

Date planted, 1923	Number of squares recorded on—					
	June 1	June 15	June 28	July 13	July 28	Aug. 11
Apr. 19	2.2	10.6	21.7	26.6	31.9	35.3
Apr. 28	0	6.5	18.6	26.4	33.3	38.7
May 5	0	5.7	17.6	23.1	25.8	28.5
May 12	0	1.7	12.8	24.2	26.4	30.9

These records show that the plants in the April 19 and April 28 plantings produced a larger number of squares than those in the plantings of May 5 and May 12. The number of squares, however, increased more rapidly on the later plantings during the first half of the squaring period, as will be seen by a comparison of the number of squares on the plants by July 13. On this date the average number of squares on plants of the May 12 planting was 24.2, as compared with 26.6 on plants of the April 19 planting, although this planting had reached the fruiting stage two weeks earlier than the planting of May 12.

The fact that the number of squares formed on the late plants by the middle of July was almost as great as the number on the early plants was largely due to a better development of the lower fruiting branches on plants of the later plantings. Table 8 gives the average number of internodes formed on fruiting branches. The numbers of internodes are determined from groups of fruiting branches, in order to simplify the presentation of the data. The first eight fruiting branches on plants of the May 5 and May 12 plantings developed more internodes than the first eight branches of the early plantings. The number of internodes on the upper fruiting branches was approximately the same on the first and last plantings, while the upper fruiting branches on the second and third plantings were not so well developed. This tendency toward the formation of more internodes on lower fruiting branches of late-planted cotton indicates that the growth of the plants was not retarded by the dry weather during June and the first part of July to so great an extent as with the early plants. This is shown in Plates I and II by the presence of squares on plants of the later plantings during the first part of August, after all squares had been shed from the plants in the early plantings.

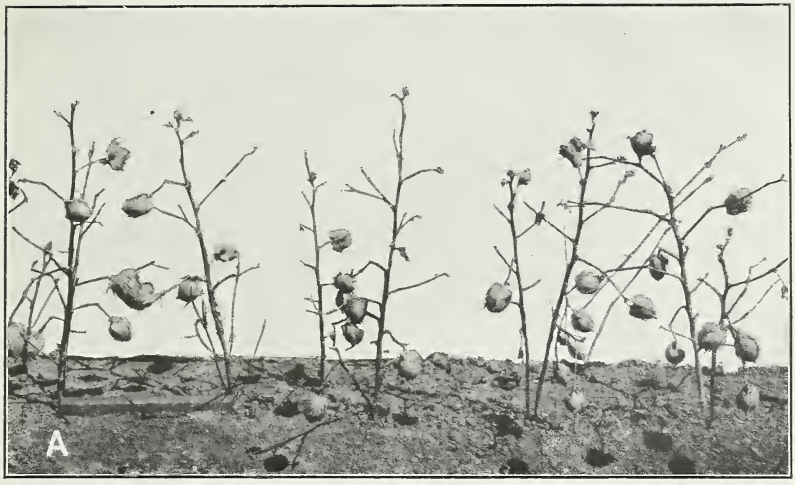
TABLE 8.—*Average number of nodes on fruiting branches of cotton plants grown in successive plantings at San Antonio on four different dates*

Date planted, 1923	Branches 1 to 4	Branches 5 to 8	Branches 9 to 12	Branches 13 to 15
Apr. 19	1.9	2.8	2.45	1.27
Apr. 28	1.57	2.87	2.07	.9
May 5	2.17	3.07	2.07	.8
May 12	2.52	3.62	2.92	1.0

The average number of internodes on the first eight fruiting branches on plants of the May 12 planting was 3.04, as compared with 2.3 internodes on plants of the April 19 planting. An even more pronounced tendency toward the formation of a greater number of internodes on the lower fruiting branches of later plantings was shown in the experiments at Charleston.

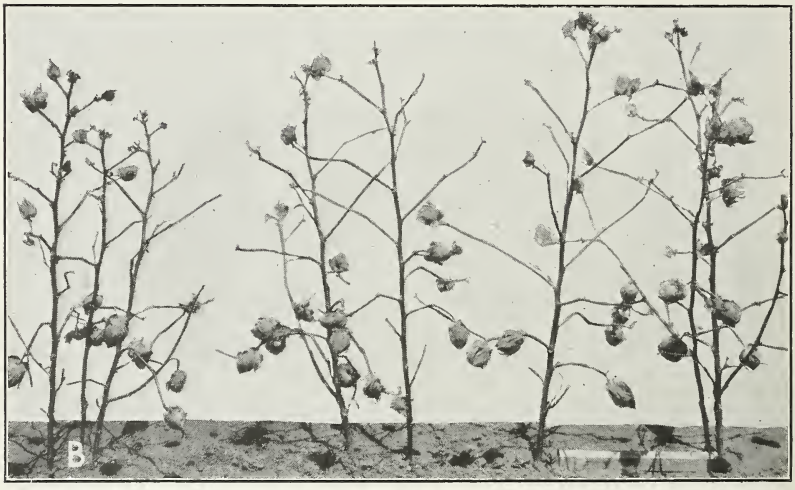
FLOWERING RECORDS OF EARLY AND LATE PLANTINGS

Flower counts were obtained from four 50-foot sections of rows in the April 19, April 28, and May 5 plantings, and from two 50-foot sections of rows in the May 12 planting. A section of row was located on the east and west ends of rows in the first and second blocks of the April 19, April 28, and May 5 plantings. No flower counts were



SIZE AND FRUITING OF COTTON PLANTS IN SUCCESSIVE PLANTINGS AT SAN ANTONIO, TEX., ON AUGUST 7.—I

A, Planted April 19; *B*, planted April 28. (Compare with Plate II)



SIZE AND FRUITING OF COTTON PLANTS IN SUCCESSIVE PLANTINGS AT SAN ANTONIO, TEX., ON AUGUST 7.—II

A, Planted May 5; *B*, planted May 12. (Compare with Plate I)

Note the larger size and production of vegetative branches on the plants in the May 12 planting, showing the need of closer spacing of plants in late-planted cotton. Also note the presence of squares and flowers on these plants, produced under drought conditions, which had checked growth in the early-planted cotton

made in the west end of the May 12 planting because of the very poor stand.

Flower counts were started on June 26 and were made daily until July 7. From that time until July 31 they were made every other day. The counts from each section of row in each planting are given in Table 9, with the total number of flowers counted each day in each planting shown graphically in Figure 5.

The total number of flowers counted on the west end of the rows is usually smaller than the number on the east end. This was due to retarded plant growth in the west end of the rows caused by Johnson grass in that part of the field.

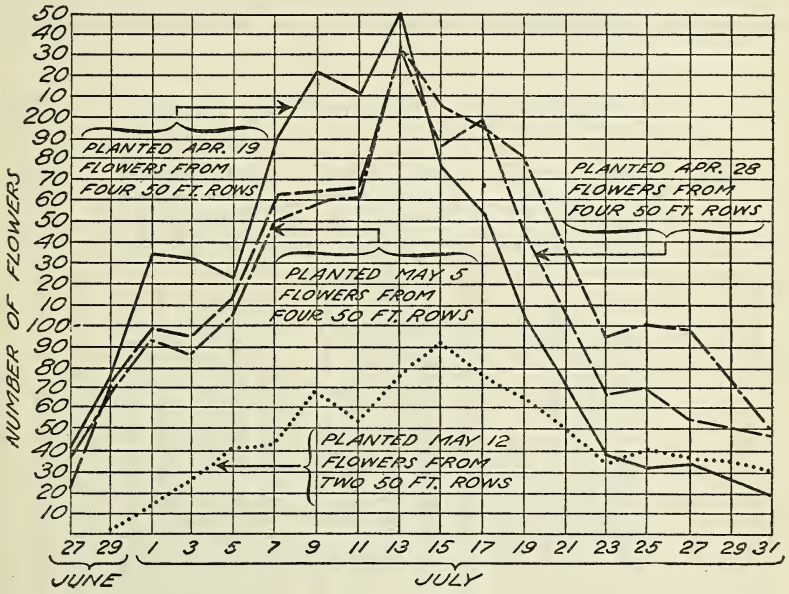


FIG. 5.—Total number of flowers recorded daily from all sections of each cotton planting at San Antonio, Tex.

The flowering of the April 19 and April 28 plantings was delayed by the removal of early squares from the plants on June 12, as previously stated. Owing to this delay, the first flowers appeared at about the same date in the plantings made on April 19, April 28, and May 5.

The plants in the April 19 and April 28 plantings were larger than those in the May 5 planting, however, and produced more flowers during the first half of the flowering period. During the period from June 26 to July 13, inclusive, the total numbers of flowers counted on the respective plantings were 1,966 on the planting of April 19, as compared with 1,635 for the planting of April 28 and 1,539 for that of May 5. Only 404 flowers were counted during the same period on the two 50-foot rows of the May 12 planting.

Although the early-planted cotton produced the largest number of flowers during the first half of the flowering period, the first three plantings reached the peak of flower production on the same day, the largest number of flowers being recorded on July 13 in each of

these plantings. During the period from July 13 to July 31, the date when flowering practically ceased, the May 5 planting produced the largest number of flowers relative to the number of plants, while the April 19 planting produced the smallest number. The total number of flowers counted during the entire season was nearly the same in each of the first three plantings, being, respectively, 2,606 for the April 19 planting, 2,517 for the April 28 planting, and 2,620 for the May 5 planting. On the two 50-foot rows of the May 12 planting 866 flowers were counted. The small number of flowers produced on these rows was due to the very irregular stand of plants.

TABLE 9.—*Numbers of flowers counted from 50-foot sections of rows of cotton grown in successive plantings at San Antonio during the period from June 26 to July 31, 1923*

Date	Planted Apr. 19					Planted Apr. 28					Planted May 5					Planted May 12		
	Block 1		Block 2			Block 1		Block 2			Block 1		Block 2					
	West	East	West	East	Total	West	East	West	East	Total	West	East	West	East	Total	Block 1, east	Block 2, east	Total
June 26	1	1	6	6	14	2	2	2	4	10	0	6	1	5	12	0	0	0
27	6	8	13	13	40	6	6	3	7	22	12	14	4	8	38	0	0	0
28	6	13	23	11	53	9	16	8	10	43	8	15	9	8	40	0	0	0
29	11	23	21	22	77	12	21	20	19	72	13	20	15	19	67	0	1	1
30	15	24	38	35	112	7	34	12	25	78	18	26	15	14	73	2	1	3
July 1	32	43	31	29	135	22	35	16	25	98	22	25	20	27	94	7	8	15
2	19	28	35	19	101	19	37	21	23	100	23	27	19	16	85	11	10	21
3	23	41	26	41	131	15	37	6	37	95	22	26	16	23	87	11	9	20
4	36	53	41	37	167	17	53	22	45	137	26	35	25	31	117	12	21	33
5	23	34	34	31	122	24	41	16	33	114	28	33	18	27	106	21	20	41
6	19	43	43	35	140	22	52	21	45	140	26	28	22	39	115	12	16	28
7	36	66	41	46	189	22	64	34	41	161	44	38	31	37	150	21	23	44
9	40	64	61	58	223	33	58	24	50	165	30	45	39	45	159	29	39	68
11	32	68	52	59	211	27	67	20	54	168	42	46	29	45	162	24	29	53
13	44	75	62	70	251	48	75	48	61	232	49	65	50	70	234	41	36	77
15	44	35	58	41	178	34	63	40	49	186	57	65	36	50	208	38	54	92
17	31	39	33	50	153	52	55	40	52	199	49	47	40	59	195	36	40	76
19	17	31	30	27	105	27	40	38	39	144	38	41	43	59	181	33	32	65
21	15	22	21	17	75	19	17	33	37	106	32	29	31	40	132	26	24	50
23	12	10	11	5	38	10	6	23	29	68	25	20	20	30	95	20	15	35
25	8	8	10	5	31	10	7	30	23	70	23	20	26	33	102	22	29	51
27	7	6	12	10	35	11	11	18	16	56	23	30	24	21	98	26	11	37
29	5	3	4	6	18	10	9	14	12	45	17	13	10	10	50	18	14	32
31	1	2	4	0	7	1	1	4	2	8	0	4	7	9	20	12	12	24
Total	483	740	710	673	2,606	459	807	513	738	2,517	627	718	550	725	2,620	422	444	866

Most of the flowers produced after the middle of July were shed as a result of adverse climatic conditions. The ability of late-planted cotton to continue flowering under severe conditions is to be noted, however. This probably was connected with the continued production of internodes on the lower fruiting branches of the late-planted cotton, which occurred both at San Antonio and at Charleston.

