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Elizabeth T. Maynard

Purdue University - Main Campus, emaynard@purdue.edu

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Sugar-enhanced Sweet Corn Cultivar Evaluation for Northern Indiana, 2009

Elizabeth T. Maynard, Purdue University, Westville, Indiana 46391

Indiana growers harvested sweet corn for fresh market sales from 5,400 acres in 2008, with an average yield of 70 cwt/A (166 crates or 3.5 tons per acre) and total value of \$11.7 million (USDA-NASS Indiana Agricultural Statistics, 2008-2009). Indiana ranks 17th among states for production of fresh market sweet corn. The 2007 USDA Ag Census reported 603 Indiana farms producing sweet corn for fresh markets and 51 farms selling to processors. Sweet corn fields for fresh market sales are located throughout the state. In northern Indiana, bicolor corn is most commonly grown. Varieties with improved eating quality are of interest to both producers and consumers. Producers are also interested in yield, ear size, appearance, and agronomic characteristics. This paper reports on 15 sugar enhanced and synergistic sweet corn cultivars and experimental lines that were evaluated at the Pinney-Purdue Agricultural Center in Wanatah, Indiana.

Materials and Methods

The trial was conducted on a Tracy sandy loam. The fall 2008 soil test showed 1.2% organic matter, pH 6.4, and 25 ppm phosphorus (P), 93 ppm potassium (K), 165 ppm magnesium (Mg), 600 ppm calcium (Ca). Prior to planting wheat as a cover crop, we applied 20, 30, and 45 lb./A N, P₂O₅ and K₂O, plus 7.8 lb./A S, and 0.8 lb./A Zn. In spring 2009, wheat was treated on May 1 with glyphosate and worked in on May 8 and 11. Fertilizer (200 lb./A 6-24-24) was broadcast to provide 12 lb. N, 48 lb. P₂O₅, and 48 lb. K₂O per acre. The trial was set up as a randomized complete block design with three replications. Cultivars were assigned to individual plots one row wide (30 inches) by 30 feet long. Corn was seeded May 19, 2009, with a finger pick-up planter set to drop 23,200 seeds per acre, and later thinned to 35 plants per 30-foot row (20,328 plants per acre). N (at 20.3 lb./A) and P (at 18.2 lb./A P₂O₅) were applied at planting from 19-17-0 (10 gal. /A), and an additional 70 lb./A N from urea ammonium nitrate solution was injected June 22. Tefluthrin (Force 3G) was applied at planting to control corn rootworms. Weeds were controlled with atrazine (Atrazine 4L) and s-metolachlor (Dual II Magnum) applied and incorporated before seeding, cultivation, and hand weeding. Irrigation was applied during the growing season as needed. Insecticides were applied as needed to control caterpillars. Emergence was recorded 10 and 24 days after planting (DAP), before thinning. Early plant vigor was evaluated 31 DAP. Seventy-three DAP, just before harvest, plant vigor, height, and degree of tiller formation, and the height from the soil to the middle of the ear was measured for three ears per plot. Each plot was harvested when corn reached marketable stage. The weights and numbers of marketable ears were recorded. Three ears from each plot were selected to evaluate degree of husk cover, husk tightness, degree of tip fill, overall attractiveness, average ear diameter, length after husking, and shank length. One person rated the flavor of each entry. Rating scales are described below and in table footnotes. Quantitative data with equal variance across treatments were analyzed using ANOVA followed by mean separation using Fisher's protected least significant difference at $P \leq 0.05$. Relationships between yield components, ear and plant characteristics, and average days to harvest were analyzed using linear regression.

Characteristic	Rating Scale
Husk Cover	5=more than 2 inches cover. 4=1.25-2 inches. 3=0.75-1.25 inches. 2=less than 0.75 inch. 1=ear exposed.
Husk Tightness	3=tight. 2=firm. 1=loose.
Tip Fill	5=kernels filled to tip of cob. 4=less than 0.5 inch unfilled. 3=0.5-1 inch unfilled. 2=more than 1 inch unfilled. 1=more than 2 inches unfilled.

Results and Discussion

The growing season was drier and cooler than normal. The USDA-NASS Indiana Crop and Weather Reports documented that from May 18 to August 16, 1,628 growing degree days (GDD) accumulated, 134 fewer than normal. Rainfall during that period totaled 7.27 inches, 4.43 inches below normal.

