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Sweet Corn Population Effects on Yield and Ear Quality, 2007

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Current recommendations for fresh market sweet corn suggest row spacing of 30 to 40 inches and in-row spacing of 8 to 10 inches for early varieties and 9 to 12 inches for late varieties. This corresponds to populations from 13,068 to 26,136 plants per acre. Variety trials at Pinney-Purdue Agricultural Center have been planted at row spacings of 30 or 36 inches and populations of 20,328 plants per acre. Some cultivars may perform well at higher populations. This trial was conducted to evaluate yield and ear characteristics of two cultivars at populations up to 50% higher than normally used in Purdue variety trials.

Materials and Methods

The trial was conducted on a Tracy sandy loam with 2.4% organic matter and 57 ppm phosphorus (P), 139 ppm potassium (K), 180 ppm magnesium (M)g, 750 ppm calcium (Ca), and pH 6.7. It was set up as a randomized complete block design with four replications. Treatments formed a factorial, with two cultivars (Holiday and Optimum R.) and four populations (100%, 110%, 120%, and 150% of the standard 20,328 plants per acre). Treatments were assigned to individual plots four rows (10 feet) wide by 30 feet long. In two reps, Holiday at 110% had only three or two rows due to restrictions on plot size. Prior to seeding, 70 lbs./A N, atrazine and s-metolachlor were broadcast and incorporated. Corn was seeded 29 June 2007 with a finger pick-up planter set to drop 35,600 seeds per acre, and later thinned to the desired stand for each treatment. N (20.3 lbs./A) and P (18.2 lbs./A of P_2O_5) were applied at planting from 19-17-0 (10 gal. /A). To control rust, propiconazole (Tilt, 4 oz./A) was applied on July 27 and August 11, and mancozeb (Dithane DF, 1.5 lbs./A) was applied on August 3. Either permethrin (Arctic 3.2EC, 6 oz./A) or zeta-cypermethrin (Mustang, 4.2 oz./A) was applied on August 16, 27, 29, 31, September 4 to control caterpillars. Irrigation was applied to incorporate herbicides and during the growing season as needed. Distance from the soil to the node of the primary ear was measured for five ears per plot. All plots of each cultivar were harvested on the same day. All primary ears from the center two rows of each plot were harvested. For the two reps of Holiday at 110% population with less than four rows, only one row was harvested. The weight and number of marketable ears were recorded and converted to per acre values based on area harvested. Three marketable ears from each plot were used to evaluate degree of husk cover, husk tightness, and degree of tip fill. Average ear diameter and length after husking, and shank length were determined for 10 marketable ears per plot. The number of USDA Fancy ears out of the 10 was recorded. The number and weight of cull ears were determined. Rating scales are described below. Quantitative data meeting assumptions of ANOVA were analyzed using ANOVA to test for the main effects of rep, cultivar, and linear and quadratic trends with respect to population. Interactions between cultivar and linear or quadratic trends were evaluated further when significant at $P \leq 0.15$.

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Characteristic	Rating Scale
Husk Cover	5: > 2 inches covered, 4: 1.25-2 inches, 3: 0.75-1.25 inches, 2: < 0.75 inches, 1: ear exposed
Husk Tightness	3: tight, 2: firm, 1: loose
Tip Fill	5: kernels filled to tip of cob, 4: < 0.5 inch unfilled, 3: 0.5 to 1 inch unfilled, 2: > 1 inch unfilled, 1: > 2 inches unfilled

Results and Discussion

For both cultivars the number of marketable ears per acre showed a similar linear increase as plant population increased (Fig. 1A). Over the population range investigated, an increase of 1,000 plants per acre led to 35 dozen more marketable ears. Marketable yield in tons per acre was not influenced by population (Fig. 1B). Holiday produced 5% more marketable ears and 6% greater yield than Optimum R.

For both cultivars the average weight of a marketable ear decreased as plant population increased (Fig. 1E). Over the population range investigated, an increase of 1,000 plants per acre led to a decrease in average ear weight of 0.15 ounce, or about 1.8% of the average weight per ear. Average ear weight did not differ between the cultivars. Marketable ear length and diameter both decreased as population increased (Figs. 1F and 1G). Over the population range investigated, an increase of 1,000 plants per acre led to a decrease of 0.017 inch and 0.0035 inch for length and width, respectively, corresponding to about 0.2% of the average dimensions. Holiday had significantly longer and wider ears than Optimum R. Shank length averaged 2.75 inches for Optimum R. and 2.22 inches for Holiday. Over the population range investigated, an increase of 1,000 plants per acre led to a decrease in shank length of 0.034 inch (data not shown). Holiday produced ears higher on the stalk than Optimum R., 24.2 inches versus 15.3 inches. As population increased, there was a gradual but significant trend towards greater ear height for both cultivars. An increase in 1,000 plants per acre led to 0.14 inch increase in ear height (data not shown).

