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BEHAVIOR OF SOME MAIZE HYBRIDS CULTIVATED WITH DIFFERENT PLANT DENSITIES

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ABSTRACT

Two field experiments were carried out at the Agric. Exp. Sta. Fac. Agric., Cairo Univ., Giza, during 2009 and 2010 seasons to study the response of three hybrids of maize, *Zea mays* L. (S.C. 10, S.C. 122 and T.W.C. 321) to four plant densities (4.76 plants/m^2, 5.56 plants/m^2, 6.67plants/m^2 and 8.33 plants/m^2) on yield and yield components. Results showed that, significant differences between maize hybrids in plant height, number of ears/plant, barren %, LAI, number of kernels /row, grain weight/ear and grain yield/plant in both seasons.

Number of rows per ear, number of ears/plant, number of kernels per row, weight of grains/ear, seed index, shilling percentage and grain yield/plant decreased significantly and gradually by increasing plant densities from 4.76 plants/m^2 to 8.33 plants/m^2. Plant height, barren %, LAI and grain yield per hectare significantly increased by increasing plant densities from 4.76 plants/m^2 to 8.33 plants/m^2. The highest grain yield/ha (9.96 and 10.32 ton/ha) were obtained by planting 8.33 plants/m^2 in 2009 and 2010 seasons. The lowest 7.88 and 8.28 tons/ha were recorded by planting 4.76 plants/m^2 in 2009 and 2010 seasons, while planting 6.67 plants/m^2 and 5.56 plants/m^2 were intermediate in grain yield/ha. Increasing plant density from 4.76 plants/m^2 to 8.33 plants/m^2 increased grain yield/ha by 25.70 and 24.98 % in 2009 and 2010, respectively, while this increase was 11.09 and 8.05 % for plant density of 6.67 plants/m^2 in 2009 and 2010 seasons. The effect of the interaction between hybrids differences and plant density treatments on yield and yield components are not significant in most studied characters except number of ears/plant, LAI and grain yield/plant.

Keywords: Maize (*Zea mays* L), hybrids, plant densities ,grain yield, ear attributes.

INTRODUCTION

Maize (*Zea mays* L.) as a cereal crop either in the world or in Egypt ranks the third most important cereal crop after wheat and rice. It has a great utility in human consumption, poultry feed and agro industry. According to Report of USDA, 2009, Egypt grew 0.72 million hectares and produced 6.17 million tons of grains, with an average yield of 8.58 tons per hectare in 2008. According to the same report, Egypt ranks the fourth in the world with respect of average productivity after USA, France and Italy. Egypt imports every year about five million tons of maize grains to reach self-sufficiency of maize production.

Grain yield of maize is more affected by variations in plant density than other members of the grass family because of low tillering ability, monoecious floral organization, and the presence of a relatively short flowering period. For each production system, there is an optimum plant density that maximizes grain yield. Maize population for maximum economic grain yield varies between 30,000 to over than 90,000 plants per hectare (Olson and Sanders, 1988). The optimum plant density plays a great role in increasing maize productivity (Al-Shebani, 1998). The use of lower plant densities delays canopy closure and increase light interception, leading to high grain production per plant but low grain production per unit area (Andrade *et al*., 1999). On the other hand, higher plant densities enhance interplant competition for assimilates, water and nutrients (Edmeades *et al*., 2000). High plant densities also stimulate barrenness and increase the anthesis-silking interval (Sangoi *et al*., 2002), thereby reducing kernel number per unit area - the main yield component of maize. Alias *et al.* (2010) observed that Pioneer-30D55 maize hybrid surpassed Pioneer-3012 and Pioneer-3062 with respect to all agro physiological traits i.e. leaf area index and dry matter accumulation with significant variation between them. Dahmardeh (2011) reported that grain yield of maize increased with increasing plant density and the highest amount of grain yield was obtained at 100,000 plants ha^{-1}.

There are many efforts were focused on increasing productivity of this crop by growing new high yielding hybrids under the most favorable plant density which may vary according the environmental conditions. The purpose of the present investigation was to identify the best maize hybrid, optimum plant density for each hybrid for obtaining higher yield.

