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INTERCROPPING STUDIES WITH MAIZE AND SOYBEAN IN RECLAIMED LAND

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ABSTRACT

Two field experiments were conducted at Nubaria Agric . Res . Station during the two successive summer seasons 1998 and 1999 to study the effect of tillage systems (no - tillage - complete tillage) and three nitrogen fertilizer levels 30 , 60 and 90 Kg N / fed . on yield of both maize and soybean as will as competitive relations of maize and soybean A split plot design with three replications was used where the main plots were occupied by tillage systems in both solid and intercropping. The nitrogen fertilizer levels were arranged at random in the sub-plots in both solid and intercropping planting .

The obtained results indicated that tillage systems had a significant effect on seed yield of soybean and grain yield of maize in the two seasons and all components of soybean plant except 100 - seed weight in the first season only . Maximum seed yield of soybean and grain yield of maize were obtained with tillage systems . The complete tillage gave highest seed yield and grain yield per fed of soybean and maize in both solid and intercropping compared to that of no-tillage . The solid stand gave highest seed and grain yield per fed of both crops .

Increasing nitrogen fertilizer levels significantly increased yield per fed of soybean and maize . The maximum yield of both crops were obtained by adding 90 Kg N / fed .

The results indicated that land equivalent ratio LER of maize and soybean values was more than one moreover, maize was always dominant crop , whereas soybean was dominated .

It could be recommended that for producing maximum intercropped yield of soybean and maize with those treatments had a complete tillage system and increasing nitrogen fertilizer levels up to 90 Kg N/ fed.

INTRODUCTION

Soybean is a leguminous crop mainly cultivated for its seeds which contain high oil and protein percentage . Soybean is cultivated as a summer crop , so it might compet other summer crops . In future , the increase in soybean production might be achieved through the increase in yield of unit area by intercropping soybean with summer crops such as maize .

Intercropping is a way to increase the productivity of land . Since , crop combinations may increase total providing for more efficient utilization of nitrogen , land and other inputs . Syarifuddin *et al.* (1974) showed that yields of legumes decreased when intercropped with corn. Garcia and Pinchinat (1976) , found that intercropped plantings as (100 %) maize + 50 % of soybean and 100 % soybean + 50 % of maize did not reduced crop yield
(maize and soybean yields) . But , in planting (100 % of soybean + 100 % of maize) maize and soybean yield were reduced . Cordero (1978) observed that the response of intercropped maize with soybean to nitrogen was maximum
when 150 - 180 kg N / ha was added . maximum soybean yield was obtained by adding 250 kg N/ha. Gunasena *et al.* (1979) found that maize yields were increased with nitrogen fertilizer application. Moallem (1979) noticed that soybean yields were 0.58 t / ha in the intercropping and were highest with the lower fertilizer rate (N PK) 75 : 50 : 25 kg / ha.Galal , *et al.* (1980) found that pod number and seed number / plant were 30.50 % higher and seed yield was 50 % greater in soybean grown alone than with maize . Mohta and R.De (1980) , reported that seed yield of soybeans when intercropped was less than of a sole crop Hiebsh (1981) , indicated that increasing maize from 14.000 to 44.000 plants / ha and applying 250 kg N/ha increased LER from 1.07 to 1.35 when intercropped with soybean . Galal and Metwally (1982) mentioned that the intercropping reduced seed yield by more than 40 % under monoculture . Other yield components such as number of pods number of seeds and 100 - seed weight were significantly reduced Singh and Chand (1980) noticed that the net profit from the application of 120 kg N/ha was higher in maize / soybean mixture than in sole plantings .

Ahmed and Rao (1982) showed that the highest LER value were generally at zero N levels (1.64) and progressvely decreased with increasing N rates (1.42) at 100 % nitrogen . Khalifa *et al.* (1983) found that intercropping soybean with maize either on one side or both sides of maize ridges, reduced ear size and tended to decrease grain yield / ha. Zeiton and El-Khawaga (1986) found that plant height (cm), number of branches / plant , pod number / plant , seed number / plant , seed index and seed yield / fed . all responded positively to the highest nitrogen level (120 kg N/fed) .Francise and Stern , (1987) noticed that the LER as a measure of the efficiency of intercropping declined with increasing level of nitrogen applied . Mohamed *et al.* (1985) showed that the aggressivity for maize (Am) was significantly increased with increasing N level upto 70 kg N/fed. it was determined for biological or grain + seed yield / fed . Rosas (1988) found that land equivalent ratio values for maize + soybean were 1.67 with no nitrogen fertilization and 1.28 with 150 kg N/ha . Dhingra *et al.* (1991) noticed that maize gave higher yields in intercrops in 1983 and 1985 only . Average yields of maize over 4 years were highest (3.69 t/ha) when grown alone in alternate rows with mungbeans .Varughese and Iruthayaraj (1996) found that grain yield was unaffected

by cropping system . Zamar and Giambastiani (1997) found that land eyuivalent ratio reached 1.09 and 1.11 in the 1st and 2nd year . Maize grain yields were higher under intercropping than in pure stand whereas grain yields of soybean were unaffected by an associated maize crop .

