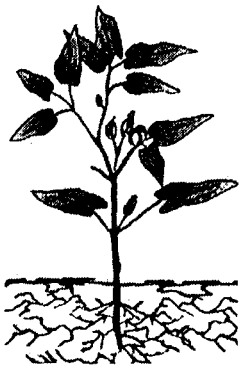

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EFFECT OF TILLAGE SYSTEMS AND NITROGEN FERTILIZATION ON YIELD AND YIELD COMPONENTS OF INTERCROPPED SOYBEAN TO SUNFLOWER IN CALCAREOUS SOILS

[12]

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ABSTRACT

A field experiment was conducted at Nubaria Agric. Res. Station during 2003 and 2004 summer seasons to study the effect of two tillage systems (tillage and no-tillage), two cropping systems (solid and intercropped) as well as three nitrogen fertilizer levels (45, 60 and 75 kg N/fad.) on yield and yield components of soybean and sunflower as well as the competitive relations of soybean and sunflower in new reclaimed land (calcareous soil). The experimental treatments were assigned in a split-split plot design with four replications. Soybean results revealed that tillage systems and intercropping treatments significantly affected plant height, number of pods/plant, seed yield/plant and seed protein content in both seasons. Increasing N levels increased plant height, number of pods/plant, seed yield/plant, seed yield/fad., seed protein content and 100-seed weight. These results hold fairly true in both seasons, except for 100 seed weight in the second season. The highest soybean yield/fad. was obtained from monoculture growing in tillage soil and receiving 75 kg N/fed in the two seasons. Data of sunflower revealed also that tillage systems significantly affected plant height, number of leaves/plant, 100-seed weight, seed yield/plant and seed yield/fad. in the two seasons. Intercropping treatments and N fertilizer levels significantly affected plant height, number of leaves/plant, head diameter, 100-seed weight, seed yield/plant, seed yield/fad. and seed oil content in both seasons. The highest seed yield/fad. of sunflower was obtained from growing in monoculture, in tillage soil and adding 75 kg N/fad. in both seasons. Results indicated that land equivalent ratio (LER) of soybean and sunflower in all treatments was more than one. Sunflower was always dominant, whereas soybean was less dominated.

INTRODUCTION

Intercropping is considered an avenue to increase productivity per unit area. Soybean and sunflower are commonly suggested as desirable intercrop species because they differ in growth vigor which could allow full utilization of the environment. On the other hand, no-tillage leaves crop residues on the soil surface that reduce the risk of water and wind erosion, reduce evaporation and increase water availability for crops. Tillage is considered as a technique that plays an important role in soil and water conservation where the processes of infiltration, run off and evaporation of the soil aimed at improving soil conditions affecting crop production (**Hillel, 1982**). **Garcia and Pinchinat (1976)** found that intercropping planting as (100% maize + 50% soybean and 100% soybean + 50% maize) did not reduce crop yield (maize and soybean yields), but planting as (100% soybean + 100% maize) reduced maize and soybean yields. **Beets (1977)** reported that inter-

