EEFECT OF SPACING BETWEEN ROWS AND HILLS AND NUMBER OF PLANTS PER HILL ON GROWTH, YIELD AND ITS COMPONENTS OF SIX MAIZE CROSSES

BY

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ABSTRACT

Two field experiments were conducted at Sakha Agriculture Research Station Kafr El-Sheikh Egypt during 2002 and 2003 growing seasons. The aim of this investigation was to study the effect of row spacing (60 and 70 cm.), number of plants/hill (one plant/hill and two plants/hill) and spacing between hills (30 and 40 cm.) on some agronomic traits, yield and its components of six maize crosses i.e. SC10, SC 122, new SC 11, TWC 310, TWC 324 and new TWC 327, the results of the combined analysis for the two growing seasons showed the following :

-Differences between two seasons were significant for all traits. Mean values for the second season 2003 were higher than the first season 2002 for all traits except silking date.

- Spacing between rows had a significant effect on all studied traits except silking date, grain yield and number of rows/ear. The highest mean values were obtained when spacing between rows was 70 cm. apart for all traits except silking date, plant and ear heights.

- The number of plants per hill had a significant effect on all traits. The highest values were recorded when one plant/hill was left for all traits except silking date.

- All traits were significantly affected by spacing between hills except plant height, grain yield and number of rows /ear. The highest mean values were obtained when spacing between hills were 40 cm. apart for all traits except silking date and ear height.

- Significant differences between maize crosses were showed for all traits. SC 10 surpassed the other five crosses for stem diameter, grain yield, ear diameter and number of kernels/row. New SC 11 was the best crosses for earliness, short plant and ear heights, SC 122 was the better for number of ears/plant ,TWC 310 was the best

for ear length and new TWC 327 was the best crosses for number of rows/ear.

- The highest value of grain yield was 28.28 Ard./Fad. obtained from 60 cm. between rows with one plant/ hill, planting at 60 cm. between rows with 40 cm. within hills produced the highest grain yield 27.47 Ard./Fad., the highest value for grain yield 28.05 Ard./Fad. was obtained when spacing between hills were spaced at 30 cm. with one plant/hill. SC 10 had the highest grain yield 30.1 Ard./Fad. when spacing between rows was 70 cm., also, the highest grain yield 30.89 Ard./Fad. was obtained for SC10, when planting at 40 cm. between hills.

INTRODUCTION

Main target of the maize research program was to determine the optimum package of recommendations for newly released maize hybrids. Plant density is one of the most important recommendations affecting the performance of maize yield. The optimum plant population for a grower is closely related to his yield. Moursi *et al.*, (1970) showed that the increasing number of plants per faddan either by reducing distance between hills or by increasing number of plants/hill caused a depression in plant height and number of ears/plant but the grain yield of two plant/hill outweighted that of one plant/hill. Chamberland (1975) reported the decrease between row spacing from 76 to 64 cm. increased yield by 2.8 ton/ha. Sayfikar (1983) planted maize in rows 51, 75 or 102 cm. apart and he reported the grain yield was higher in the narrower rows where light interception tended to increase with decrease in row spacing. Gomaa (1985) found that one plant/hill at 25 cm. between hills increased significantly number of ears/plant and grain yield compared with two or three plants/hill at 50 and 75 cm.. El-Hosary and Salwau (1989) found that the number of plants per hill had significant effects on the number of ears/plant, number of kernels/row and grain yield/plant. One plant per hill gave the maximum values for these traits. Also, they found that the distance between hill had significant effects on the stem diameter, number of ears/plant, number of kernels per row and grain yield per plant. EL-Hariri *et al.*, (1996) reported that the distance between hills had

highly significant effects on plant height, number of ears/plant, stem diameter and grain yield ton/fad. Mosa (2001) mentioned that decreased spacing between hills from 26 to 17.5 cm. with 80cm. between rows significantly increased grain yield, ear height and silking date , while number of ears/plant, ear length, ear diameter, number of rows and number of kernels/row of maize plant were significantly decreased . The aim of this investigation was to study the effect of plant number in hill, as well as spacing between hills and between rows on some agronomic traits, yield and its components of six maize crosses.

