SWEET DENT SILAGE

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Cover: Miss Nancy Rhynedance standing beside a row of sweet dent silage growing at Mt. Carmel, Conn.

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THIS circular describes a new type of corn, sweet dent silage, which was developed at this Station. It is becoming increasingly popular among dairy farmers in Connecticut. Sweet dent hybrids are three-way crosses made by combining a sweet corn inbred, C95, with various field corn hybrids. In yield trials at Mt. Carmel in 1946 and 1947 several of the sweet dent hybrids produced more tons of dry matter than the dent hybrid U. S. 13, which is a standard silage hybrid for this section. These trials corroborate the findings of various farmers that the sweet dent hybrids are more productive than the field corn hybrids commonly grown in this area. The large yields result from an unusually vigorous plant growth and a very large ear. The green unhusked ears commonly weigh more than two pounds each and often measure more than a foot in length. Some farmers report their dairy cows prefer the sweet dent silage to straight field corn silage. Chemical analyses show it to be higher in feeding value than regular silage (Table 4).

Development of Sweet Dent Silage

In our sweet corn breeding program some very late inbreds have been developed for the production of late sweet corn hybrids. One of these inbreds, C95, is unusual in several characteristics. Although a sweet corn inbred, it makes a single stalk with very few, if any, tillers and has the appearance of a good field corn inbred. It grows to a height of eight feet or more, which is unusual for an inbred. In season it matures at the same time as such standard field corn inbreds as Ill. Hy, Iowa L317 and Ind. 38-11. It is tall enough to pollinate fully such field corn hybrids as Hy x L317 and even L317 x 38-11, which is one of the tallest field corn hybrids grown. The vigorous growth of sweet corn hybrids having C95 as one parent led us to try crosses between C95 and different dent corn inbreds and hybrids. The first sweet dent silage combinations were made in 1941 when pollen of C95 was put on the inbreds 38-11, Kr, Lk, Hy and the single crosses Hy x Lk and 38-11 x Lk. From approximately 60 pollinations 10 pounds of seed were secured. This seed was more than required for our trials so some was available for testing by dairy farmers. Mr. Warren Brockett of the New Haven County Farm Bureau distributed these samples and assisted in gathering the data from the farmers. No yield records were kept for these trials, but the farmers who tried the first experimental sweet dent hybrids were so enthusiastic that more of this type of silage was produced in 1943 for trial in 1944. In 1945 the first commercial crossing plot was grown by C. F. Baldwin, Woodbridge.

A number of different field corn hybrids have been used successfully as the seed parent of the sweet dent hybrids. The first two used were Hy x Lk and 38-11 x Lk. Others that have given good results are Lk x 07, 38-11 x L317, Hy x Oh 40B, L317 x Oh 40B, C103 x Oh 40B and C102 x C103.

It is not certain yet which field corn hybrid will produce, when crossed by C95, the highest yielding sweet dent silage. Any one of the above listed hybrids works well as the seed parent, and C95 is tall enough and sheds sufficient pollen to pollinate any of them successfully, planting one pollen row to four seed rows. Likewise, the above hybrids, when combined with C95, produce sweet dent hybrids that yield as well as, or better than, U. S. 13.

The Sweet Part of the Sweet Dent

C95 is used as the pollen parent of all of the sweet dent hybrids so far developed. It was secured from a yellow type of the Long Island Beauty variety. To introduce the yellow factor into Long Island Beauty it was crossed by a first generation yellow hybrid, P39 x C81. The C81 was secured by converting C75 to a yellow type. After crossing the Long Island Beauty by yellow, it was backcrossed once to Long Island Beauty before inbreeding. The Long Island Beauty was used because it is one of the biggest and latest sweet corn varieties grown and has unusually good quality for such a large ear. A stalk of C95 is shown in Figure 1.

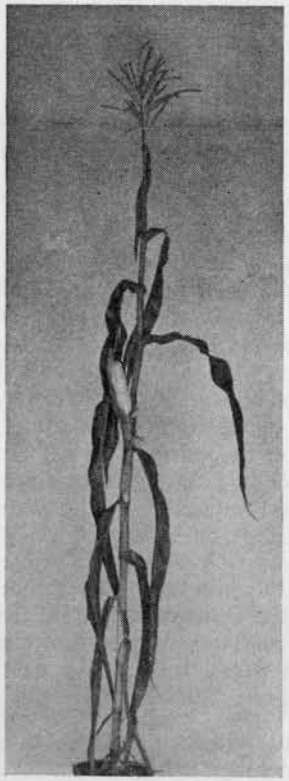

Figure 1. The C95 pollen parent of all sweet dent hybrids. This plant is 8 feet tall, an average height for C95.

