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Sweet Corn (Zea Mays L.) Cultivar Evaluation

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Abstract

A field study was used to determine the effects of agronomic practices (Treatments) on the growth and yield potential of "Devotion", "Obsession", "Passion", and "Silver Queen" sweet corn (zea mays L.) cultivars. The study was conducted on a Memphis Silt Loam, (Fine silty, mixed thermic), Typic Hapludolfs soil at the Alcorn State Experiment Station, in southwest Mississippi. Data indicate that Devotion cultivar had least (0.00) plant lodging per block, highest (4.52) value for ear cover, row count (17.2), ear grain fill (2.40) and Least (0.20) ear insect infestation. Obsession cultivar had highest (8.00) value for husk color, plant tiller (1.92), plant lodging (2.00), number of ear flags (5.60), marketable ear number (29,247.13) and weight (20, 722.08lb) per acre, individual unhusked ear (0.63 lb.), and husked ear (0.52 lbs.). passion cultivar also had zero plant lodging, longest ear length (7.85 inches), cylindrical in shape, and highest ear grain fill (2.40) as Devotion and Obsession. Silver Queen cultivar had more difficult to snap ear (1.60), highest value (6.10) for husk tightness, and eating quality (1.46). obsession cultivar which had highest marketable yields and yield components could be considered superior to Devotion, Passion and silver Queen cultivars evaluated in this study.

1.0 Introduction

Sweet Corn (Zea Mays L.) which is a variety of maize with a high sugar content belongs to the Gramineae (grass) family. It is a warm season crop that depends on high soil temperature for good germination and growth. It is one of the most popular vegetables in the USA with its popularity increasing in Asia and Europe (Tracy, 1993). In the USA, the farm value of sweet corn for processing ranks second only to tomatoes. It ranks number one in sweet corn productions followed by China, Brazil, India, and Argentina (Elicia, 2020).

Sweet corn grows on over 2,000 acres in the State of Mississippi where it is mainly grown for local market, and often not packaged or cooled prior to sale. The varieties grown in Mississippi include Jubilee, Merit, Silver Queen, and Sweet G-90. (Burnham, 1998).

The development of sweet corn varieties with enhanced sugar content is gaining popularity not only in India but in international market (Kumar, 2008). Sweet corn is a special type of maize bred for high sugar content. The total sugar content in sweet corn ranges from 25-30% (Kumar *et al*., 2012). At optimum market maturity, sweet corn will contain 5 to 6% sugar, 10 to 11% starch, 3% water soluble polysaccharide and 70% water, and moderate levels of protein, vitamin A, and potassium (Najeeb *et al*., 2011). Kernel color, sugar rate and yield are important characteristics for the processing industry (Boyette *et al*., 1990). The key to high quality sweet corn production is rapid growth, adequate soil moisture and nutrients and harvesting at optimum maturity (Canatoy, 2018). Soil moisture is found critical for the germination of sweet corn, as it absorbs more water than other types for germination to occur (Cox, 2010).

In Argentina, sweet corn production has been steadily growing in recent years and is currently a horticultural crop of great importance for both fresh consumption and for the food industry (Bertolaccini *et al*., 2010). It is a warm-season crop adapted to temperate climate although usually affected by weak seed vigor and common poor seed emergence (Zhao *et al*., 2007). Early and late out of season production in sweet corn for fresh consumption is of great significance due to the high price of ear (Bozokalfa *et al*., 2004). Producers extend harvest by staggering planting dates and planting hybrids with different maturity dates (Williams 2008).

Since one of the research objectives at the Alcorn Experiment Station is to identify new alternative crops that will adapt to the Memphis silt loam and enhance the income and quality of life of both producers and consumers, in the state, this study was used to evaluate three new sweet corn varieties for growth and yield potential in southwest Mississippi.

2.0 Purpose and Objectives

A field experiment was used to determine the effect of different agronomic practices on the growth and yield potential of "Devotion", "Obsession" and "Passion" sweet corn (Zea Mays) cultivars. These cultivars were developed by the Monsanto Seed Company, distributed by the Rupp Seeds, Incorporated, among other companies. The specific objective was to compare the three new and standard (Silver Queen) sweet corn cultivars planted in Memphis silt loam (Typic Hapludalfs: fine silty, mixed thermic) soil at the Alcorn Experiment Station in the southwest Mississippi for adaptation, growth and yield components.

