Bull. Fac. Agric., Cairo Univ., 55 (2004) :237-264.

MAIZE PRODUCTION IN NEW LANDS AT TOSHKA AND EAST EL-EWINAT REGIONS

(Received:4.11.2003)

By
F. H. S. Soliman,A. I. N. Abd El-Aal*, A.A. Mahmoud, A. A. Ahmed and M.A. Abd-El-Moula

Maize Research Program, Field Crops Research Institute, Agriculture Research Center, Giza
**South Egypt Research Station,Toshka,Agriculture Research Center,Egypt*

ABSTRACT

Toshka and East El-Ewinat projects are two agricultural giant projects, which are being executed in the South Valley and south west of Egypt, respectively to cultivate large areas of the desert. This is the first time to cultivate maize in both areas. Therefore, the main objectives of these investigations were to identify the highest yielding adapted maize hybrids under some agronomic practices using drip and central pivot irrigation systems.

At Toshka, experiments were carried out at Abo-Sembel Research Station. Results of a demonstration trial indicated that the superior maize hybrids were SC 129, TWC 321 and SC 120 which yielded 30.32, 29.63 and 28.22 ard/fed, respectively. For planting dates trial, planting maize between March 15 and April 1, and/or July15 to Aug.1 were suitable to produce the highest grain yield. In this respect, SC 10 and SC 129 gave the highest grain yield in 2001 and 2002. Six out of 16 white grain hybrids *i.e.* SC 10, SC 129, SC Watan-4, TWC 310, TWC 320 and TWC 321 produced the highest yields. Also, TWC 352 gave the highest grain yield as compared with two other yellow maize hybrids.

At East El-Ewinat region, research was conducted in cooperation with the Horticulture Service Unit. Results on large-scale planting yellow maize hybrids indicated that the average grain yield

was 27.42, 25.37, 27.55, 24.99 and 26.86 ard/fed for hybrids SC 155, TWC 352, DC Dahab, SC 3062 and SC.3084, respectively. For testing commercial and new promising hybrids,the average grain yield ranged from 36.73 for the promising SC 22 to 20.65 ard/fad for SC 155 with an average of 30.26 ard/fad. No significant differences in yield were obtained between the averages of commercial single crosses (30.23 ard/fad), promising single crosses (30.98 ard/fed), commercial three way crosses (29.27 ard/fed), promising three way crosses (31.21 ard/fed) and commercial yellow three way crosses (30.26 ard/fed). Twelve hybrids including five commercial hybrids *i.e.* SC122, SC124, TWC 321, TWC 324 and TWC 327, and seven promising hybrids *i.e.* SC 16, SC 22, SC24, TWC 421, TWC 427, TWC 440 and TWC 450 produced the highest grain yield (ranging from 36.73 to 32.23 ard/fed). In addition, yellow maize hybrids, TWC 352 and TWC 351 produced higher grain yield (31.58 and 28.93 ard/fed, respectively) than SC 155 (20.65 ard/fed).

From these studies, increasing maize production could be possible through:

1. Extensive growing of high yielding hybrids in both areas by planting maize hybrids twice annually ; early (second half of March and late (the second half of July) .
2. Increasing the area devoted for cultivating yellow maize hybrids in the new lands at Toshka and East El-Ewinate regions.
3. It is possible to grow maize materials in Abo-Simbel Research Station, Toshka Region as off-season planting (winter) during October.
4. Breeding maize for drought stress and heat tolerance at both areas.
5. Soil in Toshka and East El-Ewinat are in need of a good management and high amount of organic mater (manure) to improve the fertility and water holding capacity.

Key words: *east El-Ewinat, hybrids, maize, planting date, Toshka,*

1. INTRODUCTION

Maize is one of the most important strategic food security crops in Egypt. Increasing yield production is the only way to overcome the increasing demand for bread industry (mix 80% wheat flour with 20% maize flour in order to reduce wheat importation), feeding poultry and livestock as well as many industrial purposes. It is possible to achieve self-sufficiency in grain maize by increasing productivity per unit area through the extensive growing of high yielding hybrids in the newly reclaimed desert land. Toshka and East El-Ewinat projects are two of the giant projects, which are being executed in the South Valley and southwest of Egypt, respectively to cultivate large areas of the desert. However, This is the first time to cultivate maize (*Zea mays* L) in both areas. Therefore, scientists at the National Maize Research Program, ARC exert great effort for selcting high yielding adapted maize hybrids for testing for agronomic practices under Toshka and east El-Ewinat environmental conditions.

2. MATERIALS AND METHODS

2.1. Toshka region

All experiments were conducted in Abo-Sembel Farm Research Station, Agriculture Research Center. The station is located in the south valley of Egypt, about 1300 and 280 km south of Cairo and Aswan, respectively on latitude 22° 25 north, 31°5-longitude east and elevation of 181 m above the sea level.

Soil particle distribution, chemical characteristics and fertility conditions of the experimental sites at Abo-Sembel (Table-1) were analyzed according to Page (1982) and Soil Survey Staff (1994). In general, many fragments of various rocks and gravels dominate on the surface. These fragments are different in shape, size and colour. However, the soil texture is sandy loam to loamy. In addition, the main soil characteristics and fertility condition showed very low level of salinity, cation exchange capacity and available nitrogen and phosphorus, but potassium has medium level. In addition, the microelements iron, manganese, copper, zinc and boron are low. The total calcium carbonate varies between 13.8 to 18.8%. The soil is calcareous and requires adequate water and crop management and high

supply of organic mater (manure) to improve fertility and water holding capacity.

Table (1): Soil particle distribution, chemical characteristics and fertility conditions of the experimental sites at Abo-Sembel and East El-Ewinat.

Soil characters	Soil depth (cm)					
	Abo-Sembel			East El-Ewinat		
	0-30	30-60	60-90	0-30	30-60	60-90
Soil particle distribution						
Clay (%)	3.3	9.5	12.1	2	1	1
Silt (%)	29.7	39.0	44.9	8	11	10
Sand (%)	67.0	51.5	43.0	90	88	89
Texture	Sand loam	Loam	Loam	Sandy	Sandy	Sandy
Soil chemical characteristics and soil fertility conditions						
PH	9.10	9.10	9.00	8.87	9.0	9.35
EC (%)	0.04	0.03	0.03	0.01	0.01	0.01
CEC (meq/100 g	15.00	15.00	16.00	7.60	7.50	7.80
Ca Co_3 (%)soil)	18.80	13.80	15.70	3.65	4.20	7.20
N (ppm)	25.00	20.00	20.00	10	5	5
P (")	6.00	5.00	4.00	10	7.91	4.32
K (")	160.00	160.00	170.00	160.00	64	55
Fe (")	10.00	12.00	13.00	1.30	1.2	0.9
Zn (")	0.15	0.15	0.25	1.4	0.7	0.5
Mn (")	4.00	4.00	4.00	1.4	0.6	0.5
Cu (")	0.10	0.20	0.20	0.06	0.06	0.02
B (")	0.80	0.90	0.80	1.10	1.20	1.20

2.1.1.Comparative demonstration of some maize genotypes

Because maize (*Zea mays* L) was planned to be cultivated for the first time in Toshka, South Valley of Egypt, a preliminary field experiment with two replicates was carried out on Augest.1st, 2000 to evaluate 16 different genotypes (Table-3) under drip irrigation system. The evapotranspiration was calculated from the metrological station according to Smith (1991). The calculated water requirement is 3150

m^3/fed and is distributed according to daily plant growth for late summer planting. At soil preparation, 8 m^3 of chicken manure mixed with 50 kg of NH_4NO_3 (33.5% nitrogen) +37.5 Kg P_2O_5 + 48 kg K_2O per feddan were applied. In addition, 150 kg of nitrogen fertilizer (supplied from NH_4NO_3 33.5%) was applied in equal 6 doses (25 Kg N/weak) after thinning (18 days from planting) as a solution with irrigation water. Plots consisted of 4 rows, 6m long, one-meter wide and 50-cm. spacing between drippers. Three hills were hand planted around the drip point (triangle, spaced 15 cm) on August the 1st and thinned to one plant per hill (three plants around the drip point), providing a plant population density of 25200 plants/feddan (one feddan= 4200 m^2). All plots were irrigated for two hours daily. The field experiment was hoed twice after 18 and 30 days from planting. Data were recorded on plants grown in the inner two rows.

