Minufiya J. Agric. Res. Vol. 33 No.2: 427 - 443 (2008)

RESPONSE OF SOME MAIZE SINGLE CROSS HYBRIDS TO PLANT DENSITY UNDER DIFFERENT EGYPTIAN ENVIRONMENTAL CONDITIONS

M. M. M. Hassan, M. A. M. El-Ghonemy and R. S. H. Aly
Maize Research Program., Field Crops Research Institute, Agricultural Research Center, Giza, Egypt

(Received: Sep. 5 , 2007)

ABSTRACT: ***The present investigation was conducted at three locations, Sakha,Gemmeiza,and Ismailia Agric. Res. Stns, Field crops Res. Inst., Agric. Res. Center during the two successive growing seasons of 2005 and 2006. The soil type was loamy clay at Sakha and Gemmeiza locations and sandy at Ismailia. The main objective was to study the response of six maize white single cross hybrids, i.e. SC 10, SC 11, SC 13, SC 14, SC 15 and SC 123 to three levels of plant population densities, i.e. 20, 25 and 30 thousand plants/fed. Plant density had significant effect on all studied traits, except for tasseling and silking dates and plant height in 2005, and plant as well as ear height in 2006 season. Increasing number of plants per feddan[1] up to 30000 plants significantly delayed tasseling and silking dates but did not affect plant height; and grain yield ardab/feddan[2] (ard/fed) in 2006. On the other hand, increasing plant density decreased grain yield/plant. The six hybrids significantly differed in all studied traits in the two growing seasons. Hybrid x location interaction was significant for most studied traits in the two growing seasons. The highest yield performance and grain yield was noticed when hybrids were planting at 25-30 thousand plants/fed. Single crosses SC 10 and SC 11 produced the highest grain yield among all hybrids when planted at 25-30 thousand plants/fed in both growing seasons.***

Key words: ***Maize, Cross hybrids, Environmental.***

INTRODUCTION

Maize (*Zea mays* L.) is one of the most important cereal crops in Egypt. It is used mainly for human consumption and animal feeding. However, great attention has been paid to increase its total production by using high yielding hybrids and improving the agronomic practices, such as plant population density which plays an important role in the utilization of solar radiation which is influenced by canopy structure. Williams *et al.* (1968) reported that photosynthetic efficiency and growth in maize were strongly related to the effect of canopy architecture on vertical distribution of light within the canopy.

---

[1] One feddan = 4200 m^2
[2] One ardab = 140 kg,

Increasing plant density is one management tool to increase the capture of solar radiation within the canopy. In this respect, Dong and Cheng (1995) reported that increasing plant density can promote utilization of solar radiation by maize canopies. However, efficiency of conversion of intercepted solar radiation into economic maize yields will decrease with high plant population density because of mutual shading of plants (Beech and Basiniski 1975). It is worthy to note that there is no single recommendation for all environments because optimum plant density varies depending on nearly all unmanaged environmental factors, as well as on management factors such as soil fertility, hybrid selection, planting date, planting pattern, plant protection, and time of harvest (Beech and Basiniski, 1975). Duncan (1984) stated that the yield of a single maize plant is affected by proximity to adjacent plants. Plant population above a critical density has a negative effect on yield per plant (Jolliffe *et al*., 1990). Yield reduction per plant is due mainly to the effects of interplant competition for light, water, nutrition, and other potentially yield-limiting environmental factors. Also, Sangio (2000) reported that plant population for maize maximum economic grain yield varies from 30000 to over 90000 plants/ha depending on water availability, soil fertility, maturity rating, planting date and row spacing. Increasing plant population density led to a significant delay in silk appearance, increased number of barren plants per unit area, and decreasing number of ears per plant.

Plant population densities had numerous effects on grain yield per unit area of land. In this regard, Abd El-Gawad and El-Batal (1996) showed that increasing plant density from 20 to 30000 plants/fed increased plant height, ear height and grain yield per feddan, but significantly reduced grain yield/plant. Sangoi *et al* (2002) and Subedi, *et al* (1997) mentioned that hybrids differ in their response to plant population density. Duncan (1984) and Pecinovsky *et al*. (2004) reported that the increase in plant population lengthened the anthesis–silking interval and decreased number of grains per ear. Several investigators (Jolliffe, *et al.*, 1990, Bedeer *et al.,* 1992, Ragheb *et al.,* 1993, Ali *et al.,* 1994, Matta, *et al.,* 1994, Soliman *et al.,* 1995, Matta *et al.,* 1996, El-Agamy *et al.,* 1999, and Soliman *et al*., 2005) indicated that grain yield per unit area significantly increased as number of plants per unit area increased up to certain levels.

