J. Plant Production, Mansoura Univ., Vol. 7 (8): 877 -881, 2016

Growth Characters OF Some Maize Hybrids as Affected by Inter and Intra Row Spacings

Kandil, A. A.; A. E. Sharief* and A. M. A. Abozied
Agronomy Department, Faculty of Agriculture, Mansoura University, Egypt.
*** Corresponding Author: Email: shariefali42@gmail.com**

ABSTRACT

To study performance of some maize hybrids under different inter and intra row spacing on flowering and growth characters. Two field experiments were carried out in extension field at Sherbin Center, Dakahlia District, Egypt during summer seasons of 2014 and 2015.The results exposed that S.C. 3084 hybrid chronicled the earlier number of days to 50% tasseling, highest number of green leaves/plant and highest values of total chlorophyll, thickness stems, tallest plants and ear height and lowest ear leaf area. However, S.C 2066 hybrids recorded the latest in number of days to 50% tasseling, the lowest number of green leaves/plant, the lowest values of total chlorophyll, stem diameter, plant height and ear height and the highest values of ear leaf area. Sown maize hybrids on width rows (70 cm) produced earlier plants to 50% tasseling, highest number of green leaves/plants, highest values of ear leaf area, thickness stems, tallest plants and ear height. Whereas, sown maize plants on narrow row width (60 cm) produced earlier plants to 50% silking and highest values of total chlorophyll. Sown maize hybrids at hills of 30 cm apart produced the earlier number of days to 50 % tasseling and 50 % silking, the highest values of ear leaf area and stem diameter. While, sown maize plants at hill spacing of 25 cm apart produced the highest number of green leaves/plant. However, sown maize hybrids at hills of 20 cm apart produced highest values of total chlorophyll and tallest plants. It can be concluded that sown S.C. 3084 hybrid on 60 cm row width at hill spacing of 20 cm apart exploited maize growth characters under the environmental conditions of Dakahlia Governorate, Egypt.

Keywords: Maize hybrids, inter-intera row spacing, growth characteristics.

INTRODUCTION

Maize (*Zea mays* L.) is considered as a one of the most important strategic cereal food crops in Egypt and the world. It ranks the third among cereal crops after wheat and rice. To increase grain production per unit area of maize in delta soils. It must be determined the suitable hybrids at both row and hill spacing the maximized its productivity. Maize hybrids may be different in agronomic characters due to row width, hill spacing and plant population density that affect production per unit area. Plant population density and its distribution per unit area may be increase maize production per unit area i.e. inter and intra row spacing. So, number of plants per unit area can be achieved by controlling hill distance, distance between ridges and number of plants per hill. Maize hybrids differed in growth and flowering characteristics. In this respect, Sharifi *et al*. (2009), Alias *et al.* (2010) and El-Metwalley *et al*. (2011)summarized that for obtaining higher maize yield and net income maize to different response to growth characteristics. Attia *et al*. (2009) found that S.C.125 was earlier than S.C.162 of days to 50 % tasseling and silking. S.C.125 had the best effects of plant had ear height towards low ear position. Zamir *et al*. (2011) found that hybrid 30Y87 was early in maturity. Leilah *et al.* (2013) found that S.C. 128 produced the highest growth when sown on ridges 80 cm apart 22 cm between hills and one plant hill^{-1}. Enuieke (2013) studied effects of variety and spacing on growth characters of maize hybrid. He found that hybrid 90-22-13 was superior to other varieties investigatedgrowth characters. Sadeghi (2013) reported that hybrid of KS.C.704 had the highest leaf area index (LAI) and its delayed durability compared to other hybrids. Kandil (2013) suggested that the single S.C.10 and Kg N /ha could be utilized for attaining the maximal improvement growth parameters. Modhej *et al.* (2014) indicated that maize hybrids DKC6589 and Mobeen had the highest and lowest grain yield among studied hybrids. Zhang *et al.* (2015) revealed that photosynthetic apparatus of Shaandan 609 (SD609) hybrid maize was more resistant to drought stress than that of Zhengdan 958 (ZD958) hybrid maize. Recently, Panison *et al.* (2016) showed that the harvests performed after physiological maturity decreased the real grain productivity, especially for the hyper-early hybrids P1630H and P32R22H.