Harvest was done on Dec. 11/2000 and irrigation was stopped 15 days after. Sample of 10 random guarded plants was taken to determine plant and ear height. In addition, ears/plot were collected from the central two rows, counted and weighed. At the same time, a sample of 10 ears was taken at random to determine moisture content, shelling percentage and ear characters. Grain yield was adjusted to 15.5% moisture content and converted to ardabs/feddan (one ardab=140 kg). Analysis of variance was done according to McIntosh (1983).

2.1.2 Planting dates trial

Two field experiments were conducted during 2001 and 2002 seasons to identify the suitable planting date(s) and adapted hybrid(s) under Toshka, South valley environmental conditions. Four white (SC 10, SC 129, TWC 311, TWC 321) and one yellow (TWC 352) maize hybrids (Table-6) were planted under four early planting *i.e.* 15/2, 1/3, 15/3 and 1/4 in the first season, and 15/3 and 1/4 in the second season, as well as four late planting dates *i.e.* 15/7, 1/8, 15/8 and 1/9 in both seasons. However, planting date of 1/8/2002 was cancelled because of poor seed set due to tassels being damaged by birds. Water requirements were 364 and 3150 m^3/fed for drip irrigation system for early and late summer planting, respectively, and distributed according

to the plant daily growth. Harvesting dates and number of days from planting to harvesting in both seasons are presented in Table-2. Plot size and all cultural practices were done as described in the previous experiment. Analysis of variance was done for each planting date, early and late groups and over all planting dates according to McIntosh (1983).

Table (2): Planting and harvesting dates, and number of days from planting to harvesting in 2001 and 2002 seasons.

Planting date		Season of 2001		Season of 2002	
		Harvest date	Days from planting to harvesting	Harvesting date	Days from planting to harvesting
Early planting	15/2	30/6	135	-------	-------
	1/3	30/6	122	-------	-------
	15/3	10/7	117	12/7	119
	1/4	20/7	111	22/7	113
Late planting	15/7	27/10	104	27/10	104
	1/8	10/11	102	-------	-------
	15/8	30/11	107	2/12	108
	1/9	28/12	119	1/1//03	125

2.1.3. Evaluation of some commercial maize hybrids

Nineteen yellow and white maize hybrids (Table 9) were planted on 15/7/2002 to identify the superior hybrid(s) under Toshka, South valley environmental conditions. Experimental design, plot size, agronomic practices and analysis of variance were done as in the previous experiment. The plants were harvested on 28/10/2002 (105 days after planting).

2.2. East El-Ewinat region

This was the first time to cultivate maize in East El-Ewinat Region. All experiments were carried out at the farm of the Horticulture Service Unit, Ministry of Agriculture and Land Reclamation. This area is a large desert in the south west of Egypt, about 430 km west from Toshka and 400 km south of El-Dakhla (Governorate of El-Wady El-Gaddeed), on latitude 22° 5 north, 28° longitude east and elevation of 128.3 m asl. Soil particle distribution, chemical characteristics and fertility conditions of the experimental site at East El-Ewinat (Table1) were analyzed according to Page

(1982) and Soil Survey Staff (1994). The main soil characteristics in East El-Ewinat differ from the Toshka area. The soil texture is sandy and soil salinity is very low (less than 0.1%). Moreover, the soil is very poor in macro and micronutrients. Cation exchange capacity is very low (less than 7.8 meq/100 g), and calcium carbonate also is low (less than 7.2%. Thus, soil fertility and soil water characteristics are poor, and in both Toshka and East El-Ewinat need good management and high amount of organic mater (manure) to improve fertility and water holding capacity.

2.2.1. Field scale demonstration planting of yellow maize hybrids

Five yellow maize hybrids namely SC.155, TWC.352, DC. Dahab, SC.3062 and SC.3084 were planted in 50.0, 30.0, 7.5, 7.5 and 7.5 feddan, respectively. The objective of this trial was to identify the most productive yellow maize hybrid under central pivot irrigation system. The evapotranspiration was calculated from the metrological station according to Smith (1991). The water requirements were 4118 m^3/fed for sprinkler irrigation system (pivot system) and distributed according to plant growth daily for late summer planting. At soil preparation, 8 m^3 of chicken manure mixed with 150 kg of N P K (18:18: 10) per feddan were applied. In addition, 125 kg of nitrogen fertilizer (supplied from ammonium nitrate 33.5%) were injected in irrigation water in 10 equal doses (12.5 Kg N each 5 days) after thinning (18 days from planting). Planting maize was done during 4-6/8/2001 using machinery planter with space of 70 cm between rows and 22 cm within row, providing a population density of 27273 plants/fed. The plants were machine harvested on 12/11/2002. At harvest a sample of 10 random plots (6 x 10 m) was taken from each hybrid to determine grain yield. Ears/plot were collected, counted, weight, shelled and grain yield was adjusted to 15.5% moisture content, and converted to ardabs/feddan.

2.2.2. Evaluation of some new promising maize hybrids

Thirty-seven yellow and white maize hybrids including 17 commercial and 20 new promising hybrids (Table-12) were evaluated on 29/9/2001 to identify the most productive hybrid (s) under east El-Ewinat environmental conditions . The experiment was conducted under drip irrigation system using underground water.Water requirement was estimated as 3529 m^3/fed (calculated according to

Smith, 1991) and distributed according to plant daily growth for late summer planting. At soil preparation, 8 m^3 of chicken manure mixed with 200 kgs of N P K (18:18: 10) per feddan were applied. In addition, 125 kgs of nitrogen fertilize (as ammonium nitrate 33.5%) were injected in irrigation water in equal doses (25 Kg N weakly) after thinning (18 days from planting). Experimental design was RCBD with four replications. Plot size was 4 rows, 8 m long and 70 cm between rows with 50 cm between drippers. Two hills were planted close to each drip point, and thinned to one plant per hill giving a population density of 24000 plants/fed. Ears/plot were collected from the central two rows on 17/2/2002 and counted, weighed, shelled and grains weight was adjusted to 15.5% moisture content, and converted to ardabs/feddan. Analysis of variance was done according to McIntosh (1983).

3. RESULTS AND DISCUSSION

3.1. Toshka region

3.1.1. Comparative performance of maize hybrids under Toshka environmental conditions

Results in Table (3) indicate highly significant differences among genotypes for all the studied traits. Regarding grain yield (Table 4), the results show that the difference between the average grain yield of white single crosses group (25.86 ard/fed) and white three way crosses group (25.66 ard/fed) was insignificant. The superior white maize hybrids were SC 129 followed by TWC 321, SC 120, TWC 323, TWC 310 and TWC 324 (ranging from 30.32 to 26.06 ard/fed). On the other hand, SC 107 (w), SC 155 (y), TWC 352 (y), SC 161 (y) and Pop 21 (y) produced the lowest grain yield, but no significant differences were obtained among the yellow maize genotypes.

Regarding the number of ears per 100-plants, the highest values were observed from SC 120 (127.0) followed by SC 122 (126.4), Pop 21 (125.1), SC 129 (122.6) and TWC 321 (120.8). On the opposite, TWC 320, SC 155, TWC 323, SC 10 and SC 161 produced the lowest

Table (3): Mean squares for grain yield and other traits of 16 maize genotypes, in 2000 season.

SOV	DF	Grain yield (ard/fed)	Ears/100 plants	Ear characters				Height (cm.)	
				Diameter	Length	Rows per ear	Kernels Per row	Plant	Ear
Replications	1	0.75	184.79*	0.001	13.781**	0.020	3.188	12.5	0.78
Genotypes	15	26.30**	152.73**	0.082**	5.379**	3.504**	52.826**	977.6**	368.48**
Error	15	6.908	37.41	0.013	0.265	0.073	3.485	33.8	27.45
C.V. (%)		10.69	5.36	2.14	2.34	1.94	4.08	2.53	4.15

*, ** Significant at 0.05 and 0.01 levels of probability, respectively.

Table (4): Average grain yield and other traits for 16 different maize genotypes, in 2000, season.

