Alexandria University
Faculty of agriculture
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EFFECT OF SOWING DIRECTION AND MAIZE CULTIVARS ON INTERCROPPING EFFICIENCY OF SOYBEAN AND MAIZE

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قسم الإنتاج النباتي

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في
(المحاصـــــيل)

مقدمة من
عاطف عبد الجليل مسعود زين الدين

٢٠٠٩

لجنـــــة الإشـــــراف

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EFFECT OF SOWING DIRECTIONS AND MAIZE CULTIVARS ON INTERCROPPING EFFICIENCY OF SAYBEAN AND MAIZE

By

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ABSTRACT

Two Fied Experiments were carried out at zarzoura Experiment station during 2005 and 2006 seasons to investigate the effect of two row directions (East-West and north-south) on intercropping three maize (zea maize) cutivars are :

1- Single hybride "10" variety 2- Giza 2 variety

3- Single hybride 30K8 pioneer variety with soybean (Glycin max) Giza 22 variety as follows:

1- 2 rows of soybean : 2 rows of maize.

2- First ridge is soybean and the others maize on the same row, the space between hills of maize 30 cm and 1 plant / hill .

3- First ridge is soybean and the others maize on the same row, the space between hills of maize 60 cm and 2 plant / hill .

4- Maize as a monoculture crop.

5- Soybean as a monoculture crop.

The results of study could be summarized as follows :

Most of the studied characters had no significant effect of row direction for maize and soybean in the two studied seasons with respect to maize cultivars , results show that maize cultivars had a significant effect on all maize characters and on yield and its components of soybean in the two studied seasons.

Regarding intercropping patterns, results indicated that all maize and soybean characters were significantly affected with intercropping patterns. The

obtained data indicated that the pure stand gave the highest yield of grain and seed/fad. for maize and soybean .

The results indicated that most of interactions had no significant effect on maize and soybean characters concerning the competitive relationships the results indicated that row direction of (East – West) is the greatest values of land equivalent ratio (LER) , Relative crowding coefficient (RCC) and Aggressively (Agg.).Also , Giza 2 maize variety gave the highest values and sowing 2 rows of maize: 2rows of soybean gave the highest values of each of LER and RCC .The results indicated that maize generally was the dominate, while soybean generally was the dominated in all cases

The present study was carried to investigate the influence of rows direction, maize cultivars and intercropping patterns on growth, yield and its components of intercropping maize with soybean.

INTRODUCTION

Considerable problem reduced human feeding as the important problem which had in Egypt . Cause under the condition of limited cultivated area , total production of the is not satisfying the demands of people requirements from cereals legumes ,oil , sugar and fiber as well as fodder crops, have to came from this limited area for that reason, total production of all these crops has to be maximized per unit area . So, there are many ways which can be used to that aim, crop in densification is the important method of these methods which achieve the highest land unit . Maize is one of the important cereal crops and it rains the third crop of these crops and is the first intercrop to intercropping with other crops.

The present study was designed to find out the most effective row direction as principal factor control light duration , sort intensity and soil temperature (lehenbauar1914) which can affect the growing generally , with some maize cultivars and intercropping patterns of soybean for increasing total productivity per unit area .

The various aspects of plant population and spacing in intercropping are defined and it is recommended that , where possible , the "confounding " of these in experimental designs should be avoided . evidence of the need for higher total populations than with sole crops is presented , it is suggested that these higher populations may be especially necessary where there are large temporal differences between components crops . Willey and Soriee (1972) and Willey (1974). Little evidence is available on the possible effects of the availability of nutrients and water on yield advantages and this is clearly an area needing further study .

MATERIALS AND METHODS

Two field experiments were carried out zarzouro experiment station in the two successive seasons 2005 and2006 to investigate the effect of two row directions as follows :

East – West direction (D1, E -W) 2- North – South direction (D2 , N – S). Three cultivars of maize (zea maize L.) are :

1- Single hybride "10" variety . 2-Giza 2 variety as open pollinated cultivar .

3- Single hybride 30 k8 pioneer variety , intercropping with soybean (Glycin max l.) Giza 22as follows:

1- 2 rows of soybeen : 2 rows of maize (S_2/M_2) 2- first ridge is soybean and the other is maize on the same row , the space between hills of maize 30 cm and 1 plant / hill

3- first ridge is soybean and the other is maize on the same row , the space between hills of maize 60 cm and 2 plant / hill 4-Maize as a monoculture crop . 5- Soybean as a monoculture crop .

A split plot design with four replication was used . The two rowing directions were allocated randomly in main plots, whereas intercropping patterns as well as the maize and soybean as a monoculture crops were distributed in sub-sub plots .

The number of rows in subplot were 6 rows , the width of row 60cm . apart, the length of row is 3 m. , normal cultural treatments as well as plant protection were done for each component , the agriculture practices from sowing to harvesting were applying as shown in Table (1).

