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THE RELATION OF SPACING TO YIELD AND TO PLANT  
AND EAR DEVELOPMENT OF SOME YELLOW  
SWEET CORN HYBRIDS IN NEW YORK

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## ABSTRACT

GROWERS have experienced difficulty in obtaining adequate yields from the early yellow sweet corn hybrids. Consequently a study was initiated to determine the relation of six spacing practices to production, rate of maturity, length of ear, percentage of two-eared plants, plant height, and the degree of tillering. An early variety, Seneca Golden, a second early variety, Tendergold, and a main season variety, Golden Cross, were used for comparison.

The 4-year mean yield for Seneca Golden was highest (5.05 tons per acre) when planted in 30-inch rows with plants 9 inches apart. Tendergold produced the highest 3-year mean yield (5.18 tons per acre) when planted in 30- or 36-inch rows with plants 12 inches apart. The yield of Golden Cross was significantly decreased when planted in 30-inch drill rows with plants 9 inches apart. No significant differences were found among the other spacing practices studied, altho the highest mean yield for 3 years of Golden Cross was 5.56 tons per acre when planted in 36-inch drill rows with plants 12 inches apart.

Significant differences in maturity were found among all three varieties with the rate of maturity most rapid when the corn was planted in 36-inch drill rows with the plants 12 inches apart and in 36-inch check rows.

No significant differences in plant height due to spacing were found within any variety.

The greatest number of tillers on Seneca Golden and Tendergold were produced when planted in 36-inch drill rows with plants 12 inches apart. The most tillers were produced on Golden Cross when it was planted in 36-inch check and drill rows.

The highest percentage of two-eared plants for all three varieties was produced when they were planted in 36-inch check rows.

The ears of Seneca Golden were significantly shorter from the 30-inch drill rows with plants 9 inches apart than from the 36-inch rows. Tendergold and Golden Cross ears averaged more than an inch longer when grown in 36-inch check rows as compared to those grown in 30-inch rows with plants 9 inches apart.

A table is included for determining the amount of seed required per acre, based on spacing practice, size of seed, and percentage germination. It is advised that seed be graded into at least two sizes before the number of seeds per ounce is determined.

THE RELATION OF SPACING TO YIELD AND  
TO PLANT AND EAR DEVELOPMENT OF  
SOME YELLOW SWEET CORN  
HYBRIDS IN NEW YORK

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INTRODUCTION

THE efficient use of land and seed is essential for economical sweet corn production. Since the introduction and widespread use of Golden Cross Bantam for commercial canning and freezing, the need for an earlier companion variety of high productivity has been essential. The only early variety of satisfactory quality for canning and freezing available in this State so far is Seneca Golden, but growers have been reluctant to use the variety because it did not yield as well as the second early variety, Tendergold, or the main season variety, Golden Cross.

In order to determine means of increasing the yield of Seneca Golden in this State, an experiment was begun in 1938 to measure the effect of various plant spacings on production. Two other varieties, Tendergold and Golden Cross, were also included in the study, altho due to extreme variation in initial stand, the 1940 yield data for Tendergold and Golden Cross were discarded. In 1941 the effects of these treatments on maturity, ear size, plant height, tillering, and ear development were also studied.

Similar experiments have been conducted in Maine, Illinois, and Puerto Rico. Huelson (3)<sup>1</sup> reported higher yields from drilling than from planting in hills under conditions of the Midwest. Watson and Davis (5) indicated that in Puerto Rico the largest yields were secured from the closest spacing, altho size of ear was decreased. Bailey (1) reported that under Maine conditions less feeding area was required for their earlier variety Portcross 100 than for the main season variety Top Cross Maine Bantam. He concluded that 6 inches to 1 foot between plants planted in drill rows was the most satisfactory spacing for maximum yields under Maine conditions. As the plant feeding area was increased, the plants produced more, heavier, and longer ears and more tillers. Extreme spacings resulted in the production of smaller secondary ears.

<sup>1</sup>Figures in parenthesis refer to Literature Cited, page 18.

## PROCEDURE

The experimental plats were located on the Station's Canning Crops Farm at Geneva, where a 4-year crop rotation is maintained as follows: Corn (followed by a rye cover crop), cabbage, cannery peas (with red clover seeded with the peas), and clover sod.

With the exception of 1938, the plats were located in the regular rotation. Plats were uniformly fertilized with 300 pounds of 4-16-4 fertilizer per acre distributed with a grain drill.

An excessive amount of seed was sown to insure the emergence of an adequate number of plants. In 1938, 1939, and 1940 these were thinned to conform to the calculated average per plat. In 1941, when characters other than yield were studied, the plats were thinned in exact accordance with the space allotments for the various spacing treatments. Since it is conceivable that the true effect of variable spacing on maturity, plant height, tillering, ear length, etc., could not be determined from *average* stands, the 1941 data should be fairly indicative of these relationships.

