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THE IMPACT OF PARTIAL REPLECEMENT OF – N -FERTILIZER BY BIO-FERTILIZER ON SEED AND AGRONOMIC CHARACTERS, YIELD AND SEED QUALITY OF SESAME

BY

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ABSTRACT

This study was carried out during two successive seasons 2006 and 2007 at Shandweel Agric. Res. Station. This investigation aimed to study the effect of microbin and biogen with or without different levels N fertilizer (0, 7.5, 15, 22.5 and 30Kg/fed^{-1}) on agronomic characters, yield and seed quality of two sesame cultivars (Shandweel3 and Toshka1 cultivars). Results indicated that most of the studied characters showed significant response to the bio – fertilization in both seasons and their combined. The application of microbin + 22.5Kg N fed^{-1} significantly increased agronomic characters and yield. The application of microbin + 30Kg N fed^{-1} gave the highest values of standard germination%, radical length, seedling dry weight, seedling vigor and crude protein. The Interaction effect between sesame cultivars and partial replacement of N by bio – fertilizer had significant effect on agronomic characters, yield and seed quality. The adding of microbin +22.5Kg N fed^{-1} to Shandweel 3 gave the highest values of plant height, length of fruiting zone, number of capsules/pl., capsule length, seed yield/ pl., seed yield/ fed^{-1}, oil yield fed^{-1} and seed index. Meanwhile, adding microbin + 30Kg N fed^{-1} to Shandweel3 had significant effect on standard germination%, radical length, seedling dry weight, seedling vigor and crude protein. The application of microbin + biogen to Toshka1 recorded the highest values of accelerated ageing germination%, electrical conductivity and total carbohydrate. It could be stated that the bio- fertilizer application has the advantage as a good substitute to high N application that cause harmful chemical pollution to environment.

Key words: sesame, bio – fertilizer, seed and agronomic characters, seed quality.

INTRODUCTION

Sesame is one of the most important oil seed crops. Its widely cultivated in the tropics and subtropics. It is gaining considerable importance on account of its high economic value as an edible oil and in food processing. Turner *et al.* (1985) indicated that addition of fertilizer and organic manures has a profound influence on the microbial population in soils. Also, Ravikumar *et al.* (2004) and Nisha *et al.* (2007) reported that the bio-fertilizer improved carbon and nitrogen mineralization by promoting soil microbial activities and narrowed down C: N ratio. Effect of bio – fertilizer on cation exchange capacity of the soil became evident with time. Physical structure of the soil was influenced due to the effect of the bio – fertilizer in increasing water holding capacity. Sesame crop has an important advantage because it could be grown under high temperature, low water supply and low levels of other inputs as reported by Weiss (1983) and Ashri *et al.* (1989). Nitrogen fertilizer has a vital role in increasing sesame production. Bio – fertilizer of nitrogen is an important cultural practice for viable economic production and in protection of the environmental components from pollution. Recently, many investigators have studied the

impect of some bio – fertilizer from bacterial origin, on sesame yield and its components, such as Tiwari *et al.* (1995), Singh *et al.* (1997) and Venkatakrishnan (1998). They found that the application of chemical fertilization (NPK) and bio – organic manure in different combinations increased seed yield, number of capsules $pl.^{-1}$, seed index and oil %. Ghosh and Mohiuddin in (2000) reported that the sesame yield components such as plant height, number of branches $pl.^{-1}$, number of capsules $pl.^{-1}$, number of seeds capsules $^{-1}$,seed index and seed yield were increased by use bio - fertilizer. In contrast, Ghosh (2000) indicated that the use of bio – fertilizer did not influence significantly the growth yield attributes and yield over control. Thiruppathi *et al.* (2001) indicated that soil application of NPK 35: 23: 23 Kg ha^{-1} and *Azospirillum* seed inoculation improved the varied growth characters, yield and yield attributes of sesame. The increment in yield was 49.2% over recommended application of NPK alone.

The present study was carried out to investigate the effect of different bio – fertilizer type and different levels of mineral nitrogen on sesame seed and agronomic characters, seed yield and quality traits.

MATERIALS AND METHODS

A field experiment was conducted during the summer seasons 2006 and 2007 at the Shandweel Agriculture Research Station, ARC, Sohg Governorate to study the effect of partial replacement of chemical fertilizer by bio – fertilizer on growth, yield, yield components and seed quality of sesame. The experiment was laid out in a randomized complete-blocks design with a split plot treatment arrangements with four replications in both seasons. The plot area was 12 m^2 consisting of six rows, 4 meter long, distance between rows was 50 cm and distance between plants within row was 10 cm, with two plants per hill after thinning.

The main plots were allocated for two cultivars; namely, Shandweel3 and Toshka1. The sub – plots were devoted to the following fertilizer treatments:

1 – 30 Kg N fed^{-1} + 24 K_2O fed^{-1} + 30 P_2O_5 fed^{-1} (control)
2 – microben + 30 Kg N fed^{-1} + 24 K_2O fed^{-1} + 30 P_2O_5 fed^{-1}
3 – biogen + 30 Kg N fed^{-1} + 24 K_2O fed^{-1} + 30 P_2O_5 fed^{-1}
4 - microben + 7.5 Kg N fed^{-1} + 24 Kfed^{-1} + 30 P_2O_5 f_2O ed^{-1}
5 - biogen + 7.5 Kg N fed^{-1} + 24 K_2O fed^{-1} + 30 P_2O_5 fed^{-1}
6 - microben +15 Kg N fed^{-1} + 24 K_2O fed^{-1} + 30 P_2O_5 fed^{-1}
7 - biogen + 15 Kg N fed^{-1} + 24 K_2O fed^{-1} + 30 P_2O_5 fed^{-1}
8 - microben + 22.5Kg N fed^{-1} + 24 K_2O fed^{-1} + 30 P_2O_5 fed^{-1}
9 - biogen + 22.5 Kg N fed^{-1} + 24 K_2O fed^{-1} + 30 P_2O_5 fed^{-1}
10- microben + biogen + 24 K_2O fed^{-1} + 30 P_2O_5 fed^{-1}

Bio- fertilizer used were:

1- microbin, a mixture of phosphorus dissolving and N_2 – fixing bacteria (*Azospirllium* sp., *Azotobacter* sp., *Bacillus megatheruim* var. phosphaticum, *pseudomonas* sp and *Mycorrizea* sp.).
2- Biogen, N_2 – fixing bacteria (*Azotobacter* sp.).

