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YIELD POTENTIALITY OF SESAME AS AFFECTED BY FARMYARD MANURING AND NITROGENOUS FERTILIZATION UNDER SANDY SOIL CONDITIONS

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ABSTRACT

Two field experiments were performed in the Experimental Farm, Faculty of Agriculture, Zagazig University at Khattara, Sharkia Governorate, Egypt during 2000 and 2001 summer seasons to study the effect of farmyard manure (0 and 15 m^3/fad.), N levels (20, 40, 60 kg N/fad.) and N sources (urea, ammonium nitrate and ammonium sulphate) on yield potentiality of sesame under sandy soil conditions. The results could be summarized as follows:

Application of farmyard manure (FYM) significantly increased seed yield and most of its attributes as well as oil yield/fad., except number of seeds/capsule, seed weight/capsule and seed oil content (%), which were not affected significantly by FYM application.

Each N increment increased significantly seed yield and all attributes as well as oil yield/fad., while seed oil content (%), was not affected significantly in the two seasons and their combined.

In both seasons, addition of N as ammonium sulphate (AS) showed a favourable significant effect on plant height, fruiting zone length, number of capsules/plant, seed weight/plant and seed and oil yields/fad., whereas urea (U) recorded the lowest averages in this respect.

Significant interactions between the studied factors indicated that addition of FYM increased the response of sesame to the increase of N level particularly when given as ammonium sulphate than as ammonium nitrate or urea.

Seed yield (kg/fad.) was positively correlated with each of leaf chlorophyll content, plant height, fruiting zone length, number of branches/plant, 1000-seed weight, number of seeds/capsule, number of capsules/plant, seed weight/capsule, seed weight/plant and oil yield/fad. where correlation coefficients were 0.714, 0.903, 0.881, 0.894, 0.911, 0.474, 0.890, 0.496, 0.795 and 0.998, respectively.

Path analysis revealed that, the main sources of seed yield variation according to their relative importance were, 1000-seed weight (46.36%), fruiting zone length (30.28%) and number of capsules/plant (10.38%), since, the direct and indirect effects of these three characters amounted to 87.02% from seed yield variation.

INTRODUCTION

Sesame is a common oil and pulse tropical crop. To overcome oil gab in Egypt efforts should be devoted to expand the sesame cultivated area along with sustaining the productivity per unit area through growing high yielding varieties and improving the agronomic practices.

A great attention is being paid to the use of bioagriculture in sesame production, using organic fertilizers, in order to reduce soil, water and air pollution through reducing the use of mineral fertilizers. Farmyard manure has a considerable role in improving soil physical properties (Bhandari *et al.*, 1989 ; Tester, 1990 ; El-Mandoh and Abdel-Magid, 1996 and Shabayek, 1997). In this respect, Amar *et al.*, (1990) noticed that the most effective treatment on increasing sesame seed yield was urea +FYM followed by urea + mustard cake. In addition, Majid *et al.*, (1992) found that application of water hyacinth increased seed yield by 20% compared with cattle manure. Mondal *et al.*, (1992) reported that seed yield of sesame was increased with addition of 10 ton FYM/ha. However, Tiwari *et al.*, (1995) observed that application of 40 Kg N+ 30Kg P_2O_5+20 Kg K_2O+2.5 ton FYM+30 Kg $MgSO_4$+15 $ZnSO_4$/ha gave the highest sesame seed yield. Moreover, Abdel-Sabour and Abo El-Seoud (1996) added different rates and combinations of composts of biosolids, municipal solid waste and water hyacinth, they concluded that all compost treatments stimulated sesame growth, while the chemical composition of seed was not affected. Furthermore, EL-Kramany *et al.*, (2000) found that organic manuring with 20 m^3/fad FYM significantly increased plant height, number of branches and capsules/plant, seed index, seed yield and seed oil content of sesame.

Growing sesame in the sandy soils faces many problems, among them the low organic matter, consequently the poor soil fertility. Under such conditions previous studies stressed the need of N fertilizer for sesame. Several research workers have observed positive response of sesame to N application (Mehrotra *et al.*, 1978; Abdel-Rahman *et al.*, 1980 and Daulay and Singh, 1982). Abdel-Wahab *et al.*, (1983) observed that sesame responded to application of N up to 45KgN/fad., where plant height, fruiting zone length and branches and capsules numbers/plant were significantly increased compared with the check N. Also, Ghanem and Gomaa (1985) noticed that sesame plant height, fruiting zone length, branches and capsules numbers/plant, 1000-seed weight, seed yield/fad., and oil yield/fad. were significantly increased due to N application up to 60Kg N/fad., where seed oil content was decreased. Moreover, Ghanem (1989) observed that adding N fertilizer up to 60KgN/fad. reflected a significant increase in all yield and yield attributes and oil yield/fad. of sesame. Similar results were reported by Basha (1994) and Anton and EL-Raies (2000) when adding 75 and 120 KgN/fad. to sesame, respectively. Furthermore, Fayed *et al.*, (2000) reported that sesame number of capsules/plant and seed and oil yields/fad. were significantly increased under sandy soil conditions by N application up to 60KgN/fad.