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cropping maize with soybean in different arrangements, *i.e.* 100% + 0%, 75% + 25%, 50% + 50%, 25% + 75% and 0% +100% reduced the grain of maize and seed yields of soybean crops. **Moallem (1979)** found that soybean yield was 0.68 t/ha in the intercropping and was higher with lower fertilizer rate (75, 50 and 25 kg/ha NPK). **Galal *et al* (1980)** studied soybean and maize grown together in different patterns at different regions in Egypt. They found that pods number and seeds number/plant were 30 and 50% higher and seed yield was 50% greater when soybean was grown alone than with maize. **Mohta and De (1980)** found that seed yield of soybean, when intercropped with maize, was less than that of a solid crop. The combined seed/grain yield of the two crops in an intercrop planting was more than the individual components. **Galal and Metwally (1982)** mentioned that maize and soybean reduced seed yield of soybean by 40% than that of monoculture. Other yield components such as number of pods, number of seed and 100-seed weight were significantly reduced. **Abdel-Gawad (1989 a&b)** found that planting maize at narrow spacings gave positive aggressivity values for maize, whereas at wider spacings these values were positive in favour of soybean. **Tetiokagho (1988)** found that soybean yield decreased with the increase in maize density. **Abdel-Gawad *et al* (1989a)** found that the highest seed yield/fad. of soybean was obtained by planting sunflower with soybean at 30 cm ridge width with 3:3 intercropping patterns. **Abdel-Gawad *et al* (1989b)** found that the highest value of (LER) amounted to 1.53 from intercropping pattern (3:3) with ridge width of 60 cm. relative crowding coefficient (RCC) for sunflower and soybean became great at 60 cm ridge width. Pattern 3:3 gave the highest RCC value for sunflower and soybean. **Kersten and Hack (1991)** showed that the no-tillage system gave far worse results than any of other treatments and the best system was obtained by ploughing and ripping. **Basso *et al* (1992)** reported that seed yield was not affected by crop residue treatment, but was less by ploughing than after chiseling. **Hoque *et al* (1994)** found that no-tillage system gave the best results and followed by minimum tillage. **Raglione *et al* (1995)** reported that the highest yields were obtained with ploughing to 40 cm depth. **Varughese and Iruthayaraj (1996)** showed that grain yield was unaffected by cropping system, except in Kharif (monsoon) of 1989 when it was highest with intercropping maize with soybean at (2:2) row ratio. **Zamar and Giastiani (1997)** found that land equivalent ratio reached 1.09 and 1.11 in the 1st and 2nd years, respectively, when intercropped maize and soybean.

This work was designed to study the effect of tillage systems, intercropping soybean and sunflower; and nitrogen fertilization on yield and yield components of soybean and sunflower and their competitive relations in calcareous soil.

MATERIALS AND METHODS

A field experiment was carried out in calcareous soil at Nubaria Agric. Res. Station during 2003 and 2004 growing seasons. The major objective of this study was to investigate the effect of tillage systems, cropping systems and nitrogen fertilization on yield, yield components, seed oil content of soybean and sunflower as well as seed crude protein content of soybean, besides their competitive relations. A split-split plot design with four replicates was used. Two tillage systems (tillage and no-tillage) occupied the main plots, whereas the cropping systems (intercropping and solid planting) were arranged in the sub-plots. Three nitrogen fertilizer levels (45, 60 and 75 kg N/fad.) occupied the sub sub-plots.

Soil chemical and mechanical analysis of the experimental site are shown in **Table (1)**. The sub sub-plot size was 14.4 m^2, comprising six ridges 4 m length and 60 cm apart. "Maiac" sunflower and "Crawford" soybean cultivars were used. In both solid and intercropping plantings, soybean was sown in 10 cm hills on one side of the ridge and sunflower was sown in 30 cm hills on the other side. Thinning was done 17 days after sowing at two plants per hill for soybean and one plant per hill for sunflower. Soybean was sown on May 26 and May 30, whereas sunflower was sown on June 17 and June 22 in the first and the second seasons, respectively. Calcium superphosphate at a rate of 15.5 kg P_2O_5/fad. was applied as a base application. However, nitrogen fertilizer as ammonium nitrate (33.5 % N) was applied at two equal doses before the first irrigation after thinning and before the third irrigation. Other cultural practices were carried out as recommended.

At harvest, 10 plants from soybean and sunflower plants were randomly taken from the middle rows of each sub-sub plot to determine the yield components, viz. plant height (cm), number of pods/plant, 100-seed weight(g) and seed yield/plant (g) for soybean, as well as plant height (cm), number of leaves/plant, stem and head diameters (cm), 100-seed weight (g) and seed

Table 1. Mechanical and Chemical analysis of the soil at the experimental site in 2003 and 2004 seasons

