EFFECT OF RIDGE SPACING AND PLANT DENSITY FOR TWO MAIZE HYBRIDS

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ABSTRACT

Two field experiments were carried out at the Experimental Farm of Gemmeiza Agricultural Research Stations during 2007 and 2008 seasons to study the effect of row spacing, i.e. (60,70 and 80cm apart) and plant density, i.e. (20000, 25000 and 30000 plants/fed.) on growth, yield and yield components of two maize hybrids, i.e. (S.C125 and S.C162). A split-split plot design with four replicates was used in the two experiments.

- Results showed that increasing ridge spacing significantly recorded No. of days two 50% tassling and silking , plant and ear heights were in the same direction planting on 80 – cm ridge was associated with a significant increase in ear length , No. of kernels/row, 1000 kernels weight and grain yield (ard/fed).

- On the other side, plant density of 25000 plant/fed was associated with the highest grain yield and its component as soon as it is considered of the optimum environmental.

- Single cross 125 was earlier than single cross 162 of days to 50% tassling and silking. S.C. 125 had the best effects of plant and ear height towards low ear position, 1000 kernels weight, S.C. 162 gave the highest values of No. of ear length kernels/row and grain yield. (Ridge spacing x plant density interaction was significant for No. of days to 50% tassling and silking, plant and ear heights, No. of kernels/row. Plant density x hybrid interaction was significant for plant height, ear length, 1000 kernels weight (g) and grain yield ard./fed).

- This investigation showed that planting on 80- cm rows at plant density of 25000 plants/fed (25- cm between hills) in order to obtain the highest grain yield. This would also facilitate using the mechanization and saving costs, time, and effort.

INTRODUCTION

Maize (*zea mays* L.) is considered of important cereal crop in Egypt and the world, where, it ranged after wheat and rice from the importance. It is widely used (*zea mays* L.) in bread manufacture intural areas of the country because it conform the basis for several industries such as starch, fructose, corn flakes, alcohol, corn oil, corn sugar, corn fiber (soronoa), ethanol and biobutanol as well as the main component (about 70 %) of animal feed in Egypt, it is necessary to increase maize yield to face the wide gab between the production and consumption. High maize production can be achieved by improving cultural practices and planting the promising hybrids. Corn agronomists continually search for methods that help them to increase grain yield and net return of producing the crop plant density and row spacing affect plant distribution in field. Currently maize practices in Egypt recommend planting maize in hills on 70 cm between rows and 25 – 30 cm

between hills (within row). Brown *et al*. (1970), recorded a that 33.7% yield increase for corn grown in 51 cm rows compared with 102 cm between rows. Fulton (1970), revealed that higher plant densities (54.362 plants ha^{-1}) produced higher yields than lower densities (36.536 plants ha^{-1}), and rows spaced at 50 cm produced higher yields than rows paced 100 cm apart Lutz *et al*. (1971), reported 5% yield increase for 76 cm between ridge spacing corn parded with 102cm row spacing and an additional 2.7% yield adventage for 38 cm. ridge spacing. younis *et al*. (1989), Ragheb *et al*. (1993), revealed that 60 cm rows were associated with higher grain yield compared with 70 or 80 cm rows. Grain yield increase in response to narrows rows closely related to the improvement in light interception during the critical period for grain set. Optimum plant distribution would play an important role in distributing plants more equidistantly across the field and reduced interplant competition. Sharief (2001) shown that increasing plant population density of maize spacing 51 – 60 cm and hill spacing of 25 – 30 cm apart gave plant density for maximizing grain yield per unit area ridge spacing optimum plant density depending on ridge spacing, density pattern sowing date and hybrids. In addition, plant density x row spacing (50 cm) interaction in only one of four experimental years, indicate that the effect of narrow row spacing was greater at high plant densities that at low plant densities.

The objective of this investigation was to study the response of two new maize crosses i.e. S.C. 125, white new commercial hybrid and yellow single cross hybrids S.C. 162 to ridges spacing (60 , 70 and 80 cm) and three plant densities (20 , 25 and 30 thousand plants / fed).

MATERIALS AND METHODS

Two field Experiments were performed at the Experimental Farm of Gemmeiza Agriculture Research Station, Agricultural Research Center (ARC), Egypt during 2007 and 2008 growing seasons.

Treatments:

1. Ridge spacing (S):

Three row spacing, i.e., 60, 70 and 80 cm apart.

60 cm (divided into 17 , 21 and 26 hill/row respectively).

70 cm (divided into 21 , 25 and 31 hill/row respectively).

80 cm (divided into 23 , 29 and 34 hill/row respectively).

2. Plant density (D):

Three plant densities, i.e., 20000, 25000 and 30000 plants/fed.

3. White and yellow maize hybrids (H):

Split split plot design was used in this study with four replications. Three ridge spacing (S) were arranged in main plots, plant densities were arranged in sub plots and two hybrids were arranged in sub sub plots.