Table (1)

Mechanical and chemical analysis	**2005**	**2006**
Mechanical anal.		
Sand %	23.2	22.0
Silt %	18.8	19.3
Clay %	58.0	58.7
Texture	**Clay**	**Clay**
Chemical analysis		
PH	7.80	7.75
OM	3.14	3.12
Ec (m mohs /cm.)	1.05	1.50
SP	84.5	84.3
Anions (meq / L)		
Hco_3	3.33	2.77
C_1	3.92	3.90
So_4	7.33	8.31
Cataions (meq / L)		
Ca^{++}	5.66	4.63
Mg^{+}	2.40	1.91
Na^{+}	10.74	9.42
K^{+}	0.19	0.20

At land preparation , super phosphate (15.5%) at a rate of 30kg p_20_5 /fed. was added . Nitrogen was added as a recommended – the other recommended agronomic practices were carried out as usual . The soil analysis at 30 cm depth of the experimental site showed that the texture of soil was salty clay loam and containing (0.17 and 0.18 pp)

available N , (0.19 and 0.17 ppm) k , (7.75 and 7.70) PH and 3.12 and 3.16 %) O.M in the first and second season , respectively .

A sample of five maize plants were taken randomly to estimate the following characters i.e. , plant height (cm.) , ear height (cm) , leaf area , index (L.A.I) , ear diameter (cm.) , ear length (cm) , No. of rows / ear, No. of grains / row , No. , grain weight /ear(gm).

The $^{2\ nd}$and $^{3\ rd}$rows were collected to calculate the following data grain yield (kg/fed.) ,100-grain weight (gm.)and straw yield ton/fed.) .

Five plants of soybean were randomly taken to estimate the following parameters: plant height (cm.), No. of pods / plant , No. of seeds / pod, seed yield / plant (gm) , straw yield / plant(gm), seed yield / fed. (kg) and 100- seed weight (gm) .

competitive relationships and yield advantages :-

In order to asses nature and degree of competition between maize and soybean plants , the following data were determined :-

Land equivalent ratio (LER) ,relative crowded coefficient (RCC) and aggressively (Agg.) were calculated according to the mathematical models of Andrws and Kassam (1976), dwit (1960)and Mc- Gilchrist (1965) ,respectively .

The collected data were statistically analyzed according to the method described by Senedecore and Cochran (1976) the treatment means were compared by using the least significant differences (L.S.D) test at 5% level of probability .

Results and discussion

A- Effect of rows direction maize cultivars , intercropping patterns and their interactions on maize .

A-1- Growth characters:

Data presented in tables (2) and (3) indicated that the L.A.I , plant height and ear height did not significantly influenced by row direction during the two studied seasons . similar observation was obtained by Rodrigues and Leite , 1999 .

With respect to maize cultivars and intercropping patterns results showed that there were significant effect on the L.A.I , plant height and ear height . The highest values (4.40 and 4.48) obtained with 30 k_8 pioneer variety and (4.74 and 5.15) with

monoculture crop for L.A.I , on the other hand , it clear that the S.C.10 (V1) cultivar gave the highest values (250.8 and 283.3 cm and 115.4 and 116.9 cm) for plant height and ear height in the first and second season , respectively. Its clear from Tables(2) and (3) that maize plants grown in (S2/M2) pattern gave the tallest plants (246.1 and 247.9 cm) , while the highest values for ear height were obtained with the solid culture in the two seasons .

Regarding the interactions between the factors under study the differences between row direction x maize cultivars for L.A.I did not reach to the 5% level for significance in both seasons. Significant effect for the interaction between row direction and intercropping patterns on L.A.I was noticed in both seasons as shown in table (2) . On the other hand , it's clear that when(V3) 30K8 pioneer variety grown as a solid crop and also , when grown in N-S direction and as a solid crop gave a significant effect for L.A.I in the two successive season . Regarding the interaction between the factors understudy . The result showed that there were no significant effects on plant height in the two seasons with exception of the second order interaction(row direction x maize cultivars x intercropping patterns) in the 2005 season and also , between row direction and intercropping patterns in the 2005 and 2006 seasons .Concerning in the interaction between the factors understudy , results indicated that there were no significant effects on ear height except (row direction x maize cultivars) in 2006season only and the second order interaction(direction x varieties x intercropping patterns in 2005 on the same character .

A-2-Yield and yield components:

With respect to **ear diameter** , results showed that there was no significant effect of row directions on ear diameter as showing in Table (3) . The obtained data indicated that maize cultivars and intercropping pattern had significant effects on ear diameter were , the V_2 (Gize variety) had larger ear diameter and the pattern (S_2/M_2) produced larger size of ear diameter , these results were agreement with that obtained by Ahmed (1990) and Abdalla ,et al (1999). Results indicated that most of the interactions had no significant on ear diameter with the exception (rows direction x maize cultivars) in 2005 season .