Among the available number of nitrogenous fertilizers, ammonium sulphate, ammonium nitrate and urea are widely used in sesame cultivation. Thus, the evaluation of these forms under sandy soil conditions with regard to their effects on sesame productivity is of great importance. In this respect and under saline soil conditions, Gandhi and Paliwal (1976) found that loss of N as NH_3 was maximized when N was given in the form of urea or ammonium nitrate, such losses were attributed to a decrease in the rate of N mineralization. Under alkaline soil conditions, ammonium sulphate was found to be the most efficient N form, due to the more acidity released during biological oxidation of NH_4 along with the release of SO_4 which increases acidity and hence might decrease the rate of NH_3 losses (Tisdale and Nelson, 1970). Due to the low cation exchange capacity of sandy soils, the use of ammonium fertilizers might help in minimizing NO_3 leaching losses as well.

Therefore, this investigation was undertaken to find out the response of sesame to three N levels given in three N forms in presence and absence of the addition of FYM under sandy soil conditions.

MATERIALS AND METHODS

Two field experiments were conducted at the Experimental Farm, Faculty of Agriculture, Khattara, Sharkia Governorate, Egypt, during two successive summer seasons (2000 and 2001) to find out the response of sesame to three levels of N (20,40 and 60KgN/fad.) and three N sources (urea 46% N, ammonium nitrate 33.5% N and ammonium sulphate 20.5% N) with and without the application of $15m^3$/fad. farmyard manure (FYM) on yield and its attributes cf sesame (Giza 32) in sandy soil. The soil was sandy in texture with a pH of 7.85 and 0.50% organic matter content. The soil had available N, P and K contents of 12.4, 3.01 and 50.1 ppm, respectively (average of the two seasons for the upper 25cm of the soil). Each experiment included 18 treatments which were the combinations of three N levels and three N sources without or with application of farmyard manure. A split-split plot design with four replicates was followed. FYM was assigned to the main plots, whereas levels and sources of N were allotted in the 1^{st} and 2^{nd} order sub-plots, respectively. The area of the experimental plot was $15m^2$ (3m in width and 5m in length) included 6 rows, 50cm apart. Seeds of sesame were sown in hills 15 cm apart on May 25^{th} and 28^{th} in the two seasons, respectively. After 20 days from sowing (DAS) the seedlings were thinned to two plants per hill. Sesame was preceded by wheat in the two seasons. Calcium superphosphate (15.5% P_2O_5) at rate of 31 kg/fad. as well as potassium sulphate (48-52% K_2O) at rate of 50 kg k_2O/fad. were added at seed bad preparation. Nitrogen was applied in three equal doses (20,30 and 40 DAS). Farmyard manure (FYM) was incorporated at 10cm soil depth before sowing. The chemical properties of farmyard manure were determined according to Jackson (1958) as shown in Table 1.

Table (1): Chemical properties of farmyard manure in the two seasons

Parameters	1^{st} season	2^{nd} season
Organic matter %	13.74	13.95
Total N%	0.56	0.58
Available N ppm	301	319
Available P ppm	400	411
Available K ppm	1160	1172

The normal cultural practices for growing sesame under these conditions were followed using flood irrigation.

At 60 days after sowing, a random sample of ten plants was taken from the 2^{nd} row, where chlorophyll content of leaves was recorded using chlorophyll meter (SPAD- 503, Soil-plant analysis Development (SPAD) section Minolta Camera co., Oska, Japan) according to Castelli *et al.*, (1996). At harvest, ten plants were taken randomly from each experimental plot and the following characters were recorded: plant height (cm), fruiting zone length (cm), number of branches/ plant, number of capsules/plant, number of seeds/capsule, 1000-seed weight (gm), seed weight/ capsule (mg) and seed weight/ plant (gm). Seed yield (kg/fad.) was determined from the central three rows. Seed oil content was determined by soxhlet apparatus according to the method described by A.O.A.C. (1980). Oil yield (kg/fad.) was also calculated by multiplying the seed yield by its oil content.

Analysis of variance and combined analysis for the two seasons were carried out as described by Snedecor and Cochran (1967). For comparison between mean's. Duncan new multiple range test was applied (Duncan, 1955). The combined data of yield and yield attributes were subjected to simple correlation and path coefficient calculated according to Svab (1973).