Modarres *et al.* (1998), Said and Gaber (1999), and Badr and Sanaa Othman (2006) mentioned that increasing plant density from 20 to 30000 plants/fed significantly increased number of days from planting to 50% tasseling, plant height, ear height, and grain yield/fed. On the other hand, grain yield per plant was significantly decreased by increasing plant density. Moreover, they added that grain yield per plant was significantly decreased as plant density increased from 20 to 30000 plants/fed.

Maize hybrids (single and/or three-way crosses) differed greatly in their response to plant population densities. Pecinovsky *et al*. (2004) reported that

density-tolerant maize genotypes would be characterized by rapid completion of silk extrusion, rapid growth of the first ear, rapid first appearance of ear silk, prolificacy (number of ears/plant), reduced tassel size, and efficient production of grain per unit leaf area (productivity). Gyenes-Hegyi and Kizmus (2002) revealed that plant and ear height are important variety traits and are in close correlation with each other. Increasing plant density up to 80000 plants/ha led to a significant increase in both plant and ear height.

The main objective of the present investigation was to study the effect of plant population density on grain yield and other agronomic traits of some maize single cross hybrids ata were statistically analyzed according to Steel and Torrie (1980).

MATERIALS AND METHODS

Two field experiments were conducted at Sakha, Gemmeiza and Ismailia Research Stations, Agricultural research Center, Egypt, during the two successive growing seasons of 2005 and 2006. The soil type was loamy clay at Sakha and Gemmeiza locations and sandy at Ismailia. Irrigation system was furrow irrigation at Sakha and Gemmeiza, while it was sprinkler irrigation at Ismailia. Trials were planted on June 13, 15, and 17 in 2005; and on June 9, 12, and 14 in 2006 seasons;at Ismailia, Gemmeiza, and Sakha, respectively. The main objective of this investigation was to study the effect of three plant densities, *i.e.* 20000, 25000 and 30000 plants/fed (one feddan= 4200 m^2) on grain yield and some other agronomic traits of six single crosses namely SC 10, SC 11, SC 13, SC 14, SC 15 and SC 123. Hybrids except SC 10 and SC123 are recently released hybrids. The experimental design was split-plot in four replications. The three plant population densities were randomly assigned to the main plots and maize hybrids were randomly distributed on the sub-plots. Each sub-plot consisted of three rows, 6 m long and 70 cm apart to gave a plot size of 12.6 m^2. Two to three kernels were planted in hills spaced at 20, 25 and 30 cm along the row and thinned to one plant/hill after three weeks from planting to obtain the three plant population densities, 30000,25000, and20000, respectively. All other cultural practices were done as recommended. Twenty m^3 of organic manure were added to all experimental units at Ismailia in both seasons. 30 Kg P as P_2O_5/fed and 24 Kg of K/fed as k_2o were added at soil preparation. Nitrogen fertilizer was added in the from of urea (46.5% N) at Sakha and Gemmeiza, while it was applied in the form of ammonium nitrate (33.5% N) at Ismailia. Nitrogen was split into 3 equal doses at Sakha and Gemmeiza. The first was added at planting, while the second and the third were added by the first and second irrigations. At Ismailia, however, N was split into 8 equal doses. The first one was applied at planting, while the others were added once a week.

Studied traits were number of days from planting to 50% tasseling (pollen shedding), number of days from planting to 50% silking, plant and ear

heights, grain yield/plant and grain yield (ard/fed). Plant and ear heights (cm) were measured from ground surface to the top of tassel and the highest ear-bearing node, respectively. A sample of 5 Kgs of ear were taken for moisture determination. Grain yield was adjusted to 15.5 % moisture. Trials were harvested in October in both years of study. Data were statistically analyzed according to Steel and Torrie (1980).

RESULTS AND DISCUSSION

1. Location effect.

Test of homogeneity of the error mean squares across locations within years was not significant. Therefore, combined analysis within each year was performed in this study.

Highly significant differences were detected among locations within each year for all studied traits in 2005 and 2006 seasons indicating that locations represent different environments (Table 1). Maize plants are greatly affected by environmental factors (Sangoi *et al.,* 2002and Subedi *et al.,* 1997). However, the lowest performance of maize plants was observed for all studied traits at Ismailia in both growing seasons (Table 1, 2, and 3). This could be attributed to the low fertility sandy soil.

2. Hybrid effect.

Concerning number of days from planting to 50% tasseling and silking, the recently released single cross hybrids i.e. SC 11 and SC 13 were the earliest hybrids at all locations in both years, except for number of days to 50% tasseling and silking of SC 13 at Ismailia, which was one of the latest hybrids in 2006 (Table 1). In contrast, the recently released single cross hybrids i.e. SC 14 and SC 15 were the latest hybrids at Sakha and Gemmeiza in both years.. At Ismailia, however, SC 10 in 2005 and SC 15 in 2006 had the highest number of days to 50% tasseling and silking. Soliman *et al* (2005) reported that SC 11 and SC 13 were earlier than SC 14 and SC 15 at Toshka. Combined analysis over all locations within years revealed that SC 11 and SC 13 were the earliest, while SC 14 and SC 15 were the latest hybrids in 2005 and 2006 seasons.