Soil Properties	2003 season	2004 season
Mechanical Properties		
Sand (%)	52.9	53.3
Silt (%)	21.8	20.8
Clay (%)	25.3	25.9
Soil texture (%)	Sand clay loam	Sand clay loam
Chemical properties		
Total N (%)	0.046	0.051
Available N (ppm)	26.30	26.60
Available P (ppm)	9.68	8.40
Available K (ppm)	425.0	403.0
pH	8.2	8.1
E.C. (mmhos/cm)	2.21	1.95
O.M. (%)	0.96	0.98
$CaCO_3$ (%)	22.9	22.5

yield/plant (g) for sunflower. Seed yield per faddan for soybean and sunflower was determined on plot basis. Seed oil content of soybean and sunflower were determined by Soxhlet apparatus on dry weight basis. Protein was determined as total nitrogen by micro-Kjeldahl method according to **A.O.A.C. (1970)**, then multiplied by 6.25 (**Tripathi *et al* 1971**) to obtain protein content of soybean seeds.

The following competitive relations were determined:

1. **Land equivalent ratio (LER):** It was determined according to the equation given by **De Wit and Denbergh (1965)** as follows:

$$L\ Soybean = \frac{ycs}{ycc} \qquad L\ Sunflower = \frac{ysc}{yss}$$

LER = L Soybean + L Sunflower

2. **Relative crowding coefficient (RCC):** it was determined according to the equation given by **De Wit and Hall (1974)** as follows:

$$Kab\ soybean = \frac{ycs \times Zba}{(ycc - ycs)\ Zab}$$

$$Kba\ sunflower = \frac{ysc \times Zba}{(yss - ysc)\ Zab}$$

RCC = Kab x Kba

3. **Aggressivity (A):** it was determined according to **McGilchrists (1965)** formula as follows:

$$ACS = \frac{ycs}{ycc \times Zab} - \frac{ysc}{yss \times Zba} \quad for\ soybean$$

$$ASC = \frac{ysc}{yss \times Zba} - \frac{ycs}{ycc \times Zab} \quad for\ sunflower$$

where:

ACS = aggressivity of soybean
ASC = aggressivity of sunflower
ycc = pure stand yield of soybean
yss = pure stand yield of sunflower
ycs = intercrop yield of soybean in combination with sunflower
ysc = intercrop yield of sunflower in combination with soybean
Zab = sown proportion of species a (in combination with b)
Zba = sown proportion of species b (in combination with a)

The collected data were statistically analyzed according to **Snedecor and Cochran (1973)**.

RESULTS AND DISCUSSION

A. Soybean

1. Effect of tillage system (T)

The results presented in **Table (2)** indicated that tillage systems had a significant effect on plant height, number of pods/plant, seed yield/plant and seed yield/fed in the two seasons. Tillage system gave the highest values for all studied traits, except in case of 100-seed weight. However, seed oil and seed protein content were not significantly affected.

These results showed that tillage system may provide better germination and seedling growth of soybean compared to no-tillage. Results indicated also that using ploughed tillage system gave higher seed yield/fad. than that of no-tillage. Yield increases were estimated to 14.3 and 5.92 % in the first and second seasons, respectively. Similar results were reported by **Dhingra *et al* (1991)**, **Basso *et al* (1992)** and **Hoque *et al* (1994)**.

2. Effect of cropping systems (I)

The effect of intercropping and solid planting treatments on average seed yield, yield components, oil and protein content of soybean crop are presented in **Table (3)**.

Results indicated that solid planting showed superiority over the intercropping in all studied traits, except for 100-seed weight and seed oil content. Solid planting outyielded the intercropping by 87.44 and 58.18% in seed yield/fad. in the two seasons, respectively. These results agreed with those reported by **Garcia and Pinchinat (1976)**, **Beets (1977)**, **Mohta and De (1980)** and **Galal and Metwally (1982)**.

3. Effect of N-fertilizer levels (N)

Results in **Table (4)** showed that soybean plant height, number of pods/plant, seed yield/plant, seed yield/fad. and seed protein content were significantly increased with increasing nitrogen level in both seasons. Seed oil content was not significantly affected by nitrogen application in both seasons as well as 100-seed weight in the first season.

