J. Agric. Sci. Mansoura Univ., 31 (1): 1 - 16, 2006

INTERCROPPING EFFICIENCY OF SOME MAIZE HYBRIDS ON PEANUT IN SANDY SOILS

Nofal, Fatma A.E.[1] and R.A. Attalla[2]

1- Maize Res. Prog, Field Crop Research Institute, Agric. Res. Center, Giza, Egypt.

2- Crop Intensification Res. Dept, Field Crop Res. Inst, Agric. Res. Center, Giza, Egypt.

ABSTRACT

Two field experiments were carried out at Ismailia Agricultural Research Station, Agricultural Research Center under sprinkler irrigation in sandy soils in 2002 and 2003 to study the efficiency of some maize hybrids; SC 155, TWC 321, and TWC 352 for intercropping under different patterns; pure stand maize, pure stand peanuts in addition to 4 mixed patterns. All rows were planted with peanut then maize was planted on peanut rows in different ratios; mixed 1 (M1) 2:2 ratio maize on peanut rows: pure stand peanuts, 30 cm between maize hills and one plant/hill, mixed 2 (M2) 2:2 ratio, 50 cm between maize hills and 2 plants/hill, mixed 3 (M3), 1:1 ratio, 30 cm between hills and one plant/hill, mixed 4 M4, 1:1 ratio, 50 cm between hills and 2 plants/hill. Peanut variety Giza-5 was used. Treatments were laid out in a randomized complete block design with 3 replications. Results revealed that the highest values of peanut yield and its components were obtained when yellow maize hybrids (SC 155 and TWC 352) were associated. Intercropping system M1 was accompanied with the highest peanut yield. Maize x intercropping pattern interaction was significant for all traits. The highest pod yield was found when yellow maize hybrids were planted according to M1 pattern. Intercropping pattern M1 had the highest values of land equivalent ratio and relative crowding coefficient as well as the lowest values of aggressivety.

INTRODUCTION

Intercropping system is especially beneficial for small farmers in the low-input high risky environment of the developing areas of the world. It is perhaps the best example of how interactions between crops can be exploited to produce considerable yield benefits. Intercropping can achieve much larger yield than sole crops by using environmental resources more fully over time or more efficiently in space (Willey *et al.* 1983). Hussein, Samira M.A. *et al.* (2002) reported that intercropping system of one row of peanut intercropped with maize alternated with one row of peanut left free (50% maize and 100% peanut) was relatively better than those obtained in double maize row system when grown with same maize density (50%) and other intercropping systems (100% maize + 100% peanut , 33 % maize + 100% peanut, 25% maize + 100% peanut, and 67% maize + 100% peanut). Calavan and Weil (1988) showed that intercropping maize with peanut reduced peanut yield by 44 – 46%, while maize yields were not significantly affected. Misbuhulmunir et al (1989) found that intercropping maize with peanut reduced peanut seed yield from 33 to 49% of sole crop yields. A combination between legume and non-legume crop is probably the wide - spread type of intercropping and it has often been assumed that presence of

the legume must provide a net nitrogen benefit to the system (Willey *et al.* 1983). Moreover, Searle *et al.* (1981) reported that there is no evidence yet for direct transfer of nitrogen from the legumes to the cereals and its association and fixation is normally reduced due to the competition. Therefore, in most associations of legumes with cereals, nitrogenous fertilizer is applied to the cereals and the legumes may take advantage of it. In general, cereals demand more nitrogen than legumes (Davis *et al.* 1986). Abd-El-Motaleb et al, 1998 reported that combining maize with the erect peanut variety Giza – 5 resulting higher grain yield as well as higher shelling percentage. Gabr, 1999 found that the intercropping pattern (2: 2) was the best system because this pattern had the highest values of LER as well as had the lowest values of aggressivity. On the other hand, disadvantage of intercropping was observed by other investigators, Edje, 1982 for maize with peanut, Khedr, 1982 for maize with soybean. Hussein *et al* (2002) found that intercropping maize with legumes achieved yield advantage when measured whether by land equivalent ratio (LER) or by the relative crowding coefficient (RCC). Maize was always the dominant component, while the under story legume crop was the dominated when aggressivity (A) was measured. Maize-peanut combination is practiced on light soils in Ismailia region. In these soils, the importance of groundnut as a cash crop is usually the major component. However, intercropping maize with peanut would maximize the net profit per unit area.

The objective of this study was to test the efficiency of three maize hybrids (white and yellow hybrids) under different intercropping patterns with peanut to determine the most efficient maize hybrid for intercropping and the best intercropping pattern for maximizing the net profit per unit area.

MATERIALS AND METHODS

Two field experiments were conducted at Ismailia Agricultural Research Station during 2002 and 2003 growing seasons. Eighteen treatments were used to study the effect of six intercropping patterns as well as the efficiency of three maize hybrids i.e. SC 155, TWC 321 and TWC 352 for intercropping with peanut (Giza-5) in terms of growth, yield and yield attributes of both crops in new sandy soil under sprinkle irrigation system. Physical and chemical analysis at the experimental site is shown in Table 1.

Table 1: Mechanical and chemical analysis of the soil before conducting the experiments.

Mechanical analysis			Chemical analysis	
Coarse sand	%	67.98	PH 1 – 2.5 suspension	7.8
Fine sand	%	24.56	EC (m mohs/cm^{-1} 1 – 5)	0.136
Silt	%	3.13	OM %	0.470
Clay	%	4.33	Available N ppm	18.212
Soil texture		Sandy	" " P ppm	2.192
			" " K ppm	73.978

Randomized complete block design with three replications was used. The studied intercropping patterns were as follows.

