A294-718-10m

TEXAS AGRICULTURAL EXPERIMENT STATION

BULLETIN NO. 230 JUNE, 1918

DIVISION OF AGRONOMY

SPACING OF ROWS IN CORN AND ITS EFFECT UPON GRAIN YIELD

B. YOUNGBLOOD, DIRECTOR

COLLEGE STATION, BRAZOS COUNTY, TEXAS.

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*As of July 1, 1918.
**In cooperation with A. & M. College of Texas.
***In cooperation with United States Department of Agriculture

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SPACING OF ROWS IN CORN AND ITS EFFECT UPON GRAIN YIELD

A. B. Conner, Agronomist

Much has been said about growing corn in widely spaced rows as a means of increasing the grain yield. Experience seems to show that corn planted in rows spaced widely apart produces a better quality of grain than corn planted in regular width rows; and, no doubt, this observation has led to the belief that wide row planting of corn is conducive to higher yields. The width of the row might also involve certain advantages in farm practice, such as the introduction of intertilled legume crops, the eradication of weeds and grass, or the early preparation of the land for small grain. It is the purpose of this bulletin to deal only with that phase of width of row work which has to do with the yield of grain per acre, treating the other phases involved in succeeding papers.

The Division of Agronomy has conducted a series of tests, embracing a total of 234 plats, at seven different points in the State, over a period of from two to five years at each point, for the purpose of determining the effect of the width of the row on the grain yield.

LOCATION OF THE WORK

The experiments reported in this paper have been conducted for five successive years at the Main Station, College Station; for four years at substations at Beeville, Troup, Angleton and Temple; for three years at Beaumont; and for two years at Nacogdoches. These points represent different soil and climatic conditions existing in the corn-growing regions of Texas, and the results secured would seem applicable to the different agricultural regions in this State that grow corn.

METHODS OF CONDUCTING TESTS

Every possible precaution has been taken in the conduct of these tests to eliminate errors due to conditions surrounding the work. The previous treatment of the land, as regards cropping and soil preparation, has been the same for all plats under comparison at any one place each year. The same variety of corn has been used in comparative tests, the same time of planting used, and the same cultivation practiced throughout. The matter of stand, which is one of the most common sources of error, has been determined in every case, with two or three exceptions, by actual count of the mature plants on the land. Some differences in stand have been noted, nearly always in favor of the narrowly spaced rows. These differences, however, are so slight in most cases as to be considered insignificant. It must be borne in mind that while the spacing of the rows was varied, the number of stalks per acre was constant. Thus, one stalk was grown on each square yard, whether the middles were three feet wide with three feet between the

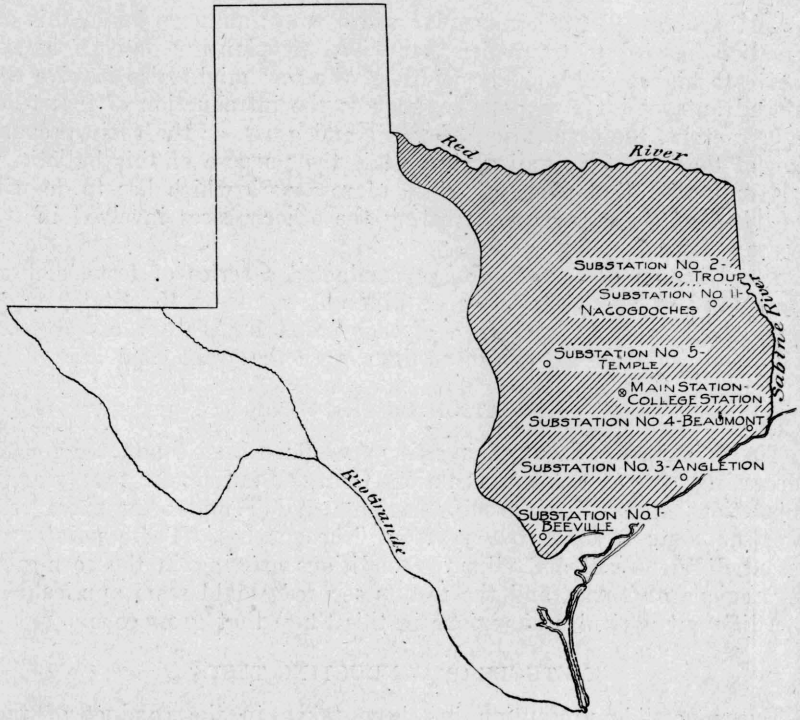

Figure 1.—The shaded portion of the map is the principal corn growing region of Texas. The points designated show the location of the work reported in this bulletin.