The bio – fertilizers produced and distributed commercially by the General organization for Agriculture Equalization Found ation (GOAEF), Ministry of Agriculture, Egypt. Sesame seeds were inoculated just before sowing with bio – fertilizer. The other cultural practices were done according to recommended methods. The physical and chemical analysis of the experimental soil in 2006 and 2007 are given in Table (1).

Data were recorded on ten random selected plants per plot for the studied characters as follows: days to 50% flowering, plant height, length of fruiting zone, number of capsules $pl.^{-1}$, capsule length, seed yield capsules $pl.^{-1}$ (g), seed yield fed^{-1} (ard) and oil yield fed^{-1}(Kg).

Table (1): Physical and chemical soil characteristics of the experimental field in 2006 and 2007 seasons.

Analysis	Seasons	
	2006	2oo7
Mechanical of analysis:		
Clay %	22.53	19.88
Silt%	29.65	29.95
Fined sand%	40.36	42.68
Co ace sand%	7.46	7.49
Soil type	Loam	Loam
Chemical of analysis:		
O. M. %	1.37	1.32
CaCO3%	0.92	1.56
Ec nrmohs/25°C	0.113	0.189
Anions m eq/L:		
CO_2	0.0	0.0
HCO_3	0.6	0.5
CL	0.3	0.7
SO_4	0.64	0.55
Cations m eq/L:		
Ca	0.6	0.4
Mg	0.4	0.1
Na	0.44	1.09
K	0.1	0.16
pH	7.8	7.6
Available nutrients (P. P.M):		
N %	37.94	52.17
P %	5.09	7.05
K %	197.34	186.77

The quality seeds tests were conducted at Giza Agric. Res. Station and lab. of the Seed Technology Depart., Field Crop Res. Instit. ARC during 2006 and 2007 seasons.

Before starting seed- lab tests, initial moisture content and seed index(weight of 1000 seeds in g) of each seed sample were measured.

Germination test: one hundred pure seeds of each sample were placed on Petri dishes containing filter paper soaked with distilled water. The Petri dishes were placed in an incubator at 25 ± 1°C for 6 days. Normal seedlings were counted according to the international rules of (ISTA,1993). Germination percentage was calculated using the formula by Krishnasamy and Seshu (1990).

$$\text{Germination (\%)} = \frac{\text{number of normal seedlings}}{\text{number of seed tested}} \times 100$$

vigor index was calculated using the formula of Copeland (1976).

$$\text{Seed vigor index} = \text{number of seeds germinated (1st count)} + \frac{\text{number of seeds germinated (last count)}}{\text{Number of days to first count Number of days to last count}} \times 100$$

Evaluation of seedlings:

Normal seedlings obtained from standard the germination test were used for seedling evaluation according to the rules of the Association of Official Seed Analysis (AOSA,1983). Seedling shoot and root length

were measured after 6 days of germination test. Twenty-five seedlings from each Petri dish were randomly selected and shoot and root length of individual seedlings were recorded. The shoots and roots were also dried at 70°C for 72 h. seedling vigor index was calculated using data recorded on germination percentage and seedling growth according to (ISTA,1985) by the formula given below:
Seedling vigor index = seedling length (cm) × germination percentage

Electrical conductivity test:

The electrical conductivity of the leachate was determined according to procedures described by AOSA (1983). Four subsamples of 50 seeds of each cultivar were weighed to 0.001g, placed into plastic cups with 250 ml of distilled water, and held at 25°C. After 24 h, the electrical conductivity of the leachates was determined using Ec meter. The mean values were expressed in $\mu S\ cm^{-1}\ g^{-1}$ seed weight.

Accelerated ageing:

The seeds were kept in an aging chamber at 45°C and 100% relative humidity for 3 days. After aging, the seeds were dried up in the sun and percentage survival of the seeds was determined by standard germination test at 25°C and the mean normal seedling percentage was calculated according to (AOSA, 1983).

Chemical composition:

Samples of about 50g of air dried seeds of each genotype were randomly chosen from two replications and fine ground for estimating chemical composition i.e. total nitrogen was determined using Kjeldahl Method (AOAC, 2000), crude protein was calculated by multiplying the total nitrogen by factor of 6.25. Total carbohydrates were evaluated according to (AOAC, 2000). Crude oil percentage was determined using Soxhlet apparatus and hexane as solvent according to (AOAC, 2000).

Data were statistcally analyzed according to procedures outlined by Sendecor and Cochen(1990). According to the homogeneity test, the results in 2006 and 2007 were similar, so the combined analysis of the two seasons results were conducted.

RESULTS AND DISCUSSION

A - Morphological and yield contributing characters:

Results in Table (2) show the effect of sesame cultivars on agronomic characters. Data exhibited that all the agronomic characters were not significant except days to 50% flowering, length of fruiting zone and number of capsules $pl.^{-1}$. Shandweel 3 was higher than Toshka1 in number of capsules $pl.^{-1}$. Whiles, Toshka1 exhibited significant higher than Shandweel 3 for length of fruiting zone. El-Habash *et al.* (2007) indicated that no significant difference were found between two Egyptian cultivars (Shandweel 3 and Giza 32) by application of bio – fertilizer. Moreover, Ghosh (2000) did not find any significant influence to the bio – fertilizer on the growth or yield of sesame over the control.

Table (2): Effect of sesame cultivars on agronomic characters.