Six spacing treatments were studied in the experiment as follows: A, 36-inch check rows with plants thinned 3 to the hill; B, 36-inch drill rows with plants thinned to stand 12 inches apart; C, 36-inch drill rows with plants thinned to stand 9 inches apart; D, 30-inch check rows with plants thinned 3 to the hill; E, 30-inch drill rows with plants thinned to stand 12 inches apart; and F, 30-inch drill rows with plants thinned to stand 9 inches apart. In Fig. 1 is shown the arrangement of the plats and their relationship to each other.

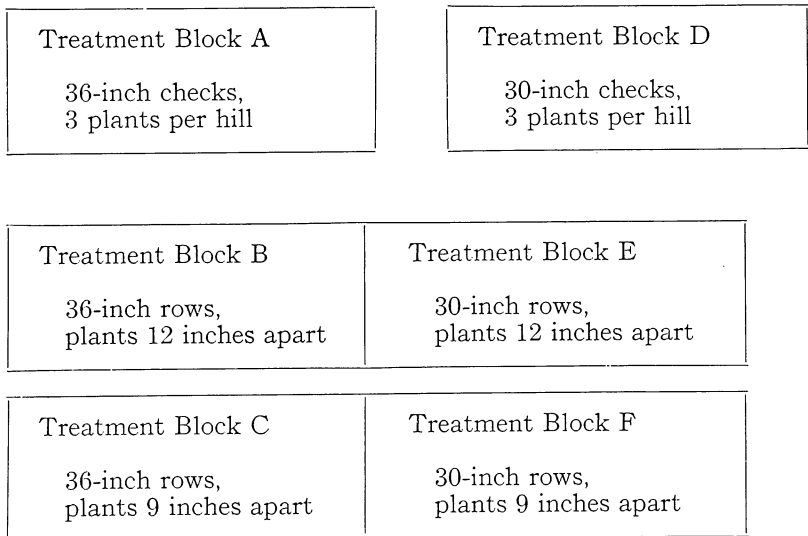


FIG. 1.—ARRANGEMENT OF THE PLATS.

All spacing treatments consisted of three-row, 75-foot plats replicated five times with appropriate guard rows along the sides of every treatment block. In view of the plat size the arrangement was such as to utilize tractor and team labor as much as possible. Thus, all 36-inch rows and all 30-inch rows were placed adjacent to each other. Since treatment blocks A and D consisted of check row plats, it was necessary to leave adequate room to manipulate cultivator equipment for two-way cultivation.

The response of three varieties was studied in this experiment. These were Seneca Golden, an early variety; Tendergold, a second early sort; and Golden Cross, the main season variety. Tendergold is a topcross hybrid and the other two are single cross hybrids. Two rows each of five replications were harvested for yield records. These were measured in pounds of snapped ears per plat harvested for whole kernel corn at the time indicated by an experienced field man from a commercial canning company. In the third row a sample of 50 consecutive plants of replications 1, 3, and 5 was studied to determine the relationship of plant height, double earedness, tillering, ear length, and maturity to the various spacing treatments used.

## DISCUSSION OF RESULTS

### EFFECT OF SPACING ON YIELD

Yield records were secured on Seneca Golden for 4 years and for 3 years each on Tendergold and Golden Cross. These data are recorded in Tables 1 to 3, and are presented in graphic form in Figs. 2 and 3. Considerable variation in yield between years is apparent. In the case of Seneca Golden over a period of 4 years (Table 1), the yield varied from 3.09 tons per acre to 5.56 tons per acre for the same treatment (A), yet in 3 years out of 4 significant increases (5) were obtained from the 30 inch rows with plants 9 inches apart (F) over the 36 inch check rows (A), and over A and B treatments in 1940 and 1941. This is indicative of a trend which shows that the closest planting (F) should produce significantly higher yields than the standard treatment (B). This is clearly shown in the 1940 results when the F treatment produced a gain of 1.66 tons per acre over treatment A and 1.36 tons over treatment B. Likewise, in 1941, when the same treatment showed gains of 0.76 tons and 1.04 tons over the A and B treatments, respectively. These are all significant increases. In 3 years out of 4, the yields of Seneca Golden planted in 30- and 36-inch drill rows with plants 12 inches apart exceeded those obtained from 30- and 36-inch check rows, and in 2 years out of the 4 the increases were significant.

TABLE 1.—EFFECT OF SPACING ON YIELD IN TONS PER ACRE OF SENECA GOLDEN.