MATERIALS AND METHODS

This study was carried out in 2009 and 2010 summer seasons at Agric. Exp. Sta., Fac. Agric., Cairo University, Giza, Egypt. Three different maize hybrids (S.C. 10, S.C. 122 and T.W.C. 321) were kindly provided by Maize Res. Dept., Agric. Res. Center (ARC).

Grains of the three tested hybrids of maize were sown on May 21 in the 1st season and May 30 in the 2nd one under four plant densities, i.e. 4.76 plants/$m^{2,}$ 5.56 plants/m^2, 6.67plants/m^2 and 8.33 plants/m^2. The soil of the experimental site was clay loam. A split-plot design with randomized complete blocks arrangement in five replicates was used. Main plots were devoted to the three maize hybrids. Sub-plots were assigned to the four plant densities. Each sub-plot consisted of four ridges, 4 m length and 0.6 m width for each ridge.

At harvest, 10 guarded plants from each plot were randomly taken to measure the following individual plant characters, i.e. leaf area (LA) which was recorded according to Francis *et al*. (1969) as follows: Leaf length x maximum width x 0.75. Plant height, barren stalks, number of ears per plant was also recorded. Number of ears per plant was calculated by dividing number of ears per plot on number of plants per plot. Number of rows per ear and number of kernels per row were recorded using five random ears/plot at harvest. Seed index mean using shelled grains of each plot to two samples of 100 kernels weight was adjusted at 15.5% grain moisture. Shelling percentage was estimated by dividing the grain yield per plot (adjusted at 15.5% grain moisture) on weight of ears/plot at harvest. Grains weight per ear was estimated by dividing the grain yield per plot (adjusted at 15.5% grain moisture) on number of ears/plot at harvest. Grain yield per plant estimated by dividing the grain yield per plot (adjusted at 15.5% grain moisture) on number of plants/plot at harvest. Grain yield per hectare by adjusting grain yield / plot to hectare.

Analysis of variance of the split plot design was computed according to Snedecor and Cochran (1967). LSD values were calculated to test the significance of differences between means.

RESULTS AND DISCUSSION

Grain yield and its attributes of three maize hybrids

Data presented in Table (1) showed significant differences between maize hybrids in both seasons in grain yield and its attributes. Plants of S.C.10 were the tallest in the first and second season (258.8 and 216.9 cm, respect.). The shortest ones were that of S.C.122 in 1stseason and 2nd season (236.4 and 197.6 cm, resp.). This result is in agreement with those reported by yokozawa and Hara (1995) and Shams El-Deeb and El-Habbak (1996). Height of maize plants can vary depending on the hybrid and growing condition (Gyner-Hegyi *et al.,* 2002). The minimum LAI was recorded in S.C.122 hybrid plants, while the highest LAI was observed in S.C.10 plants.

The highest number of ears per plant was that of S.C.122 hybrid in 2010 season (0.94) and S.C.10 hybrid in 2009 season (0.92). Differences in number of ears/plant between maize hybrids may be due to the genetically differences between them. Single cross 10 surpassed all maize hybrids in grain weight/ear, while the T.W.C. 321 hybrid had the lowest grain weight/ear. The difference between maize hybrids in weight grains/ear may be due to difference in genetic makeup. Similar results were reported by Sharifi *et al*. (2009), Compean *et al*. (2009), Gozubenli (2010) and Alias *et al.* (2010).

S.C.122 hybrid had the highest number of kernels per row was 39.0 in the first season and 36.9 in the second one, while S.C.10 hybrid had the lowest number of kernels per row (36.1) was that of S.C.10 hybrid in the second season and T.W.C.321 hybrid in the first season. Hybrids did not show significant effect on seed index (Table 1). The three hybrid maize did not significantly differ in shilling percentage in both seasons (Table 1).

The minimum percentage of barren plants (8.1 %) was recorded with S.C.10, while the highest percent (9.9) was observed in the T.W.C. 321 hybrid. Moreover, S.C. 122 was intermediate in percentage of barren plants. Ritchie and Alagarswamy (2003) indicated that maize genotypes appear to have major genetic differences in barrenness.