Increasing N-fertilizer level from 45 to 60 kg N/fad. significantly increased seed yield/fad., but further increase resulted in slight increase in yield/fad. Similar results were reported by **Moallem (1979)**, **Dhingra *et al* (1991)** and **El-Douby *et al* (1992)**.

4. Interaction effects

Data in **Table (5)** showed that the effect of the 1st order interaction, *i.e.* T x I, T x N and I x N was not significant which means that the levels of each of these variables behaved the same under the level of other variables. On the other hand, the effect of the second order interaction (T x I x N) on seed yield/fad. was significant which means that the levels of the studied variables did not behave similarly. Results also indicated that the differences in soybean seed yield/fad. was not significant between N_1 and N_2 treatments and reached the significant level between N_2 and N_3 treatments with solid planting and no-tillage. On the other hand, contradicting results were recorded with the tillage treatment.

B. Sunflower

1. Effect of tillage systems (T)

Results presented in **Table (6)** showed that plant height, number of leaves/plant, 100-seed weight, seed yield/plant and seed yield/fad. were significantly affected by tillage systems in the two seasons. On the other hand, tillage system had no significant effect on stem and head diameters as well as oil seed content in the two seasons. It is evident that applying tillage system gave the highest values for all the tested traits compared to no tillage. These results also indicated that tillage system may provide better germination and seedling growth as compared to no-tillage. Similar results were reported by **Kersten and Hack (1991)**, **Basso *et al* (1992)**, **Hoque *et al* (1994)**, **Raglione *et al* (1995)** and **Celik and Unver (1999)**.

2. Cropping systems (I)

The obtained results indicated that there was a significant effect of planting treatments on all studied traits, except the stem diameter, in the two growing seasons **(Table 7)**.

Table 2. Effect of tillage systems on yield and some yield components of soybean in 2003 and 2004 seasons

Traits / Treatments	Plant height (cm)	Number of pods/ plant	100-seed weight (g)	Seed yield /plant (g)	Seed yield/fad. (kg)	Seed oil content (%)	Seed protein content (%)
	2003 season						
T_1	85.03	26.45	17.46	9.14	843.44	18.54	39.71
T_2	76.98	24.43	16.83	8.45	738.50	18.82	39.26
L.S.D at 5%	3.45	1.36	N.S.	0.31	21.17	N.S.	N.S.
2004 season							
T_1	83.84	25.62	17.51	9.74	762.97	18.81	40.03
T_2	76.74	24.60	17.21	8.32	720.27	19.69	40.21
L.S.D at 5%	4.11	0.73	N.S.	0.76	17.96	N.S.	N.S.

T_1: Tillage
T_2: No-tillage

Table 3. Effect of cropping systems on yield and some characteristics of soybean in 2003 and 2004 seasons

Traits / Treatments	Plant height (cm)	Number of pods/ plant	100-seed weight (g)	Seed yield /plant (g)	Seed yield/fad. (kg)	Seed oil content (%)	Seed protein content (%)
	2003 season						
I_1	62.95	21.71	16.87	6.60	550.08	18.63	39.03
I_2	99.06	29.18	17.41	10.98	1031.85	18.73	39.94
L.S.D at 5%	3.45	1.36	N.S.	0.31	21.17	N.S.	0.56
2004 season							
I_1	64.09	20.17	17.40	6.54	504.00	19.08	39.90
I_2	96.50	30.04	17.32	11.52	797.24	19.42	40.35
L.S.D at 5%	4.11	0.73	N.S.	0.76	17.96	N.S.	0.29

I_1: Intercropping planting
I_2: Solid planting

Table 4. Effect of N-fertilizer level on yield and other characteristics of soybean in 2003 and 2004 seasons

