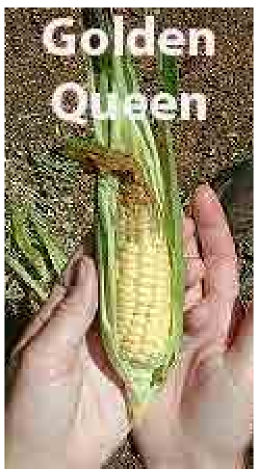
ECHO® Research Notes

Volume 1 |No. 7

Performance of Five Alley-Cropped Sweet Corn Varieties Grown in Bohoc, Haiti

Dr. Tim Motis
ECHO Inc.
2004



Abstract

This trial was conducted in 2004 to compare growth and yield parameters of five sweet corn (*Zea mays*) varieties (‘NE-EDR’, ‘ZC2451F’, ‘Golden Queen’, ‘Hawaiian Supersweet’, and ‘True Gold’) grown between rows of leguminous trees (mostly Leucaena leucocephala) trees in the Central Plateau of Haiti. With more than double the fresh ear (cob + kernels + husk) weight (220 g/m^2) of the other varieties (30 to 90 g/m^2), Hawaiian Supersweet showed the most promise for growing sweet corn in Haiti.

Introduction

Haitian farmers typically grow corn to make flour. Therefore, it is unlikely that sweet corn will ever gain wide acceptance as a major field crop. There may, however, be a place for sweet corn grown as a vegetable in household gardens.

Corn plants take up a substantial amount of nutrients from the soil. Organic sources of fertility are especially important where synthetic fertilizers are unaffordable or inaccessible to farmers. One way to supply organic matter and nutrients is to use a system called alley cropping in which crops are planted between rows of nitrogen-fixing trees. The trees are periodically pruned to prevent shading of the crop. Prunings are then used either as feed for livestock or incorporated into the soil. While supplying organic matter, the trees also minimize soil erosion. It should be noted that in climates with low rainfall, the trees may compete with the crop for water.

This study was conducted to evaluate five varieties of sweet corn for their performance in an alley-cropping production system. We wanted to see which varieties performed best with no inputs of fertilizer (other than leaf litter from the trees) or irrigation.

Materials and Methods

Rows of nitrogen-fixing trees (*Leauceana leaucephala* and *Gliricidia sepium*) had been established in the 90’s. The trees were spaced roughly 60 cm apart within rows, with 4.6 m between rows. By 2004, the year during which this study was conducted, the trees were 6 to 9 meters tall. Prior to planting the crop, the trees were sawed to waist height and the wood used in a kitchen to cook food for school children. Subsequently, workers hoed the ground between the rows of trees to break up the soil and prune tree roots. Corn plots were planted between 31 May and 4 June.

Table 1. Weather data for each week of the corn trial with day 1 and day 77 (3 days before final harvest) on 31 May and 15 Aug. 2004, respectively.

			Avg relative humidity (%)		Avg air temp (°C)	
Day	**Dates**	**Rainfall (mm)**	**Min**	**Max**	**Min**	**Max**
7-Jan	31 May-6 June	69.6	22	34	39	94
14-Aug	7-13 June	92.2	22	34	40	93
15-21	14--20 June	38.1	21	35	37	94
22-28	21-27 June	missing data	missing data	missing data	missing data	missing data
29-35	28 June-4 July	48.3	22	34	47	94
36-42	5-11 July	17.8	21	34	42	92
43-49	12-18 July	146	21	34	47	94
50-56	19-25 July	22.9	22	34	41	94
57-63	26 July- 1 Aug	73.7	21	33	49	95
64-70	2-8 Aug	39.4	22	34	39	94
71-77	9-15 Aug	66	21	34	41	94
Total rainfall		**613.9**				

Each plot was 3 m long by 2.4 m wide with 5 rows per plot. Varieties (see Table 2) were replicated three times and arranged in a randomized complete block design.

Local practices were followed in establishing the crop. Two corn seeds were placed in each planting station. Planting stations, dug 5 to 10 cm deep with a machete or small hoe, were spaced 1 m apart within rows, with 60 cm of space between rows. Seeds in the stations were covered 2.5 cm deep with soil and allowed to grow without thinning. The wide spacing between double-seeded corn planting stations takes into account the fact that soil fertility and moisture are often low, and other crops such as sweet potato are often intercropped with the corn. Pigeon pea (*Cajanus cajun*) was planted at the same time to establish a 1.2 m-wide pigeon pea buffer between individual corn plots.