1. Pure stand maize, where maize were planted in rows with 60 cm in width x 5 m length and 25 cm between hills then thinned to one plant by the first irrigation.
2. Pure stand peanuts (was grown on both sides of the ridge and 20 cm between hills.

In addition to four mixed patterns, where all rows were planted with peanut then maize were planted on peanut rows in different ratios as follows:

3. Mixed 1 (M1) 2:2 ratio (maize on peanut rows: pure stand peanuts), 30 cm between hills and one plant/hill.
4. Mixed 2 (M2) 2:2 ratio, 50 cm between hills and 2 plants/hill.
5. Mixed 3 (M3), 1:1 ratio , 30 cm between hills and one plant/hill.
6. Mixed 4 (M4), 1:1 ratio, 50 cm between hills and 2 plants/hill.

Organic manure (20 m^3/feddan) was added to all experimental plots before plowing. Seeds of peanut were inoculated with bacterial root knot (Rizobium legume inosrum). Nitrogen fertilizer was applied to maize and peanut in the form of ammonium sulphate (20.6 % N) at the rate of 120 kg N/feddan (fed) for maize rows, in eight equal doses, the first was applied a week after planting and the rest was added weekly and 30 kg N for peanut rows. Phosphorus fertilizer was added at the rate of 30 kg /fed in the form of calcium super phosphate (15.5% P_2O_5) at planting. Potassium fertilizer was added at the rate of 48 kg/fed in the form of potassium sulphate (48% K_2O) in two equal doses, first dose after planting and the second one a month later. Plot size was 24 m^2 (8 rows x 60 cm wide x 5 m long). Maize and peanut were planted on the 19th and the 25th of May in 2002 and 2003, respectively.

Sprinkler irrigation was applied every three days intervals. Maize and peanut were harvested on the 20th and the 25th of September in 2002 and 2003, respectively. Four rows of maize and peanut were harvested and maize grain yield was adjusted to 15.5% moisture. The followed traits were recorded:

A- Maize.

1. Number of days from planting to 50% tasseling.
2. Number of days from planting to 50% silking
3. Plant height (cm) was measured from the ground surface to the top of the tassel.
4. Ear position % (ear height x100 / plant height).
5. Number of ears/fed.
6. Grain yield/plant (g).
7. Grain yield ardab/feddan (ard/fed.).
8. Ear length (cm).
9. Ear diameter (cm).
10. Kernel depth (cm) = (ear diameter – cob diameter) / 2.
11. Number of rows/ear.
12. Number of kernels/row.

B- Peanut.

1. Plant height (cm) was measured (cm) from the soil surface up to the plant top.
2. Number of branches/plant.
3. Number of pods/plant.
4. Weight of pods/plant (g).
5. Weight of 100 pod (g).
6. Weight of seeds/100 pod (g).
7. Shelling %.(weight of seeds / weight of pods) x 100.
8. Pods yield (ardab/fed.) was calculated to the whole plot then to fedden. 2,3, and 4 characters were recorded as average of 10 guarded plant from each plot.

C- Competitive relationship and yield advantages.

1- Land equivalent ratio (LER) as described by Willey (1979) is as follows:

$$LER = [(Ypm/Ypp) + [(Ymp/Ymm)]$$

2- Relative crowding coefficient (k) as mentioned by De-Wit (1960):

$$K1 = [(Ypm * \% Z2) / (Ypp - Ypm) * \% Z1$$
$$K2 = [(Ymp * \% Z1) / (Ymm - Ymp) * \% Z2$$

3- Aggressivety as mentioned by Mc–Gilichrist (1960):

$$Agg. = A1 - A2 \text{ for peanut}$$
$$Agg. = [(Ypm / Ypp * \% Z1) - (Ymp / Ymm * \% Z2)$$
$$Agg. = A2 - A1 \text{ for maize}$$
$$Agg. = [(Ymp / Ymm * \% Z2) - (Ypm / Ypp * \% Z1)$$

where,
Ypp = yield of pure stand peanut,
Ymm = yield of pure stand Maize,
Ypm = yield of peanut intercropped with maize,
Ymp = yield of maize intercropped with peanut,
% Z1 = area occupied by peanut,
% Z2 = area occupied by maize.

Total income and net return were estimated as follows:

Total income = Total yield x unit price
Net return = Total income – Total cost
Total cost = Labor cost + Fertilizer cost
Unit price was estimated according to market price.

Data were statistically analyzed according to Steel and Torrie (1980). The treatment means were compared according to new LSD test according to Waller and Duncan (1969).

RESULTS AND DISCUSSION

1.Effect on peanut:

A- Effect of maize hybrids.

Data recorded in Table 2 indicated that maize hybrids had significant effects on peanut traits i.e. plant height, number of branches/plant, number of pods/plant, weight of pods/plant, 100-pod weight, weight of seeds/100 pod, and pod yield in 2002 and 2003 and shelling percentage in the second

season. Maize hybrids TWC 321 was accompanied with the tallest peanut plants followed by SC 155, while TWC 352 was associated with the shortest peanut ones in both seasons. On the other hand, TWC 352 was associated with the highest number of branches/plant followed by SC 155 then TWC 321 in both seasons. Peanut plants, which intercropped with SC 155 and TWC 352 had the greatest number of pods/plant in 2002 and 2003, respectively. But TWC 321 was accompanied with the lowest number of pods/plant in both seasons. The highest weight of pods/plant, weight of 100 pods and seed weight / 100 pods was obtained when peanut was intercropped with SC 155 and TWC 352 in the first season. In the second season, however, peanut plants were superior for the above traits when intercropped with maize hybrids TWC 352 averaged over intercropping patterns. Shelling% were not significantly different in 2002. In 2003, the highest shelling% of peanut plants was achieved when intercropped with TWC 352. The highest pod yield was obtained when peanut was intercropped with SC 155 and TWC 352 in 2002 and 2003, respectively.