Cultivars	Days to 50% flowering	Plant height (cm)	Length of fruiting zone (cm)	No. of capsulespl^{-1}.	Capsule length (cm)
Shandweel 3	52.00	181.6	143.4	196.2	3.72
Toshka 1	51.03	184.7	147.0	191.4	3.68
$LSD_{0.05}$	0.45	4.44	1.82	308	0.10

Data in Table (3) showed that all sesame agronomic characters were significantly affected by partial replacement of chemical fertilize by bio – fertilizer. The application of macrobin + 22.5 Kg N fed^{-1} and biogen + 22.5 Kg N fed^{-1} gave the highest

values followed by macrobin+15.0 Kg N fed^{-1} and bioben + 15.0 Kg N fed^{-1} for all studied agronomic characters except days to 50% flowering. The increase in these characters may be due to the benefit role of nitrogen fixers for enhancing plant growth through their capacity in nitrogen fixation as well as the effect of their metabolites secretions on both the plant, in general, and rhizobia in particular. In the same time, bio – fertilizers contains free living nitrogen fixing micro-organisms which could be participate in supplying the growing plant partially by their nitrogen requirement. These results are in agreement with those used biological fertilizer with N_2 – fixing and phosphate – dissolving microorganisms. They emphasized the great importance of it in increasing crop production (Sayed *et al.*, 2003; Helal and Sayed 2005; Nour – El – Dein and Salama 2006; Abd El – Razek and El – Sogheir 2006; El – habbasha *et al.*, 2007 and Ismail *et al.*, 2007).

Table (3): Effect of partial replacement of chemical fertilizer by bio – fertilizer on agronomic characters.

Fertilizer treatments Kg fed^{-1}	Days to 50 % flowering	Plant height (cm)	Length of fruiting zone (cm)	Number of capsules pl^{-1}	Capsule length (cm)
1- 30 N + 24 K_2O + 30 P_2O_5 (control)	49.00	178.7	137.4	181.0	3.1
2- microben + treat. 1	50.92	180.4	39.3	190.5	3.6
3 - biogen + treat. 1	51.67	179.3	139.1	201.3	3.6
4- microben + 7.5 Kg N fed^{-1} + 24 K_2O fed^{-1} + 30 P_2O_5 fed^{-1}	50.08	173.4	137.8	183.0	3.6
5- biogen + treat. 4	50.83	176.7	142.7	180.2	3.5
6- microben +15 Kg N fed^{-1} + 24 K_2O fed^{-1} + 30 P_2O_5 fed^{-1}	52.42	185.8	150.5	195.6	3.8
7- biogen + treat. 6	52.25	189.2	150.3	195.7	3.9
8-microben + 22.5Kg N fed^{-1} + 24 K_2O fed^{-1} + 30 P_2O_5 fed^{-1}	53.33	194.9	158.5	207.3	4.2
9- biogen + treat. 8	53.25	194.8	157.3	211.5	4.2
10- microben+biogen+24 K_2O fed^{-1} + 30 P_2O_5 fed^{-1}	51.25	178.2	139.3	193.3	3.4
$LSD_{0.05}$	0.91	4.10	4.32	5.06	0.15

The reaction among the cultivars and replacement of chemical fertilizer by bio – fertilizer are presented in Table (4). Results show no significant difference in the interaction between two sesame cultivars and fertilizer treatments. The application microbin + 22.5Kg N fed^{-1} with both cultivars gave the highest value followed by application biogen + 22.5Kg N fed^{-1} of plant height, length of fruiting zone, number of capsules $pl.^{-1}$ and capsule length. Meanwhile, application of microben + 7.5 Kg N fed^{-1} with Shandweel 3 and 30 Kg N fed^{-1} + 24 K_2O fed^{-1} + 30 P_2O_5 fed^{-1} (control) with Toshka1 were more favorable for flowering. All the interactions among the studied treatments may be the attributed to the effect of N and P as main components of nutrients. Phosphorytation of adenosine diphosphate (ADP) to adenosine triphosphate (ATP), also, phosphate acts as an activator of some enzymes, leading to enhancement of the metabolism processes and formation of new cells (Dhillon,1978).

B – Seed and oil yield characters:

Data of Table (5) showed the effect of cultivars on seed yield pl^{-1}, seed yield fed^{-1} and oil yield fed^{-1}. The difference between the two cultivars were significant for all studied characters except seed yield pl^{-1}. Cultivar Shandweel3 recorded highest seed yield fed^{-1} and oil yield fed^{-1}. These results are in agreement with obtained by El – Habbsha *et al.* (2007).

Table (4): Effect of interaction between sesame cultivars and partial replacement of chemical fertilizer by bio – fertilizer on agronomic characters.

Cultivars	Treatments	Days to 50 % flowering	Plant height (cm)	Length of fruiting zone (cm)	Number of capsules pl^{-1}	Capsule l engih (cm)
Shandweel 3	1- 30 N + 24 K_2O + 30 P_2O_5 (control)	50.2	179.5	138.2	184.0	3.2
	2- microben + treat. 1	52.3	181.2	138.3	181.3	3.6
	3 - biogen + treat. 1	52.5	175.5	137.8	174.0	3.6
	4- microben + 7.5 Kg N fed^{-1} + 24 K_2O fed^{-1} + 30 P_2O_5 fed^{-}	49.5	170.7	135.3	170.0	3.5
	5- biogen + treat. 4	50.3	174.0	141.0	174.7	3.5
	6- microben +15 Kg N fed^{-1} + 24 K_2O fed^{-1} + 30 P_2O_5 fed^{-}	53.0	184.0	146.5	184.0	3.8
	7- biogen + treat. 6	53.0	187.0	146.2	189.7	3. 9
	8-microben + 22.5Kg N fed^{-1} + 24 K_2O fed^{-1} + 30 P_2O_5 fed^{-1}	53.8	195.5	156.5	149.3	4.3
	9- biogen + treat. 8	53.5	192.8	157.2	194.0	4.3
	10- microben + biogen + 24 K_2O fed^{-1} + 30 P_2O_5 fed^{-1}	51.5	175.8	136.8	177.3	3.5
Toshka 1	1- 30 N + 24 K_2O + 30 P_2O_5 (control)	47.8	177.8	136.7	183.3	3. 0
	2- microben + treat. 1	49.5	179.7	140.3	184.7	3.6
	3 - biogen + treat. 1	50.8	183.0	140.3	184.7	3.6
	4- microben + 7.5 Kg N fed^{-1} + 24 K_2O fed^{-1} + 30 P_2O_5 fed^{-}	50.8	176.2	140.2	180.0	3.7
	5- biogen + treat. 4	51.3	179.3	144.3	181.3	3.5
	6- microben +15 Kg N fed^{-1} + 24 K_2O fed^{-1} + 30 P_2O_5 fed^{-}	51.8	187.7	154.5	191.3	3.9
	7- biogen + treat. 6	51.5	191.3	154.3	195.0	3.8
	8-microben + 22.5Kg N fed^{-1} + 24 K_2O fed^{-1}+ 30 P_2O_5 fed^{-1}	52.8	197.0	160.5	196.7	4. 2
	9- biogen + treat. 8	53.0	194.2	157.3	194.0	4.1
	10- microben + biogen + 24 K_2O fed^{-1} + 30 P_2O_5 fed^{-1}	51.0	180.5	141.7	186.0	3.8
	LSD at 0.05	1.3	5.8	4.3	7.2	0.22

