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EXPERIMENTAL PRODUCTION OF SEVERAL NEW SWEET CORN VARIETIES FOR CANNING, AND FOR FRESH MARKET USE, IN TRINIDAD

by

A. J. Vlitos[1/] and W. N. L. Davies[2/]

INTRODUCTION

The establishment of a modern, well-equipped food processing plant* in Trinidad has stimulated a more intensive cultivation of food crops by peasant farmers. Pigeon peas (Cajanus cajan) were the first crop to have been produced, marketed, and processed successfully. Growers have been encouraged to extend their acreages of this crop, but have been asked to consider growing other crops as well.

One of the problems facing the processing plant is the seasonal characteristics of the pigeon pea crop. The peas mature in mid-December, and once these are harvested and processed, the canning plant may lay idle for the rest of the year. Thus in cooperation with the Tate and Lyle Central Agricultural Research Station several crops have been studied for their suitability to Trinidad environments and for their potential as processed, canned foods. One of the most promising of these is sweet corn.

Several varieties of sweet corn were imported and evaluated at the Research Station over a two-year period. A pilot scheme was set up in 1964 which enabled trials to be carried from field through to processing and canning. The present paper reviews these studies.

1/ Director of Research, Tate & Lyle C.A.R.S., Trinidad and
2/ Agronomist

* International Foods, Ltd.

EXPERIMENTAL

Experiment 1

Seed of the sweet corn variety PR 30 (developed by the Agricultural Experiment Station in Puerto Rico) was imported into Trinidad in 1963. A fertilizer trial was laid down on Waterloo loam and clay soil at the Tate and Lyle C.A.R.S. on 5th April 1963. Prior to planting the experimental area was treated with ground limestone to adjust the pH to approximately 6.5.

The trial consisted of 5 x 4 randomized blocks. Plot sizes were approximately 1/400th acre each. Four seeds were planted in hills at one foot intervals along rows spaced four feet apart. Overhead irrigation with "Wright Rain" irrigation equipment was used as required.

The fertilizer treatments were as follows:-

1. N P K: Calcium ammonium nitrate at 2 cwt./acre + Triple super phosphate at 2 cwt./acre + Muriate of Potash at 2 cwt./acre.
2. P K: Triple super phosphate at 2 cwt./acre + Muriate of Potash at 2 cwt./acre.
3. N K: Calcium ammonium nitrate at 2 cwt./acre + Muriate of potash at 2 cwt./acre.
4. N P: Calcium ammonium nitrate at 2 cwt./acre + Triple super phosphate at 2 cwt./acre.
5. Control: No fertilizer

The fertilizers were applied on 16th April 1963. The experimental area was hard-weeded on 25th April 1963 and treated with Simazine at 2.5 lbs. active/acre.

Experiment 2.

It had been observed that the varieties Spancross and Illinichief tasselled at a very early stage in their vegetative growth when grown under our conditions. A trial was laid down to compare the tasselling of the two varieties with that of PR 50 and with a local variety of field corn. Also effect of early tasselling on yields was evaluated.

The trial consisted of plots 1/400th of an acre, laid down as a 4 x 4 Latin Square. It was located on Waterloo loam and clay at Tate and Lyle C.A.R.C. and planted on 12th September 1963 under very wet conditions. Three to four corn seeds were sown at intervals of one and a half feet, along rows spaced four feet apart.

Two weeks after planting the following fertilizers were applied to the plots:

a) Calcium ammonium nitrate at 2 cwt./acre

b) Triple super phosphate at 2 cwt./acre, and

c) Muriate of potash at 2 cwt./acre.

Experiment 3.

In 1964, it was decided to plant the PR 50 variety of sweet corn on a pilot scale. An area of approximately 1¾ acre was available. Filter press mud was applied at the rate of about 50 tons/acre. This was buldosed over the area and then ploughed in. Ridges were formed five feet apart and good drainage was ensured by an adequate system of field drains.

Four seeds of the IR 50 variety of sweet corn were planted at intervals two feet along the tops of ridges. Planting was carried out between 6th and 8th April 1964. Irrigation was applied by means of Wright Rain irrigation equipment, as required.

Weed control was maintained initially by means of a pre-emergence application of Atrazine (2 lbs. active/acre). Two weeks after planting the seedlings were thinned to two per hill. Insect control, subsequent to germination, was obtained by dusting newly emerged plants lightly with 10% Sevin.

Fertilization of the corn was carried out at the following rates:-

21st April 1964:	Sulphate of ammonia at 1 cwt./acre Triple super phosphate at 2 cwt./acre
11th May 1964:	Sulphate of ammonia at 1 cwt./acre
21st May 1964:	Muriate of potash at 2 cwt./acre

When the ears emerged control of the larvae of the corn ear worm Heliothis armigera was attempted by weekly sprayings of all ears with 85% Sevin sprayable in water.

Experiment 4.