Row width plays a great on maize plant population. In this respect, Darwich (2009), Onyango (2009), Attia *et al*. (2009)and El-Mekser *et al*.(2009)indicated that increasing distance between rows from 60 to 70 and 80 cm lead to a significant increase in growth character due to better interception and utilization of solar radiation and the increase in photosynthetic processes. Gobeze *et al*. (2012) revealed that row spacing and plant density influenced growth, yield and its component. These characters were significantly higher at row spacing of 0.9 m with plant density of 5 plants /m^2. Leilah *et al.* (2013) found planting maize in ridges 80 cm apart improved growth characters. Whereas, Fahad *et al.* (2016) reported that maize plants sown in row having 60 cm apart improved growth parameters.

Many investigators studied the effect of hill spacing between hills on hybrids growth, in this regard, Bisht *et al.* (2012)found that growth characters increased in the narrow rows due to limited intra-row plant competition for light, nutrients and water. It has also been reported that population above the optimum has resulted in lodging that has caused a reduction in maize production. Leilah *et al*. (2013) found that increasing plant spacing up to 30 cm between hills increased all growth characters, except No. of days from sowing to 50 % tasseling and plant height, which increased due to sowing maize at hills 20 cm apart.

Sowing maize plants at hills 25 cm apart surpassed other plant spacing in growth parameters. In addition, Ukonze *et al.* (2016)showed that the 70 x 30 and 60 x 40 cm spacing gave higher values of the morphological parameters than 80 x 20 cm. With regard to yield, 80 x 20 cm gave the highest average cob weight and 1000-grain weight.The interaction among row width and hill spacing significantly affected on grain yield and yield components, in this respect, Mahgoub and El-Shenawy (2006) observed that plant density and hybrids interaction was significant for No. of days to 50 % silking, No. of ears /plant, grain yield /plant and grain yield /fed.The present investigation was objective to study inter, intera row spacing and plant population density on the flowering and growth characters of some single cross maize hybrids.

MATERIALS AD METHODS

The current investigation was carried out at the extension field at Mahelt Engaq Village, Sherbin Center, Dakahlia District during summer growing seasons of 2014 and 2015. The objective of this investigation was aimed to study the effect of inter and intra row spacing on plant growth, yield, and yield components of some maize hybrids.Two separate field trials were conducted during each year of 2014 and 2015 summer seasons. One trail for each row spacing (RS), *i.e*. 60 and 70 cm between ridges. The experimental design used in each trail was split-plot design in four rep locations.The main plots were assigned for maize hybrids and hill spacing were randomly distributed in the sub-plots. The combined analysis was done over the two row pacing experiments. Eight plant population densities and its distribution were the combination offour hybrids and four plant spacing as follows:

1. Row spacing: 60 and 70 cm apart.
2. Maize hybrids (H): Four yellow maize hybrids *i.e.*(SC) 3084, (SC) 3062, (SC) 2055 and (SC)2066.
3. Plant Spacing (S): The four hill spacing were 15, 20, 25 and 30 cm hill spacing apart.

Each plot consisted of five ridges, 4.5 m long and the ridge width was differed according to the treatment. The outer two ridges (1st and 5th) were considered as borders. Grain yield and yield components were determined from the remaining two ridges. The previous crop was wheat in both years. Planting date was done on June 16 in 2014 season, and June 6 in 2015 season. Calcium superphosphate 15.5% P_2O_5) at the rate of 200 kg/fad was applied before planting. Three rains were hand planted in each hill. Thinning to one plant per hill was done before the first irrigation. Hoeing twice was done for controlling weeds before the first and second irrigations. Nitrogen fertilizer in the form of urea (46.0 %N) at the rate of 120 kg N/fad was applied in two equal doses before the first and the second irrigation, respectively. Recommended agricultural practice in the region was applied.These distributed of eight plant population densities was presented in Table 1.