Yellow maize hybrids tended to be shorter with less vegetative growth than the white hybrid TWC 321. Consequently, the competition of yellow hybrids to peanut plants is less than the white hybrid. The increase in plant height of peanut plants might be due to the competition between peanut and maize plants for light, which might cause elongation of the internodes of peanut plants, at the expense of number of branches / plant, which reduced number pods/plant and consequently, pod yield These results are in agreement with those reported by Edje (1982); Khedr (1982); Abd-El-Motaleb and Yousef (1998), and Gabr (1998).

B- Intercropping patterns effect:

Intercropping systems had significant effects on all studied traits of peanut in the two growing seasons (Table 2). The longest peanut plants were obtained when M4 followed by M3 pattern were practiced, while pure stand peanut treatment had the shortest plant in both seasons. Pure stand peanut had the greatest number of branches/plant, number of pods/plant, weight of pods/plant, weight of 100 pods, weight of seeds/100 pods, shelling% and pod yield followed by M1, M2, M3 and M4 in the same order in both seasons. These results are in agreement with several investigators; Sharma and Meusingh (1987); El-Mihi *et al.* (1990); Dahatonde et al (1996), and Gabr (1998). Intercropping patterns M1, M2, M3, and M4 reduced peanut yields by 36–50% compared with the pure stand yield. These results are in agreement with Calavan and Weil (1988), and Misbuhulmunir et al (1989).

Intercropping pattern M1 exceeded all other intercropping patterns in all traits, except for plant height in both growing seasons. The superiority effect of intercropping pattern M1 on yield components of peanut might be attributed to increasing the competition between maize and peanut plants for light intercepted by foliage as well as for moisture and edaphic factors in the soil. In both seasons, intercropping system M1 gave the highest pod yield/fed, compared with all other intercropping patterns. This pattern gave higher pod yield than M2, M3 and M4 by 9.64, 15.33 and 21.90% in 2002 season and by 6.90, 12.79 and 17.24% in 2003 season, respectively.

Table 2. Effect of maize hybrid and intercropping pattern on peanut plant height (cm), number of branches/ plant, number of pods/ plant, weight of pods/ plant (g), weight of 100 pods (g), weight of seed/100 pods, shelling % and pod yield (ardab/fed) in 2002 and 2003 growing seasons.

Treatments	Plant height cm		No of branches/ plant		No of pods/ plant		Weight of pods/plant gm		Weight of 100 pods (g)		Weight of seeds/100 pods		Shelling %		Pod yield (ardab/fed)	
	2002	2003	2002	2003	2002	2003	2002	2003	2002	2003	2002	2003	2002	2003	2002	2003
A-Maize hybrids																
SC 155	54.1b+	59.7b	10.3b	9.9b	21.4a	19.0b	28.6a	29.0b	139.6a	150.9b	95.4a	101.4b	67.6a	66.8b	9.9a	11.6b
TWC 321	59.0a	64.3a	8.5c	8.9c	19.9c	18.5c	26.9b	27.4c	134.9b	144.2c	91.7b	95.9c	66.7a	66.0c	9.1c	10.9c
TWC 352	50.8c	56.9c	10.7a	10.3a	20.5b	19.9a	28.6a	29.6a	141.7a	151.7a	96.5a	102.6a	67.2a	67.3a	9.6b	12.0.a
B- Intercropping																
Pure peanut	50.5e	55.0e	13.7a	12.7a	29.2a	28.5a	38.3a	44.7a	200.6a	199.0a	151.5a	142.1a	75.5a	71.4a	15.3a	17.3a
M1	53.1d	59.5d	10.7b	10.4b	20.2b	17.9b	28.9b	26.6b	143.3b	143.3b	96.9b	95.3b	67.6b	66.5b	9.1b	11.0b
M2	55.4c	61.4c	9.2c	9.3c	19.0c	16.8c	26.3c	25.4c	124.9c	138.0c	82.5c	91.2c	66.1c	66.1c	8.3c	10.4c
M3	56.4b	62.9b	8.2d	8.1d	17.7d	15.9d	24.1d	23.5d	116.4d	133.9d	4.1d	87.4d	64.2d	65.3d	7.7d	9.6d
M4	57.7a	64.9a	7.2e	7.6e	16.9e	15.2e	22.5e	22.2e	108.4e	130.1e	7.6e	84.3e	62.3e	64.8e	7.1e	9.1e

+ Vertical means with the same letter(s) are not significantly different.

C - Maize hybrids x intercropping pattern interaction.