Single crosses SC 11, SC 13, and SC 123 had the shortest plant height and the lowest ear placement at all locations in both years, except for SC 123 at Sakha, which had intermediate plant height in 2005 and 2006. On the other hand, hybrids SC 10, SC 14, SC 15 were the tallest plants and had the highest ear height at all locations (Table 2). Combined analysis over locations within years showed that single crosses SC 11, SC 13, and SC 123 had the shortest plant height and lowest ear height in both years of study. Soliman *et al* (2005) reported, in a field experiment conducted at Toshka, that SC 13 and SC 123 had the shortest plant height.

Table 1

Table 2

Table 3

Results revealed that SC 10 and SC 11 had the highest grain yield/plant and grain yield (ard/fed), while SC 123 was the most inferior hybrid regarding these traits at all locations in 2005 and 2006 and the combined analysis (Table 3). Soliman *et al* (2005) found, at Toshka, that SC 10, SC 11 and SC 123 had the highest grain yield/plant and grain yield/fed. Beech and Basiniski (1975) and Pecinovsky *et al*. (2004) reported that the differences in grain yield between maize hybrids were due mainly to maturity groups, heterotic effects, and environmental effects.

3. Plant density effect.

Plant density of 20 thousand plants/fed was associated with a significant reduction in number of days to 50% tasseling at Gemmeiza in 2005 and Sakha and Gemmeiza in 2006 (Table 4). Increasing plant density did not significantly affect number of days to 50% tasseling at Sakha and Ismailia in 2005 and Ismailia in 2006. Plant density of 20 thousand plants/fed was linked with a significant reduction in number of days to 50% silking at Gemmeiza and Ismailia in 2005, and Sakha and Gemmeiza in 2006 (Table 4). Combined analysis over locations within years indicated that plant density of 20 thousand plants/fed was associated with a significant reduction in number of days to 50% tasseling and silking in 2006. However, this reduction is within half a day, which had little effect from the practical standpoint. Soliman *et al* (2005) reported that increasing plant density delayed pollen shedding and silk appearance. These results are in good agreement with those reported by Beech and Basinski (1975), Jolliffe, *et al.* (1990), Ragheb *et al.* (1993) and Soliman *et al.* (2005) who revealed that increasing plant population density increased number of days to 50% tasseling and silking.

Increasing plant density did not significantly affect plant height at all locations in 2005, 2006, and the combined analysis over locations within years (Table 5). On the other hand, increasing plant density was associated with a significant increase in ear height at Sakha and Ismailia in 2005, and Sakha in 2006 (Table 5). Combined analysis over locations within years showed that ear height increased as plant density increased from 20 to 25 or 30 thousand plants/fed in 2005. This combined effect was not significant in 2006. These results differed from those obtained by Abd El-Gawad and El-Batal (1996), Said and Gaber (1999), and Badr and Sanaa Othman (2006). They mentioned that increasing plant densities from 20 to 30000 plants/fed significantly decreased plant and ear heights. However, Ali *et al*. (1994), El-Agamy *et al*. (1999) and Gyenes-Hegyi and Kizmus (2002) reported that the reduction of ear height due to increasing population density was due mainly to the competition among the dense plants for light and available nutrients.

Increasing plant density was associated with a significant reduction in grain yield per plant at all locations in both years and the combined analysis over locations within year (Table 6). But this effect was not significant at

Table 4

Table 5

Table 6

Ismailia in 2005. The reduction in grain yield per plant may be due to the mutual shading among adjacent plants, which reduced the amount of solar radiation and light intercepted by plants. Jolliffe, *et al.* (1990) found that the yield reduction per plant is due to the effects of interplant competition for light, water, nutrition, and other potentially yield-limiting environmental factors.