RESULTS AND DISCUSSION

A: leaf chlorophyll content, plant height, fruiting zone length and number of branches/plant:

A.1- Farmyard manure effect:

In the two seasons and their combined, application of farmyard manure at the rate of 15m^3/fad. significantly increased leaf chlorophyll content, plant height, fruiting zone length and number of branches/plant. The favourable effect of farmyard manure in enhancing these traits could be ascribed to the role of farmyard manure in providing sesame with it requirements from macro and micronutrients (Table 1). The role of FYM in improving soil physical and biological properties cannot be neglected in this respect (Bhandari *et al.*, 1989 and Shabayek, 1997).

A.2- Nitrogen levels effect:

Applying N fertilizer up to 60KgN/fad. to sesame reflected significant effects on leaf chlorophyll content, plant height, fruiting zone length and branches number/plant (Table 2). On the average of the two seasons, the fruiting zone length was increased from 55.82 to 58.91 and then to 61.40cm when the N level was increased from 20 to 40 and then to 60KgN/fad. Also, the number of branches/ plant was increased from 1.762 to 2.306 and 2.492 due to these two N increments. It is evident that nitrogen enhanced vegetative growth of sesame and hence improved yield contributing characters. These improvements were rather expected as the soil of the experimental site was sandy with a very poor soil fertility level from nitrogen. These results are in general accordance with those reported by Abdel-Wahab *et al.*, (1983), Ghanem and Gomaa (1985) and Ghanem (1989).

A.3- Nitrogen sources effect:

Varying N sources arrier reflected significant effect on plant height and fruiting zone length in both seasons, and their combined, however, leaf chlorophyll content and number of branches/plant were not significantly affected (Table 2). These data clearly indicate that ammonium containing fertilizer (AS and AN) were more efficient than ammonium releasing fertilizers (U) in enhancing plant elongation and fruiting zone length.

Table (2): Effect of farmyard manure, nitrogen levels and nitrogen sources on leaf chlorophyll content, plant height, fruiting zone length and number of branches/plant of sesame in the two growing seasons and their combined.

Main effects and interactions	Leaf chlorophyll content♦			Plant height (cm)			Fruiting zone length (cm)			No. of branches/plant		
	2000	2001	Combined	2000	2001	Combined	2000	2001	Combined	2000	2001	Combined
Farmyard manure (m^3/fad.)(M)												
0.0	38.37b	34.33b	36.35b	101.3b	94.48b	97.90b	57.39b	52.27b	54.83b	1.924b	1.639b	1.781b
15.0	41.40a	37.73a	39.56a	109.1a	103.2a	106.2a	64.97a	60.21a	62.59a	2.754a	2.428a	2.591a
F. test	**	**	**	**	**	**	*	*	**	*	*	**
Nitrogen levels (KgN/fad.)(N)												
20.0	38.16c	34.55c	36.35c	101.3c	96.47c	98.87c	57.63c	54.00c	55.82c	1.871c	1.652c	1.762c
40.0	40.19b	35.83b	38.01b	105.3b	98.25b	101.8b	61.84b	55.99b	58.91b	2.499b	2.112b	2.306b
60.0	41.31a	37.71a	39.51a	109.1a	101.8a	105.4a	64.08a	58.73a	61.40a	2.647a	2.336a	2.492a
F. test	**	**	**	**	**	**	**	*	**	*	*	**
Nitrogen Sources (S)												
Urea (U)	39.85	36.00	37.92	103.1c	97.45c	100.3c	59.22c	55.00b	57.11c	2.333	2.033	2.183
Ammonium nitrate(AN)	39.90	36.06	37.98	105.0b	98.19b	101.6b	61.14b	55.82b	58.48b	2.341	2.032	2.187
Ammonium sulphate (As)	39.91	36.03	37.97	107.6a	100.9a	104.2a	63.18a	57.90a	60.54a	2.343	2.036	2.189
F. test	N.S.	N.S.	N.S.	*	*	**	*	*	*	N.S.	N.S.	N.S.
Interaction												
M X N	N.S.	N.S.	N.S.	*	N.S.	**	N.S.	*	**	*	*	*
M X S	N.S.	N.S.	N.S.	N.S.	N.S.	*	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
N X S	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.

♦ Determined using chlorophyll meter (SPAD).

*, ** and N.S indicate significant at 0.05, 0.01 and insignificant, respectively.

Table (3): Effect of farmyard manure, nitrogen levels and nitrogen sources on yield attributes of sesame in the two seasons and their combined.