Genotypes	Grain yield Ard/fed	Ears per 100-plants	Ear Characters				Height (cm.)	
			Diameter	Length	Rows/ear	Kernels per row	Plant	Ear
SC.10	24.84	105.3	5.1	22.7	12.60	50.6	233.5	132.5
SC.107	17.35	116.4	4.9	22.9	14.00	43.3	167.5	93.0
SC.120	28.22	127.0	5.3	23.9	13.60	51.3	234.0	123.0
SC.122	25.21	126.4	5.1	22.8	13.40	48.5	223.5	130.5
SC.123	25.39	115.2	5.4	21.5	13.80	44.1	233.5	125.5
SC.129	30.32	122.6	5.4	22.4	14.6	45.1	257.0	148.0
Mean	**25.86**	**118.8**	**5.2**	**22.7**	**13.7**	**47.2**	**224.8**	**126.9**
SC.155 (Y)	19.31	103.2	5.3	17.7	14.8	33.8	228.5	128.0
SC.161 (Y)	22.91	107.9	5.4	20.6	15.0	43.2	221.5	120.5
Mean	**21.11**	**105.6**	**5.4**	**19.2**	**14.9**	**38.5**	**225.0**	**124.3**
TWC.310	26.36	108.7	5.2	23.2	12.4	48.3	252.0	137.5
TWC.320	22.72	100.9	5.4	23.8	13.0	49.4	266.5	146.0
TWC.321	29.63	120.8	5.6	22.6	14.6	50.9	246.0	139.5
TWC.322	25.54	113.5	5.1	21.8	12.4	48.7	223.5	118.0
TWC.323	26.66	103.6	4.9	22.0	12.6	49.1	231.0	117.5
TWC.324	26.06	110.8	5.4	23.3	13.4	48.3	217.5	111.0
Mean	**25.66**	**109.7**	**5.3**	**22.8**	**13.1**	**49.1**	**239.4**	**128.3**
TWC.352 (Y)	20.49	119.0	5.5	19.6	15.4	37.1	215.0	124.5
Population 21	21.65	125.1	5.1	20.8	15.2	40.4	223.0	123.5
Grand mean	**24.58**	**114.2**	**5.3**	**22.0**	**14.0**	**45.8**	**229.6**	**126.2**
LSD 5%	5.60	13.00	0.24	1.1	0.6	4.0	12.40	11.2

values. They produced 100.9, 103.2, 103.6, 105.3 and 107.9 ears/100-plants, respectively. However, insignificant difference was obtained between both the white single crosses group (118.8 ears/100 plants) and the white three way crosses group (109.7 ears/100 plants). Comparison among yellow genotypes indicated that Pop 21 possessed the highest value followed by TWC 352, SC 161 and SC 155, but no significant differences were found between TWC 352 and both of Pop 21 and SC 161, as well as between SC 161 and both of SC 155 and TWC 352.

For ear characters (Table-4), seven crosses, *i.e.* TWC 321, TWC 352(Y), SC 161(Y), SC 123, SC 129, TWC 320 and TWC 324 in descending order, recorded the thickest ears. They had ear diameter ranging from 5.6 to 5.4 cm, and SC 107 and TWC 323 gave the thinnest ear diameter of 4.9 cm. Regarding ear length, the longest ears for white crosses were found for SC 120 (23.9 cm), TWC 320 (23.8 cm), TWC 310 (23.8 cm) and TWC 324 (23.3 cm), whereas yellow SC 155 and TWC 352 produced the shortest ears, 17.7 and 19.6 cm, respectively. In addition, insignificant difference was found between white single cross group (22.7 cm) and the white three way crosses (22.8 cm). For the number of rows/ear, yellow maize TWC 352, Pop 21 and SC 161 possessed the best values (15.0 to 15.4). Also, the best white hybrids for the number of rows/ear were SC 129 and TWC 321 with values of 14.6, whereas SC 10, TWC 310, TWC 322 and TWC 323 had the lowest number (12.4- 12.5). For the number of kernels/row, the best hybrids were SC 120 (51.3) followed by TWC 321(50.9) and SC 10 (50.6), whereas SC 155 and TWC 352 gave the lowest numbers (33.8 and 37.1).

For plant and ear height, Tables 3 and 4 indicate that the tallest plants and the highest ear placement over all genotypes were obtained from four hybrids TWC 320 (266.5 and 146.0 cm), SC 129 (257.0 and 148.0 cm), TWC 310 (252.0 and 137.5 cm), respectively, whereas SC 107 gave the shortest plants (167.5 cm) and the lowest ear placement (93.0 cm). However, the white three way cross group possessed significantly taller plants (239.4 cm) as compared with single cross group (224.8 cm), the difference between both groups for ear height was insignificant (128.3 and 126.9 cm, respectively). The differences among yellow genotypes *i.e.* SC 155, SC 161, TWC 352 and Pop-21 for plant and ear heights were insignificant, except the difference between SC 155 and TWC 352 for plant height (288.5 and 215.0 cm).

The genotypic differences reported herein are probably due to genetic differences and their reflection on the number and/or the length of the internodes above and below the top most ear.

3.1.2. Planting dates trial

Analysis of variance for grain yield/fed. (Table-5) revealed highly significant differences among all planting dates in both seasons. Generally, grain yield (Tables 6 and 7) of 2001 season (21.96 ard/fed) was higher than that of 2002 season (18.33 ard/fed). This result may be attributed to that the experiment in 2002 was conducted in a land cultivated for two years so it had more organic matter, where as 2001 experiment was carried out in a land very poor in organic matter. The highest grain yield (Tables-6 and 7) was obtained by planting maize on 1/4 followed by 1/8, 15/7 and 15/3 in the first season which gave 23.71, 23.45, 23.39 and 22.91 ard/fed, respectively. In the second season planting maize on 15/7 followed by 15/3 and 1/4 produced 20.16, 19.60 and 19.42 ard/fed, respectively. Average grain yield of early planting group significantly outyielded that of late planting group by 5.3% and 11.2% in the first and second seasons, respectively. The differences among the late planting group were highly significant, but not among the early planting group in both seasons. These results may be due to the effect of favorable environmental conditions (air temperature, plant duration and intensity) that increase vegetative growth and dry matter accumulation of maize plants. Similar results were obtained by Alissi and Power (1976), Bishr *et al.* (1977), Ibrahim *et al.* (1979), Sood *et al.* (1979), Eckert (1984), Widstrom *et al.* (1984), Abdel-aziz (1987), Prasad and Joshi (1988), Khedr *et al.* (1990), Bali *et al.* (1991), Cirilo and Andrade (1994), Younis *et al.* (1995), Gouda *et al.* (1998) and Hassaan (1999). With respect maize hybrids, SC 10 and SC 129 possessed significantly the highest grain yield/fed, whereas TWC 352 gave the lowest grain yield/fed for each planting date, over early and late planting, as well as over all planting dates in both seasons. The differences in yielding ability among hybrids may be attributed to the differences in its genetic constitutions. The previous results indicated that increasing maize production could be possible through extensive growing of high yielding hybrids in this area by planting maize hybrids twice annually, early planting during 15/3 to 1/4 and late planting during 15/7 to 1/8, without delaying planting winter crops (Table 4). However, adopting such recommendation will depend on the feasibility of crop rotation.

Regarding grain yield/plant, analysis of variance (Table-5) showed highly significant differences among the early planting group, late planting group and over all planting dates in both seasons, except that of the early planting group in the first season. Early planting group (Tables-6 and 7) possessed higher grain yield/plant (120.9 gm) as compared with the late planting group (108.9gm) in the second season. Generally, the highest grain yield/plant was observed from planting maize on 15/7 followed by 1/8, 1/4 and 15/3 in the first season (ranged from 138.7 to 131.3 gm/plant), and planting maize on 15/3 and 15/7 in the second season with an average of 126.3 and 127.5 gm/plant, respectively. These results may be attributed to the effect of the environmental conditions on vegetative growth, which affected grain filling and ear size. Bishr *et al.* (1977), Sood *et al.* (1979), Abdel-Aziz (1987), Prasad and Joshi (1988), Bali *et al.* (1991), Cirilo and Andrade (1994) and Hassaan (1999) reported similar results. Maize hybrids, SC 10 and SC 129 were superior, which they produced significantly the highest average grain yield/plant, whereas TWC 352 was the lowest one for each planting date, over early and late planting as well as over all planting dates in both seasons. The differences in yielding ability of maize plant among hybrids may be attributed to the differences genetic constitutions.