Grain yield (ard/fed) increased as plant density increased from 20000 to 25000 plants/fed at Sakha and Gemmeiza in 2005, and Sakha and Ismailia in 2006. On the other hand, grain yield increased as plant density increased from 20 up to 30 thousand plants/fed at Ismailia in 2005, and Gemmeiza in 2006. Combined analysis over locations within years indicated that plant density of 25 and 30 thousand plants/fed were associated with the highest grain yield/fed in 2005 and 2006 seasons. These results were in good agreement with those reported by El-Deeb (1990) and Badr and Sanaa Othman (2006) who found that plant population density had a significant effect on grain yield/fed. Several investigators indicated that increasing plant population densities up to certain levels, significantly increased grain yield per unit area (El-Kalla *et al.,* 1985, Simeonov and Tsankova (1990), Abd Alla, 1991, Badr *et al.,* (1993), Dong and Cheng., 1995, El-Zeir *et al.,* 1998, and Said and Gaber, 1999). However, Abdel Aziz (1987) and Nedic *et al.* (1991) reported that increasing plant population densities decreased grain yield per unit area. On the other hand, Nunez-Hernandez *et al.* (1996) revealed that grain yield was not significantly affected by increasing plant population density. Ragheb *et al.* (1993) and Sangoi *et al.* (1997) mentioned that the efficiency of conversion of intercepted solar radiation into economic maize yields will significantly decrease with high plant population density because of mutual shading of plants. Younis, *et al.* (1989) and Sangoi (2000) indicated that population density for maize maximum grain yield varies from 30000 to over 90000 plants/ha, depending on water availability, soil fertility, maturity rating, planting date and row spacing.

4. Hybrid x plant density Interaction.

Hybrid x plant density Interaction will be discussed for the combined analysis over locations within years. This interaction was not significant for number of days to 50 % tasseling, number of days to 50 % silking, plant height, ear height in both seasons (data not shown). Data presented in Table (7) revealed that the effect of the first order interaction of hybrid x plant density was highly significant for grain yield/plant and grain yield/fed in 2005 and 2006 seasons. All studied hybrids produced maximum grain yield per plant when planted at the rate of 20000 plants per feddan. However, SC 11 produced maximum grain yield under 20000 plants/fed followed by SC 10 but the difference between SC 10 and SC 11 was not significant at 20000 plants/fed in 2005. The reduction in grain yield per plant by increasing

number of plants per feddan was due mainly to the mutual shading and competition between plants for light, solar radiation, and nutrients.

Regarding grain yield (ard/fed), SC 11 produced the highest grain yield when planted at 25 and 30 thousand plants/fed followed by SC 10 (Table 7).

Table 7 : Hybrid x plant density interaction for grain yield/plant and grain yield (ard/fed), data were combined over the three locations in 2005 and 2006 seasons.

Plant density	Hybrid	Grain yield/plant (g)		Grain yield (ard/fed)	
		2005	2006	2005	2006
20	10	176.6	186.4	25.9	27.4
	11	177.4	194.0	25.6	28.9
	13	164.7	164.8	24.4	24.7
	14	168.6	170.4	24.9	25.4
	15	172.0	160.8	25.0	24.0
	123	150.5	163.7	21.8	24.5
25	10	173.3	163.2	30.4	28.5
	11	165.7	170.7	28.3	30.3
	13	161.6	151.1	27.8	26.8
	14	155.2	158.7	26.1	27.9
	15	151.4	155.7	26.4	27.7
	123	149.2	137.6	26.1	24.2
30	10	135.2	134.7	28.5	28.7
	11	147.9	135.7	30.3	29.5
	13	130.9	127.3	27.7	28.0
	14	128.1	128.7	27.2	28.2
	15	128.1	118.8	27.7	26.1
	123	127.1	109.1	27.2	23.9
LSD 0.05 for comparing hybrid means at each plant density level		8.3	8.1	1.50	1.40

CONCLUSIONS

Single crosses SC 11 and SC 13 were the earliest in terms of number of days to 50 % tasseling and silking, while SC 14 and SC 15 were the latest hybrids in 2005 and 2006 seasons. Single crosses SC 11, SC 13, and SC 123

had the shortest plant height and lowest ear height. Results revealed that SC 10 and SC 11 had the highest grain yield/plant and grain yield (ard/fed), while SC 123 was the most inferior hybrid regarding these traits at all locations in 2005 and 2006. Plant density of 20 thousand plants/fed was associated with a significant reduction in number of days to 50% tasseling and silking in 2006. However, this reduction is within half a day, which had little effect from the practical standpoint. Increasing plant density did not significantly affect plant height. Ear height increased as plant density increased from 20 to 25 or 30 thousand plants/fed. Increasing plant density was associated with a significant reduction in grain yield per plant at all locations in both years and the combined analysis over locations within year. Plant density of 25 and 30 thousand plants/fed was associated with the highest grain yield (ard/fed) in 2005 and 2006 seasons. Single cross SC 11 produced the highest grain yield when it was planted at 25000 and 30000 plants/fed followed by SC 10.

REFERENCES

Abd Alla, A. A. (1991). Yield variation in corn and its relationship to some agricultural factors. M. Sc. Thesis, Fac. Agric., El-Minia Univ.

Abd El-Gawad, M. H. and M. A. El-Batal (1996). Response of maize productivity to the growth retardant "uniconazole" under high nitrogen fertilization and plant density. Annals of Agric. Sci., Moshtohor, 34(2): 429-440.