The present study was carried out to investigate the effect of intercropping soybean with maize , two tillage systems as well as three nitrogen fertilizer levels on yield and competitive relations of maize and soybean .

MATERIAL AND METHODS

Two field experiments were carried out at Nubaria Agric . Res . Station during the two successive growing seasons i.e. 1998 and 1999 . The objectives of this study was to investigate the effect of intercropping maize with soybean on yield and its attributes of maize and soybean and their competitive relations .

The study included 12 treatments divided into six intercropping treatments (the combinations between two tillage systems i.e. tillage and no tillage and three nitrogen fertilizer levels i. e. 30,6o and 90 kg / fed .

Besides , six solid stand treatments (the combinations between two tillage systems i.e. tillage and no tillage and three nitrogen fertilizer levels 30.6o and 90 kg / fed . The Crawford soybean as an early cultivar from Iv group was sown on April 20 in the first and on April 23 in the second season . Maize was sown on the other side of the same ridge (1 : 1) and was sown on May 12 in the first season and on May 15 in the second season . A split plot design with three replications was used . The plot area was 24 m^2 (4 × 6 m) and contained ten ridges with 60 cm apart . The tillage systems occupied the main plots in both solid and intercropping planting . The three nitrogen fertilizer levels were arranged in sub-plots in both solid and intercropping treatments . Pre-sowing superphosphate (15.5 % P_2O_5) was applied as abase application at the rate of 100 kg per feddan . Ammonium nitrate fertilizer (33.5 % N) was applied in the two equal portions . The first was added after thinning for both two crops being just before the first irrigation , while the second part was applied just before the second irrigation .

Maize was thinned to a single plant per hill after 20 days from sowing . Thinning of soybean was conducted after 19 days from sowing to 15 cm between plants with plants per hill . Other cultural practices were carried out as recommended .

At harvest 10 plants from soybean plants were randomly taken from the middle rows of each plot to measure plant height , number of pods / plant , 100 - seed weight and seed yield / plant .

Seed yields / feddan of soybean and maize were recorded from the hole plot area . The following two competitive relations were determined .

1- Land equivalent ration (LER) :It was determined according to De Wit and Den Bergh 1965 equation as follows :

$$L\ maize = \frac{ycs}{ycc} \quad \& \quad L\ soybean = \frac{ysc}{yss}$$

LER= L maize + Lsoybean .

2- Aggressivity (A) :It was determined according to Mc Gilchrists (1965) formula as follows :

$$Acs = \frac{Ycs}{ycc \times zab} - \frac{ycs}{ycc \times zab}$$

$$Asc = \frac{ysc}{yss \times zba} - \frac{Ysc}{yss \times zba}$$

Were Acs = maize

Asc = aggressivity for soybean

ycc = Pure stand yield of maize

yss = Pure stand yield of soybean

Ysc = intercroped yield of maize(in combination with soybean)

Ysc = intercroped yield of soybean (in combination with maize)

Zab = sown proportion of species of (in a combination with b)

Zba = sown proportion of species of b (in a combination with a

The collected data were statistically analyzed according to Snedecor and Cochran (1967) .

RESULTS AND DISCUSSION

A - Soybean

Data presented in Table 1 indicated that tillage systems had significant effect on all characters studied in the two seasons in both solid and intercropping except 1oo-seed weight in the two seasons.

The highest value of seed yield per fed was obtained from tillage conservation compared to no tillage. Also, the results indicated that soybean yield was the highest when grown alone compare to intercropping and in all characters which were studied. Increasing nitrogen fertilizer levels, significantly increased seed yield and all characters in both solid and intereropping planting significantly increases in seed yield / fed was postulated by using the highest nitrogen fertilizer levels (90 Kg N / feddan) .