S.C. 122 surpassed all maize hybrids in grain yield/plant, while S.C. 10 and T.W. C. 321 were the lowest in the grain yield/plant in 2010, respectively. The superiority of S.C. 122 might have been due to lower percentage of barren plants, longer ears, higher weight of grains/ear and higher shilling percentage. The lower potential ability of S.C. 10 and T.W.C.321 may be attributed to the lower values of ear characteristics and shelling percentage. Duncan (2002) reported that yield reduction per plant was due to the effects of interplant competition for light, water, nutrition and other potentially yield limiting environmental factors, similar results were reported by Azam *et al*.

(2007), Compean *et al*. (2009), Sharifi *et al*. (2009), Alias *et al*. (2010) and Gozubenli (2010).

Grain yield per hectare significantly influenced by plant densities (Table 1). It could be concluded that differences between maize hybrids may be due to the genetically differences between them.

Table 1: Differences between grain yield and its attributes of some maize hybrids in 2009 and 2010 seasons.

Agronomic Traits	Maize hybrids		
	S.C. 10	S.C. 122	T.W.C. 321
2009 season			
Plant height (cm)	258.8 a	236.4 c	251.1 b
Leaf area index	6.9	6.6	6.8
Silking (%)	72.0	72.0	72.0
Ears /plant (no)	0.92 a	0.88 b	0.89 b
Barren (%)	8.2	8.8	9.9
Rows /ear (no)	12.2	12.2	12.7
Kernels/ row (no)	38.4 a	39.0 a	36.5 b
Seed index(100kernel),gm	38.5	37.7	39.1
Ear grain weight(gm)	181.9	191.3	189.3
Shelling (%)	89.84	91.18	90.56
Grain yield/plant (gm)	167.4	168.8	167.0
Grain yield/ha (ton)	8.90	8.90	8.70
2010 season			
Plant height (cm)	216.9 a	197.6 b	201.4 b
Leaf area index	6.3 a	4.9 c	5.7 b
Silking (%)	71.0	72.0	71.0
Ears /plant (no)	0.90 b	0.94 a	0.90 b
Barren (%)	8.1 b	8.5 ab	9.3 a
Rows /ear (no)	12.5	12.5	12.5
Kernels/ row (no)	36.1 b	36.9 ab	37.6 a
Seed index(100kernel),gm	38.6	38.6	38.0
Ear grain weight(gm)	196.2 a	191.0 b	190.2 b
Shelling (%)	91.34	91.64	91.87
Grain yield/plant (gm)	171.4 b	186.5 a	175.3 b
Grain yield/ha (ton)	9.14	9.07	8.90

Means in the same row followed by the same litter are not significantly different at 5% level of probability.

Effect of plant density on maize grain yield and its attributes

Data presented in Table (2) illustrate that the significant differences among planting densities were found in plant height in the first season only. Increasing plant density from 4.76 plants/m^2 to 5.56 plants/m^2 and from 5.56 plants/m^2 to 6.67 plants/m^2, and also from 6.67 plants/m^2 to 8.33 plants/m^2 significantly increased plant height by 0.86%, 1.54% and 2.28% in the first season. Yokozawz and Hara (1995) who cited that height of the final plant is strongly influenced by environmental conditions during stem elongation. Similar results were obtained by Ali *et al*. (1994), Shams El-Deen and El-Habbak (1996), Amany Mohammed (1999), Eisa Nadia (1998) and Hassan

(2000). However, Bangarwa *et al*. (1993) found that plant height was not affected by plant densities treatments.

Table 2: Maize grain yield ant its attributes as affected by four plant densities in 2009 and 2010 seasons.