Abdel Aziz, A. A. (1987). Effect of some agricultural practices on yield and yield components of corn (Zea maize L.). M. Sc. Thesis, Fac. Agric., Minia Univ.

Ali, A. A., A. H. Awad and E. A. Khedr (1994). Effect of planning date and plant density on growth and yield of maize. Minofiya J. Agric. Res., 19(4): 1697-1705.

Badr, M. M. A and Sanaa A. Othman (2006). Effect of plant density, organic manure, bio and mineral nitrogen fertilizers on maize growth and yield and soil fertility. Annals of Agric. Sc., Moshtohor, 44(1): 75-88.

Badr, S. K., Aly, A. M. and M. N. Sherif (1993). Response of different maize genotypes to plant population density. Menofiya J. Agric. Res., 18(3): 1573-1582.

Bedeer, A. A., A. Sh. A. Gorda and M. M. A. Ragheb (1992). Response of maize varieties to plant density and nitrogen fertilization under farmer's conditions. Egypt. J. Appl. Sci., 7(7):1-14.

Beech, A. and A. J. Basiniski (1975). Effect of plant populations and row spacing on early and late maize hybrids in the Ord Vally. Australian J. Exp. Agric. and Animal Husbandry 15(74): 406-413.

Dong, P. Y. and Y. N. Cheng (1995). A study on the factorial relationship between density and yield of maize. Beijing Agric. Sci., 13(1): 23-25 (CF Internet Search).

Duncan, W. G. (1984). A theory to explain the relationship between corn populations and grain yield. Crop Sci. 24:1141–1145.

El-Agamy, A. I., G. A. Morshed, F. H. Soliman and M. Kh. Osman (1999). Performance of some yellow maize hybrids under different plant population densities and nitrogen fertilizar levels. J. Agric. Sci., Mansoura Univ., 24(3): 911-923.

El-Deeb, A. A. (1990). Effect of plant density and nitrogen level on the yield models of certain maize cultivars. Proc. 4th Conf. Agron., Cairo, 15-16 Sept., 1:419-434.

El-Kalla, S. E., M. H. El-Hindi, A. S. Hanna, and N. G. Ainer (1985). Maize growth, yield and yield components and chemical composition of grains as affected by different irrigation systems. Agric. Res. Review, 63(7): 167-175.

El-Zeir, F. A., A. A. El-Shenawy, E. A. Amer and A. A. Galal (1998). Influence of narrow row spacing (high plant density) and nitrogen fertilization on two maize hybrids. J. Agric. Sci., Mansoura Univ., 23(5): 1855-1864.

Gyenes-Hegyi, Z., I. Pók and L. Kizmus (2002). Plant height and height of the main ear in maize (Zea mays L.) at different locations and different plant densities. Acta Agronomica Hungarica, 50(1): 75-84 (CF Internet Search).

Jolliffe, P. A., A. J. P. Tarimo and G. W. Eaton (1990). Plant growth analysis: Growth and yield component responses to population density in forage maize. Annals of Botany, 65:139-147.

Matta, S. E. G., A. A. Ali and A. A. Abd El-Aziz (1994). Effect of plant density and its distribution on growth and yield of maize. Zagazig J. Agric. Res., 21(4): 1067-1076.

Matta, S. E. G., E. A. F. Khedr and M. A. Younis (1996). Effect of stand reduction on maize growth and grain yield. Egypt. J. Appl. Sci., 11(2): 322-335.

Modarres, A. M., R. I. Hamilton, M. Dijak, L. M. Dwyer, D. M. Stewart, D. E. Mather and D. L. Smith (1998). Plant population density effects on maize inbred lines grown in short-season environments. Crop Sci., 38(1): 104-108.

Nedic, M., D. Glamoclija, V. Milutinovic and Z. Jelicic (1991). The effect of nitrogen application date and rate on maize yield. Arhiv-za Poljoprivredone Nauk, 52 (187): 215-227.

Nunez-Hernadez, G., F. G. Castaneda, S. Martin del Campo and J. J. Ortiz (1996). Effect of plant density on forage and grain yield production in maize with spreading and erect leaves. ITEA Production Animal, 92A(2):126-133 (CF Internet Search).

Pecinovsky, K., G. Benson, D. Farnham (2004). Corn row spacing, plant density, and maturity effects. Iowa State Univ., Northeast Research and Demonstration Farm, ISF02-13.

Ragheb, M. M. A., A. A. Bedeer and A. Sh. A. Gouda (1993). Effect of row spacing and plant population density on grain yield of some hybrids. Zagazig J. Agric. Res., 20(2): 581-594.