SHEDDING OF BOLLS IN EARLY AND LATE PLANTINGS

As a result of dry weather considerable shedding of bolls occurred in the different plantings. In order to compare the extent of boll shedding in these plantings, the numbers of shed bolls were recorded from the 50-foot sections of rows on which the flower counts were obtained. These counts do not represent the total number of bolls,

as many shed bolls undoubtedly were covered with soil when the plants were cultivated and others were shed later in the season after the records were obtained.

Table 10 gives the number of shed bolls recorded from each section of row in each planting during the period from June 30 to August 2. These bolls were picked up every day from June 30 to July 7 and at intervals of two or three days thereafter.

Boll shedding started about July 1 in the first three plantings and reached its peak on July 17. Although more bolls were shed from the April 19 planting during the period from June 30 to July 17, the larger numbers of bolls from the April 28 and May 5 plantings were shed during the latter part of July. This no doubt was due to the larger proportion of late flowers produced by these plantings.

TABLE 10.—*Numbers of shed bolls recorded from 50-foot sections of rows of cotton grown in successive plantings at San Antonio during the period from June 30 to August 2, 1923*

Date	Planted Apr. 19					Planted Apr. 28					Planted May 5					Planted May 12		
	Block 1		Block 2		Total	Block 1		Block 2		Total	Block 1		Block 2		Total	Block 1, east	Block 2, east	Total
	West	East	West	East		West	East	West	East		West	East	West	East				
June 30	0	1	4	2	7	0	0	0	1	1	0	0	0	0	0	0	0	0
July 1	0	3	1	3	7	0	1	1	1	3	0	0	1	3	4	0	0	0
2	2	7	1	5	15	1	1	1	3	6	5	6	2	4	17	0	0	0
3	0	3	1	4	8	1	6	0	2	9	1	6	0	3	10	0	0	0
4	2	2	6	2	12	0	2	3	8	13	1	5	5	5	16	0	0	0
5	4	2	6	7	19	4	1	0	13	18	3	7	2	8	20	1	0	1
6	3	2	5	3	13	1	1	9	5	16	4	4	7	5	20	1	0	1
7	7	7	12	9	35	8	17	6	10	41	9	8	9	9	35	4	2	6
9	15	24	31	27	97	13	34	16	33	96	22	30	17	18	87	12	10	22
11	23	61	41	35	160	21	56	17	49	143	19	46	30	33	128	28	21	49
13	42	76	67	61	246	44	80	48	68	240	51	51	49	36	187	26	30	56
15	46	106	92	65	309	49	97	44	64	254	48	46	57	56	207	33	30	63
17	86	129	107	96	418	71	149	55	99	374	75	108	63	86	332	32	59	91
19	51	117	81	96	345	67	136	39	70	312	78	106	57	83	324	45	46	91
23	42	73	52	90	257	52	89	55	89	285	57	78	49	75	259	40	78	118
25	22	33	31	26	112	29	44	35	33	141	35	40	36	54	165	28	32	60
27	24	12	34	17	87	36	27	45	41	149	54	39	40	68	201	57	39	96
30	21	24	23	24	92	25	28	32	66	151	50	60	44	74	228	50	55	105
Aug. 2	22	33	22	28	105	24	26	22	52	124	49	55	35	63	202	33	45	78
Total	412	715	617	600	2,344	446	795	428	707	2,376	561	695	503	683	2,442	390	447	837

For the period from June 30 to August 2 the total numbers of shed bolls recorded from the April 19, April 28, and May 5 plantings were 2,344, 2,376, and 2,442, respectively, while only 837 shed bolls were recorded from the two 50-foot rows of the May 12 planting. The smaller number of bolls shed from the May 12 planting is due to the fact that fewer flowers were produced.

The fact that the numbers of flowers produced and the numbers of bolls shed were nearly the same on each of the first three plantings indicates that there was no significant difference in the proportion of flowers produced and the extent of shedding during the period of observation. It is probable, however, that more boll shedding would have been recorded on the later plantings if the counts had been continued in August.

SHEDDING OF SQUARES FROM WEEVIL INJURY

As previously stated, the first indication of weevil infestation after the removal of squares and the application of poison was noted during the last week in June. The progress of the infestation is shown by records of weevil damage during the period from June 25 to July 31. These records were obtained by counting the number of weevil-punctured squares that were shed during 2-day intervals from a 50-foot section of a row in each block of each planting. These data are graphically shown in Figure 6, the total number of shed squares from the two blocks in each planting being combined in each curve.

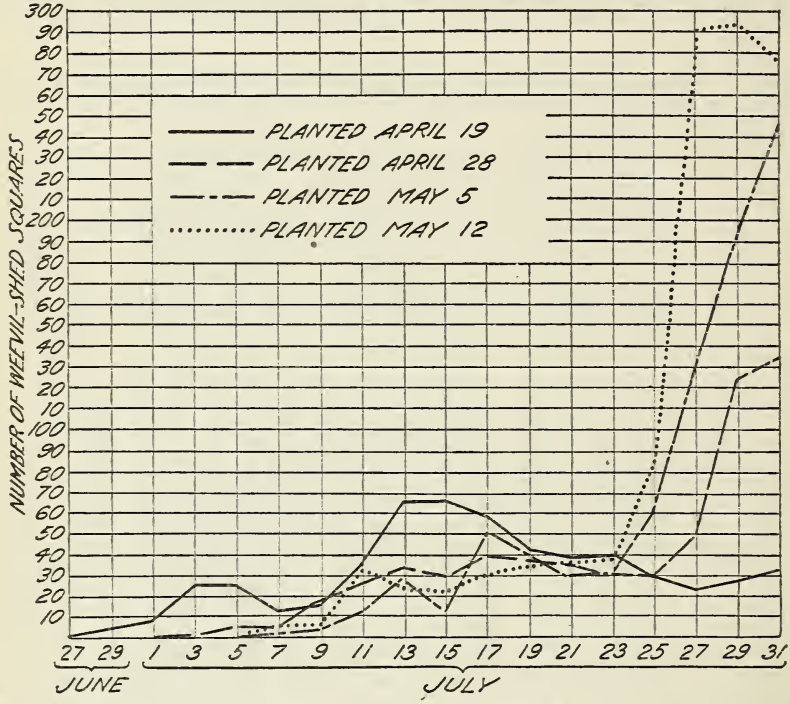


FIG. 6.—Number of weevil-shed squares from two 50-foot sections of rows in each planting of cotton at San Antonio, Tex.

The first weevil-shed squares in the April 19 planting were found on June 29 and in each of the three later plantings by July 7. The first planting showed a higher rate of square shedding during the first half of July, but the extent of weevil damage in all plantings was practically the same by the 19th of that month. The number of squares shed from the first planting decreased after this date, but increased very rapidly in each of the later plantings.

This abrupt shift in the extent of shedding is due to the fact that there were more squares on plants in the later plantings during the last half of July. It is probable that the absence of squares on the early plants resulted in a concentration of weevils on the later plantings. This condition of heavy weevil infestation in the late-planted

cotton illustrates the difficulty of obtaining accurate comparisons of productiveness from adjacent plantings of early and late planted cotton when complete weevil control is not obtained.

WEEVIL DAMAGE TO BOLLS

Records of the extent of weevil injury to bolls in the different plantings were made on four dates during the period of boll opening. These records were obtained from the same 50-foot sections of rows which were used in comparisons of flowering and boll shedding. The weevil damage was determined by counting the number of injured and uninjured locks in each of the bolls that had opened in the intervals between the four dates when the records were made. This afforded a means of comparing the extent of the injury to early and late bolls of the successive plantings.

Table 11 gives the number of bolls picked, the number showing weevil damage, the total number of locks, and the number and percentage of locks damaged by the weevils. The records from the four 50-foot sections of the first three plantings are summarized and presented in a single unit corresponding to a 200-foot row.

TABLE 11.—*Extent of weevil injury to bolls in successive plantings of cotton at San Antonio*

Date planted, 1923	Date picked	Number of bolls picked	Number of bolls damaged by weevils	Total number of locks	Locks damaged by weevils	
					Number	Per cent
Apr. 19	Aug. 14	243	56	1,061	92	8.7
	Aug. 18	312	57	1,390	89	6.4
	Aug. 30	403	175	1,733	366	21.1
	Sept. 10	101	72	432	163	37.7
Total		1,059	360	4,616	710	15.4
Apr. 28	Aug. 14	161	52	719	66	9.2
	Aug. 18	215	52	968	69	7.1
	Aug. 30	519	249	2,258	521	23.1
	Sept. 10	138	105	584	239	40.9
Total		1,033	458	4,529	895	19.8
May 5	Aug. 14	105	25	472	35	7.4
	Aug. 18	216	31	968	52	5.4
	Aug. 30	521	313	2,387	656	27.5
	Sept. 10	198	129	849	299	35.2
Total		1,040	498	4,676	1,042	22.3
May 12	Aug. 30	300	192	1,410	433	30.7
	Sept. 10	86	69	375	173	46.1
Total		386	261	1,785	606	33.9

The maturation period of Lone Star bolls in Texas has been shown to be about 42 days,[4] so that bolls open before August 18 must have developed from flowers appearing prior to July 8. The small amount of weevil injury to these early bolls is due to the slight weevil infestation during the first part of the flowering stage of the plants and also to the presence of squares. While squares are available

[4] Martin, R. D., W. W. Ballard, and D. M. Simpson. Growth of fruiting parts in cotton plants. *In* Jour. Agr. Research, v. 25, p. 204. 1923.

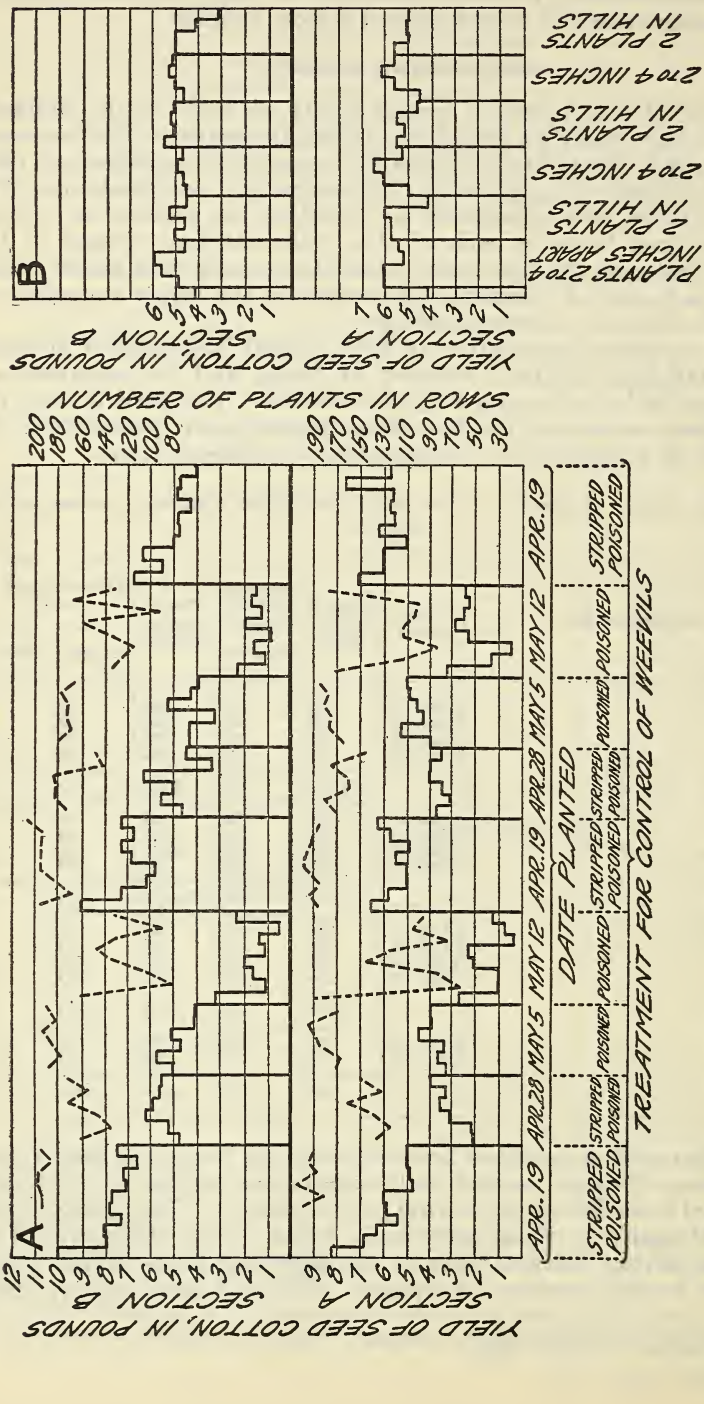


FIG. 7.—Row yields of successive plantings of cotton at San Antonio, Tex., each abscissa representing a separate row. Number of plants in rows shown by broken lines; yield of seed cotton in pounds shown by solid lines (A). Row yields of spacing test of cotton planted on May 12 at San Antonio, Tex., with no treatment for weevil control (B).

for the weevils to work upon, there is less injury to the bolls, though the fact that from 7 to 9 per cent of the locks on early bolls were damaged shows that the presence of squares is not a complete protection against weevil attack. The greater injury to the later bolls corresponds to the heavier infestation of weevils in the latter part of July and to the fact that there were very few squares on the plants at that time.