Data recorded in Table 3 indicated that the effect of interaction between maize hybrids and intercropping pattern was highly significant for all traits in both seasons, except for shelling % in the first season. Pure stand peanut followed by M1 pattern was associated with the highest mean for number of branches/plant, number of pods/plant, weight of pods/plant weight of 100 pods, weight of seed/100 pods, shelling%, and pod yield. Intercropping pattern of M4 with TWC 321 gave the highest plant height. More branches was obtained when peanut was intercropped with maize hybrids TWC 352 under M1 pattern in both seasons. The greatest number of pods/plant and weight of pods/plant were achieved when peanut was intercropped with SC 155 in the first season and TWC 352 in the second season under M1 pattern. The largest weight of 100 pods and weight of seed/100 pods were obtained when intercropping pattern M1 was used with TWC 352 in both seasons. The highest value for shelling % was obtained when peanut was intercropped with TWC 352 in the second season. The highest pod yield was obtained when peanut was intercropped with SC 155 and TWC 352 in the first and second seasons, respectively.

D – Competitive relationships.

Data in Table 4 revealed that all intercropping combinations achieved yield advantage relative to the sole cropping. Maize hybrid TWC 352 under M1 pattern gave the highest LER (1.22) compared with all other maize hybrids and intercropping systems. Also, results indicated that this hybrid under M1 pattern gave the lowest agressivity 0.48, but the highest relative crowding coefficient (RCC) 2.45, compared to all other intercropping patterns in both seasons.

Evaluation of different maize hybrids and intercropping systems were made for combined average as a total income of the two components, compared to each of them as a solid crop due to market price (Table 4). Maize hybrid TWC 321 under M1 intercropping system gave the highest income (4320.55 L.E.), followed by the same hybrid under M3 intercropping system, while the lowest one was recorded by TWC 352 under M4. The highest increment in net income was achieved when TWC 321 was planted under M1 intercropping pattern. It gave 673.30 L.E., compared to peanut or maize hybrids as a solid crop (average over both seasons).

2 – Effect on maize:

A- Hybrids effect:

Results in Table 5 and 6 indicated that there were highly significant differences among maize hybrids for growth traits, ear traits and grain yield and its components. Regarding number of days to 50% tasseling and silking, yellow maize single cross 155 and TWC 352 were the earliest hybrids, while the white TWC 321 was the latest in both seasons.

Plant height and ear position of the different hybrids varied significantly. Plant height ranged from 262 cm to 296 cm in the first season and from 219 to 241 in the second season. White TWC 321 was significantly taller than the yellow hybrid SC 155 and TWC 352 in both seasons.

Table 3. Maize hybrid x intercropping interaction for plant height (cm), number of branches/ plant, number of pods/ plant, and weight of pods/plant (g), weight of 100 pods (g), weight of seed/100 pods, shelling % and pod yield (ardab/fed) in 2002 and 2003.

Traits / Treatments		Plant height cm		No of branches/ plant		No of pods/ plant		Weight of pods/plant (g)		Weight of 100 pods (g)		Weight of seeds/100 pods		Shelling %		Pods yield (ardab/fed)	
		2002	2003	2002	2003	2002	2003	2002	2003	2002	2003	2002	2003	2002	2003	2002	2003
SC155	Pure peanut	50.5	53.8	13.2	12.5	29.6	28.2	38.0	44.8	207.3	198.5	155.5	141.3	75.0	71.2	15.4	17.2
	M1	52.4	57.9	11.2	10.6	21.1	17.2	29.7	27.2	142.6	146.7	97.7	97.2	68.5	66.3	9.8	11.1
	M2	54.1	60.0	10.4	10.0	19.7	17.0	27.0	26.0	123.5	140.6	82.	93.4	66.3	66.4	8.5	10.8
	M3	55.8	62.5	8.8	8.8	18.5	15.8	24.8	24.2	116.9	136.2	74.4	88.2	65.3	65.1	8.1	9.8
	M4	57.7	64.1	7.6	7.7	17.9	15.6	23.4	22.5	107.4	132.5	67.5	86.2	62.8	65.0	7.5	9.2
TWC321	Pure peanut	52.4	57.4	12.8	12.4	28.5	28.7	38.2	44.7	199.3	198.1	150.9	141.5	75.7	71.4	15.1	17.3
	M1	57.3	64.4	9.0	9.6	19.3	16.8	27.8	24.9	138.6	136.7	93.2	89.4	67.2	65.4	8.3	10.1
	M2	61.2	65.6	7.6	8.3	18.8	16.2	24.90	23.4	121.1	131.7	79.5	85.2	65.7	64.7	7.7	9.4
	M3	61.8	66.4	7.0	7.3	16.9	15.6	23.0	22.3	110.1	128.7	69.6	82.7	63.3	64.3	7.3	9.1
	M4	62.2	67.5	6.0	6.9	16.1	15.0	20.53	21.4	105.5	125.6	65.1	80.5	61.7	64.1	6.8	8.8
TWC352	Pure peanut	48.5	52.5	15.1	13.7	29.4	28.6	38.7	44.8	195.2	199.7	148.1	143.0	75.9	71.6	15.3	17.4
	M1	49.5	54.7	11.8	11.3	20.2	19.0	29.2	27.5	148.7	147.6	99.7	98.8	67.1	67.0	9.3	11.9
	M2	50.9	57.7	9.6	10.3	18.4	17.93	27.0	26.7	130.0	141.4	86.0	94.0	66.4	66.4	8.5	10.9
	M3	51.5	59.0	8.7	8.3	17.8	17.5	24.5	24.9	122.2	137.4	78.2	90.7	64.0	66.0	7.8	10.0
	M4	53.3	60.3	8.1	8.0	16.6	16.40	23.7	23.8	112.4	132.2	70.3	86.7	62.5	65.6	7.1	9.5
LSD 0.05 for hybrid x intercropping interaction		0.4	0.5	0.5	0.4	0.5	0.5	0.6	0.4	3.9	0.7	3.2	0.4	NS	0.3	0.2	0.1