MATERIALS AND METHODS

This investigation was carried out at Sakha Agriculture Research Station Kafr El-Sheikh Egypt during 2002 and 2003 seasons. The previous crop in both seasons was wheat, date of sowing was 30 May in 2002 and 13 June in 2003 and soil is caly loam. Each experiment was in factorial treatments combination of two row spacing (60 and 70 cm. apart), two plant densities in hills (one and two plant/hill), two distance between hills (30 and 40 cm. apart within the rows) and six commercial crosses namely: single cross 10, new single cross 11, single cross 122, three way cross 310, three way cross 324 and new three way cross 327. The treatments during both seasons of the study were arranged in split-split plot design with four replications. Row spacing and plant densities in hill were arranged at random in the main plots, while distance between hills in the sub- plots and crosses in the sub-sub plots. Each plot consist of 4 rows, 6 m long. The thinning of plants, one or two plant/hill was done before the first irrigation. Other culture practices were applied as recommended. The data recorded were taken on the two inner rows for 50% silking date (number of days from planting to 50% emergence silking), plant and ear height (cm.) were measured from soil surface to the upper most node on ten guarded plants from each plot at flowering, stem diameter (cm.) was measured on ten guarded plants from each plot at flowering, number of ears/plant was measured by divided total number of harvested ears on total number of plants in plot, grain yield (Ard./Fad.) adjusted based on 15.5% grain moisture content and shelling percent (estimated Kg/plot which is used to estimate the

yield Ard./Fad.), ear length (cm.), ear diameter (cm.), number of rows/ear and number of kernels/row were measured from random sample of ten ear were taken from each plot as an average. Data of the two seasons were subjected to combined analysis according to Snedecor and Chochran (1980).

RESULTS AND DISCUSSION

Combined analysis of variance for ten traits of maize over two years are presented in Table-1. Years (Y) mean squares were highly significant for all traits, indicating an overall differences between years. Mean values for the second season (2003) were higher than the corresponding ones in the first season (2002) for all the traits except silking date Table-2. This may be attributed to differences in environmental conditions specially increasing in temperature at 2002 season according to Meteriological Station at Rice Resarch Traiminy center (RRTC). This result was in agreement with that obtained by Mosa (1996) who stated that most growth and ear traits of maize were affected by years.

Mean squares for spacing between rows (R) were significant to highly significant for all the traits except silking date, grain yield and number of rows/ear. The interaction between (RxY) was not significant for all the traits except silking date and ear length, indicating that most of the studied traits were affected by row spacing but not affected significantly by (RxY) interaction, this showed that spacing between rows and years act independently on all traits under this study. The highest mean values were obtained when spacing between rows were 70 cm. apart for all the traits except silking date, plant and ear heights. This result was in harmony with that obtained by Ekha *et al.*, (1977), Sayfikar (1983) Younis *et al.*, (1989) and El-Zeir *et al.*, (1998) they found that most growth, yield and yield components traits were affected by row spacing.

Highly significant mean squares due to number of plants/hill (P) were detected for all the traits. The interactions between (PxY) and (PxR) were significant for all the traits except (PxY) interaction for ear height, stem diameter and number of kernels/row and (PxR) interaction for ear height, number of ears/plant, ear diameter and number of rows/ear.

Table 1: Combined analysis of variance for ten traits of maize over two years.

