

EFFECT OF INTERCROPPING SUNFLOWER WITH SOYBEAN AS AFFECTED BY PLANT SPACINGS OF SUNFLOWER AND NITROGEN FERTILIZER LEVELS ON YIELD UNDER RECLAIMED LAND CONDITION

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ABSTRACT

Two field experiments were carried out at Nubaria Agric. Res. Station during 1998 and 1999 seasons to study the effect of plant spacing of sunflower i.e. 20 and 30 cm between hills and three nitrogen fertilizer levels i.e. 45, 60 and 75 kg N/fed on yield and competitive relations of sunflower and soybean. A split plot design with three replications was used. The main results could be summarized as follows. The two plant spacings of sunflower occupied the main plots in both solid stand and intercropping planting. The nitrogen fertilizer levels were arranged in sub plots in both solid and intercropping treatments.

The results indicated that plant spacing of sunflower had a significant effect on seed yield of soybean plants, seed yield of sunflower, land equivalent ratio and aggressivity in the two seasons. Increasing plant spacing of sunflower significantly decreased seed yield of sunflower. The spacing of 20 cm gave highest seed yield of sunflower compared to hill spacing of 30 cm. Nitrogen fertilizer levels were significant effect on seed yield of soybean in the two seasons and aggressivity only in the second season. Increasing nitrogen fertilizer levels significantly increased seed yields of soybean. Maximum seed yield / feddan of soybean was obtained by adding 60 kg N/fed. All interactions did not show any significant effect on all studied characters. It could be concluded that increasing plant spacing of sunflower to 30 cm between hills increased LER value and more than one, sunflower was dominant crops, whereas soybean was dominated.

INTRODUCTION

Intercropping may be a way to increase the productivity of land. Bean and sunflower are commonly suggested as desirable intercrop species because different growth rates of these species should allow full utilization of the environment with minimum competition for light. Galal and Metwally (1982) mentioned that intercropping corn and soybean reduced seed yield by 40% less than under monoculture. Assey *et al.* (1983) found that changing the cropped soybean density from 40 up to 120 thousand plants did not reflect any significant differences respecting land equivalent ratio and aggressivity of maize and soybean. Robinson (1984) found that yield from intercropped sunflower and soybeans in alternate rows 39 cm apart were less than from soybeans growing alone but 450 kg/ha higher than from sunflowers grown alone. Shafshak *et al.* (1986 a - and b) found that seed yields from

intercropping ranged from 522 to 729 kg /fed. in soybean and from 403 to 629 kg/fed in sunflower compared with 1125 and 782 from pure stands. Also , found that land equivalent ratio (LER) increased with plant density . Umrani *et al.* (1987) showed that intercropping of sunflower and pigeonpea in 2:1row ratio in rows 60 cm apart gave highest value for seed yield and land equivalent ratio .Furthermore several studies were made on intercropped sunflower with soybean. Abdel-Gawad *et al* (1989) (a , b and c). Hiremath *et al.* (1989) and Venugopal *et al* (1990), Dhingra *et al* (1991) Ujjinaiah *et al.* (1991) Shivarmaru and Shivashankar (1992). Bhattacharya and Gautam (1993) Pal *et al.* (1991), found that the seed yield of sunflower and soybean were reduced by intercropping with grain sorghum . Gode and Bobde (1993) found that soybean seed yield was 1.66t/ha when grown alone and 0.35-058t when intercropped with sorghum. The highest net profit was obtained by intercropped sorghum with soybean in a 1 : 1 row ratio . Varughese and Iruthayaraj (1996) showed that grain yield was unaffected by cropping system except in kharif (monsoon) (1989) when it was highest when intercropping in a 2 : 2 row ratio . Zamar and Giambastiani (1997) found that land equivalent ratio reached 1.09 and 1.11 in the 1st and 2nd year, respectively . This work was designated to study the effect of intercropping sunflower with soybean as affected by plant spacing of sunflower and nitrogen fertilization on yield and competitive relations of sunflower and soybean in reclaimed land .

MATERIAL AND METHODS

The present investigation was carried out at Nubaria Agric Research Station during the two successive growing seasons i.e. 1998 and 1999. The major objective of this study was to study the effect of intercropping sunflower and soybean as affected by plant spacing of sunflower and nitrogen fertilizer levels on yield to both crops and competitive relations of soybean and sunflower in reclaimed land .The study included 15 treatments divided into six intercropping treatments (the combinations between two plant spacing of sunflower i . e. 20 and 30 cm between hills and three nitrogen levels of 45,60 and 75kg N/fed Besides, nine solid stand treatments divided into the six treatments of sunflower (the combinations between two plant spacing of sunflower 20 and 30 cm between hills and three nitrogen levels 45,60 and 75 kg N/fed and three treatments of soybean were planted in hills 10 cm apart with two plants per hill with three nitrogen levels 45 , 60 and 75 kg N / fed .The Crawford soybean as an early cultivar from the IV group . Soybean was sown on May 10 in the first season and on May 16 in the second season. Whereas, sunflower treatment were sown on the other side of the same ridge , and was sown on May 24 in the first season and on May 30 in the second season. A split plot design with three replications was used the two plant spacing of sunflower occupied the main plots in both solid stand and intercropping planting .The nitrogen fertilizer levels were arranged in sub plots in both solid and intercropping treatments . The plot area was 14.4m² and include six rows each of 2.4x 6. Pre -sowing super-phosphate (15.5%) P₂O₅ was applied as base application at the rate of 50kg fed Ammonium nitrate (33.5 N) was applied as activating does after 28 days from sowing .