TREATMENTS	1938	1939	1941	3-YEAR MEAN	1940	4-YEAR MEAN
A.....	3.09	4.09	5.56	4.25	3.97	4.17
B.....	3.90	4.88	5.28	4.69	4.27	4.58
C.....	3.68	4.43	5.84	4.65	5.02	4.74
D.....	3.44	4.14	6.22	4.60	4.21	4.50
E.....	3.82	5.04	5.54	4.80	4.84	4.81
F.....	3.55	4.72	6.32	4.86	5.63	5.05
Difference necessary for significance, 5 per cent.....	0.40	0.54	0.32	0.26	0.59	0.68

Three years' data were obtained for Tendergold (Table 2). In 1938 and 1939, the highest yields for this variety were obtained when planted in 36- and 30-inch rows with plants 12 inches apart (B and E) when significant gains of 0.56 and 1.03 tons, respectively, for B and 0.54 and 0.78 ton for E, respectively, were obtained over that from Tendergold planted in 36-inch check rows with 3 plants to the hill (A). The mean yields for the 3 years also show that the 36 and 30 inch rows with plants 12 inches apart (B and E) produced significantly higher yields than when planted in 36-inch check rows. Under the conditions of this experiment, Tendergold therefore was most productive when planted in 36-inch rows, and in 30-inch rows, with plants 12 inches apart. When spaced 9 inches in the row, the yields for 1938 and 1939 were reduced.

TABLE 2.—EFFECT OF SPACING ON YIELD IN TONS PER ACRE OF TENDERGOLD.

TREATMENTS	1938	1939	1941	3-YEAR MEAN
A.....	4.39	4.23	5.05	4.56
B.....	4.95	5.26	5.32	5.18
C.....	4.51	4.59	5.72	4.94
D.....	4.43	4.48	5.63	4.85
E.....	4.93	5.01	5.50	5.15
F.....	4.52	4.27	5.76	4.85
Difference necessary for significance, 5 per cent.....	0.48	0.64	0.39	0.44

Three years' data on Golden Cross (Table 3) indicate that a space allotment of 30-inch rows with plants 9 inches apart (F) is too close for maximum production. Highest yields were obtained when this variety was planted in 36-inch drill rows with plants 12 inches apart

(B), altho yields were not significantly lower when planted with three plants to the hill in either 30- or 36-inch check rows (A and D), or in 36-inch drill rows with plants 9 inches apart, or 30-inch drill rows with plants 12 inches apart (C and E). The use of the check row system or the drill row system with Golden Cross is dependent upon the planting equipment available, the cost, and the necessity for two-way cultivation as a weed control measure. No significant differences in yields were obtained between the two systems for Golden Cross.

TABLE 3.—EFFECT OF SPACING ON YIELD IN TONS PER ACRE OF  
GOLDEN CROSS BANTAM.

TREATMENTS	1938	1939	1941	3-YEAR MEAN
A.....	5.12	4.50	6.64	5.42
B.....	5.32	5.18	6.17	5.56
C.....	4.86	4.44	6.37	5.22
D.....	4.74	4.85	6.30	5.30
E.....	5.05	4.78	6.20	5.34
F.....	4.71	3.86	5.92	4.83
Difference necessary for significance, 5 per cent.....	0.43	0.59	0.60	0.58

The 3-year mean yields for the three varieties are shown graphically in Fig. 2, as well as that for the 4-year mean for Seneca Golden. They indicate that a definite decrease in yield was obtained from Seneca Golden and Tendergold when these varieties were planted in hills, particularly when the rows were spaced 36 inches apart (A). In the case of Seneca Golden, the highest yields were obtained, within the limits of this experiment, when planted in 30-inch drill rows with the plants spaced 9 inches apart (F). With Tendergold highest yields were obtained when the plants were spaced 12 inches apart in either 30- or 36-inch rows (E and B). In contrast, the yields of Golden Cross were not significantly decreased when grown in 36-inch check rows in comparison to 36-inch drill rows with plants 12 inches apart, altho yield from the latter spacing was somewhat higher.

In order to visualize the comparative yields of the three varieties obtained in 1941 when other plant and ear characters were also studied, the data are presented graphically in Fig. 3. The variation in yield for Seneca Golden was marked, having extended from a low of 5.28 tons (B) to a high of 6.32 tons (F), a significant increase.

