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SWEET CORN INBREDS

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FIGURE 20. Representative plants of Whipple inbreds, (left) number 6 and (right) number 2, with an ear of Whipcross C6.2.

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Production of Crossed Sweet Corn Seed

CROSSED SWEET CORN has been increasing rapidly in popularity since its introduction by this Station in 1926. A survey just completed shows that there were more than 2,761,000 pounds of hybrid seed produced last year. This is enough to seed more than 276,000 acres, probably ten times the amount planted in 1932, when 80,000 was the total acreage of both crossed sweet and field corn. Such a remarkable advance is due partly to the fact that growers are becoming conscious of the superiority of hybrids, and partly to the drop in price of such seed. It points to a definite trend toward crossed varieties.

The production figures quoted were secured, for the most part, from seed companies and individuals who grew such seed. We wish to express our appreciation for the whole-hearted cooperation of those who have contributed to this report, as well as to members of the staffs of experiment stations in the various states who supplied information. The tabulations were made on March 27, 1936. While we have tried to secure yields from everyone who grew crossed seed, there are possibly some producers whom we have missed. Hence the actual production is undoubtedly in excess of the figures given. However, any error will be small. We hope that such a survey may be made every few years.

The average number of acres of sweet corn used for canning in 1928-32 was 313,950. The 1930 census states that 483,053 acres of sweet corn were raised for sale. Thus we see that the amount of crossed sweet corn seed produced in 1935 is sufficient to plant an acreage to supply practically the whole canning trade, or enough to seed more than half of the total sweet corn acreage in the United States.[1]

It is interesting also to note that Golden Cross Bantam was by far the most popular hybrid in 1935. More than 1,226,000 pounds of this seed alone were produced, which means that there will be about 123,000 acres of Golden Cross Bantam in 1936.

Seed of hybrids introduced or first recommended by this Experiment Station also made an excellent showing, amounting to 150,000 pounds, or sufficient to plant 15,000 acres. This figure represents more than three times the total Connecticut sweet corn acreage (4,576 acres) in 1929, and almost half of the total New England acreage for that year (35,312 acres).[2]

Production and Increase of Inbred Seed

The inbred seed used in the production of sweet corn crosses must be kept pure if the hybrids are to remain the same from year to year. We plan to increase the Connecticut Station inbreds and supply only seed

[1] In making these estimates we have allowed 10 pounds of seed to the acre.
[2] Both of these figures are from the federal agricultural census for 1930.

that is true to type. There are several steps where precaution must be exercised in the increasing of inbred seed. These might be enumerated as follows:

1. **Seed for the foundation increase plot must be hand-pollinated.** There are no exceptions to this rule. It is such an easy matter to hand-pollinate seed for the foundation plot that there is no excuse for not doing so. Last year 100 hand-pollinations of Connecticut 2 gave 83 ears with 6 pounds of shelled grain. Since the kernels are small this is almost enough seed to plant an acre, from which we may expect a yield of 750 pounds in 1936. The yield of this inbred is low in comparison with some others. Probably 50 pollinations of Purdue 39 would be sufficient to produce seed for an acre foundation seed plot. With C6, 75 hand-pollinations produce 6 pounds of shelled seed, enough for about half an acre, because the seeds are large. These pollinations should be sib-mated rather than selfed to avoid a further reduction in vigor of the inbred.

2. **The hand-pollinations for the foundation stock should be made within an increase plot of the inbred.** This materially reduces the chances for contamination by stray pollen grains during the hand-pollinating.

3. **The foundation increase plot should be well isolated from all other corn.** The importance of this is self-evident since the seed grown in the foundation increase plot will be used the next year for further increase. It is difficult to say just what is adequate isolation. The general rule is, the farther from any other corn the better. Woodland or orchards serve as barriers for pollen and will reduce the distance required for proper isolation. It is also possible to create an artificial pollen barrier by planting several rows of a luxuriant growing crop along the borders of the increase plot. Late maturing corn may be used. We have found hemp (*Cannabis sativa* L) admirably suited for this purpose.