Traits / Treatments	Plant height (cm)	Number of pods/ plant	100-seed weight (g)	Seed yield /plant (g)	Seed yield/fad. (kg)	Seed oil content (%)	Seed protein content (%)
	2003 season						
N_1	77.50	23.09	16.72	7.99	756.51	18.07	38.65
N_2	80.20	25.14	17.01	8.84	797.90	18.55	39.70
N_3	85.31	28.09	17.69	9.55	818.49	19.42	40.11
L.S.D at 5%	4.63	1.93	0.64	0.57	27.53	N.S.	1.12
2004 season							
N_1	56.06	22.76	17.15	8.24	719.27	18.65	39.60
N_2	78.88	24.13	17.34	9.02	742.87	18.68	40.15
N_3	85.93	28.44	17.58	9.82	762.71	18.66	40.62
L.S.D at 5%	6.03	1.13	N.S.	0.93	21.04	N.S.	0.55

N_1: 45 kg N/fed
N_2: 60 kg N/fed
N_3: 75 kg N/fed

Table 5. Effect of the interaction between tillage systems, cropping systems and N-fertilizer levels on soybean seed yield per faddan in 2003 and 2004 seasons

T	I	2003 season				2004 season			
		N-fertilizer levels (kg/fad.)				N-fertilizer levels (kg/fad.)			
		N_1	N_2	N_3	Mean	N_1	N_2	N_3	Mean
T_1	I_1	570.84	591.33	603.86	588.67	503.78	512.88	546.71	521.12
	I_2	1050.78	1117.06	1126.78	1098.20	993.75	1000.80	1019.93	1004.82
	Mean	810.81	854.19	865.32	843.44	748.76	756.84	783.32	762.97
T_2	I_1	473.89	527.31	533.29	511.49	467.20	490.37	503.08	486.88
	I_2	930.56	955.93	1010.04	965.51	912.37	967.45	981.16	953.66
	Mean	702.22	741.62	771.66	738.50	689.78	728.91	742.12	720.27
L.S.D at 5%									
T x I		NS				NS			
T x N		NS				NS			
I x N		NS				NS			
T x I x N		46.75				41.59			

T: Tillage systems
T_1: Tillage
T_2: No-tillage

I: cropping systems
I_1: Intercropping planting
I_2: Solid planting

N: Nitrogen fertilizer levels
N_1: 45 kg N/fad.
N_2: 60 kg N/fad.
N_3: 75 kg N/fed
N_3: 75 kg N/fed

Table 6. Effect of tillage systems on yield and some yield components of sunflower in 2003 and 2004 seasons

Traits / Treatments	Plant height (cm)	Number of leaves /plant	Stem diameter (cm)	Head diameter (cm)	100-seed weight (g)	Seed yield /plant (g)	Seed yield/fad. (kg)	Seed oil content (%)
	2003 season							
T_1	179.91	31.54	1.93	18.83	6.74	44.75	829.80	38.95
T_2	176.59	27.46	1.87	18.29	6.41	39.10	742.35	38.66
L.S.D at 5%	2.54	1.73	N.S.	N.S.	0.29	2.14	35.14	N.S.
2004 season								
T_1	177.01	30.27	2.03	19.60	7.05	45.58	762.31	39.02
T_2	171.87	26.81	1.89	18.94	6.53	37.05	712.16	39.56
L.S.D at 5%	2.78	1.42	N.S.	N.S.	0.37	3.86	41.86	N.S.

T_1: Tillage
T_2: No-tillage

Table 7. Effect of cropping systems on yield and some yield components of sunflower in 2003 and 2004 seasons

Traits / Treatments	Plant height (cm)	Number of leaves /plant	Stem diameter (cm)	Head diameter (cm)	100-seed weight (g)	Seed yield /plant (g)	Seed yield/fad. (kg)	Seed oil content (%)
	2003 season							
I_1	174.87	26.51	1.82	17.34	5.92	37.44	663.57	38.20
I_2	179.62	32.49	1.99	19.78	7.23	46.41	908.58	39.40
L.S.D at 5%	2.54	1.73	N.S.	1.53	0.29	2.14	35.14	0.36
2004 season								
I_1	170.51	25.84	1.88	17.83	6.20	36.33	612.71	38.67
I_2	178.35	31.23	2.04	20.71	7.37	46.30	861.75	39.61
L.S.D at 5%	2.78	1.42	N.S.	1.79	0.37	3.86	41.86	0.57

I_1: Intercropping planting
I_2: Solid planting

Results showed that values of seed yield/fad. of solid sunflower were 36.9 and 40.6 % more than that of intercropping treatment in the first and second growing seasons, respectively. The obtained results were similar to those reported by **Moallem (1979)**, **Mohta and De (1980)** and **Abdel-Gawad *et al* (1989b)**.