S.O.V	Silking date days	Plant height cm.	Ear height cm.	Stem diameter cm.	No.of ears/ plant	Grain yield Ard/Fad	Ear length cm.	Ear diameter cm.	No.of rows/ear	No.of kernels/row
Years (Y)	885.13**	188815.69**	71613.38**	17.46**	0.79**	8526.07**	104.27**	9.56**	20.63**	761.34**
Rep/Y	8.55	741.96	536.73	0.07	0.01	71.91	1.76	0.003	0.7	48.85
Spacing between rows (R)	0.023	1338.77*	2430.09**	0.37*	0.35**	9.41	103.65**	1.38**	0.04	163.93**
R x Y	44.96**	386.00	1.5	0.001	0.01	11.01	6.85**	0.04	1.58	6.07
No.of plants/hill (P)	285.31**	9811.14**	1120.67*	11.87**	6.17**	101.37**	269.17**	4.42**	9.07**	622.45**
PxY	48.88**	1399.19*	0.9	0.02	0.17**	130.65**	8.73**	0.57**	4.46*	12.94
PxR	38.13**	5377.52**	42.67	0.46**	0.001	413.62**	19.31**	0.09	0.41	112.55**
PxYxR	1.15	390.07	1544.01**	0.01	0.01	18.68	0.43	0.15*	0.53	20.21
Error	3.35	294.08	175.77	0.05	0.009	9.73	0.71	0.03	0.72	12.13
Spacing between hills (H)	32.08**	12.39	595.01*	2.02**	1.05**	29.27	67.25**	0.83**	2.91	288.25**
HxY	22.52**	242.02	84.38	0.01	0.06**	3.93	0.64	0.02	0.68	2.55
HxR	3.57	232.62	29.26	0.06	0.008	83.14*	2.45	0.001	0.94	39.59
HxYxR	0.003	1.63	0.38	0.2*	0.0001	0.67	7.91	0.02	0.18	9.65
HxP	28.71**	1422.19*	682.67*	0.05	0.02*	332.30**	19.85**	0.22*	0.49	154.15**
HxYxP	13.13**	422.94	2.34	0.001	0.07**	1.25	7.57	0.38**	1.02	21.99
HxRxP	3.19	320.84	84.83	0.003	0.02*	9.50	13.46*	0.54**	2.28	131.01**
HxYxRxP	7.32*	56.25	94.01	0.01	0.01	159.40**	2.85	0.0001	0.36	0.17
Error	1.31	188.07	129.39	0.029	0.004	12.47	2.46	0.04	0.74	15.59
Crosses C	71.82**	8764.57**	5358.89**	0.23**	0.12**	334.68**	9.28**	0.38**	10.46**	87.96**
CxY	8.10**	1596.99**	880.26**	0.09**	0.09**	141.29**	3.57**	0.17**	22.92**	47.72**
CxR	1.44	21.17	83.84	0.003	0.008	22.51*	1.49	0.01	0.91	4.70
CxYxR	0.74	140.17	133.44	0.03	0.004	13.82	1.06	0.03	1.29	2.74
CxP	6.94**	269.93	95.83	0.1**	0.06**	16.57	1.31	0.01	1.67*	7.01
CxYxP	2.62	190.05	65.77	0.06**	0.2**	14.77	1.72*	0.02	0.39	5.98
CxRxP	0.58	400.22*	214.80*	0.008	0.005	4.62	0.67	0.04	0.21	3.27
CxYxRxP	2.94	59.02	25.79	0.005	0.004	0.81	0.78	0.03	0.99	1.55
CxH	1.72	684.59**	319.59**	0.02	0.01	39.20**	0.25	0.04	0.99	1.73
CxYxH	2.15	221.75	89.21	0.02	0.006	11.40	0.91	0.02	0.71	10.03
CxRxH	0.30	179.99	65.24	0.02	0.006	6.39	0.94	0.03	0.59	25.01*
CxYxRxH	0.25	83.53	45.94	0.02	0.004	9.93	0.49	0.04	1.73*	16.97
CxPxH	0.99	64.81	46.20	0.03	0.009	13.79	0.79	0.06	0.87	9.47
CxYxPxH	1.54	50.28	165.64	0.01	0.004	7.53	0.42	0.03	0.93	2.91
CxRxPxH	0.54	95.32	86.11	0.009	0.005	2.45	1.09	0.01	1.37	5.42
CxYxRxPxH	2.63	65.18	10.79	0.01	0.008	12.82	0.49	0.01	0.41	9.62
Error	1.38	132.11	75.82	0.02	0.004	9.93	0.76	0.03	0.67	10.23
CV%	1.82	4.00	5.30	6.34	7.30	11.72	4.13	3.74	6.32	7.37

*,** significant at 0.05 and 0.01 level of probability, respectively.

Table (2): The average values for ten traits of maize as affected by years, spacing between rows, number of plants/hill, spacing between hills and crosses.