Table 4. Competitive relationships, total income and net return of peanut as affected by some maize hybrids and intercropping system over both 2002 and 2003 seasons

Characters		Yield		LER			K			A		Total income	Net return
Treatments													
		Peanut	Maize	Lp	Lm	LER	Kp	Km	K	Ap	Am		
SC 155	M1	10.40	11.93	0.64	0.56	1.20	0.88	2.57	2.26	-0.54	+0.54	4070	393
	M2	9.63	12.78	0.59	0.60	1.19	0.63	3.01	1.90	-0.62	+0.62	4020	343
	M3	8.97	12.50	0.55	0.59	1.14	0.61	2.92	1.78	-0.55	+0.55	3831	154
	M4	8.33	14.18	0.51	0.66	1.17	0.52	3.86	2.00	-0.83	+0.83	3930	254
Peanut pure		16.34	0000									3677	
Maize pure		0000	21.27									3084	
TWC 321	M1	9.22	15.49	0.57	0.58	1.15	0.65	2.85	1.85	-0.60	+0.60	4321	673
	M2	8.58	15.49	0.53	0.59	1.12	0.56	3.31	1.85	-0.65	+0.65	4177	529
	M3	8.18	17.09	0.50	0.65	1.15	0.52	3.94	2.05	-0.82	+0.82	4319	671
	M4	7.82	16.24	0.48	0.62	1.10	0.46	3.22	1.48	-0.74	+0.74	4114	467
Peanut pure		16.21	0000									3647	
Maize pure		0000	26.26									3808	
TWC 352	M1	10.64	11.27	0.65	0.57	1.22	0.94	2.61	2.45	-0.48	+0.48	4028	352
	M2	9.73	11.85	0.60	0.60	1.20	0.74	3.17	2.35	-0.60	+0.60	3908	231
	M3	8.91	12.06	0.54	0.60	1.14	0.60	3.12	1.87	-0.66	+0.66	3753	767
	M4	8.52	12.16	0.51	0.61	1.12	0.53	3.18	1.69	-0.71	+0.71	3680	4
Peanut pure		16.34	0000									3677	
Maize pure		0000	19.91									2887	

The price was calculated as market price Peanut = 3 LE. Kg pod Maize = 145 LE. For ardab of grain.

Table 5. Effect of maize hybrid and intercropping pattern on number of days to 50% tasseling and silking, plant height (cm), ear position %, no of ears/feddan, grain yield/plant (g) and grain yield (ard/fed) in 2002 and 2003 growing seasons.

Characters / Treatments	Days to 50% tasseling		Days to 50% silking		Plant height (cm)		Ear position %		No of ears / Feddan		Grain yield / Plant (g)		Grain yield ard/fed	
	2002	2003	2002	2003	2002	2003	2002	2003	2002	2003	2002	2003	2002	2003
A- Maize hybrids :														
SC 155	60.6b+	55.8b	61.9b	56.9b	262b	219b	49.2a	53.7a	16733a	14960b	119.1a	148.0b	14.3a	14.7b
TWC 321	64.3a	60.5a	66.3a	61.4a	296a	241a	49.4a	55.5a	16320a	16030a	127.6a	213.0a	15.3a	20.9a
TWC 352	60.7b	56.3b	62.1b	57.5b	267b	222b	49.4a	54.7a	16813a	14960b	112.6a	138.0b	13.5a	13.4c
B- Intercropping Patterns:														
Pure maize	61.7a	57.3a	63.1a	58.3a	278a	240a	48.8a	54.2a	26044a	22400a	107.9b	163.1b	20.8a	24.2a
M1	62.0a	57.2a	64.4a	58.4a	270a	224bc	48.6a	54.5a	13244b	12667c	123.1ab	185.6a	11.9b	13.9bc
M2	62.0a	58.1a	63.1a	59.2a	275a	213c	50.9a	57.6a	14822b	13983b	114.2b	137.4c	13.0b	13.8c
M3	62.0a	57.4a	63.3a	58.4a	272a	232ab	49.8a	52.8a	14000b	12633c	142.0a	192.2a	13.7b	14.0bc
M4	61.8a	57.6a	63.2a	58.4a	278a	227abc	49.7a	54.2a	15000ab	14900b	117.7b	150.4b	12.6b	15.8b

+ Vertical means with the same letter(s) are not significantly different.

There were no significant differences between hybrids in terms of ear position in the first and the second seasons. The present results are in agreement with those reported by Shafshak *et al.* (1994), Hassan (2000), Nofal and Mobarak (2003) and Nofal *et al.* (2005).

Yield and its components of different maize hybrids during 2002 and 2003 seasons are presented in Table 5. There were no significant differences among maize hybrids for number of ears/fed, yield per plant and grain yield (ard/fed) in 2002 season, while in 2003, differences among maize hybrids for such traits were significant. In 2003 season, TWC 321 had the highest number of ears/fed followed by SC 155, and TWC 352 the same number of ears/fed, On the other hand, there were highly significant differences among hybrids with regard to yield/plant. The hybrid TWC 321 gave the highest yield/plant followed by SC 155, but TWC 352 was the lowest. Maize hybrids differed significantly in terms of grain yield/fed. Hybrid TWC 321 produced the highest grain yield followed by SC 155, while TWC 352 was the lowest. In table 6, maize hybrids differed significantly in yield components traits. In 2002 season, ear length, kernel depth, number of rows/ear and number of kernels/row were detected for highly significant differences among maize hybrids. For example, TWC 321 had the highest ear length, kernel depth, and number of kernels/row. This suggests that the white hybrid TWC 321 which possess better yield components in terms of longer ears, deeper kernel and greater number of kernel/row was the most superior hybrid due to the contribution of the yield components to its ultimate grain yield.