3. Effect of N-fertilizer levels (N)

The results presented in **Table (8)** showed that all studied traits were significantly affected by nitrogen fertilizer levels in the two seasons, except for stem diameter in 2004 season. Increasing nitrogen fertilizer levels up to 75 kg N/fad. increased plant height, number of leaves/plant, stem diameter, head diameter, 100-seed weight, seed yield/plant, seed yield fad. and seed oil content in the two seasons.

Results revealed that there were no significant differences between average seed yield/fad. for the 60 and 75 kg N/fad. levels in the two growing seasons. Therefore, it could be concluded that the 60 kg N/fad. is the best N-fertilizer rate for sunflower production in the new reclaimed soils at Nubaria region. Similar results were obtained by **Beets (1977)**, **Galal *et al* (1980)**, **and Abdel-Gawad *et al* (1989a and b)**.

4. Interaction effects

Data in **Table (9)** showed that the effect of the 1st order interaction, *i.e.* T x I, T x N and I x N was not significant which means that the levels of each of these variables behaved the same under the level of other variables. On the other hand, the effect of the second order interaction (T x I x N) on seed yield/fad. was significant which means that the levels of the studied variables did not behave similarly. Results also indicated that the differences in sunflower seed yield/fad. was not significant between N_1 and N_2 treatments and reached the significant level between N_2 and N_3 treatments with solid planting and no-tillage. On the other hand, contradicting results were recorded with the tillage treatment.

C. Competition relationships

1. Land equivalent ratio (LER)

Data in **Table (10)** indicated that LER values were greater than one when sunflower intercropped with soybean in the two seasons. It is clear that the actual productivity was higher than the expected one. The highest values were obtained from the combination of tillage x nitrogen fertilizer at the lowest level (45 kg N/fad.) (1.30 and 1.23) in the two seasons, respectively. Whereas the lowest values were obtained from the combination of tillage x nitrogen fertilizer at the highest level (75 kg N/fad.) (1.27 and 1.21) in 2003 and 2004 seasons, respectively. Concerning the no-tillage system, the highest values were obtained from the interaction of no-tillage x nitrogen fertilizer at the moderate level (60 kg N/fad.) (1.28) in the first season and no-tillage x nitrogen fertilizer at the lowest level (45 kg N/fad.) (1.26) in the second season, whereas the lowest values were obtained by no-tillage x nitrogen fertilizer at lowest level (45 kg N/fad.) and no-tillage x nitrogen fertilizer at the highest level (75 kg N/fad.) (1.20 and 1.21) in the two seasons, respectively. Similar results were reported by, **Abdel-Gawad *et al* (1989b)** and **Dhingra *et al* (1991)**.

2. Relative crowding coefficient (RCC)

Data in **Table (10)** showed that RCC values were greater than one in the two seasons. The highest values were obtained from the interaction of tillage x nitrogen fertilizer at the lowest level (45 kg N/fad.) (3.90 and 2.61) in the two seasons, respectively. Whereas the lowest values were obtained from the interaction of tillage x nitrogen fertilizer at highest level (75 kg N/fad.) (3.23 and 2.47) in 2003 and 2004 seasons, respectively. In the no-tillage system, the highest values were recorded by no-tillage x nitrogen fertilizer at the moderate level and no-tillage x nitrogen fertilizer at the lowest level (3.06 and 3.10) in the second season, respectively, and the lowest values were obtained from no-tillage x nitrogen fertilizer at lowest level and no-tillage x nitrogen fertilizer at the highest level (2.35 and 2.46) in the two seasons, respectively. Similar results were obtained by **Abdel-Gawad *et al* (1989b)** and **Dhingra *et al* (1991)**.