Table 1. Different plant population densities due to row width and hill spacing.

Row width	Hill spacing	Plant populations densities
60 cm	15 cm	46.666 Plant/fad
60 cm	20 cm	35.000 Plant/fad
60 cm	25 cm	28.000 Plant/fad
60 cm	30 cm	23.333 Plant/fad
70 cm	15 cm	40.000 Plant/fad
70 cm	20 cm	30.000 Plant/fad
70 cm	25 cm	24.000 Plant/fad
70 cm	30 cm	20.000 Plant/fad

Studied characters:

Flowering and growth characters:

1-Number of days to 50% tasseling: It was recorded on plot basis as the number of days from planting to 50 % tassels emergence.

2-Number of days to 50% silking: It was recorded on plot basis as the number of days from planting to 50 % silk emergence.

3-Number of green leaves/plant.

4-Chlorophyll content: Five SPAD-502 readings were measured on ear bearing leaves of five plants by the portable chlorophyll meter (SPAD-503, Minolta, Japan). Mean of five SPAD-502 readings by the portable chlorophyll meter (SPAD-502, Minolta, Japan) on different randomly chosen five plants in the inner two ridges of each experimental plot were recorded. Chlorophyll content was determined as SPAD unit (Soil and Plant Analysis Department) of Minolta Co. These units were transformed to mg m as described by Digital.

5-Ear leaf area in (cm^2): It was measured according to Gardner *et al.*(1985) as follow:Leaf area = leaf length x maximum leaf width x 0.75.

6-Stem diameter (cm.): It was measured on the second internode from the ground surface.

7-Plant height (cm): It was measured as the mean of five guarded plants measured from soil surface to the base of tassel.

8-Ear height (cm): It was measured as the mean of five guarded plants from the soil surface to the node bearing of the upper most ear.

All obtained data were statistically analyzed according to the technique of analysis of variance (ANOVA) for the split – plot design to each experiment (row spacing), then combined analysis was done between row spacing trails as published by Gomez and Gomez (1991) by using "MSTAT-C" computer software package. Least significant of difference (LSD) method was used to test the differences between treatment means at 5 % level of probability as described by Snedecor and Cochran (1980).

RESULTS AND DISCUSSION

I- Performance of maize hybrids:

A significant difference among four yellow maize hybrids *i.e.*SC 3084, SC 3062, SC 2055 and SC 2066were detected on flowering and growth characters i.e. number of days to 50% tasseling, number of green leaves/plant, chlorophyll content, ear leaf area stem

diameter plant height and ear height in both seasons. However, number of days to 50% silking(in both seasons), number of green leaves/plant (in the first season) and stem diameter i(n the second season) did not significantly differed due to studied maize hybrids. The results in Tables (1 and 2) obviouslydisplayed that S.C. 3084 hybrid recorded the earlier number of days to 50% tasseling, highest number of green leaves/plant and number grains/row, highest values of leaves total chlorophyll, thickness stems, tallest plants and ear height and recorded the lowest ear leaf area. However, S.C. 2066 hybrids recorded the latest in number of days to 50% tasseling, the lowest number of green leaves/plant, the lowest values of total chlorophyll, thin stems,shortest plants and ear height and highest ear leaf area. These results in good agreement to those reported byAlias et al. (2010), El-Metwalley et al. (2011), Leilah et al. (2013), Sadeghi (2013), Kandil (2013), Modhej et al. (2014), Zhang et al. (2015) and Panison et al. (2016).