The highest value of seed yield / fed was obtained from adding 90 Kg N/fed compared to adding 30 Kg N/fed. The interaction between tillage systems and nitrogen fertilizer levels had significant effect on all characters were studied except 100 seed weight in both solid and intereropping planting in the two seasons. Similar results were also reported by Galal . *et al.* (1980) , Mohta and R. De(1980) , Galal and Metwally (1980) , Cordero (1978) and Zeiton and El - Khawaga (1986) .

B - Maize

Table 2 shows tillage systems, nitrogen fertilizer levels and the interactions between tillage systems and nitrogen fertilizer levels had significant effect on grain yield of maize plants in both solid and interopping planting in the two seasons. Data presented in table 2 showed that the highest value of grain yield / fed was obtained from tillage conservation compared to no tillage and also , increasing nitrogen fertilizer levels increased grain yield / fed . The results of grain yield / fed indicated that solid planting showed the greatest grain yield compared to those intercropped significantly increases in seed yield / fed was postulated by using the highest nitrogen fertilizer levels (90 Kg N / feddan). Similar results were also reported by Syarifuddin *et al.* 1974 , Gunasema *et al.* (1979) , Dhingra *et al.* (1991) and Varuphese and lruthayarij (1996) .

table1

C - Competition relations .

The results presented in Table 3 - could be attributed to of land equivalent ratio of soybean which was always little than that of land equivalent ratio of maize. The results also indicated that LER of soybean and maize valued more than one. Also, the maize was the dominant and soybean was dominated .

Data listed in Table 3 show that tillage system had significant effect on land equivalent ratio LER and aggressivity values for economic yields of soybean and maize in the second season . The interaction between tillage systems and nitrogen fertilizer levels did not cause any significant effect on LER and aggressivity values in the two seasons . Similar results were also reported by Hiebsh (1981) , Ahmed and Rao (1982) , Francise and Stern (1987) and Mohamed *et al.* (1985) .

Table 2: Grain yield/feddan of maize as affected by tillage systems and nitrogen fertilizer levels in 1998 and 1999 seasons .

Nitrogen levels	grain yield ard / fed Tillage systems 1998		Mean	grain yield ard / fed Tillage systems 1999		Mean
	No- tillage	tillage		No- tillage	tillage	
Intercropping						
30	8.66	10.74	9.70	8.22	12.75	10.48
60	9.07	11.49	10.28	8.45	13.15	10.80
90	9085	11.88	10.86	8.99	13.92	11.45
Pure-stand						
30	13.74	17.11	15.42	13.13	17.05	15.09
60	14.01	17.82	15.91	14.05	18.03	16.04
90	14.63	18.56	16.59	14.76	18.56	16.66
Means	11.66	14.60	13.13	11.27	15..58	13.42
L.S.D. at 0.05 level						
I			**0.3**			**1.74**
N			**0.97**			**1.15**
I × N			**1.38**			**1.63**

Table 3 : Land equivalent ratio and Aggressivity values for grain and seed yields as affected by tillage systems and nitrogen fertilizer levels in the two seasons

tillage sysbems	N. levels kg /	LER 1998	LER 1999	Aggressivity 1998 ACS	Aggressivity 1998 ASC	Aggressivity 1999 ACS	Aggressivity 1999 ASC
No.	30	1.20	1.18	0.06	-006	0.08	-0.08
tillage	60	1.23	1.18	0.05	-005	0.04	-0.04
	90	1.27	1.21	0.07	-007	0.01	-0.01
tillage	30	1.19	1.38	0.05	-005	0.12	-0.12
	60	1.26	1.33	0.02	-0.02	0.13	-0.13
	90	1.26	1.39	0.02	-0.02	0.11	-0.11
Means		1.23	1.28	0.04	-0.04	0.08	-0.08
L.S.D. at 0.05 levels							
I	**NS**	**007**	**NS**	**NS**	**0.04**	**-0.04**	
N	**0.NS**	**NS**	**NS**	**NS**	**NS**	**NS**	
I × N	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	

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دراسات عن تحميل الذرة الشامية مع فول الصويا فى الأراضى الجديدة

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*** قسم بحوث التكثيف المحصولى - بمحطة البحوث الزراعية بالنوبارية معهد بحوث المحاصيل الحقلية**