The origin of the Long Island Beauty variety is uncertain. It is thought to have been derived from a hybrid between two of the oldest sweet corn varieties, Late Mammoth and Stowells Evergreen. Both of these varieties have been listed in seed catalogs for almost 100 years. Long Island Beauty strongly resembles Late Mammoth and we suspect these names have at times been used interchangeably for the same variety of corn. The stock we used more nearly corresponds to descriptions of Late Mammoth, although we secured it as Long Island Beauty. It is slightly later than Stowells Evergreen but quite distinct from it. Stowells Evergreen has a rather deep kernel and a small cob. When pollinated by a starchy corn, the kernels are dented and it is known as a latent dent corn. On the other hand Long Island Beauty and Late Mammoth are latent flint corn types. When pollinated by a starchy corn, the kernels are invariably flinty. Also these varieties have a large cob with a rather shallow kernel. The origin of these latent flint types is uncertain. They may have come from some of the tropical many-rowed flint varieties. Whatever the origin, they have been separate and distinct from any dent corn influence for a long time and give a large hybrid vigor response when crossed by dent corn varieties. These sweet-dent hybrids are in a sense flint-dent hybrids and give a growth response characteristic of some such hybrids.[1]

Yielding Ability of Sweet Dent Hybrids

One of the first requirements of a silage corn is that it produce a good quantity of silage. Since corn varieties vary so much in maturity and moisture content, it is customary to calculate yield on a dry matter basis. The variety that produces the most dry matter to the acre is the most valuable, other things being equal, since it has been shown that in feeding value a pound of dry matter of any silage type is equivalent to a pound of dry matter of any other silage type regardless of the moisture content, or maturity, or of the amount of grain in the silage (White and Johnson, 1929).

Yield trials were conducted in 1946 and 1947. In each year 24 different sweet dent hybrids were grown in comparison with U. S. 13, the standard field corn silage type in southern Connecticut. These were planted in a 5 x 5 lattice square design with three replications of each variety. Data from these trials are found in Tables 1 and 2.

Also in 1947 an observation trial was conducted at Ellington by the Eastern States Farmers' Exchange. We are grateful to them for the data secured from this trial. Two fields of corn were grown, U. S. 13 and the sweet dent silage type Oh40B. C103 x C95. Within each field four different plots were selected more or less at random for determining yield. Each plot consisted of a row 50 feet long. The plants within this row were counted, weighed and one sample of each was dried and yields were calculated in tons of dry matter to the acre. These data are found in Table 3.

[1] Conn. Agr. Expt. Sta. Bul. 310, "Canada-Leaming Corn".

TABLE 1. SWEET DENT ENSILAGE TEST, MT. CARMEL, 1946

Planted May 6, 1946—Harvested October 7-8, 1946

Pedigree	Days to ½ silks	Dry matter tons per acre	Grain bu. per acre	Field notes
C102 x 95	91	5.35	95	Erect, broad leaf, unif. 8/8
C104 x 95	93	5.17	86	Stalks down at harvest
Hy.Lk x 95	93	4.99	65	Some stalks down at harvest
38.L317 x 95	92	4.96	80	Tall, erect, high ears 10/8
C103 x 95	90	4.87	90	Tall, erect, 10/8, best stalk
I159 x 95	91	4.81	90	Fairly erect, tall, 10/8
K4 x 95	99	4.75	51	Badly lodged 8/8, down 10/8
L317 x 95	95	4.72	81	Dark green, tall, erect 8/8
Hy.40 x 95	88	4.67	72	Some lodged 8/8
L317.40 x 95	91	4.62	77	Few lodged 8/8, f. erect 10/8
CC35 x 95	87	4.54	81	Lodged 8/8, f. erect 10/8
Hy x 95	90	4.52	81	Some lodged 8/8, f. erect 10/8
U.S. 13	92	4.48	80	Few lodged 8/8, erect 10/8
Lk.07 x 95	94	4.44	67	Badly lodged 8/8
Ill. A x 95	92	4.42	76	Lodged 8/8, f. erect 10/8
Kr x 95	91	4.35	72	Lodged 8/8, also 10/8
40B x 95	88	4.32	80	Some lodged 8/8, also 10/8
Wf9 x 95	90	4.25	74	Some lodged 8/8, f. erect 10/8
CC26 x 95	92	4.23	69	Lodged 8/8, also 9/27
P8 x 95	93	4.21	46	Some lodged 8/8, erect 10/7
New R4 x 95	91	4.16	75	Lodged 8/8, f. erect 10/7
38-11 x 95	97	3.75	56	Slow starting, some lodged 8/8
Sweet Kr x 95	90	3.59	61	Lodged 8/8, down 10/8
4-8 x 95	89	3.54	56	Some lodged 8/8
4-8 x 95 2nd. plt.	98	2.50	18	All lodged 8/8
j.s.d. at .05 P		.77 tons	22 bu.	