Said, E. M. and E. M. E. Gaber (1999). Response of some maize varieties to nitrogen fertilization and plant density. J. Agric. Sci., Mansoura Univ., 24(4): 1665-1675).

Sangoi, L. (2000). Understanding plant density effects on maize growth and development: an important issue to maximize grain yield. Ciencia Rural. Santa Maria, 31(1): 159-168 (CF Internet search).

Sangoi, L., M. A. Gracietti, C. Rampazzo and P. Bianchetti (2002). Response of Brazilian maize hybrids from different eras to changes in plant density. Field Crops Res., 79(1): 39-51.

Simeonov, N. and G. Tsankova (1990). Effect of fertilizers and plant density on yield of maize hybrids with two ears. Resteneiv"dni-Nauki", 27(8): 14-18 (CF Internet Search).

Soliman, F. H. S., A. A. Ahmed and M. E. Abd El-Azeem (2005). Maize productivity under different plant densities in Toshka region, South Valley of Egypt. Egypt. J. Appl. Sci., 20(5b): 671-695.

Soliman, F. H. S., A. Sh. Gouda, M. M. A. Ragheb and Samia A. Amer (1995). Response of maize (Zea mays L.) hybrids to plant population density under different environmental conditions. Zagazig J. Agric. Res., 22(3): 663-676.

Steel, R. G. D. and J. H. Torrie (1980). Principles and procedures of statistics: A biometrical approach. 2nd (ed). McGraw-Hill Book Co., New York, USA.

Subedi, K. D. and B. K. Dhital (1997). Plant population density dynamics of maize under farmers' management in the western hills of Nebal. Experimental Agric., 33:189-195.

Williams, W. A., R. S. Loomis, W. G. Duncan, A. Dovart and F. Nunez (1968). Canopy architecture at various population densities and the growth and grain yield of corn. Crop Sci., 8:303-308.

Younis, M. A., S. M. M. Amer, A. H. Awad, SH. F. Aboul-Saad (1989). Effect of row spacing and plant population on maize grain yield. Egyptian J. Appl. Sci. 4 (3): 359-365.

استجابة بعض الهجن الفردية من الذرة الشامية لكثافة النباتات تحت الظروف البيئية المصرية المختلفة

محمد محمود حسان – محمد أحمد محمد الغنيمى – رزق صلاح حسنين على

برنامج بحوث الذرة الشامية– معهد بحوث المحاصيل الحقلية– مركز البحوث الزراعية

الملخص العربي

أجرى هذا البحث خلال موسمى ٢٠٠٥ ، ٢٠٠٦ بالمزرعة البحثية لكل من محطة بحوث الجميزة والإسماعيلية وسخا وذلك لدراسة استجابة ستة هجن فردية من الذرة الشامية بيضاء الحبوب هى هـ.ف. ١٠ ، ١١ ، ١٣ ، ١٤ ، ١٥ ، ١٢٣ لثلاثة مستويات مختلفة من الكثافة النباتية هى ٢٠ ، ٢٥ ، ٣٠٠٠٠ نبات/فدان. نوع التربة هى الطمييـة الطينيـة فى محطتى بحوث سخا والجميزة ، والرملية فى الاسماعيلية . كان لكثافة النباتات تأثيرا معنويا على جميع الصفات موضع الدراسة ماعدا كل من تاريخ ظهور الحريرة ، وتاريخ انتشار حبوب اللقاح ، وارتفاع النبات فى موسم عام ٢٠٠٥. وارتفاع كل من النبات والكوز فى موسم عام ٢٠٠٦. وقد ادت زيادة عدد النباتات بالفدان حتى ٣٠٠٠٠ نبات الى حدوث تأخير معنوى فى ظهور الحريرة وانتشار حبوب اللقاح بينما لم تؤثر على إرتفاع النبات ومحصول الحبوب بالأردب /فدان فى موسم ٢٠٠٦. ومن ناحية اخرى فقد أدت زيادة كثافة النباتات إلى نقص محصول الحبوب /للنبات.وقد اختلفت الهجن موضع الدراسة فيما بينها باختلاف الظروف البيئية فى سنتى الدراسة حيث كان التفاعل بينهما معنويا لمعظم الصفات موضع الدراسة ، وقد أعطى هـ ف. ١٠ و هـ ف ١١ أعلى محصول حبوب بين الهجن المختلفة وذلك عند زراعتهما تحت كثافات نباتية من ٢٥ إلى ٣٠ ألف نبات /فدان فى كلا الموسمين .

Table 1: Days to 50% tasseling and silking of the maize hybrids at Sakha (Sak), Gemmeiza (Gem), and Ismailia (Ism) locations in 2005 and 2006 seasons.