Main effects and interactions	Number of capsules/plant			Number of seeds/capsule			1000-seed weight (gm)			Seed weight/capsule (mg)			Seed weight/plant (gm)		
	2000	2001	Combined	2000	2001	Combined	2000	2001	Combined	2000	2001	Combined	2000	2001	Combined
Farmyard manure (m^3/fad.)(M)															
0.0	32.17b	28.80b	30.49b	41.77	39.55	40.66	2.925b	2.735b	2.830b	179.5	167.0	173.2	3.135b	2.673b	2.904b
15.0	44.44a	38.77a	41.60a	41.87	39.58	40.72	3.362a	3.246a	3.304a	179.9	167.7	173.8	4.173a	3.619a	3.896a
F. test	**	**	**	N.S.	N.S.	N.S.	*	*	**	N.S.	N.S.	N.S.	*	*	*
Nitrogen levels (KgN/fad.)(N)															
20.0	34.67c	30.70c	32.68c	35.86c	33.42c	34.64c	2.966c	2.839c	2.902c	166.9c	155.7c	161.3c	3.144c	2.666c	2.905c
40.0	38.16b	33.16b	35.67b	41.07b	38.59b	39.83b	3.110b	2.987b	3.049b	160.6b	167.7b	174.1b	3.584b	3.166b	3.375b
60.0	42.06a	37.50a	39.78a	46.53a	46.68a	47.60a	3.355a	3.145a	3.250a	191.7a	178.6a	185.1a	4.233a	3.606a	3.920a
F. test	**	*	**	*	**	**	*	**	**	*	**	**	*	**	**
Nitrogen Sources (S)															
Urea (U)	36.94c	32.74c	34.64c	41.79	39.55	40.67	3.143	2.992	3.067	179.6	166.6	173.1	3.422	3.003c	3.212c
Ammonium nitrate (AN)	37.88b	33.27b	35.58b	41.80	39.56	40.68	3.143	2.987	3.065	179.4	167.4	173.4	3.641	3.111b	3.376b
Ammonium sulphate(AS)	40.09a	35.35a	37.72a	41.87	39.57	40.72	3.145	2.993	3.069	180.1	167.9	174.0	3.898	3.324a	3.611a
F. test	**	**	**	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	*	**
Interaction															
M X N	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	*	*	N.S.	N.S.	N.S.	N.S.	*	N.S.	N.S.
M X S	N.S.	**	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
N X S	**	N.S.	**	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.

*, ** and N.S indicate significant at 0.05, 0.01 and insignificant, respectively.

Yawalkar *et al.*, (1967) found that the acidity released from ammonium sulphate (AS) is more than that released from ammonium nitrate (AN), which in turn was more than that released from urea (U). As the soil of the experimental field had a higher pH value (7.85), the use of AS followed by the use of AN, was more efficient improving the availability and the uptake of plant nutrients particularly phosphorus (*Tisdale and Nelson, 1970*).

A.4- Interaction effect:

Some of the interactions affected significantly the aforementioned characters. But, no valuable information could be added to those of the main effects therefore, data of these interactions were excluded.

B. Yield attributes:

B.1- Farmyard manure effect:

The results in Table (3) show that farmyard manure addition significantly increased number of capsules/plant, 1000-seed weight and hence seed weight/plant in both seasons and their combined. But, this addition was without significant effect on number of seeds/capsule or seed weight/ capsule. The favourable effect of FYM on these yield attributes was also observed on leaf chlorophyll content and plant height as well as fruiting zone length and number of branches/plant (Table 2). These results ascertain those reported by EL-Kramany *et al.*, (2000).

B.2- Nitrogen levels effect:

In both seasons, each increment in N-level secured a significant increase in number of capsules/ plant, number of seeds/capsule, 1000-seed weight, seed weight/ capsule and seed weight/plant. These data were ascertained by the combined analysis. The response to N fertilizer could be explained by the apparently inadequate level of available N in sandy soils and in turn the well utilization of added N up to the highest N level tried herein (60KgN/fad.). These results are in general accordance with those reported by Mehrotra *et al.*, (1978), Abdel-Rahman *et al.*, (1980), Ghanem (1989), Basha (1994) and Anton and EL-Raies (2000).

B.3- Nitrogen sources effect:

Ammonium sulphate was more efficient than AN and U, as far as, number of capsules/plant and seed weight/plant are concerned. But N sources had no significant effects on number of seeds/capsule, 1000-seed weight and seed weight/ capsule. The highest number of capsules/plant (37.72) was recorded by AS, whereas, the lowest one (34.84) was recorded by U. Similar effects were observed in plant height and fruiting zone length (Table 3).

It may be explained that sesame made better use of ammonium sulphate and ammonium nitrate than urea due to more acidity released from the formers than from the latter. The high efficiency of AS and AN compared to U could be partly attributed to more N volatilization losses from urea under alkaline soil conditions (Alessi and Power, 1972).