Warm soil temperatures just after planting led to rapid emergence, and by 10 DAP emergence averaged 95% of the intended seeding rate. Nine varieties had more than 95% emergence and did not differ significantly from CSEBF7-253, which had the highest at 107% (Table 1). Two varieties, Navajo and Luscious, had emergence less than 75%, significantly lower than all of the others. For these varieties, low emergence led to final stands of 78% and 79% of the desired population, respectively; other varieties were within 90% of the desired stand after thinning. Differences in early vigor were readily apparent and were reflected in scores ranging from 3 (Navajo and Luscious) to 8.3 (BC 0822) on the 9-point rating scale (Table 1). Six varieties received ratings not significantly different than BC 0822. Fastlane and Providence had low vigor, not significantly different from Navajo and Luscious. Plant vigor near harvest ranged from 3 to 8, but did not necessarily correspond to early vigor. Montauk, Providence, and BC 0822 appeared the most vigorous, and Fastlane the least (Table 1). Three of the four earliest varieties were among varieties with the lowest vigor ratings at harvest. Most varieties produced tillers, except Fastlane, which consistently had few or none. CSYBF7-257, and to a lesser extent, Vitality, consistently produced long tillers (Table 1).

Results for yield and ear quality are presented in Table 2. Marketable yield averaged 7.7 tons per acre. Montauk produced the highest yield, 10.8 tons per acre. Providence and GH 0851 produced significantly less at 9.8 and 9.7 tons per acre, respectively. CSEBF7-253 was fourth, at 9.0 tons per acre, and along with the three above it, significantly more than the other 11 varieties in the trial. Half of the varieties produced between 6.5 and 9.0 tons per acre: CSEYF7-248, BC 0822, CSYBF7-257, CSYBF7-256, CSQBF7-262, Luscious, and Navajo. Vitality, HMX 6358BES, Fastlane, and Trinity produced from 5.7 to 6.3 tons per acre, significantly less than all except Navajo. The number of marketable ears ranged from 1,210 to 1,678 dozen per acre, and averaged 1,550. Eleven varieties produced more than 1,564 dozen per acre, including CSQBF7-262, GH 0851, CSYBF7-257, Providence, Montauk, CSYBF7-256, CSEBF7-253, BC 0822, Trinity, HMX 6385BES, and Vitality. Navajo and Luscious produced the fewest ears per acre, due at least in part to the low plant stand. Average weight per ear ranged from 0.61 lb. (Vitality) to 1.09 lb. (Montauk). Average ear weight and yield in tons per acre were both correlated with days to harvest: later-maturing varieties tended to produce heavier ears and more tons per acre. Luscious and Navajo produced ears a little heavier than would be expected based on their harvest dates, and BC 0822 produced ears a little lighter than would be expected based on its harvest date.

Ear length ranged from 7.3 to 8.5 inches, and diameter ranged from 1.7 to 2.1 inches. The longest ears were produced by Providence, GH 0851, Montauk, CSEYF7-248, and CSEBF7-253 (8.3 to 8.5 inches). CSYBF7-257, HMX 6358BES, and BC 0822 produced ears 7.7 to 7.9 inches long. The shortest ears ranged from 7.3 to 7.6 inches and included Trinity, Vitality, Navajo, CSQBF7-262, CSYBF7-256, Fastlane and Luscious. Varieties that had ears with a diameter of 2 inches or greater included Luscious, Montauk and Navajo. Fastlane, Vitality, Trinity, and CSYBF7-257 had the narrowest ears at 1.7 to 1.8 inches. Shank length ranged from 2.8 inches to 5.4 inches and averaged 4.0 inches (Table 1). Varieties with the longest shanks included Montauk, Providence, Fastlane, and GH 0851 (4.7 to 5.4 inches). Varieties with the shortest shanks included HMX 6358BES, Vitality, CSQBF7-262 and Trinity (2.8-3.3 inches). Ear length and shank length were positively correlated with days to harvest. HMX 6458BES and CSEYF7-248 produced longer ears, and BC 0822 produced shorter ears than would be expected based on their harvest dates. Fastlane had much longer shanks than expected based on harvest date. Ear height, measured from the ground to mid-ear, ranged from 19.7 inches for HMX 6358BES, to 32.6 inches for Montauk and was correlated with harvest date — later varieties tended to have higher ears. CSYBF7-257 had ears closer to the ground than would be expected based on harvest date.