II- Effect of row width:

Regarding the effect of row width (60 and 70 cm) between ridges on maize hybrids flowering and growth characters i.e. number of days to 50% tasseling, number of days to 50% silking, number of green leaves/plant, chlorophyll content, ear leaf area stem diameter plant height and ear height in both seasons. Theresults in Tables (1 and 2) clearlyrevealed that there was a significant effect on number of days to 50% tasseling, number of days to 50% silking, number of green leaves/plant, chlorophyll content, ear leaf area stem diameter plant height and ear height, with exception number of green leaves/plant, total chlorophyll content in leaves and plant height in the first season and ear height in the second season.Sown maize hybrids on width rows (70 cm) produced the earlier plants to 50% tasseling, highest number of green leaves/plants, highest ear leaf area, thickness stems, tallest plants and ear height. Whereas, sown maize hybrids on narrow row width (60 cm) produced the earlier plants to 50% silking andhighest values of total chlorophyll.It is well known that good distribution of maize plants permits canopy to intercept more light energy and hence increase vegetative growth and grain yield. Controlling inter and intra plant competitions would help maize plants to accept more lights, absorb more water and improve nutrient uptake from soil. These results in good accordance with those reported by Attia et al. (2009), El-Mekser et al.(2009), Gobeze et al. (2012), Leilah et al. (2013) and Fahad et al. (2016).

III- Effect of hill spacing:

Concerning to the effect of hill spacing i.e. 15, 20, 25 and 30cm hill apart on hybrids flowering and growth characters i.e. number of days to 50% tasseling, number of days to 50% silking, number of green leaves/plant, chlorophyll content, ear leaf area stem diameter plant height and ear height. The results clearly indicated that hill spacing significantly affected these traits in both seasons excluding number of green leaves/plant in the first season only. Theresults in Tables (1 and 2) evidentlyindicated thatsown maize hybrids at hills 30 cm apart produced the earlier in number of days to 50 % tasseling and 50 % silking,highest ear leaf area and thickness stems. While, sown maize hybrids at hill spacing of 25 cm apart produced highest number of green leaves/plant. However, sown maize plants at hills 20 cm apart produced the highest values of total chlorophyll and tallest plants.Good distribution of maize plants permits canopy to intercept more light energy and hence increase vegetative growth and grain yield.Controlling inter and intra plant competitions would help maize plants to accept more lights, absorb more water and improve nutrient uptake from soil.Similar results were reported by Sharifi et al. (2009), Bisht et al. (2012), Leilah et al. (2013) and Ukonze et al. (2016).

VI- Effect of interactions:

Results in Tables (2 and 3) indicated that there no significant differences due to the interaction between studied maize hybrids and row width as well as the interaction between maize hybrids, row width and hill spacing on number of days to 50% tasseling, number of days to 50% silking, number of green leaves/plant, chlorophyll content, ear leaf area stem diameter plant height and ear height in both seasons. The results presented in Table (4) clearly showed that the interaction between row width and hill spacing significantly affected on number of days to 50 % tasseling, number of days to 50 % silking, number of green leaves/plant, stem diameter, plant and ear height only in 2015 season. The results showed that the earlier number of days to 50 % tasseling, number of days to 50 % silking, stem diameter, plant and ear height was recorded from sown hybrids on width rows (70 cm) at hill spacing of 30 cm and highest number of green leaves/plant was obtained from sown on the same rows but at 25 cm apart. Similar results were reported by El-Metwally et al. (2011),Sharifi et al. (2012), Leilah et al. (2013).

With respect to the effect of the interaction between studied maize hybrids and hill spacing, the results in Table (5) showed a significant effect on total chlorophyll content in leaves, stem diameter, ear leaf area, plant and ear height only in 2014 season.The results showed that highest values of total chlorophyll, thickness stems and highest values of ear leaf area were produced from sown S.C. 2066 hybrid at hill spacing of 30 cm. Meanwhile, tallest plants and ear height were obtained from sown S.C. 3062 hybrid at hill spacing of 15 cm. Similar conclusion were reported byMahgoub and El-Shenawy (2006), Bisht *et al.* (2012), Leilah et al. (2013)andUkonze *et al.* (2016).

Table 2: Number of days to 50 % tasseling and 50 % silking, number of green leaves/plant and total chlorophyll content in leaves as affected by maize hybrids, row width and hill spacing as well as their interactions during 2014 and 2015 seasons.