Each plot consists of 5 rows with 6 m length; the two outer rows number one and five were left as border rows. The row number 2 was left for vegetative samples. The two outer rows number one and five were left as border rows. The two row number three and four were left for yield and yield components. Maize grains were hand sown in hills at the rate of 2 – 3 grains/hill using dry sowing method (Afir) on one side of the ridge with the

above mentioned hill spacing during the third week of may in 2007 and 2008 seasons. The other agricultural practices were kept the same as normally practiced in maize fields according to the recommendation of ministry of Agriculture and land Reclamation, except for the factors under study. While, the studied characters were :

1. Days to 50% tassling : (number of days from sowing to 50% emergence of tassling)
2. Days to 50% silking : (number of days from sowing to 50% emergence of silking)
3. Plant height (cm)   4. Ear height (cm)   5. Ear length (cm)
6. Number of kernels per row: 7. 1000 kernel weight (g):
8. Grain yield (ard./fed.): It was determined by the weight of grains per kilograms adjusted to 15.5 moisture content of each plot, then converted to ardab per feddan.

All data were statistically analysis according to the technique of analysis of variance (ANOVA) for the split split – plot design as published by Gomez and Gomez (1984) by means of " MSTAT – C" Computer software package. The treatment means were compared using least significant difference (LSD) method at 5 % levels of probability according to the producer outlined by Waller and Duncan (1969).

RESULTS AND DISCUSSION

Means of days to 50% tasseling , silking , plant height and ear height as affected by ridge spacing, plant density of two maize hybrid and their interactions as show in Table (1):

1- Effect of ridge spacing :

Number of days to 50% tasseling and silking were significantly affected by ridge spacing in both seasons (2007and 2008). The earliest value of these traits were obtained at 60 cm ,while, the latest value was at 80 cm. Plant height was significantly by row spacing in both seasons. ,while, ear height exhibited significant differences for row spacing in both seasons. The lowest value was at 60cm apart between rows as shown in Table 1. The hybrids had significant differences in 2007 season, but it was not significant in 2008 season , row spacing exhibited significant differences on number of kernels/row in 2008 season, but it was not significant in 2007 season. The highest value of number of kernels/row was obtained at row width 80cm , Increasing the distance among rows from 60 to 80cm apart significantly increased 1000 kernels weight in 2007 season and ridge spacing exhibited significant differences on grain yield/fed. Where the higher values of grain yield/fed was at 80cm apart between rows, while, the lower values were obtained at 60cm apart between rows. These results were agreement with those Aly *et al.* (1996) and El- Koomy (2000), Atta–Allah (1996) and Mahgoub and El-Shenawy (2006) , Younis (1994), El-Habbak (1996), Mosalem (1998), El-Sheikh (2000), and Khalil (2001).

2- Effect of plant density :

Number of days to 50% tasseling and silking were affected by plant density in first season, plant density had no effect on plant height in 2007

season but it had significant differences in 2008 season, ear height was not significant by plant density in both seasons as shown in Table 1. , plant density was significant on ear length in both seasons where the highest value was at 20000 plant/fed , effect of plant density was not significant on number of kernels/row in both seasons , increasing plant density from 20000 to 30000 plant/fed led to significantly decreased 1000 kernels weight in 2007 season , Plant density exhibited significant differences in both seasons on grain yield/fed, where the plant density 25000 plant/fed gave the highest values of grain yield/fed. and it considered the optimum density or the optimum environmental as shown in Table 2.

3- Behavior of hybrids :

S.C. 125 was earlier than S.C. 162 in both seasons for to 50% tassling and silking , also the two hybrids exhibited the same effects and it was the same order on plant height trait , the highest value was obtained of ear height for S.C 162 , there was significant differences between two maize hybrids, where S.C 162 gave the highest value under two seasons comparing to S.C. 125 , maize hybrids showed significant differences on number of kernels/row in 2007 and 2008 seasons. S.C. 162 gave higher values on number of kernels/row comparing to S.C. 125 , the two hybrids exhibited significant differences on 1000 kernels weight where S.C. 125 gave the highest value of 500 kernels weight during the two seasons , the two maize hybrids exhibited significant differences for grain yield/fed. in both seasons. S.C. 162 gave the highest value of grain yield/fed. during the two seasons similar results were recorded , Meky (1993), Atta-Allah (1996) Mosalem (1998) Khalil *et al.* (2000) , El-Sheikh (2000), and Khalil (2001) , Nawar *et al.* (1991), Younis *et al.* (1994), Aly *et al.* (1996), El-Zeir *et al.* (1998), Said and Gaber, (1999) and Hassan, (2000).