4. **The foundation plot should be properly rogued.** Even with hand-pollination of the seed of the foundation increase plot, a stray pollen grain may have found its way in. The seed of such fertilization would produce an extremely vigorous plant that would shed enough pollen seriously to contaminate an acre or more of foundation stock. Hence it is necessary to go through the increase plot just *before* any silks have emerged and pull up any plants that are more vigorous than the inbred. Any questionable plants should be destroyed. Rogueing can be accomplished more easily if the plants are sown in drills rather than in hills. If an outcrossed plant is growing in a hill with inbred plants, the whole hill must be destroyed to make sure that all of the tillers of the crossed plant are removed.

5. **Seed grown in the foundation increase plot is to be used to grow larger increase plots another year.** It is not to be used in crossing plots unless there is an ample supply. Seed from the larger or second increase plot will be used for crossing plots to produce hybrid seed. (The second increase plot must also be properly isolated and thoroughly rogued.) By this method it is possible to use seed no more than two generations removed from hand-pollinated seed for all production fields. If such a procedure is practiced carefully, a greater uniformity of the crossed sweet corn will result.

The following table shows the different grades of inbred seed for sale, the use for which each grade is intended and the price asked for each.

TABLE 1. INBRED SEED, PRICE AND USAGE.

Grade	Price per pound	Intended Usage
1. Hand pollinated	not for sale	To produce foundation seed plot
2. Once removed from H. P. seed	1.00	To produce second increase plot
3. Twice removed	.75	Production fields ♂ parent, and ♀ parent if ample supply
4. Three times removed	.50	Seed rows only in production fields. To be used only if there is no seed of 2 or 3

Seed of greater purity is required for the pollen row than for the seed parent. This is obvious because the pollen parent furnishes pollen for all the seed rows and if not properly rogued there is a chance for considerable contamination at pollination time. In the seed rows any off-type ears can be discarded at harvest time.

Connecticut Station Inbreds

For the present we are maintaining six sweet corn inbreds, three multiple sweet corn varieties, and three of field corn. A multiple variety is a synthetic type produced by recombining several of the best inbreds of any given variety into a new strain that can be carried on similarly to any open-pollinated variety. Brief descriptions of the inbreds and multiple varieties follow.

Connecticut 2 is an inbred out of the Whipple variety that matures in about the same season. The plant is dark green. The top leaves are rather crinkly and have a tendency to clasp the stalk rather firmly, especially near the tassel, so there is no elongated stalk near the base of the tassel as in most corn. The tassels are inclined to bend over as they mature (Figure 20), showing the sun red glumes. This gives the inbred a reddish cast as one looks over the top of a field. Connecticut 2 is partially resistant to bacterial wilt and wholly susceptible to corn rust, a disease that does not usually damage varietal corn. Although, as a rule, it is not seriously damaged by rust, we saw one field, planted late in 1935, so badly affected that not an ear was produced. Where rust is present, we recommend planting Connecticut 2 early, not after June 1 in this locality. If planted early it will make ample pollen and also good ears.

Connecticut 2 is used as the pollen parent of Whipcross C6.2 and C7.2, and of Spancross C2. Another hybrid that did especially well last year was Whipcross P39.C2. A topcross of unusual promise was Charcross C2 (Charlevoix × Conn. 2). Another promising top-cross last year was Orcross C2 (Sweet Orange × C2). In fact C2 does well in combination with almost any midseason or early corn, imparting hybrid vigor and dark green foliage to the cross. A first early hybrid that showed up well

in 1935 trials was Marcross C13.2. The Golden Early Market inbred used in this hybrid (C13) is very resistant to bacterial wilt and consequently the hybrid can be expected to show the same characteristic. In making hybrids Whipcross C6.2 and C7.2, the inbreds can be planted at the same time provided C2 is used as the pollen parent. For the hybrids Spancross C2 and Marcross C13.2, Connecticut 2 must be planted 10 days to 2 weeks earlier than the seed parents.