3. Aggressivity

Aggressivity values obtained indicated that sunflower was the dominant component and soybean crop was the less dominated in all interaction treatments as shown in **Table (10)**. These results may be due to fast growth and strong vigor of sunflower plants than soybean plants. Similar results were obtained by **Abdel-Gawad *et al* (1989b)** and **Dhingra *et al* (1991)**.

Table 8. Effect of N-fertilizer levels on yield and some yield components of sunflower in 2003 and 2004 seasons

Character / Treatment	Plant height (cm)	Number of leaves /plant	Stem diameter (cm)	Head diameter (cm)	100-seed weight (g)	Seed yield /plant (g)	Seed yield/fad. (kg)	Seed oil content (%)
	2003 season							
N_1	174.62	27.44	1.74	17.03	5.96	39.38	763.67	37.96
N_2	177.79	29.49	1.85	18.29	6.44	41.15	782.22	38.98
N_3	179.34	31.57	2.12	20.36	7.33	45.24	812.34	39.46
L.S.D at 5%	3.61	2.95	0.26	2.56	0.84	3.66	40.91	0.88
2004 season								
N_1	172.11	26.26	1.84	17.46	6.02	37.52	709.08	38.67
N_2	174.69	28.87	1.89	18.82	6.77	40.71	735.22	39.23
N_3	176.51	30.48	2.16	21.53	7.58	45.72	767.40	39.98
L.S.D at 5%	3.05	2.09	N.S.	2.16	0.95	4.78	46.58	0.76

N_1: 45 kg N/fad.
N_2: 60 kg N/fad.
N_3: 75 kg N/fad.

Table 9. Effect of the interaction among tillage systems, cropping systems and N-fertilizer levels on seed yield/faddan of sunflower in 2003 and 2004 seasons

T	I	2003 season				2004 season			
		N-fertilizer levels (kg/fed)				N-fertilizer levels (kg/fad.)			
		N_1	N_2	N_3	Mean	N_1	N_2	N_3	Mean
T_1	I_1	699.56	713.85	730.24	714.55	611.26	632.75	640.18	628.06
	I_2	914.23	930.56	990.39	945.06	851.70	900.11	937.86	896.55
	Mean	806.89	822.20	860.31	829.80	731.48	766.43	789.02	762.31
T_2	I_1	590.16	618.27	629.36	612.59	583.24	593.86	615.00	597.36
	I_2	850.75	866.22	899.37	872.11	790.13	814.19	876.57	826.96
	Mean	720.45	742.24	764.36	742.35	686.68	704.02	745.78	712.16
L.S.D at 5%									
T x I		NS				NS			
T x N		NS				NS			
I x N		NS				NS			
T x I x N		51.03				58.65			

T: Tillage systems
T_1: Tillage
T_2: No-tillage

I: cropping systems
I_1: Intercropping planting
I_2: Solid planting

N: Nitrogen fertilizer levels
N_1: 45 kg N/fed
N_2: 60 kg N/fed
N_3: 75 kg N/fed

Table 10. Effect of the interaction among tillage systems, cropping systems and N-fertilizer levels on competitive relationships and yield advantageous of soybean and sunflower in 2003 and 2004 seasons

T	N-fertilizer levels (kg/fed)	LER		RCC		Aggressivity			
						2003		2004	
		2003	2004	2003	2004	ACS	ASC	ACS	ASC
T_1	N_1	1.30	1.23	3.90	2.61	0.22	- 0.22	0.21	- 0.21
	N_2	1.30	1.21	3.68	2.48	0.24	- 0.24	0.19	- 0.19
	N_3	1.27	1.21	3.23	2.47	0.21	- 0.21	0.15	- 0.15
T_2	N_1	1.20	1.26	2.35	3.10	0.18	- 0.18	0.22	- 0.22
	N_2	1.28	1.24	3.06	2.77	0.18	- 0.18	0.22	- 0.22
	N_3	1.23	1.21	2.61	2.46	0.17	- 0.17	0.19	- 0.19

T: Tillage systems N_1: 45 kg N/fad.
T_1: Tillage N_2: 60 kg N/fad.
T_2: No-tillage N_3: 75 kg N/fad.