The effect of partial replacement of chemical fertilizer by bio–fertilizer on seed yield pl^{-1}, seed yield fed^{-1} and oil yield fed^{-1} are presented in Table (6). Data indicated that microbial inoculation used increases seed yield pl^{-1}, seed yield fed^{-1} and oil yield fed^{-1} over control. The increase ranged from 8.5to 35.2, 4.47 to 37.00 and 0.32 to 15.4% for seed yield pl^{-1}, seed yield fed^{-1} and oil yield fed^{-1}, respectively. The treatment microbin + 22.5 Kg N fed^{-1} (treatment No. 8) recorded the highest seed yield pl^{-1}, seed yield fed^{-1} and oil yield fed^{-1} followed by biogen + 22.5Kg N fed^{-1} (treatment No. 9). The increase in seed yield and oil yield due to increase in attributed characters, viz plant height, length of fruiting zone and number of capsules pl^{-1}. Many authors emphasised the positive effect of inculcation with *Azotobacter* and *Azospirillum* on yield (Chauhan *et al.*, 1990; Singh *et al.*, 1997; Venkatakrishnan,1998; Zein *et al.*, 2000; Sayed *et al.*, 2003; Helal and Sayed, 2005; Nour – El – Dein and Salama,2006, and El – habbasha *et al.*, 2007).

Table (5): Effect of sesame cultivars on seed yield pl $^{-1}$, seed yield fed^{-1} and oil yield fed^{-1}

Cultivars	Seed yield, g. pl^{-1}	Seed yield, ard.fed^{-1}	Oil yield, Kg. fed^{-1}
Shandweel 3	26.1	6.7	337.7
Toshka 1	26.0	6.3	310.2
$LSD_{0.05}$	0.46	0.16	0.06

Table (6): Effect of partial replacement of chemical fertilizer by bio – fertilizer on seed yield pl^{-1}, seed yield fed^{-1} and oil yield fed^{-1}.

Treatments	Seed yield, g. pl^{-1}	seed yield, ard.fed^{-1}	oil yield, Kg. fed^{-1}
1- 30 N + 24 K_2O + 30 P_2O_5 (control)	21.9	5.8	346.5
2- microben + treat. 1	24.9	6.7	347.8
3 - biogen + treat. 1	26.7	6.8	357.8
4- microben + 7.5 Kg N fed^{-1} + 24 K_2O fed^{-1} + 30 P_2O_5 fed	24.3	6.1	378.1
5- biogen + treat. 4	23.7	6.9	348.2
6- microben +15 Kg N fed^{-1} + 24 K_2O fed^{-1} + 30 P_2O_5 fed	26.5	6.8	347.6
7- biogen + treat. 6	27.7	7.0	347.8
8-microben + 22.5Kg N fed^{-1} + 24 K_2O fed^{-1} + 30 P_2O_5 fed^{-1}	29.6	7.9	399.9
9- biogen + treat. 8	29.3	7.7	387.6
10- microben + biogen + 24 K_2O fed^{-1} + 30 P_2O_5 fed^{-1}	24.5	6.2	242.1
LSD 0.05	1.3	0.31	0.16

Results in Table (7) show the interaction effects among the sesame cultivars and partial replacement of chemical fertilization by bio – fertilization on seed yield pl^{-1}, seed yield fed^{-1} and oil yield fed^{-1}. Data revealed that the interaction between sesame cultivars and fertilizer treatment had significant effect on seed yield pl^{-1}, seed yield fed^{-1} and oil yield fed^{-1}. The application of microbin + 22.5Kg N fed^{-1} (treatment No. 8) with Shandweel 3 and Toshka1followed by biogen + 22.5Kg N fed^{-1} (treatment No. 9) with two cultivars gave the highest values for those traits. Using microbin + 22.5Kg N fed^{-1} (treatment No. 8) increased shandeel3 and Toshk1 seed yield pl^{-1} by 23.9 and 29.8% over control, respectively. The same treatments increased seed yield fed^{-1} and oil yield fed^{-1} for shandeel3 and Toshk1 cultivars over control by 40.6, 33.8, 13.5 and 17.3%, respectively. It is noted that this positive influence of inoculation on seed yield and oil yield may be due to the effect of N_2 fixing and phosphate dissolving microorganisms presents in the used inoculums and their role in availability of N and P through N_2 – fixation and solubility of soil phosphates. In addition, these microorganisms release growth [illegible] which make the plant more healthy, due to increasing the absorbing capacity of root system. These results are in agreement with those obtained by (El – Komy *et al.*, 1993; Zein *et al.*, 2000; El – Doby,2002; Sayed *et al.*, 2003; Nour – El – Dein *et al.*, 2005; Hanna *et al.*, 2005; Nour – El – Dein *et al.*, 2006, and El – habbasha *et al.*, 2007). Generally using bio – fertilizer could reduce N- mineral fertilizer and accompanied with lower environmental pollution.