Data were collected for weather, germination percentage, plant population, plant height, caterpillar damage, tassling and silking times, grain yield, and fresh plant biomass. Yield data were taken from the inner three rows when the silks had begun to dry and kernels were still milky. Data were subjected to analysis of variance using GenStat. Means (values averaged over the three replications) were separated using the "least significant difference" method (see Tables for explanation) if the associated P value was less than or equal to significance level of 0.05. Correlation between several yield and plant growth parameters was carried out with Minitab.

Table 2. Effect of variety on seed germination percentage and final plant population of sweet corn planted between rows of leguminous trees. Data below were averaged over three replications.

Variety	Germination (%)	Population (plants/plot)
NE-EDR Sh2/P1614830	28	9
ZC2451F/P1618810	45	16
Golden Queen	56	17
Hawaiian Supersweet	65	21
True Gold	52	11
P value	**0.053**	**0.108**
LSD value	**23.64**	**---**

Means were separated using Least Significant Difference (LSD) test when P values were less than 0.05. Two or more means within a column are significantly different when the difference between them exceeds the LSD value. Seed germination and final plant population were determined on 14 June and 20 July, respectively. Note that these measurements apply to the entire plot, whereas ears were harvested from the inner three of five rows of plants.

Table 3. Effect of variety on height of sweet corn plants grown between rows of leguminous trees. Data below were averaged over eight measurements per each of three replications.

	Plant Height at 3 times (m)		
Variety	**13-Jul**	**28-Jul**	**9-Aug**
NE-EDR Sh2/P1614830	0.5	1	1.21
ZC2451F/P1618810	0.63	0.83	0.81
Golden Queen	0.5	0.9	0.96
Hawaiian Supersweet	0.59	1.2	1.24
True Gold	0.38	0.74	0.79
P value	**0.004**	**0.014**	**0.013**
LSD Value	**0.103**	**0.231**	**0.271**

Means were separated using Least Significant Difference (LSD) test when P values were less than 0.10. Any two means within a column are significantly different when the difference between them exceeds the LSD value.

Results and Discussion

The plots received 30 and 36 mm of rainfall on 31 May and 2 June, respectively. These rainfall events occurred at planting time and supplied soil moisture for seed germination. Seed germination percentage was highest with Hawaiian Supersweet; statistically similar percentages were obtained with Golden Queen, True Gold, and ZC2451F (Table 2). Seeds of NE-EDR germinated as well as those of ZC2451F but not as well as Hawaiian Supersweet, Golden

Table 4. Effect of variety on percentage of sweet corn plants in a plot that were damaged by caterpillar larvae. Data below were averaged over three replications.

Variety	Caterpillar damage (% of population)
NE-EDR Sh2/P1614830	49
ZC2451F/P1618810	15
Golden Queen	64
Hawaiian Supersweet	29
True Gold	18
P Value	**0.027**
LSD Value	**31.04**

Means were separated using Least Significant Difference (LSD) test when P values were less than or equal to 0.10. Two or more means within a column are significantly different when the difference between them exceeds the LSD value.

Queen, and True Gold. Final plant population on 20 July did not differ, at the 5% significance level, between the varieties.

Weather data recorded during the season showed that the crop received 208 and 269 inches of rain (Table 1).

Plant height differed among varieties at each of the three times heights were measured (Table 3). Plant growth with all the varieties appeared to be the most rapid between 13 and 28 July. Heights did not appear to increase appreciably between 28 July and 9 August.

August. On 28 July and 9 August, Hawaiian Supersweet plants were taller than all the other varieties excep NE-EDR Sh2.

Table 5. Effect of variety on the percentage of sweet corn plants, grown between rows of leguminous trees, that had tassled on 20 July, 28 July, and 9 August. Data below were averaged over three replications.

Variety	Tassling at three times (% of plants in a plot)		
	20-Jul	**28-Jul**	**9-Aug**
NE-EDR Sh2/P1614830	12	44	86
ZC2451F/P1618810	64	90	88
Golden Queen	51	73	62
Hawaiian Supersweet	0	66	81
True Gold	50	65	71
P Value	**0.002**	**0.077**	**0.163**
LSD Value	**26.11**	**30.79**	**---**

Means were separated using Least Significant Difference (LSD) test when P values were less than or equal to 0.10. Two or more means within a column are significantly different when the difference between them exceeds the LSD value.

Table 6. Effect of variety on the percentage of sweet corn plants, grown between rows of leguminous trees, that had silked on 20 July, 28 July, and 9 August. Data below were averaged over three replications.