Husk cover ratings averaged 3.8. Ten varieties averaged 4 or better, indicating at least 1.25 inches of husk cover: Luscious, BC 0822, CSQBF7-262, CSYBF7-256, GH 0851, Navajo, CSEBF7-253, Providence, and CSEYF7-248. CSYBF7-257, Trinity, and Vitality averaged between 2.8 and 3.4, indicating 0.75 to 1.25 inches of cover on most ears. Two varieties, HMX6358BES and Fastlane, averaged less than 2.5, indicating some ears with less than 0.75 inch of husk cover. Husk cover was correlated with harvest date: later varieties tended to have better husk cover. The husks of Fastlane, HMX 6358BES, Luscious, BC 0822 were loose around the ear tip. Tip fill ratings averaged 4.1. Navajo, Vitality, GH 0851, CSYBF7-256, CSYBF7-257, HMX 6358BES had good tip fill, averaging 4.3 or more, indicating that most ears had ears with less than 0.5 inch of the tip unfilled. These varieties were significantly better than Montauk, Fastlane, BC 0822, CSQBF7-262, and CSEYF7-248, which ranged from 3.4 to 3.8, indicating some ears with more than 0.5 inch of unfilled kernels. Luscious, CSEBF7-253, and Trinity had good tip fill, indicating ears with about 0.5 inch of unfilled kernels. Providence had the worst tip fill rating at 3.0 (0.5 to 1 inch unfilled kernels), though not significantly lower than CSEYF7-248. For overall ear quality in terms of appearance, CSEBF7-253 received the highest rating. Other varieties above the 6.0 average included BC 0822, CSEYF7-248, Navajo, Montauk, CSYBF7-256, and CSYBF7-257. Fastlane, Trinity, and CSQBF7-262 received the lowest ratings for overall ear appearance.

Varieties that received flavor ratings of very good to excellent, or better, included BC 0822, CSYBF7-256, CSYBF7-257, GH 0851, and Providence. Fastlane consistently received a rating of very good.

Often, producers select one or two varieties in each maturity range so it is helpful to compare varieties of similar maturity. Among the four earliest varieties in this trial, yield did not differ significantly whether measured in dozens or tons per acre. HMX 6358BES and Fastlane produced longer ears than the other two early varieties. HMX 6358BES had reasonable ear quality, but Fastlane had poor husk cover. Vitality and Trinity produced ears of similar length and reasonable quality, but short flag leaves on Trinity might reduce its attractiveness to some buyers. Among five entries harvested 78 to 80 DAP, yields tended to be lower for Navajo and

Luscious, associated with lower plant stands. Ear quality was generally acceptable to good. Among the four bicolor entries harvested 83 or more days after planting, yield in dozens per acre did not differ significantly, but Montauk produced the greatest and BC 0822 the least yield in tons per acre. Montauk and Providence produced the longest, and BC 0822 the shorter ears in this maturity class. Ear quality was generally reasonable.

Careful evaluation of results presented in Tables 1 and 2 combined with results from other locations and years should aid producers in selecting varieties best suited to their operations.

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Table 1. Emergence, final stand, plant vigor, tillering, plant height, and ear shank length for 15 sugar-enhanced and synergistic sweet corn varieties in northern Indiana, 2009. Varieties listed in order of harvest date within color.

Cultivar	Emergence ^z	Final Stand		Plant Vigor ^y		Tillers ^x	Height Class ^w	Shank Length ^v
		plants/A		June 19	July 31			
Fastlane	91	19,554	4.0	3.0±0.6	1.0±0.0	2.0±0.0	5.1	
HMX 6358BES	92	20,328	7.3	5.7±0.7	3.0±0.6	2.0±0.0	2.8	
Vitality	92	20,328	6.7	4.0±0.6	3.7±0.3	2.0±0.0	2.8	
Trinity	100	20,328	6.0	4.0±0.6	1.3±0.3	2.0±0.0	3.3	
Navajo	74	15,875	3.0	4.7±0.3	2.3±0.3	2.0±0.0	3.7	
CSQBF7-262	95	20,328	7.7	4.7±0.3	2.7±0.3	2.0±0.0	3.1	
CSYBF7-256	101	20,134	5.7	4.0±0.6	1.7±0.7	2.0±0.0	3.9	
CSYBF7-257	105	20,328	5.7	5.3±0.3	4.0±0.6	2.0±0.0	4.4	
Luscious	71	16,069	3.0	6.7±0.3	2.0±0.6	2.7±0.3	4.0	
CSEBF7-253	107	20,328	7.3	7.3±0.3	1.7±0.3	3.0±0.0	3.7	
BC 0822	97	20,134	8.3	7.7±0.3	2.0±0.0	3.0±0.0	4.1	
Montauk	101	20,328	5.7	8.0±0.0	3.3±0.3	3.0±0.0	5.4	
Providence	101	20,134	4.7	8.0±0.0	2.0±0.0	2.7±0.3	5.2	
CSEYF7-248	94	20,134	6.7	7.3±0.3	2.0±0.0	3.0±0.0	4.3	
GH 0851	102	20,328	7.3	6.7±0.9	3.3±0.7	2.3±0.3	4.7	
<i>Grand Mean</i>	95	19,645	5.9	5.8	2.4	1.9	4.0	
<i>LSD .05^u</i>	12	–	2.2	–	–	–	0.8	

^yPercentage of intended seeding rate (23,200 seeds per acre). Planted May 19, 2009, emergence data May 29.

^v1=very weak, 5=average, 9=very vigorous. Mean ± standard error if AOV not performed.

^x1=no or very few tillers, 3=tillers common but not tall enough to interfere with harvest, 5=tillers tall enough to interfere with harvest on most plants. Mean ± standard error.