Agronomic Traits	Plant densities (plants/m2)			
	4.76	**5.56**	**6.67**	**8.33**
2009 seasons				
Plant height (cm)	244 c	246 bc	250 b	256 a
Leaf area index	5.3 d	5.9 c	7.2 b	8.8 a
Silking (%)	71.1 b	72.3 a	72.2 a	72.9 a
Ears /plant (no)	0.93 a	0.91 a	0.87 b	0.87 b
Barren (%)	6.5 b	6.2 b	7.3 b	15.8 a
Rows /ear (no)	12.9 a	12.2 b	12.2 b	12.0 b
Kernels/ row (no)	40.5 a	38.9 b	37.6 b	34.7 c
Seed index(100kernel),gm	42.7 a	40.7 b	37.2 c	33.2 d
Ear grain weight(gm)	205.2 a	192.9 b	183.2 c	168.6 d
Shelling (%)	92.1 a	91.4 a	90.1 b	88.6 c
Grain yield/plant (gm)	191.4 a	177.7 b	155.7 c	146.1 d
Grain yield/ha (ton)	7.88 c	8.67 b	8.80 b	9.96 a
2010 season				
Plant height (cm)	203	205	206	208
Leaf area index	4.1 d	5.0 c	6.0 b	7.3 a
Silking (%)	69.5 b	70.3 b	72.3 a	72.9 a
Ears /plant (no)	1.00 a	0.97 a	0.90 b	0.88 b
Barren (%)	5.5 c	6.2 bc	7.1 b	15.8 a
Rows /ear (no)	13.2 a	12.6 ab	12.1 bc	12.0 c
Kernels/ row (no)	39.5 a	37.9 b	36.3 c	33.8 d
Seed index(100kernel),gm	42.4 a	39.4 b	37.0 c	34.7 d
Ear grain weight(gm)	206.6 a	197.8 b	188.7 c	176.8 d
Shelling (%)	94.4	93.0	90.9	88.2
Grain yield/plant (gm)	201.9 a	187.8 b	169.7 c	151.5 d
Grain yield/ha (ton)	8.28 c	8.61 bc	8.92 b	10.32 a

Means in the same row followed by the same litter are not significantly different at 5% level of probability.

LAI was significantly influenced by Plant density (Table 2). Increasing plant density gradually increased LAI. The highest LAI was obtained by planting 8.33 plants/m^2, and the lowest LAI was obtained by planting 4.76 plants/m^2. Similar results were reported by Bangarwa *et al*. (1993) who found that LAI increased with any increase in plant density. Eisa Nadia (1998) found that LAI, increased with increasing plant density from 15,000 to 30,000 plants/fad. Saberali (2007) showed that in high maize density (105,000), leaf area index was more than in low maize density (70,000) throughout of growth season. While Kamel (1997) found that LAI decreased with increasing plant density from 18,000 to 30,000 plants/fad..

Percentage of barren plants was significantly influenced by plant densities (Table 2). Increasing plant density gradually increased percentage of barren plants. The highest percentage of barren plants was obtained by planting 8.33 plants/m^2, and the lowest one was recorded by planting 4.76

plants/m^2, while planting 6.67 plants/m^2 and 5.56 plants/m^2 were intermediate in barrenness percent. The increase in percentage of barren plants by increasing plant density may be due to interplant competition for nutrient, water and light at higher plant densities. Similar results were reported by Shams El-Deen and El-Habbak (1996) who observed that increasing plant density from 4.76 to 7.14 plants/m^2 significantly increased percentage of barren plants. Ritchie and Alagarswamy (2003) indicated that high maize yields at plant densities ranging from seven to ten plants m^{-2} but barrenness occurred more frequently when plant densities exceed 10 plants m^{-2}.

Number of ears/plant for all hybrids decreased gradually by increasing plant densities from 4.76 to 8.33 plants/m^2. Planting 4.76 plants/m^2 produced the highest number of ears per plant, while plants of 8.33 plant/m^2 density were the lowest in number of ears per plant. Similar results were obtained by Tollennar and Stewart, (1992) who reported that ears per plant declined with increasing plant density and Faisal *et al.* (1996) who found that increasing plant densities from 4.76 to 5.71 plants/m^2 significantly increased number of ears/plant.