Differences in growth, grain yield and its components among maize hybrids under this study might due to the differences in their genetic make up, which affected their response to stress conditions and environmental factors that affected biological activities and consequently, the total biomass. Result are in agreement with those reported by Gouda *et al.* (1992), Badr *et al.* (1993), Atta Allah (1996), Hassan (2000), Nofal and Mobarak (2003), and Nofal *et al.* (2005). They recorded significant differences among different maize hybrids in grain yield and its components

B– Intercropping patterns effect:

Differences among intercropping treatments were not significant for number of days to 50% tasseling and silking, plant height, and ear position in both 2002 and 2003 seasons, except for plant height in 2003, which was highly significantly affected (Table 5). This indicated that growing maize in pure stand without peanut, was associated with the longest plant height (240 cm) when M3 pattern was practiced, followed by M4 then M1, while M2 was accompanied with the shortest plant height. No significant differences were found among intercropping treatments regarding ear position (%). Pure stand maize had the greatest number of ears/feddan followed by M4 in the first season and M2 and M4 in the second season. Intercropping patterns M3 and M1 in 2003 were accompanied with the highest grain yield/plant. However, the difference among M1, M2, M4, and pure stand maize were not significant in the first season. Moreover, M2 and M4 were associated with the lowest grain yield/plant in 2003. The superiority of intercropping treatments over the pure stand maize may be attributed to better make use of light energy

intercepted by maize plants of the superior treatment. Pure stand maize, as expected, had the highest grain yield in both seasons. Since grain yield was obtained from the whole land area compared with intercropping treatments, which were obtained from one half of the land area. Differences among M1, M2, M3, and M4 in 2002 and M1, M3, and M4 in 2003 were not significant. Treatment M2 tended to produced the lowest grain yield in both seasons, Moreno (1995) recorded similar results. Intercropping significantly affected ear length, ear diameter and number of kernels/row (Table 6). Intercropping patterns had longer ears than pure stand maize in both seasons. However, the difference between M2 pattern and pure stand maize was not significant in the second season. Intercropping patterns M1, M2 and M3 were associated with greater ear diameter than pure stand maize in the first season. The difference between M4 and pure stand maize in the first season was not significant. In the second season, however, there were no significant differences among all intercropping treatments in terms of ear diameter. These results are in agreement with those obtained by Sherif , Sahar (1993) and Ibrahim ,Sahar (2000). They found that improving these traits was mainly due to the reduction plant density per unit area, under intercropping, which resulted in minimizing the competition between maize plants for light, minerals and the supplied water. Pure stand maize was accompanied with the highest number of ears/feddan followed by M4, M2, M3, and M1 in the first season and M4, M2, M1 and M3 in the second season (Table 6). No significant differences were detected among intercropping pattern treatments regarding kernel depth and number of rows/ear in both seasons.

Table 6. Effect of maize hybrid and intercropping pattern on ear length (cm),ear diameter (cm), kernel depth (cm), number of rows/ear, and number of kernels/row in 2002 and 2003 growing seasons.

Characters	Ear length (cm)		Ear diameter (cm)		Kernel depth (cm)		No of rows/ ear		No of kernels / row	
Treatments	2002	2003	2002	2003	2002	2003	2002	2003	2002	2003
A- Maize hybrid										
SC 155	16.0b*	15.2c	4.4	4.8	0.82	1.0	14.5	14.4	34.9	33.3
TWC 321	17.9a	20.0a	4.4	5.0	0.89	1.1	13.7	13.5	41.8	44.5
TWC 352	16.1b	17.4b	4.5	4.9	0.80	1.0	15.8	15.7	36.2	37.2
B- Intercropping Pattern:										
Pure maize	15.7b	16.1b	4.4b	4.9a	0.82a	1.1a	14.4a	14.4a	35.7c	38.0b
M1	16.8a	17.8a	4.5a	4.9a	0.86a	1.0a	14.4a	14.5a	39.1ab	38.4ab
M2	16.8a	17.4ab	4.5a	4.9a	0.83a	1.0a	14.8a	14.4a	36.8bc	37.4b
M3	17.3a	18.5a	4.5a	5.0a	0.86a	1.1a	14.8a	14.6a	39.8a	40.0a
M4	16.7a	18.0a	4.4b	4.9a	0.82a	1.0a	14.7a	14.6a	36.8bc	38.0b

+ Vertical means with the same letter(s) are not significantly different.

C- Interaction effect:

Maize hybrids x intercropping patterns interaction was significant for 50% silking and plant height (Table 7). Results revealed that TWC 352 under M1 or M2 pattern was accompanied with the lowest number of days to 50%

silking as well as the shortest plant height. In addition, hybrid TWC 321 under M4 pattern had the highest plant height (305 cm).

Table 7. Effect of interaction between maize hybrid and intercropping pattern on number of days to 50 % silking and plant height in 2002.