Map adapted from "Geography of the World's Agriculture" United States Department of Agriculture, 1918.

stalks in the row, or six feet wide with eighteen inches between the stalks in the row. The further precaution of using guard rows, both at the ends and at the sides of plats, was taken to obtain conditions comparable and applicable in the field under the systems of planting used.

Figure 2.—Spacing of rows three feet apart, with individual stalks 36 inches apart in the row. This distribution carries 4840 stalks to the acre.

Figure 3.—Spacing of rows six feet apart, with individual stalks 18 inches apart in the row. This distribution carries 4840 stalks to the acre.

RESULTS

At College Station

The test at College Station has covered a period of five successive years, 1912 to 1916, inclusive. Each year comparisons were made between rows spaced three feet apart and rows spaced six feet apart. In 1912, 1913 and 1914, an additional series, in which two rows spaced three feet apart alternated with two fallow rows spaced three feet apart, was added as a third distribution. The results for the five-year period are shown in the following table.

Table 1.—Average yearly yield of corn from rows of varying widths and the general average yield for all years at College Station.

Spacing of rows.	1912			1913			1914			1915		1916			Total no. plats.	Average acre yield bus.
	No. plats.	Per cent stand.	Acre yield bus.	No. plats.	Per cent stand.	Acre yield bus.	No. plats.	Per cent stand.	Acre yield bus.	No. plats.	Acre yield bus.	No. plats.	Per cent stand.	Acre yield bus.		
3 feet apart.....	1	104.0	35.00	6	83.8	21.47	4	82.4	18.08	1	25.58	4	97.86	37.16	16	27.40
6 feet apart.....	1	64.7	29.85	2	79.4	19.60	4	77.1	16.78	1	18.17	4	96.63	36.61	12	24.20
Two rows 3 feet apart alternating with two fallow rows 3 feet apart.....	1	78.5	25.23	2	80.0	20.40	4	77.8	16.74	.....	.....	.....	.....	.....	.....	.....

It should be pointed out that the low yield from the six-foot spacing in 1912 was, undoubtedly, due to poor stand. The same is perhaps true in 1915, where the stand is not shown. During both of these years, the June and July rainfall was favorable to a normal stand of 4840 stalks per acre. During 1913, 1914 and 1916, the stands are seen to be comparable.

It is noticeable that the grain yield each year is consistently in favor of the three-foot spacing, as is also the average for the whole period of five years. These results indicate that the actual yield in grain secured from the three-foot spacing is slightly greater than that secured from the six-foot spacing.

It seems that when two rows spaced three feet apart are planted so as to alternate with two fallow rows spaced three feet apart there is little difference from the yield of rows spaced six feet apart.

At Beeville

The results at Substation No. 1, Beeville, embrace a period of four years, 1912, 1913, 1914 and 1915, and, with the exception of a single instance in 1912, three distributions were compared throughout. The results for each of the four years and the average for all four years are shown in the following table:

Table 2.—Average yearly yield of corn from rows of varying widths and the general average yield for all years at Beeville.

Spacing of rows.	1912		1913		1914			1915			Total no. plats.	Average acre bus.
	No. plats.	Acre yield bus.	No. plats.	Acre yield bus.	No. plats.	Per cent stand.	Acre yield bus.	No. plats.	Per cent stand.	Acre yield bus.		
3 feet apart	2	27.08	6	9.49	6	95	39.95	6	93	18.88	20	23.83
6 feet apart	2	27.43	6	10.27	6	81	35.18	6	66	16.44	20	22 33
Two rows 3 feet apart alternating with two fallow rows 3 feet apart	.....	.....	6	10.55	6	76	33.14	6	62	15.35	.....	.....