High yields for Tendergold were obtained from treatments D, C, and F, yet when planted in 36-inch check rows with three plants per

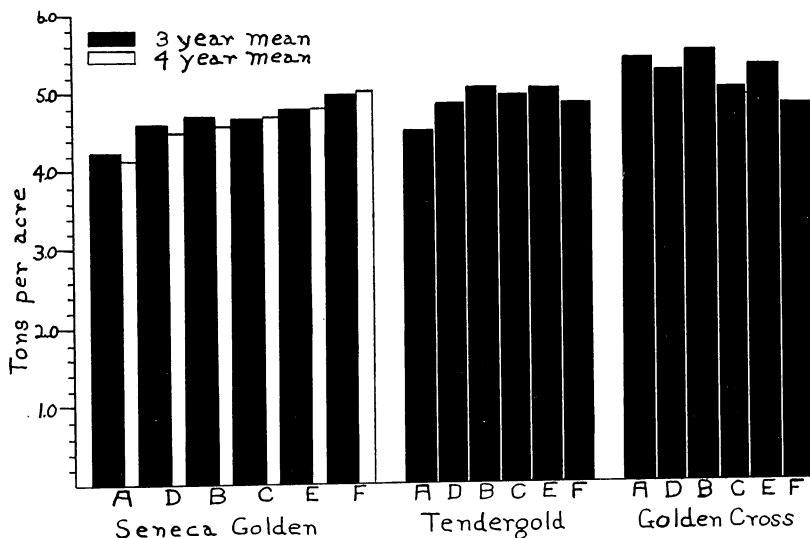


FIG. 2.—EFFECT OF SPACING ON YIELD OF SWEET CORN, 1938–41.

Spacing treatments were as follows: A, 36-inch check rows, 3 plants per hill; B, 36-inch drill rows, plants 12 inches apart; C, 36-inch drill rows, plants 9 inches apart; D, 30-inch check rows, 3 plants per hill; E, 30-inch drill rows, plants 12 inches apart; and F, 30-inch drill rows, plants 9 inches apart.

hill (A), the yield was significantly less than all others except treatment B. This is contrary to the 3-year mean yields, and clearly indicates the fallacy of using a single year's results to interpret yield data. Moreover, the mean yield for Tendergold for all treatments during 1941 was less than for Seneca Golden, in spite of the fact that according to data in Table 5 Tendergold was more mature. This relationship did not exist any other year, nor has it existed in regular variety yield trials. This suggests the possibility that over a period of years, hybrid sweet corn varieties, due to slight changes in inbreds or a change in the stock of the open-pollinated variety used to produce the topcross hybrid, may not be suitable for obtaining experimental data unless seed out of the same bag is used for the duration of the experiment.

Maximum yields for Golden Cross were obtained from the 36 inch check rows, with 3 plants to the hill (A), altho this did not differ significantly from any other spacing except F which showed a significant reduction from the close spacing. In general, this is in agreement with the mean yields for 3 years as illustrated in Table 3 and Fig. 2.



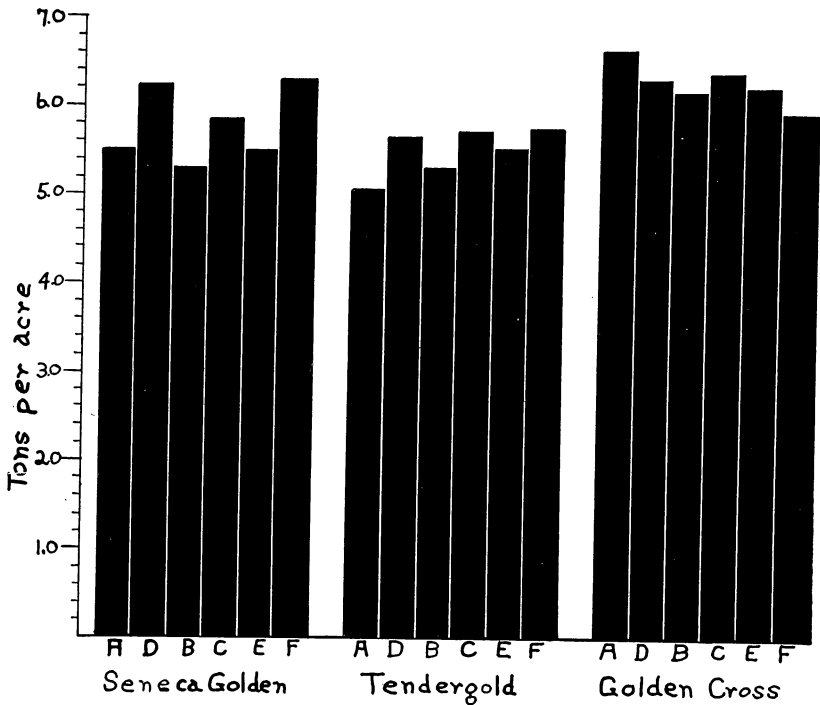


FIG. 3.—EFFECT OF SPACING ON YIELD OF SWEET CORN IN 1941.