Considering number of ears/100-plants, Table-5 revealed that significant differences were obtained among the early planting group, late planting group and over all planting dates in the first season. Means of number of ears/100-plant reached maximum values for planting maize on 15/8, 1/9, 1/4, 1/8 and 15/3/2001 with an average of 104.3, 103.9, 103.6, 103.3 and 103.0, respectively with no significant differences between them. The other planting dates (15/2, 1/3 and 15/7) gave the lowest number of ears/100-plant. In this respect, Abdel-Aziz (1987), Gouda *et al.* (1998) and Hassaan (1999) concluded that early planting maize on mid May to mid June significantly increased the number of ears/plant. Significant differences among hybrids (Tables 5, 6 and 7) were obtained for all planting dates in both seasons, except of 15/2, 1/3 and 15/3 in the first season. However, SC 10 and SC 129 exhibited the highest number of ears/100-plants, whereas TWC 352 and TWC 311 gave the lowest values for each planting date, over early and late planting groups, and also over all planting dates. The differences in the number of ears/100-plant

Table (5): Analysis of variance including planting dates and 5 maize hybrids for grain yield and some characters evaluated under Toshka Region in 2001 and 2002 seasons.

Planting date	SOV	DF	MS				
			Grain yield (ard/fed)	Grain yield/ plant (gm)	No. of ears/ 100- plant	Plant height (cm)	Ear pos. (%)
			Season of 2001				
15/2/2001	Replication (Rep)	3	17.96	296.2	13.25	2679.9**	12.64
	Hybrids (Hyb)	4	20.54*	657.7**	14.20	950.4*	11.73
	Error	12	5.74	123.7	7.21	27.0	4.91
	CV. (%)		11.05	8.90	2.66	2.50	3.70
1/3/2001	Rep.	3	6.07	171.9	1.752	18.62	1.68
	Hyb.	4	31.58*	945.6**	9.40	911.6**	7.65**
	Error	12	8.42	175.2	9.75	44.1	0.60
	CV. (%)		13.33	10.48	3.08	3.12	1.42
15/3/2001	Rep.	3	2.19	29.6	2.34	42.1	0.27
	Hyb.	4	22.50*	702.7*	9.20	268.2**	13.04**
	Error	12	6.85	149.6	7.60	16.1	0.64
	CV. (%)		11.43	9.31	2.68	1.78	1.46
1/4/2001	Rep.	3	15.24*	318.8*	6.19	217.1**	1.40
	Hyb.	4	20.12*	642.1**	19.47**	312.3**	5.72*
	Error	12	3.62	81.7	1.79	4.6	1.38
	CV. (%)		8.02	6.66	1.29	0.97	2.14
Over early PD	Planting date (PD)	3	18.88	483.6	32.08*	1255.8	0.67
	Rep/ PD	12	10.36	204.1	5.88	739.4	4.00
	Hyb.	4	90.07**	2827.5**	43.84**	2218.9**	31.64**
	PD x Hyb.	12	1.56	40 ?	2.81	74.5**	2.17
	Error	48	6.16	1 ..5	6.59	22.9	1.68
	CV. (%)		11.02	: 88	2.51	2.21	2.36
15/7/2001	Rep.	3	4.00	177.6	7.65	12.89	0.58
	Hyb.	4	20.18*	581.2*	25.89**	1029.0**	12.41**
	Error	12	5.54	208.4	3.83	22.7	0.04
	CV. (%)		10.06	10.46	1.91	2.23	1.30
1/8/2001	Rep.	3	12.48	581.8*	0.11	277.7**	0.34
	Hyb.	4	14.82*	530.9*	33.40**	269.5**	4.59**
	Error	12	4.18	156.7	5.35	10.9	0.63
	CV. (%)		8.72	9.06	2.24	1.43	1.46
15/8/2001	Rep.	3	5.25	237.1	4.50	124.3*	0.76
	Hyb.	4	17.38*	767.3*	28.5*	654.2**	8.92**
	Error	12	4.61	190.8	4.2	28.1	0.23
	CV. (%)		10.76	11.80	1.97	2.47	0.88
1/9/2001	Rep.	3	7.09	454.0*	0.95	69.7*	0.48
	Hyb.	4	8.29*	501.0**	43.54**	233.1**	7.17**
	Error	12	2.19	90.5	7.40	14.6	0.69
	CV. (%)		7.89	8.28	2.62	1.79	1.52
Over late PD	PD	3	114.80**	3392.3**	15.17*	239.6	0.77
	Rep/ PD	12	7.21	362.6	3.30	121.1	0.54
	Hyb.	4	56.35**	2253.7**	108.66**	1801.1**	27.94**
	PD x Hyb.	12	1.44	41.9	7.56	128.3**	1.72**
	Error	48	4.13	162.1	5.20	18.9	0.51
	CV. (%)		9.50	10.01	2.21	2.01	1.31
Over all PD	PD	7	64.51**	1693.7**	28.43**	649.8	0.67
	Rep/ PD	24	8.79	238.4	4.59	430.3	2.27
	Hyb.	4	143.68**	5017**	141.85**	3910.7**	44.21**
	PD x Hyb.	28	1.67	44.3	5.96	102.5**	3.86**
	Error	96	5.14	147.3	5.90	20.9	1.09
	CV. (%)		10.33	9.45	2.36	2.11	1.91

Table (5): Continued.

Planting date	SOV	DF	MS				
			Grain yield (ard/fed)	Grain yield/ plant (gm)	No. of ears/ 100- plant	Plant height (cm)	Ear pos. (%)
			Season of 2002				
15/3/2002	Replication (Rep)	3	0.38	97.48	18.81*	25.43	6.407
	Hybrids (Hyb)	4	9.63*	383.15*	85.60**	270.81*	6.237
	Error	12	2.47	114.97	4.22	65.92	3.416
	CV. (%)		8.02	8.49	2.01	3.91	3.42
1/4/2002	Rep.	3	2.57	86.60	3.89	25.92	0.49
	Hyb.	4	6.25	347.86*	78.80**	412.93*	5.00
	Error	12	2.72	96.18	4.93	85.29	2.14
	CV. (%)		8.50	8.48	2.17	4.34	2.70
Over early PD	Planting date (PD)	1	0.33	1130.14*	0.10	275.63**	0.08
	Rep/ PD	6	1.48	92.04	11.35	25.66	3.50
	Hyb.	4	14.69**	619.70**	157.31**	630.54**	10.56*
	PD x Hyb.	4	1.18	111.31	7.10	53.19	0.68
	Error	24	2.60	105.58	4.58	75.60	2.78
	CV. (%)		8.26	8.50	2.09	4.13	3.08
15/7/2002	Rep.	3	5.07	124.53	2.41	64.18	1.54
	Hyb.	4	14.72*	934.76*	59.75**	586.18**	11.07**
	Error	12	3.01	108.81	1.80	125.81	1.77
	CV. (%)		8.61	8.18	1.32	5.30	2.45
15/8/2002	Rep.	3	4.27	96.78	8.55	10.73	3.66
	Hyb.	4	18.01*	1016.2**	42.8**	241.93*	6.37*
	Error	12	5.26	168.48	1.94	70.19	1.34
	CV. (%)		13.48	12.45	1.36	4.01	2.13
1/9/2002	Rep.	3	11.35	317.83	1.03	16.32	4.34
	Hyb.	4	4.31	386.18*	42.68**	342.18*	4.13
	Error	12	3.67	118.17	1.06	80.44	1.91
	CV. (%)		12.39	11.47	1.00	4.22	2.57
Over late PD	PD	2	114.21**	5680.3**	2.35	78.65	1.22
	Rep/ PD	9	6.89	179.71	4.00	30.41	3.18
	Hyb.	4	33.38**	2195.3**	104.45**	1017.93**	17.92**
	PD x Hyb.	8	1.83	70.95	2.39	76.17	1.83
	Error	36	3.98	131.82	1.60	92.15	1.67
	CV. (%)		11.37	10.55	1.24	4.55	2.39
Over all PD	PD	4	80.29**	3999.00**	1.21	110.22**	0.67
	Rep/ PD	15	4.73	144.64	6.94	28.51	3.29
	Hyb.	4	47.01**	2.654.8**	290.59**	1611.44**	28.05**
	PD x Hyb.	16	1.47	103.34	4.76	60.64	1.19
	Error	60	3.43	121.32	2.79	85.53	2.12
	CV. (%)		10.10	9.69	1.63	4.39	2.69

*, ** Significant at 0.05 and 0.01 levels of probability, respectively.

Table (6): Mean performance of 5 maize hybrids grown on 5 planting dates for grain yield and other characters under Toshka Region in 2001 season.