During the seasons of 1912 and 1913, weather conditions were quite favorable for corn production. In both 1914 and 1915, the rainfall was rather limited in June and July, the time when the corn most needed water. This point is brought out to emphasize the fact that during these two years conditions were more or less favorable to the thinner stands shown in the six-foot spacing. The yields, however, are consistently in favor of the three-foot spacing showing an average, for the four-year period, of 23.83 bushels per acre for the three-foot spacing and 22.33 bushels per acre for the six-foot spacing. The third distribution, i. e., two rows spaced three feet apart alternating with two fallow rows spaced three feet apart, showed practically the same results as the six-foot spacing.

At Troup

The test at Substation No. 2, Troup, has covered a four-year period, 1914 to 1917, inclusive, and in each year a comparison was made between rows spaced three feet apart and rows spaced six feet apart. The results are shown in the following table.

Table 3.—Average yearly yield of corn from rows of varying widths and the general average yield for all years at Troup.

Spacing of rows.	1914			1915			1916		1917			Total. No. plats.	Average acre yield bus.
	No. plats.	Per cent stand.	Acre yield bus.	No. plats.	Per cent stand.	Acre yield bus.	No. plats.	Acre yield bus.	No. plats.	Per cent stand.	Acre yield bus.		
3 feet apart	8	97.7	10.4	2	86	16.4	2	20.40	2	89.6	20.02	14	16.80
6 feet apart	8	94.6	9.5	2	88	19.8	2	18.65	2	89.5	16.04	14	15.99
Two rows 3 feet apart alternating with two fallow rows 3 feet apart	8	95.5	8.7	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....

It will be observed that the stands throughout this test are comparable. The yield was slightly in favor of the rows spaced three feet apart in three years out of four. The general average for all years tested shows a grain yield of 16.80 bushels per acre for the rows spaced three feet apart and 15.09 bushels per acre for the rows spaced six feet apart.

At Angleton

The test at Substation No. 3, Angleton, has embraced a total of forty-eight plats over a period of four years, 1913, 1914, 1916 and 1917. In this test, rows spaced three feet apart were compared with rows spaced six feet apart throughout the period. In 1913 and 1914, a third distribution, in which two three-foot rows alternated with two fallow rows spaced three feet apart, was carried. The results are shown in the following table.

Table 4.—Average yearly yield of corn from rows of varying widths and the general average yield for all years at Angleton.

Spacing of rows.	1913		1914		1916			1917			Total no. plats.	Average acre yield bus.
	No. plats.	Acre yield bus.	No. plats.	Acre yield bus.	No. plats.	Per cent stand.	Acre yield bus.	No. plats.	Per cent stand.	Acre yield bus.		
3 feet apart	8	19.00	8	11.97	2	78.2	29.38	2	93.5	31.38	20	22.93
6 feet apart	6	18.55	6	11.09	2	65.1	20.46	2	92.5	30.05	16	20.03
Two rows 3 feet apart alternating with two fallow rows 3 feet apart	6	18.60	6	10.86	.....	.....	.....	.....	.....	.....	.....	.....

The average yearly yields here favor the three-foot spacing throughout. The average yield for all years is 22.93 bushels per acre for the three-foot spacing and 20.03 bushels per acre for the six-foot spacing, a difference of 2.90 bushels per acre.

In 1912 and 1914, the third distribution showed no marked difference from the six-foot spacing.

At Beaumont

The results at Substation No. 4, Beaumont, covered a period of three years, 1915, 1916 and 1917. Rows spaced three feet apart were compared with rows spaced six feet apart with the results shown in the following table.

Table 5.—Average yearly yield of corn from rows of varying widths and the general average yield for all years at Beaumont.

Spacing of rows.	1915			1916			1917			Total no. plats.	Average.	
	No. plats.	Per cent stand.	Acre yield bus.	No. plats.	Per cent stand.	Acre yield bus.	No. plats.	Per cent stand.	Acre yield bus.		Per cent stand.	Acre yield bus.
3 feet apart	2	94.4	24.88	2	96.00	39.07	2	93.3	19.89	6	94.50	27.94
6 feet apart	2	92.0	26.20	2	93.05	37.39	2	91.7	16.94	6	92.25	26.84

The stands throughout this test are directly comparable. The results show slightly greater yields from the three-foot spacing than from the six-foot spacing.