Treatments	Silking date days	Plant height cm.	Ear height cm..	Stem diameter cm.	No.of ears/plant	Grain yield Ard./Fad.	Ear length cm.	Ear diameter cm.	No.of rows/ear	No.of kernels/row
Years										
2002	65.91a	265.34a	150.58a	2.04 a	0.85 a	22.17a	20.57a	4.61 a	12.72 a	42.02 a
2003	62.88 b	309.69b	177.90b	2.47 b	0.94 b	31.60b	21.61b	4.93 b	13.18 b	44.84 b
Spacing between rows										
60 cm.	64.4a	289.39a	166.76a	2.22 a	0.86 a	26.73a	20.57a	4.71a	12.9 a	42.78 a
70 cm.	64.39a	285.65b	161.72b	2.29 b	0.92 b	27.04a	21.61b	4.83b	12.96a	44.08 b
No.of plants/hill										
1 plant	63.53 a	292.57a	165.95a	2.43 a	1.02 a	27.40a	21.93 a	4.88 a	13.10 a	44.70 a
2 plants	65.26 b	282.46b	162.53b	2.08 b	0.77 b	26.37b	20.25 b	4.66 b	12.80b	42.16 b
Spacing between hills										
30 cm.	64.68 a	287.34a	165.49a	2.18 a	0.84 a	26.61a	20.67a	4.72 a	12.86a	42.56 a
40 cm.	64.10 b	287.70a	163.0 b	2.33 b	0.95 b	27.16a	21.51b	4.82 b	13.04a	44.30 b
Crosses										
SC 10	64.45	298.46	170.54	2.34	0.89	30.09	21.39	4.85	12.65	44.83
SC 122	63.39	274.79	153.29	2.17	0.94	27.48	20.71	4.65	12.46	44.32
SC 11	63.01	272.01	152.87	2.24	0.92	27.72	20.68	4.70	12.77	44.10
TWC 310	64.51	287.96	164.76	2.22	0.81	24.25	21.48	4.81	13.11	43.15
TWC 324	65.18	292.75	169.81	2.31	0.90	27.59	21.43	4.80	13.13	42.07
TWC 327	65.82	299.14	174.17	2.25	0.90	24.17	20.85	4.81	13.58	42.11
L.S.Dc 0.05	0.20	3.98	3.01	0.05	0.02	1.09	0.30	0.06	0.28	1.10
0.01	0.26	5.24	3.97	0.06	0.03	1.43	0.39	0.07	0.37	1.45

While the interaction between (PxYxR) was not significant for all traits except ear height and ear diameter, meaning that all the traits were affected by number of plants/hill and most traits were affected significantly by (PxY) and (PxR) interactions. The highest values were recorded when one plant/hill was left for all the traits except silking date (Table-2).These results are in agreement with that obtained by Salwau (1985) who mentioned that one plant/hill increased yield components of maize, whereas two plants/hill gave the maximum yield/faddan. El-Hosary and Salwau (1989) found that the number of plant per hill had a significant effect on the

number of ears/plant, number of kernels/row and grain yield/plant and they found that one plant per hill gave the maximum values for these traits. The effect of interaction between years and number of plants/hill (PxY) on grain yield Ard./Fad. are shown in Fig1. The highest value of grain yield was 31.66 Ard./Fad. obtained at 2003 season and two plants/hill, whereas the lowest value was 21.07 Ard./Fad., obtained at 2002 season and two plants/hill. The effect of interaction between spacing between rows and number of plants/hill (PxR) on grain yield (Ard./Fad.) are shown in Fig 2. The highest value of grain yield was 28.28 Ard./Fad. obtained from 60 cm. between rows with one plant per hill, but the lowest value was 25.18 Ard./Fad. obtained from 60 cm. between rows with two plants/hill.

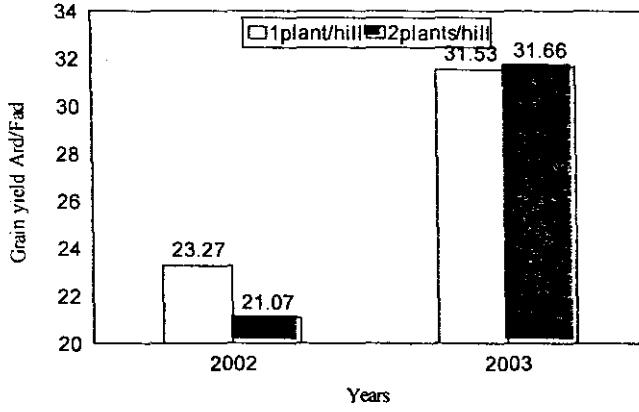

Fig 1.The effect of interaction between yrars and number of plants/hills on grain yield Ard./Fad.

