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Sugar-enhanced Sweet Corn Cultivar Evaluation for Northern Indiana, 2010

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Indiana growers harvested sweet corn for fresh market sales from 6,100 acres in 2009, with an average yield of 69 cwt/acre (164 crates or 3.45 tons per acre) and total value of \$16.8 million (USDA NASS, 2010). Indiana ranks 14th 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, bi-color 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 17 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 2009 soil test showed 1.5% organic matter, pH 6.7, and 34 ppm phosphorus (P), 103 ppm potassium (K), 190 ppm magnesium (Mg), 650 ppm calcium (Ca). Fertilizer (130 lb./acre of 0-0-60 and 108 lb./acre of 0-45-0) was broadcast to provide 48 lb. P₂O₅ and 78 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 (30 inches) wide by 30 feet long. Corn was seeded May 27, 2010, with a finger pick-up planter and later thinned to 35 plants per 30-foot row (20,328 plants per acre). Nitrogen (N) (at 20.3 lb./acre) and P (at 18.2 lb./acre P₂O₅) were applied at planting from 19-17-0 (10 gal./acre), and an additional 70 lb./acre N from urea ammonium nitrate solution was injected June 17. 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, one cultivation, and hand weeding. Irrigation was applied during the growing season as needed. Mancozeb (Dithane DF[®] 1.5 lb./acre) was applied on July 9 to control rust. Permethrin (Arctic 3.2EC[®], 4 fl. oz./acre) was applied on July 30 to control caterpillars. Emergence was recorded seven and 13 days after planting (DAP), before thinning. Sixty-one DAP, just before harvest, plant vigor, height, and degree of tiller formation were rated 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 and 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 wetter and warmer than normal. The USDA National Agricultural Statistics Service Indiana Crop & Weather Reports documented that from May 24 to August 15, the growing degree days (GDD) accumulation was 2,321, 387 more than normal. Rainfall during that period total 13.96 inches, 3.06 inches more than normal. More than half of the rain came in June, and rainfall from July 26 through August was 0.78 inch below normal.

Warm soil temperatures led to rapid emergence, and by 13 DAP emergence averaged 89% of the intended seeding rate (data not shown). Venue had 100% emergence, significantly greater than all other varieties. Plant vigor ratings near harvest showed little difference among varieties (data not shown). All varieties produced tillers. Fastlane and Rendezvous were noted to have shorter and fewer tillers, and CSYBF7-263 consistently produced longer tillers (data not shown).

Results for yield and ear quality are presented in Table 1. Per acre yields have been calculated by multiplying plot yields by the number of plots per acre and likely overestimate expected yield from field scale production. Marketable yield averaged 8.0 tons per acre. Montauk produced the highest yield, 10.5 tons per acre, but was not significantly greater than Sparkler at 9.9 tons per acre. Providence and Primus were similar to Sparkler, at 9.8 and 9.5 tons per acre, respectively. All other varieties produced significantly less than these top four. Powwow, Charisma, Ambrosia, Espresso, BC 0822, CSYBF7-263, Temptation, and Synergy produced between 6.7 and 9.1 tons per acre, significantly more than Rendezvous, Venue, Vitality, Fastlane, and Polka New. Polka New and Fastlane produced the lowest yield, but not significantly less than Vitality.

The number of marketable ears ranged from 1,387 to 1,694 dozen per acre, and averaged 1,610. Espresso, Ambrosia, and Montauk all produced 1,694 dozen per acre, representing one marketable ear from every plant. One other variety in the top 25% was BC 0822. Varieties in the middle range between 1,573 and 1,670 dozen per acre included Charisma, Sparkler, Primus, Temptation, Venue, Polka New, Providence, Powwow, and CSYBF7-263. Varieties in the lowest quartile included Synergy, Vitality, Fastlane, and Rendezvous. Average weight per ear ranged from 0.62 pound (Polka New) to 1.04 pound (Montauk). This weight includes the complete shank. For varieties with long shanks that would be broken off before selling this is an overestimate of the marketable weight. 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. Montauk and Sparkler produced ears a little heavier than would be expected based on their harvest dates, and Venue, BC 0822, Synergy, and Vitality produced ears a little lighter than would be expected based on their harvest dates.