Treatments / Characters	Number of days to 50 % tasseling		Number of days to 50 % silking		Number of green leaves/plant		Total chlorophyll (SPAD)	
	2014	2015	2014	2015	2014	2015	2014	2015
A- Maize Hybrids:								
SC 3084	59.3	53.9	67.0	59.6	14.7	15.6	40.79	40.48
SC 3062	62.7	54.2	67.0	59.4	14.7	15.0	40.40	40.14
SC 2055	60.7	53.5	67.0	59.6	14.9	14.5	40.76	40.41
SC 2066	58.8	53.4	67.0	59.5	14.5	14.2	41.24	41.01
F. test	*	*	NS	NS	NS	*	*	*
LSD at 5 %	1.0	0.8	-	-	-	0.7	0.41	0.31
B- Row width:								
60 cm	62.4	55.7	68.7	61.0	14.6	14.6	40.93	40.77
70 cm	58.3	51.7	65.3	58.1	14.8	15.1	40.66	40.24
F. test	*	*	*	*	NS	*	NS	*
C- Hill spacing:								
15 cm between hills	61.7	54.8	68.2	60.1	14.6	14.7	40.73	40.58
20 cm between hills	61.0	54.3	67.8	59.5	15.0	14.5	41.40	40.87
25 cm between hills	60.1	53.1	66.4	59.3	14.6	15.1	40.93	41.04
30 cm between hills	58.7	52.7	65.5	59.2	14.6	15.0	40.11	39.54
F. test	*	*	*	*	NS	*	*	*
LSD at 5 %	0.6	0.5	0.6	0.5	-	0.5	0.39	0.43
D- Interactions F-Test:								
A × B	NS	NS	NS	NS	NS	NS	NS	NS
A × C	NS	NS	NS	NS	NS	NS	*	NS
B × C	NS	*	NS	*	NS	*	NS	NS
A × B × C	NS	NS	NS	NS	NS	NS	NS	NS

Table 3: Ear leaf area, stem diameter plant and ear height as affected by maize hybrids, row width and hill spacing as well as their interactions during 2014 and 2015 seasons.

Treatments / Characters	Ear leaf area (cm^2)		Stem diameter (cm)		Plant height (m)		Ear height (m)	
	2014	2015	2014	2015	2014	2015	2014	2015
A- Maize Hybrids:								
SC 3084	884.5	894.2	2.16	2.21	3.27	3.20	1.70	1.70
SC 3062	892.8	882.8	2.20	2.19	3.36	3.38	1.72	1.68
SC 2055	898.8	896.2	2.15	2.18	3.18	3.22	1.66	1.65
SC 2066	904.9	905.3	2.16	2.15	3.33	3.19	1.64	1.56
F. test	*	*	*	NS	*	*	*	*
LSD at 5 %	19.3	21.3	0.04	-	0.08	0.10	0.03	0.04
B- Row width:								
60 cm	892.0	889.7	2.14	2.15	3.30	3.20	1.67	1.65
70 cm	898.5	899.6	2.20	2.21	3.27	3.30	1.69	1.65
F. test	*	*	*	*	NS	*	*	NS
C- Hill spacing:								
15 cm between hills	849.8	838.1	2.16	2.16	3.29	3.32	1.66	1.63
20 cm between hills	897.1	895.6	2.11	2.11	3.32	3.23	1.67	1.63
25 cm between hills	900.6	907.0	2.19	2.20	3.29	3.25	1.69	1.67
30 cm between hills	933.6	937.8	2.21	2.26	3.23	3.20	1.69	1.66
F. test	*	*	*	*	*	*	*	*
LSD at 5 %	36.9	42.9	0.03	0.06	0.05	0.08	0.02	0.03
D- Interactions F-Test:								
A × B	NS	NS	NS	NS	NS	NS	NS	NS
A × C	*	NS	*	NS	*	NS	*	NS
B × C	NS	NS	NS	*	NS	*	NS	*
A × B × C	NS	NS	NS	NS	NS	NS	NS	NS

Table 4: Number of days to 50 % tasseling, No. of days to 50 % silking and No. of green leaves/plant, stem diameter, plant height and ear height as affected by the interaction between row width and hill spacing during 2015 season.