Seed of four varieties of sweet corn was made available to Tate and Lyle C.A.R.S. by Seed Research Specialists Inc., of Iowa. The four varieties were:-

Aristogold Bantam Evergreen

Floribelle

Goldengrain, and

Valleygold

It was known that Valleygold had performed well in North Dakota and also in South Texas. Floribelle is a high-yielding sweet corn both in Ontario, Canada and Southern Florida. Goldengrain is the most widely-used variety for canning and processing work in Texas(2). It was, therefore, of considerable interest to evaluate these varieties under tropical conditions.

Limited quantities of seed were made available initially, and a small trial was planted in which the performance of the new varieties was compared with FR 50. The trial, planted on 9th April 1964, was laid down as a 5 x 5 Latin Square. Each plot consisted of one row ten feet long with a five foot space between rows and a four foot space between plots along each row. Three seeds were planted on the tops of the ridges, spaced at 2 ft. intervals. The seedlings were subsequently thinned out to one plant per hole.

Germination counts and growth measurements were recorded periodically. Records were kept of the number of ears obtained at harvest from each plot and the weights of these ears.

5. The Canning Process

At the present time the canning factory has no mechanical means of preparing whole kernel sweet corn for the canning process. When there is a readily available supply of sweet corn to meet the needs of a market then the necessary machinery will be installed. The pigeon peas and sweet corn go through similar canning processes,

therefore the existing canning machinery is being used for sweet corn.

Briefly, the details of the process (from the time the sweet corn arrives at the canning factory, to canning) is as follows:-

The corn is first weighed, complete with husks. The husks are removed by hand and weighed. The kernels are removed from the cobs, and separate weights are recorded for kernels and cobs. The husks, kernels and cob are then each expressed as a percentage of the weight of the original ear.

The kernels are then placed on the processing line and are washed with clean cold water before entering a chamber in which they undergo blanching. Blanching consists of passing the kernels through steam at 180°F. for 6 minutes after which they are again washed with clean cold water. The kernels are then inspected, on a processing line for imperfect grains, husks etc. before being passed into the hopper.

The cans are sterilized by steam issuing from a jet before being positioned under the hopper. Approximately 10 oz. of sweet corn are placed into each can, and is filled with the preserving fluid. This consists of a solution of 1% common salt and 2% sucrose in water and is at a temperature of 212°F. After filling, each can is inspected prior to capping and sealing.

The sealed cans are placed in the retorts where the contents are cooked under pressure. Each retort accommodates three baskets. Each basket holds approximately 450 1 lb. cans. The cooking process lasts for 45 minutes and is carried out under steam pressure at

240 lb./sq. in. The cans are cooled in water. The canning process is now complete. The cans of corn are then labelled and crated.

RESULTS

Experiment 1.

The crop was harvested between the 19th and 26th June 1963 (71 days after planting). Results are presented in Table 1.

Table 1.

Treatment	Total No. of Ears	Total Wt. of Ears (lbs.)	No. of Ears per plot	Wt. of Ears per plot (lbs.)
N P K	71	29	17.75	7.25
N K	52	22	13.00	5.50
N P	69	29	17.25	7.25
P K	49	18	12.25	4.50
Control	46	16	11.50	4.00

There was a response, in terms of weight of sweet corn produced, to applications of nitrogenous fertilizers. The response was greatest when applications of nitrogen were combined with applications of phosphate. There was an insignificant response to the applications of nitrogen and potassium in the absence of phosphate(3).

Experiment 2.

In this variety trial very little growth was observed in all four varieties. This was thought to be due to the very wet conditions under which the trial was laid down and also to poor drainage.

Experiment 3.

The sweet corn in the pilot plot grew very well and harvesting of the ears began on 16th June 1964, 71 days after planting. Ears were harvested at intervals between that date and July 10th when harvesting operations were completed.

The crop were inspected for insect damage and then delivered to the canning factory for processing.

The area yielded 3,447 lb. of sweet corn, representing a yield of some 1,970 lb./acre.

Difficulty was experienced in controlling the larvae of the corn earworm Heliothis armigera. This insect is a serious pest of corn and is a source of trouble to all commercial canners(1). All ears were therefore cleaned of any damaged areas prior to being despatched to the canning plant. In subsequent trials, very effective control of H. armigera has been obtained by injecting 1% Sevin in Risella oil into the earliest visible silks.

Experiment 4.

The results of this experiment are presented in Tables 2 and 3.

Table 2.

Variety	Germination %	Growth Measurements (in cm.)			
		26 days	29 days	33 days	41 days
Aristogold Bantam Evergreen	92	46.9	55.9	64.8	100.1
Valleygold	92	39.7	49.1	60.0	93.1
Floribelle	80	37.8	44.8	51.6	79.2
Goldengrain	100	50.9	60.4	69.5	104.5
PR 50	100	41.4	48.4	60.8	90.0

With the exception of Floribelle the varieties germinated fairly well. Goldengrain grew vigorously and maintained a rapid growth rate. Floribelle did not exhibit vigour.