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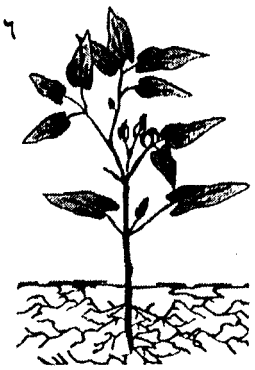

حوليات العلوم الزراعية
جامعة عين شمس ، القاهرة
مجلد(٥٣)، عدد (١)، ١٤٥-١٥٦، ٢٠٠٨

تأثير نظم الخدمة والتسميد النيتروجينى على الحاصل ومكوناته لمحصولى عباد الشمس وفول الصويا المحملين معاً فى الأراضى الجيرية

[١٢]

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أجريت هذه الدراسة بمحطة البحوث والتجارب الزراعية بالنوبارية خلال موسمى ٢٠٠٣، ٢٠٠٤م لدراسة تأثير نظم الخدمة (خدمة، بدون خدمة) ومعاملات التحميل (زراعة منفردة ، زراعة محملة) وثلاثة مستويات من التسميد النيتروجينى (٤٥، ٦٠ و٧٥ كجم نيتروجين/فدان) على حاصل عباد الشمس وفول الصويا ومكوناتهما والعلاقات التنافسية بينهما فى الأراضى الجيرية وكان التصميم المستخدم قطع منشقة مرتين فى أربع مكررات، ويمكن تلخيص النتائج فيما يلى:

١. فول الصويا

أظهرت النتائج أن نظم الخدمة ومعاملات التحميل كان لهما تأثير معنوى على طول النبات ، عدد القرون / نبات ، حاصل النبات و حاصل الفدان ، كما أن معاملات التحميل كان لها تأثير معنوى على محتوى البذور من البروتين خلال موسمى الزراعة ، كما أظهرت النتائج أن مستويات التسميد النيتروجينى كان لها تأثير معنوى على جميع الصفات التى تم دراستها بإستثناء وزن الـ ١٠٠ بذرة وذلك فى الموسم الأول ، كما أعطت الخدمة الكاملة أعلى حاصل بالمقارنة بالزراعة بدون خدمة خلال موسمى الزراعة ، كما أوضحت النتائج أن أعلى حاصل بذور/ فدان نتج من الخدمة الكاملة مع إضافة ٧٥ كجم نيتروجين/فدان وذلك فى الزراعة المنفردة خلال موسمى الزراعة.

٢. عباد الشمس

أوضحت النتائج أن نظم الخدمة كان لها تأثير معنوى على طول النبات ، عدد الأوراق/ نبات ، وزن الـ ١٠٠ بذرة ، حاصل النبات وحاصل الفدان خلال موسمى الزراعة ، كما كان لمعاملات التحميل ومستويات التسميد النيتروجينى تأثير معنوى على طول النبات ، عدد الأوراق ، قطر القرص ، وزن الـ ١٠٠ بذرة ، حاصل النبات ، حاصل الفدان والنسبة المئوية لمحتوى الزيت وذلك خلال موسمى الزراعة ، كما أظهرت النتائج أن مستويات التسميد النيتروجينى كان لها تأثير معنوى فى الموسم الأول على قطر الساق ، كما نتج أعلى حاصل بذور/فدان من الخدمة الكاملة مع الزراعة المنفردة وبإضافة ٧٥ كجم نيتروجين/فدان خلال موسمى الزراعة.

أوضحت النتائج أن قيمة المكافىء الأرضى لمحصول عباد الشمس وفول الصويا كانت أكبر من واحد صحيح، كما أشارت النتائج إلى سيادة عباد الشمس على فول الصويا وذلك عندما تم حساب العدوانية.

تحكيم: أ.د توكل يونس رزق
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