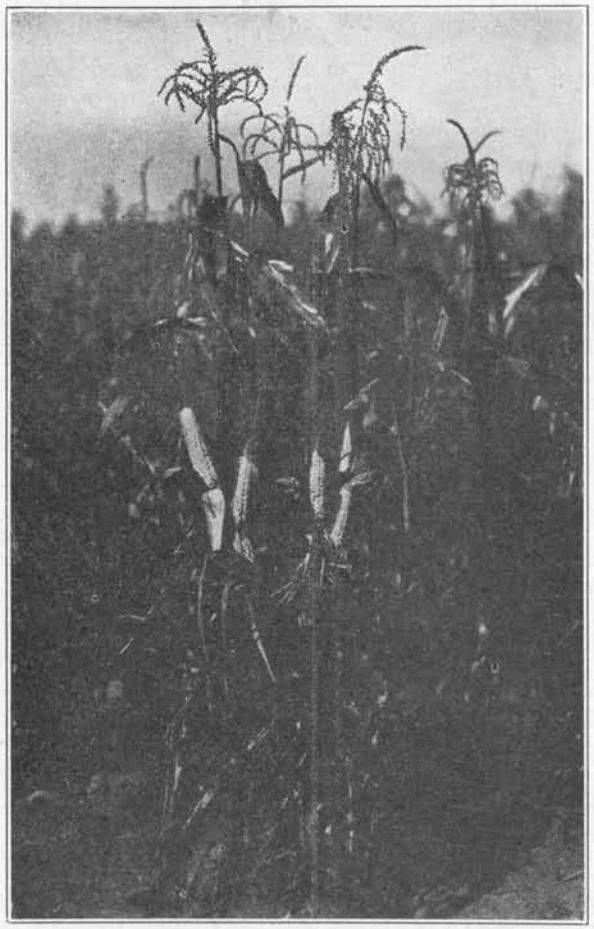

FIGURE 21. Connecticut 78, red-leaved parent of Redgreen, first crossed sweet corn to be grown commercially.

Connecticut 6, the seed parent of Whipcross C6.2, is a little earlier than C2, is light green in color and bears its tassel erect on a rather elongated stalk. The ears are set low on the stalk, not over a foot from the ground. C6 is resistant to bacterial wilt and to rust. The ears are well formed and many of them have a slight beak, or remnant of a tassel, on the tip. This character does not usually appear in the F_1 hybrid unless

the other parent has the same characteristic. The kernels are rather broad. C6 is used as the seed parent of Whipcross C6.2 and as the pollen parent of Marcross C6, and Marcross C13.6. For the last two hybrids C6 should be planted 10 days earlier than the Golden Early Market variety or inbred, if it is to be used as the pollen parent. For use as the seed parent, C6 should be planted two weeks earlier than C13 or Golden Early Market.

Connecticut 7, another Whipple inbred, is the seed parent of Whipcross C7.2. Both inbreds can be planted at the same time in the production of this hybrid. C7 makes a rather slender ear and has a narrow kernel. Consequently, Whipcross C7.2 has a narrow, deep kernel like its parents. C7 is only partially resistant to bacterial wilt. Therefore Whipcross C7.2 is not recommended in regions where wilt is prevalent.

Connecticut 13, a Golden Early Market inbred, makes a short stocky plant resembling the parent, but reduced in size. The ears are very similar to Golden Early Market. Unlike the variety, however, the inbred C13 is highly resistant to bacterial wilt, the most resistant inbred we have tested at this Station. C13 is used as the seed or pollen parent of Marcross C13.6, and as the seed parent of Marcross C13.2. It must be planted 10 days to 2 weeks later than the Whipple inbreds.

Connecticut 77 is a Stowells Evergreen inbred, the pollen parent of Redgreen. The plant is wholly green in all parts with no traces of sun red in the anthers and glumes in the tassel. The ear is similar to Stowells Evergreen in type, but much smaller. C77 and C78 can be planted at the same time when making crossed seed of Redgreen. C77 is pearly white and imparts this character to the F_1 hybrid.

Connecticut 78 is a red-leaved plant having an ear very similar to Crosby. It is rather late in maturing. The kernels are very translucent, are tightly placed on the ear, and have a tender pericarp which sometimes cracks open upon drying. This inbred is of the composition ABp1 and is consequently sun red, a character which gives the F_1 hybrid, Redgreen, a characteristic reddish appearance. C78 is used as the seed parent of Redgreen and as the pollen parent of Pearlcross, a somewhat earlier white hybrid of high quality. This hybrid also has sun-red leaves and stalks (Figure 21).

Three multiple varieties are being maintained in sweet corn: M. Whipple, M. Golden Early Market, and M. Spanish Gold. The inbreds that were used in making these multiple varieties are all resistant to bacterial wilt. Hence, the varieties are resistant. Seed of each of these is available at fifty cents ($.50) a pound.