Weight of ear grains was significantly decreased by increasing plant densities (Table 2). Increasing plant density from 4.76 to 8.33 plants/m^2 reduced weight of grain/ear by 17.8 and 14.4 % in 2009 and 2010seasons, respectively, while reduction was 10.7, 8.7, and 9.7 % for 6.67 plant/m^2 in 2009 and 2010seasons, respectively. Also, increasing plant density from 4.76 to 5.56 plants/m^2 reduced weight of grains/ear by 6.0 and 4.3 % in 2009 and 2010 seasons, respectively. The reduction in weight of grains/ear by increasing plant density may be due to interplant competition. High plant densities delay silk emergence that lead to decrease in kernel number per ear and reduction in total grain yield. Edmeades *et al*. (2000) found that high plant densities enhance interplant competition for assimilates, particularly during the period bracketing silking, favoring apical dominance and decreasing the ratio of ear to tassel growth rate. Similar results were reported by Zeidan and Amany (2006). Maddonni *et al.* (2006), Shakarami and Rafiee (2009) and Gozubenli (2010).

Number of rows per ear was significantly influenced by plant densities in both seasons of study (Table 2). Increasing plant density gradually decreased number of rows per ear. Planting 4.76 plants/m^2 had the highest number of rows per ear, while plating 8.33 plants/m^2 had the lowest number of rows per ear. Mohammed, Amany (1999) found that, ear length, ear diameter, number of rows/ear, number of kernels/row and 100-kernels weight decreased with increasing plant densities from 20 to 35 thousand plants/fad.

Plant density had significantly effect on number of kernels per row in both seasons (Table 2). Increasing plant density gradually significantly increased number of kernels per row. The highest number of kernels per row was obtained by plant density 4.76 plants/m^2 and the lowest one was obtained by plant density 8.33 plants/m^2 in both seasons.

Kernel weight (100 kernel weight) was significantly decreased by increasing plant density from 4.76 to 8.33 plants/m^2 in both seasons (Table 2). The reduction in kernel weight at high plant density may be due to interplant competition. Such represent interplant competition for incident photosynthetic photon flax densities, soil nutrients and soil water. This results in limited supplier of carbon and nitrogen and consequent decrease in kernel number per plant and kernel size (Lomcoff and Loomis, 1994).

Increasing plant density significantly decreased shelling percentage. The highest shelling percentage was obtained by sowing 4.76 plants/m^2 and the lowest one was obtained by sowing 8.33 plants/m^2. Similar results were reported by Eisa, Nadia (1998), Hassan (2000) and Ogunlela *et al.* (2005). These results are also in harmony with those reported by Sangoi *et al*. (2002) and Ogunlela *et al*. (2005).

Data presented in Table (2) illustrate that the significant differences among planting densities were found for grain yield/plant in both seasons. Increasing plant densities from 4.76 to 5.56 plants/m^2, from 5.56 to 6.67 plants/m^2 and from 6.67 to 8.33 plants/m^2 and also from 4.76 to 8.33 plants/m^2 significantly decreased grain yield/plant by 191.4, 177.7, 155.7 % and 146.1 in the first season, by 201.9, 187.8, 169.7 and 151.5 % in the second season.

Plants grown at the higher plant densities produced the lowest grain yield per plant, while the highest grain yield per plant in both seasons (Table 2). These results could be due to the highest competition between plants in the dense population. Tokatlidis and Koutroubas (2004) found that the increased gap between pollen shedding and silking under higher plant density constitute key factor for increase ear barrenness and therefore influenced negatively the final grain yield. Similar results were obtained by Boyat *et al*. (1990), Sangoi (1996), Akamn (2002), Xue *et al*. (2002), Lauer and Rankin (2004), Maddonni *et al.* (2006), Zeidan and Mahmoud, Amany (2006), Ahmad *et al*. (2007) and Shakarami and Rafiee (2009).

Increasing plant density gradually increased grains yield/ha. The highest grain yield/ha (9.96 and 10.32 tons/ha were obtained by planting 8.33 plant/m^2 in 2009 and, 2010 season, respectively. The lowest grain yields (7.88 and 8.28 tons/ha) were recorded by planting 4.76 plants/m^2 in 2009 and 2010 seasons, respectively, while planting 6.67 plants/m^2 and 5.56 plants/m^2 were intermediate in grain yield/ha. Increasing plant density from 4.76 to 8.33 plants/m^2 increased grain yield/ha by 25.7 and 24.98 % in 2009 and 2010 seasons, respectively, while the increase reached 11.1, 8.1 and 9.5 % for plant density of 6.67 plants/m^2 in 2009 and 2010 season, respectively.