Row Width	Hill Spacing	No. of days to 50% tasseling	No. of days to 50 % silking	No. of green leaves/plant	Stem diameter	Plant height cm	Ear height cm
60 cm	15 cm	56.4	69.2	14.3	2.08	3.09	1.63
	20 cm	56.2	68.7	14.6	2.08	3.31	1.65
	25 cm	55.5	68.8	14.6	2.17	3.24	1.64
	30 cm	55.0	68.0	15.2	2.24	3.06	1.67
70 cm	15 cm	53.2	67.3	15.3	2.24	3.31	1.63
	20 cm	52.3	66.8	14.6	2.14	3.33	1.62
	25 cm	50.8	64.0	15.8	2.22	3.20	1.66
	30 cm	50.5	63.1	14.9	2.28	3.35	1.70
F. test		*	*	*	*	*	*
LSD at 5 %		0.8	0.8	0.7	0.09	0.12	0.05

Table 5: Total chlorophyll content (SPAD) in leaves, stem diameter, ear leaf area (cm2), and plant height and ear height as affected by the interaction between maize hybrids and hill spacing during 2014 seasons.

Hybrids	Hill Spacing	Total chlorophyll	Stem diameter	Ear leaf area (cm^2)	Plant height cm	Ear height
SC 3084	15 cm	41.52	2.20	812.5	3.40	1.67
	20 cm	40.88	2.11	831.7	3.13	1.66
	25 cm	41.07	2.18	972.0	3.26	1.73
	30 cm	39.67	2.17	921.8	3.02	1.71
SC 3062	15 cm	39.61	2.20	888.1	3.46	1.75
	20 cm	42.14	2.20	933.6	3.33	1.73
	25 cm	42.30	2.15	828.8	3.38	1.72
	30 cm	37.43	2.27	920.8	3.35	1.71
SC 2055	15 cm	39.46	2.12	882.2	3.24	1.66
	20 cm	41.66	2.10	909.0	3.25	1.69
	25 cm	40.31	2.18	894.7	3.15	1.64
	30 cm	41.60	2.20	909.2	3.24	1.66
SC 2066	15 cm	41.73	2.15	816.4	3.17	1.61
	20 cm	40.95	2.06	914.2	3.22	1.59
	25 cm	39.95	2.22	906.7	3.21	1.69
	30 cm	42.41	2.23	982.4	3.17	1.65
F. test		*	*	*	*	*
LSD at 5 %		2.07	0.07	33.2	0.16	0.05

CONCLUSION

It could be concluded that sown S.C. 3084 hybrid on 60 cm row width and hill spacing 20 cm apart to increasing maize growth characters under the environmental conditions of Dakahlia Governorate, Egypt.

REFERENCES

Alias, M.A.; H.A. Bukhsh; R. Ahmad; A.U. Malik; S. Hussain and M. Lshaque (2010). Argo-physiological traits of three maize hybrids as in flounced by varying plant density. J. Animal and Plant Sci., 20(1): 34-39.

Attia, A.N.E.; S.A. El-Moursy; G.M.A. Mahgoub and M.M.B. Darwich (2009). Effect of ridge spacing and plant density for row maize hybrids. J. Agric. Sci. Mansoura Univ., 34(7): 8073-8080.

Bisht, A.S.; A. Bhatnagar; M.S, Pal and V. Singh (2012). Growth dynamics, productivity and economics quality protein maize (*Zea mays* L.) under varying plant density and nutrient management practices. Madras Agric. J., 99: 73-76.

Darwich, M. M. B. (2009). Effect of row spacing and plant density on grow the yield and its component of some new maize hybrids.