Spacing treatments were as follows: A, 36-inch check rows, 3 plants per hill; B, 36-inch drill rows, plants 12 inches apart; C, 36-inch drill rows, plants 9 inches apart; D, 30-inch check rows, 3 plants per hill; E, 30-inch drill rows, plants 12 inches apart; and F, 30-inch drill rows, plants 9 inches apart.

In view of the yield data presented, it seems reasonable to conclude (a) that the season has a marked influence on the effect of spacing on sweet corn production; (b) that over a period of years the yield of Seneca Golden was highest when the seed was drilled in 30-inch rows at a rate to insure a stand of one plant every 9 inches; (c) that in 2 years out of 3, maximum yields for Tendergold were obtained when planted in 30- or 36-inch drill rows with plants 12 inches apart; and (d) that the maximum yields for Golden Cross were obtained when the variety was planted in 36-inch drill rows with plants 12 inches apart, altho no significant decrease resulted from other space treatments studied in this experiment except when the variety was planted in 30 inch rows with plants 9 inches apart.

## RATE OF PLANTING

It is well known that the size of hybrid seed may vary from year to year due to the growing conditions experienced by the seed crop. Table 4 has been prepared to aid the grower in determining the number of pounds to be sown per acre based on seed size, germination, and space allotment. In column one are listed various seed sizes based on the number of seeds per ounce. The range recorded will cover the seed of practically all yellow sweet corn varieties with the exception of Golden Country Gentleman. The remainder of the table is divided into five sections based on the various spacings used in this study. Since the average area allotted per plant in treatments A and B are identical (3 square feet per plant) the amount of seed used for these two planting methods is the same. Each section of Table 4 is divided into three columns based on the germination of the seed to be planted. Since it is improbable that even every good seed will grow into a mature corn plant, it is suggested that the germination column 10 per cent lower than the actual germination be used in determining the right amount of seed to plant per acre. Thus, if a grower decides to plant Seneca Golden seed with a germination test of 90 per cent and averaging in size about 180 seeds per ounce, he would determine from Table 4 the amount of seed required for the spacing desired. For example, if he decided to plant in rows 30 inches apart with plants to stand 9 inches apart, he would refer to section F, column 2, the third line from the bottom (F spacing, 80 per cent germination) and find that  $9\frac{1}{2}$  pounds of seed would be required per acre. If the seed is graded into at least two sizes before the seed sizes are determined, the effectiveness of the table obviously would be increased.

## EFFECT OF SPACING ON PLANT AND EAR DEVELOPMENT

It has been shown that the yield of sweet corn can be influenced by different spacings and that the yield of Seneca Golden in particular can be substantially increased by proper spacing so that it will compare favorably with the yield of Golden Cross.

It was also of interest to determine why and how these changes in yield were brought about. This led to a study of plant and ear characters in which the factors of maturity, plant height, tillering, double earedness, and ear lengths were measured.

These data were secured in 1941. Since the plants in 1941 were thinned to conform to the exact space allotments rather than average

TABLE 4.—RATE OF SEEDING SWEET CORN IN POUNDS PER ACRE FOR DIFFERENT PERCENTAGES GERMINATION AND DIFFERENT SEED SIZES.

No. of Kernels per oz.	SPACING TREATMENT A, 36 IN. CHECKS, 3 PLANTS PER HILL B, 36 IN. ROWS, PLANTS 12 IN. APART			SPACING TREATMENT C, 36 IN. ROWS, PLANTS 9 IN. APART			SPACING TREATMENT D, 30 IN. CHECKS, 3 PLANTS PER HILL			SPACING TREATMENT E, 30 IN. ROWS, PLANTS 12 IN. APART			SPACING TREATMENT F, 30 IN. ROWS, PLANTS 9 IN. APART		
	Germination, per cent			Germination, per cent			Germination, per cent			Germination, per cent			Germination, per cent		
	90	80	70	90	80	70	90	80	70	90	80	70	90	80	70
100.....	10.0	10.0	12.0	13.0	14.5	15.5	14.0	15.5	17.0	12.0	13.0	14.0	16.0	17.5	19.0
110.....	9.0	10.0	10.5	12.0	13.0	14.0	13.0	14.0	15.5	11.0	12.0	13.0	14.5	16.0	17.0
120.....	8.0	9.0	9.5	11.0	12.0	13.0	12.0	13.0	14.0	10.0	11.0	12.0	13.0	14.5	15.5
130.....	7.5	8.0	9.0	10.0	11.0	12.0	11.0	12.0	13.0	9.0	10.0	11.0	12.0	13.5	14.5
140.....	7.0	7.5	8.5	9.5	10.5	11.0	10.0	11.0	12.0	8.5	9.5	10.0	11.5	12.5	13.5
150.....	6.5	7.0	8.0	9.0	9.5	10.5	9.5	10.5	11.0	8.0	9.0	9.5	10.5	11.5	12.5
160.....	6.0	7.0	7.5	8.5	9.0	10.0	9.0	10.0	10.5	7.5	8.0	9.0	10.0	11.0	12.0
170.....	6.0	6.5	7.0	8.0	8.5	9.0	8.5	9.0	10.0	7.0	8.0	8.5	9.5	10.0	11.0
180.....	5.5	6.0	6.5	7.5	8.0	8.5	8.0	8.5	9.5	6.5	7.0	8.0	9.0	9.5	10.5
190.....	5.0	5.5	6.0	7.0	7.5	8.0	7.5	8.0	9.0	6.5	7.0	7.5	8.5	9.0	10.0
200.....	5.0	5.0	6.0	6.5	7.0	7.5	7.0	7.5	8.5	6.0	6.5	7.0	8.0	8.5	9.5