Ear length in cm : Data in (Table 4) showed that rows direction had a significant effect on ear length in 2006 season . Data indicated that maisze cultivars and intercropping patterns were significantly affected on ear length . V_1 (S.C.10) had the tallest ears (19.58 and 19.99 cm) in both seasons , while a monoculture crop and (S2/M2) intercropping patterns had the tallest ears (20.10. 20.60 and 20.23,20.39 cm) in both seasons , respectively . similar this results were obtained by Assay, et al (1992d) and Abdalla, et al (1999) . But the interactions had no significant on ear length .

Number of rows in ear : results in (Table 4) indicated that rows direction had insignificant effect on number of rows in ear . Maize varieties and intercropping patterns had insignificant effect on number of rows in ear ,V_3 (30 k_8 pioneer variety) produced ears with more rows than other varieties and intercropping (S_2/M_2) pattern (13.43 and 13.58 row / ear) in both seasons, while the lowest values (12.39 and 12.22 row/ear) when maize grown in (S/M_{60}) pattern in the two seasons .In this connection, Ahmed(1990) and Abdalla , et al (1999) . The interaction effects were significant on the most studied characters maize plants grown in E-W direction with V_2 (Giza2 variety) and intercropping (S_2/M_2) pattern recorded the highest values (14.88 and 14.93 row/ ear) in the two seasons , while the lowest values for this character (11.20 and 11.25 row/ear) were obtained by planting V2(Giza 2cv.) in the same direction and intercropping pattern (S/M_{60}) in the two seasons

Number of grains in row : It is shown clearly from (Table 5) that rows direction had a significant on No. of grains / rows in 2006 season only, planting in N-S gave the highest No. of grains / rows , similar observation was by Hugh – Melcon (1990) he found that the N-S treatment gave significantly greater of corn . As shown in Table (5) for No. of grains in row were significantly affected by maize cultivars and intercropping patterns , the single cross 10(V1) produced the highest No. of grains in row, while cropping systems (S_2 / M_2) and a monoculture crop recorded the highest values for No . of grains in row. The interactions had no significant on this studied character except (rows direction × intercropping patterns) in 2005 season.

100-grain weight (in gm) : No detected effect of rows direction on 100-grain weigh was observed (Table 5) . Maize cultivars significantly differed in 100-grain weight,V_2 (Gize2 variety) gave the highest values , also 100- grain weight of intercropping patterns was significantly lower than pure stand except (S_2 / M_2) pattern. The interactions had no significant effect on this character with the exception (rows direction × maize varieties), EL-Hefni , et al (1984) and Ahmed (1990) in harmony with those report these results .

Grain yield per ear (in gm) : As shown in Table (6) grain yield / ear of rows direction was insignificant in both seasons , similar results was obtained by Russo- Vincent (2002) who found that rows direction had no major consideration when crops are strip-cropped. The maize cultivars have significant in 2006 season , single cross – 10 (V1)had higher grains weight / ear, Quaranta , et al (1999) who reported that the hybrids giving the best results. Grain yield /ear of intercropping patterns , was significantly lower than pure stand the grain yield under (S/M_{30}) and (S/M_{60}) patterns were lower than that of(S2/M2) pattern Rana et al (2001) and Toaima (2006).Most of the interactions had insignificant on this character .

Grain yield per fed. (in kg) : As results in table (6) cleared that rows direction had no significant on grain yield / fed . the obtained by Russo – Vincent (2002) who found rows orientation are not major considerations when bell pepper, cucumber and sweat corn are strip cropped . Surprisingly S.C.10(V_1) was the best yields follows by 30k8 (V3) , whereas the open pollinated variety Giza2 (V_2) had the least yields , similar results by Hugo Cordova (2002) who found that , QPM hybrids often had a yield advantage more than yields of open pollinated varieties. Intercropping patterns solid culture produced the highest grain yield followed by(S_2/M_2) intercropped Pattern in both seasons, while (S/M_{30}) pattern had the lowest grain yield /fed . followed by (S/M_{60}) pattern these results are in agreement with those of Abdalla , et al(1999) and Toaima(2006) in the two seasons . The interactions had no significant effect on grain yield, similar results reported by Abdalla, et al(1999)

who found that , in results characters showed no reaction between maize with soybean .

B- effect of rows direction , maize cultivars , intercropping patterns and their interactions on soybean characters .