**** قسم بحوث المحاصيل الزيتية - بمحطة البحوث الزراعية بالنوبارية معهد بحوث المحاصيل الحقلية**

تم تنفيذ فذت هذه الدراسة فى محطة البحوث الزراعية بالنوبارية خلال الموسمين الصيفيين ١٩٩٨ - ١٩٩٩ وذلك لدراسة تأثير نظم الخدمة (خدمة - وبدون خدمة) وثلاث معادلات من التسميد النتروجين (٣٠،٦٠،٩٠ كيلو جرام نتروجين لكل فدان) على الإنتاجية لكلا المحصولين المحملين والعلاقات التنافسية بينهما وتم تنفيذ التجربة فى تصميم القطع المنشقة مرة واحدة ووضعت معاملات الخدمة فى القطعة الرئيسية ومعدلات التسميد النتروجينى فى القطع الشقية وذلك فى كل من الزراعة المنفردة والمحملة بنظام ١ : ١ على ريشتى الخط وأوضحت النتائج فيما يلى :

١- أوضحت النتائج أن معاملات الخدمة قد أثرت تأثيرا معنويا على صفة محصولى الذرة وفول الصويا وكذلك على مكونات محصول فول الصويا ما عدا وزن ١٠٠ بذرة فى الموسم الأول وأن معاملات الخدمة أعطت أعلى محصول لكل من الذرة وفول الصويا وأن الخدمة الكاملة أعطت أعلى محصول فى كل من الذرة وفول الصويا وذلك فى الزراعة المنفردة والمحملة . وأن الزراعة المنفردة أعطت أعلى محصول فى كل من الذرة وفول الصويا .

٢- أشارت النتائج الى أن زيادة معدلات التسميد للنتروجين يزداد المحصول ومكوناته فى كل من الذرة وفول الصويا وأقصى زيادة كانت بإضافة ٩٠ كيلو جرام نتروجين / فدان

٣-أوضحت النتائج أن مكافئ إستغلال الأرض لكل من الذرة وفول الصويا كان أكثر من واحد وكان محصول الذرة سائد عن فول الصويا . وكانت أعلى زيادة فى الموسم الثانى عند المعاملة بالخدمة وزيادة التسميد النتروجينى حتى ٩٠ كجم ن للفدان.

توصى الدراسة بتحميل فول الصويا والذرة الشامية على ريشتى الخط والمعاملة بالخدمة والتسميد الأزوتى بمعدل ٩٠ كم وحدة أزوت للفدان للحصول على أعلى انتاجية من وحدة المساحة.

Table 1 : Plant height, number of pods/plant , 100-seed weight, seed yield/plant and seed yield / feddan of soybean as affected by tillage systems and nitrogen fertilizer levels in 1998 and 1999 seasons .

Tillage	N	Plant height cm		No -of pods per plant		100 - Seed / weight (g)		Seed yield / plant (gm)		Seed yield / fe (kg)	
systems	kg/fd	1998	1999	1998	1999	1998	1999	1998	1999	1998	19
intercropping	30	54.3	51.9	19.6	20.9	17.51	17.02	4.49	5.29	516.6	53
No.	60	59.4	54.6	22.5	23.9	18.17	17.76	5.31	5.30	562.9	55
tillage	90	64.2	61.2	29.3	25.5	18.25	18.13	6.17	5.31	592.5	60
Tillage	30	59.6	65.3	27.9	27.5	17.94	17.84	5.57	5.95	670.8	61
	60	66.1	65.5	31.0	28.4	17.99	18.30	6.65	6.07	722.6	63
	90	69.5	74.5	33.1	32.9	18.33	18.44	7.38	7.11	743.3	70
pure stand	30	82.9	79.0	40.5	36.3	18.46	18.54	10.22	9.94	926.1	96
No	60	83.9	80.5	44.3	40.1	18.53	18.79	10.95	10.32	945.2	97
tillage	90	84.	81.7	45.7	45.7	18.55	18.93	11.31	11.76	985.1	100
	30	102.5	104.5	50.2	54.1	18.34	18.42	12.45	11.95	1166.2	96
Tillage	60	103.7	106.3	52.3	55.1	19.05	18.99	12.93	12.31	1170.5	105
	90	105.7	107.5	55.7	56.7	19.11	18.32	13.41	12.42	1201.3	109
Means		78.0	77.7	35.2	37.2	18.35	18.37	8.90	8.64	850.3	80
L.S . D at 0 . 05 levels											
		87.7	**109.7**	**0.9**	**0.1**	**NS**	**NS**	**3.03**	**1.59**	**7.3**	**8.5**
1											
		24.2	**48.4**	**0.7**	**0.7**	**0.7**	**0.64**	**5.53**	**1.88**	**6.4**	**7.6**
N											
		34.3	**68.5**	**1.0**	**1.0**	**NS**	**NS**	**7.82**	**7.66**	**9.0**	**10.8**
1 × N											