3.0 Materials and Methods

A field experiment was used to determine the effects of agronomic practices (Treatments) on the growth and yield components of "Devotion", "Obsession", "passion", and "Silver Queen" sweet corn (Zea Mays L.) cultivars. Whereas the Devotion, Obsession and Passion cultivars are new to the State of Mississippi, Silver Queen is considered a standard cultivar in this study. The study was conducted on a Memphis silt loam soil in southwest Mississippi.

Field preparation was limited to single disking and row preparations. The experiment plot design was Randomize Complete Block (RCB) where each row was 20.0 feet long, 4.0 feet wide and replicated 4 times. Tractor was used for disking and row preparations. Three pounds of fertilizer 13N-13P-13K was applied per row at row preparation. Weed control was by minimum tillage with rototiller, hoeing and hand pulling as needed, whereas early prevention of insect infestation was with Seven(R) Insect Killer. Three kernels (seeds) were planted at 2.0 inches depth and thinned to a single plant at 10.0 inches apart, on rows 12.0 inches apart after plants were 3 to 4 inches tall.

Four rows on each bed were planted with each of the 3 test plants (new cultivars) and a standard or control (Silver Queen) cultivar. The two outside rows on each bed served as borders to protect the two middle rows which served as the "Experimental Rows", used for data collections from each cultivar. Data collections on the growth and growth components include kernel (seed) germination, tillers per plant, plant lodging per row and ear insect infestations. Collections on yield and yield components include ear ease of snap, ear cover, husk color, shank length, ear length and shape. Data were also collected on ear row count, grain fill, eating quality, grain and marketable yields.

Seed germination from the experimental rows were first determined, 11 days from the seeding, and repeated 7 days later, before the percent germination from each block was reported for each cultivar. Thirty days from the seeding date, the seedlings were thinned down to one plant per till. Sixty-one days from the seeding date, data were collected on insect infested ears, tiller per plant, and plant lodging per row. Ninety-five from the seeding date, ears were harvested, and data were collected on ease of snap, ear cover, flags per ear, hush color, shank length, ear length

and shape, ear row count, ear grain fill, eating quality and grain row pattern, and marketable yields (ear numbers and weights). The average values for the data collected from the experimental rows of each block were used for the statistical analysis of variance (ANOVA) and means (averages) were separated by the Least significant difference (LSD) test procedure (Steel *et al*., 2006).

4.0 Results and Discussion

Treatment effects on sweet corn cultivars kernel germination, plant tillers, plant lodging, ear ease of snap, ear cover and ear flags are presented in Table 1. Although kernel germination percent was not significant among cultivars evaluated in this study, their average (82.25%) due to a range from 80% for Passion cultivars to 85% for Devotion cultivar were comparable to the 79.40% average due to a range from 64% for Coastal cultivars to 90% for Passion cultivar reported for southwest Georgia (Andre et al., 2020). The highest germination percent reported for Passion cultivar in Georgia could be due to differences in field environment and/or variations in the agronomic practices. Treatment effects were significant for plant lodging and ear cover and highly significant for flags per ear. Plant lodging was highest (2.0) for Obsession cultivar, whereas no plant lodging was observed for Devotion, Passion, and Silver Queen cultivars. This could mean that the three cultivars with zero lodging, have stronger underground fibrous roots and aboveground prop roots for greater anchorage and the plants supply of water and nutrients (ESAU, 1977) than Obsession cultivar. However, this highest lodging value reported for Obsession is comparable to $2.3^{+}/_{-}$ 0.7 for Variant cultivar, and lower than $6.7^{+}/_{-}$0.9 for Temptation cultivar (Maynard, 2008). The value for ear cover was highest (4.52) for Devotion cultivar but was not different from 4.51 reported for Obsession in this study. Both cultivars had best ear covers compared to Passion and Silver Queen cultivars. Ear flags or leaves were highest (5.60) for obsession but was not different from 4.72 and 4.60 reported for Passion and Devotion cultivars, respectively. Ear flag leaves are important to corn plants, because they capture more sunlight leading to higher yields (Bechman, 2017).