Sunflower was thinned to a single plant per hill after 22 days from sowing. Thinning of soybean was conducted after 20 days. Other cultural practices were carried out as recommended. At harvest the all plant from whole plots were taken to estimate of seed yield of the each of sunflower and soybean and competitive relation of sunflower and soybean. The following to competitive relations were determined:

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

$$L \text{ sunflower} = \frac{y_{cs}}{y_{cc}} \text{ and } L \text{ soybean} = \frac{y_{sc}}{y_{ss}}$$

$$LER = L \text{ sunflower} + L \text{ soybean} .$$

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

$$A_{cs} = \frac{Y_{cs}}{Y_{cc} \times z_{ab}} - \frac{Y_{sc}}{y_{ss} \times z_{ba}} \quad A_{sc} = \frac{y_{sc}}{y_{ss} \times z_{ba}} - \frac{y_{cs}}{y_{cc} \times z_{ba}}$$

Were A_{cs} = aggressivity for sunflower

A_{sc} = aggressivity for soybean

y_{cc} = Pure stand yield of sunflower

y_{ss} = Pure stand yield of soybean

Y_{cs} = intercrop yield of sunflower (in combination with soybean)

Y_{sc} = intercrop yield of soybean (in combination with sunflower)

Z_{ab} = sown proportion of species of (in a combination with: b)

Z_{ba} = 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

Date presented in Table 1 indicated that plant spacing of sunflower and nitrogen fertilizer differed significantly on seed yield of soybean plants in the two seasons in both solid and intercropping planting. Increasing plant spacing of sunflower decreased significantly seed yields of soybean plants. Results showed that spacing of 30 cm was higher than that 20 cm spacing in the two seasons in both solid and intercropping planting. It may be due to high efficiency of photosynthesis and good weed control. These results agree with the results of Shafshak *et al.* (1986) and Assey *et al.* (1983). Also increasing nitrogen fertilizer levels from 45 to 75 kg N/fed. increased seed yield of soybean. In the same time the interaction between plant spacing of sunflower and nitrogen fertilizer levels were not affected significantly on seed yield of soybean plants.

B. Sunflower

Results in Table 2 showed that plant spacing of sunflower differed significantly on seed yield / feddan. Increasing plant spacing increased seed

yield / fed. The 30 cm spacing gave more yields than of 20 cm spacing in the two seasons in both solid and intercropping plantings. Ujjinaiah *et al* (1991) mentioned that seed yield of sunflower were 629 - 984 kg / ha when grown alone and 239 - 692 kg when intercropped with pigeonpea. Shivarmu and Shivashankar (1992) found that sunflower seed yield in the intercrop was slightly but significantly increased by increasing sunflower population and decreasing soybean population above 50 % of the pure stand population and higher with single than with paired rows.

The present results indicated that increasing nitrogen fertilizer levels and interaction between plant spacing of sunflower and nitrogen fertilizer did not cause any significant effect on seed yield / feddan.

C-Competition

1- Land equivalent ratio (LER).

It is clear from Table 3 that LER for seed yield of sunflower and seed yield of soybean was always greater than one, and was significantly affected by plant spacing of sunflower on LER for yields of soybean and sunflower in the two seasons. Increasing plant spacing from 20 cm to 30 cm increasing LER values for yield in the two seasons. These results are in agreement with those reported by Assey *et al.* (1983), Shafshak *et al* (1986) Ujjinaiah *et al* (1991) and Hiremath *et al* (1994).

The nitrogen fertilizer levels and interactions between plant spacing and nitrogen fertilizer levels did not cause any significant effect on LER for yield of soybean and sunflower.

2- Aggressivity (A)

The results indicated that aggressivity values for sunflower as well as for soybean were significantly affected by plant spacing of sunflower in the two seasons. Aggressivity with plant spacing of 20cm was higher than that plant spacing of 30 cm (Table 3). However, sunflower was the dominant crop whereas soybean was dominated. Similar results were also reported that Shafshak *et al.* (1986), Assey *et al* (1983) and Abdel-Gawad *et al.* (1989) found that sunflower was dominant intercrop component and soybean was dominated under 1 : 1, 2 : 2 and 3 : 3 intercrop pattern.

Table 1: Effect of plant spacing of sunflower and nitrogen fertilizer on seed yield of soybean plants in 1998 and 1999 seasons.