TABLE 2. SWEET DENT ENSILAGE TEST, MT. CARMEL, 1947

Planted: June 12—Harvested: October 8-10

Pedigree	Days to ½ silks	Dry matter tons per acre	Grain bu. per acre
07 x C95	71	4.61	61
B164 x C95	67	4.58	65
Hy dwarf x C95	68	4.51	67
C102 x C95	65	4.48	76
Hy x C95	71	4.43	54
C103.40B x C95	69	4.35	54
K4 x C95	76	4.34	38
I159 x C95	68	4.23	69
Tl-1-2-2 x C95	70	4.11	57
R4.38-11 x C95	68	4.11	63
K155 x C95	74	4.10	38
Hy.40B x C95	68	4.08	53
C17 x C95	76	4.07	23
Lk.07 x C95	70	4.02	56
L317 x C95	76	4.01	35
Kr x C95	69	3.96	65
L317.40B x C95	72	3.71	44
W24 x C95	67	3.68	58
U.S. 13	70	3.66	52
40B x C95	67	3.09	40
j.s.d.—at .05 P		.90	

Note: Lowest five experimental hybrids not listed but were used in making calculations.

TABLE 3. SWEET DENT ENSILAGE TEST, ELLINGTON, 1947

Plots	No. plants	Pounds per 50 foot row	Tons per acre	Per cent dry matter	Tons dry matter
U.S. 13					
1	52	205.5	29.8	19.2	5.72
2	64	187.0	27.1	——	5.20
3	54	202.0	29.3	——	5.63
4	45	145.0	21.0	——	4.03
Average			26.8	——	5.15
Sweet Dent 40B.C103 x C95					
1	63	222.0	32.2	17.8	5.73
2	68	216.0	31.3	——	5.57
3	63	218.0	31.6	——	5.62
4	58	231.0	33.5	——	5.96
Average			32.2	——	5.73

There was some question as to whether part of the increased yield of the sweet dent hybrid may have been due to an increased number of plants per row. However, in all of the plots except one there were more than 50 plants per 50 feet or spacings less than a foot apart. Ordinarily it is not recommended that such late varieties as these be grown at spacings less than a foot apart for silage. To determine the effect of stand and yield, the yields were plotted against the number of plants per 50 foot row (Figure 2). Although it is not wise to draw sweeping conclusions from one year's

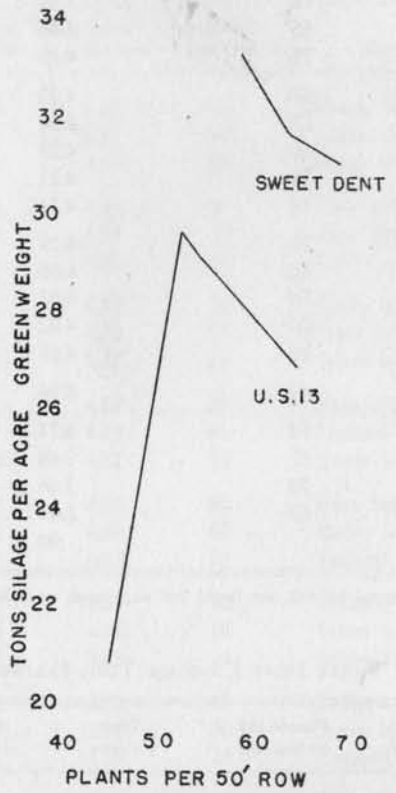

Figure 2. Yield in tons per acre, green weight, plotted against number of plants in a 50 foot row, for U. S. 13 and sweet dent hybrid C103.0h 40B x C95. Data from trials at Ellington.

trials, this graph would indicate that all of the sweet dent rows were spaced too close together. The same might be true for U. S. 13 were it not for the drop in yield at the 45 plant spacing. From these meager data it is not possible to tell if this drop is significant. More spacing trials should be run to determine the optimum spacing for maximum yields of silage of these hybrids, as well as others commonly grown for this purpose.