Hybrids (Hyb)	Early planting					Late planting					Mean over all (PD)
	15/2	1/3	15/3	1/4	Mean	15/7	1/8	15/8	1/9	Mean	
	Grain yield (ard/fed)										
SC. 10	23.62	25.14	25.91	26.52	25.30	26.24	25.89	21.88	20.26	23.57	24.43
SC. 129	23.08	24.05	24.54	25.50	24.29	24.54	24.87	21.37	19.82	22.65	23.47
TWC.311	21.34	20.48	21.64	22.22	21.42	21.21	22.21	19.49	18.01	20.23	20.82
TWC.321	22.43	20.97	22.59	23.13	22.28	23.95	23.13	20.50	19.00	21.64	21.96
TWC.352	17.92	18.21	19.89	21.17	19.30	21.02	21.17	16.61	16.69	18.87	19.09
Mean	21.68	21.77	22.91	23.71	22.52	23.39	23.45	19.97	18.76	21.39	21.96
LSD 5% for Hybrids	3.69	4.47	4.03	2.93	1.76	3.62	3.15	3.31	2.28	1.4	11
Planting dates	----	----	----	----	NS	----	----	----	----	1.9	1.9
PD x Hyb.	----	----	----	----	NS	----	----	----	----	NS	NS
	Grain yield /plant (gm)										
SC. 10	135.4	144.9	148.4	150.3	144.8	154.2	153.5	128.4	128.8	141.2	142.9
SC. 129	134.2	138.3	140.1	147.1	139.9	144.4	142.6	127.8	124.1	134.7	137.3
TWC.311	123.9	120.1	125.2	128.3	124.4	130.2	131.5	109.7	108.4	119.9	122.2
TWC.321	127.6	122.2	128.5	132.4	127.7	141.3	140.0	123.1	110.9	128.8	128.2
TWC.352	103.6	106.3	114.3	120.4	111.2	123.6	123.0	96.2	102.0	111.2	111.2
Mean	124.9	126.4	131.3	135.7	129.6	138.7	138.1	117.0	114.8	127.2	128.4
LSD 5% for Hybrids	17.1	20.4	18.8	13.9	8.2	22.3	19.3	21.3	14.6	9.0	6.0
Planting. dates	----	----	----	----	NS	----	----	----	----	13.1	10.1
PD x Hyb.	----	----	----	----	NS	----	----	----	----	NS	NS
	Number of ears per 100-plants										
SC. 10	102.4	103.6	103.9	105.7	103.9	104.8	106.3	108.5	107.6	106.8	105.3
SC. 129	102.5	101.7	104.3	105.7	103.6	104.8	106.5	103.5	107.0	105.4	104.5
TWC.311	98.2	101.1	100.7	100.7	100.1	98.8	100.0	102.4	101.8	100.8	100.5
TWC.321	101.7	101.4	103.9	103.9	102.7	101.9	101.7	105.2	102.9	102.9	102.8
TWC.352	99.9	99.3	102.2	102.1	100.9	101.1	102.2	101.8	100.0	101.3	101.1
Mean	100.8	101.4	103.0	103.6	102.2	102.3	103.3	104.3	103.9	103.4	102.8
LSD 5% for Hybrids	NS	NS	NS	2.1	1.8	3.0	3.6	3.2	4.2	1.6	1.2
Planting dates	----	----	----	----	1.7	----	----	----	----	1.3	1.4
PD x Hyb.	----	----	----	----	NS	----	----	----	----	NS	NS
	Plant height (cm)										
SC. 10	226.3	234.1	236.0	234.3	**232.7**	234.5	233.5	230.8	224.8	**230.9**	**231.8**
SC. 129	219.4	222.1	229.1	225.0	**223.9**	225.5	222.5	221.8	213.5	**220.8**	**222.4**
TWC.311	197.6	201.4	216.6	213.3	**207.2**	210.8	219.8	211.3	206.3	**212.0**	**209.6**
TWC.321	205.5	211.3	225.3	222.8	**216.7**	200.0	216.0	212.8	215.8	**211.0**	**213.7**
TWC.352	188.6	197.4	217.3	213.3	**204.1**	197.5	211.8	196.5	206.5	**203.1**	**203.6**
Mean	**207.5**	**213.3**	**224.9**	**221.7**	**217.8**	**213.6**	**220.7**	**214.6**	**213.4**	**215.6**	**216.2**
LSD 5% for Hybrids	8.0	10.2	6.17	3.3	3.4	7.3	4.9	8.2	5.9	3.1	2.3
Planting dates	----	----	----	----	NS	----	----	----	----	NS	NS
PD x Hyb.	----	----	----	----	6.8	----	----	----	----	6.2	6.4

Table (6): Continued.

Hybrids (Hyb)	Early planting					Late planting					Mean over all (PD)
	15/2	1/3	15/3	1/4	Mean	15/7	1/8	15/8	1/9	Mean	
	Ear position (%)										
SC. 10	56.9	56.5	57.1	56.9	56.8	56.4	56.1	56.3	56.6	56.4	56.6
SC. 129	52.7	53.1	53.0	54.3	53.3	53.3	53.3	54.3	54.4	53.8	53.6
TWC.311	53.8	54.4	54.4	54.9	54.4	56.1	54.5	56.2	55.1	55.5	54.9
TWC.321	53.5	54.4	53.0	54.3	53.8	55.4	53.8	54.2	54.5	54.9	54.1
TWC.352	55.6	56.1	55.9	53.8	55.4	52.4	53.9	52.8	52.9	53.0	54.2
Mean	54.5	54.9	54.7	54.8	54.7	54.7	54.3	54.8	54.7	54.6	54.7
LSD 5% for Hybrids	NS	1.2	1.3	1.8	0.9	1.1	1.2	0.7	1.3	0.5	0.5
Planting dates	----	----	----	----	NS	----	----	----	----	NS	NS
PD x Hyb.	----	----	----	----	NS	----	----	----	----	1.0	1.5

among hybrids may be attributed to the differences in genetic constitutions.

Plant height (Tables 5, 6 and 7) was significantly affected by planting date only in the second season for the early planting group and over all planting dates. Maize planted on 1/4, 1/9 and 15/7/2002 had the tallest plants of 213.0, 212.6 and 211.5 cm, respectively. On the contrary, maize planted on either 15/3 or 15/8/2002 gave the shortest plants of 207.7 and 208.7 cm, respectively. These variations in plant height may be due to the weather factors prevailing during the vegetative growth of plants in relation with internode length. Abdel-Aziz (1987), Khedr *et al.*,1990), Gouda *et al.* (1998) and Hassaan (1999) reported that plant height reached its maximum values for the early and decreased with late planting. The differences among hybrids (Table-5) were significant for each planting date, over early and late planting group as well as over all planting dates in both seasons. Results in Tables (6 and 7) showed that SC 10 was significantly the tallest hybrid, followed by SC 129, whereas TWC 352 and TWC 311 gave the shortest plant height. The differences in plant height among hybrids may be due to the differences in the number and/or length of the internodes, and/or caused by environmental interactions.

Table (7): Mean performance of 5 maize hybrids grown on 5 planting dates for grain yield, and other characters under Toshka Region in 2002 season.

Hybrids (Hyb)	Early planting			Late planting				Mean over. all (PD)
	15/3	1/4	Mean	15/7	15/8	1/9	Mean	
Grain yield (ard/fed)								
SC.10	20.70	20.69	20.70	21.81	19.56	16.38	19.25	19.83
SC.129	21.43	20.45	20.94	21.91	18.83	16.56	19.10	19.83
TWC.311	18.69	19.54	19.12	19.11	15.80	14.56	16.49	17.54
TWC.321	19.64	18.73	19.19	20.56	16.42	15.57	17.52	18.18
TWC. 352	17.54	17.67	17.60	17.39	14.48	14.26	15.38	16.27
Mean	19.60	19.42	19.51	20.16	17.02	15.47	17.55	18.33
LSD 5% for								
Hybrids	2.423	2.543	1.66	2.67	3.53	NS	1.65	1.17
Planting dates	----	----	NS	----	----	----	1.88	1.47
PD x Hyb.	----	----	NS	----	----	----	NS	NS
Grain yield /plant (gm)								
SC.10	129.7	127.8	128.8	140.9	124.1	105.4	123.5	125.6

Table (7): Cont.