Treatments	Characters	Days to 50% silking	Plant height
		2002	2002
SC155	Pure maize	62.0	275
	M1	62.3	258
	M2	61.7	269
	M3	62.7	264
	M4	61.7	267
TWC321	Pure maize	65.0	286
	M1	69.7	301
	M2	66.3	286
	M3	65.7	300
	M4	65.0	305
TWC352	Pure maize	62.3	273
	M1	61.3	262
	M2	61.3	268
	M3	61.7	253
	M4	63.0	263
$LSD_{0.05}$ for hybrid x intercropping interaction		3.1	17

REFERENCES

Abd-El-Motaleb, H.M. and M.S.H. Yousif (1998). Intercropping maize with two varieties of peanut under two levels of nitrogenous fertilizer. Proc. 8th Conf. Agric., Suez Canal Univ., Ismailia, Egypt.

Atta Allah, S.A.A. (1996). Effect of irrigation intervals and plant densities on growth , yield and its components of some maize varieties Proc. 7th Conf. Agron 1:59–70, Mansoura Egypt .

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

Calavan, K.M. and R.R. Weil. (1988). Peanut – corn intercrop performance as affected by within row corn spacing at a constant row spacing. Agron. H., (80): 635 – 642.

Dahatonde, B.N.; A.B. Turkhede; M.R. Kale and B.M. Surgawanshi (1996). Studies on intercropping of groundnut and sesamum. PKV Research J. (1995), 19 (1) : 83 – 84, Department of Agron., PKV, Akola, Maharashtra. India (C.F. Field Crop Abst. Vol. 49 (12): 9017.

Davis, J.H.C.; J.N., Woolley and R.A. ,Moreno (1986). Multiple cropping system. 7 – Multiple cropping with legumes and starchy Roots. Macmillan Publishing Company, New York, USA, P 133 – 160.

Edje, O.T. (1982). Comparative development and yield and other agronomic characteristics of maize and groundnut in monoculture and in association. Proc. 2nd symposium on intercropping in semi – arid areas, Morogora, Tanzania, IDRC, 17 – 26. (C.F. Field Crop Abst., 34 (11).

El – Mihi, M.M. ; A.S. El – Gamal; M.A.El – Masry and A.S. Kamel (1990). Growth and yield of sesame and groundnut in monoculture and association under different patterns and plant spacing. Proc. 4th Conf. Agron. Cairo Univ. Vol. 11: 571 – 580.

Gabr, E.M.A. (1998). Effect of preceding winter crops and potassium fertilizer levels on growth and yield of intercropped peanut and sesame in new sandy soils. Proc. 8th Conf. Agron., Suez Canal Univ. Ismailia, Egypt, 28 – 29 Nov. 1998.

Gouda, A. Sh. A. ; M. M. Abdellah and R.I.I. Faisal (1992).Response of some maize varieties to nitrogen fertilization. Annals Agric. Sci., Moshtohor 30 (4):1649 – 1660.

Hassan, A.A. (2000).Effect of plant population density on yield and yield components of eight Egyptian maize hybrids. Bull. Fac. Agric., Cairo Univ. , 51:1–16.

Hussein, Samira M.A.; S.A.A. Shams and A.M. El-Melegy (2002). Effect of some intercropping patterns and folier application with nutrients mixture on yield of maize and peanut. Annals Agric. Sci., Moshtohor 40 (3): 1427 – 1447.

Ibrahim, Sahar T.A. (2000). Effect of some cultural practices on the performance of intercropping maize and potato. Ph. D. Thesis. Fac. Of Agric. Moshtohor Zagazig Univ. (Benha Branch).

Khedr, E.A.F. (1982). Studies on inter-planting of soybean in the maize field. M.Sc. Thesis, Fac. Agric., Moshtohor, Zagazig Univ.

Mc- Gilchrist (1960). Analysis of competition experiments. Biometric, 21 : 975 – 985.

Misbuhulmunir, M.Y.; Sammons, D.J. and Weil, R.R. (1989). Corn- peanut performance in relation to components crops and planting dates. Agron. J. (81): 184 – 189.

Moreno, I. (1995). Intercropping potato with maize (Zea mays L.) under environmental stress conditions. Departameno de fitotenis, Instituto Nacional de Ciencias Agricolas, Gaveta Postal No. 1 Sanjose de Las Lagas, La Habana, Cuba Cultivos. Tropicales 1995. 16: 3, 61 – 63 (c.f. The Common Wealth Agricultural Bureaux Abstracts, Dialog Fil No. 95 – 076455).

Nofal, Fatma A.E. and El. A. Mobarak (2003). Influence of manure and nitrogen on grain yield and some physical properties of maize hybrids under sandy soil conditions. Egypt J. Sci.; 18 : (8B):497–507.

Nofal, Fatma A.E.; G.M.A. Mahgoub and R.I.I. Faisal (2005). Nitrogen use efficiency of some maize hybrids under different rates of nitrogen fertilizer. Egypt J. Appl. Sci. 20 (4) : 145 –157.

Searle, P.G.E.; Y. Comudom; D.C. Shedden and R.A. Nance (1981). Effect of maize and legume intercropping system and fertilizer nitrogen on crop yield and residual nitrogen. Field Crop Res., 4: 133 – 145

Shafshak, S.E.; G.Y. Hammam, Samia M Amer and Fatma A.E. Nofal (1994). Differential growth and yield response of some maize genotypes to nitrogen fertilization. Annals of Afric. Sci., Moshtohor, 32 (3): 1265 – 1278.