Treatment effects on sweet corn cultivar husk color, shank length, husk tightness, ear length and ear shape are presented in Table 2. Both Obsession and Passion cultivars have dark green husks, whereas the Devotion has dark husks and Silver Queen has light green husks. They are leaf-like structures that wrap around the ear for protection, and have significant C_3 fixation of CO_2, contributing to the production of 16% husk cellulose (Yakir et al., 1991). Shank length value was highest (3.50 inches) for Passion cultivars, and lowest (2.26 inches) for Silver Queen cultivars. The average shank length (2.94 inches) reported for these cultivars is comparable to 3.4 inches average reported for 12 other cultivars (Maynard, 2008). Ear length was longest (7.88 inches) for Passion cultivar but was significantly different only from the 6.84 inches reported for Silver Queen cultivar. The ear shape is cylindrical for all cultivars.

Treatment effects on ear row count, ear grain fill, eating quality, ear weight and grain arrangement are reported in Table 3. Ear row count was highest (17.2) for Devotion cultivar, and lowest (12.8) for Silver Queen cultivar. The value for Devotion cultivar was not significantly different from 16.6 rows reported for Obsession cultivar. Corn hybrids characterized by "girthy" ears exhibit more kernel rows than hybrids with tapering ears (Nielsen, 2007). The ear grain fill value was significantly highest (3.70) for Silver Queen cultivar. The value indicates that this cultivar has moderate grain fill, whereas the other three cultivars with score of 2.40 each possess ears with good grain fill. The eating quality scores for row sweet corn cultivar range from 1.29 for Obsession cultivar to 1.46 for Silver Queen cultivar. The quality was considered generally as very good, based on the flavor of the raw kernels, for the four sweet corn cultivars evaluated. The quality of the sweet corn raw product is influence by tenderness and maturity (Campbell and Mckerie, 1967). Grain row pattern or arrangements were curved for Devotion and Obsession (CR), slightly curved

Table 1: Sweet corn cultivar kernel germination, plant tillers, plant lodging, ease of snap, ear cover and ear flags.

Sweet Corn Cultivar	Kernel Germination (%)	Plant Tillers	Plant Lodging	Ear Ease of Snap	Ear Cover	Ear Flag
Devotion	85[U]	1.64[V]	0.00[W]	1.40[X]	4.52[Y]	4.60[Z]
Obsession	81.70	1.92	2.00	1.20	4.51	5.60
Passion	80.00	2.28	0.00	1.40	4.34	4.72
Silver Queen	82.30	2.10	0.00	1.60	4.25	3.12
Mean	82.25	1.99	0.50	1.40	4.41	4.51
LSD, 5%	NS	NS	0.30	NS	0.08	1.00
LSD, 1%	NS	NS	NS	NS	NS	1.40
CV, %	24.50	23.99	21.40	45.53	10.10	16.05

[U] Values represent percent germination 18 days after seeding. [V] Values are average number of tillers per plant. [W] Values represent average number of plants lost per blocks due to wind pressure. [X] Where 1 = easy to pull, 2-5= difficult to pull. [Y] Where 1 = partial cover, 2-5= covered to the tip. [Z] Where 1 = no flag, 2-5= numerous flags

Table 2: Sweet Corn cultivar husk color, shank length, husk tightness, ear length and ear shape

Sweet Corn Cultivar	Husk Color	Shank Length (Inches)	Husk Tightness	Ear Length (Inches)	Ear Shape
Devotion	10.00[X]	2.62	5.70[Y]	7.52	CY[Z]
Obsession	8.00	3.36	5.80	7.84	CY
Passion	8.00	3.50	5.60	7.88	CY
Silver Queen	15.0	2.26	6.10	6.84	CY
Mean	8.2	2.94	5.80	7.52	-
LSD, 5%	4.0	0.42	NS	0.38	-
LSD, 1%	5.6	0.58	NS	0.52	-
CV, %	28.23	10.34	28.18	3.58	-

[X] Where 5 = dark green, 10 = green, 15= light green. [Y] Where 5 = very tight, 10 = tight. [Z] Where CY = cylindrical

Table 3: Sweet corn cultivar ear row count, ear grain fill, eating quality, ear weight and grain arrangement.