Hybrids (Hyb)	Early planting			Late planting				Mean over-all (PD)
	15/3	1/4	Mean	15/7	15/8	1/9	Mean	
SC.129	134.9	122.5	128.7	144.4	117.9	104.4	122.2	124.8
TWC.311	122.5	111.7	117.1	117.1	95.6	86.4	99.7	106.6
TWC.321	133.2	111.4	122.3	126.8	96.9	93.3	105.7	112.3
TWC. 352	110.9	104.7	107.8	108.5	86.8	84.4	93.2	99.1
Mean	126.3	115.6	120.9	127.5	104.3	94.8	108.9	113.7
LSD 5% for Hybrids	16.5	15.1	10.6	16.1	19.9	16.7	9.5	7.0
Planting dates	----	----	7.42	----	----	----	9.6	8.1
PD x Hyb.	----	----	NS	----	----	----	NS	NS
Number of ears per 100-plants								
SC.10	109.0	107.7	108.3	107.4	107.2	107.7	107.4	107.8
SC.129	104.0	106.0	105.0	104.1	104.3	103.2	103.9	104.3
TWC.311	97.5	99.6	98.6	98.1	100.5	99.6	99.4	99.1
TWC. 321	102.5	101.1	101.8	100.8	101.8	100.7	101.1	101.4
TWC. 352	98.4	97.1	97.7	98.9	98.9	100.4	99.4	98.7
Mean	102.3	102.3	102.3	101.8	102.5	102.3	102.2	102.3
LSD 5% for Hybrids	3.2	3.4	2.21	2.1	2.2	1.6	1.1	1.1
Planting dates	----	----	NS	----	----	----	NS	NS
PD x Hyb	----	----	NS	----	----	----	NS	NS
Plant height (cm)								
SC.10	217.3	227.5	222.4	229.8	219.5	225.5	224.9	223.9
SC.129	215.3	217.8	216.5	217.8	208.5	212.8	213.0	214.4
TWC.311	198.0	207.3	202.6	204.0	200.5	208.8	204.4	203.7
TWC.321	204.8	211.3	208.0	205.0	212.8	215.5	211.1	209.9
TWC. 352	203.3	201.0	202.1	200.8	202.3	200.3	201.1	201.5
Mean	207.7	213.0	210.3	211.5	208.7	212.6	210.9	210.7
LSD 5% for Hybrids	12.5	14.2	9.0	17.3	12.9	13.8	8.0	5.9
Planting dates	----	----	3.9	----	----	----	NS	3.6
PD x Hyb	----	----	NS	----	----	----	NS	NS
Ear position (%)								
SC.10	55.4	55.0	55.2	55.7	54.8	54.6	55.0	55.1
SC.129	53.4	53.9	53.7	52.8	53.2	54.1	53.4	53.5
TWC.311	55.5	55.5	55.5	55.7	56.0	54.7	55.5	55.5
TWC.321	53.2	54.1	53.7	55.0	53.9	53.3	54.1	53.9
TWC. 352	53.0	52.5	52.8	52.2	52.8	52.3	52.6	52.6
Mean	54.1	54.2	54.2	54.3	54.1	53.8	54.1	54.1
LSD 5% for Hybrids	NS	NS	1.72	2.1	1.8	NS	1.1	0.92
Planting dates	----	----	NS	----	----	----	NS	NS
PD x Hyb	----	----	NS	----	----	----	NS	NS

For ear position (%), Tables-5, 6 and 7 reveal that planting date did not exert any effect on this trait in both seasons. Meanwhile, the differences among hybrids were significant for all planting dates in both seasons, except planting dates on 15/2 in the first season and 15/3, 1/4 and 1/9 in the second season. SC 10 produced the highest ear placement for planting dates 1/3, 15/3, 1/4, 1/8 and 1/9 as well as over early and late planting group in the first season. In addition, both SC 10 and TWC 311 expressed the highest ear placement when planted on 15/7 and 15/8 in both seasons as well as over early and late planting groups, and over all planting dates in the second season. On the other hand, TWC 352 was the lowest one for all planting dates in both seasons. It is known that ear position is greatly affected by the genetic makeup of the plants and less influenced by environmental condition.

The interaction of planting date x hybrids was insignificant for all studied traits in the early and late planting groups as well as overall planting dates in both seasons, except plant height in the early, late planting groups and overall planting dates, ear position (%) in the late planting group and overall planting dates in the first season.

3.1.3. Evaluation of some commercial maize hybrids under Toshka environmental conditions

Analysis of variance (Table-8) indicates highly significant differences among hybrids for the five studied traits. Grain yield/fed (Table-9) ranged from 20.87 for SC 10 to 15.58 ard/fed for TWC Pion 30B9 with an average of 17.87 ard/fed. The differences for yield between the single cross group (17.79 ard/fed) and the three way cross group (17.96 ard/fed) was insignificant.

Table (8): Analysis of variance involving 19 maize commercial hybrids for grain yields and some characters evaluated under Toshka Region in 2002 season.

SOV	DF	MS				
		Grain yield (ard/fed)	Grain yield per plant (gm)	No. of ears per 100-plant	Plant height	Ear position (%)
Reps.	3	7.992	96.517	19.895	1164.2**	12.436*
Hybrids	18	10.848**	549.751**	25.658**	78.4.6**	26.356**
Error	54	4.107	168.051	12.459	167.6	4.425
CV (%)		11.34	11.80	3.57	6.21	3.79

*, ** Significant at 0.05 and 0.01 levels of probability, respectively.

Table(9):Mean performance of 19 maize commercial hybrids grown under Toshka Region in 2002 season.

No.	Hybrids	Grain yield (ard/fed)	Grain yield/plant (gm)	No. of ears / 100-plant	Plant height (cm)	Ear position (%)
1	SC.10 (W)	20.87	127.7	98.5	226.5	53.8
2	SC.123 (W)	18.68	114.9	98.5	201.5	54.8
3	SC.129 (W)	19.41	117.4	100.0	224.5	55.6
4	SC.155 (W)	16.93	106.0	104.1	213.8	59.9
5	SC.Watan-4 (W)	19.06	120.3	99.0	199.8	56.8
6	SC.HyTc2010	15.86	91.1	97.9	195.0	59.8
7	SC.HyTc3040	16.78	106.8	96.7	182.5	52.6
8	SC.Pion3062 (Y)	16.72	101.4	98.2	192.8	55.1
9	SC.Pion30K8	16.33	97.9	96.9	210.8	58.4
10	SC.Nagaah (W)	17.24	103.5	96.8	202.3	52.6
Means of single crosses		17.79	108.7	98.7	205.0	55.9
11	TWC.310 (W)	20.11	124.2	101.3	208.3	54.8
12	TWC.320 (W)	19.56	120.2	102.1	227.5	51.5
13	TWC.321 (W)	20.46	131.3	101.5	218.0	54.2
14	TWC.323 (W)	18.18	109.4	96.9	222.3	53.0
15	TWC.324 (W)	17.52	109.8	101.5	215.8	53.6
16	TWC.352 (Y)	17.67	108.2	101.5	199.8	59.1
17	TWC.Watan-1 (W)	16.33	101.6	95.7	188.3	54.3
18	TWC.Pion30B9	15.58	91.6	96.0	229.8	57.4
19	TWC.Nefertety(W)	16.20	97.6	95.2	204.5	57.4
Means of three way crosses		17.96	110.4	99.1.	212.7	55.0
Means overall hybrids		17.87	109.5	89.9	208.6	55.5
LSD (5%)		2.87	18.3	5.0	18.4	3.0

The best yielding hybrids were SC 10 followed by TWC.321, TWC.310, TWC.320, SC.129, SC.Watanya-4 and SC.123. They had the highest average grain yield which ranged from 20.87 to 18.68 ard/fed. On the other hand, eight hybrids *i.e.* TWC Pion 30B9, SC HyTc 2010, TWC Nefertety, SC.Pion30K8, TWC.Watanya-1, TWC.Pion3062, SC.HyTc3040 and SC.155 produced the lowest grain yield which ranged from 15.58 to 16.93 ard/fed.

Regarding grain yield/plant, highly significant differences were obtained among hybrids. The difference between average grain yield/plant of the single cross group (108.7 gm) and the three way cross group (110.4 gm) was insignificant. Hybrids TWC.321 followed by SC 10, TWC.310, SC.Watanya-4 and TWC.320 possessed the highest average grain yield/plant of 131.3, 127.7, 124.2, 120.3 and 120.2 gm, respectively. On the opposite, four hybrids, SC HyTc 2010, TWC Pion 30B9, TWC Nefertety and SC.Pion30K8 had the lowest values of 91.1, 91.6, 97.6 and 97.9 gm/plant, respectively. Similar trend was obtained for grain yield/fed.

