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Cotton Spacing

AGRICULTURAL EXPERIMENT STATION
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Cotton Spacing[1]

THE PROPER spacing of cotton for the production of maximum yields is of considerable interest to farmers. The amount of vegetative growth made by individual cotton plants is markedly influenced by spacing. If the plants are closely spaced or if several plants per hill are left in chopping, the resulting stalks are small and spindling; whereas, plants widely spaced produce a larger and more bushy type of stalk. These differences in stalk growth have often led to erroneous conclusions regarding the amount of cotton produced by variously spaced plants.

In order to study the effect of spacing on the yield of cotton, experiments were conducted at various localities from 1924 to 1935. In one experiment the effect of spacing on the size of boll and length and percentage of lint was also studied. It is the purpose in this circular to report the results of these experiments.

GENERAL PLAN OF EXPERIMENTS

There are three possible ways in which the number of cotton plants per acre may be varied, any one or any combination of which may be employed. They are: variations in the width of rows; variations in the distance between hills; and variations in the number of plants per hill. Each of these methods of variation was employed in the experiments conducted.

In all experiments the rows were accurately laid off at the proper distances and seed was planted under a marked wire. The plants were thinned by hand to the desired number per hill after they were well established. As a general rule no measures were taken to control the boll weevil.

Variations in Drill Spacings With Constant Width Rows

First Experiment.—This experiment was conducted on a sandy loam soil at Auburn over the six-year period 1924-1929. Cotton on different plots was spaced 6, 12, 18, 30, and 36 inches apart in 3½-foot rows with one, two, three, and four plants per hill at each drill distance. Each spacing was in duplicate on both fertilized and unfertilized plots.

The six-year average yields of seed cotton produced in this experiment are presented in Table 1. The largest yield was produced when cotton was spaced 18 inches in the drill with either two or four plants per hill, and the two smallest yields were produced by the two extremes in spacing. The maximum difference in yields, in this experiment, as a result of spacing was approximately 250 pounds of seed cotton per acre.

[1] The experiments herein reported were conducted by H. B. Tisdale, R. Y. Bailey, Fred Stewart, R. C. Christopher, J. P. Wilson, and J. T. Williamson. The manuscript was prepared by E. L. Mayton.

TABLE 1.—Pounds of Seed Cotton per Acre Produced at Various Drill Spacings in 3½-Foot Rows.

Number of plants per hill	Drill Spacing — inches											
	6		12		18		24		30		36	
	Six-year average pounds of seed cotton per acre											
	Fert.[1]	Un-fert.	Fert.[1]	Un-fert.	Fert.[1]	Un-fert.	Fert.[1]	Un-fert.	Fert.[1]	Un-fert.	Fert.[1]	Un-fert.
1	1,042	527	998	493	963	487	931	461	848	419	832	422
2	985	464	1,037	516	1,083	518	1,059	507	983	454	979	465
3	909	428	994	488	1,045	478	1,082	525	1,006	499	988	467
4	834	381	996	466	1,083	485	1,039	477	1,070	480	992	415

[1] Fertilized at the rate of 600 pounds of superphopshate, 300 pounds of nitrate of soda, and 50 pounds of muriate of potash per acre.

On fertilized or unfertilized plots satisfactory yields were produced when cotton was spaced 6 inches in the drill with one plant per hill, 12 inches with two plants, 18 and 24 inches with either two, three, or four plants, and 30 inches with four plants. As a whole, the largest yields were produced at the 18- and 24-inch drill spacings.

The effect of spacing on the size of boll, percentage of lint, and length of lint was studied in this experiment. For these studies 100 bolls were picked at random from each plot and from their total weight was calculated the number of bolls per pound. These separate batches were ginned on a small gin and the percentage and the length of lint were determined.

The results of these studies are presented in Table 2. It will be seen that close spacing markedly decreased the size of bolls. In almost every instance, an increase in the number of plants per acre caused a decrease in the size of the bolls produced. At the closest spacing on fertilized plots ninety-four bolls were required to make a pound of seed cotton; at the widest spacing only seventy-three were required. These two spacings, as was shown in Table 1, produced almost identical yields but it required approximately one fourth longer to harvest the cotton from the closer spacing because of the larger number of bolls. Fertilization increased the size of bolls about 5 per cent.

The results presented in Table 2 on the percentage of lint and the length of lint show that neither was significantly affected by variations in spacing.