B.4- Interaction effect:

Data in Table (3-a) show a significant effect to the interaction between N levels and N sources on number of capsules/plant (combined). It is evident that the number of capsules/plant showed greater response to each N increment when N was given as AS than as AN. The lowest response was obtained when N was given as urea. Each N increment produced an average increase of 3.56, 2.66 and 1.16 capsule/plant, for the these three N sources in respective order (regression coefficient).

Table (3-a): Number of capsules/plant as affected by nitrogen levels and nitrogen sources (combined).

N Levels (kg N/fad.)	N sources		
	Urea	Ammonium nitrate	Ammonium sulphate
20	B 32.21c	B 32.30c	A 33.54c
40	C 34.25b	B 35.29b	A 37.47b
60	C 38.06a	B 39.14a	A 42.14a
Regression coefficient	1.16	2.56	3.56

C. Seed yield, seed oil content (%) and oil yield:

C.1- Farmyard manure effect:

It is obvious from the recorded data in Table (4) that the application of 15m^3/fad. FYM significantly increased seed and oil yields/fad., however, FYM had no significant effect on seed oil content (%).

The increase observed in seed yield due to addition of FYM is rather expected as most of seed yield attributes were increased due to this addition (Tables 2 and 3). It is evident that the increase in sesame yield due to addition of the FYM could be explained through its favourable effect on water retention and hence on applied nutrients against leaching (Askar, *et al.*, 1994). Thus, the beneficial effect of organic manuring on yield potentiality for several crops was, also, reported by Amar *et al.*, (1990); Majid *et al.*, (1992); Mondal *et al.*, (1992) and Tiwari *et al.*, (1995) on sesame.

C.2- Nitrogen levels effect:

Data in Table (4) show that increasing N level, from 20 to 40 and 60KgN/fad. caused significant increase in seed and oil yields/fad. This trend was true in both seasons and their combined. However, seed oil content % was not affected by N levels. According to the combined analysis, the seed yield/fad. was increased from 192.9 to 227.5 and then to 272.8Kg/fad. when the N level was increased from 20 to 40 and then 60KgN/fad. Also, the oil yield was increased from 96.77 to 114.0 and then 136.8 kg/fad. when N level was increased from 20 to 40 and 60KgN/fad.

It is clear that the response of seed yield to N fertilization, generally is in correspondence with the response of most yield attributes to increment of N fertilizer level, too (Tables 2 and 3). These results are in accordance with those reported by Basha (1994), Anton and EL-Raies (2000) and Fayed *et al.*, (2000).

Table (4): Effect of farmyard manure, nitrogen levels and nitrogen sources on seed and oil yields/fad. and seed oil content (%) of sesame in the two seasons and their combined.

Main effects and interactions	Seed yield (Kg/fad.)			Seed oil content (%)			Oil yield (kg/fad.)		
	2000	2001	Combined	2000	2001	Combined	2000	2001	Combined
Farmyard manure (m^3/fad.) (M)									
0.0	209.4b	171.0b	190.2b	49.26	51.22	50.24	103.2b	87.63b	95.40b
15.0	303.4a	240.5a	272.0a	49.25	51.21	50.23	149.4a	123.2a	136.3a
F. test	**	**	**	N.S.	N.S.	N.S.	**	**	**
Nitrogen levels (KgN/fad.)(N)									
20.0	210.6c	175.0c	192.9c	49.25	51.23	50.24	103.9c	89.69c	96.77c
40.0	257.2b	197.8b	227.5b	49.25	51.21	50.23	126.7b	101.3b	114.0b
60.0	301.2a	244.5a	272.8a	49.26	51.20	50.23	148.4a	125.2a	136.8a
F. test	**	**	**	N.S.	N.S.	N.S.	**	**	**
Nitrogen Sources (S)									
Urea (U)	238.7c	193.5c	216.1c	49.26	51.23	50.24	117.6c	99.17c	108.4c
Ammonium nitrate (AN)	254.2b	203.8b	229.0b	49.24	51.20	50.22	125.2b	104.4b	114.7b
Ammonium sulphate(AS)	276.3a	220.0a	248.2a	49.26	51.22	50.24	136.1a	112.7a	124.4a
F. test	**	**	**	N.S.	N.S.	N.S.	*	*	**
Interaction									
M X N	**	**	**	N.S.	N.S.	N.S.	*	**	**
M X S	**	**	**	N.S.	N.S.	N.S.	*	*	**
N X S	**	**	**	N.S.	N.S.	N.S.	N.S.	N.S.	**

*, ** and N.S indicate significant at 0.05, 0.01 and insignificant, respectively.

