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SWEET CORN POTENTIAL FOR CULTIVATION IN TRINIDAD AND TOBAGO

Richard A. I. Brathwaite

Department of Crop Science, Faculty of Agriculture,
University of the West Indies, St. Augustine, Trinidad.

ABSTRACT

Results of research work conducted in the Faculty of Agriculture on sweet corn *(Zea mays* L. var. *saccharata* Sturt) are discussed and the potential for the cultivation of the crop indicated. A new high yielding (over 35,000 marketable cobs per ha) synthetic cultivar, Local F7, developed at the University is identified.

RESUMEN

Los resultados del trabajo de investigación del choclo (*Zea mays* L. var. *saccharata* Sturt) llevados a cabo en la Facultad de Agricultura son discutidos y la posibilidad para su cultivo es indicada. Se identifica una variedad, sintética-criolla F7 de gran rendimiento (más de 35,000 mazorcas para mercadeo/ha), desarrollada en la Universidad de West Indies.

Keywords: Sweet Corn, Trinidad & Tobago

Field corn *(Zea mays)* is a popular crop in Trinidad & Tobago where it is grown by small farmers often in mixtures with pigeon pea *(Cajanus cajan)* especially during the wet season (June - December) It is generally harvested at the green immature stage (milk stage) and used in lieu of sweet corn *(Zea mays* var. *saccharata* Sturt.)

In Trinidad & Tobago sweet corn has not been grown commercially to any great extent; up to 1980 production had been confined mainly to semi-commercial activity at the now closed University of the West Indies Texaco Food Crops Farm (Cropper and Brathwaite, 1977; Brathwaite, 1979). There are a few reports on sweet corn production and processing investigations (Vlitos and Davies, 1964; Cropper, 1975, 1976; Cropper and Ferguson, 1977), and Cropper (1972) demonstrated the crop's potential for production and processing.

Consumption of imported frozen and canned sweet corn has been increasing, but there has always been much interest in sweet corn for local fresh marketing and processing. In 1979 work on sweet corn was initiated in the Cereals and Other Grains Research Programme of the Faculty of Agriculture. The major objective of the project was the identification of high quality sweet corn cultivars suitable for local cultivation and the determination of agronomic optima for their economic production by farmers in suitable cropping systems. This paper summarises the main findings of the investigations and introduces the locally developed sweet corn synthetic cultivar.

Cultivar evaluation

A number of cultivars were imported, mainly from the United States of America, for local evaluation. All of the cultivars were hybrids except the synthetics PR 50 and Sure Sweet from Puerto Rico. Few of the evaluation trials were carried out during the dry season because of the lack of adequate and reliable irrigation facilities. All trials were randomized and plots measured 3.0m x 2.25m. Seeds of each cultivar were hand planted at a depth of about 5cm in mounds 25cm apart along rows spaced at 75cm; at least two seeds were planted per mound. The plants were thinned to one plant per mound 1 week after germination. Table 1 presents three years' data on those cultivars which showed acceptable germination and produced cobs. The high yield potential of many of the cultivars is clearly indicated. Because of the paucity of seed, a few cultivars (Calico King, XPH 2553, Yukon, and the AVX and GH cultivars) were not evaluated every year during the period. Cultivars were normally ready for harvest 15 to 20 days after silking and cobs with silk turning dark brown were harvested 64 to 72 days after planting. Cultivars like PR 50, Tendertreat, Sugar Loaf, Florida Staysweet, CXP 514, AVX 2540, Mainliner, White Lightning Hawaiian Super Sweet, Sweet Tennessee, GH 3045, GH 3045, GH 2269, GH 2581, Golden Queen Banner, Resistall, XPH 2553, and Calico King consistently produced two marketable ears per plant.