Quality of marketable ears as measured by the proportion of USDA Fancy ears declined as population increased for Optimum R. but not for Holiday (Fig. 1C). Over the population range investigated, an increase of 1,000 plants per acre led to 4% fewer Fancy ears for Optimum R. Overall, Optimum R. produced a higher proportion of Fancy ears than Holiday. Ratings for the quality characteristic of tip fill declined for both cultivars as population increased (Fig. 1H). Over the population range investigated, an increase of 1,000 plants per acre led to a decrease of 0.1 in the rating for tip fill. Optimum R. had better tip fill than Holiday, 4.0 versus 2.8. Ratings for husk cover and husk tightness did not show trends with respect to population (data not shown). Optimum R. averaged 5 and Holiday averaged 3.7 for husk cover; the two had similar ratings for husk tightness, averaging 1.3. The percent of cull ears, increased as population increased for Holiday but not for Optimum R. (Fig. 1D) Optimum R. averaged 12% culls and Holiday averaged 9% culls over all populations.

Increasing plant population by 50% resulted in 23% more marketable ears, but also led to reduced ear quality and smaller ears. Reduction in quality was related to reduced tip fill, a smaller proportion of Fancy ears (for Optimum R.), and a greater percentage of cull ears (for

Holiday). The ideal population for any particular farm will take into account both yield and quality in addition to production costs and expected revenue.

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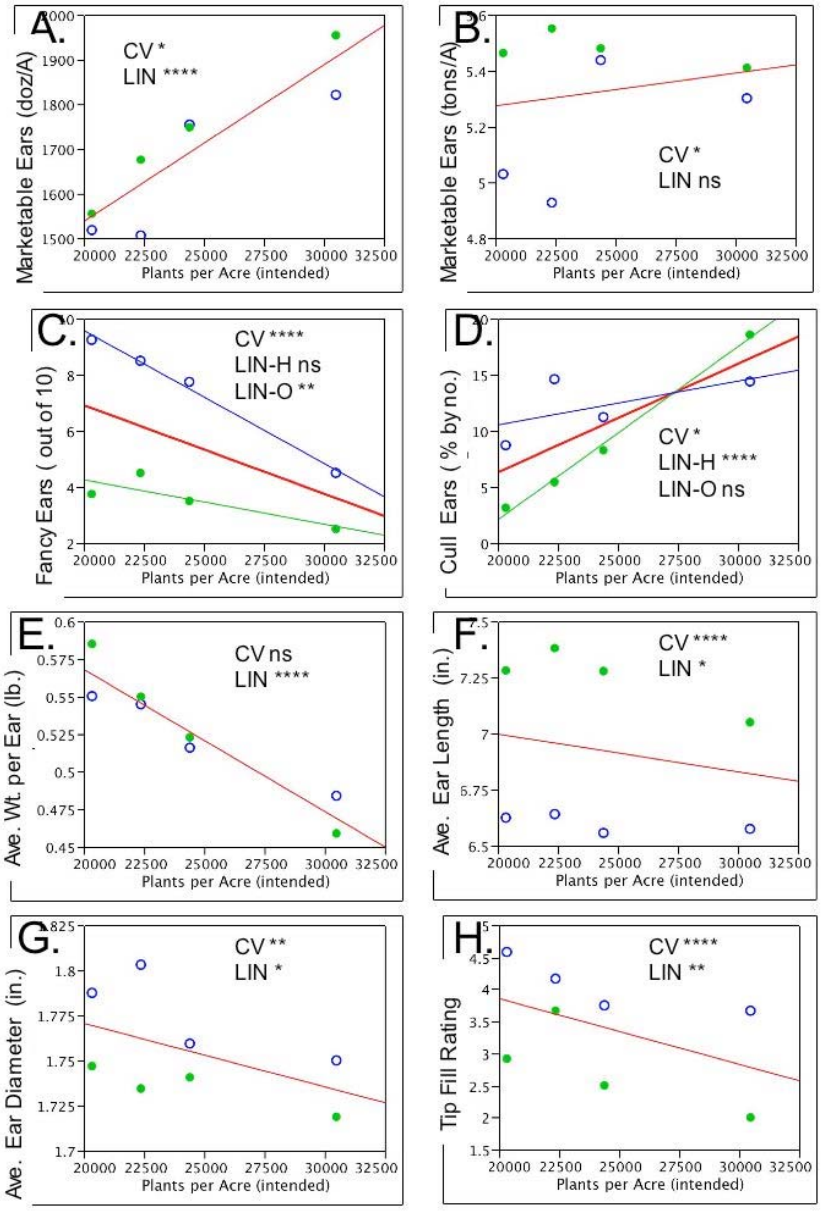

Figure 1. *Relationships between yield and ear characteristics of Holiday and Optimum sweet corn and plant density, Wanatah, Indiana, 2007. Open circles=Optimum; Solid circles=Holiday. Significance of cultivar main effect (CV), linear trend across cultivars (LIN), or, if CV X LIN significant at P<.10, linear trend for each cultivar separately (LIN-H and LIN-O) indicated by ****=P≤.0001, **=P≤.01, *=P≤.05, ns=not significant.*

A. Number of marketable ears per acre.
B. Yield of marketable ears per acre.
C. Number of Fancy ears out of 10.
D. Percent cull ears by number.
E. Average weight per ear.
F. Average ear length.
G. Average ear diameter.
H. Tip Fill Rating.