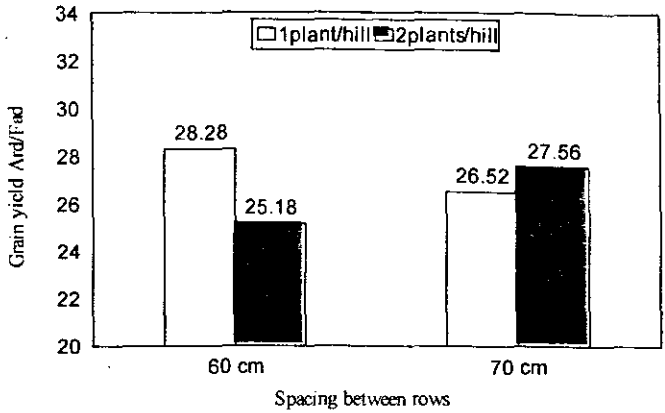

Fig2.The effect of interaction between spacing between rows and number of plants/hills on grain yield Ard./Fad.

All the traits were significantly affected by spacing between hills (H) except plant height, grain yield and number of rows /ear. The interactions between (HxY), (HxR), (HxYxR), (HxP), (HxYxP), (HxRxP) and (HxYxRxP) were not significant for all traits except (HxY) interaction for silking date and number of ears/plant, (HxR) interaction for grain yield, (HxYxR) interaction for stem diameter, (HxP) interaction for silking date, plant and ear heights, number of ears/plant, grain yield, ear length, ear diameter and number of kernels/row, (HxYxP) interaction for silking date and number of ears/plant and ear diameter, (HxRxP) interaction for number of ears/plant, ear length, ear diameter and number of kernels/row and (HxYxRxP) interaction for silking date and grain yield. The highest mean values were obtained when spacing between hills were spaced 40 cm. for all traits except silking date and ear height (Table-2). Significant effect of the distance between hills on most growth, yield and yield components traits of maize were reported by Salem *et al.*, (1983) EL-Shaer *et al.*, (1987), El-Hosary and Salwau (1989), El-Hariri *et al.*, (1996) and Mosa (2001). Significant interaction between spacing between rows and spacing between hills (HxR) on grain yield Ard./Fad. are shown in Fig 3. Planting at 60 cm. between rows with 40 cm. within hills produced the highest value 27.47 Ard./Fad., while the lowest value 25.99 Ard./Fad. was detected from 60 cm. between rows with 30

cm. within hill. Highly significant interaction between number of plants/hill and spacing between hills (HxP) for grain yield are shown in Fig 4.The highest value 28.05 Ard./Fad. was obtained when spacing between hills were spaced 30 cm. with one plant/hill. Whereas the lowest value 25.16 Ard./Fad. was obtained from 30 cm. between hill and two plants/hill. Significant difference of the interaction between years, spacing between rows, number of plants/hill and spacing between hills are shown in (Table-3). The highest value 34.28 Ard./Fad. obtained at 2003 season, 70 cm. between rows, two plants/hill and 40 cm. between hills, while the lowest value 17.68 Ard./Fad. obtained at 2002 season, 60 cm. between rows, two plants/hill and 30 cm. between hills.

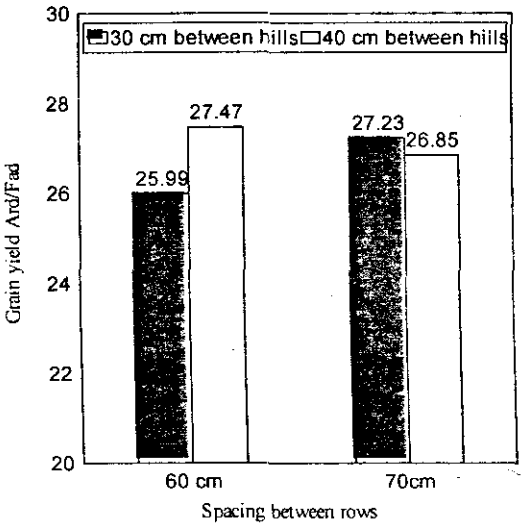

Fig3.The effect of interaction between spacing between rows and hills on grain yield Ard./Fad.

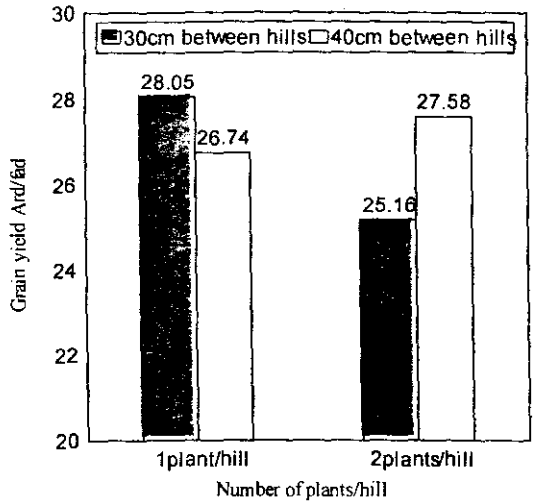

Fig 4: The effect of interaction between number of plants/hill and spacing between hills on grain yield Ard./Fad.