Standing Ability of Sweet Dent Hybrids

A good silage hybrid must be able not only to produce a good yield but it must also have a good enough root and stalk to enable it to withstand

Figure 3. Standing ability of C95 (row at extreme left) and C103 x 0h 40B, third from left as compared to ordinary corn, an Evergreen hybrid, second row from left. Picture made in February, 1947.

summer storms and remain erect at harvest time so that it may be harvested by machinery (Figure 3). One of the good qualities of U. S. 13 is its ability to remain erect until harvested. Some of the sweet dent hybrids are not as good in this respect while others are superior. The 1946 trials were subjected to several summer storms and valuable information on standing ability was obtained. The best hybrid in these trials was C103 x C95 which was completely erect at harvest in early October. Figure 4 shows a comparison between this hybrid and U. S. 13 which remained fairly erect throughout the season. The C103 x 95 produced .39 tons more dry matter than U. S. 13, not enough to be significant statistically but showing a trend

Figure 4. C103 x 95 left, U. S. 13 on right. C103 x 95 not only more uniform but was more erect at harvest time, October, 1946.

in the right direction. Another hybrid in these trials that stood as well as U. S. 13 was C102 x C95. This hybrid was the most productive in the trials with 5.35 tons of dry matter per acre, .87 tons more than U. S. 13, a difference that is significant statistically. From this trial it would seem that the hybrid C102.103 x C95 would yield appreciably more than U. S. 13 and stand equally well or better. This hybrid was produced the first time in 1947 for trial in 1948. It will be the principal sweet dent hybrid to be produced in 1948.

Chemical Analysis of Sweet Dent Silage

As stated earlier in this circular, chemical analyses have shown the sweet dent silage to be superior to ordinary silage. These tests were made in 1946 from samples taken January 14, 1946, at the Westbrook Laboratory (Ellington) of the Eastern States Farmers' Exchange, West Springfield, Mass. We are grateful for these analyses which were made by chemists of the above named cooperative. Results of these analyses are shown in Table 4. These analyses need to be repeated on samples grown another year. The sweet dent silage was lower in moisture content with a consequent higher dry matter which is shown as an increase in protein, fat and carbohydrate. The higher percentage of ash resulted in relatively higher percentages of phosphorus, potassium and chlorides. Whether these differences are significant is not possible to state but there is an indication, at least, that the sweet dent silage is at least the equal of U. S. 13 in feeding value, possibly superior.

TABLE 4. CHEMICAL ANALYSIS OF SWEET DENT SILAGE COMPARED WITH REGULAR DENT SILAGE (U.S. 13).

Samples from Westbrook Laboratory, January 14, 1946.

Sample	Moisture	Ash	Protein	Fat	Fiber	Carbohydrates
U.S. 13	85.40	0.80	1.20	0.70	5.50	11.90
Sweet dent	80.00	1.50	2.15	0.90	6.80	15.45

Sample	Chlorides as salts	Magnesium as MgO	Calcium as CaO	Phosphorus as P_2O_5	Potassium as K_2O
U.S. 13	0.05	0.07	0.11	0.11	0.19
Sweet dent	0.20	0.05	0.11	0.27	0.57

Sample	Carotene	Boron	Manganese	Cobalt	Copper	Iron
U.S. 13	12,200[1]	3	5	0.06	0.5	78[2]
Sweet dent	11,400[1]	4	5.4	0.04	0.5	101[2]

[1]—units per pound.
[2]—parts per million.
others—percentage.