space allotments, it seems reasonable to assume that such measurements should represent fairly the relationships under study.

#### DETERMINATION OF MATURITY

It was necessary to use some rapid measure of maturity in order to determine the relative age of the samples. At harvest time the top ears from a 50-plant sample were husked by hand and separated into five maturity classes, *viz.*, immature, ear pack, fancy whole kernel, fancy cream style, and standard cream style. Such a classification is illustrated in Table 5. These data represent the grading results of Seneca Golden as grown in 36 inch check rows with 3 plants to the hill (A). In order to have a basis for analysis and comparison, each class was assigned an arbitrary numerical factor indicative of its relative maturity. By multiplying this maturity factor with the number of ears in each class, a maturity value was determined the sum of which was used as an index of relative maturity for the entire

TABLE 5.—DETERMINATION OF MATURITY VALUES FOR SENECA GOLDEN, TREATMENT A, 1941.

MATURITY CLASS	MA- TUR- ITY FAC- TOR	REPLICATION 1		REPLICATION 2		REPLICATION 3		MEAN MA- TURITY VALUE
		No. ears	Ma- turity value	No. ears	Ma- turity value	No. ears	Ma- turity value	
Immature.....	1	1	1	1	1	1	1	1
Whole ear.....	2	8	16	7	14	6	12	14
Whole kernel.....	3	24	72	23	69	26	78	73
Fancy cream.....	4	15	60	18	72	12	48	60
Standard cream....	5	2	10	1	5	5	25	13
Total maturity values.....			159		161		164	161

graded sample. In Table 5 the total maturity values for three replications were 159, 161, and 164, the mean of which, 161, was used to indicate the maturity of Seneca Golden corn grown under the conditions of spacing treatment A.

Similar mean maturity values were calculated for all spacing treatments for the three varieties and are presented in Table 6 for comparison. Thus, the maturity increases as the maturity values become larger. The values for the three replications were used to determine statistically the significant differences in maturity among the samples.

TABLE 6.—EFFECT OF SPACING ON MATURITY OF SWEET CORN, 1941.

TREATMENTS	SENECA GOLDEN	TENDERGOLD	GOLDEN CROSS
A.....	161	183	181
B.....	152	178	165
C.....	132	160	145
D.....	145	155	151
E.....	149	162	145
F.....	131	155	133
Difference necessary for significance, 5 per cent..	9	7	10

In order to interpret the maturity values in terms of raw corn grades, the maturity values were converted into percentages of prime milk stage ears. As a basis for this conversion the United States grade specifications (4) used by Maine canners were examined. In Maine, much of the corn is graded on the percentage of prime milk stage ears per load, *viz.*, grade 1, 50 per cent or better—whole kernel style; grade 2, 35 to 49 per cent—fancy cream style; grade 3, 20 to 34 per cent—extra standard cream style; grade 4, less than 20 per cent—standard cream style. Since no corn was used for the whole ear pack (freezing or canning), it was necessary to break down the group which included 50 per cent or better prime milk stage corn.

As a basis for such a division the standards used by one of the largest canners of sweet corn in New York State were applied. These standards were based also on the percentage of prime milk stage ears per load, *viz.*, grade 1, 85 per cent or more—whole ear style for freezing or canning; grade 2, 70 to 84 per cent—whole kernel style; grade 3, 50 to 69 per cent—fancy cream style; grade 4, 30 to 49 per cent—extra standard cream style; grade 5, below 30 per cent—standard cream style. Altho these standards are somewhat higher than those used in Maine, they have been used as a basis for interpreting data secured under New York conditions.