^w1=less than 5 feet, 2=5 to 6 feet, 3=more than 6 feet. Mean ± standard error.

^uMeasured from attachment to stalk to base of ear; average of three ears per replication.

^zMeans differing by more than this amount are significantly different at $P \leq .05$ based on Fisher's Protected LSD. – AOV not performed.

Table 2. Yield, ear size, and quality of synergistic and sugar-enhanced sweet corn in northern Indiana, 2009. Varieties listed in order of harvest date within color.

Cultivar	Seed Source ^z	Color	Days to Harvest ^y		GDD to Harvest ^x	Yield of Marketable Ears		Avg. Ear Weight lb	Ear Length in	Ear Dia. in	Ear Ht. in	Husk Cover ^w	Husk Tightness ^w	Tip Fill ^w	Overall ^w	Flavor ^v
			Pred.	Actual		doz/A	ton/A									
Fastlane	ST	BI	67	74	1,293	1,452	6.2	0.72	7.6	1.7	22.4	1.6	1.0±0.0	3.8	3.3±0.3	VG
HMX6358BES	HM	BI	66	76	1,328	1,565	6.0	0.64	7.9	1.8	20.4	2.3	1.1±0.1	4.8	5.0±0.6	VG-F
Vitality	RU	BI	67	76	1,328	1,565	5.7	0.61	7.3	1.8	21.6	2.8	1.7±0.2	4.4	5.7±0.3	VG-G
Trinity	CR	BI	75	76	1,328	1,581	6.3	0.66	7.3	1.8	19.7	3.4	1.8±0.2	4.0	4.0±0.0	E-G
Navajo	ST	BI	67	78	1,359	1,242	6.6	0.88	7.4	2.0	22.6	4.4	2.0±0.2	4.3	7.0±0.0	G-F
CSQBF7-262	CR	BI	-	78	1,359	1,678	7.2	0.71	7.4	1.8	21.4	4.1	1.8±0.2	3.7	4.3±0.3	VG-G
CSYBF7-256	CR	BI	-	80	1,413	1,646	7.7	0.78	7.5	1.9	23.3	4.1	1.6±0.3	4.8	7.3±0.3	VG-E
CSYBF7-257	CR	BI	-	80	1,413	1,662	7.9	0.80	7.9	1.8	20.4	3.4	1.4±0.3	4.8	7.3±0.3	E-VG
Luscious	RU	BI	75	80	1,413	1,210	7.1	0.98	7.6	2.1	26.6	4.0	1.1±0.1	4.1	7.7±0.3	F
CSEBF7-253	CR	BI	-	83	1,472	1,629	9.0	0.92	8.3	1.9	25.6	4.6	2.0±0.0	4.0	8.0±0.0	G
BC 0822	SY	BI	77	84	1,492	1,581	8.0	0.85	7.7	1.8	27.1	4.0	1.1±0.1	3.7	6.3±0.7	VG-E
Montauk	ST	BI	78	85	1,512	1,646	10.8	1.09	8.3	2.1	32.6	4.9	2.4±0.3	3.9	7.3±0.3	VG-E
Providence	RU	BI	82	87	1,561	1,662	9.8	0.99	8.5	1.8	28.6	4.8	2.3±0.3	3.0	5.0±0.0	E-VG
CSEYF7-248	CR	Y	-	81	1,439	1,452	8.0	0.93	8.3	1.9	28.8	4.9	2.7±0.7	3.4	6.7±0.7	G
GH 0851	SY	Y	81	86	1,534	1,678	9.7	0.97	8.4	1.8	27.3	4.2	2.7±0.2	4.6	5.7±0.3	E,-VG
Grand Mean						1550	7.7	0.83	7.8	1.9	24.6	3.8	1.8	4.0	6.0	-
LSD .05 ^u						-	0.7	0.06	0.4	0.09	3.4	1.0	-	0.7	-	-
r ²						ns	0.87	0.72	0.61	ns	0.67	0.59	-	-	-	-

^zSeed Source: CR=Crookham, HM=Harris Moran, RU=Rupp, ST=Stokes, SY=Syngenta.

^yDays from planting to harvest. Predicted number is from seed supplier.

^xGDD=corn growing degree days.

^wHusk cover, tip fill: 1=worst, 5=best. Husk tightness: 1=loose, 3=very tight. Overall: 1=worst, 9=best. Mean ± standard error if no AOV.

^vFlavor: F=fair, G=good, VG=very good, E=excellent. Summary of ratings by one person for three ears per cultivar.

^uMeans differing by more than this amount are significantly different at P≤.05 based on Fisher's Protected LSD. - AOV not performed.

^t2 for regression vs. actual days to harvest is the proportion of variability explained by days to harvest. ns=regression not significant at P≤.05.