Variety	Silking at three times (% of plant population)		
	20-Jul	**28-Jul**	**9-Aug**
NE-EDR Sh2/P1614830	0	4	51
ZC2451F/P1618810	8	35	63
Golden Queen	0	36	35
Hawaiian Supersweet	0	1	64
True Gold	0	23	48
P Value	**0.097**	**0.014**	**0.276**
LSD Value	**5.66**	**21.7**	**---**

Means were separated using Least Significant Difference (LSD) test when P values were less than or equal to 0.10. Two or more means within a column are significantly different when the difference between them exceeds the LSD value.

Caterpillar damage, as percent of plants in a plot that were harmed, was lowest and similar with ZC2451F and True Gold (Table 4) Damage was intermediate with Hawaiian Supersweet and highest with Golden Queen. Many of the corn plants in nearby farms are damaged by caterpillars. Caterpillar damage may explain why local farmers do not thin after double or triple seeding their corn.

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Varietal differences in the percentage of plants that were tassling occurred only at the first counting time on 20 July (Table 5). At this time, a much lower percentage of Hawaiian Supersweet and NE-EDR plants had tassles than of plants of the remaining varieties.

Thus, Hawaiian Supersweet and NE-EDR began tassling later than the other varieties. Percentage of plants with tassles appeared to increase steadily with time, from 20 July to 9 August, with NE-EDR and Hawaiian Supersweet. Tassles were the portion of a corn plant that appeared to be most affected by caterpillars. Tassles produce the pollen received by the silks which, in turn, results in kernel formation.

Silking began sometime between 20 (when only ZC2451F plants had silks) and 28 July (Table 6). On 28 July, the percentage of plants with silks was higher for ZC2451F and Golden Queen than for NE-EDR and Hawaiian Supersweet. Plants of Hawaiian Supersweet and NE-EDR had very few silks on 28 July; silking for these varieties occurred mainly between 28 July and 9 August.

Ear weight per plot (inside three rows) was the only yield parameter that varied between varieties (Table 7). Hawaiian

Table 7. Sweet corn ear production and plant (leaves and stems) biomass with five varieties grown between rows of leguminous trees. Data below were averaged over three replications.

Variety	Ears (cob + kernals + husk)		Fresh plant (stem + leaf) wt	
	No./m²	**g/m²**	**g/ear**	**(g/ plant)**
NE-EDR Sh2/P1614830	1.4	90	75	156
ZC2451F/P1618810	1.4	70	52	63
Golden Queen	1.2	60	46	107
Hawaiin Supersweet	2.3	22	92	123
True Gold	0.6	30	45	64
P value	**0.075**	**0.001**	**0.074**	**0.008**
LSD Value	**---**	**0.65**	**---**	**187.4**

Means were separated using Duncan's multiple range test. Two or more means are significantly different when no letters following the means are the same.

Supersweet produced more than twice as much corn, in terms of weight than any of the other varieties. Ear weight per 10 m square was significantly (P value of <0.001) correlated (Pearson correlation coefficient of 0.82; a value of 1 would indicate perfect correlation) with ear number. Ear number ranged from 0.6 ears/m^2 with True Gold to 2.3 ears/m^2 with Hawaiian Supersweet. In turn, ear number correlated (Pearson coefficient = 0.72) significantly (P = 0.002) with final plant population. Ear weight per m^2 was also significantly (P = 0.74) correlated (Pearson coefficient = 0.002) with individual ear weight, which ranged from 45 g/ear with True Gold to 92 g/ear with Hawaiian Supersweet. These correlations suggest that highest yield with Hawaiian Supersweet resulted from a combination of factors [ear number (which could have been influenced by plant population and plant productivity) and size] even though values for each factor did not differ (at P = 0.05) between varieties.

Fresh plant biomass was highest and similar with NE-EDR and Hawaiian Supersweet, intermediate with Golden Queen, and lowest and similar with ZC2451F and True Gold (Table 7). It was observed that plants of the smallest and lowest yielding varieties, ZC24514 and True Gold, tassled early (Table 5) and then stopped growing (Table 3).

Conclusion

Results of this study indicate that of the varieties tested, Hawaiian Supersweet is best suited for growth in the central plateau of Haiti. Yields of Hawaiian Supersweet, although higher than the other varieties, did not appear to be very substantial. It is possible that, in the alley-cropping system used, the plants did not receive sufficient nutrition for optimal yields. More work is needed to determine if greater yields could be obtained by growing Hawaiian Supersweet with locally available soil amendments such as composted sugarcane bagasse, animal manure, or a combination of organic fertility sources with NPK fertilizer.