Table 1. Performance of sweet corn cultivars on River Estate loam soil in Trinidad[a]

Cultivar	Marketable ear yield (1000's/ha)	Dehusked ear weight (g)	Dehusked ear length (cm)	Plant height (cm)
Local breeding line	54.2	157	18.1	150
Sure Sweet	55.8	125	15.9	160
PR 50	49.8	155	16.9	162
Tendertreat	67.5	171	23.3	138
Snow Queen	58.3	174	21.3	107
Sugar Loaf	43.0	150	17.4	98
Terrific	32.4	154	17.5	121
Reliance	50.0	111	14.2	77
Florida Staysweet	43.7	123	18.6	102
CXP 514	47.5	121	16.5	105
AVX 5641	48.4	129	17.9	105
AVX 2519	46.4	155	17.8	104
AVX 2562	40.5	154	18.2	118
AVX 2540	34.0	151	19.6	117
AVX 2539	54.0	165	18.4	111
Mainliner	43.3	195	22.3	88
Miracle	44.5	154	22.3	88
Monarch Advance	33.5	174	20.1	108
NK 199	38.9	164	17.4	116
Paramount	33.5	146	18.9	92
Yukon	37.2	154	19.6	90
White Lightning	34.7	134	16.5	112
Hawaiian Super Sweet	16.3	125	19.0	115
Mini-Max	22.8	106	17.4	77
Sweet Tennessee	51.7	146	28.6	114
Jubilee	69.3	136	18.3	104
GH 3045	41.0	130	16.4	91
GH 2269	75.1	128	16.8	122
GH 2581	33.4	140	17.7	93
GH 1901	99.7	63	12.9	67
Golden Queen	50.5	137	17.1	113
Banner	36.5	139	17.4	104
Resistall	48.6	123	16.8	112
Reward	88.9	57	13.1	54
XPH 2553	20.3	125	16.7	80
Calico King[b]	-	164	20.6	95
Atlantic	52.3	150	19.0	180

[a] Summary of results from rainfed field trials conducted over a 3-year period.
[b] Few marketable ears were produced

Consumer acceptability

Consumer acceptability tests have formed an important aspect of the research project. Many testers have reported favourably on most of the cultivars and stated that they would purchase them if they were on sale at reasonable prices. All testers showed preference for cultivars with yellow, cream, and white kernels, in descending order, but accepted white types when yellow or cream types were unavailable. Table 2 presents typical evaluation results on the local breeding line.

Table 2. Taste testing: results from 77 respondents evaluating the sweet corn local breeding line F_7 in Trinidad

Question	% of respondents replying
1) *Cooking preference*	
Boiled	100
Roasted	0
2) *Taste*	
Very sweet	18
Moderately sweet	78
Not sweet	3
3) *Hardness for chewing*	
Too hard	6
Too soft	6
Just right	88
4) *Size*	
Reasonable	83
Too small	17
5) *Other comments*	
Too glutinous	4
Immature	9
Need for more	8
Satisfactory	79

Plant nutrition

Sweet corn is a heavy feeder and responds to a high level of soil fertility. Results from trials indicate that although fertilizer rates will vary depending on a number of factors including soil type, plant density and rotations, a blanaced, well timed, fertilizer programme is essential for optimum yields. An adequate supply of plant nutrients should be available during the early growth stages of the plant and there should be enough to maintain steady rapid growth up to harvest. Acceptable yields of high quality marketable ears have been produced on River Estate loam soil at the University Field Station (where the majority of the studies were conducted) with a combined basal application of 60kg N ha^{-1}, 20 kg P_2O_5 ha^{-1}, and 50kg K_2O ha^{-1} followed by an application of 60kg N ha^{-1} four weeks later as a banded side dressing. Studies on other soil types suggest that an alternative general recommendation in the absence of soil test data is the basal application of at least 300kg ha^{-1} of a complete fertilizer, e.g. 20:10:10: or 15:7:7, followed by 60kg N ha^{-1} as a banded side dressing at four weeks. Studies are still in progress.