El-Mekser, H.A.; H.E. Mosa; M.G. Balbaa and M.A.M. El-Gonemy (2009). Effect of row orientation, row spacing and plant population density on grain yield and other agronomic traits in maize (Zea mays L.). Alex. J. Agric. Res,54(3):17-27.

EL-Metwally, A.E., A.A. El-Deeb, S.A. Safina and B.G. Rabbani, (2011). Behavior of some maize hybrids cultivated with different plant densities. J. plant prod. Mansoura Univ., 2(3): 479-490. M. Sc. Thesis, Fac. of Agric. Mansoura Univ.

El-Metwally, A.E., A.A. El-Deeb, S.A. Safina and B.G. Rabbani, (2011). Behavior of some maize hybrids cultivated with different plant densities. J. plant prod. Mansoura Univ., 2(3): 479-490.

Enuieke, E.C. (2013). Effects of variety and spacing on growth characters of hybrids maize. Asian J. of Agric. And Rural Development. 3(5): 296-310.

Fahad S.; S. Saud; H. Muhammad; S. Hassan; A. Shah and F. Ullah (2016). Effect of row spacing and methods of sowing on the performance of maize. Austin Food Sci., 1(2): 1-4.

Gardner, F.P.; R.B. Pearce and R.L. Michell (1985). Physiology of crop plant. Iowa State Univ. Press Ames. Iowa. USA pp. 58-75.

Gobeze, Y.L.; G. Michaelceronio and L.D.V. Rensburg (2012). Effect of row spacing and plant density on yield and yield component of maize (*Zea mays* L.) under irrigation. J. of Agric. Sci. and Technology, 263-271.

Gomez, K.A. and A.A. Gomez (1991). Statistical Procedures in Agricultural Research, John Wiley and Sons, New York.

Kandil, E.E.E. (2013). Response of some maize hybrids (*Zea mays* L.) to different levels of nitrogenous fertilization. J. of Applied Sci. Res., 9(3): 1902-1908.

Leilah, A.A.; S.E. El-Kalla; K.A. El-Douby and A.M.K. Abd Rabboh (2013). Maximizing corn productivity through some modern farming systems. J. Plant Production, Mansoura Univ., 4(4): 561-575.

Mahgoub, G.M.A. and A.A. El-Shenawy (2006). Response of some maize hybrids to row spacing and plant density. Proc. Of 1st Conf. Field Crop Res. Inst., ARS, 22-24 Aug., Egypt, PP. 285-293.

Modhej, A.; A. Kaihani and S. Lack (2014). Effect of nitrogen fertilizer on grain yield and nitrogen use efficiency in corn (*Zea mays* L.) hybrids under irrigated conditions. Proc. Natl. Acad. Sci., India, Sect. B Biol. Sci., 84(3): 531-536.

Onyango, O.C. (2009). Decreased row spacing as an option for increasing maize (Zea mays L.). Yield in Trans Nzoia district, Kenya. J. of plant Breed. and Crop Sci. 1(8): 281-283.

Panison, F.; L. Sangoi; D.F. Kolling ; C.M.M. Coelho and M.M. Durli (2016). Harvest time and agronomic performance of maize hybrids with contrasting growth cycles. Acta Scientiarum. Agronomy Maringá, 38(2): 219-226.

Sadeghi., M. (2013). The determination of plant density on dry matter accumulation, grain yield and yield components of four maize hybrids. Intr. J. of Agric. and Crop Sci., 5(2): 109-114.

Sharifi, S. R.; Sedeqi, M. and Gholipouri, A. (2009). Effect of population density on yield and yield attributes of maize hybrids. Iran. Res. J. of Biol. Sci. 4(4): 375 – 379.

Snedecor, G. W. and W. G. Cochran (1980). Statistical Methods, 7th Ed., Ames, IA: The Iowa State University Press.

Ukonze, J.A.; V.O. Akor; and U.M. Ndubuaku (2016). Comparative analysis of three different spacing on the performance and yield of late maize cultivation in Etche local government area of Rivers State, Nigeria. African J. of Agric. Res., 11(13): 1187-1193.