C.3- Nitrogen sources effect:

In both seasons and their combined, significant differences could be detected in seed and oil yields/fad. due to varying N fertilizer, but seed oil content % was not affected by N sources. It was obvious that addition of N in the form of ammonium sulphate (AS) produced the highest seed and oil yields/fad., whereas U produced the lowest ones. These data reflect those observed in most seed yield attributes. It was mentioned that the highest averages of plant height, fruiting zone length (Table2), number of capsules/plant, seed weight/plant (Table3) were recorded when N was given as AS, followed by AN and U, in respective order.

C.4- Interaction effect:

Data of combined analysis presented in Table (4-a) show that seed and oil yields/fad. were significantly affected by the interaction between FYM and N levels. It was evident that addition of FYM increased the efficiency of added N as expressed in more magnitude of seed yield/fad. response to each N increment (57.35) compared with this response (22.6) in absence of this addition. This was also observed in the response of oil yield/fad. to N level increase. Therefore, the highest seed and oil yields (330.4 and 165.5 kg/fad.) were recorded when sesame received 15m^3/fad. and 60 KgN/fad., whereas the lowest ones (170.1 and 85.27 Kg/fad.) were obtained when FYM was not added and N was given in 20KgN/fad.

Table (4-a): Seed and oil yields (Kg/fad.) as affected by farmyard manure and nitrogen levels (combined).

Farmyard manure m^3/fad.	N levels (Kg N/fad.)			
	20	40	60	Regression coefficient
	Seed yield/fad.			
0.0	C 170.1b	B 185.2b	A 215.3b	22.60
15.0	C 215.7a	B 269.8a	A 330.4a	57.35
	Oil yield/fad.			
0.0	C 85.27b	B 92.85b	A 108.1b	11.42
15.0	C 108.3a	B 135.2a	A 165.5a	28.60

Table (4-b): Seed and oil yields (kg/fad.) as affected by farmyard manure and nitrogen sources (combined).

Farmyard manure (m^3/fad.)	N sources		
	Urea	Ammonium nitrate	Ammonium sulphate
	Seed yield/fad.		
0.0	C 179.9b	B 188.4b	A 202.3b
15.0	C 252.3a	B 269.6b	A 294.0a
	Oil yield/fad.		
0.0	C 90.28b	B 94.45b	A 101.5b
15.0	C 126.5a	B 135.1a	A 147.4a

Table (4-c): Seed and oil yields (kg/fad.) as affected by nitrogen levels and nitrogen sources (combined).

N levels (Kg/fad.)	N sources		
	Urea	Ammonium nitrate	Ammonium sulphate
	Seed yield (Kg/fad.)		
20	C 182.9c	B 190.0c	A 205.9c
40	C 212.2b	B 226.7b	A 243.6b
60	C 253.3a	B 270.2a	A 295.0a
Regression coefficient	23.4	33.3	30.8
	Oil yield (Kg/fad.)		
20	C 91.72c	B 95.25c	A 103.4c
40	C 106.4b	B 113.6b	A 122.1b
60	C 127.0a	B 135.5a	A 147.8b
Regression coefficient	11.72	16.57	15.22

It is obvious from Table (4-b) that addition of FYM increased the response of sesame seed and oil yields/fad. to the addition of N in the form of AS than in the form of AN or urea.

D- Yield analysis:

D.1- Correlation studies:

Data of simple correlation coefficients between seed yield and its contributing characters of sesame are presented in Table (5). Seed yield showed positive and significant correlation with each of leaf chlorophyll content, plant height, fruiting zone length, number of branches/plant, 1000-seed weight, number of seeds/capsule, number of capsules/ plant, seed weight/ capsule, seed weight/plant and oil yield. In this respect, Ghanem (1989) observed that oil yield/fad. was positively correlated with each of plant height, fruiting zone length, number of branches and capsules / plant, seed weight/ capsule, 1000-seed weight and both straw and seed yields. Basha (1994) found that seed yield was positively correlated with each of plant height, fruiting zone length, number of branches and capsules / plant, seed weight/ plant, 1000- seed weight and both oil and straw yields.

Also, leaf chlorophyll content showed positive and significant associations with plant height, fruiting zone length, number of branches / plant, 1000-seed weight, number of seeds/ capsule, number of capsules/ plant, seed weight/ capsule, seed weight/ plant and oil yield/fad.

Likewise, plant height was positively correlated with fruiting zone length, number of branches/ plant, 1000-seed weight, number of seeds / capsule, number of capsules/plant, seed weight/ capsule, seed weight/plant and oil yield/fad.

Table (5): Simple correlation coefficients between seed yield (Kg/fad.) and its attributes of sesame (combined).