With respect to the number of ears/100-plants, 6 out of 19, hybrids *i.e.*, SC. 155 followed by TWC.320, TWC.321, TWC.324, TWC.352 and SC. 129 produced significantly the highest average number of ears/100-plant of 104.1, 102.1, 101.5, 101.5, 101.5 and 100.0, respectively. On contrast, four hybrids, *i.e.*, TWC Nefertety, TWC Watanya-1, SC HyTc3040 and TWC 323 gave significantly the lowest number of ears/100-plant of 95.2, 95.7, 96.7 and 96.9, respectively. However, the difference between the single cross group (98.7 ears/100-plant) and the three way cross group (99.1 ears/100-plant) was insignificant.

Plant height showed that the difference between the single cross group (205.0 cm) and the three way cross group (212.7 cm) was insignificant. The tallest hybrids were TWC. Pion 30B9 followed by TWC.320, SC 10, SC 129 and TWC.323, which ranged from 229.8 to 222.3 cm., whereas, SC HyTc3040 and TWC. Watanya-1 had the shortest plants of 182.5 and 188.3 cm, respectively. For ear position (%), Table(9) indicates that insignificant difference was obtained between the single cross group (55.9) and the three way cross group (55.0). However, the highest ear placements overall hybrids were obtained for hybrids SC 155 (59.9), SC HyTc2010 (59.8), TWC 352 (59.1) and SC Pin 30k8 (58.4), whereas, TWC 320 (51.5), SC HyTc3040 (52.6) and TWC.324 gave significantly the lowest ear placement. The differences among hybrids reported herein probably are due to the genetic differences and their reflection on the number and/or length of the internodes above and below the top most ear of the plant .

3.2. East El-Ewinat Region (South West of Egypt)

3.2.1. Demonstration on a wide scale for five yellow maize hybrids

Average grain yields (Table10) were 27.42, 25.37, 27.55, 24.99 and 26.86 ard/fed for hybrids SC 155, TWC 352, DC Dahab, SC 3062 and SC 3084, respectively. This indicates that increasing yellow maize production may be materialized through extensive growing of high yielding hybrids in this area.

Table (10): Average grain yield (ard/fed) of 5 yellow commercial maize hybrids grown at East El-Ewinat Region in 2001 season.

Plot No	Hybrids				
	SC.155	TWC.352	DC. Dahab	SC.3062	SC.3084
1	29.67	23.89	28.39	24.54	27.43
2	28.00	26.37	25.73	27.91	28.52
3	30.55	28.50	29.06	21.85	26.64
4	26.14	21.82	29.28	25.04	23.82
5	24.01	27.34	23.92	28.00	24.91
6	27.06	21.73	26.41	26.23	29.53
7	29.82	20.98	27.19	20.84	28.27
8	24.52	26.21	30.23	24.92	30.03
9	25.37	28.03	26.09	23.68	23.32
10	28.93	28.44	29.22	26.60	25.83
Average	27.42	25.37	27.55	24.99	26.86

3.2.2. Evaluation of some new and promising maize hybrids under East El-Ewinat environmental conditions

Results of grain yield presented in Tables(11 and 12) indicate highly significant differences among hybrids.

Table (11): Analysis of variance involving 37 commercial and promising maize hybrids for grain yields evaluated in 2001 season.

SOV	DF	MS	F Values
Replications	3	62.681	6.07**
Hybrids	36	53.112	5.14**
Error	108	10.333	
CV (%)	**10.62**		

*, ** Significant at 0.05 and 0.01 levels of probability, respectively

Table(12): Yield of 17 commercial and 20 new promising maize hybrids grown at east El-Ewinat region in 2001 season.

Ent No.	Hybrids	Grain yield (ard/fed)	Ent No.	Hybrids	Grain yield (ard/fed)
1	SC. 10 (Comm.) w	31.53	19	TWC.321 (Comm.) w	33.83
2	SC.122 (Comm.) w	36.10	20	TWC.322 (Comm.) w	27.53
3	SC.123 (Comm.) w	23.50	21	TWC.323 (Comm.) w	27.68
4	SC.124 (Comm.) w	32.83	22	TWC.324 (Comm.) w	33.38
5	SC.129 (Comm.) w	29.43	23	TWC.325 (Comm.) w	28.60
Average of Comm. SC's		30.68	24	TWC.326 (Comm.) w	25.83
6	SC.12 (Prom.) w	28.43	25	TWC.327 (Comm.) w	34.50
7	SC.14 (Prom.) w	29.68	26	TWC.311 (Comm.) w	28.50
8	SC.15 (Prom.) w	25.18	27	TWC.314 (Comm.) w	23.58
9	SC.16 (Prom.) w	33.63	Average of Comm. W TWC's		29.27
10	SC.17 (Prom.) w	31.88	28	TWC.440 (Prom.) w	32.78
11	SC.19 (Prom.) w	31.50	29	TWC.450 (Prom.) w	33.13
12	SC.21 (Prom.) w	29.85	30	TWC.424 (Prom.) w	29.68
13	SC.22 (Prom.) w	36.73	31	TWC.425 (Prom.) w	31.45
14	SC.23 (Prom.) w	30.60	32	TWC.423 (Prom.) w	30.40
15	SC.24 (Prom.) w	32.23	33	TWC.426 (Prom.) w	25.00
Average of Prom. SC's		30.97	34	TWC.422 (Prom.) w	31.68
16	SC.155 (Comm.) y	20.65	35	TWC.427 (Prom.) w	34.78
17	TWC. 351 (Comm.) y	28.93	36	TWC.421 (Prom.) w	33.57
18	TWC. 352 (Comm.) y	31.58	37	TWC.428 (Prom.) w	29.63
Average of Comm. y TWC's		30.26	Average of Prom. W TWC's		31.21
Average overall hybrids = 30.26					
LSD 5% = 4.51 ard/fed.					

Comm. = Commercial hybrids Prom. = New promising hybrids W = White and Y = Yellow

Average grain yield ranged from 36.73 for the promising SC 22 (13) to 20.65 ard/fed for SC 155 (16) with an average of 30.26 ard/fed. No significant differences for yield were obtained between the average of the five hybrid groups *i.e.*,the commercial single crosses (30.23 ard/fed),the promising single crosses (30.98 ard/fed) ,the commercial

three way crosses (29.27 ard/fed), the promising three way crosses (31.21 ard/fed) and the commercial yellow three way cross group (30.26 ard/fed). Twelve hybrids included five commercial *i.e.* SC122 (2), SC124 (4), TWC 321 (17), TWC 324 (20) and TWC 327 (23), and seven promising hybrids *i.e.* SC16 (10), SC22 (14), SC24 (16), TWC 421 (34), TWC 427 (33), TWC 440 (26) and TWC 450 (27) produced the highest grain yield (ranged from 36.73 to 32.23 ard/fed. On the other hand, six hybrids included four commercial *i.e.* SC123 (3), SC155 (6), TWC 326 (22), TWC 314 (25), and two promising *i.e.* SC 15 (9) and TWC 426 (31) had the lowest yield (ranged from 20.65 to 25.83 ard/fed). Comparing the yellow maize hybrids, TWC 352 produced the highest grain yield of 31.58 ard/fed, followed by TWC 351 (28.93 ard/fed), while SC 155 gave the lowest yield of 20.65 ard/fed.

Recommendations:

From the previous data, increasing maize production could be possible through:

1-Extensive growing of high yielding hybrids in this area by planting maize hybrids twice annually, early planting during 15/3 to 1/4 and late planting during 15/7 to 1/8, without a delay in planting the winter season.

2-Increasing the area devoted for cultivating yellow maize hybrids in the new land at Toshka and east El-Ewinate regions.

3-For maize breeding program, it is possible to plant maize materials in Abo-Sembel Research Station, Toshka Region as off-season planting (winter) during October.

4-It is important to start maize breeding programs for drought stress and heat tolerance at Abo-Sembel Research Station, Toshka Region and/or East El-Ewinat Research Station.

5-Soil in Toshka and east El-Ewinat are in need of a good management and high amount of organic matter (manure) to improve the fertility and water holding capacity.

4. REFERENCES

Abdel-Aziz A. A. (1987). Effect of some agriculture practices on yield and yield components of corn (Zea *mays* L). M. Sc. Thesis, Fac. Agric., El-Minia Univ. Egypt.