Single crosses	Days to 50% tasseling								Days to 50% silking							
	2005				2006				2005				2006			
	Sak.	Gem.	Ism.	Comb.	Sak.	Gem.	Ism.	Comb.	Sak.	Gem.	Ism.	Comb.	Sak.	Gem.	Ism.	Comb.
SC 10	62.8	63.7	68.3	64.9	62.2	62.3	67.6	64.0	63.0	63.9	70.7	65.9	63.0	62.9	69.8	65.3
SC 11	62.0	62.6	66.8	63.8	60.4	59.7	65.0	61.7	62.3	63.1	69.1	64.8	61.4	60.3	67.0	62.9
SC 13	62.3	62.4	66.7	63.8	61.3	60.4	67.4	63.1	62.5	62.8	68.8	64.7	62.7	61.1	70.0	64.6
SC 14	63.8	64.1	67.3	65.1	62.5	63.4	67.5	64.5	64.8	64.7	69.9	66.4	63.8	64.1	69.9	65.9
SC 15	63.8	64.2	67.1	65.0	63.5	63.1	68.1	64.9	64.7	64.7	69.8	66.4	64.7	64.0	71.1	66.6
SC 123	63.0	62.9	66.8	64.3	62.3	62.6	67.5	64.1	62.9	63.1	69.2	65.1	62.5	63.0	69.7	65.1
Mean	63.0	63.3	67.2	64.5	62.0	61.9	67.2	63.7	63.4	63.7	69.6	65.5	63.0	62.6	69.6	65.1
$LSD_{0.05}$	0.7	0.7	1.0	0.5	1.0	0.4	1.2	0.5	0.8	0.8	1.1	0.5	1.0	0.5	1.4	0.6
CV %	1.4	1.4	1.9	1.6	1.9	0.9	2.2	1.8	1.6	1.5	2.0	1.8	2.0	0.9	2.5	2.0

Table 2: Plant and ear heights (cm) of the maize hybrids at Sakha (Sak), Gemmeiza (Gem), and Ismailia (Ism) locations in 2005 and 2006 seasons.

Single crosses	Plant height (cm)								Ear height (cm)							
	2005				2006				2005				2006			
	Sak.	Gem.	Ism.	Comb.	Sak.	Gem.	Ism.	Comb.	Sak.	Gem.	Ism.	Comb.	Sak.	Gem.	Ism.	Comb.
SC 10	306	297	262	288	308	256	281	282	179	167	116	154	176	145	128	150
SC 11	286	279	242	269	289	244	257	263	150	146	102	132	161	123	118	134
SC 13	277	274	239	263	289	243	259	264	154	144	105	134	162	135	114	137
SC 14	307	299	246	284	303	260	282	282	178	167	112	152	172	147	126	148
SC 15	308	286	255	283	302	250	257	269	183	166	121	156	180	147	124	150
SC 123	288	277	239	268	288	235	258	260	159	149	106	138	164	127	114	135
Mean	295	285	247	276	297	248	266	270	167	156	110	144	169	137	121	142
$LSD_{0.05}$	13	8	12	6	7	5	18	6	7	5	8	4	7	4	NS	5
CV %	5.4	3.5	5.9	5.0	2.9	2.2	8.2	5.1	5.1	4.0	9.4	5.9	4.9	3.2	12.5	7.2

Table 3 : Grain yield/plant (g) and grain yield (ard/fed) of the maize hybrids at Sakha(sak), Gemmeiza(Gem), and Ismailia(Ism)locations in 2005 and 2006 seasons.

Single crosses	Grain yield/plant (g)								Grain yield (ard/fed)							
	2005				2006				2005				2006			
	Sak.	Gem.	Ism.	Comb.	Sak.	Gem.	Ism.	Comb.	Sak.	Gem.	Ism.	Comb.	Sak.	Gem.	Ism.	Comb.
SC 10	195.8	180.0	109.3	161.7	170.8	209.4	104.2	161.4	34.87	30.53	19.54	28.31	29.58	37.55	17.44	28.19
SC 11	195.7	189.1	106.3	163.7	173.7	209.6	117.2	166.7	33.68	31.85	18.75	28.09	30.91	37.55	20.21	29.55
SC 13	180.5	184.1	92.6	152.4	149.1	193.9	100.1	147.7	32.54	30.78	16.62	26.65	27.05	34.99	17.48	26.51
SC 14	184.8	179.5	87.5	150.6	162.9	190.8	104.1	152.6	32.84	30.89	14.50	26.08	29.27	34.13	18.18	27.19
SC 15	186.2	166.8	98.5	150.5	158.2	178.0	99.0	145.1	33.21	28.27	17.62	26.37	28.32	31.85	17.62	25.93
SC 123	169.8	169.1	87.8	142.2	149.4	172.9	88.1	136.8	30.52	28.57	16.00	25.03	26.38	30.89	15.33	24.20
Mean	185.4	178.1	97.0	153.5	160.7	192.4	102.1	151.7	32.94	30.15	17.17	26.75	28.59	34.49	17.71	26.93
$LSD_{0.05}$	10.9	6.3	7.3	4.8	9.4	6.3	8.6	4.7	1.97	1.03	1.44	0.86	1.71	1.18	1.33	0.81
CV %	7.2	4.3	9.1	6.6	7.1	4.0	10.3	6.6	7.3	4.1	10.2	6.4	7.3	4.1	9.11	6.4

Table 4: Effect of plant density on number of days to 50% tasseling and silking at Sakha(sak), Gemmeiza(Gem), and Ismailia (Ism)locations in 2005 and 2006 seasons.