Parameters	1	2	3	4	5	6	7	8	9	10	11
Y-seed yield/fad.	0.714**	0.903**	0.881**	0.894**	0.911**	0.474**	0.890**	0.496**	0.795**	0.043	0.998**
1- leaf chlorophyll content	-	0.824**	0.767**	0.804**	0.815**	0.682**	0.853**	0.651**	0.617**	0.409**	0.736**
2- plant height		-	0.905**	0.877**	0.871**	0.571**	0.906**	0.510**	0.854**	0.145	0.906**
3- fruiting zone length			-	0.833**	0.855**	0.468**	0.876**	0.479**	0.766**	0.105	0.884**
4- number of branches/plant				-	0.902**	0.505**	0.878**	0.464**	0.831**	0.001	0.890**
5- 1000-seed weight					-	0.526**	0.928**	0.512**	0.819**	0.045	0.910**
6- Number of seeds/capsule						-	0.463**	0.887**	0.413**	0.403**	0.496**
7- Number of capsules/plant							-	0.493**	0.758**	0.229	0.900**
8- Seed weight/capsule								-	0.249	0.557**	0.529**
9- Seed weight/plant									-	0.292*	0.772**
10- Seed oil percentage											0.103
11- Oil yield/fad.											-

Moreover, fruiting zone length had positive and significant associations with number of branches/plant, 1000-seed weight, number of seeds/ capsule, number of capsules / plant, seed weight / capsule, seed weight / plant and oil yield/fad.

Meanwhile, number of branches/plant indicated positive and significant relationships with 1000-seed weight, number of seeds/ capsule, number of capsules/plant, seed weight/ capsule, seed weight/ plant and oil yield/fad.

Similarly, 1000- seed weight gave positive and significant relations with number of seeds/ capsule, number of capsules/plant, seed weight / capsule, seed weight/ plant and oil yield/fad.

Furthermore, number of seeds/capsule was closely correlated with number of capsules / plant, seed weight / capsule, seed weight/ plant and oil yield/fad.

Number of capsules/plant indicated positive significant relationships with seed weight/ capsule, seed weight/ plant and oil yield/fad.

Seed weight/ capsule gave positive and highly relations with seed weight / plant and oil yield/fad.

Ultimately, positive and significant interrelationship was recorded between seed weight/ plant and oil yield/fad.

The present results indicate that seed yield and its contributing characters were positively and significantly associated. Thus, it seems evident that all these characters contributed to the final seed yield of sesame.

D-2- Path analysis:

Partitioning of simple correlation coefficients between seed yield on one hand and each of number of capsules/ plant, fruiting zone length and 1000-seed weight on the other hand are illustrated in Table (6).

Table (6): Partitioning of simple correlation coefficients between seed yield and its components of sesame.

Source of variation	Value
Number of capsules/plant	
Direct effect	0.116
Indirect effect via fruiting zone length	0.302
Indirect effect via 1000-seed weight	0.472
Total (ry_1)	0.890
Fruiting zone length	
Direct effect	0.343
Indirect effect via number of capsules/plant	0.103
Indirect effect via 1000-seed weight	0.435
Total (ry_2)	0.881
1000-seed weight	
direct effect	0.508
indirect effect via number of capsules/plant	0.109
indirect effect via fruiting zone length	0.294
Total (ry_3)	0.911

It is obvious from the results that the direct effect of number of capsules/ plant as well as the indirect effect via fruiting zone length and 1000-seed weight were positive and valued about 0.116, 0.302 and 0.472, respectively. In this respect Gupta and Chopra (1984) showed that capsules on branches number affected seed yield directly as well as indirectly. For fruiting zone length, the data showed that the direct effect as well as the indirect effects via number of capsules / plant and 1000-seed weight were positive and valued 0.343, 0.103 and 0.435, respectively.

1000- seed weight showed positive direct effect with about 0.508, while the indirect effects via number of capsules / plant and fruiting zone length were positive and valued 0.109 and 0.294, respectively. In the same respect Basha (1994) observed that 1000-seed weight affected seed yield directly and indirectly.

The relative importance in contributing to seed yield recorded as percentages of variation for number of capsules/ plant, fruiting zone length and 1000-seed weight and their interactions are shown in Table (7). The calculation of path coefficient indicated that 1000-seed weight had the greatest direct effect with about 25.9% followed by fruiting zone length with about 11.8%, number of capsules/ plant was the lowest in this respect with about 1.36%. Concerning the indirect effects, it was clear also that 1000-seed weight was the highest followed by fruiting zone length and the lowest was number of capsules / plant. Also, R^2 recorded herein reached 87.02% of the total yield variation. However, the residual effect of the other seed yield components included in the present study was, only, 12.98% only. This residual variation could be attributed to other yield contributing characters. Finally, according to the relative importance, the studied characters could be arranged as follows; 1000-seed weight (46.36), fruiting zone length (30.28) and number of capsules/ plant (10.38). In this connection Ghanem (1989) noticed that, number of capsules / plant, seed weight/ capsule and 1000-seed weight were the main sources of yield variation. Moreover, Basha (1994) revealed that, fruting zone length, number of capsules/ plant and 1000-seed weight were the main sources of yield variation. Furthermore, Awaad and Basha (2000) observed that number of capsules/plant, seed oil content, number of branches/plant and 1000-seed weight were the most important characters.