The increase of about 12 per cent in the injury to bolls in the planting of May 12, as compared with that of May 5, as shown in Table 11, is due to the fact that practically all the bolls produced in the last planting were from flowers appearing after July 8, so that most of the bolls in this planting were immature when the weevil infestation reached its peak during the latter part of July. It is probable also that weevil injury caused the shedding of many late bolls that otherwise might have been retained and developed to maturity.

YIELDS FROM SUCCESSIVE PLANTINGS AT SAN ANTONIO

During the first week in August the first open bolls were found on the plantings of April 19, April 28, and May 5. Although there was little difference in the time when the first open bolls appeared on these three plantings, that of April 19 matured the bulk of its crop sooner than the others. This was in accord with the larger number of early flowers produced by the first planting. The entire crop of all plantings had matured by September 10, but the scarcity of labor delayed picking until September 19.

TABLE 12.—*Yield of seed cotton from successive plantings at San Antonio*

Date planted, 1923	Block	Row	Number of plants			Yield of seed cotton (pounds)		
			Section A	Section B	Per row	Section A	Section B	Per row
Apr. 19		1				8.25	10.00	18.25
		2				6.75	8.00	14.75
		3				6.25	8.12	14.37
		4				5.44	7.25	12.69
	1	5	198	194	392	5.87	7.87	13.74
		6	182	193	375	6.00	7.75	13.75
		7	205	198	403	4.75	7.12	11.87
		8	189	197	386	4.82	7.21	12.03
Block total			774	782	1,556	21.44	29.95	51.39
		9	194	185	379	5.00	6.56	11.56
		10	190	197	387	5.00	7.50	12.50
Apr. 28		1	137	163	300	2.06	4.75	6.81
	2	2	126	135	261	2.19	5.25	7.44
		3	138	147	285	3.12	6.25	9.37
		4	162	172	334	3.58	5.94	9.52
		5	131	154	285	3.31	5.64	8.95
Block total			557	608	1,165	12.20	23.09	35.28
		6	149	172	321	4.00	5.62	9.62
May 5		1	170	187	357	3.25	5.00	8.25
	3	2	168	177	345	3.70	5.79	9.49
		3	185	186	371	3.44	4.69	8.13
		4	188	193	381	4.52	5.12	9.64
		5	195	181	376	3.87	4.18	8.05
Block total			736	737	1,473	15.53	19.78	35.31
		6	170	189	359	4.00	4.12	8.12

TABLE 12.—*Yield of seed cotton from successive plantings at San Antonio*—Con.

Date planted, 1923	Block	Row	Number of plants			Yield of seed cotton (pounds)		
			Section A	Section B	Per row	Section A	Section B	Per row
May 12		1	220	164	384	2.69	3.25	5.94
		2	63	80	143	1.00	1.12	2.12
	4	3	83	105	188	1.00	1.62	2.62
		4	146	135	281	2.12	2.00	4.12
		5	127	149	276	2.37	1.18	3.55
		6	72	131	203	.40	1.37	1.77
Block total			428	520	948	5.89	6.17	12.06
		7	107	89	196	.75	.50	1.25
		8	99	133	232	1.25	2.37	3.62
Apr. 19		1	186	198	384	6.50	9.06	15.56
		2	193	169	362	5.75	7.25	13.00
	5	3	186	184	370	5.00	6.12	11.12
		4	198	196	394	5.00	5.75	10.75
		5	198	196	394	5.50	6.94	12.44
		6	193	195	388	4.94	7.37	12.31
Block total			775	771	1,546	20.44	26.18	46.62
		7	190	194	384	5.67	6.73	12.40
		8	185	207	392	6.25	7.37	13.62
Apr. 28		1	170	174	344	3.75	4.69	8.44
	6	2	182	183	365	3.06	5.62	8.68
		3	160	181	341	3.50	5.00	8.50
		4	162	184	346	4.05	6.36	10.41
		5	176	144	320	4.00	3.62	7.62
Block total			680	692	1,372	14.61	20.60	35.21
		6	145	149	294	3.50	4.50	8.00
May 5		1	166	180	346	4.00	4.37	8.37
	7	2	177	170	347	5.25	4.37	9.62
		3	174	174	348	4.25	3.62	7.87
		4	181	173	354	4.60	5.28	9.88
		5	178	179	357	4.94	4.25	9.19
Block total			710	696	1,406	19.04	17.52	36.56
		6	186	168	354	5.06	3.87	8.93
May 12		1	173	135	308	3.25	2.37	5.62
		2	112	126	238	1.37	1.12	2.49
	8	3	85	113	198	.50	1.62	2.12
		4	114	142	256	2.25	.87	3.12
		5	112	162	274	2.87	2.06	4.93
		6	104	93	197	2.50	1.25	3.75
Block total			415	510	925	8.12	5.80	13.92
		7	100	192	292	2.25	1.75	4.00
		8	178	132	310	2.44	1.50	3.94
Apr. 19		1	------	------	------	7.19	6.81	14.00
		2	------	------	------	6.00	5.50	11.50
	9	3	------	------	------	6.00	6.44	12.44
		4	------	------	------	5.19	5.00	10.19
		5	------	------	------	6.25	4.75	11.00
		6	------	------	------	5.56	4.62	10.18
Block total			------	------	------	23.00	20.81	43.81
		7	------	------	------	5.75	4.25	10.00
		8	------	------	------	5.62	4.87	10.49
		9	------	------	------	7.62	4.75	12.37
		10	------	------	------	5.75	4.00	9.75

The rows in this test were divided into two 100-foot sections by a line stretched across the field, and the weight of seed cotton was recorded from each section of each row. Section A includes the western half of the field and section B the eastern half, where the plants were notably larger. The weight of seed cotton and the number of plants are stated in Table 12. These data are also shown graphically in Figure 7. In comparing the yields of the four plantings the weight of seed cotton from only the four inside rows of each block is used.. The yields of the outside rows vary to a considerable extent, being affected by adjoining blocks of earlier or later planted cotton.

The highest yield of seed cotton was obtained from the April 19 planting, the yields from three 4-row blocks having been 51.39, 46.62, and 43.81 pounds, respectively. The yields from the April 28 and May 5 plantings were about equal. Two blocks of the April 28 planting yielded 35.28 and 35.21 pounds, while the May 5 planting produced 35.31 and 36.56 pounds. Very low yields were recorded from the May 12 planting, the two blocks having produced only 12.06 and 13.92 pounds of cotton, respectively.

Consistent differences in the yield of the east and west sections of rows occurred in all plantings. The lower yields from the west section of rows were due to the presence of Johnson grass, which retarded the growth of plants in this part of the field.

In the May 12 planting no thinning was done in parts of rows where a stand was obtained, so that the plant counts are not comparable with those obtained from the other plantings. Though the low yields of the May 12 planting may be ascribed very largely to the poor stand of plants, the larger proportion of bolls injured by the weevils was also a factor.

The higher yields obtained from the cotton planted on April 19 may also be ascribed, at least in part, to the smaller percentage of injured bolls, showing that the weevil conditions were not as severe during the early period of boll development.

Nearly the same numbers of flowers and shed bolls were recorded from the April 19, April 28, and May 5 plantings, and the totals of the yields from the four 50-foot sections of rows of each planting from which these records were obtained were nearly the same, having been 12.68 pounds from the April 19 planting, 12.15 pounds from the planting of April 28, and 11.67 pounds from that of May 5. Nevertheless, the total block yields were considerably higher on the April 19 planting.

It seems possible that the higher yields obtained from the 50-foot sections of rows in the April 28 and May 5 plantings, as compared with the total block yields, may have been due to the fact that all of the weevil-infested squares were picked up under the 50-foot sections during July for record purposes.

The additional protection that may have been given to the 50-foot sections by collecting the weevil-shed squares would not render the yields less significant. On the contrary, the yields that were secured from these sections of rows may be more indicative of the results that might have been secured if the later plantings had been apart from the earliest planting and had not been subjected to the weevil infestation from the early cotton.

PERCENTAGE OF 5-LOCK BOLLS ON EARLY AND LATE PLANTINGS AT SAN ANTONIO

A feature that was found to differ in the several plantings was the proportion of bolls with five locks. A record was obtained of the number of locks in bolls picked from four 50-foot sections of rows in the April 19, April 28, and May 5 plantings.

Data from each planting are presented in Table 13, showing the number of 4-lock and 5-lock bolls picked on August 18 and September 10 from two 50-foot rows on the east side of the field and two 50-foot rows on the west side. As stated previously, the presence of Johnson grass on the west side of the field retarded the development of the plants, and lower yields were obtained than on the east side.

The data presented in Table 13 show that a consistently higher percentage of 5-lock bolls were produced on the large plants in the east end of the rows. In the April 19 planting the large plants produced 41.2 per cent of 5-lock bolls, as compared with only 23.8 per cent on the small plants. The large and small plants in the April 28 planting produced, respectively, 49.5 and 23.8 per cent of 5-lock bolls and in the May 5 planting 50.3 and 27.6 per cent. There was little difference in the percentage of 5-lock bolls produced on the small plants in the first three plantings, but the percentage of these bolls produced on the large plants in the May 5 planting was 9 per cent higher than in the April 19 planting.

TABLE 13.—*Number of bolls and percentage of 5-lock bolls picked on August 18 and September 10 from large plants on the east end of rows and from small plants on the west end of rows in the successive adjacent plantings of cotton at San Antonio*

Date planted, 1923	Size	Date picked	Number of bolls				Percentage of 5-lock bolls
			5-lock	4-lock	3-lock	Total	
Apr. 19	Small plants	Aug. 18	70	162	1	233	30.0
		Sept. 10	37	179	1	217	17.1
Total			107	341	2	450	23.8
	Large plants	Aug. 18	146	176	0	322	45.3
		Sept. 10	105	181	1	287	36.6
Total			251	357	1	609	41.2
Apr. 28	Small plants	Aug. 18	42	87	1	130	32.3
		Sept. 10	51	207	3	261	19.5
Total			93	294	4	391	23.8
	Large plants	Aug. 18	146	99	0	245	59.6
		Sept. 10	172	225	0	397	43.3
Total			318	324	0	642	49.5
May 5	Small plants	Aug. 18	36	95	0	131	27.5
		Sept. 10	87	225	3	315	27.6
Total			123	320	3	446	27.6
	Large plants	Aug. 18	120	70	0	190	63.2
		Sept. 10	178	224	1	403	44.2
Total			298	294	1	593	50.3

A SEPARATE LATE PLANTING AT SAN ANTONIO

A separate late planting of cotton was also made at San Antonio on May 12, the same date as the last of the consecutive adjacent plantings and from the same stock of seed. The surface soil had dried, but by using broad sweeps in front of the planter drill the seed was dropped in moist earth. Germination was rapid, and a fairly good stand of plants was obtained, although most of the rows had a few skips due to imperfect germination. Most of the seed in these skips germinated following a rain on May 30, but the seedlings were weak and most of them died or remained stunted. The location of this planting with relation to other fields of cotton on the experiment farm is shown in Figure 1.