Plant density

Studies have shown that plant density and plant spacing have a significant affect on the uniformity of the crop, size of ears and ear yields, and quality of weed control. Generally, ear yields have been increased by planting more plants per unit area; the number and size of ears per plant decrease as plant density increases. Results show that the optimum plant desnity varied depending particularly on the cultivar, type and fertility and moisture status of the soil. Under conditions of limited moisture availability on Cunupia clay soil a density of 30,000 plants ha^{-1} was found to be optium in cultivars 'PR 50', 'CXP 514' and the local breeding line. A similar density was adequate on a Las Lomas clay loam of limited fertility status. In a trial in which densities above 50,000 plants ha^{-1} were evaluated, all densities gave good yields but consumers complained that ears were excessively small and variable. To date, the summary results suggest that, under normal conditions, a plant density range of 35,000 to 48,000 plants ha^{-1} is satisfactory for good yields of acceptable quality ears in the cultivars evaluated.

Weed control

In Trinidad & Tobago manual methods are still commonly employed for the control of weeds in corn. Many herbicides are registered for use in field corn in the United States of America but the inclusion of sweet corn in rotations with vegetables which are often susceptible to the common triazine herbicide residues, and the greater susceptibility of sweet corn cultivars to herbicide injury necessitates the local evaluation of these herbicides in the crop. Table 3 presents herbicide treatments which provided good weed control without significant crop injury and acceptable yields of marketable ears of sweet corn with little or no residue carryover on different soil types. Predominant weeds on many of the experimental sites included *Amaranthus* spp., *Brachiaria* spp., *Digitaria* spp., *Echinochloa colonum, Eleusine inidca, Euphorbia* spp., *Phyllanthus amarus,* and *Setaria* spp. Best results were often provided by pre-emergence combinations of atrazine (1.0kg a.i. ha^{-1}) + alachlor (2.0kg a.i. ha^{-1}) and alachlor (2.0kg a.i. ha^{-1}) + metribuzin (0.6kg a.i. ha^{-1}). *Rottboellia exaltata* has become a problem at specific locations and is now the subject of a special project.

Table 3. Recommended herbicide treatments (kg a.i./ha) for weed control in sweet corn[a].

Pre-plant incorporated treatments
Alachlor (1.5 - 2.0)
Atrazine (1.0 - 1.6) + alachlor(1.5 -2.0)
Atrazine (1.0 - 1.6) + butylate (3.0 - 4.5)
Cyanazine (1.0 - 1.6) + butylate (3.0 - 4.5)

Pre-emergence treatments
Alachlor (2.0)
Alachlor (2.0) + metribuzin (0.6)
Alachlor (1.0 -1.6)
Atrazine (1.0 -1.6) + alachlor (1.5 - 2.0)
Atrazine (1.0 - 1.5) + metolachlor (1.5 - 2.0)
Cyanazine (1.0 - 1.6) + alachlor (1.5 - 2.0)
Cyanazine (1.0 - 1.6) + metolachlor (1.5 - 2.0)

Poste-mergence treatments
2-4D amine salt (0.25 - 0.75)
Atrazine (1.0 - 2.0)
Bentazon (0.75 - 1.0)
Linuron (0.75 - 1.0)
Paraquat (0.5 - 1.0)

[a] At least 85 % control. Summary information from eight field trials mainly on River Estate and St. Augustine loams and Cunupia clay soils with different cultivars including the synthetics 'Sure Sweet', 'PR 50', 'Local Breeding lines' and the hybrids 'Mainliner' and different coded AVX germplasm materials.

Cost and returns

Table 4 presents the labour requirement in sweet corn production on three farms with different levels of mechanization. A mean labour requirement for the production of one hectare was 132 mandays. Harvesting and crop protection practices made the major demands on labour.

Economic data presented in Table 5 show that the mean gross margin on the selected farms was TT$39,182 per ha with a mean total variable cost of production of TT$9,735. All the farmers in the study realised profits.

Table 4. Labour requirement in sweet corn production:three private farms in Trinidad.