Zamir, M.S.I.; A.H. Ahmad; H.M.R. Javeed and T. Latif (2011). Growth and yield behavior of two maize hybrids towards different plant spacing. Cercetari Agro. in Moldova, 46(2): 33-40.

Zhang, R.H.; X.H. Zhang; J.J. Camberato and J.Q. Xue (2015). Photosynthetic performance of maize hybrids to drought stress. Russian J. Plant Physiol., 62(6): 788–796.

تأثر صفات نمو بعض هجن الذرة الشامية بالمسافة بين وداخل الصفوف

احمد ابو النجا قنديل* ,على السعيد شريف* و احمد مختار احمد أبوزيد

قسم المحاصيل كلية الزراعة جامعة المنصورة

أجريت تجربتان بحقل إرشادي بمحلة انجاق بمركز شربين – محافظة الدقهلية خلال الموسمين ٢٠١٤, ٢٠١٥ لتقييم سلوك بأربع هجن الذرة الشامية الصفراء (ه.ف. ٣٠٨٤، ه.ف. ٣٠٦٢، ه.ف.٢٠٥٥، ه.ف. ٢٠٦٦) وذلك تحت أربع مستويات للزراعة وهي(١٥, ٢٠, ٢٥و ٣٠سم.) في تجربتين منفصلتين ذو معدل تخطيط مختلف حيث كان عرض الخط ٦٠ ،٧٠ سم.وتم تنفيذ التجارب في تصميم القطع المنشقة مرة واحدة ثم تم عمل تحليل تجميعي للحصول على التأثير الرئيس لعرض الخط وتفاعلاتـه.وتتلخص نتـائج الدراسـة فيمـا يلـي: أوضـحت النتـائج ان الهجـين الفـردي ٣٠٨٤ سـجل تبكيـرا لصـفة ظهـور ٥٠% مـن النـورات المـذكرة، عـدد الاوراق الخضراء/نبات، محتوى الكلوروفيل، قطر الساق، ارتفاع النبات، ارتفاع الكوز واقل نسبة لصفة مساحة ورقة الكوز. بينما الهجين الفردي ٢٠٦٦ كان متأخرا لصفة ظهور ٥٠% من النورات المذكرة واقل القيم لصفات عدد الاوراق الخضراء/نبات، محتوى الكلوروفيل، قطر الساق، ارتفاع النبات، ارتفاع الكوز وسجل ارتفاع لقيم صفة مساحة ورقة الكوز. أشارت النتائج الى ان الزراعة على عرض خط ٧٠ سم سجل تبكيرافي صفة ظهور ٥٠% من النورات المذكرة واعلى القيم لصفات عدد الاوراق الخضراء/ نبات، ارتفاع قيمة مساحة ورقة الكوز، قطر الساق،ارتفاع النبات. بينما نتج عن زراعة نباتات الذرة الشامية على عرض خط ٦٠ سم تبكير في صفة ظهور ٥٠% من النورات المؤنثة وارتفاع قيم صفة نسبة الكلوروفيل. أظهرت النتائج ان الزراعة على مسافة ٣٠ سم بين الجور تبكيرا في ظهور ٥٠% من النورات المذكرة والمؤنثة، واعلى قيم لصفات ارتفاع النبات، ارتفاع الكوز، مساحة ورقة الكوز وقطر الساق. نتج عن زراعة نباتات الذرة الشامية على مسافة ٢٥سم بين الجور سجلت اعلى قيم لصفة عدد الاوراق الخضراء/ نبات. نتج عن زراعة نباتات الذرة الشامية على مسافة ٢٠ سم بين الجور اعلى قيم لصفات محتوى الكلوروفيل وارتفاع النبات. يمكن التوصية بزراعة الهجين الفردي ٣٠٨٤ على خطوط عرض ٦٠ سم ومسافة زراعة ٢٠ سم بين الجور لتعظيم انتاجية الذرة الشامية تحت ظروف محافظة الدقهلية – مصر.