N. Kg/fed	Spacing		Pure stand	Means	Spacing		Pure stand	Means
	20	30			20	30		
45	581.52	683.25	1053.23	772.33	534.48	698.38	1000.38	744.37
60	619.42	705.15	1033.16	785.91	652.45	728.56	1067.23	816.08
75	684.68	776.91	1145.43	869.01	723.29	801.23	1139.76	888.09
Means	628.54	721.77	1076.94	809.08	636.74	742.72	1069.12	816.19

L.S.D at 0.05 Level

	1998	1999
Nitrogen (N)	59.86	135.41
Spacing (S)	34.81	33.23
S×N	NS	NS

Concerning the effect of nitrogen fertilization on the aggressivity values for sunflower and soybean, results indicated that there was significant increase in the second season only in aggressivity values. Increasing nitrogen fertilizer levels increased aggressivity values for sunflower and soybean. The interaction between plant spacing and nitrogen fertilizer levels were not significantly affected on aggressivity in the two seasons.

Table 2: Effect of plant spacing of sunflower and nitrogen fertilizer on seed yield of sunflower plants in the two seasons

Spacing (S)	Nitrogen kg / fed(1998)			Means	Nitrogen kg /fed 1999			Means
	45	60	75		30	45	60	
Intercropping								
30 cm	754.24	808.18	812.81	791.81	815.79	795.55	825.71	812.35
20 cm	662.57	661.13	675.88	666.53	668.39	669.16	659.71	665.75
Pure stand								
20	975.16	1035.32	1104.99	1038.49	1031.43	1051.48	1070.82	1051.24
30 cm	894.10	869.33	920.60	894.69	895.30	969.83	920.08	928.40
Means	821.52	843.49	878.57	849.53	852.73	871.51	869.08	864.44

L.S.D at 0.05 Level .

	1998	1999
Spacing (S)	63.37	54.40
Nitrogen (N)	NS	NS
S x N	NS	NS

Table (3) : Land equivalent ratio (LER) and aggressivity values for seed yield of soybean and sunflower as affected by plant spacing of sunflower and nitrogen fertilizer Levels in 1998 and 1999 seasons

Spacing	N	LER		Aggressivity			
		1998	1999	1998		1999	
				ACS	ASC	ACS	ASC
20	45	1.33	1.31	0.13	-0.13	0.07	-0.07
	60	1.32	1.36	0.23	-0.23	0.10	-0.10
	75	1.37	1.40	0.17	-0.17	0.06	-0.06
Means		1.34	1.35	0.17	-0.17	0.07	-0.07
30	45	1.42	1.46	0.12	-0.12	0.01	-0.01
	60	1.39	1.37	0.14	-0.14	0.07	-0.07
	75	1.41	1.42	0.25	-0.25	0.10	-0.10
Means		1.40	1.41	0.17	-0.17	0.06	-0.06

L.S.D at 0.05 Levels

Spacing (s)	0.04	0.04	0.09	-0.09	0.07	-0.07
Nitrogen (N)	NS	NS	NS	NS	0.08	-0.08
S x N	NS	NS	NS	NS	NS	NS

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تأثير مسافات زراعة عباد الشمس ومستويات التسميد النتروجيني على تحمیل عباد الشمس مع فول الصويا تحت ظروف الأراضي الجديدة فتحى رجب رمضان نوار معهد بحوث المحاصيل الحقلية بالانوبارية

أجريت هذه الدراسة في خلال موسمی الصيفی ١٩٩٨ و ١٩٩٩ في محطة البحوث الزراعية بالانوبارية وذلك لدراسة تأثير مسافات زراعة عباد الشمس (٢٠ و ٣٠ سم بين المسافات) ومستويات التسميد النتروجيني (٤٥ ، ٦٠ ، ٧٥ كم نيتروجين / فدان) على المحصول في فول الصويا وعباد الشمس والعلاقات التنافسية لكلا المحصولين و لقد تم تنفيذ التجارب في تصميم القطع المنشفة مرة واحدة ويمكن تلخيص أهم النتائج المتحصل عليها فيما يلي :-

أدت نتائج مسافات زراعة عباد الشمس تأثيرا معنويا على محصول عباد الشمس وفول الصويا وقيمة المكافئ الأرضي في الموسمين ،وبزيادة مسافة زراعة عباد الشمس حتى ٣٠ سم بين الجور أدى إلى نقص المحصول معنويا في عباد الشمس بينما أعطت المسافة ٢٠ سم بين الجور إلى أعلى محصول لعباد الشمس مقارنة بمسافة ٣٠ سم بين الجور .

أدى زيادة معدل التسميد النتروجيني إلى زيادة محصول فول الصويا / فدان في الموسمين وقيمة الموانية في الموسم الثاني وأعطى المعدل ٦٠ كم / فدان أعلى محصول في الموسم الأول .

نقد زادت قيمة المكافئ الأرضي بزيادة مسافة زراعة لعباد الشمس وكان عباد الشمس هو المحصول السائد عن فول الصويا .

لم يكن هناك أي تأثير معنوي نتيجة لتفاعل المسافات لزراعة عباد الشمس ومستويات التسميد النتروجيني على أي صفة تحت الدراسة .