Ear length ranged from 7.4 to 8.9 inches, and diameter ranged from 1.6 to 2.1 inches. The longest ears were produced by Primus and Providence, both 8.9 inches, but not significantly longer than Montauk at 8.5 inches. Ambrosia and Espresso followed, with ears from 8.2 to 8.3 inches and not significantly shorter than Montauk. Fastlane, Venue, and Vitality had the shortest ears at 7.4 inches, but they were not significantly shorter than CSYBF7-263, Polka New,

Rendezvous, Synergy, and Charisma. Varieties with ears 2 inches or greater in diameter included Montauk, Powwow, Synergy, Ambrosia, and Temptation. Of these, the first four did not differ significantly. Polka New, Fastlane, and Venue had the narrowest ears at 1.6 to 1.7 inches. Shank length ranged from 3.2 inches to 6.9 inches and averaged 5.1 inches. Varieties with shanks longer than 6 inches included Providence, Primus, CSYBF7-263, Sparkler, and Montauk. Of these, the first three did not differ significantly. Vitality had the shortest shanks, but did not differ from Espresso. Other varieties in the lowest quartile for shank length (less than 4.5 inches) included Ambrosia, Polka New, and Temptation. Ear length, ear diameter, and shank length were positively correlated with days to harvest. Providence, Primus, Montauk, Ambrosia, and Espresso produced longer ears, and Synergy and Venue produced shorter ears than would be expected based on their harvest dates. Montauk, Ambrosia, and Temptation had wider ears and Venue had narrower ears than would be expected based on harvest date. CSYBF7-263 had longer shanks, and BC 0822, Ambrosia, Espresso, and Vitality shorter shanks than would be expected based on harvest date. Ear height, measured from the ground to mid-ear, ranged from 22.1 inches for Polka New, to 34.7 inches for Charisma and was correlated with harvest date — later varieties tended to have higher ears. Charisma and Rendezvous had higher ears and Synergy ears closer to the ground than would be expected based on harvest date.

Husk cover ratings averaged 3.3. Five varieties averaged 4 or better, indicating at least 1.25 inches of husk cover: CSYBF7-263, Espresso, Sparkler, BC 0822, and Providence. Ambrosia, Vitality, Polka New, Temptation, Montauk, Primus, Synergy, and Charisma averaged between 2.7 and 3.8, indicating 0.75 to 1.25 inches of cover on most ears. Rendezvous, Fastlane, and Venue averaged below 2.5, indicating some ears with less than 0.75 inches of husk cover. Powwow averaged 1.3, indicating that on most ears evaluated husks did not cover the kernels. The husks of Powwow, Rendezvous, Fastlane, Synergy, Venue, Vitality, and BC 0822 were consistently loose around the ear tip. Tip fill ratings averaged 3.8. Rendezvous, Primus, Synergy, Providence, Montauk, Venue, Vitality, Sparkler, and Charisma had good tip fill, averaging 3.9 or more, indicating that most ears had ears with less than 0.5 inch of the tip unfilled. Ambrosia received the lowest rating for tip fill of 2.4, indicating more than 1 inch unfilled on most ears. Charisma received the highest rating for overall ear quality in terms of appearance. Other varieties above the 5.2 average included Polka New, BC0822, Temptation, Synergy, Primus, CSYBF7-263, Providence, Sparkler, and Montauk. Powwow, Fastlane, and Rendezvous received the lowest ratings for overall ear appearance.

Varieties that received flavor ratings of very good to excellent, or better, included Sparkler, Montauk, BC 0822, Primus, and Providence.

Often, producers select one or two varieties in each maturity range so it is helpful to compare varieties of similar maturity. Of the two earliest varieties, Polka New had better husk cover, shorter shanks and ears closer to the ground than Fastlane. Yields and ear sizes were similar. Of the four varieties harvested 67 to 68 DAP, Espresso had the longest ears, Temptation had the widest ears, and Vitality had the shortest ears and received the lowest rating for overall appearance, in part, because husk cover was not very good. Of the five varieties harvested 70 to 72 DAP, Ambrosia had the longest and widest ears, followed by Sparkler, and Venue had the smallest ears. Charisma had the best overall ear quality followed by Sparkler. Yield of Rendezvous was variable and husk cover was not good. Of the six varieties harvested 74 to 77 DAP, Primus and Providence had the longest ears, followed by Montauk, and Synergy had the shortest ears. Overall ear quality was low for Powwow because of poor husk cover.

Careful evaluation of results presented in Table 1 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. Yield, ear size, and quality of synergistic and sugar-enhanced bi-color sweet corn in northern Indiana, 2010. Varieties listed in order of harvest date.