Increasing plant density from 5.56 to 6.67 plants/m^2 did not significantly differ in grain yield/ha in both seasons. Gouda *et al*. (1993) reported that maize grain yield was significantly increased by raising plant density from 4.76 to 5.71 plants/m^2, while Ragheb et al. (1993) reported that grain yield was not significantly affected by increasing plant density from 4.76 to 5.71 plants/m^2. These results are in harmony with those obtained by Mohammed, Amany (1999), Said and Gaber (1999), Maddonni *et al.* (2006), Zeidan and Mohammed, Amany (2006) and Dahmardeh (2011).

Eisa, Nadia (1998) found that plant height, LAI, number of days to 50% tasseling and silking and percentage of barren plants increased with increasing plant density from 15,000 to 30,000 plants/fad. Saberali (2007) investigated the effects of plant density on growth and physiological index of maize. While, Kamel (1997) found that 50% tasseling, number of kernels/row, ear length, number of rows/ear and grain yield/plant decreased with increasing plant density from 18,000 to 30,000 plants/fad. Mohammed, Amany (1999) found that number of days to 50% silking, and ear height increased with increasing plant densities. Mohammed, Amany (1999) found that number of days to 50% silking, and ear height increased with increasing plant densities

Grain yield and its attributes of three maize hybrids under four plant densities.

Results in Table (3) indicate that the interaction between maize hybrids and plant densities had no significant effect on plant height, percentage of barren plants, number of kernels, 100 grains weight, number of rows per ear, grain weight/ear, shilling percentage and number of kernels per row, grain yield/plant in both seasons.

The interaction between maize hybrids and plant densities on LAI was significant in the second season (Table 3). The results pointed out that optimum plant density for high LAI was not the same for all maize hybrids, or some are more adapted to higher plant densities i.e. S.C.10 in the second season. LAI for all maize hybrids increased gradually by increasing plant densities from 4.76 to 8.33 plants/m^2. The highest LAI (8.5 and 8.9) was obtained from S.C. 10 at density of 8.33 plants/m^2 in the second season, respectively, while the lowest LAI was obtained from all maize hybrids (not significant between maize hybrids) at density of 4.76 plants/m^2.

The interaction effect between maize hybrids and plant densities on number of ears/plant was significant in the first and second seasons (Table 3). The results pointed out that optimum plant density for producing the highest number of ears/plant was not the same for all maize hybrids. The highest number of ears per plant was obtained from S.C. 10 and S.C.122 at density of 4.76 and 5.56 plants/m^2 in the first and second seasons. S.C.122 responded to produce more ears /plant when cultivated with 6.67plants/m2. The lowest number of ears per plant was obtained from all hybrids (not significant between hybrids) at density of 8.33 plants/m^2.

The interaction effect between maize hybrids and plant densities on grain yield/plant was significant in the second season except of first season (Table 3). The results pointed out that optimum plant density for high grain yield/plant was not the same for all maize hybrids, or some are more adapted to higher plant densities i.e. S.C.122 and T.W.C. 321 in the second season. Grain yield/plant for all maize hybrids decreased gradually by increasing plant densities from 4.76 to 8.33 plants/m^2. The highest grain yield per plant (208.3 and 200.8 gm) was obtained from S.C. 122 and S.C. 10 at density of 4.76 plants/m^2 in the second season respectively, while the lowest grain weight per plant was obtained from all maize hybrids (not significant between maize hybrids) at density of 8.33 plants/m^2.

Table 3: Interaction between plant density and maize hybrids (D×H) on maize grain yield and its attributes in 2009 and 2010 seasons and its attributes.