Table (3): Effect of the third order interaction between years spacing between rows, number of plants/hill and spacing between hills on grain yield Ard./Fad.

Year	Spacing between rows (R)	Number of plants/hill (P)	Spacing between hills (H)	
			30 cm.	40 cm.
2002 season	60 cm.	One plant/hill	25.09	23.11
		Two plants/hill	17.68	22.86
	70 cm.	One plant/hill	22.67	22.21
		Two plants/hill	21.74	22.02
2003 season	60 cm.	One plant/hill	32.16	32.75
		Two plants/hill	29.01	31.15
	70 cm.	One plant/hill	32.29	28.9
		Two plants/hill	32.22	34.28

L S D 0.05 = 1.99
0.01 = 2.63

Significant differences between maize crosses (C) were showed for all the traits (Table -1). Moreover it is clear from (Table-2), that SC 10 out yielded the other five crosses in stem diameter, grain yield, ear diameter and number of kernels/row, new SC 11 was the best crosses for earliness, short plant and ear heights, SC 122 the better crosses for number of ears/plant, TWC 310 was the best for ear length and new TWC 327 was the best for number of rows/ear. The results also, showed that SC 10 surpassed SC 122 and new SC 11 in grain yield Ard./Fad. by 8.67% and

7.87% respectively. While, TWC 324 surpassed TWC 310 and new TWC 327 in grain yield Ard./Fad. by 12.10% and 12.39% respectively. These results were in harmony with the obtained by Abou-Khadrah (1984), Salama *et al.*, (1994) , Younis *et al.*, (1994) and El-Sheikh (1998) they stated that maize hybrids differ in growth parameters and productive efficiency i.e. yield and its components.

Mean squares due to first order interactions showed that; (CxY) was significant for all the traits, while (CxR) (CxP) and (CxH) interactions were not significant for all traits except (CxR) interaction for grain yield, (CxP) interaction for silking date, stem diameter, number of ears/plant and number of rows/ear and (CxH) interaction for plant height, ear height and grain yield. The second order interactions (CxYxR), (CxYxP), (CxRxP), (CxYxH) ,(CxRxH) and (CxPxH),also the third order interactions, (CxYxRxP), (CxYxRxH),(CxYxPxH) and (CxRxPxH) and fourth order interaction (CxYxRxPxH) were not significant for all traits except (CxYxP) interaction for stem diameter, number of ears/plant and ear length, (CxRxP) interaction for plant height and ear height, (CxRxH) interaction for number of kernels/row and (CxYxRxH) interaction for number of rows/ear.

The effect of interaction between years and crosses on grain yield Ard./Fad. are shown in Table 4. The highest value for grain yield was obtained for SC 10 (35.82 Ard./Fad.) in 2003 season, while the lowest value was obtained for the new TWC 327 (20.12 Ard./Fad.) in 2002 season. The effect of interaction between spacing between rows x crosses on grain yield Ard./Fad. in Table 4, showed that SC 10 had the highest value 30.1 Ard./Fad. when spacing between rows was 70 cm., while the new TWC 327 had the lowest grain yield 23.88 Ard./Fad. when spacing between rows was 60 cm. The new SC 11 had the highest value when spacing between rows was 70 cm. The effect of interaction between spacing between hills and crosses on grain yield Ard./Fad. Table 4, showed that The highest grain yield was obtained for SC 10 (30.89 Ard./Fad.) when spacing between hills 40 cm., whereas, the lowest value was obtained by planting at 30 cm. between hills in case of new TWC 327(23.21 Ard./Fad.) New SC 11 had the highest grain yield when planting at 30 cm. between hills.