Plant height : results in Table (7) showed that rows direction had no significant on plant height in the two studied . Maize cultivars were insignificance on planet height in both seasons , similar results obtained by Abdalla , et al (1999) . Intercropping patterns had significant on plant height in the first season, a monoculture crop had tallest plant , while the shortest plants were under condition (S/M_{60}) pattern ,similar results were obtained by Toaima (2006). Regarding the interactions among the factors results indicated that there were no significant effects on plant height except (maize cultivars × intercropping patterns) in 2005 season .

Number of pods per plant: Data presented in (Table 7) showed that rows direction had significant effect on No. of pods / plants, N-S direction recorded the highest No. of pods / plants, the final technical report of Paulownia project (phase 11) (1998), the best orientation of Paulownia are south –north . The obtained data revealed that maize cultivars and intercropping patterns had significant effect on No. of pods / plant , plants grown under condition V_2 (Giza 2.) resulted the highest values of No. of pods / plant and the pattern (S_2/M_2) produced the highest No. of pods / plants , similar findings were reported by Nawar , et al (1986) and Assey , et al (1992 d) .The interactions , data revealed that had no significant on No. of pods / plants , with the exception (rows direction x intercropping patterns) in 2005 season.

Number of seeds in pod : No. of seeds /pod was not significantly affected by either rows direction in both sowing seasons (Table 8). Comparing maize cultivars revealed significant effect on No. of seeds / pod in 2002 season , only , also No. of seeds / pod was significantly affected by either intercropping patterns in 2006 season only, the highest No. of seeds / pod under (Giza2 maize cv.) and soybean stand in favour of solid culture , this results reported by , Assey, et al(1992b) and Assey , et

al (1992d) . Results showed that the interactions had no remarkable effect on this character except (maize cultivars x intercropping pattern) in2005.

Weight of 100-seed (in gm): results in table(8) show that rows direction was insignificance effect on 100-seed weight in two seasons . Neither maize cultivars nor intercropping patterns significantly affected seed index, the different treatment was very slight , in this connection, Assey, et al (1992d) and Toaimma (2006). It was also observed that the interactions among factors were significant effects on 100-seed weight in all treatments in both seasons .

Seed yield per plant (in gm): Table (9) indicated that seed yield /plant of rows direction was significant in 2006 season sowing soybean in N-S direction increased seed yield/plant , the obtained results by Duncan and Schapaugh (1993).. With respect to maize cultivars and intercropping patterns were significant effects on the seed yield/plant, soybean under grown V_2 (Giza 2 cv.) and sowing in pure stand or (S_2/M_2) patterns had the highest seed yield/plant , while S.C.10 (V_1 CV.) and (S/M_{60}) intercropping pattern were produced the lowest seed yield/plant, El-Billy (1991) and Assey, et al (1992d) recorded similar conclusions . Considered the interaction data revealed that there were no significant on seed yield / plant except (rows direction x maize cultivars) in 2006 season , only .

Seed yield / fed.(in kg) : Data on seed yield / fed. are shown in Table (9) indicated that seed yield/fed. are significantly affected by rows direction in 2006 season planting in N-.S direction recorded increases in seed yield by 3.82% as compared with E-W direction , this results may be due to U.S.D.A Report may (2000) row orientation increased yields by an average of 12% compared to random orientation. Maize cultivars and cropping patterns have significant effect on seed yield/fed. in two seasons , intercropped soybean with V_2(Giza 2 maize variety) gave higher seed yield than planting soybean under maize hybrids varieties , but soybean grown in pure stand had higher seed yield/fed. , while soybean seed yield of (S_2/M_2) pattern was significantly higher than that of (S/M_{30} and S/M_{60}) patterns, the increase in soybean yield with the increase in number of alternating ridges of soybean , also this results reported by Assey, et al (1992d) and Abdalla ,et al (1999). Data indicated

that the interactions among factors had no significant effects on seed yield/fed. exception (rows direction x intercropping patterns).

C- Competitive relationships

Data on land equivalent, ratio (LER) and relative crowding coefficient (k) are showing in in Table (10) (LER) always exceeding unity , E-.W direction was produced higher than of N-S direction. . Concerning maize cultivars effect, it is observed that the highest (LER) values were obtained from intercropped intercropping the hybrids as compared to open pollinated cultivar

(Giza 2 cv.). Advantage of land use from intercropping patterns were higher yields than sole crop. (1.40 and 1.43) were application intercropping patterns compared with sole crop , in both season , while the respective values for (S/M_30 and S/M_{60}) patterns were (1.25, 1.26 and 1.30,1.30) in two seasons and relative crowding coefficient (k) in posed in similar trend as LER.

With respect to aggressively (Agg.) , data in table ( ) indicated that soybean the lowest values compared with maize , maize generally was the dominated , while soybean generally was the dominated in all cases. Generally in all intercropping systems advantage than pure stand Willey (1979 and 1980) and similar trend was realize by Abdalla ,et al (1999) and Toaima (2006)

It could be concluded that the best productivity of land .

results……..