On June 24th (76 days after planting), the first mature ears were harvested. Subsequent pickings were made at intervals up to July 8th 1964. The results, in terms of numbers of ears per plant and mean weight per ear are presented in Table 3.

Table 3.

Variety	Yield Data	
	No. of Ears per plant	Mean Wt./Ear (oz.)
Aristogold Bantam Evergreen	2.6	5.5
Valleygold	3.0	5.3
Floribelle	3.2	4.1
Goldengrain	1.8	5.7
PR 50	3.0	6.4

Floribelle yielded slightly more ears per plant than any of the other varieties and though the ears contained kernels of exeellent quality they were lighter in weight than those of the other varieties.

Goldengrain produced few ears per plant but they were heavier than the ears of all the other varieties with the exception of PR 50. However the ears of Goldengrain were unsatisfactory because the kernels were very few and very scattered on the receptacles.

Aristogold Bantam Evergreen produced relatively few ears of reasonable weight, but as with Goldengrain the kernels tended to be sparse and scattered on the receptacles.

Valleygold produced kernels of excellent quality in good formation on the receptacles.

PR 50 produced the heaviest ears and the kernels were of good quality and were in regular formation on the receptacles.

5. The Results of the Canning Process

A considerable quantity of PR 50 was processed. In view of the rather small plot sizes comparatively few ears of the other four varieties were processed. Nevertheless samples of the canned products were forwarded to the Company's associates in the United States for a Grading Report. Extracts from this report are presented in Table 4.

Table 4.

Extract from Canned Food Grading Report

Details	Puerto Rico 50	Valleygold	Aristogold Bantam Evergreen	Floribelle	Goldengrain	Possible Score	Additional Comment
Date of Canning	2.7.64	30.6.64	30.6.64	30.6.64	30.6.64		
Style Pack	whole	whole	whole	whole	whole		
Kernel Size	small	large	large	large	large		
Color	9	8	7	6	6	10-9	
Cut	9	8	7	7	6	10-9	Cut not uniform
Tenderness and Maturity	30*	26*	23*	20*	16*	14-36	
Presence of Defects	17	17	16	15	14	20-18	Workmanship could be improved
Flavor	15	14	12	10	10	20-18	Typical of over-mature corn
Grade	C*	D*	D*	D*	D*		
Remarks	Best flavor and overall corn, but defects not too good	Somewhat hard and tough	Quite tough and hard	Very tough hard, unflavorful corn	Very tough hard, unflavorful corn		

The grading report (Table 4) indicates that PR 50 is the most acceptable sweet corn variety of the five which were tested. Though its final grading was only C* it gave the best flavour and was superior, in other ways, to the other varieties. Undoubtedly, as with the other varieties, one of the contributing factors to the rather low general grading, was the fact that the crop were somewhat overmature at harvest.

It was to be expected that the kernels would not be uniform because they are presently being cut by hand. With machine processing this defect, most likely, will be eliminated. Also, the comment that workmanship in the canning process could be improved is understandable, as this was the first attempt to process sweet corn in Trinidad.

DISCUSSION

Sweet corn production in Trinidad appears to be feasible, judging from the preliminary results. Not only does the crop provide a need for year-round processing, and canning, but it is also of potential value for the fresh market during both the rainy and dry seasons.

One important point emerging from the experiments is that not all varieties of sweet corn are capable of yielding well in Trinidad at all times of the year. PR 50, for example, when planted in early April yields well in June and July, but when planted in late July and harvested in September and October, does not perform as well.

On the other hand, Valleygold and Floribelle do not do as well when planted in April as when planted in July. It is quite feasible therefore to produce high-quality sweet corn in Trinidad by planting at least these three varieties at the time of year best suited to each. Further experiments along this direction are underway.

Goldengrain and Aristogold Bantam Evergreen do not appear to be suited to Trinidad conditions either during the rainy or dry season. Although both varieties made good vegetative growth, and did not tassel prematurely, yields of grain were poor. There was also a high incidence of scattered grains in both varieties. Spancross is also not adaptable to Trinidad conditions, as it tassels precociously.

Present indications are that, with more experience and by use of machines to prepare whole kernels for canning, the processing will improve. The timing of harvests shall also have to be improved to reduce the incidence of hardness and loss of flavour.

SUMMARY

A number of field trials evaluating several varieties of sweet corn indicated that PR 50, Valleygold, and Floribelle are suited for cultivation in Trinidad. PR 50 was found to be suitable for planting in April and harvest in June/July while Valleygold and Floribelle are better suited for planting in June/July and Harvest in September/October. The results of processing and canning experiments with these varieties are presented and discussed.

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REFERENCES

1. Metcalf, C.L., and W.P. Flint (1928). "Destructive and Useful Insects. Their Habits and Control" 4th Edit. Revised by R.L. Metcalf 1962. McGraw-Hill Book Co. Inc.

2. Smith, S.N. (1964). Private communication.

3. Tate & Lyle C.A.R.S. (1963). C.A.R.S. Annual Report 1963.