C- Seed quality characters:

Effect of sesame cultivars on seed vigor parameters viz, seed index, standard germination %, seed vigor index, accelerated ageing germination% and electrical conductivity are present in Table (8). Data indicated that there were significant differences between the two cultivars in standard germination%, accelerated ageing germination% and electrical conductivity. Meanwhile, seed index and seed vigor index exhibited no significant effect between Shandweel3 and Toshk1. Shandweel3 surpassed Toshk1 in standard germination%. Where, Toshka1 surpassed Shandweel3 in accelerated ageing germination % and electrical conductivity.

Table (7): Effect of interaction between sesame cultivars and partial replacement of chemical fertilizer by bio – fertilizer on seed yield pl^{-1}, seed yield fed^{-1} and oil yield fed^{-1}.

Cultivars	Treatments	Seed yield, g. pl^{-1}	Seed yield, ard.fed^{-1}	Oil yield, Kg. fed^{-1}
Shandweel 3	1- 30 N + 24 K_2O + 30 P_2O_5 (control)	24.42	5.81	370.4
	2- microben + treat. 1	25.57	6.98	359.8
	3 - biogen + treat. 1	26.75	7.38	375.6
	4- microben + 7.5 Kg N fed^{-1}+24 K_2O fed^{-1}+ 30 P_2O_5 fed^{-1}	23.54	4.81	292.4
	5- biogen + treat. 4	22.55	4.62	237.0
	6- microben +15 Kg N fed^{-1} + 24 K_2O fed^{-1} + 30 P_2O_5 fed	25.95	7.40	348.2
	7- biogen + treat. 6	27.44	7.05	324.7
	8-microben + 22.5Kg N fed^{-1}+24 K_2O fed^{-1}+30 P_2O_5 fed^{-1}	30.25	8.17	420.3
	9- biogen + treat. 8	29.45	8.04	414.0
	10- microben + biogen + 24 K_2O fed^{-1} + 30 P_2O_5 fed^{-1}	24.77	6.49	234.5
Toshka 1	1- 30 N + 24 K_2O + 30 P_2O_5 (control)	22.37	5.74	323.5
	2- microben + treat. 1	24.31	6.55	307.8
	3 - biogen + treat. 1	26.57	6.25	340.0
	4- microben + 7.5 Kg N fed^{-1}+24 K_2O fed^{-1}+ 30 P_2O_5 fed^{-1}	24.98	5.28	283.9
	5- biogen + treat. 4	24.93	5.10	.259.4
	6- microben +15 Kg N fed^{-1} + 24 K_2O fed^{-1} + 30 P_2O_5 fed	27.13	6.24	306.9
	7- biogen + treat. 6	27.84	6.90	291.0
	8-microben + 22.5Kg N fed^{-1}+24 K_2O fed^{-1}+30 P_2O_5 fed^{-1}	29.03	7.68	379.6
	9- biogen + treat. 8	29.00	7.30	361.2
	10- microben + biogen + 24 K_2O fed^{-1} + 30 P_2O_5 fed^{-1}	24.15	5.96	249.8
	LSD 0.05	1.88	0.44	0. 22

Table (8): Effect of sesame cultivars on seed vigor parameters.

Cultivars	Seed index	Standard germination %	Seed vigor index	Accelerated ageing germination%	Electrical conductivity
Shandweel 3	5. 39	94.53	41. 84	74. 91	33. 05
Toshka 1	5. 46	94. 01	41. 76	79. 45	33. 46
$LSD_{0.05}$	0.16	0. 15	0. 12	1.34	0.12

Data in Table (9) reveal the effect of partial replacement of chemical fertilizer by bio – fertilizer on seed vigor parameters. Results indicated that all application treatments significantly increased seed index than control treatment. The application of microbin + 22.5Kg N fed^{-1} (treatment No. 8) and biogen + 22.55Kg N fed^{-1} (treatment No. 9) recorded the highest value of seed index. The effect of fertilizer treatments was significantly obvious effect on standard germination%, accelerated ageing germination% and electrical conductivity. Adding microbin + 30Kg N fed^{-1} (treatment No. 2) produced the highest standard germination% of the harvested seeds. It is clear from Table (9) that the highest seed vigor index was obtained by the chemical application of NPK fertilizer alone (control). Meanwhile, adding microbin + biogen to PK chemical fertilizer recorded the highest value of accelerated ageing germination% and electrical conductivity.

Table (9): Effect of partial replacement of chemical fertilizer by bio – fertilizer on seed vigor parameters.

Treatments	Seed index	Standard germination %	Seed vigor index	Accelerated ageing germination%	Electrical conductivity
1- 30 N + 24 K_2O + 30 P_2O_5 (control)	4.94	97.53	44.20	77.38	31.99
2- microben + treat. 1	5.34	97.71	43.11	77.64	30.99
3 - biogen + treat. 1	5.55	97.13	43.65	77.09	32.00
4- microben+7.5 Kg N fed^{-1}+24 K_2O fed^{-1}+30 P_2O_5 fed^{-1}	5.05	92.28	41.10	77.42	34.14
5- biogen + treat. 4	5.21	92.50	40.37	77.32	34.82
6- microben +15 Kg N fed^{-1} + 24 K_2O fed^{-1} + 30 P_2O_5 fed^{-1}	5.16	93.52	40.67	74.90	33.40
7- biogen + treat. 6	5.60	92.36	39.75	77.40	33.90
8-microben + 22.5Kg N fed^{-1}+24 K_2O fed^{-1}+ 30 P_2O_5 fed^{-1}	6.00	94.87	43.18	77.36	32.67
9- biogen + treat. 8	6.08	94.48	42.84	77.44	32.88
10- microben+biogen+24 K_2O fed^{-1}+30 P_2O_5 fed^{-1}	5.32	90.33	39.12	78.06	35.75
LSD 0.05	0.34	0.21	0.57	2.25	0.29