CLOSE SPACING IN LATE PLANTINGS

The tendency of late-planted cotton to produce a large "rank" type of stalk under certain conditions renders it desirable to leave the plants closer together in the rows, in order to suppress excessive vegetative growth. Plants which grow large require a longer season to mature a crop, and when the season is shortened by late planting overgrown plants are an added disadvantage.

The principle of controlling the vegetative growth of plants by spacing the plants closer in the rows has been tested under a wide range of conditions. Equal or greater yields have usually been obtained from close-spaced plants when tested in direct comparison with wide-spaced plants. A greater degree of earliness is usually obtained by close spacing. In open stands with the plants averaging from 2 to 4 inches apart in the row, larger yields have been obtained without thinning.

In order to test the effect of close spacing when cotton is planted late, this experiment was planned as a comparison of plants chopped to two plants in a hill with plants left unthinned in the rows. The test consisted of three 4-row blocks of each spacing, the unthinned blocks alternating with the blocks of thinned plants. The outside blocks were protected by guard rows.

The plant spacing used in comparison with the unthinned blocks was the same as that used in the time-of-planting test, two plants being left in hills with the hills 12 inches apart. Thinning was done in these rows on June 15, when the plants averaged about 8 inches in height and had from six to eight nodes.

OVERWINTERED WEEVILS AVOIDED

Although the late-planted cotton was examined at frequent intervals for indications of weevil infestation, no trace of weevil injury was found during June.

The fact that infestation from overwintered weevils was avoided in the separate late planting probably was due to hot dry weather during the first part of June. During this period the plants were small and had not yet formed squares, so that if weevils came in they had little protection against the high temperatures and did not survive to attack the squares when they had reached sufficient size to enable the weevils to begin breeding. Thus, it appeared that the planting of May 12 had been sufficiently late to avoid infestation from overwintered weevils under the conditions encountered at San Antonio.

LATER WEEVIL INJURY

The first indication of weevil infestation in the late-planted cotton was noted on July 8, after the plants had begun to produce flowers. It is probable that this infestation resulted from migratory or stray weevils from the nearest field of early-planted cotton. A field of cotton planted on April 12 was located about 200 feet southwest of the late-planting test. This early-planted cotton was heavily infested with weevils, and migration may have occurred from this field during the first part of July.

In order to show the progress of infestation in the late-planted cotton, a record was obtained of the number of weevil-punctured squares which were shed from the plants in two 50-foot sections of rows. The number of squares shed each day are graphically presented in Figure 8. The first squares shed as a result of weevil injury were found on July 11. The shedding was very slight until July 25, when a rapid increase occurred. The sudden increase at this time

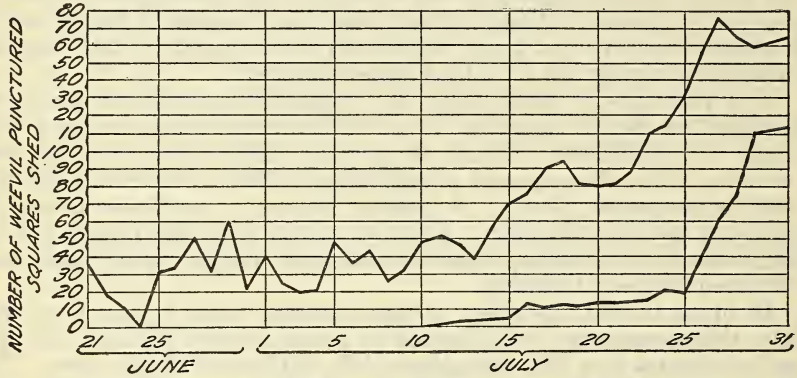


FIG. 8.—Number of weevil-punctured squares shed from a 100-foot section of row in cotton planted on April 22 and on May 12 at San Antonio, Tex. The upper line represents cotton planted on April 22; first squares on May 27. The lower line represents cotton planted on May 12; first squares on June 10. No treatment for the control of weevils was given in either field

was probably due to an increased infestation by weevils migrating from near-by fields of early-planted cotton.

A similar record of weevil-punctured squares was obtained from a field of cotton planted on April 2, located about 600 feet north of the late-planted cotton. These data are included in Figure 8 for purposes of comparison with data regarding the late-planted cotton.

The first squares on the cotton planted April 22 appeared during the last week in May. Weevils were found on plants in this field by June 1, and a 12 per cent infestation was recorded on June 6. As squares were available early in June, it was possible for the weevils to deposit eggs and insure the appearance of a new generation of weevils by the latter part of the month. Thus, the May 12 planting did not get weevils for more than a month later than the April 22 planting, and the breeding of an early generation of weevils during June was entirely avoided in the late-planted cotton.

Even if favorable conditions for natural control of weevils did not occur, effective control might be obtained in late-planted cotton by applying poison just before squares are produced. This method of control probably would be limited to late-planted cotton which did

not produce squares until the emergence of weevils from hibernation had been completed. Poison applied before the appearance of squares in early-planted cotton would be less effective, as late emerging weevils would reinfest the field.

DEVELOPMENT OF PLANTS IN THINNED AND UNTHINNED ROWS

In order to compare the development of the plants in thinned and in unthinned cotton, records of plant height and number of nodes on the main stalk, the number of squares produced, and the number of internodes on the fruiting branches were obtained on 10 representative plants of each spacing. These records were started on June 27 and were taken at biweekly intervals until August 9.

The average number of internodes on the main stalk and the height of plants on June 27 were practically the same on plants which had been thinned to two in a hill on June 15 and on plants left unthinned. Those in both spacings averaged 11.1 nodes on this date, while the height averaged 28.8 centimeters for unthinned and 28.9 centimeters for the thinned plants.

The number of internodes on plants of both spacings remained practically equal throughout the period during which data were obtained. The final records, obtained on August 9, showed that the unthinned plants averaged 17.2 internodes, while the thinned plants averaged 18 internodes on the main stalk. The thinned plants had grown to a slightly greater size, however, their height averaging 67.3 centimeters, as compared with 63.2 centimeters on those unthinned. It is apparent that different plant spacings had a negligible effect on the development of internodes of the main stalk and on the height of the plants. The dry weather at San Antonio during this season retarded the development of all plants, and it is possible that greater differences in the size of plants would have resulted if more moisture had been available.

Although the development of the main stalk was the same on thinned and unthinned plants in this test, the thinned plants had a larger number of internodes formed on the fruiting branches, as shown by records obtained on August 9, when the growth of all plants had practically stopped. These data, showing the comparative nodal development of groups of fruiting branches on thinned and unthinned plants, are presented in Table 14. The thinned plants had a consistently larger number of internodes on each group of fruiting branches than the unthinned plants.

TABLE 14.—*Number of squares on plants and average number of internodes on fruiting branches of thinned and unthinned plants in a late-planting test of cotton at San Antonio in 1923*

Plant spacing	Total number of squares on plants at 2-week periods				Average number of internodes on fruiting branches on August 9		
	June 27	July 12	July 25	August 9	Branches 1 to 4	Branches 5 to 8	Branches 9 to 12
Unthinned	10.6	18.7	24.1	25.4	1.8	2.4	1.7
Thinned (two plants in a hill)	10.1	22.9	30.6	34.0	2.3	3.2	2.3

The average number of squares formed on 10 plants of each spacing is shown in Table 14. The unthinned plants averaged 10.6 squares each on June 27, as compared with 10.1 squares on thinned plants. On August 9, when the final record of all squares formed was obtained, the thinned plants averaged 34 and the unthinned plants 25.4 squares per plant.

The greater fruiting capacity of individual plants when two plants are left in hills does not represent the relative fruitfulness of thinned and unthinned cotton. When equal areas of each spacing are compared, the greater number of plants in unthinned rows, usually more than offsets the difference in fruiting capacity of individual plants. This is illustrated in Plate III by the number of bolls set on equal sections of rows of thinned and unthinned plants.

PRODUCTION OF FLOWERS ON THINNED AND ON UNTHINNED ROWS

Daily records of the number of flowers were obtained from July 2 to July 7 and at 2-day intervals thereafter until August 6. These records were obtained from a 50-foot section of rows of thinned and of unthinned plants, each section being representative of similarly spaced plants throughout the test. There were 144 plants in the section of unthinned cotton and 98 plants in the thinned section. The data of flower production are given in Table 15.

TABLE 15.—*Flowers counted in 50-foot sections of rows of cotton unthinned compared with those on plants thinned to two in a hill with the hills 12 inches apart at San Antonio*

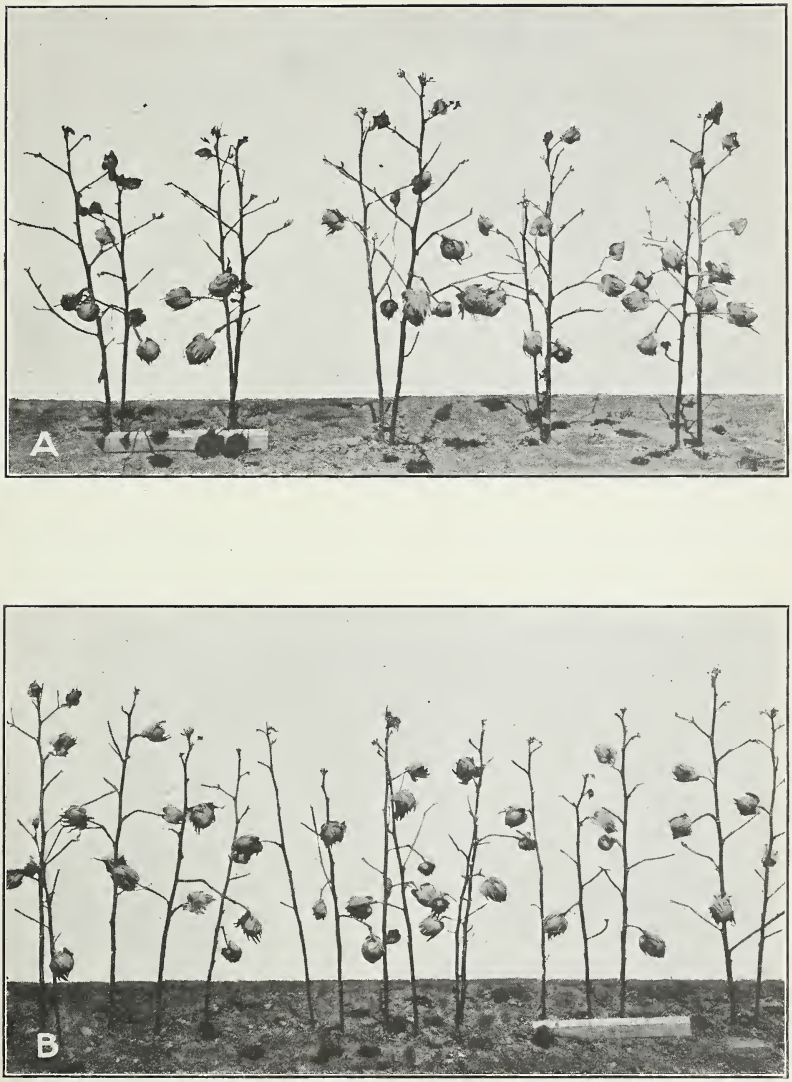
Date, 1923	Unthinned	Thinned	Date, 1923	Unthinned	Thinned	Date, 1923	Unthinned	Thinned
July 2	30	10	July 13	64	46	July 29	30	23
July 3	28	8	July 15	69	41	July 31	19	21
July 4	22	14	July 17	64	58	Aug. 2	4	17
July 5	31	11	July 19	54	48	Aug. 4	3	14
July 6	52	17	July 21	46	41	Aug. 6	1	11
July 7	33	22	July 23	41	35			
July 9	62	30	July 25	43	41	Total	782	566
July 11	50	17	July 27	36	41			

Although individual plants of thinned cotton have a greater fruiting capacity than unthinned plants, comparisons of equal areas of each spacing show that a larger number of flowers were produced by the unthinned plants. A total of 782 flowers was counted on the 50-foot section of unthinned cotton, as compared with 566 flowers on an equal section of thinned plants. The difference of 216 more flowers on the unthinned cotton represents an increase of about 38 per cent in favor of the unthinned plants in this test.