Second Experiment.—A second cotton spacing experiment which was somewhat different in detail from the one previously discussed was conducted on the Main Station at Auburn, on the Wiregrass, Tennessee Valley, and Sand Mountain Substations, and on the Prattville Experiment Field over the five-year period, 1930-1934. The plot treatments were identical at all locations. The soil types represented were as follows: sandy loams on the Main Station, Wiregrass Substation, and Prattville Field; fine sandy loam on the Sand Mountain Substation; and clay loam on the Tennessee Valley Substation. These types are representative of the most important cotton soils of the State.

Since the 18-inch drill spacing with two stalks per hill produced the greatest yield in the previous experiment, this spacing was used on the check plots in this experiment. On other plots the hills were spaced 9, 18, and 27 inches apart in 3½-foot rows with one, three, and six plants per hill at each drill distance. Each plot received 600 pounds per acre of a 6-10-4 fertilizer.

The five-year average yield at each location and the average yield of all crops at all locations, which is an average of twenty-five crops of cotton, are presented in Table 3.

These results show that the yield of cotton was reduced at the very close or very wide spacings. It will be noted that on the three highest yielding plots the hills were spaced 18 inches in the drill

Table 2.—The Number of Bolls per Pound and the Length and Percentage of Lint of Cotton Produced at Various Spacings.

Plot No.	Number of plants per hill	Number inches hills apart in drill	Number of plants per acre	Number of bolls per pound[1]		Percentage of lint[1]		Length of lint in 1/32 inch[2]	
				Fertilized	Unfertilized	Fertilized	Unfertilized	Fertilized	Unfertilized
1	1	6	24,891	84	88	38	40	26	28
2	2	6	49,782	88	95	38	40	27	27
3	3	6	74,673	93	98	38	40	28	28
4	4	6	99,564	94	103	38	40	28	27
5	1	12	12,446	77	83	38	39	25	27
6	2	12	24,892	88	88	38	40	26	27
7	3	12	37,338	88	92	38	40	27	27
8	4	12	49,784	89	91	38	40	27	28
9	1	18	8,297	75	79	38	39	27	28
10	2	18	16,594	78	84	38	39	26	28
11	3	18	24,891	83	90	37	38	27	27
12	4	18	33,188	83	90	38	40	27	29
13	1	24	6,223	72	77	38	39	26	28
14	2	24	12,446	78	83	38	39	27	28
15	3	24	18,669	79	84	38	39	26	29
16	4	24	24,892	81	86	38	39	27	28
17	1	30	4,978	75	78	38	39	27	28
18	2	30	9,956	76	81	37	39	27	28
19	3	30	14,934	79	81	38	39	26	29
20	4	30	19,912	81	85	38	38	27	28
21	1	36	4,148	73	79	38	39	26	27
22	2	36	8,296	78	81	38	39	27	28
23	3	36	12,444	78	81	38	39	27	27
24	4	36	16,592	78	84	38	39	27	27

[1] Six-year average.
[2] Three-year average.

Table 3.—The Production of Cotton at Various Drill Spacings in 3½-Foot Rows at Different Locations in Alabama.

Plot No.	Spacing		Number of plants per acre	Pounds of seed cotton per acre Five-year average 1930-1934[1]					
	Inches hills apart	Number of plants per hill		Main Station	Substations			Prattville Field	Grand average of all crops
					Wiregrass	Tennessee Valley	Sand Mountain		
1	18	2	16,594	1,098	1,404	1,235	1,456	1,004	1,239
2	9	1	16,594	1,109	1,361	1,194	1,467	976	1,221
3	9	3	49,782	1,043	1,267	1,170	1,326	882	1,138
4	9	6	99,564	1,029	1,162	1,186	1,331	771	1,096
5	18	2	16,594	1,138	1,433	1,298	1,458	983	1,262
6	18	1	8,297	1,084	1,399	1,364	1,413	1,023	1,257
7	18	3	24,891	1,134	1,363	1,375	1,458	961	1,258
8	18	6	49,782	1,083	1,343	1,322	1,416	865	1,144
9	18	2	16,594	1,142	1,419	1,304	1,476	943	1,257
10	27	1	5,532	1,083	1,275	1,226	1,381	992	1,191
11	27	3	16,596	1,157	1,335	1,259	1,386	957	1,219
12	27	6	33,192	1,116	1,313	1,238	1,388	881	1,187
13	18	2	16,594	1,103	1,415	1,336	1,458	978	1,258
Average of check plots 1, 5, 9, and 13				1,120	1,418	1,293	1,462	977	1,254

[1] Each plot received annually 600 pounds of a 6-10-4 fertilizer per acre.

with either one, two, or three stalks per hill. There was a difference of only 5 pounds of seed cotton per acre in the yields produced at these three spacings. These average results show that, if cotton is blocked in chopping to this approximate distance, which is about two to three hoe widths, from one to three plants per hill will produce the maximum yield in 3½-foot rows. It is clearly shown that six plants per hill are too many since the smallest yield at each drill spacing was produced when this number of plants was left.