Cultural operation	Labour requirements on private farms [a] (mandays/ha)		
	Farm 1[b]	Farm 2[c]	Farm 3[d]
Land preparation	2.5	7.5	8
Planting	25	10	26
Irrigation	-	-	8
Fertilizing	10	12	10
Chemical weed control	-	5	6
Hand weeding and moulding up	25	10	15
Chemical pest and disease control	15	16	15
Harvesting	59	64	56
Post-harvest handling	2	1	1
Total	138.5	125.5	130

[a] The local breeding line (F_7) was grown on all farms except Farm 1 where cultivar 'Atlantic' was grown.

[b] All operations were done manually except land preparation which invloved one rotavation.

[c] Full mechanical land preparation which involved brush cutting, disc/ploughing and two rotavations. Planet Junior planter and Planet Junior fertilizer drill were used for planting and fertilizer application, respectively.

[d] Full mechanical land preparation as on Farm 2. All other operations were carried out manually.

Table 5. Analysis of cost and returns of sweet corn production on private farms in Trinidad[a].

Area planted (ha)	Gross returns (TT$/ha)	Total variable cost of production (TT$/ha)	Gross margin (TT$/ha)
0.10	56380	10315	46065
0.15	40126	10125	30001
0.25	56650	9385	44265
0.28	42153	8375	33778
0.05	52272	10473	41799
Mean	48916	9735	39182

[a] All rainfed crops planted in April - May 1985. Cultivars 'Atlantic' and 'PR 50' were grown on the 0.05 and 0.28 ha areas, respectively. The local F_7 was grown at all other sites. TT$2.42 = US$1.00.

A new synthetic cultivar

Breeding work involving an open pollination of a group of genotypes conducted as part of the Research Programme has resulted in the development of a F_7 generation, a specific line of which is about ready for release as a new synthetic cultivar. The original crosses were made at the University of the West Indies in 1981. Selections were subsequently made amongst populations on the basis of specific characteristics including cob size, yield, plant characteristics and taste, and rated for disease and pest tolerance. Replicated field trials at different locations were conducted. In all trials the synthetic cultivar gave yields of over 35,000 marketable ears ha^{-1}. Table 6 presents statistics on the synthetic.

Table 6. Characteristics of the local (Trinidad & Tobago) sweet corn synthetic cultivar F_7.

Maturity	70 days
Plant height	172 cm
Ear height	63 cm
Ear length	18-20 cm
Ear weight	155 g
Kernel colour	Light yellow
No. of rows	10 - 12
Pericarp	Very good
Flavour	Very good
Ears per plant	2

In general the synthetic is a rugged performer suitable for either field or backyard cultivation. The ear is enclosed in a tight husk with excellent protection. The ears are tapered and have good tip fill. Recent analyses indicated that the synthetic contains similar total sugar as imported hybrids CXP 514 and Monarch Advance and the synthetics PR 50 and Sure Sweet.

Conclusion

Results obtained with the numerous trials clearly indicate that the production of high yields of acceptable quality ears of sweet corn is possible in Trinidad & Tobago. A number of the imported hybrids are quite adaptable. However, under conditions of limited soil fertility and soil moisture availability, many of these hybrids do poorly. The foregoing data clearly indicate the significant potential of the local synthetic cultivar in terms of yield, quality of ears and acceptability to consumers. There are several advantages to be derived from the adoption of such a synthetic; its maintenance and the production of seeds for farmers is easy; such cultivars can be moved easily from farmer to farmer and be saved by farmers from year to year; seed production costs are reasonable.

Although many successful crops have been produced in the project there are areas which urgently require further work; continuation of breeding work for the development of disease-resistant cultivars; control of corn grass; a study on a new disease which appears to be bacterial stalk rot caused by *Erwinia* spp. (personal communication ; Dr. Elango, Departmental of Plant Sciences and Biochemistry, University of the West Indies); and the interface between production and processing. Praedial larceny can also be a serious problem.

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