A greater degree of earliness of the unthinned plants is indicated by the number of flowers produced during the first part of the flowering period. A total of 372 flowers was recorded on the unthinned plants during the period from July 2 to July 13, as compared with 175 flowers on the thinned plants during the same period.

WEEVIL DAMAGE TO BOLLS

A record of the extent of weevil injury to bolls was obtained from two 50-foot sections of rows in the late-planted cotton. On August



PLANTS IN SEPARATE LATE PLANTINGS OF COTTON AT SAN ANTONIO, WITH THE VEGETATIVE BRANCHES SUPPRESSED BY CLOSE SPACING

A, Two plants in a hill with the hills 12 inches apart; *B*, unthinned cotton

COMPARATIVE SIZE AND FRUITING OF COTTON PLANTS IN SUCCESSIVE PLANTINGS AT CHARLESTON, S. C.

A, Planted April 5; *B*, planted April 25. (Photographed August 14)

20 all open bolls were picked, and the number of good and weevil-damaged locks was recorded. Similar data were obtained for bolls which opened between August 20 and September 1 and between September 1 and September 18.

A total of 211 bolls was picked from the two sections of rows on August 20. Of these bolls only 25 locks showed signs of weevil damage, representing 2.6 per cent of the total number of locks. On September 1, 613 bolls were picked, and 17.9 per cent of the locks were found to be damaged. Of 259 bolls picked on September 18, 34 per cent had damaged locks. A total of 18.8 per cent of the locks was damaged on the 1,083 bolls picked during the season. This weevil injury to bolls was much less than occurred in the other experiment on the cotton planted on the same date but between the earlier plantings. As shown in Table 11, the May 12 planting in the comparison of successive adjacent plantings had 33.9 per cent of all the locks damaged by weevils instead of 18 per cent in the separate late planting. This shows that even a slight isolation of the late plants had a notable effect upon weevil infestation and the resultant injury to the crop.

YIELDS FROM THINNED AND FROM UNTHINNED ROWS

The late-planted cotton was picked on September 18, at which time all bolls had opened. The field was divided into two equal sections by drawing lines across it at right angles to the rows, and the weight of seed cotton from each section of each row was recorded separately. The length of rows in each section was 100 feet.

The row yields from this test are presented graphically in Figure 7 in comparison with the row yields obtained from the successive plantings. The yields and number of plants per row in the late-planting test are given in Table 16.

The row yields of seed cotton indicate that soil conditions were very uniform throughout the field. Most of the difference in row yields resulted from imperfect stands, some of the rows having short sections with no plants or with a very irregular stand. This irregularity in stand interfered with an accurate comparison of the two systems of plant spacing, as some of the unthinned rows had fewer plants than some rows which had been thinned to two plants in a hill. The poorest stands occurred consistently on the outside rows of each block. As a 2-row planter was used it is probable that these thin stands were due to faulty operation of one side of the planter.

In view of the better stands on the two inside rows of each block, a more accurate comparison of yields may be obtained from these rows. The total yield of seed cotton from the inside rows of the three blocks of unthinned cotton was 67.07 pounds, as compared with a yield of 61.97 pounds from the inside rows of the three thinned blocks. From these weights the mean yield of one 200-foot row of unthinned cotton was found to be 11.18 ± 0.31 pounds, while the mean yield of an equal length of row of thinned cotton was 10.33 ± 0.45 pounds.

The difference in average yield of seed cotton between the unthinned rows and the rows which were thinned to two plants in a hill with hills 12 inches apart is less than twice the probable error, indicating that there was no significant difference in yield between the thinned

and the unthinned cotton. (Pl. III.) The cost of production was somewhat lower with the unthinned cotton, however, as the expense of chopping was eliminated.

TABLE 16.—*Yield of seed cotton in a late-planting test at San Antonio in 1923*

Plant spacing	Block	Row	Number of plants			Yield of seed cotton (pounds)		
			Section A	Section B	Per row	Section A	Section B	Per row
Unthinned	Guard	1						14.00
		2						13.52
Do	1	3	276	282	558	6.00	4.81	10.81
		4	320	347	667	6.04	5.62	11.66
		5	325	321	646	5.25	5.87	11.12
		6	246	177	423	5.50	4.62	10.12
Block total			1,167	1,127	2,294	22.79	20.92	43.71
Two plants in a hill (hills 12 inches apart)	2	1	157	151	308	5.75	5.00	10.75
		2	196	189	385	5.75	4.69	10.44
		3	181	189	370	6.00	5.25	11.25
		4	149	125	274	4.25	4.50	8.75
Block total			683	654	1,337	21.75	19.44	41.19
Unthinned	3	1	179	191	370	5.00	4.50	9.50
		2	265	307	572	6.12	4.69	10.81
		3	294	281	575	6.49	4.87	11.36
		4	218	216	434	5.25	4.69	9.94
Block total			956	995	1,951	22.86	18.75	41.61
Two plants in a hill (hills 12 inches apart)	4	1	143	158	301	5.50	5.50	11.00
		2	194	195	389	5.20	5.15	10.35
		3	196	164	360	5.50	5.19	10.69
		4	155	157	312	4.62	5.00	9.62
Block total			688	674	1,362	20.82	20.84	41.66
Unthinned	5	1	196	169	365	4.50	4.62	9.12
		2	269	256	525	5.62	5.00	10.62
		3	260	271	531	6.19	5.31	11.50
		4	196	202	398	5.62	5.12	10.74
Block total			921	898	1,819	21.93	20.05	41.98
Two plants in a hill (hills 12 inches apart)	6	1	174	140	314	5.62	5.00	10.62
		2	190	191	381	5.00	5.00	10.00
		3	177	167	344	5.12	4.12	9.24
		4	100	56	156	5.00	3.12	8.12
Block total			641	554	1,195	20.74	17.24	37.98
Unthinned	Guard	1						11.50
		2						12.00
		3						11.50

YIELDS FROM COTTON EXPERIMENTS AT SAN ANTONIO

The yields of seed cotton obtained from the separate field of late-planted cotton were greater than those from cultural and variety tests conducted at San Antonio during the same season. The yields from the late-planted cotton were exceeded only by the April 19 planting in the successive plantings. The average row yield from the late-planted test, the successive plantings, two cultural tests, and the Lone Star blocks in the variety test are given in Table 17. The same variety of seed was used in all these plantings.

TABLE 17.—*Average row yields of cotton in all experiments conducted at San Antonio*

Kind of experiment	Date planted, 1923	Treatment for weevils	Plant spacing	Average yield from a 200-foot row (pounds)
Separate late planting	May 12	None	Unthinned	11.18
			2 plants in a hill	10.33
	Apr. 19	Square stripped, poisoned.	do	11.82
Successive adjacent plantings	Apr. 28	do	do	8.81
	May 5	Poisoned	do	8.98
	May 12	do	Very poor stand	3.25
Cultural test No. 1, field C3	Apr. 23	None	Unthinned	8.28
			1 plant to 12 inches	6.78
Cultural test No. 2, field C3	do	do	1 plant to 10 inches	5.8
			2 plants to 10 inches	6.5
Lone Star check in variety test D3.	Apr. 22	do	6 inches	6.5

SOIL, CLIMATIC, AND WEEVIL CONDITIONS AT CHARLESTON, S. C.

A comparison of successive plantings of cotton was made in South Carolina on the farm of F. P. Seabrook on James Island, about 10 miles southeast of Charleston. The soil where the cotton was planted is light and sandy, well drained, and representative of the lighter type of soil of the Sea Islands. It is technically described by the Bureau of Soils as Norfolk fine sand. This type of soil normally produces a comparatively small plant and is admirably suited for cotton.

The winters are mild, and the soil becomes warm early in the spring. Cotton can usually be planted the last week in March without danger of frost injury. The summer temperatures are moderate. Rainfall is abundant and fairly well distributed, although periods of dry weather are often experienced in the spring and early summer, while periods of excessive rainfall are common in late July and August. Records of maximum and minimum temperatures and of the precipitation were obtained at James Island from March 14 to October 15. These records are summarized in Table 18.

TABLE 18.—*Average maximum and minimum temperatures and monthly precipitation at James Island (near Charleston), S. C., from March to October, 1923*

Items of comparison	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.
Average temperatures (° F.):								
Maximum	[1] 67.3	72.2	77.0	85.6	87.2	88.9	85.4	[2] 76.9
Minimum	[1] 51.5	54.6	65.8					
Precipitation (inches)	2.23	1.82	6.27	2.54	9.36	8.09	3.13	3.06

[1] March 14 to 31 only. [2] October 1 to 15 only.

During the season of 1923 cold dry weather during April was unfavorable to the growth of cotton in the seedling stage. With warmer weather and more abundant moisture in May, growth became more rapid, and conditions were favorable for setting a crop during June and the early part of July. Excessive rainfall in the latter part of July and in August resulted in an abnormally high degree of boll shedding.

Heavy infestation from overwintered weevils is to be expected under normal conditions. The abundant protection afforded by native vegetation and the mild winters of the Sea Island sections afford excellent conditions for successful hibernation. Weevil emergence begins early, the first weevils usually being noted during April, feeding on the growing tips of the young cotton plants. The bulk of the cotton in this district is planted during the latter part of March, and squares begin to appear by the middle of May.

During 1923 many fields in this section were heavily infested with weevils by June 10, while other fields farther away from favorable hibernation places showed very slight infestation. Hot dry weather during June caused high mortality of weevil larvæ in those fields where clean cultivation was practiced and the plants were still small, so that the sunlight could reach the shed squares. Although weevil infestation was reduced by the natural control factors in June, the appearance of a new generation of weevils early in July caused infestation to increase gradually, so that in the fields where control measures were not applied infestation was practically complete by the middle of July.

COMPARISON OF SUCCESSIVE ADJACENT PLANTINGS AT CHARLESTON

Four successive plantings, as shown in Figure 9, were made on James Island on April 5, 16, 25, and May 4, each planting being in duplicate. The arrangement of the plantings was similar to those at San Antonio. Plats numbered 3, 4, 6, 7, and 8 consisted of six rows, while plats 2, 5, and 9 had seven rows, the additional row being considered as a guard, on account of being adjacent to a much earlier planting. Guard blocks 1 and 10 were also planted on each side of the field on April 5. The rows were 310 feet long and spaced 5 feet apart.

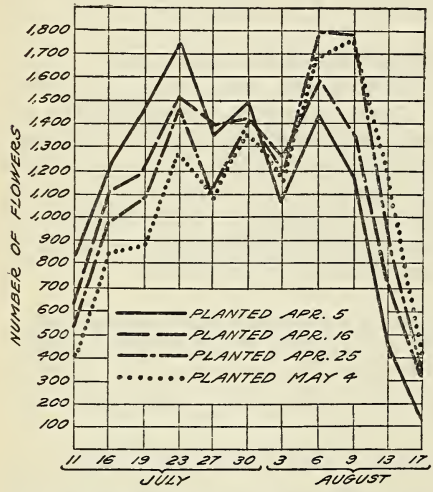


FIG. 9.—Flowering record of successive plantings of cotton on James Island, near Charleston, S. C., July 11 to August 17

The experiment was planted with seed of a very uniform strain of the Meade variety of Upland long-staple cotton. This variety has a staple length of 1⅝ inches and is adapted for use on the South Carolina Sea Islands. The seed was planted by hand in hills 12 inches apart. The cold dry weather of April delayed germination and caused a slow growth of the early cotton during the seedling stage. With higher air temperatures and adequate moisture in May, growth became more rapid. The plants in each planting were thinned to two to the hill 12 inches apart when they reached a height

of about 6 inches. Guard plats numbered 1 and 10 were thinned to one plant per hill 12 inches apart.