4- Interaction between factors :

The interactions between ridge spacing with hybrids and plant density on plant height were significant, also the interactions between hybrids and plant density were significant in both seasons , ear height was significantly affected by all interactions, except, interaction between maize hybrids and plant density , the interactions among all studied factors on 100 kernels weight was highly significant in both seasons, except the interaction between maize hybrids and plant density was significant in 2007 season and not significant in 2008 season , the interaction between the different factors exhibited significant differences, except, ridge spacing × plant density was not significant in 2008 season as reported by. Said and Gaber, (1999) and Hassan, (2000). Nawar *et al.* (1991), Younis *et al.* (1994), Aly *et al.* (1996), El-Zeir *et al.* (1998), Mosalem (1998) , Khalil (2001) , El-Habbak (1996), and Hassan *et al.* (2000).

Table 1 : Number of days from sowing to 50% tasseling , silking , plant height (cm) and ear height (cm) as effected by ridge spacing, plant density and varieties performance as wells their interaction during 2007 and 2008 on seasons.

Characters / Treatments	50 % Tasseling		50 % Silking		Plant height (cm)		Ear height (cm)	
	2007	2008	2007	2008	2007	2008	2007	2008
A - Row spicing (cm)								
60 (cm)	59.87 B	60.37 B	60.75 B	60.37 B	250.25 B	246.12 B	138.12 B	139.41 B
70 (cm)	59.91 B	59.50 C	60.91 B	59.50 C	248.12 B	258.54 A	135.79 B	147.37 A
80 (cm)	60.33 A	61.08 A	61.33 A	61.08 A	255.29 A	260.62 A	141.54 A	146.33 A
F test	*	*	*	*	*	*	*	*
B – Plant density								
20	59.83 B	60.45	60.83 B	60.45	251.91	257.50 A	138.83	143.62
25	59.87 B	59.87	60.87 B	59.87	252.83	256.45 A	139.54	145.45
30	60.41 A	60.62	61.29 A	60.62	248.91	251.33 B	137.08	144.04
F test	*	NS	*	N S	N S	*	N S	N S
C- Varieties								
S.C. 125	59.30	59.94	60.25	59.94	245.33	252.13	135.63	144.80
S.C. 162	60.77	60.69	61.75	60.69	257.11	258.05	141.33	143.94
F test	*	*	*	*	N S	*	*	N S
D- Interaction								
A x B	**	*	*	*	*	**	**	**
A x C	*	*	N S	*	**	**	**	**
B x C	N S	N S	N S	N S	*	*	*	N S
A x B x C	**	N S	**	N S	**	**	**	**

Table 2: Number of days from sowing to ear length (cm) , no. of kernels/row , 500 kernels weight (g) and grain yield (ard/fed) as effected by ridge spacing, plant density and varieties performance as wells their interaction during 2007 and 2008 on seasons.

Characters / Treatments	Ear length (cm)		No. of kernels/row		1000-Kernels weight (gm.)		Grain yield (ard/fed)	
	2007	2008	2007	2008	2007	2008	2007	2008
A - Row spicing (cm)								
60 (cm)	20.10	19.94 B	44.25	43.43 B	358.66 B	319.50 A	30.82 B	27.75 B
70 (cm)	20.41	20.12 B	44.25	44.60 B	365.24 B	288.04 C	31.55 B	28.38 B
80 (cm)	20.36	21.32 A	44.45	46.17 A	380.34 A	305.16 B	34.75 A	31.51 A
F test	N S	*	N S	*	*	*	*	*
B – Plant density								
20	20.93 A	20.76 A	45.35	45.37	374.86 A	311.64 A	30.88 C	27.84 C
25	20.61 A	20.39 A	44.72	44.57	368.32 A	295.36 B	33.80 A	30.75 A
30	19.32 B	20.23 B	42.87	44.27	361.06 B	305.70 A	32.43 B	29.06 B
F test	*	*	N S	N S	*	*	*	*
C- Varieties								
S.C. 125	18.87	19.08	43.89	43.40	372.96	312.24	29.18	27.31
S.C. 162	21.71	21.84	44.74	46.07	363.20	296.22	35.56	31.12
F test	*	*	*	*	*	*	*	*
D- Interaction								
A x B	*	*	N S	N S	**	**	**	**
A x C	N S	N S	**	N S	**	**	*	N S
B x C	N S	*	N S	N S	*	N S	**	*
A x B x C	N S	N S	*	N S	**	**	**	*