The interaction between sesame cultivars and partial replacement of chemical fertilizer by bio – fertilizer on seed vigor parameters is presented in Table (10). Data show that all studied seed vigor parameters were significantly effect by the interaction between two studied factors (sesame cultivars x fertilizer treatments). The application of biogen + 22.5Kg N fed^{-1} (treatment No. 9) with Toshka1 produce the highest seed index without significant difference from the treatment biogen + 22.5Kg N fed^{-1} (treatment No. 9) with Shandweel3 or microbin + 22.5Kg N fed^{-1} (treatment No. 9) with either Shandweel3 or Toshka1. In the other the hand, adding microbin + 30Kg N fed^{-1} (treatment No. 2) with Shandweel3 recorded the highest value of standard germination% and seed vigor index without significant difference than the same application with Toshka1. The highest value of accelerated ageing germination % and electrical conductivity by adding microbin + biogen to Toshka1 followed by adding same treatment to Shandweel3. These results are in harmony with those obtained by Hegazy *et al.* (1992), Hanna *et al.* (2005) Nour – El – Dein *et al* .(2006).

Table (11) represents the effect of sesame cultivars on seedling characters. The data revealed that Shandweel3 significantly surpassed Toshka1 and recorded high values of radical length, seedling dry weight and seedling vigor index. Meanwhile,Toshka1 significantly surpassed Shandweel3 in shoot length.

Regarding effect of partial replacement of chemical fertilizer by bio - fertilizer, the data in Table (12) revealed that the application of microbin + 30Kg N fed^{-1} (treatment No. 2) significantly increased all studied seedling characters except shoot length. No significant difference was found between treatments and control on seedling vigor index.

With respect to the interaction between sesame cultivars and partial replacement of chemical fertilizer by bio – fertilizer (Table 13). The treatment microbin + 30Kg N fed^{-1} (treatment No. 2) with Shandweel3 recoded the highest value of radical length, seedling dry weight and seedling vigor index. Meanwhile, the control treatment with Shandweel3 recorded the highest value of shoot length. The study of Zein *et al.* (2000) found that

neither N – levels nor *Azotobacter* inoculation effected germination%, but they found significant increase in radical and shoot length due to inoculation. In addition, study of Nour EL – Dein *et al.* (2005) indicated that inoculation of wheat with *Azotobacter* or farmyard manure addition increased seed index and seedling dry weight.

Table (10):Effect of interaction between sesame cultivars and partial replacement of chemical fertilizer by bio – fertilizer on seed vigor parameters.

Cultivars	Treatments	Seed index	Standard germination %	Seed vigor index	Accelerated ageing germination %	Electrical conductivity
Shandweel 3	1- 30 N + 24 K_2O + 30 P_2O_5 (control)	4.90	97.74	43.01	76.07	31.83
	2- microben + treat. 1	5.36	98.01	43.43	75.92	30.51
	3 - biogen + treat. 1	5.60	97.84	44.50	75.62	31.51
	4- microben + 7.5 Kg N fed^{-1} + 24 K_2O fed^{-1} + 30 P_2O_5 fed^{-1}	5.01	92.42	41.52	74.02	34.07
	5- biogen + treat. 4	5.13	93.59	40.34	73.25	34.77
	6- microben +15 Kg N fed^{-1} + 24 K_2O fed^{-1} + 30 P_2O_5 fed^{-1}	5.35	93.39	41.01	74.53	33.22
	7- biogen + treat. 6	5.46	91.85	39.45	74.22	33.57
	8-microben + 22.5Kg N fed^{-1} + 24 K_2O fed^{-1} + 30 P_2O_5 fed^{-1}	5.98	94.89	43.26	76.27	32.46
	9- biogen + treat. 8	6.05	94.83	42.72	75.80	32.85
	10- microben + biogen + 24 K_2O fed^{-1} + 30 P_2O_5 fed^{-1}	5.09	90.71	39.12	73.38	35.67
Toshka 1	1- 30 N + 24 K_2O + 30 P_2O_5 (control)	4.97	97.33	42.79	78.70	32.14
	2- microben + treat. 1	5.33	97.40	44.64	79.37	31.47
	3 - biogen + treat. 1	5.50	96.42	42.79	78.57	32.49
	4- microben + 7.5 Kg N fed^{-1} + 24 K_2O fed^{-1} + 30 P_2O_5 fed^{-1}	5.08	92.14	40.69	80.82	34.22
	5- biogen + treat. 4	5.30	91.40	40.40	81.40	34.87
	6- microben +15 Kg N fed^{-1} + 24 K_2O fed^{-1} + 30 P_2O_5 fed^{-1}	4.96	93.64	40.33	75.28	33.59
	7- biogen + treat. 6	5.73	92.87	40.06	80.58	34.23
	8-microben + 22.5Kg N fed^{-1} + 24 K_2O fed^{-1} + 30 P_2O_5 fed^{-1}	6.03	94.85	44.00	78.45	32.88
	9- biogen + treat. 8	6.11	94.17	42.96	79.48	32.92
	10- microben + biogen + 24 K_2O fed^{-1} + 30 P_2O_5 fed^{-1}	5.56	89.95	39.13	82.73	35.83
	LSD at 0.05	0.48	0.29	0.81	3.19	0.41

Table (11): Effect of sesame cultivars on seed vigor parameters.

Cultivars	Radical length	Shoot length	Seedling dry weight	Seedling vigor index
Shandweel 3	3.43	2. 47	3. 45	559. 1
Toshka 1	3. 31	2. 50	3. 31	546. 9
LSD 0.05	0. 06	0. 03	0. 02	2. 3

Table (12): Effect of partial replacement of chemical fertilizer by bio – fertilizer on seedling characters.