Sweet Dent Silage not a Grain Corn

The ears of the sweet dent hybrids should *never* be saved for grain. One reason is that they have about 25 per cent of sweet kernels which are not good for poultry feeding and not as valuable as starchy corn for all purposes desired of a grain corn. Because of the large attractive ears (Figure 5) it is a temptation to save some of the ears for grain. However, the cob is rather large and the ears dry slowly. Unless dried quickly considerable molds would develop, especially in the sweet kernels. So it seems advisable *never* to save the sweet dent ears for grain. The corn is purely a silage type. Work is in progress to convert C95 to a starchy corn. It was crossed by two different flint types, one secured from H. C. Kantz, East Stroudsburg, Pa., and another from Dr. L. C. Curtis who secured it in North Africa. The reason flint corn varieties were used as the source of the starchy gene was that it is desired to keep the starchy C95 a true flint type. When this breeding program is complete, we will have a field corn hybrid similar in every way to the sweet dent variety but one that is all starchy. Such a hybrid might be used as a grain corn as well as a silage type.

Sweet Dent Hybrids for the Future

Improvements in sweet dent hybrids will come by producing types with even better stalks than any available today. Probably more improvement will come in this respect rather than in increased yields. At present the C103 inbred, known as the low breakage line, is able to withstand corn borers and summer storms better than any other inbred. If this low breakage and lodging resistance of C103 can be incorporated into the other inbred used in making the dent single cross, and also into the C95 inbred, then a hybrid better in standing ability should be available. Other dent lines will be tested to see if it is possible to secure another low breakage line that is as good as C103 or perhaps even better.

Figure 5. Left to right, C95, sweet dent hybrid L317.0h 40B x C95 and L317 x 0h 40B. Note large size of sweet dent ears, a factor in producing such large yields. Also note sweet kernels segregating on sweet dent ears.

Another improvement that might be made in the sweet dent hybrids is to make a hybrid with a high sugar content in the stalk juices. It has been found recently (Singleton, 1948) that the C103 inbred has sucrose in the juice in an amount approaching that of sugar cane. This high sucrose percentage was present after the mature ears had been harvested. It should be possible to produce other inbreds having a genetic constitution similar to C103 in sucrose content of the stalk juice. When such inbreds are available, it will be possible to produce a silage type with appreciably more sugar present than anything now available. What effect this will have on the nutritive value of the silage is, of course, a problem for future research.

Seed Production of Sweet Dent Silage

In producing seed the dent corn single cross hybrid is always used as the seed parent. The C95 could not possibly be used as a seed parent because it sets very little seed unless the husks are cut off to a shorter length (Singleton, 1946). Since first generation dent hybrids are used as the seed parents a good yield of seed is obtained. The usual rate of planting is four seed rows to one pollen row. At this rate of planting ample pollen is available. The C95 produces a big tassel that sheds pollen abundantly. It is sometimes difficult to get a good stand of C95 since it is hard to dry this inbred properly to give a good quality seed. Hence, it is advisable to plant the C95 at a thicker rate than normal, even if some thinning is necessary. A poor stand of C95 will result in improper pollination. On ears poorly pollinated there will be a high proportion of round kernels. These grow just as well as the flat kernels but are more difficult to plant in most corn planters. C95 and the seed rows can be planted at the same time.

The seed rows make a rather tall growth in most cases and detasseling is somewhat difficult. No detasseling machines are used in Connecticut. One grower has solved the problem by putting his detasseling crew on horses. They are then tall enough to pull the tassels without difficulty. In some cases the detasseling has been done with a corn knife by cutting the plant just as high as it is possible to reach. This may reduce the yields slightly but the detasseling can be more easily accomplished by this method. It might be advisable to put extra length handles on the corn knives used for detasseling.

Seed Stocks Available in 1948

There is a fair supply of C95 available for use as the pollen parent. Seed may be purchased from this Experiment Station. The price is $1.00 a pound. In regard to seed parent stocks for 1948 very little is available. An abundant supply of Oh 40B x C103 was produced in 1947. Unfortunately a hard freeze hit this corn in late September and the germination is only 40 per cent, too low to be used for field planting. However, single crosses used in commercial dent corn hybrids are available from various sources, names of which will be sent upon request. Any one of several

hybrids involving the inbreds Hy, 38-11, L317 and Oh 40B should make a good seed parent. Plans are underway to produce a good supply of seed of C103 x C102 for use as a seed parent in 1949.

In regard to commercial seed of the sweet dent hybrids, they were produced in good supply in 1947. Names of seedsmen selling these hybrids will be sent upon request. The Connecticut Experiment Station has no sweet dent silage seed for sale.

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