Table (7): Direct and joint effect of seed yield components presented as percentage of seed yield variation of sesame.

Source of variation		C.D.	%
Number of capsules/Plant		0.0136	1.36
Fruiting zone length		0.1181	11.81
1000-seed weight		0.2589	25.89
Number of capsules/plant X fruiting zone length		0.0703	7.03
Number of capsules/plant X 1000-seed weight		0.1103	11.03
Fruiting zone length X 1000-seed weight		0.2990	29.90
R^2		0.8702	87.02
Residual		0.1298	12.98
Total		1.00	100.00
	Direct	Indirect	Total
Number of capsules/plant	1.36	9.02	10.38
Fruiting zone length	11.81	18.47	30.28
1000-seed weight	25.89	20.47	46.36
Total	39.06	47.96	87.02

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تأثير التسميد البلدى والنيتروجينى على إنتاجية السمسم تحت ظروف الأراضى الرملية

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أقيمت تجربتان حقليتان بمزرعة كلية الزراعة بالخطارة– محافظة الشرقية خلال موسمى ٢٠٠٠، ٢٠٠١ لدراسة تأثير إضافة ١٥م٣ سماد بلدى مقارنة بعدم الإضافة، ثلاث مستويات من التسميد النيتروجينى (٢٠،٤٠،٦٠كجم ن/ف) وثلاث صور من النيتروجين (يوريا، نترات أمونيوم، سلفات أمونيوم) على القدرة الإنتاجية للسمسم بالأراضى الرملية ويمكن تلخيص النتائج فيما يلى:

أدى التسميد العضوى بالسماد البلدى إلى زيادة معنوية فى محصول البذور ومعظم مساهماته وكذلك محصول الزيت فى حين لم يتأثر كل من عدد البذور بالكبسولة، وزن بذور الكبسولة ومحتوى الزيت بالبذور بإضافة السماد البلدى وذلك مقارنة بعدم الإضافة.

ادت كل زيادة فى معدل التسميد النيتروجينى من ٢٠ إلى ٦٠كجم ن/فدان لزيادة معنوية فى محصول البذور ومساهماته وكذلك محصول الزيت ماعدا محتوى الزيت بالبذور التى لم تتأثر خلال موسمى النمو وفى التحليل التجميعى للموسمين.

ادت إضافة النيتروجين على صورة سلفات أمونيوم إلى زيادة معنوية فى كل من ارتفاع النبات، طول المنطقة الثمرية، عدد الكبسولات/النبات، وزن بذور النبات ومحصول البذور والزيت/فدان على حين سجلت اليوريا أدنى المتوسطات.

لوحظ تداخل فعل معنوى بين عوامل الدراسة حيث كانت استجابة السمسم لزيادة مستوى التسميد النيتروجينى أعلى عند إضافة السماد البلدى أو إضافة السماد النيتروجينى على صورة سلفات أمونيوم .

أظهرت البيانات وجود ارتباط موجب ومعنوى بين محصول البذور وكل من محتوى الورقة من الكلوروفيل ، ارتفاع النبات ، طول المنطقة الثمرية ، عدد الأفرع / النبات ، وزن ١٠٠٠-بذرة ، عدد البذور بالكبسولة ، عدد الكبسولات / النبات ، وزن بذور الكبسولة ، وزن بذور النبات ، محصول الزيت / فدان حيث كان معامل الارتباط : ٠,٧١٤ ، ٠,٩٠٣ ، ٠,٨٨١ ، ٠,٨٩٤ ، ٠,٩١١ ، ٠,٤٧٤ ، ٠,٨٩٠ ، ٠,٤٩٦ ، ٠,٧٩٥ ، ٠,٩٩٨ ، على الترتيب .

أوضحت نتائج تحليل معامل المرور أهمية وزن ١٠٠٠ بذرة ، طول المنطقة الثمرية وعدد الكبسولات / النبات حيث ساهمت بحوالى ٤٦,٣٦ ، ٣٠,٢٨ ، ١٠,٣٨% من التباين الكلى فى محصول البذور للفدان على التوالى .