Sharma, S.K. and Meusingh (1987). Intercropping of oil seed crops with ground nut in drought brone region of semi- arid zone. J.of oil seed Research. 1 (2) 175 – 184.

Sherif, Sahar A.M. (1993). Studies on nitrogen fertilizer requirements for different patterns of soybean-maize intercropping under some African environmental conditions. M.Sc. Thesis , plant Resources Dept. Inst. Of African Research & studies, Dept. of National Resources, Cairo Univ.

Steel R.G.D. and J.H. Torrie, (1980). Principles and procedures of statistics, 2nd Edit., McGrow Hill Book Company.

Waller, R.A. and D.P. Duncan, (1969). A bias role for symmetric multiple comparison problem. Amer-Satat. Assoc. J. December, 1485 –1503.

Willey, R.W. (1979). Intercropping- Its importance and research needs. Part I: Competition and yield advantages and 2. Agronomy and research approaches (c,f, Field Crop Abstr., 32: 1 – 10, 73 – 85).

Willey, R.W.; M. Natarajan; M.S. Reddly; M.R. Rao; and P.T.C. Nambiar; J, Kannaiyan and V.S. Bhatnagar (1983). Better crop for food- Intercropping studies with annual crops (Ciba foundation Symposium 97). Pitman Book, London. P 83 – 100.

Youssef , S.F. (1991). A study of Precision Land Leveling by Laser Scraper in Relation to Water Distribution and Total Yield. M.Sc. Thesis Fac. Of Agric. Zagazig Univ. Egypt.

كفاءة تحميل بعض هجن الذرة الشامية على الفول السوداني في الأراضي الرملية

فاطمة عبد الحميد نوفل[1] و رجب أحمد عطا الله[2]

[1] قسم الذرة الشامية - معهد بحوث المحاصيل الحقلية – مركز البحوث الزراعية – الجيزة – مصر

[2] قسم بحوث التكثيف ا لمحصولي- معهد بحوث المحاصيل الحقلية – مركز البحوث الزراعية – الجيزة – مصر

أجريت تجربتان حقليتان في محطة بحوث الإسماعيلية – مركز البحوث الزراعية- تحت نظام الري بالرش في الأراضي الرملية خلال موسمي ٢٠٠٢ ، ٢٠٠٣ لدراسة كفاءة بعض هجن الذرة الشامية (هـ . ف ١٥٥ ، هـ . ث ٣٢١ ، هـ . ث ٣٥٢) تحت نظم مختلفة من التحميل وهى ذرة شامية فقط . فول سوداني فقط ، زراعة كل القطع التجريبية بالفول السوداني ثم زرعت هجن الذرة على خطوط الفول السوداني طبقا للنظم التالية: النظام الأول M1 نسبة ٢ ذرة : ٢ فول سوداني يزرع الذرة على الفول السوداني وتكون المسافة بين الجور ٣٠ سم وتخف النباتات على نبات واحد في الجوره – النظام الثلنى M2 بنسبة ٢ ذرة : ٢ فول سوداني والمسافة بين الجور ٥٠ سم على أن يترك نباتين فى الجورة ـــ النظام الثالث M3 بنسبة ١ ذرة : ١ فول سوداني وكانت المسافة بين الجور ٣٠ سم مع ترك نبات واحد فى الجورة ـــ النظام الرابع M4 بنسبة ١ ذرة : ١ فول سوداني والمسافة بين الجور ٥٠ سم على ان يترك نباتين فى الجوره.وقد تم زراعة الصنف جيزه ـــ٥ من الفول السودانى وكان تصميم التجربة فى قطع كاملة العشوائية ذو ثلاث مكررات.

وتتلخص أهم النتائج فيما يلى:

١- تم الحصول على أعلى محصول فول سودانى ومكوناته عندما كان مصاحبا للهجن الصفراء.(هجين ثلاثى ٣٥٢ هجين فردى ١٥٥).
٢- كان نظام التحميل الأول !M مرتبط بأعلى محصول للفول السودانى
٣- كان التفاعل بين هجن الذره ونظم التحميل معنويا لكل الصفات المدروسة
٤- تم الحصول على أعلى محصول قرون عندما زرعت الهجن الصفراء طبقا انظام التحميل الأول !M .
٥- اعطى نظام التحميل الأول أعلى قيمة لمعامل استغلال الأرض ومعامل الحشد النسبى وأقل قيم للعدوانية .
٦- كان هناك إختلافات معنوية بين هجن الذرة فى صفات النمو والمحصول ومكوناته.
٧- كان الهجين الفردى الأصفر ١٥٥ أبكر فى ظهور النورات المذكره والمؤنثه يليه الهجين الثلاثى الأصفر ٣٥٢ ثم الهجين الأبيض ٣٢١ .
٨- كان الهجين الثلاثى ٣٢١ اكثر النباتات طولا يليه الهجين الثلاثى الأصفر ٣٥٢.
٩- لم تكن هناك إختلافات معنوية بين الهجن فى صفة موقع الكوز فى كلا الموسمين.
١٠-لم تكن هناك إختلافات معنوية بين الهجن فى عدد الكيزان / فدان ، محصول الحبوب / نبات ومحصول الحبوب / فدان فى الموسم الأول ، بينما فى الموسم الثانى أعطى الهجين الثلاثى الأبيض ٣٢١ أعلى محصول حبوب/ نبات وأعلى محصول حبوب / فدان ، أطول كوز ، أعمق حبة وأكثر حبوب / الصف .