The data included in Table 6, therefore, can be interpreted as follows:

Maturity value	Raw corn classification
125-136	1. Whole ear style for freezing or canning (or fresh market)
137-156	2. Whole kernel style
157-178	3. Fancy cream style
179-199	4. Extra standard cream style
200-	5. Standard cream style

In view of the increased yield obtained from the closest spacing on Seneca Golden, it is reasonable to assume, in view of the maturity values, that the yield of treatments C and F for Seneca Golden would have been greater had the crop been allowed to remain a day or two longer in the field. Since one of the objectives of the experiment was to determine the influence of spacing on rate of maturity, it was necessary to harvest all plats the same day. Unfortunately, a comparison of the rate of maturity can be made only on 1941 data, since this was the only year sufficient replications were studied for statistical analysis.

Seneca Golden corn harvested from 36 inch check and drill rows (A and B) was significantly more mature than that from other treatments, and that harvested from 30 inch rows, with plants 9 inches apart (F) was distinctly younger in maturity than any except treatment C. The maturity range of Tendergold followed much the same trend with corn produced under treatments A and B, significantly more mature than any of the others, and treatments F and D, significantly less mature than the others. A similar relationship was found to be true with Golden Cross with maturity rate of corn planted in 36-inch check rows the most rapid, followed by that in treatment B. Again F treatment was significantly slower to mature than any other treatment.

#### EFFECT OF SPACING ON PLANT HEIGHT

Height measurement of a 50-plant sample for each of three replications were recorded a day or so before the variety was harvested. These data are given in Table 7. No significant differences in height were found due to the spacing among the three varieties, altho Tendergold plants grown in 36-inch check rows (A) were 0.40 foot

TABLE 7.—EFFECT OF SPACING ON PLANT HEIGHT IN FEET, 1941.

TREATMENTS	SENECA GOLDEN	TENDERGOLD	GOLDEN CROSS
A.....	5.47	5.97	6.43
B.....	5.57	5.90	6.40
C.....	5.57	5.93	6.43
D.....	5.43	5.70	6.17
E.....	5.33	5.57	6.13
F.....	5.33	5.60	6.13
Difference necessary for significance, 5 per cent..	0.52	0.42	0.58

taller than those grown in 30-inch drill rows with plants 12 inches apart (E), this difference being on the threshold of significance.

#### EFFECT OF SPACING ON AVERAGE NUMBER OF TILLERS PER PLANT

The number of tasseled tillers per plant was counted when plant heights were recorded. These data are given in Table 8 and show that in the case of Seneca Golden significantly more tillers were produced on plants in 36 inch rows, with plants 12 inches apart than from treatments A, D, and F. No significant differences in tillering were found in the 36 and 30 inch drill rows with plants spaced 9 and 12 inches apart (C and E respectively).

TABLE 8.—EFFECT OF SPACING ON AVERAGE NUMBER OF TILLERS PER PLANT, 1941.

TREATMENTS	SENECA GOLDEN	TENDERGOLD	GOLDEN CROSS
A.....	0.767	1.160	0.953
B.....	1.187	1.253	0.913
C.....	0.800	0.810	0.573
D.....	0.620	0.680	0.493
E.....	0.807	0.860	0.627
F.....	0.507	0.460	0.347
Difference necessary for significance, 5 per cent..	0.393	0.221	0.215

With Tendergold there was no significant difference in tillering between the 36-inch check rows and the 36-inch drill rows with plants 12 inches apart (A and B). Both of these treatments, however, developed significantly more tillers than did any of the other treatments. Plants grown at the closest spacing (F) produced significantly fewer tillers than treatments A, B, C, and E.

Treatments A and B were most conducive to tillering for Golden Cross, where averages of 0.953 and 0.913 tiller per plant were produced. These were significantly greater than for any other treatment. In the closest spacing (F), significantly fewer tillers were produced than in all other treatments except D.

#### EFFECT OF SPACING ON PERCENTAGE OF TWO-EARED PLANTS

In 1941 all usable second ears were counted at harvest time and the percentage of plants bearing them was calculated. These data are recorded in Table 9. A study of the data reveals that significant

differences among all three varieties were found. For Seneca Golden and Tendergold plants grown in 36 inch check rows (A) produced significantly more usable second ears than any other treatment, and in the case of all three varieties treatment B produced significantly more second ears than any treatment but A.

Practically no second ears were produced on Seneca Golden when planted in 30-inch rows with plants 9 inches apart. No significant difference between E and F treatments in Tendergold was obtained, altho treatment C produced significantly more second ears than treatment F.

In the case of Golden Cross no significant differences were obtained in treatments C, D, E, and F, altho treatments A and B both produced significantly more second ears than any one of the other treatments. No significant difference was found between the 36-inch check row treatment (A) and the 36-inch drill row treatment (B).