DAMAGE BY OVERWINTERED WEEVILS

While cotton had been grown on an adjoining field in 1922, early destruction of stalks and unfavorable conditions for hibernation in the vicinity of the field undoubtedly afforded some protection to the 1923 planting. Although careful search was made no evidence of weevil infestation was found until June 14, when punctured squares were seen at three places in the field. Records made on June 20 showed that about 1 per cent of the squares had been damaged by weevils.

STRIPPING OF FLORAL BUDS

The entire field was stripped of squares and poison applied on June 20. The mode of procedure in the removal of squares was essentially the same as that used at San Antonio, described on pages 6 and 7. The laborers were instructed to remove all squares whose bracts were one-half inch or more long, a size that is attained in about 10 days after the young buds are large enough to be distinguished readily. There were many squares of this size or larger in the April 5 and April 16 plantings, but only a few in the April 25 and May 4 plantings that were large enough to be removed. Counts were made of the total number of squares removed from representative rows of each plat, and the average number of squares removed per plant was found to be as follows: First planting, 4.5; second 3.8; third, 1.6; fourth, 1.1. During the removal of the squares 78 weevils were captured.

Field observations indicated that reinfestation from later emerging weevils would have occurred if the squares had been removed earlier than June 20 during 1923. The planting made on April 25 was at the proper stage for stripping on June 20. Plantings made after May 1 could normally be poisoned successfully without stripping, as the weevil emergence was practically complete before the squares were large enough to harbor larvæ.

Calcium arsenate in dust form was applied to the plants on June 21 with a hand gun. Heavy rains washed the poison from the plants during the afternoon of that day. As poison should remain on the plants a minimum of 48 hours to be effective, a second application was made on June 22, which remained on the plants until June 27. No further measures were taken to control the weevil during the remainder of the season.

LATE-SEASON WEEVIL DAMAGE

Examinations were made frequently in this test for indications of weevil infestation following the removal of squares and poisoning. On July 12 two small infested spots were found, but infestation remained very slight and on July 27 was only about 3 per cent. There was no appreciable difference in the infestation of the different plantings. Migration of weevils from other fields began early in August, and by August 13 the experimental field was heavily infested. No attempt was made to control migratory weevils, as adverse weather conditions and defoliation of the plants by leafworms prevented the setting of bolls on any of the plantings after July 31.

Weevil damage to mature bolls was a minor factor as compared with damage from anthracnose, boll-rot, and bollworms.

RATE OF SEEDLING GROWTH INCREASED BY LATER PLANTING

In order to compare the rate of plant development in the four plantings, records of the formation of nodes on the main stalk were obtained from 10 representative plants in each planting. Differences in the growth rate during the seedling stage of these four plantings are shown by the interval between the planting date and the date of appearance of the first square in each planting.

As shown by the data in Table 19, the period from the date of planting to the appearance of the first square on the April 5 planting was 51 days, as compared with 44 days for the planting of April 16, 40 days for that of April 25, and 38 days for that of May 4. The latter planting reached the fruiting stage of development in 13 days less time than the planting made on April 5.

TABLE 19.—*Rate of nodal growth during the seedling stage of cotton grown in successive plantings at Charleston on four different dates*

Date planted, 1923	Average date of appearance of first fruiting branch	Number of days—	
		After planting[1]	Per node
Apr. 5	May 26	51	6.37
Apr. 16	May 30	44	5.50
Apr. 25	June 4	40	5.00
May 4	June 11	38	4.75

[1] As these records were made from the planting date rather than from the date of germination, a deduction of about five or six days is necessary in comparing these figures with those that were obtained in Texas. (See Table 3.)

The April 5 planting required an average of 6.37 days for the development of each of the first eight nodes, as compared with 4.75 days per node for the May 4 planting, a difference in growth rate of 1.62 days. Higher air temperatures and warmer soil conditions during the seedling stage of growth are probably the factors causing this increased rate of growth in the later plantings. The cotton plant is very sensitive to low temperatures, and if the young seedlings are exposed to periods of cold weather their growth may be so checked that they may not readily resume normal growth when conditions again become favorable.

PLANT GROWTH DURING THE FRUITING PERIOD

Records of plant growth during the fruiting period indicate that the accelerated development of the internodes of late-planted cotton is practically confined to the seedling stage. The average date of appearance of the first and twelfth fruiting branches on 10 plants of each planting and the average interval between the appearance of successive fruiting branches are presented in Table 20. The number of days required by each planting for the development of the first 11 fruiting branches was as follows: April 5 planting, 31 days; April 16, 27 days; April 25, 29 days; and May 4, 28 days.

TABLE 20.—*Rate of nodal growth during the fruiting stage of cotton grown in successive plantings at Charleston on four different dates*

Date planted, 1923	Average date of appearance of fruiting branches		Average number of days for production of fruiting branches		Total fruiting branches on Aug. 11
	First branch	Twelfth branch	For 11 branches	Per branch	
Apr. 5	May 26	June 26	31	2.82	20.3
Apr. 16	May 30	do	27	2.45	21.5
Apr. 25	June 4	July 3	29	2.63	21.2
May 4	June 11	July 9	28	2.54	20.5

While the rate of fruiting-branch production remained fairly constant under conditions of uninterrupted growth during June and early July, the rate of growth in the older cotton was checked about the middle of July, making it possible for the younger cotton to overcome the lead established earlier in the season by the early-planted cotton. The final measurements on all plantings, made on August 11, showed very little difference in the number of fruiting branches. The April 5 planting averaged 20.3 fruiting branches per plant, as compared with 21.5 for that of April 16, 21.2 for that of April 25, and 20.5 for that of May 4.

Each node on a fruiting branch provides for the development of a floral bud or square. Thus, the theoretical fruiting capacity of the plant may be measured by the total number of its fruiting nodes. The average per plant of the total number of squares formed on 10 plants of each planting on June 20, July 2, July 13, and August 11 are shown in Table 21. The data in this table were afforded by normal unstripped plants.

TABLE 21.—*Total number of squares per plant on given dates on cotton grown in successive plantings at Charleston on four different dates*

Date planted, 1923	June 20	July 2	July 13	Aug. 11
Apr. 5	22.5	41.1	52.6	66.9
Apr. 16	20.6	39.0	53.3	76.0
Apr. 25	13.6	30.4	45.6	77.4
May 4	8.3	26.6	42.2	82.7

On June 20 the average number of squares on the plants in each planting was as follows: April 5, 22.5; April 16, 20.6; April 25, 13.6; and May 4, 8.3, a difference of 14.2 fruiting nodes per plant between the first and fourth plantings. The greater fruiting capacity of the April 5 planting was maintained until July 13, at which time it had been passed by the second planting. Final measurements of fruiting capacity were made on August 11. While the total number of fruiting branches per plant in all plantings was practically the same on this date, the fruiting capacity of the different plantings increased progressively with later plantings. The total number of squares produced on the April 5 planting was 66.9, as compared with 82.7 on the May 4 planting. Partial cessation of the growth of the lower fruiting branches in the older plantings rather than a

slower rate of development is the cause for the complete reversal of the position of the four plantings in regard to the total number of squares formed on the plants. The later plantings continued the production of new internodes on the lower fruiting branches after the growth of the latter was checked on the older cotton. The comparative size and fruiting of early and late planted cotton are illustrated in Plate IV.

EFFECT OF REMOVING FLORAL BUDS

Records of the number of flowers produced on stripped and unstripped plants grown in Florida in 1922 indicated that an increased rate of flowering results from the removal of squares from the plants.[5] In an endeavor to analyze the reaction of cotton plants to square stripping, comparisons of plant development and the fruiting capacity of a series of stripped and unstripped plants in each of the successive plantings were made at Charleston, S. C., during 1923. From these records it is possible to show the effect of square pruning on the height of plants, number of fruiting branches, number of internodes on the fruiting branches, and the total number of squares formed on the plants.

Squares were removed from 10 plants in each planting on June 20. Table 22 shows the average number of squares removed from these plants, varying from 10.4 squares per plant in the first to 0.8 in the last planting.

TABLE 22.—*Number of squares removed on June 20 from cotton plants grown in successive plantings at Charleston on four different dates*

Date planted, 1923	Average number of squares		
	On plant	Squares removed	
		Number	Per cent
Apr. 5	24.0	10.4	43.3
Apr. 16	21.1	8.2	38.9
Apr. 25	10.9	2.5	22.9
May 4	7.6	.8	10.5

The height of the plants was recorded weekly from June 21 until August 11. These data are presented in Table 23, showing the weekly growth in height of the stripped and unstripped plants for the four different plantings.

The plants in the first three plantings from which squares had been removed on June 20 made slightly more growth during the period from June 21 to August 11.

The increase in the growth of the stripped plants was 2.9 centimeters in the first planting, 17 centimeters in the second, and 4.7 centimeters in the third. The unstripped plants in the last, or May 4, planting made more growth than the stripped plants, the increase being 11.2 centimeters. While the comparison of growth of stripped

[5] Smith, G. D. A preliminary report upon an improved method of controlling the boll weevil. Fla. Agr. Exp. Sta. Bul. 165, p. 18-24, illus. 1922.

and unstripped plants in the first three plantings shows that the stripped plants grew larger than those not stripped, the increases are hardly significant.

TABLE 23.—*Average height of stripped and of unstripped cotton plants grown in successive plantings at Charleston on four different dates in 1923*

Planting date and condition	Average height on date given (centimeters)										
	June 4	June 14	June 21	June 29	July 6	July 13	July 21	July 27	Aug. 3	Aug. 11	Growth from June 21 to Aug. 11
April 5 planting:											
Stripped	18.6	27.4	35.3	46.0	54.7	62.1	68.6	70.7	73.3	74.3	39.0
Unstripped			37.3	46.2	51.9	62.0	67.4	70.2	71.8	73.4	36.1
Increase in growth of stripped plants											2.9
Apr. 16 planting:											
Stripped	21.8	28.2	35.9	45.9	55.3	63.5	76.1	82.4	85.2	85.8	49.9
Unstripped			33.6	41.9	49.2	53.0	58.4	61.6	65.4	66.5	32.9
Increase in growth of stripped plants											17.0
Apr. 25 planting:											
Stripped	14.4	19.2	25.4	31.7	38.7	46.9	58.0	63.3	67.0	68.7	43.3
Unstripped			27.7	33.2	41.1	48.8	57.4	61.2	64.4	66.3	38.6
Increase in growth of stripped plants											4.7
May 4 planting:											
Stripped	12.0	15.8	21.3	28.2	36.7	47.2	58.9	64.1	64.0	65.4	44.1
Unstripped			22.8	31.5	40.8	50.6	63.9	70.8	75.8	78.1	55.3
Increase in growth of unstripped plants											11.2

If acceleration of fruiting results from the removal of squares this would be shown by an increase in the number of fruiting branches or by an increased number of internodes on the branches. Weekly records of the number of fruiting branches from June 3 to August 11 on stripped and on unstripped plants are shown in Table 24. In the stripped plants of the April 5 planting, from which 43.3 per cent of the squares were removed on June 20, there was a total increase of only four-tenths of a fruiting branch per plant for the entire season. The gain in the number of fruiting branches of 2.5 in the stripped plants of the April 16 planting and 0.3 in that of April 25 with a loss of 1.4 in the May 5 planting would indicate that no significant increase in the number of fruiting branches was obtained by the removal of squares. The stimulating effect of the removal of 43.3 per cent of the squares was not sufficient to change materially the normal rate of fruiting-branch production.[6]

[6] Martin, R. D., W. W. Ballard, and D. M. Simpson. Growth of fruiting parts in cotton plants. *In* Jour. Agr. Research, v. 25, p. 195–208, illus. 1923.