We are maintaining stocks of both Purdue 39 and Purdue 51 since these inbreds are used to such an extent in this territory for making hybrid sweet corn, especially Golden Cross Bantam. At present our stocks of seed are several generations removed from hand-pollinated seed. They were grown in well isolated plots last year and off type plants were carefully rogued. Consequently the inbred seed available is quite true to type and is recommended for production fields. If anyone desires to increase either of these inbreds, we would suggest they get a small quantity of seed direct from Dr. Glenn Smith at Purdue University, Lafayette, Indiana. Our seed is recommended for production fields only. The price is fifty cents ($.50) a pound. In future years we shall have seed of these two inbreds, one and two generations removed from hand-pollinated seed, the same as our own inbreds.

Multiple varieties of three different field corn stocks are being maintained. These are Multiple Burwell and Multiple Leaming, the two parents of Canada-Leaming; and Multiple Burr White, the seed parent of Burr-Leaming. Multiple Leaming is used as the parent of Burr-Leaming. Each of these three Multiple varieties is for sale at ten cents (.10) a pound.

The following table gives the seed for sale in 1936.

TABLE 2. SEED FOR SALE BY THE CONNECTICUT EXPERIMENT STATION, 1936.

Inbred or Variety	Type and Season	Generations removed from hand-pollinated seed	Wilt-resistance: Resistant Intermediate Susceptible	Germination February or March, 1936	Price per pound	Year grown
Conn 2	Whipple	1	intermediate	94.5	1.00	35
(large eared strain)	Whipple	2	intermediate	95.5	.75	35
Conn 2 bulk	Whipple	3	intermediate	97.5	.50	35
Conn 6	Whipple	1	resistant	97.5	1.00	35
Conn 6	Whipple	2	resistant	90.5	.75	35
Conn 7	Whipple	2	intermediate	64	.75	32
Conn 7	Whipple	3	intermediate	85	.50	33
Conn 13	G. E. Market	3	very resistant	89.5	.50	35
Conn 78	Red leaves	2	late, escapes wilt	99	.75	34
Conn 77	Evergreen	3	late, escapes wilt	95	.50	35
P 39	Purdue Bantam	3+	resistant	100	.50	35
P 51	Golden Bantam	3+	intermediate	95.0	.50	35
M. Spanish Gold	Spanish Gold	1	resistant	98.0	.50	35
M. G.E. Market	G. E. Market	1	resistant	97.5	.50	35
M. Whipple	Whipple	1	resistant	99.5	.50	35
	FIELD CORN					
M. Leaming	Leaming	3+	resistant	91.	.10	34
M. Burr White	Burr	3+	resistant	98.	.10	33
M. Canada Flint	Canada Flint	3+	intermediate	99.5	.10	35

Earliness of Connecticut Inbreds

In any crossing program, where inbreds of different seasons are being grown in crossing plots, it is essential to know just when each inbred matures. Thus planting may be timed to insure pollen of the pollen parent when silks appear on the seed parent. The ideal condition is to plant both inbreds at the same time but this is possible only if both take approximately the same number of days to develop.

In order to determine the relative maturity of Connecticut inbreds, each of the different kinds was planted at ten-day intervals from May 21 to July 1. These dates are the outside limits for planting production fields in this region. The inbreds and varieties used in the experiment were: Spanish Gold, C13, C6, C2, Whipple and Purdue 39. A Manila

string tag was tied to the tassel of each plant the day upon which the tassel began shedding pollen. This date was written on the top half of the tag. When the silks appeared, the date of emergence was written down below the date of tassel. After all the tassels and silks had emerged, the tags were collected and the data tabulated.