There was some variation in yields produced at the 18-inch drill spacing at the different locations but as a whole this drill spacing was the most satisfactory. These results show that when cotton was spaced to give from 8,000 to 25,000 plants per acre the largest yields were obtained. Very close spacings tended to increase the percentage of cotton open at the first picking but due to the production of smaller bolls the labor in picking was increased.

In connection with this experiment on the Main Station the spacings were duplicated on unfertilized plots and the results are in general agreement with those where liberal applications of fertilizer were made.

Variations in Width of Rows

In experiments at Auburn and on the Wiregrass Substation the effect of variations in the width of rows on the yield of cotton was studied. In these tests the number of plants per acre was held constant by inverse variations in the width of rows and drill spacings. Each spacing was duplicated under two conditions of fertilization; on the Wiregrass Substation 600 and 300 pounds per acre of a 6-10-4 fertilizer were used; at Auburn 600 pounds of 6-10-4 and no fertilizer were used.

The width of rows was varied from 2½ to 6½ feet. The results, Table 4, show that the largest yields were produced in 2½-, 3½-, or 4½-foot rows. When cotton was liberally fertilized there was very little difference, at either location, in the amount of seed cotton produced when the row width was varied from 2½ to 4½ feet. Where only moderate fertilizer applications were made the largest yields were produced in 2½- and 3½-foot rows, and where no fertilizer was applied decidedly the largest yield was produced in the narrowest rows.

Three plots with row widths of 3 feet were included in the spacing experiment reported in Table 3. On these plots cotton plants were spaced 36 inches in the drill with one, three, or six plants per hill. The largest yield was produced by three plants per hill; this spacing gave 14,520 plants per acre and the yield was only 33 pounds of seed cotton per acre less than the highest yielding plot. The yield was considerably reduced when only one plant was left in hills 36 inches apart.

Table 4.—The Production of Cotton in Various Width Rows at Two Locations.

Width of rows in feet	Main Station			Wiregrass Substation		
	Number of plants per acre	Pounds of seed cotton per acre[1]		Number of plants per acre	Pounds of seed cotton per acre	
		600 lbs. acre 6-10-4	Unfertilized		600 lbs. acre 6-10-4[2]	300 lbs. acre 6-10-4[3]
2½	20,027	1,046	683	16,000	1,262	1,025
3½	20,027	1,055	559	16,000	1,274	1,047
4½	20,027	1,026	511	16,000	1,248	765
5½	20,027	977	472	16,000	1,213	749
6½	——	——	——	16,000	1,141	902

[1] Five-year average.
[2] Three-year average.
[3] Two-year average.

A second experiment, in which the width of cotton rows was varied, was conducted at the Wiregrass Substation from 1933 to 1935. The number of plants per acre was held constant by variations in the distance between hills. The following average yields were obtained in this experiment; in 3-foot rows, 1,368 pounds of seed cotton; in 4½-foot rows, 1,244 pounds; and in 6-foot rows, 1,161 pounds per acre.

SUMMARY

Experiments were conducted from 1924 to 1935 to study the effect of the spacing of cotton plants on the size of bolls, the length and percentage of lint, and yield of seed cotton. The results of these studies may be briefly summarized as follows:

(1) The yield of cotton and the size of boll were the only factors studied which were affected by variations in spacing.

(2) The yield of cotton was influenced by variations in the width of rows, in the distance between hills, and in the number of plants per hill.

(3) Spacings which gave less than 8,000 and more than 25,000 plants per acre tended to reduce the yield.

(4) The size of boll was increased by wide spacings and decreased by close spacings.

(5) The optimum spacing was practically the same on the different soil types on which these experiments were conducted.

RECOMMENDATION

Based on the results of studies presented in this circular it is recommended that cotton be spaced 18 inches apart in the drill with from one to three plants per hill. The width of rows, where liberal applications of fertilizer are made, may vary from 2½ to 4½ feet. Under conditions of low fertility or where only moderate fertilizer applications are made the width of rows should not be more than 3½ feet.