Sweet Corn Cultivar	Ear Row Count	Ear Grain Fill	Eating Quality Raw	Grain Row Patter	Insect Infestation Per Ear
Devotion	17.2[V]	2.40[W]	1.32[X]	CR[Y]	0.20[Z]
Obsession	16.6	2.40	1.29	CR	4.80
Passion	15.8	2.40	1.40	SCR	0.88
Silver Queen	12.8	3.70	1.46	SR	1.75
Mean	15.6	2.73	1.37	-	1.91
LSD, 5%	0.92	0.93	NS	-	2.51
LSD, 1%	1.28	NS	NS	-	2.31
CV, %	4.26	4.9	39.48	-	14.20

[V] Average rows for 5 husked ears per block. [W] Where 1 = good, 5 = moderate grain fill. [X] Where 1 = very good, 5 = good [Y] Where CR = curved row, SCR = Slightly curved, SR = Straight. [Z] Where 1 = slight infestation, 5 = major infestation

(SCR) for Passion cultivar and straight (SR) for Silver Queen cultivar. Insect infestation per ear was least for Devotion (0.20) and highest (4.80) for Obsession cultivar. The generally low cornworm infestation observed could be due to the early planting and proper weed management during the study period. Nagel (2021) reported that early planted sweet corn in Mississippi mature before the corn earworm population becomes large enough to reduce quality of harvested crops.

Treatment effects on sweet corn cultivar marketable ear number and weight are presented

Table 4: Sweet Corn cultivar marketable ear number and weight

Sweet Corn Cultivar	Marketable Unhusked (#/A)	Marketable Unhusked (lb./A)	Marketable Individual Unhusked (lb.)	Marketable Individual Husked (lb.)
Devotion	21,033.26	13,192.44	0.63	0.52
Obsession	29,247.13	20,722.08	0.70	0.56
Passion	24,891.43	17,837.28	0.69	0.50
Silver Queen	18,979.71	12,445.68	0.59	0.40
Mean	23,537.88	16,049.37	0.65	0.50
LSD, 5%	552.28	382.19	0.06	0.05
LSD, 1%	639.92	443.90	NS	0.08
CV, %	14.39	17.27	6.33	7.75

[x] Values are based on individual husked and unhusked ears from the experimental rows.
[y] Values are based on the averages of the total yields per block.

in Table 4. The marketable unhusked ear number per acre was significantly highest (29,247.13) for Obsession cultivar, and lowest (18,979.71) for Silver Queen cultivar. Their weights per acre are also highest (20,722.08 lbs.) for Obsession cultivar, and lowest (12,445.68 lbs.) for Silver Queen sweet corn cultivar. The values for individual unhusked sweet corn ears were highest (0.70lb) for Obsession cultivar and lowest (0.59 lb.) for Silver Queen cultivar. The Obsession cultivar also had highest (0.56 lb.) weight for individual husked sweet corn cultivars. The yield per acre is generally comparable to the grand mean (1,478.00 dozen per acre) reported for 12 sweet corn cultivars in Northern Indiana (Maynard, 2008). These values are also generally higher than 13,000.00 to 24,000.00 for unhusked marketable ear reported for the State of Iowa (ICES, 2020).

5.0 Conclusions

Data suggest that the newly introduced sweetcorn cultivars (Devotion, Obsession and Pasion) which showed generally better growth and yield potential than the standard cultivar (Silver Queen) could be profitable additions to cultivars currently available to sweet corn producers in Mississippi. The Obsession cultivar which had highest significant yield potential could be considered superior to both the Devotion and Passion cultivars. Findings indicate that the three newly sweet corn cultivars planted during the third week of March in southwest Mississippi will produce marketable yields before the early summer high temperature in July in the region. Using appropriate agronomic practices to prevent or significantly control weeds and other pests early in the growing season will lead to the production of high-quality ears and cobs by the three sweet corn cultivars evaluated in this study. The higher germination percent (90%) reported for Passion cultivar in Georgia (Amite et al., 2020) compared to (80%) reported for the same cultivar in this study could be due to differences in field environment and/or method(s) or agronomic production practices used at different locations. Where wind pressure impacts growth and development, both Devotion and Passion cultivars which had stronger underground fibrous roots, and aboveground prop roots for greater plant anchorage are to be considered.

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