TABLE 24.—*Average number of fruiting branches per plant on stripped and unstripped cotton grown in successive plantings at Charleston on four different dates in 1923*

Planting date and condition	Date when data were recorded												Number of fruiting branches formed from June 19 to Aug. 11
	June 3	June 7	June 14	June 19	June 26	July 2	July 9	July 13	July 18	July 24	Aug. 3	Aug. 11	
Apr. 5 planting:													
Stripped	4.6	6.1	8.1	10.2	13.0	15.0	16.7	17.4	19.1	19.9	21.3	21.7	11.5
Unstripped	-----	-----	-----	9.2	11.5	13.7	15.5	16.3	17.7	18.2	19.7	20.3	11.1
Apr. 16 planting:													
Stripped	-----	5.5	6.9	9.6	12.5	14.4	16.4	17.6	19.5	21.0	22.6	24.2	14.6
Unstripped	-----	-----	-----	9.4	11.6	13.4	15.4	16.2	17.5	18.6	20.8	21.5	12.1
Apr. 25 planting:													
Stripped	-----	2.6	4.5	6.4	9.0	10.7	12.9	13.9	15.4	17.3	19.6	20.3	13.9
Unstripped	-----	-----	-----	7.6	10.0	11.6	13.6	14.8	16.8	18.2	19.9	21.2	13.6
May 4 planting:													
Stripped	-----	.4	2.6	5.3	8.5	9.9	12.4	13.3	15.4	17.0	19.0	19.0	13.7
Unstripped	-----	-----	-----	5.4	8.5	10.0	12.3	13.2	15.3	17.2	19.3	20.5	15.1

The average number of internodes per fruiting branch was obtained for the stripped and unstripped plants in each planting. For convenience, these data have been arranged in groups of five consecutive fruiting branches and are presented in Table 25.

TABLE 25.—*Average number of internodes per fruiting branch of stripped and of unstripped cotton plants grown in successive plantings at Charleston on four different dates in 1923*

Planting date and condition	Number of fruiting branches				Average total squares
	1 to 5	6 to 10	11 to 15	16 to 20	
Apr. 5 planting:					
Stripped	5.3	5.0	4.1	1.4	83.6
Unstripped	4.3	4.2	3.2	1.4	66.9
Increase on stripped plants	1.0	.8	.9	.0	16.7
Apr. 16 planting:					
Stripped	5.7	6.2	4.8	3.1	195.9
Unstripped	4.2	4.8	3.8	2.1	76.0
Increase on stripped plants	1.5	1.4	1.0	1.0	29.9
Apr. 25 planting:					
Stripped	4.9	5.4	4.1	1.7	81.6
Unstripped	4.2	5.1	3.9	2.0	77.4
Increase on stripped plants	.7	.3	.2	—.3	4.2
May 4 planting:					
Stripped	5.6	5.6	4.2	2.0	87.0
Unstripped	5.4	5.3	3.8	1.8	82.7
Increase on stripped plants	.2	.3	.4	.2	4.3

A consistently larger number of internodes was formed on the fruiting branches of the stripped plants in the April 5 and April 16 plantings. As the total number of fruiting branches was practically the same on the stripped and on the unstripped plants the increase in number of internodes on fruiting branches resulted in a greater fruiting capacity of the stripped plants. The stripped plants in the April 5 planting averaged 83.6 squares per plant, while the unstripped

plants averaged only 66.9 squares. An even greater increase occurred in the April 16 planting, the stripped plants averaging 105.9 squares as compared with 76 on the unstripped cotton.

Only a slight increase in the number of internodes occurred on fruiting branches of stripped plants in the April 25 and May 5 plantings. As few squares were removed from these plants, no such stimulation of growth would be expected as occurred on plants from which a large percentage of squares was removed.

From the foregoing data on the effect of removal of the squares it would appear that no material increase in height or number of fruiting branches was caused. The consistent increase in the number of internodes per fruiting branch indicates, however, that the growth of the fruiting branches is affected by the removal of the early squares. A more continued or prolonged growth seems to result from their removal rather than a faster rate of development. A somewhat analogous though more extreme result of pruning is found in "boll-weevil cotton" as described by Cook.[7]

FLOWERING RECORDS OF EARLY AND LATE PLANTINGS

Flower counts were started on July 11 and were made twice a week until August 17, a period of 38 days. These counts were made on the four inside rows of two plats of the April 5 planting and on one plat of the April 16, April 25, and May 4 plantings. The length of the rows was 310 feet. The flower records for each plat are given in Table 26 and are graphically shown in Figure 9 (p. 30).

TABLE 26.—*Flowering record of cotton plants grown in successive plantings at Charleston on four different dates*

Plat	Date planted, 1923	Thinning distance	Date of counting (number of flowers)											Total of 11 counts
			July 11	July 16	July 19	July 23	July 27	July 30	Aug. 2	Aug. 6	Aug. 9	Aug. 13	Aug. 17	
No. 2	Apr. 5	2 plants at 12 inches	817	1,206	1,463	1,750	1,348	1,496	1,064	1,432	1,172	449	120	12,317
No. 3	Apr. 16	do	616	1,109	1,200	1,519	1,400	1,428	1,260	1,593	1,384	714	282	12,505
No. 4	Apr. 25	do	549	976	1,095	1,459	1,112	1,427	1,200	1,798	1,789	923	335	12,663
No. 5	May 4	do	390	841	875	1,264	1,087	1,358	1,158	1,689	1,765	1,218	384	12,029
No. 6	Apr. 5	do	728	1,014	1,184	1,499	1,113	1,216	1,103	1,311	1,286	593	190	11,237

Although the first flowers appeared in all plantings at nearly the same date, the more advanced development of the early-planted cotton resulted in a higher flowering rate for this planting during the first part of the flowering period. On July 11, the date on which the first counts were made, 817 flowers were counted on the first planting, as compared with 616 for the second, 549 for the third, and 390 for the fourth. A higher rate of flowering was maintained by the first planting until July 27, at which time a larger number of flowers was recorded on the second planting. Beginning on August 6, the April 25 and May 4 plantings were flowering more profusely than the two earlier plantings.

The sudden decline in the rate of flowering which occurred during the second week in August is attributable to infestation from migrating weevils and the defoliation of the plants by the cotton leafworm.

[7] Cook, O. F. Boll-weevil cotton in Texas. U. S. Dept. Agr. Bul. 1153, 20 p., illus. 1923.

In plats 5 and 6, where the April 5 and May 4 plantings were grown side by side, 7 per cent more flowers were recorded from the May 4 planting. Owing to a high rate of boll shedding during late July and in August, few bolls were matured from flowers produced during that time.

Data were obtained from 20 plants of each of the four plantings, showing the number and percentage of bolls set from flowers which opened during weekly periods from July 7 to August 14. Data from these 80 plants are combined and presented in Table 27. During the week from July 7 to 14, 80.9 per cent of the flowers were set as bolls. Only 47.1 per cent of the flowers produced during the following week were set and 15.2 per cent during the third week. This declining rate of boll setting continued during the period from August 7 to 14, when only 3.1 per cent of the flowers set. Thus, the larger numbers of flowers produced by the later plantings during late July and August were of little value in setting a crop under the conditions of this experiment.

TABLE 27.—*Number of flowers recorded and number and percentage of bolls set on 80 cotton plants at Charleston during each of five weekly periods in 1923*

Item	July 7 to 14	July 15 to 22	July 23 to 30	July 31 to Aug. 6	Aug. 7 to 14
Flowers	157	276	296	205	162
Bolls:					
Number	127	130	45	14	5
Percentage	80.9	47.1	15.2	6.8	3.1

YIELDS FROM SUCCESSIVE PLANTINGS AT CHARLESTON

As a result of complete defoliation of the plants by leafworms, the bolls opened rapidly during the latter part of August, and the bulk of the crop was open the first week in September. The first picking was made on September 10 and a small second picking on October 4. The field was divided into equal sections by a line across the center of the field at right angles to the rows. Each section of each row was picked separately and weighed on scales graduated to one-tenth of a pound. The picking results are given in Table 28 and graphically presented in Figure 10.

Plant counts for each section of row are included in Table 28. Irregular stands resulted in considerable variation in the number of plants per row. While higher yields would be expected in rows having a perfect stand, it has been found impracticable to make corrections in the yields on account of deficient stands.

The yields from the four inside rows in each plat are used for comparisons between different plantings. The yields of outside rows were affected by adjoining plats of earlier or later plantings.

The total yields from the first and second plats of each planting are as follows: April 5, 279.5 pounds; April 16, 244.9 pounds; April 25, 235 pounds; May 4, 222.4 pounds. While these figures show an increase for the early-planted cotton, reference to the plat yields in Table 28 indicate that most of the gain was due to better soil on one side of the field. Plat 2, planted April 5, yielded 158.5 pounds, while plat 6, planted on the same date, yielded 121 pounds. Plats 3 and 7,

COMPARATIVE FRUITING OF EARLY-PLANTED AND LATE-PLANTED COTTON IN SUCCESSIVE PLANTINGS AT CHARLESTON, S. C.

The April 5 planting is at the left and the May 4 planting at the right

planted April 16, yielded 136.8 and 108.1 pounds, respectively. Plats 4 and 8, planted April 25, yielded 130.6 and 104.4 pounds, and Nos. 5 and 9, planted May 4, yielded 111.8 and 110.6 pounds, respectively.

The fact that such wide differences in yield occurred on the first and second plats of the first three plantings indicates that the high yields from the first plats were due to more fertile soil in that part of the field. The yields from the first and second plats of the May 4 planting were practically equal, and comparatively small differences in the yield of the different plantings occurred on plats 5, 6, 7, 8, and 9. Plat 5, planted on May 4, yielded only 10 pounds less than plat 5, planted on April 5.[8] (Pl. V.)

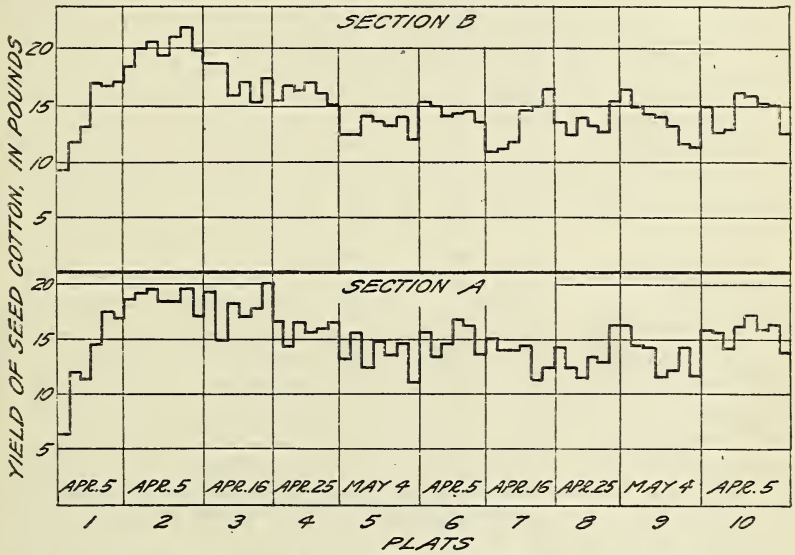


FIG. 10.—Row yields from successive plantings of cotton at Charleston, S. C., April 5 to May 4

TABLE 28.—*Yield of seed cotton grown in successive plantings at Charleston on four different dates in 1923*

Date planted and plat number	Row No.	Number of plants			Yields of seed cotton (pounds)						
					First picking, Sept. 10		Second picking, Oct. 4		Total		
		Section A	Section B	Total	Section A	Section B	Section A	Section B	Section A	Section B	Row
Apr. 5	1	214	226	440	17.1	16.1	1.7	2.5	18.8	18.6	37.4
Plat No. 2	2	208	207	415	17.8	18.1	1.6	2.0	19.4	20.1	39.5
	3	241	209	450	18.7	19.5	1.2	1.4	19.9	20.9	40.8
	4	242	231	473	17.2	17.4	1.4	2.1	18.6	19.5	38.1
	5	232	240	472	17.0	19.6	1.6	1.9	18.6	21.5	40.1
Total		923	887	1,810	70.7	74.6	5.8	7.4	76.5	82.0	158.5
	6	242	224	466	18.1	20.2	1.8	2.0	19.9	22.2	42.1
	7	136	211	347	15.6	17.6	1.7	2.4	17.3	20.0	37.3

[8] By calculating the probable error of the average row yield of these two plats, the difference in yield was found to be only three times the probable error of the difference. As the average row yields were obtained from only eight rows, a difference of three times the probable error is not considered significant.