TABLE 9.—EFFECT OF SPACING ON PERCENTAGE OF TWO-EARED PLANTS, 1941.

TREATMENTS	SENECA GOLDEN	TENDERGOLD	GOLDEN CROSS
A.....	22.0	32.0	42.0
B.....	15.3	22.0	32.7
C.....	11.3	17.3	14.7
D.....	6.0	14.7	14.0
E.....	7.3	10.7	15.3
F.....	1.3	6.7	10.7
Difference necessary for significance, 5 per cent..	4.7	7.6	11.5

#### EFFECT OF SPACING ON EAR LENGTH

After the husked ears had been classified for maturity, length measurements were taken. These data are given in Table 10. The ears of Seneca Golden were significantly shorter from treatment F than from treatments A, B, and C, but no significant difference in ear length was found among treatments A to E, inclusive.

The differences were much more apparent with Tendergold, since the ears were more than an inch longer on plants grown in 36-inch check rows (A) as compared to those grown in 30-inch drill rows with plants 9 inches apart (F). Likewise, in the A treatment the ears were significantly longer than those produced in treatments C and E. No significant difference in ear length was found between treatments A, B, and D.



TABLE 10.—EFFECT OF SPACING ON EAR LENGTH IN INCHES, 1941.

TREATMENTS	SENECA GOLDEN	TENDERGOLD	GOLDEN CROSS
A.....	7.03	7.07	7.23
B.....	7.13	6.90	6.90
C.....	6.97	6.60	6.67
D.....	6.90	6.70	6.70
E.....	6.83	6.67	6.60
F.....	6.60	6.03	5.97
Difference necessary for significance, 5 per cent..	0.37	0.39	0.34

Differences in ear length were most pronounced with Golden Cross where treatment A ears were 1.26 inches longer than treatment F ears. Ears from the A treatment were significantly longer than those from all other treatments except B, with the difference between these two on the threshold of significance. The ears from the F treatment were significantly shorter than those from any other treatment.

### CONCLUSIONS

On the basis of the data presented, the following conclusions may be made:

1. Considerable variation in yield from year to year may be expected from the same space allotment due to variations in temperature and rainfall.

2. The mean yield for 4 years for Seneca Golden was greatest when the seed was drilled in 30-inch rows at a rate to insure a plant stand of one to every 9 inches. In 2 years out of 4 significant increases were obtained by this spacing over the 36-inch drill row spacing with plants 12 inches apart.

3. In 2 years out of 3 of the spacings under comparison in this experiment, maximum yields for Tendergold were obtained when the variety was planted in 30- or 36-inch drill rows with plants 12 inches apart.

4. The maximum yield for Golden Cross was obtained when it was planted in 36-inch drill rows with plants 12 inches apart, altho no significant decrease resulted from other space treatments used in this experiment except when the variety was planted in 30-inch rows with plants 9 inches apart (treatment F). Available planting equipment and the necessity for rigorous weed control should determine whether this variety is planted in check or drill rows.

5. All three varieties matured most rapidly when grown in the largest space allotment, *viz.*, 36-inch check rows or 36 inch drill rows with plants 12 inches apart. They matured the slowest when planted in 30-inch rows with the plants spaced 9 inches apart.

6. There was no significant difference in plant height as the result of the various spacing treatments for any variety.

7. With Seneca Golden the highest degree of tillering was attained when the plants were grown in 36-inch drill rows with plants 12 inches apart. No significant difference in the amount of tillering for Tendergold was found when grown in 36-inch check rows or 36-inch drill rows with plants 12 inches apart. Significantly more tillers were produced by these two treatments than by any others. Significant increases in tillering for Golden Cross were obtained in the 36-inch check and drill row spacings over all other treatments.

8. When all three varieties were planted in 36-inch drill rows with plants 12 inches apart, significantly more second ears were produced than for any other treatment except the 36-inch check row system. The number of second ears for all varieties was reduced markedly when planted in 30-inch rows either 9 or 12 inches apart or when planted 9 inches apart in 36-inch drill rows.

9. Length of ears was significantly increased for all three varieties by wider spacing, but no significant difference in ear length occurred when these varieties were grown in 36-inch check rows and 36-inch drill rows with plants 12 inches apart. The least variation was obtained for Seneca Golden for which variety no significant difference in length was found among the first five treatments. Ears grown in 30-inch drill rows with plants 9 inches apart were significantly shorter than those grown in 36-inch rows. Tendergold ears grown in 36-inch check rows were significantly longer than those grown in 30- and 36-inch drill rows with plants 9 inches apart and in 30-inch check rows. Ears of Golden Cross were significantly longer when grown in 36-inch check rows than by any other spacing in this experiment except in 36-inch drill rows with plants 12 inches apart.

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