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PERCENTAGE STAND AND SUGARS IN FOUR FLORIDA SWEET CORNS[1]

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Abstract. **The sweet corns 'Iobelle', 'Florida Sweet', and 'F-449' were compared to an experimental hybrid which contains the gene** brittle-A (bt-A). **Germination rates, total emergence, and total sugars at several stages of ear development were measured. Approximately 90% of the genetic material of the** bt-A **hybrid came from the parents of 'Florida Sweet'. Seven days after planting, the % stands of 'Florida Sweet', Iobelle', 'F-449', and the** bt-A **hybrid were 34%, 77%, 55%, and 84%, respectively. After 9 days the comparable values were 38%, 82%, 66%, and 92%. At 18 to 22 days post-pollination, sugar levels of the** bt-A **hybrid were double those of 'Iobelle' and were 86% of those found in 'Florida Sweet' and 'F-449'.**

In recent years, emphasis has been placed on the development of sweet corn cultivars (*Zea mays* L.) with increased sugar levels in the marketed ear. In Florida, the sweet corn 'Florida Sweet' which carries the gene *shrunken-2* (*sh2*) has recently been developed (7). This sweet corn contains 2 to 3 times as much sugar as normal sweet corns and taste panel data show that most consumers prefer sweeter corn (6). Although 'Florida Sweet' has the advantages of extremely elevated sugar levels in the edible portion, poor germination and seedling vigor have curtailed its wide-spread use.

In an attempt to overcome the problems associated with *sh2* sweet corns, a program was initiated to examine other starch-defective genes in terms of effects on carbohydrate composition of the developing ear, and on seed and seedling vigor. Recently, the gene *brittle-A* (3) was compared to the gene *sugary* (*su*), the latter being the starch-defective gene found in most sweet corns. It was shown that the *bt* seed germinated as well as *su* seed, yet *bt* contained twice the sugar found in *su* ears.

The genes *su*, *bt-A* and *sh2* were obtained in very similar genetic backgrounds and their relative effects on sugar in the edible ear and on seed and seedling vigor were noted. A recently developed *sh2* line, 'F-449' also was evaluated and compared to the other 3 sweet corns.

Materials and Methods

'Florida Sweet', 'Iobelle', and 'F-449' seeds were obtained through the Florida Seed Foundation. The experimental *brittle-A* (*bt*) hybrid was developed by the following procedure. 'Florida 32' and 'Florida 56', the parents of 'Florida Sweet' (8), were each crossed to a *bt* stock. The hybrid involving 'Florida 56' was then backcrossed 3 times to 'Florida 56'; the resulting progeny was inbred 2 generations and material homozygous for *bt* was selected. The same protocol was used to develop the *bt* counterpart of 'Florida 32' except that 2 backcrosses were performed. Hybrid *bt* seed was produced from these converted lines.

Seedling vigor measurements were obtained by placement of 25 seeds in moist seed germination paper at 25°C. After 7 days, radicle length, fresh and dry weight, and number of total seedlings and normal seedlings were determined. These parameters were also measured on material initially exposed to 10°C for 10 days followed by 7 days at 25°C. Data are averages of 4 replications.

Field planting was done in June 1977 in a fine sandy soil. Fifteen seeds were planted in rows 15 ft long, spaced 4 ft apart. Twelve replications of each line were evaluated. Recommended cultural practices (4) were used. Individual plots were counted daily to determine % emergence and the Emergence Rate Index (ERI) was calculated according to Shmueli and Goldberg (5).

Total sugars were measured basically by the methods of Gonzales et al. (1) from kernels harvested at various developmental stages (2). Data for each genotype and each developmental stage were based on 3 replications and are expressed as % fresh wt.

Results

Under laboratory conditions, the *bt* hybrid produced the most vigorous seedlings followed by 'Iobelle', 'F-449', and 'Florida Sweet' in that order (Table 1). The *bt* seedlings were significantly greater than those of 'Iobelle' in % normal seedlings and fresh wt when germinated at 25°C or 10°C. No significant differences between *bt* and 'Iobelle' were found in % total germination, radicle length or dry wt. 'Iobelle' was more vigorous than 'F-449' in seedling fresh and dry wt when germination occurred at either temperature and radicle length when seeds were germinated at 10°C. However, 'F-449' produced more normal seedlings at 10°C. Seedlings of 'F-449' were significantly greater than those of 'Florida Sweet' in every measurement of vigor except % dry wt.

In the field, total number of seedlings produced was highest at 8 to 9 days after planting and decreased thereafter because of seedling death (Fig. 1). Seven days after planting, the % stands of 'Florida Sweet', 'Iobelle', 'F-449', and the *bt* hybrid were 34%, 77%, 55%, and 84%, respectively. Twenty-one days after planting, the highest % stand was observed in *bt* (83%) and 'Iobelle' (77%) (Table 2). 'F-449' produced a 60% stand; a value significantly higher than that of 'Florida Sweet' (34%) yet much lower than that observed for the other sweet corns. Emergence Rate Index

Table 1. Seedling vigor of the 4 sweet corns when germinated at 25°C or 10°C.