TABLE 28.—*Yield of seed cotton grown in successive plantings at Charleston on four different dates in 1923*—Continued

Date planted and plat number	Row No.	Number of plants			Yields of seed cotton (pounds)						
					First picking, Sept. 10		Second picking, Oct. 4		Total		
		Section A	Section B	Total	Section A	Section B	Section A	Section B	Section A	Section B	Row
Apr. 16	1	246	224	470	17.6	17.0	2.0	1.9	19.6	18.9	38.5
Plat No. 3	2	248	255	503	13.4	16.8	1.8	2.1	15.2	18.9	34.1
	3	232	229	461	16.3	14.1	2.1	2.0	18.4	16.1	34.5
	4	226	253	479	15.6	15.8	1.6	1.6	17.2	17.4	34.6
	5	214	217	431	16.2	14.2	1.8	1.4	18.0	15.6	33.6
Total		920	954	1,874	61.5	60.9	7.3	7.1	68.8	68.0	136.8
	6	243	250	493	18.6	16.3	1.8	1.5	20.4	17.8	38.2
Apr. 25	1	201	234	435	14.3	14.2	2.5	1.5	16.8	15.7	32.5
Plat No. 4	2	198	242	440	12.3	14.8	2.2	2.2	14.5	17.0	31.5
	3	221	242	463	14.8	14.4	1.9	2.2	16.7	16.6	33.3
	4	204	236	440	13.9	15.5	2.1	1.8	16.0	17.3	33.3
	5	221	235	456	14.2	14.4	2.0	1.9	16.2	16.3	32.5
Total		844	955	1,799	55.2	59.1	8.2	8.1	63.4	67.2	130.6
	6	217	202	419	15.0	14.1	1.7	1.2	16.7	15.3	32.0
May 5	1	206	189	395	12.0	11.7	1.4	.9	13.4	12.6	26.0
Plat No. 4	2	194	152	346	13.8	10.8	2.0	1.9	15.8	12.7	28.5
	3	196	195	391	11.2	12.5	1.5	1.8	12.7	14.3	27.0
	4	217	205	422	13.5	12.5	1.6	1.5	15.1	14.0	29.1
	5	184	173	357	11.8	11.3	1.9	2.2	13.7	13.5	27.2
Total		791	725	1,516	50.3	47.1	7.0	7.4	57.3	54.5	111.8
	6	224	197	421	13.6	12.7	1.4	1.7	15.0	14.4	29.4
	7	208	207	415	10.1	11.7	1.2	.6	11.3	12.3	23.6
Apr. 5	1	259	230	489	15.0	14.9	1.0	.6	16.0	15.5	31.5
Plat No. 6	2	225	226	451	12.5	14.4	1.2	.9	13.7	15.3	29.0
	3	236	244	480	13.7	13.8	1.2	.6	14.9	14.4	29.3
	4	226	242	468	16.4	13.8	.6	.7	17.0	14.5	31.5
	5	248	241	489	16.0	14.0	.5	.7	16.5	14.7	31.2
Total		935	953	1,888	58.6	56.0	3.5	2.9	62.1	58.9	121.0
	6	215	237	452	13.0	13.3	.9	.6	13.9	13.9	27.8
Apr. 16	1	262	222	484	14.5	10.5	.9	.6	15.4	11.1	26.5
Plat No. 7	2	239	233	472	12.9	10.7	1.4	.6	14.3	11.3	25.6
	3	250	244	494	12.4	10.8	1.9	1.2	14.3	12.0	26.3
	4	249	243	492	13.6	14.1	1.1	.8	14.7	14.9	29.6
	5	256	223	479	10.4	14.4	1.1	.7	11.5	15.1	26.6
Total		994	943	1,937	49.3	50.0	5.5	3.3	54.8	53.3	108.1
	6	236	232	458	12.0	16.2	.7	.5	12.7	16.7	29.4
Apr. 25	1	231	245	476	13.5	13.0	1.0	.9	14.5	13.9	28.4
Plat No. 8	2	249	237	486	11.7	12.0	1.0	.7	12.7	12.7	25.4
	3	252	243	495	10.5	13.0	1.2	1.1	11.7	14.1	25.8
	4	210	217	427	11.1	12.4	1.6	.9	13.7	13.3	27.0
	5	245	256	501	11.5	11.6	1.9	1.2	13.4	12.8	26.2
Total		956	953	1,909	45.8	49.0	5.7	3.9	51.5	52.9	104.4
	6	220	256	476	15.2	14.0	1.4	1.7	16.6	15.7	32.3
May 4	1	218	194	412	14.5	15.0	2.1	1.6	16.6	16.6	33.2
Plat No. 9	2	203	196	399	13.1	13.7	1.6	1.3	14.7	15.0	29.7
	3	164	186	350	12.2	12.0	2.3	2.5	14.5	14.5	29.0
	4	169	193	362	9.3	11.9	2.5	2.4	11.8	14.3	26.1
	5	149	164	313	10.1	11.3	2.3	2.1	12.4	13.4	25.8
Total		685	739	1,424	44.7	48.9	8.7	8.3	53.4	57.2	110.6
	6	156	125	281	11.7	10.1	2.9	1.7	14.6	11.8	26.4
	7	155	173	228	9.4	9.3	2.6	2.4	12.0	11.7	23.7

The uniformity of yields from plats 5 to 9 are shown by the graphic presentation of row yields, Figure 10.

ADVERSE CONDITIONS AT GAINESVILLE, FLA.

A series of successive plantings and a separate late planting similar to the experiments in Texas and South Carolina were also located at Gainesville, Fla., in cooperation with the Agricultural Experiment Station of the University of Florida, but owing to very adverse seasonal conditions the comparisons could not be carried out as at the other locations. The soil upon which these plantings were made is of a light sandy character with a subsoil not retentive of water. Owing to the lack of fertility in this soil cotton production is largely dependent upon the use of commercial fertilizers.

Extremely dry weather through March and April delayed germination and caused poor stands and was followed by excessive rainfall during May and June. From May 15 until July 4, a period of 51 days, rainfall was recorded on 44 days, the total precipitation being 19.37 inches. Owing to this excessive rainfall the fertilizer was leached from the soil and plant growth was greatly retarded. Even the earliest planted cotton reached a height of only 12 to 18 inches, and the growth of the late-planted cotton was so checked that many plants never reached the fruiting stage.

Weevils were present in the successive plantings before squares appeared on the plants. Squares appeared on the early plantings during the latter part of May, and on June 6 they were removed from the plants and poison was applied. The method of stripping and poisoning was the same as that used in Texas and South Carolina.

Records of weevil emergence from hibernation are maintained by the experiment station. An abnormally high percentage of hibernated weevils survived the winter of 1922–23, and emergence continued over an unusually long period. Only about 6 per cent of the weevils placed in hibernation cages normally survive the winter. On June 6, when the squares were removed from the plants in the successive planting test, 22.6 per cent of hibernated weevils had emerged. Emergence continued until July 31, at which time 26.86 per cent of the weevils placed in hibernation cages had emerged.

As a result of this prolonged period of emergence cotton became reinfested with weevils after the squares had been removed and poison applied. On July 2, however, the average infestation of squares on all cotton planted at the experiment station was only 3.24 per cent. This indicated that square removal and poisoning had been effective in delaying the appearance of the new generation of weevils, though the conditions were such that no significant data could be secured.

SUMMARY

In the season of 1923 four successive plantings of cotton were made at San Antonio, Tex., Charleston, S. C., and Gainesville, Fla., to compare the growth and fruiting habits of the plants as affected by the time of planting.

The successive plantings were treated for control of overwintered weevils by removing and destroying early squares, followed by an application of calcium arsenate. At San Antonio a separate late

planting, more remote from other cotton, was made on May 12 and was not protected by poison or square stripping.

In the successive plantings at San Antonio the squares were removed from plants of the first two plantings, and poison was applied to the entire field on June 12. Reinfestation was found two weeks afterwards, probably from weevils bred in early squares which had been shed before the control measures were used.

At Charleston the squares were removed from the plants and poison was applied on June 20. No trace of weevil injury was found until July 12.

At Gainesville the squares were removed on June 6. Abnormally late emergence of weevils caused reinfestation after control measures were applied.

Infestation from overwintered weevils was avoided in the separate late planting made on May 12 at San Antonio. This planting became infested early in July, however, probably from weevils migrating from near-by plantings.

Comparisons of plants from which the squares were stripped with unstripped plants were made at Charleston. No increase in height of plants or number of fruiting branches resulted from the removal of squares. More nodes developed on the fruiting branches of stripped plants, indicating that removal of early squares tended to prolong the period of growth of fruiting branches. (Tables 22, 23, 24, 25.)

At San Antonio and Charleston late-planted cotton grew more rapidly during the seedling stage. Nodes were produced on the main stalk at a faster rate, and the internodes were longer than on the early-planted cotton. The first squares on the later plantings were produced in fewer days after planting. (Tables 2, 3, 9.)

The last of the successive plantings at San Antonio on May 12 produced nearly as many fruiting branches as the first planting on April 19. The lower fruiting branches of the later plantings produced more nodes than the early plantings. (Tables 6, 7, 8; figs. 3 and 4.)

At Charleston the growth of the early-planted cotton was checked about the middle of July, while the later plantings continued normal growth. By August 11 the average number of fruiting branches was practically the same on all plantings. (Table 20.)

Owing to the production of more nodes on the lower fruiting branches, the later plantings produced a larger total number of floral buds than the early-planted cotton. (Table 21.)

The later planted cotton at San Antonio and Charleston continued a high rate of flowering later in the season and produced a slightly larger total number of flowers than the early-planted cotton. (Tables 9, 26; figs. 5 and 9.)

In the separate late planting on May 12 at San Antonio plants in unthinned open-stand rows when compared with plants left two in a hill showed that 38 per cent more flowers were produced in the unthinned cotton than where the plants were left in hills. More than twice as many flowers were recorded on the unthinned plants during the first 10 days of the flowering period. (Table 15.)

Data on flower production and boll shedding during the period from June 25 to August 2 indicated that the proportion of shed bolls

was practically the same on cotton planted at San Antonio on April 19, April 28, and May 5.

In the first half of July at San Antonio a larger number of squares was injured by weevils on the first planting, while during the latter part of July the number of weevil-damaged squares rapidly increased in the later planted cotton. This increase was due to the presence of many young squares on the later planted cotton, while the formation of squares on the early-planted cotton had almost ceased.

No shedding of weevil-infested squares occurred in the separate planting of May 12 at San Antonio until July 11, after flowering had started. The weevil injury to squares in this planting was much less than in the successive plantings (fig. 8).

Also there was a larger amount of injury to bolls of the later successive plantings which had a larger percentage of young bolls during the latter part of July. (Table 11.) The damage to bolls in the separate planting made on May 12 was less than occurred in the successive plantings.

The early-planted cotton yielded more than the later planted cotton in the successive plantings at San Antonio, but the last planting had a very poor stand in addition to greater weevil injury to bolls. (Table 12; fig. 7.)

The yields of the separate late planting on May 12 nearly equaled the yield of the first of the successive plantings on April 19 and exceeded the yields of the second and third plantings on April 28 and May 5. (Tables 16 and 17; fig. 7.)

The highest total yields at Charleston were produced by early-planted cotton, but with a wide variation of soil conditions in different parts of the field. Comparison of yields from a uniform part of the field showed only slight differences in the yields of the early and late plantings. (Table 28; fig. 10.)

Considering the variations that appeared in the results of the experiments and the fact that the later rows of the successive plantings were only partially protected against weevils from the earlier rows, the experiments do not show that later planting is impracticable either in Texas or South Carolina. From the nature of the problem a wide range of seasonal and soil conditions must be tested before a general advantage can be demonstrated.

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