Treatments	Radical length	Shoot length	Seedling dry weight	Seedling vigor index
1- 30 N + 24 K_2O + 30 P_2O_5 (control)	3.63	2.74	3.55	621.6
2- microben + treat. 1	3.71	2.67	3.62	623.7
3 - biogen + treat. 1	3.64	2.61	3.57	607.1
4- microben + 7.5 Kg N fed^{-1}+24 K_2O fed^{-1}+30 P_2O_5 fed^{-}	3.19	2.32	3.29	508.5
5- biogen + treat. 4	3.10	2.30	3.28	498.9
6- microben +15 Kg N fed^{-1}+24 K_2O fed^{-1}+30 P_2O_5 fed^{-}	3.38	2.49	3.32	549.1
7- biogen + treat. 6	3.29	2.42	3.27	527.3
8-microben + 22.5Kg N fed^{-1}+ 4 K_2O fed^{-1}+30 P_2O_5 fed^{-1}	3.50	2.56	3.49	575.4
9- biogen + treat. 8	3.40	2.52	3.44	456.8
10- microben + biogen + 24 K_2O fed^{-1} + 30 P_2O_5 fed^{-1}	2.87	2.18	2.98	456.0
LSD 0.05	0.06	0.04	0.03	6.57

Table (13): Effect of interaction between sesame cultivars and partial replacement of chemical fertilizer by bio – fertilizer on seedling characters.

Cultivars	Treatments	Radical length	Shoot length	Seedling dry weight	Seedling vigor index
Shandweel 3	1- 30 N + 24 K_2O + 30 P_2O_5 (control)	3.65	2.75	3.63	626.2
	2- microben + treat. 1	3.80	2.73	3.76	639.9
	3 - biogen + treat. 1	3.78	2.59	3.65	623.3
	4- microben + 7.5 Kg N fed^{-1}+24 K_2O fed^{-1}+30 P_2O_5 fed^{-}	3.23	2.29	3.37	510.5
	5- biogen + treat. 4	3.14	2.29	3.37	508.2
	6- microben +15 Kg N fed^{-1}+24 K_2O fed^{-1}+30 P_2O_5 fed^{-}	3.42	2.46	3.29	549.3
	7- biogen + treat. 6	3.35	2.33	3.28	526.3
	8-microben + 22.5Kg N fed^{-1}+ 4 K_2O fed^{-1}+30 P_2O_5 fed^{-1}	3.57	2.55	3.56	581.0
	9- biogen + treat. 8	3.41	2.50	3.46	560.3
	10- microben + biogen + 24 K_2O fed^{-1} + 30 P_2O_5 fed^{-1}	2.95	2.18	3.17	465.5
Toshka 1	1- 30 N + 24 K_2O + 30 P_2O_5 (control)	2.77	2.74	3.47	616.9
	2- microben + treat. 1	2.67	2.61	3.47	607.5
	3 - biogen + treat. 1	2.63	2.63	3.49	590.9
	4- microben + 7.5 Kg N fed^{-1}+24 K_2O fed^{-1}+30 P_2O_5 fed^{-}	2.39	2.36	3.22	506.6
	5- biogen + treat. 4	2.30	2.30	3.19	489.6
	6- microben +15 Kg N fed^{-1}+24 K_2O fed^{-1}+30 P_2O_5 fed^{-}	2.51	2.52	3.36	548.9
	7- biogen + treat. 6	2.49	2.47	3.27	528.3
	8-microben + 22.5Kg N fed^{-1}+ 4 K_2O fed^{-1}+30 P_2O_5 fed^{-1}	2.58	2.58	3.42	569.7
	9- biogen + treat. 8	2.55	2.58	3.41	562.2
	10- microben+biogen+24 K_2O fed^{-1}+30 P_2O_5 fed^{-1}	2.22	2.18	2.79	448.2
	LSD 0.05	0.07	0.06	0.04	9.29

From the above data bio - fertilizer addition slightly increased studied seed vigor parameters and all seedling characters except shoot length. This may be attributed to the effective role of microbial inoculation on plant nutrion. Bahatia *et al.* (1998) and Younes *et al.* (2000) reported that inoculation with N_2 fixing and phosphaste – dissolving microorganisms may improve soil fertilizer and production.

Data in Table (14) illustrated the effect of sesame cultivars on the chemical composition of seeds. Shandweel3 exhibited significant superiority in crude oil and crude protein (5o.4% and 23.34%). Toshka1 was higher than Shandweel3 in total carbohydrate (12.63%).

Table (14): Effect of sesame cultivars on chemical composition of sesame seeds.

Cultivars	Crude oil %	Crude protein %	Total carbohydrate%e
Shandweel 3	50.40	23.34	11.59
Toshka 1	49.23	23.14	12.63
LSD0.05	0.10	0.04	0.32

Effect of replacement of chemical fertilizer by bio – fertilizer on the chemical composition 0f seeds is presented in Table (15). Data indicated that crude oil did not significantly affected by the studied treatments.

With respect to crude protein, adding microbin + 30Kg N fed^{-1} (treatment No. 2) significantly increased crude protein (23.58). Meanwhile, the application of microbin + bioben (treatment No. 10) exhibited the highest value of total carbohydrate (12.63).

Table (15): Effect of partial replacement of chemical fertilizer by bio –. fertilizer on chemical composition of sesame seeds.

Treatments	Crude oil %	Crude protein %	Total carbohyd rate%
1- 30 N + 24 K_2O + 30 P_2O_5 (control)	50.30	23.45	11.84
2- microben + treat. 1	50.11	23.58	11.76
3 - biogen + treat. 1	49.85	23.53	11.78
4- microben + 7.5 Kg N fed^{-1} + 24 K_2O fed^{-1} + 30 P_2O_5 fed^{-1}	49.74	22.99	12.25
5- biogen + treat. 4	49.61	22.96	12.43
6- microben +15 Kg N fed^{-1} + 24 K_2O fed^{-1} + 30 P_2O_5 fed^{-1}	49.72	23.22	12.06
7- biogen + treat. 6	49.60	23.15	12.25
8-microben + 22.5Kg N fed^{-1} + 24 K_2O fed^{-1} + 30 P_2O_5 fed^{-1}	50.01	23.42	12.05
9- biogen + treat. 8	49.83	23.33	11.86
10- microben + biogen + 24 K_2O fed^{-1} + 30 P_2O_5 fed^{-1}	49.38	22.76	12.81
LSD 0.05	0.16	0.04	0.16