Plant densities	Maize hybrids	Plant height (cm)	Ear height (cm)	Silking	Ears per plant(no)	Barrenes (%)	LAI	Rows per ear(no)
2009 Season								
4.76 pl/m^2	SC 10	255	112	71	1.00 a	5.5	5.4	12.8
	SC 122	229	109	71	0.90 bc	6.5	5.3	12.8
	TWC 321	247	107	71	0.90 bc	7.6	5.2	13.2
5.56 pl/m^2	SC 10	255	113	73	0.94 b	5.5	5.8	12.0
	SC 122	232	106	73	0.90 bc	5.6	6.0	12.0
	TWC 321	251	108	71	0.90 bc	7.5	6.0	12.8
6.67 pl/m^2	SC 10	260	117	73	0.90 bc	6.3	7.5	12.0
	SC 122	237	109	72	0.86 cd	7.1	6.7	12.0
	TWC 321	253	112	72	0.86 cd	8.7	7.5	12.8
8.33 pl/m^2	SC 10	265	121	73	0.84 d	15.4	9.2	12.0
	SC 122	248	114	72	0.88 cd	15.9	8.6	12.0
	TWC 321	254	116	73	0.90 bc	16.00	6.8	12.0
2010 Season								
4.76 pl/m^2	SC 10	211	97	69	1.02 a	5.5	4.5 f	12.8
	SC 122	193	103	70	1.04 a	5.5	3.5 g	13.6
	TWC 321	203	102	70	0.94 bc	5.5	4.3 f	13.2
5.56 pl/m^2	SC 10	216	97	69	0.88 cde	5.4	5.5 e	12.8
	SC 122	199	104	71	1.02 a	6.5	4.3 f	12.4
	TWC 321	200	102	71	1.02 a	6.5	5.3 e	12.8
6.67 pl/m^2	SC 10	219	100	72	0.82 e	5.5	6.7 bc	12.4
	SC 122	199	99	73	1.00 ab	7.1	5.3 e	12.0
	TWC 321	200	99	72	0.88 cde	8.6	6.1 d	12.0
8.33 pl/m^2	SC 10	222	102	73	0.88 cde	16.0	8.5 a	12.0
	SC 122	199	100	73	0.90 cd	14.8	6.3 cd	12.0
	TWC 321	203	100	73	0.86 de	16.6	7.1 b	12.0

Table 3: (continued)

Plant densities	Maize hybrids	Kernels per row(no)	Seed index(g)	Grain weight/ ear(g)	Shelling %	Grain yield/plant (g)	Grain yield /he (ton)
2009 Season							
4.76 pl/m^2	SC 10	41	42.6	201.0	91.14	198.0	8.17
	SC 122	41	42.0	209.2	92.73	190.5	7.87
	TWC 321	39	43.5	205.4	92.44	185.8	7.60
5.56 pl/m^2	SC 10	39	40.4	181.2	90.50	174.1	8.76
	SC 122	40	40.1	198.4	91.70	179.7	8.70
	TWC 321	37	41.6	199.2	91.90	179.4	8.54
6.67 pl/m^2	SC 10	38	37.2	176.0	89.22	154.2	8.80
	SC 122	38	36.2	186.4	91.06	156.1	8.85
	TWC 321	36	38.0	187.2	90.17	156.9	8.75
8.33 pl/m^2	SC 10	35	33.7	169.6	88.51	143.6	9.85
	SC 122	36	32.4	171.0	89.45	148.9	10.14
	TWC 321	33	33.4	165.2	87.96	146.0	9.88
2010 Season							
4.76 pl/m^2	SC 10	38	42.4	209.4	93.99	203.7 ab	8.47
	SC 122	40	42.4	205.6	94.28	208.3 a	8.29
	TWC 321	40	42.4	204.7	95.04	193.6 bc	8.10
5.56 pl/m^2	SC 10	37	39.6	201.8	92.85	174.2 d	8.76
	SC 122	37	39.6	195.6	93.05	197.0 abc	8.41
	TWC 321	39	39.0	195.9	93.02	192.2 bc	8.66
6.67 pl/m^2	SC 10	35	37.3	192.7	90.51	155.9 ef	8.98
	SC 122	37	37.6	187.2	91.20	187.8 c	9.00
	TWC 321	37	36.2	186.4	90.93	165.4 de	8.80
8.33 pl/m^2	SC 10	34	35.0	180.8	88.02	151.8 f	10.34
	SC 122	34	34.8	175.6	88.03	152.8 ef	10.55
	TWC 321	34	34.2	173.8	88.50	149.9 f	10.10

Means in the same column followed by the same litter are not significantly different at 5% level of probability.