Alissi J. and Power J. F. (1976). Response of an early maturing corn hybrid to planting dates and population in northern plains. Argon. J. 68:153-155

Bali A. S., Shah M. H., Singh K. N. and Raina T. S. (1991). Response of the maize (*Zea mays* L.) composite to planting date and fertility rate under irrigation condition of Kashmir valley. Indian J. Argon.36: 259-260

Bishr M. A., Abdallah M. M. and El-Sayed A. A. (1977). Effect of planting dates on grain yield of some maize varieties at different locations in ARE. Agric. Res. Rev., 55(9): 125-135.

Cirilo A. G. and Andrade F. H. (1994). Planting date and maize productivity. 1- crop growth and dry matter partitioning. Crop Sci., 34: 1039-1043.

Eckert D. J. (1984). Tillage system X planting dates interactions in corn production. Agron. J., 76(4): 580-582.

Gouda A. Sh., Soultan M. A. and El-Zeir F. A. (1998). Response of some newly released white and yellow maize hybrids to planting dates. J. Agric. Sci. Mansoura Univ. 23 (3): 1013-1019.

Hassaan M. M. M. (1999). Effect of planting dates on the response of the hybrid maize to nitrogen fertilization. M.Sc. Thesis, Fac. Agric., Al-Azhar Univ., Cairo.

Ibrahim M. S. A., El-Shourbagy F. A., Iskander A. Z. and Abd El-Karim M. M. (1979). Effect of planting dates on grain production of some maize varieties. Res. Bull. Fac. Agric. Ain-Shams Univ., 1219.

Khedr E. A., Matta S. E. G., Mahgoub G. M. A. and Sadek S. E. (1990). Effect of planting dates on growth and yield of some maize varieties. Egypt. J. Appl. Sci., 5 (8): 792-800.

McIntosh M. S. (1983). Analysis of combined experiments. Agron. J. 75:153-155

Page A. L. (1982). Methods of soil analysis. Part II, chemical and microbiological properties, second edition, Wisconsin USA.

Prasad K. and Joshi H. C. (1988). Response of maize germplasm to planting time under rain fed conditions of northwestern mid-Himalayas. Indian J. Agric. Res., 22(4): 179-182.

Smith N. (1991). Cropwat for Eto calculation using Pennaman Montieth Method. FAO, Pub. 46.

Soil Survey Staff (1994). Keys to soil taxonomy. USDA, Soil Conservation Service.

Sood B. R., Awasthi O. P. and Sharma S. K. (1979). Effect of cultural practices on yield and grain quality in maize. Indian J. Agric. Res., 13(2): 119-121.

Widstrom N. W., Young G. R., Martin W. K. and Shaver D. L. (1984). Grain and forage yield of irrigated second-crop corn seeded on five planting dates. Agron. J., 76(6): 883-886.

Younis M. A., Salama F. A. and Faisal R. I. (1995). Effect of planting dates and nitrogen levels on growth and yield of maize. J. Agric. Sci. Mansoura Univ. 20 (1): 9-14.

إنتاج الذرة الشامية بالأراضي الجديدة في توشكي بجنوب الوادي وشرق العوينات بالجنوب الغربي لمصر

فتحي حسن سيد سليمان ، على إسماعيل نجيب عبد العال*، عاطف عبد القادر محمود ، أحمد عبد العزيز أحمد ، مجدى أحمد عبد المولى

برنامج الذرة الشامية-معهد بحوث المحاصيل الحقلية-مركز البحوث الزراعية
* محطة البحوث الزراعية بابوسمبل-توشكي جنوب الوادي

ملخص

يعتبر مشروعي توشكي بجنوب الوادي وشرق العوينات بالجنوب الغربي من مصر من المشروعات الزراعية العملاقة لتنمية مساحات واسعة من الصحراء وهذه أول مرة يتم فيها زراعة الذرة الشامية في كلا المنطقتين. ولذلك فإن من أهم أهداف هذه الدراسات هو الوصول إلى أفضل الهجن إنتاجا والتي تجود زراعتها في المنطقتين و إختبارها تحت بعض المعاملات الزراعية باستخدام نظامي الري الحديث بالتنقيط أو المحوري.تم تنفيذ التجارب بمحطة البحوث الزراعية بأبوسمبل-منطقة توشكي ومنطقة شرق العوينات بالتعاون مع وحدة الخدمات البستانية. ويمكن تلخيص أهم النتائج فيما يلي:

أولا: منطقة توشكي:

١.أظهرت نتائج التجربة الإسترشادية أن الهجين الفردي ١٢٩ والثلاثي ٣٢١ والفردي ١٢٠ تعتبر أفضل الهجن حيث أعطت أعلى محصول ٣٠,٣٢ ، ٢٩,٦٣ ، ٢٨,٢٢ أردب/فدان على الترتيب .

٢.أوضحت نتائج تجربة مواعيد الزراعة أن أفضل ميعاد لزراعة الذرة الشامية كان خلال الفترة من ٣/١٥ إلى ٢٠٠٣/٤/١ أو من ٧/١٥ إلى ٨/١ للحصول على أعلى محصول. كما أعطى الهجين الفردي ١٠ ، الهجين الفردي ١٢٠ أعلى محصول خلال موسمي الدراسة ٢٠٠١ و ٢٠٠٢.

٣. أوضحت نتائج تجربة مقارنة هجن الذرة الشامية أن أعلى قدرة محصولية كانت لستة هجن من ١٦ هجين بيضاء الحبوب وهى الهجين الفردي ١٠ والهجين الفردي ١٢٩ والهجين الفردي وطنية -٤ والهجين الثلاثي ٣٢٠ والهجين الثلاثي ٣٢١ , كما أعطى الهجين الثلاثي الأصفر ٣٥٢ أعلى محصول مقارنة بالهجينين الأخريين.

ثانيا: منطقة شرق العوينات:

١. أوضحت نتائج الزراعة الموسعة لمقارنة هجن الذرة الشامية الصفراء أن محصول الحبوب الناتج من كل من الهجين الفردي ١٥٥ والثلاثي ٣٥٢ والزوجي دهب والفردي ٣٠٦٢ والفردي ٣٠٨٤ هو ٢٧,٤٢ ، ٢٥,٣٧ ، ٢٧,٥٥ ، ٢٤,٩٩ ، ٢٦,٨٦ إردب / فدان على الترتيب.

٢. وبالنسبة لتجربة مقارنة محصول الهجن التجارية والجديدة المبشرة فقد أظهرت النتائج وجود فروق عالية المعنوية بين الهجن وبعضها حيث تراوح المحصول من ٣٦,٧٣ إلى ٢٠,٦٥ إردب/فدان للهجين الجديد فردي ٢٢ والهجين التجاري الأصفر فردي ١٥٥ على الترتيب بمتوسط عام ٣٠,٢٦ إردب/فدان. وقد تفوق عدد ١٢ هجين منها ٥ هجن تجارية حيث تراوح المحصول من ٣٦,٧٣ إلى ٣٢,٢٣ إردب/فدان. وبالنسبة للهجن الصفراء فقد تفوق كل من الهجينين الثلاثيين التجاريين ٣٥٢و ٣٥١ على الهجين الفودي التجاري ١٥٥ حيث كانت المتوسطات ٣١,٥٨ و٢٨,٩٣ و٢٠,٦٥ إردب/فدان على الترتيب.

وتوصى النتائج السابقة بأنه يمكن زيادة إنتاج محصول الذرة الشامية من خلال:

١.زراعة الهجن عالية الإنتاج في منطقتي توشكي وشرق العوينات مرتين في السنة الأولى خلال الفترة من ٣/١٥ إلى ٤/١ والثانية من ٧/١٥ إلى ٨/١ وبدون أي تأخير في زراعة المحصول الشتوي.

٢.زيادة المساحة المنزرعة من الذرة الشامية الصفراء في كلا المنطقتين مع توفير الاستهلاك المائي.

٣.إن الظروف البيئية والمناخية مناسبة لتنفيذ برنامج تربية لاستنباط هجن عالية المقاومة للحرارة والجفاف.

٤.يمكن لمربى الذرة الشامية زراعة مواد التربية كعروة شتوية خلال النصف الأول من أكتوبر بمحطة البحوث الزراعية بأبوسمبل-توشكي بجنوب الوادي.

المجلة العلمية لكلية الزراعة – جامعة القاهرة – المجلد (٥٥)العدد الثانى (إبريل ٢٠٠٤):٢٣٧-٢٦٤.