Plant Density (1000)	Days to 50% tasseling								Days to 50% silking							
	2005				2006				2005				2006			
	Sak.	Gem.	Ism.	Comb.	Sak.	Gem.	Ism.	Comb.	Sak.	Gem.	Ism.	Comb.	Sak.	Gem.	Ism.	Comb.
20	63.1	62.6	68.3	64.7	62.0	61.1	66.8	63.3	63.2	63.0	70.7	65.6	62.8	61.9	69.0	64.6
25	63.0	63.9	66.6	64.5	61.5	62.7	67.5	63.9	63.4	64.3	69.1	65.6	62.3	63.2	70.2	65.2
30	62.8	63.5	66.6	64.3	62.6	61.9	67.3	63.9	63.5	63.8	68.9	65.4	64.0	62.6	69.5	65.4
Mean	63.0	63.3	67.2	64.5	62.0	61.9	67.2	63.7	63.4	63.7	69.6	65.6	63.0	62.6	69.6	65.1
$LSD_{0.05}$	NS	1.0	NS	NS	0.7	0.6	NS	0.3	NS	1.1	1.5	NS	0.2	0.5	NS	0.4
CV %	1.4	1.4	1.9	1.6	1.9	0.9	2.2	1.8	1.6	1.5	2.0	1.8	2.0	0.9	2.5	2.0

Table 5: Effect of plant density on plant and ear heights (cm) at Sakha (Sak), Gemmeiza (Gem), and Ismailia (Ism)locations in 2005 and 2006.seasons.

Plant Density (1000)	Plant height (cm)								Ear height (cm)							
	2005				2006				2005				2006			
	Sak.	Gem.	Ism.	Comb.	Sak.	Gem.	Ism.	Comb.	Sak.	Gem.	Ism.	Comb.	Sak.	Gem.	Ism.	Comb.
20	293	282	240	272	297	249	272	273	162	152	102	139	166	139	123	143
25	295	287	251	278	300	249	260	270	169	158	117	148	174	137	120	144
30	298	286	249	278	292	245	265	267	170	158	112	147	167	136	119	141
Mean	295	285	247	276	297	248	266	270	167	156	111	145	169	137	121	142
$LSD_{0.05}$	NS	NS	NS	NS	NS	NS	NS	NS	5	NS	11	4	6	NS	NS	NS
CV %	5.4	3.5	5.9	5.0	2.9	2.2	8.2	5.1	5.1	4.0	9.4	5.9	4.9	3.2	12.5	7.2

Table 6: Effect of plant density on grain yield/plant (g) and grain yield (ard/fed) at Sakha (Sak), Gemmeiza (Gem), and Ismaila (Ism)locations in 2005 and 2006 seasons.

Plant Density (1000)	Grain yield/plant (g)								Grain yield (ard/fed)							
	2005				2006				2005				2006			
	Sak.	Gem	Ism.	Comb.	Sak.	Gem	Ism.	Comb.	Sak.	Gem	Ism.	Comb.	Sak.	Gem	Ism.	Comb.
20	209.7	196.2	98.9	168.3	182.9	216.6	120.5	173.4	31.36	28.00	14.49	24.62	27.36	32.35	17.76	25.82
25	192.3	185.0	100.8	159.4	169.3	194.9	104.3	156.2	33.88	31.81	17.52	27.53	30.10	34.64	17.99	27.57
30	154.2	153.0	91.4	132.9	129.9	165.7	81.4	125.7	33.59	31.26	19.50	28.12	28.30	36.50	17.37	27.39
Mean	185.4	178.1	97.1	153.5	160.7	192.4	102.1	151.7	33.00	30.20	17.20	26.75	28.59	34.49	17.71	26.93
$LSD_{0.05}$	8.9	7.9	NS	4.4	11.6	4.9	5.8	4.0	1.94	1.20	1.32	0.75	1.92	0.90	NS	4.73
CV %	7.2	4.3	9.1	6.7	7.1	4.0	10.3	6.6	7.3	4.1	10.2	6.9	7.3	4.1	9.1	6.4