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سلوك بعض هجن الذرة الشامية المنزرعة تحت كثافات نباتية مختلفة

المتـــولي عبـــدالله المتـــولي، علــــي أبومنـــدور الـــديب ، ســـيد أحمـــد ســـفينة و بركات الله غلام رباني
قسم المحاصيل – كلية الزراعة – جامعة القاهرة – جيزة – مصر

أجريت تجربتان حقليتان بمحطة التجارب الزراعية لكلية الزراعة جامعة القاهرة بالجيزة، خلال موسمي ٢٠٠٩،٢٠١٠. كان الهدف من هذا البحث دراسة إستجابة بعض هجن الذرة الشامية الفردية والثلاثية (هـ.ف ١٠ ، هـ.ف ١٢٢ و هـ. ث ٣١٠) للزراعة في أربع كثافات نباتية مختلفة و هي ٢٠ سم بين الجور (٨,٣٣ نبات /م^{٢})، ٢٥ سم بين الجور (٦,٦٧ نبات/ م^{٢})، ٣٠ سم بين الجور (٥,٥٦ نبات /م^{٢}) و ٣٥ سم بين الجور (٤,٧٦ نبات/ م^{٢}) علي محصول الذرة و مكوناتة. و كانت أهم النتائج المتحصل عليها كالأتي: وجود إختلاف معنوي بين هجن الذرة الشامية في بعض الصفات طول النبات ، عدد كيزان النبات، نسبة النباتات الغير حاملة، دليل مساحة الاوراق، عدد حبوب الصف، وزن حبوب الكوز و وزن حبوب النبات خلال موسمي الزراعة و متوسط الموسمين. كما اظهرت النتائج أنة كلما إزداد عدد النباتات في المتر المربع (من ٤,٧٦ الي ٨,٣٣ نبات/م^{٢}) كان هناك تأثير معنوي عالي بالانخفاض في قيم بعض الصفات وهي عدد صفوف الكوز، عدد كيزان النبات، عدد حبوب الصف، وزن حبوب الكوز، دليل البذرة، نسبة التفريط، و محصول حبوب النبات. كما أعطت بعض الصفات زيادة معنوية عالية بالزيادة في عدد النباتات في المتر المربع (من ٤,٧٦ الي ٨,٣٣ نبات/م^{٢}) وهي طول النبات ، نسبة النباتات الحاملة للكيزان ، دليل مساحة الاوراق و محصول الحبوب للهكتار. و سجل أعلي محصول من حبوب و حدة المساحة عندما زرعت الهجن في اعلي كثافة نباتية (٨,٣٣ نيات/م^{٢}) خلال موسم ٢٠٠٩ و ٢٠١٠ ومتوسط الموسمين علي التوالي. كما سجل اقل محصول من وحدة المساحة في الكثافة النباتية المنخفضة(٤,٧٦ نبات/م^{٢}) خلال موسم ٢٠٠٩ و٢٠١٠ ومتوسط الموسمين علي التوالي. كما أوضحت النتائج أنة بزيادة الكثافة النباتية من ٤,٧٦ الي ٨,٣٣ نبات/م^{٢} أدي إلي زيادة في محصول حبوب الهكتار بـ ٢٥,٧٠، ٢٤,٩٨ و ٢٥,٣٣ % خلال موسم ٢٠٠٩ و ٢٠١٠ و متوسط الموسمين علي التوالي، بينما إزداد محصول الهكتاربـ ١١,٠٩، ٨,٠٥ و٩,٥٢ % عند زيادة الكثافة النياتية من ٤,٧٦ الي ٦,٦٧ نبات/م^{٢} خلال موسمي ٢٠٠٩ و ٢٠١٠ و متوسط الموسمين علي التوالي. كما اوضحت النتائج أن تأثير التفاعل بين الأصناف و الكثافة النباتية كان غير معنوي في بعض الصفات ما عدا عدد كيزان النبات، دليل مساحة الاوراق و محصول حبوب النبات.

الكلمات الدالة: الذرة الشامية ، الهجن، الكثافة النباتية، المحصول.

قام بتحكيم البحث

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