Results in Table (16) show the effect of interaction between sesame cultivars and partial replacement of chemical fertilizer by bio – fertilizer on the chemical composition of sesame seeds. Data revealed that crude oil did not significantly affected by the studied treatments with both cultivars. The highest crude protein was obtained by adding microbin + 30Kg N fed^{-1} (treatment No. 2) to Shandweel3,which, was significantly higher than those given by the other treatments. On the other hand, adding microbin + biogen (treatment No. 10) to Toshka1 produced the highest total carbohydrate with significant difference than those obtained by other treatments. The absence of significant responses for inoculation on crude oil was not in accordance with that of Hanna *et al.* (2005) as

they found that the crude oil increased due to *Azspirillium* inoculation. This contradiction may be due to the difference in crop species. The presence of significant difference in crude protein and carbohydrate was similar to studies by Zein *et al.*(2000)on wheat crop and Hanna *et al.* (2005) on sorghum as they found that inoculation of wheat with *Azotobacter* and sorghum with *Azospirllum* increased both traits.

Finally, the present study recommended that microbin + 22.5Kg N fed^{-1} + 24 K fed^{-1} + 30 P_2O_5 fed^{-1} gave the optimum seed yield fed^{-1} and oil yield fed^{-1} and improved soil chemicals. It is worthy to mention that bio – fertilizer inoculation can be successfully applied in order to reduce 25% 0f the amount of the consumed chemical nitrogen fertilizer. Rationalization the consumption of the chemical fertilizers by partial replacement with bio – fertilizers has two advantages 1) save money of expensive chemical fertilization, and 2) protect the environment from chemical pollution.

Table (16): Effect of interaction between sesame cultivars and partial replacement of chemical fertilizer by bio – fertilizer on chemical composition of sesame seeds.

Cultivars	Treatments	Crude oil	Crude protein	Total carbohydrate
Shandweel 3	1- 30 N + 24 K_2O + 30 P_2O_5 (control)	23.51	23.55	11.47
	2- microben + treat. 1	23.67	23.71	11.43
	3 - biogen + treat. 1	23.61	23.66	11.27
	4- microben + 7.5 Kg N fed^{-1}+24 K_2O fed^{-1}+ 30 P_2O_5 fed^{-1}	23.09	23.10	11.61
	5- biogen + treat. 4	23.16	23.14	11.77
	6- microben +15 Kg N fed^{-1} + 24 K_2O fed^{-1} + 30 P_2O_5 fed	23.24	23.26	11.47
	7- biogen + treat. 6	23.19	23.17	11.76
	8-microben + 22.5Kg N fed^{-1}+24 K_2O fed^{-1}+30 P_2O_5 fed^{-1}	23.48	23.52	11.65
	9- biogen + treat. 8	23.46	23.42	11.20
	10- microben + biogen + 24 K_2O fed^{-1} + 30 P_2O_5 fed^{-1}	22.85	22.86	12.27
Toshka 1	1- 30 N + 24 K_2O + 30 P_2O_5 (control)	23.33	23.35	12.21
	2- microben + treat. 1	23.44	23.45	12.09
	3 - biogen + treat. 1	23.40	23.42	12.30
	4- microben + 7.5 Kg N fed^{-1}+24 K_2O fed^{-1}+ 30 P_2O_5 fed^{-1}	22.87	22.88	12.90
	5- biogen + treat. 4	22.78	22.78	13.08
	6- microben +15 Kg N fed^{-1} + 24 K_2O fed^{-1} + 30 P_2O_5 fed	23.17	23.17	12.65
	7- biogen + treat. 6	23.13	23.13	12.47
	8-microben + 22.5Kg N fed^{-1}+24 K_2O fed^{-1}+30 P_2O_5 fed^{-1}	23.34	23.31	12.45
	9- biogen + treat. 8	23.25	23.25	12.51
	10- microben + biogen + 24 K_2O fed^{-1} + 30 P_2O_5 fed^{-1}	22.65	22.66	13.35
	LSD 0.05	0.07	0.05	0.22

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تأثير الإحلال الجزئى للتسميد الكيمائى بالتسميد الحيوى على صفات البذرة والصفات الزراعيه ومحصول وجودة بذور السمسم

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أجري هذا البحث خلال موسمى ٢٠٠٦ و٢٠٠٧ بمحطه البحوث الزراعيه بشندويل محافظه سوهاج لدراسه دور التلقيح بمخلوط من بعض الميكروبات المثبتة للازوت الجوى والمذيبه للفوسفات فى وجود أوعدم وجود التسميد النيتروجينى المعدنى على الصفات الانتاجيه والمحصول وكذلك جودة التركيب الكميائى لبذورصنفين من السمسم (شندويل ٣ وتوشكى ١). وقد أظهرت اغلب الصفات المدروسه تأثير معنوى بتداخل التلقيح الميكروبى والتسميد النيتروجينى المعدنى. وقد أظهرت المعامله بالميكروبين + ٢٢,٥ كجم ن/ف زياده معنويه على الصفات الانتاجيه والمحصوليه وأغلب صفات جوده البذور وكذلك التركيب الكيمائى للبذور. وأظهر التفاعل بين أصناف السمسم ومعاملات التسميد تأثير معنوى على صفات طول النبات، طول المنطقه الثمريه، عدد كبسولات للنبات، طول الكبسوله،محصول البذورللنبات، محصول البذورللفدان،محصول الزيت للفدان، دليل البذره. وقدأعطت المعامله بالميكروبين + ٢٢,٥ كجم ن/ف للصنف شندويل ٣ زياده معنويه لمحصول البذور للنبات ومحصول البذور للفدان ومحصول الزيت للفدان ودليل البذره. كما أعطت المعامله بالميكروبين + ٣٠كجم ن/ف أعلى قيمه للصفات: النسبه المئويه للانبات وطول الجذير والوزن الجاف للبادره ودليل قوه البادره والنسبه المئويه للبروتين بينما أعطت المعامله الميكر وبين + البيوجين أعلى قيمه للصفات ودليل قوة البذره والتوصيل الكهربى ونسبه الكربوهيدرات.