At Temple

The test at Substation No. 5, Temple, has embraced a total of thirty-three plats, and a period of four years, 1913, 1914, 1915 and 1916. Each year, three distributions were compared. These were rows spaced three feet apart, rows spaced six feet apart and two rows spaced three feet apart alternating with two fallow rows spaced three feet apart. The results are shown in the following table.

Table 6.—Average yearly yield of corn from rows of varying widths and the general average yield for all years at Temple.

Spacing of rows	1913		1914		1915		1916			Total no. plats.	Average acre yield bus.
	No. plats.	Acre yield bus.	No. plats.	Acre yield bus.	No. plats.	Acre yield bus.	No. plats.	Per cent stand.	Acre yield bus.		
3 feet apart	4	24.50	2	33.80	3	27.52	2	100.0	22.92	11	27.18
6 feet apart	4	22.56	2	23.40	3	24.03	2	96.2	21.30	11	22.82
Two rows 3 feet apart alternating with two fallow rows 3 feet apart	4	19.10	2	23.40	3	21.09	2	94.5	18.79	11	20.59

It is observed that the results show consistently better yields from the three-foot spacing than from the six-foot spacing. The stands in 1914 were considered unsatisfactory. The third distribution shows lower yields than either the three-foot spacing or the six-foot spacing.

At Nacogdoches

The test at Substation No. 11, Nacogdoches, has covered a period of two years, 1913 and 1914. During this time a comparison was made between three-foot spacing and six-foot spacing. The results are shown in the following table.

Table 7.—Average yearly yield of corn from rows of varying widths and the general average yield for all years at Nacogdoches.

Spacing of rows.	1913		1914			Total no. plats.	Average acre yield bus.
	No. plats.	Acre yield bus.	No. plats.	Per cent stand.	Acre yield bus.		
3 feet apart	2	9.60	4	100.0	6.07	6	7.81
6 feet apart	2	8.20	4	77.2	8.82	6	8.51

In 1913, the results favored the three-foot spacing. In 1914, however, the results seemed to favor the six-foot spacing. The months of June and July, however, were very dry and favored the thinner spacing. The average yields for the two years show 7.81 bushels per acre for the three-foot spacing and 8.51 bushels per acre for the six-foot spacing, or an advantage of .70 bushels for the six-foot spacing.

Summary of Results

The following table shows the average results for regular and wide spacing of rows at the several different points where the test was conducted. No attempt has been made to average the results for the third distribution in this summary table, as an average of this distribution would in nowise be comparable to the other material presented.

Table 8.—Average yield of corn planted in wide and narrow rows at different points, and average for all points.

Spacing of rows.	Acre yield bushels.							
	College Station.	Beeville.	Troup.	Angleton.	Beaumont.	Temple.	Nacogdoches.	Average.
3 feet apart	27.40	23.83	16.80	22.93	27.94	27.18	7.81	21.98
6 feet apart	24.20	22.33	15.99	20.03	26.84	22.82	8.51	20.10

It is seen that the average results at College Station, Beeville, Troup, Angleton, Beaumont, and Temple favor the regular, or three-foot, spacing; while the average results at Nacogdoches are slightly in favor of the wide, or six-foot, spacing. The general average at all points is 21.98 bushels per acre for the regular, or three-foot, spacing, and 20.10 bushels per acre for the wide, or six-foot spacing, a difference of 1.88 bushels per acre in favor of regular spacing.

CONCLUSIONS

Experiments reported in this paper deal only with the comparative yields secured from corn in widely and narrowly spaced rows, having the same number of plants to the acre.

The experiments reported cover 234 separate trials at seven points in the State, for a period of from two to five years, and are regarded as reliable.

Better stands were secured from plantings made in regular rows spaced three feet apart than from rows spaced six feet apart.

Regular distribution of corn plants on the land favors as large or larger grain yields than irregular distribution.

Irregular distribution, i. e., six-foot spacing, may prove more profitable than regular spacings without actually resulting in greater yields of grain, inasmuch as wide middles are better suited to the introduction of intertilled legume crops, allow cheaper cultivation where the land is weedy, and under certain conditions give better preparation for small grains.

Whether or not wide spacing is more profitable than regular spacing depends upon local conditions in every individual case.

The results presented in this paper emphasize the fact that the mere widening of the rows will not increase the grain yield, and the practice should not be followed except in cases where other advantages result.