Cultivar	Seed Source ¹	Days to Harvest ²		GDD to Harvest ³	Yield of Marketable Ears		Ear Length <i>in</i>	Ear Dia. <i>in</i>	Shank Length <i>in</i>	Ear Ht. <i>in</i>	Husk Cover ⁴	Husk Tightness ⁴	Tip Fill ⁴	Over-all ⁴	Flavor ⁵
		Pred.	Actual		<i>doz/A</i>	<i>ton/A</i>									
Fastlane	MM	67	64	1,414	1,549±48	5.9	7.4	1.7	5.4	25.1	1.9±0.4	1.0±0.0	3.8±0.1	2.3±0.3	G-M
Polka New	CR	70	64	1,414	1,597±28	5.9	7.5	1.6	4.2	22.1	3.2±0.1	1.9±0.1	3.2±0.1	5.3±0.3	VG-G
Temptation	RI	72	67	1,473	1,629±43	7.6	7.8	2.0	4.3	28.2	3.2±0.4	1.3±0.0	3.4±0.3	6.0±0.0	M
Vitality	RU	65	67	1,473	1,565±43	6.0	7.4	1.8	3.2	24.6	2.8±0.6	1.1±0.1	4.4±0.2	3.0±0.0	M-G
CSYBF7-263	CR	75	68	1,495	1,581±43	7.9	7.5	1.9	6.2	28.9	5.0±0.0	1.4±0.3	3.4±0.1	7.0±0.0	G-VG
Espresso	RU	70	68	1,498	1,694±0	8.2	8.2	1.8	3.6	24.7	4.7±0.3	2.6±0.4	3.0±0.4	5.0±1.0	P
Rendezvous	MM	70	70	1,548	1,387±106	6.8	7.5	1.9	5.2	33.0	1.6±0.1	1.0±0.0	3.9±0.2	2.3±0.3	G-VG
Ambrosia	RU	75	71	1,562	1,694±0	8.5	8.3	2.0	4.0	26.9	2.7±0.0	2.0±0.0	2.4±0.1	4.7±0.3	G-E
Charisma	RU	74	71	1,562	1,662±32	8.5	7.7	1.9	5.1	34.7	3.8±0.5	1.6±0.3	5.0±0.0	8.0±0.0	VG-G
Venue	MM	71	71	1,570	1,613±32	6.7	7.4	1.7	5.3	30.7	2.2±0.1	1.1±0.1	4.4±0.1	2.7±0.3	VG
Sparkler	RU	82	72	1,593	1,646±28	9.9	7.9	1.9	6.1	30.4	4.6±0.2	2.0±0.0	4.4±0.2	7.0±0.6	VG-E
Montauk	MM	79	74	1,638	1,694±0	10.5	8.5	2.1	6.0	34.4	3.3±0.6	2.6±0.3	4.3±0.5	7.3±0.3	E-VG
Powwow	MM	75	74	1,638	1,581±43	8.7	7.8	2.1	5.4	33.8	1.3±0.2	1.0±0.0	3.4±0.1	2.3±0.3	G
BC 0822	SY	77	75	1,675	1,678±16	8.1	7.8	1.9	4.5	32.3	4.4±0.3	1.1±0.1	3.1±0.1	6.0±0.6	E
Synergy	RU	76	76	1,694	1,565±32	7.6	7.6	2.1	5.0	24.6	3.6±0.3	1.0±0.0	4.1±0.1	6.0±0.0	VG-G
Primus	SY	81	77	1,730	1,629±43	9.5	8.9	1.9	6.8	33.2	3.6±0.3	1.3±0.2	4.0±0.3	6.7±0.3	E
Providence	RU	82	77	1,712	1,597±28	9.8	8.9	1.9	6.9	30.8	4.1±0.4	1.3±0.2	4.1±0.2	7.0±0.0	E-VG
<i>Grand Mean</i>					<i>1,610</i>	<i>8.0</i>	<i>7.9</i>	<i>1.9</i>	<i>5.1</i>	<i>29.3</i>	<i>3.3</i>	<i>1.5</i>	<i>3.8</i>	<i>5.2</i>	–
<i>LSD .05⁶</i>					–	<i>0.7</i>	<i>0.4</i>	<i>0.1</i>	<i>0.8</i>	<i>2.5</i>	–	–	–	–	–
<i>r²</i> ⁷					<i>ns</i>	<i>0.51</i>	<i>0.38</i>	<i>0.37</i>	<i>0.30</i>	<i>0.37</i>	–	–	–	–	–

¹Seed Source: CR=Crookham, MM=Mesa Maize, RI=Rispens, RU=Rupp, SY=Syngenta.

²Days from planting to harvest. Predicted number is from seed supplier.

³GDD=corn growing degree days.

⁴Husk 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.

⁵Flavor: F=fair. G=good. VG=very good. E=excellent. Summary of ratings by one person for three ears per cultivar.

⁶Means differing by more than this amount are significantly different at $P \leq .05$ based on Fisher's Protected LSD. – =AOV not performed.

⁷ r^2 for regression vs. actual days to harvest is the proportion of variability explained by days to harvest. ns=regression not significant at $P \leq .05$.