Table (4): Effect of the first order interaction between crosses and years, spacing between rows and spacing between hills.

cross	Year		Spacing between rows		Spacing between hills	
	2002	2003	60 cm.	70 cm.	30 cm.	40 cm.
SC 10	24.36	35.82	30.08	30.1	29.29	30.89
SC 122	23.79	31.18	27.86	27.1	27.7	27.27
SC 11	21.56	33.88	26.45	29.0	27.88	27.56
TWC 310	21.68	26.82	24.29	24.21	25.08	23.42
TWC 324	21.52	33.65	27.81	27.36	26.49	28.68
TWC 327	20.12	28.22	23.88	24.46	23.21	25.13
L.S.D 0.05	1.54		1.54		1.54	
0.01	2.03		2.03		2.03	

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الملخص العربى

تأثير المسافة بين الخطوط والجور وعدد النباتات بالجورة على صفات، النمو الخضري،المحصول ومكوناته لـ ٦ هجن من الذرة الشامية

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أجريت هذه الدراسة بمحطة البحوث الزراعية بسخا بكفرالشيخ- جمهورية مصر العربية موسمى ٢٠٠٢-٢٠٠٣ وذلك لدراسة تأثير المسافة بين الخطوط (٦٠ و ٧٠ سم) ، عدد النباتات فى الجور (نبات فى الجورة و٢ نبات فى الجورة) والمسافة بين الجور (٣٠ و ٤٠ سم) على صفات النمو الخضرى والمحصول لـ٦ هجن من الذرة الشامية وهى هـ.ف ١٠، هـ.ف ١٢٢، هـ.ف ١١، هـ.ث٣١٠، هـ.ث٣٢٤، هـ.ث٣٢٧ و أظهر التحليل المشترك للعوامل المدروسة النتائج الاتية:

- كانت الاختلافات بين السنوات عالية المعنوية لجميع الصفات تحت الدراسة. متوسطات جميع الصفات موسم ٢٠٠٣ أعلى من متوسطات موسم ٢٠٠٢ ما عدا صفة تاريخ ظهور ٥٠% من النورات المؤنثة.
- كان تأثير المسافة بين الخطوط معنويا لجميع الصفات المدروسة ما عدا صفات تاريخ ظهور ٥٠% من النورات المؤنثة ، محصول الحبوب وعدد الصفوف بالكوز. مسافة ٧٠ سم بين الخطوط أعطت أعلى متوسطات لجميع الصفات ما عدا صفة تاريخ ظهور ٥٠% من النورات المؤنثة وارتفاع النبات والكوز.

– اظهر عدد النباتات فى الجورة تأثير معنوى على جميع الصفات. أعلى متوسطات تحصل عليها كانت عند ترك نبات واحد فى الجورة لجميع الصفات ما عدا صفة تاريخ ظهور ٥٠% من النورات المؤنثة.

– كان تأثير المسافة بين الجور معنويا لجميع الصفات المدروسة ما عدا صفات ارتفاع النبات، محصول الحبوب وعدد الصفوف بالكوز. تحصل على أعلى المتوسطات عند الزراعة على مسافة ٤٠ سم بين الجور لجميع الصفات ما عدا صفات تاريخ ظهور ٥٠% من النورات المؤنثة وارتفاع الكوز.

– كانت الاختلافات بين الهجن معنوية فى جميع الصفات. أظهرت أن ه.ف١٠ أعطى أعلى متوسطات لصفات قطر الساق، محصول الحبوب، قطر الكوز وعدد الحبوب بالصف. تميز ه.ف ١١ (هجين تجارى جديد) فى التبكير، وقصر النبات والكوز كما كان ه.ف ١٢٢ أفضل الهجن فى صفة عدد الكيزان للنبات و تفوق ه.ث٣١٠ فى صفة طول الكوز و ه.ث ٣٢٧ (هجين تجارى جديد) كان أفضل الهجن لصفة عدد الصفوف بالكوز.

– أعطت الزراعة على مسافة ٦٠ سم بين الخطوط وترك نبات واحد بالجورة أعلى محصول ٢٨,٢٨ أردب/فدان كما ان الزراعة على مسافة ٦٠ سم بين الخطوط و٤٠ سم بين الجور تعطى أعلى محصول ٢٧,٤٧ أردب/فدان ،كما أعطت الزراعة على مسافة ٣٠ سم بين الجور وترك نبات واحد بالجورة أعلى محصول ٢٨,٠٥ أردب/فدان.كذلك أعطى هجين فردى ١٠ أعلى محصول ٣٠,١ أردب/فدان عند الزراعة على تخطيط ٧٠ سم. كما انه أعطى أعلى محصول ٣٠,٨٩ أردب/فدان عند الزراعة على مسافة ٤٠ سم بين الجور.