Corn	% germ	% Normal seedlings	Radicle length (cm)	Fresh wt. (gm)	Dry wt. (gm)
			25°C		
Iobelle	98a	87b	14.5a	0.86b	0.14a
F-449	97a	86b	13.6a	0.72c	0.09b
Fla. Sweet	80b	66c	10.6b	0.56d	0.07b
bt hybrid	100a	100a	13.4a	1.00a	0.19a
			10°C		
Iobelle	97a	84b	17.2a	0.88b	0.13a
F-449	98a	95a	15.0b	0.64c	0.09b
Fla. Sweet	46b	27c	13.4c	0.47d	0.07b
bt hybrid	100a	96a	16.8a	1.25a	0.16a

[z]Mean separation within columns by Duncan's multiple range test, 5% level.

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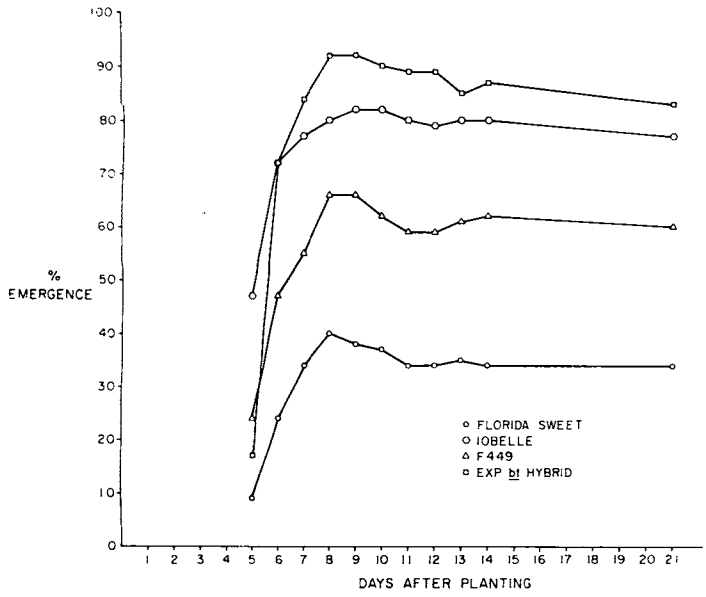

Fig. 1. Percentage emergence of Florida Sweet, Iobelle, F-449, and experimental *bt* hybrid at various days after planting.

Table 2. Final stand and emergence rate index of sweet corns grown in the field.

Corn	% stand	E.R.I.
Fla. Sweet	34c[z]	29c
Iobelle	77a	67a
F-449	60b	50b
bt hybrid	83a	68a

[z]Mean separation within columns by Duncan's multiple range test, 5% level.

(ERI), (Table 2), calculations showed that the rates of emergence of *bt* hybrid and 'Iobelle' were significantly faster than those of 'F-449' and 'Florida Sweet'. Seedlings of 'F-449' emerged more quickly than those of 'Florida Sweet'.

The *sh2* containing sweet corns 'Florida Sweet' and 'F-449' had the greatest amount of sugar in ears harvested at 18 to 28 days post-pollination (Table 3) although at 18 and 22 days, sugar content in *bt* kernels was not significantly different from that observed in the *sh2* sweet corns. During the 18 to 22 day period, the peak of sugar content in the *sh2* lines, sugar content in *bt* was 86% of that found in 'F-449' and 'Florida Sweet'. At the latter developmental stages (24 and 28 days post-pollination), sugar content of *bt* was significantly lower than that of the *sh2* lines although it was still approximately double that found in 'Iobelle'.

Discussion and Conclusion

Examination of the recently developed *sh2* line, 'F-449' showed that it is substantially more vigorous than the older *sh2* corn 'Florida Sweet'. Furthermore, the increase in vigor was not associated with decreased sugar content in the developing ear. Although vigor of 'F-449' is substantially greater than that of 'Florida Sweet', it is, however, not comparable to that of 'Iobelle' and the *bt* hybrid.

Critical comparison of all data gleaned from 'Florida Sweet', 'Iobelle', and the *bt* hybrid can be made since all are closely related and thus differences due to other gene loci have been minimized. In general, measurements of seed and seedling vigor place these into two classes. Seedlings of 'Iobelle' and the *bt* hybrid were most vigorous in all tests. In some instances, the *bt* seedlings appeared to be more vigorous than those of 'Iobelle'. On the other hand, 'Florida Sweet' seeds and seedlings were less vigorous in every comparison. As shown here and in a previous report (3), the *bt* gene conditions twice the sugar found in *su* ('Iobelle') kernels when harvested at normal market maturity. The level of sugar in *bt* kernels is 86% of that found in *sh2* ('Florida Sweet'). Thus, it would appear that *bt* could be used in the production of sweet corns for Florida, since its seedling vigor is equal to or greater than that of 'Iobelle' and the sugar content in the ear is almost equal (86%) to that of 'Florida Sweet'.

Table 3. Sugar content of sweet corns harvested at various days after pollination.

Corn	Age (Days) 18	20	22	24	28
Fla. Sweet	5.85a[z]	7.16a	5.73a	5.65a	3.83a
F-449	4.69a	6.74a	5.82a	6.64a	4.14a
bt hybrid	5.12a	4.69b	5.62a	3.46b	2.46b
Iobelle	2.54b	2.54c	2.08b	1.82c	1.35c

[z]Mean separation within columns by Duncan's multiple range test, 5% level.

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