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تأثير عرض الخط والكثافة النباتية على هجنين من الذرة الشامية
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أجريت تجربتان حقليتان بالمزرعة البحثية بمحطة البحوث الزراعية بالجميزة وذلك خلال موسمي ٢٠٠٧ و ٢٠٠٨ لدراسة تأثير عرض الخط (٨٠،٧٠،٦٠ سم) والكثافة النباتية (٢٠٠٠٠،٢٥٠٠٠،٣٠٠٠٠ ألف نبات/فدان) وذلك لدراسة تأثيرها على النمو والمحصول ومكوناته لهجنين من الذرة الشامية وهما (هـ٠ف ١٢٥ أبيض, هـ٠ف ١٦٢ أصفر).
وكان التصميم المستخدم للتجربتين هو القطع المنشقة مرتين في أربع مكررات .
وأظهرت النتائج ما يلي :-
١- تأثير عرض الخط :
تأثرت كل من صفة ٥٠% لقاح و ٥٠% حريره بعرض الخط (٦٠سم) في كلا الموسمين وتأثر كل من ارتفاع النبات والكوز(سم) بعرض الخط معنويا حيث كانت قيمة عرض الخط ٦٠سم أكثر تأثيرا وتأثرت صفة طول الكوز (سم) في الموسم الثاني ٢٠٠٨ مقارنة بالموسم الأول ٢٠٠٧ بالنسبة لعرض الخط (٨٠سم). وتأثرت صفة عدد الحبوب/السطر خلال الموسمين بعرض الخط وتأثرت صفة وزن الــ ١٠٠٠ حبة معنويا مع زيادة عرض الخط وتأثرت صفة محصول الحبوب بعرض الخط حيث أعطت قيما عالية عند ٨٠سم بينما الأقل عند ٦٠سم.

٢- تأثير الكثافة النباتية :

تأثرت كل من صفة ٥٠% لقاح و ٥٠% حريره معنوياً بتغير الكثافة النباتية كما أظهرت التفاعلات فروقا معنوية للصنفين هـ٠ف ١٦٢ ، ١٢٥ خلال الموسمين وبالنسبة لصفة طول الكوز تأثرت الكثافة النباتية معنويا على نفس الصفة عند ٢٠٠٠٠ نبات مقارنة بالكثافتين ٢٥ ، ٣٠ ألف نبات وبالنسبة لصفة عدد الحبوب/السطر لم تتأثر بالكثافة النباتية وبالنسبة لصفة وزن الـ ١٠٠٠ حبة تناقصت مع زيادة الكثافة النباتية وتأثرت صفة محصول الحبوب بالكثافة النباتية حيث كانت الكثافة النباتية ٢٥٠٠٠ نبات الأعلى قيمة للمحصول.

٣- سلوك الأصناف :

أظهر هـ٠ف ١٢٥ قدرة على التبكير مقارنة بـ هـ٠ف ١٦٢ خلال الموسمين لكل من صفة ٥٠% لقاح و ٥٠% حريره وأظهر هـ٠ف ١٦٢ تأثيرات معنوية أعلى مقارنة بـ هـ٠ف ١٢٥ لكل من صفة ارتفاع النبات والكوز كما أظهر هـ٠ف ١٦٢ قيما أعلى لصفة طول الكوز مقارنة بـ هـ٠ف ١٢٥ وبالنسبة لصفة عدد الحبوب/السطر أظهر هـ٠ف ١٦٢ أيضاً قيما أعلى عن هـ٠ف ١٢٥ وبالنسبة لصفة وزن الـ ١٠٠٠ حبة أعطى صنف هـ٠ف ١٢٥ قيما أعلى مقارنة بـ هـ ٠ف ١٦٢ وبالنسبة لصفة محصول الحبوب أعطى هـ٠ف ١٦٢ قيما عالية في كلا الموسمين ٢٠٠٧ ـ ٢٠٠٨.

٤- التفاعل بين العوامل تحت الدراسة:

بالنسبة لصفة ٥٠% لقاح و ٥٠% حريره كانت التفاعلات معظمها معنويا في كلا الموسمين وأظهرت التفاعلات فروقا معنوية للصنفين هـ٠ف ١٦٢ ، ١٢٥ خلال الموسمين لصفتي ارتفاع النبات والكوز كما أظهر التفاعل بين عرض الخط وهجن الذرة كانت معنوية بالنسبة لصفة طول الكوز وأظهر التفاعل بين عرض الخط والكثافة النباتية فروقا معنوية بالنسبة لصفة عدد الحبوب/السطر بينما كانت معظم التفاعلات تحت الدراسة معنوية لصفة الـ ١٠٠٠حبة. كما أظهرت جميع التفاعلات تحت الدراسة فرقا معنوية ما عدا التفاعل بين عرض الخط والكثافة النباتية في الموسم ٢٠٠٨.

٥- التوصية

عموما من النتائج المتحصل عليها في هذه الدراسة يمكن التوصية بزراعة الذرة الشامية عند عرض خط ٨٠ سم وعلى كثافة نباتية ٢٥٠٠٠ نبات حيث أعطت أعلى محصول للحبوب وتعتبر هذه الظروف أفضل بيئة مناسبة لمعظم هجن الذرة الشامية.