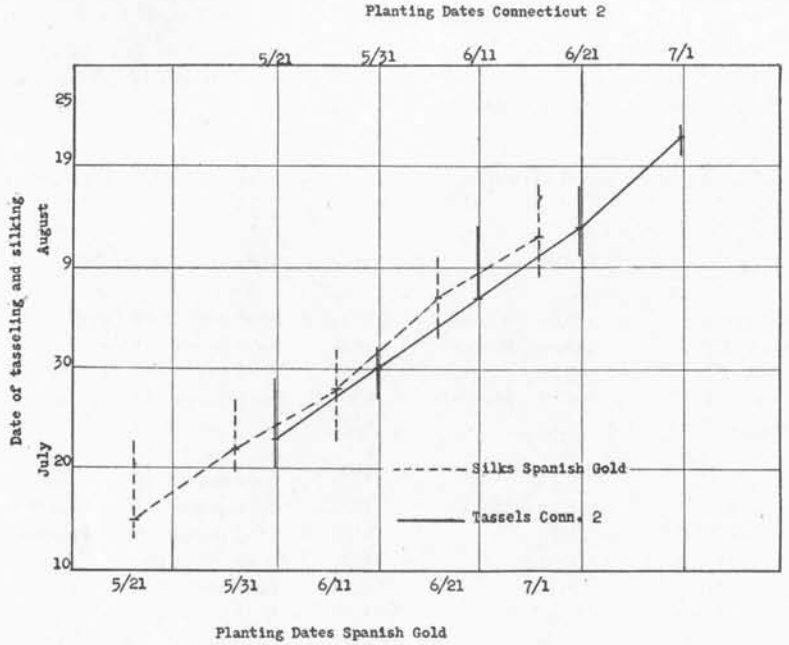

FIGURE 22. This graph shows the silking dates of Spanish Gold and date of tasseling of C2 when planted at 10-day intervals from May 21 to July 1. The solid vertical bars represent the range of appearance of tassels for each planting date of C2. The small horizontal mark across this bar represents the mean date, the day when half of the tassels of C2 were shedding pollen. These dates were joined by a black solid line to represent the mean tassel line of C2 when planted at 10-day intervals. Correspondingly, the broken lines represent the silking dates of Spanish Gold. The tassel line of C2 and the silk line of Spanish Gold have been made practically to coincide by moving the Spanish Gold graph 14 days to the left, indicating that Spanish Gold must be planted 14 days later than C2.

The tags were first cut in two so that the top halves represented the tassel dates and the bottom halves the dates of silking. These cards were then assorted into their respective dates and a graph was made showing the range of tasseling and silking for any given planting date. The mean date also indicated on this graph, was assumed to be the day when half of the plants in a row had either tasseled or silked. The mean dates were then connected with a line which represents roughly the tassel or silk line for any variety or inbred. A solid line was used for the tassels and a dotted line for silks. All were plotted on the same scale of graph paper. Consequently we were able to superimpose one graph upon another, place them against a window or other strong light, and see at a glance whether the tassel and silk lines of the two inbreds coincide. If all the silks of Spanish Gold, for example, are out before there is any pollen

shed on C2 when planted on the same day, we know that we must shift one graph to the right or left until we get the tassel line of Connecticut 2 *below* the silk line of Spanish Gold. When this is accomplished the planting dates of both Connecticut 2 and Spanish Gold can be read using now the dates that coincide (one will be directly over the other, (see Figure 22). Spanish Gold should be planted two weeks later than Connecticut 2.

The following table gives the hybrids recommended for production in 1936 and the relative planting dates of the two parents of each cross in order to secure perfect pollination.

TABLE 3. RECOMMENDED HYBRIDS FOR 1936. RELATIVE PLANTING DATE OF THE TWO PARENTS

Hybrid	Seed Parent	Pollen Parent	Relative Planting Date
Spancross C2	Spanish Gold	C2	Seed parent 14 days late
Spancross P39	Spanish Gold	P39	Seed parent 21 days late
Spancross P39	P39	Spanish Gold	Seed parent 21 days early
Marcross C6	G. E. Market	C6	Seed parent 10 days late
Marcross C13.6	C13	C6	Seed parent 10 days late
Marcross C13.6	C6	C13	Seed parent 14 days early
Marcross C13.2	C13	C2	Seed parent 14 days late
Marcross P39	G. E. Market	P39	Seed parent 14-18 days late
Marcross C13.P39	P39	C13	Seed parent 16-20 days early
Whipcross C6.2	C6	C2	Both same time
Whipcross C7.2	C7	C2	Both same time
Whipcross P39.C2	P39	C2	Both same time
Whipcross P39	Whipple	P39	Seed parent 7 days late
Golden Cross Bantam	P39	P51	Both same time
Redgreen	C78	C77	Both same time