RESPONSE OF SOME SESAME(*Sesamum indicum* L.) CULTIVARS TO FERTILIZATION TREATMENTS BY MICRONUTRIENTS, BIOFERTILIZER AND HUMIX.

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Abstract: Two field experiments were carried out during the two successive seasons (2004 and 2005) in the Experimental Farm, Faculty of Agriculture, South Valley University, Qena, Egypt. The experiments studied the response of sesame cultivars Giza 32, Toushki 1 and Shandaweel 3 to foliar fertilization by micronutrients,biofertilizer (microbien) and Humix.

Results showed that application of micronutrient + biofertilizer (microbien) + Humix significantly increased plant height, number of capsules /plant, 1000-seed weight, seed oil content seed yield /plant, and biological, straw, seed and oil yields /fad but decreased the height of first capsule, compared to the untreated control. Toushki 1 and Giza 32 cvs. surpassed Shandaweel 3 in seed yield and yield attributes, while seeds of Giza 32 cv. were richer in oil content over other cultivars. The highest yield and yield attributes were obtained when Toushki 1 or Giza 32 cvs. were treated with micronutrient + biofertilizer (microbien) + Humix.

Key words: sesame, fertilization, micronutrients, biofertilizer, humix.

Introduction

Sesame (*Sesamum indicum* L.) is considered as one of the most important oil crops in Egypt. Only 10% of Egypt's needs from vegetable oils are produced locally of which cotton seed oil is the main source. Moreover, oil crops occupy not more than 1.8 – 2.0 % of cropped area in Egypt. It is difficult to increase the area under oil crops in the old lands because of restrictions on the crop rotation and high competition between various cash crops. Therefore, great efforts should be undertaken to increase the area devoted to oil crops in the new reclaimed lands. However, these lands suffer from shortage of organic matter, biota and micronutrients. Organic matter plays an important role for improving soil physical properties and help retain applied nutrients essential for plant growth.

Several workers have reported the influence of micronutrients, biofertlizer and humic acid on yield and its components of sesame crop. Foliar spraying with micro nutrients was reported to have favourable effects on

yield and yield attributes of sesame as shown by El-Hariri, *et al.* (1988), Tiwari, *et al.* (1995), Abd-El-Moneem (1996), Galal and El-Nagar (1997), Jan *et al*. (1999) and Surahmaniyan, *et al*. (1999). However, El-Hariri (1988) and Abdel-Wahab, *et al*. (2005**)** who indicated that oil % in sesame seeds was not affected by micronutrients treatment. Also, increases in seed yield and yield components due to biofertilization, were reported by El-Mandoh and Abdel-Magid (1996), El-Karamany, *et al*. (2000), Ghosh (2000), Imayavaramban, *et al.* (2002) and Sarala, *et al.* (2002). Meanwhile, Singaravel and Govindasamy (1998), found that seed yield and dry matter production were the greatest with N fertilizer + humic acid + biofertilizer (*Azospirillum*). By contrast, Abdel-Wahab, *et al*. (2005) reported that application of micronutrients and biofertlizer (cerealin) had no effect on yield and yield components.

Varietal differences in yield and yield attributes were shown by El-Hifny *et al* (1988), Tiwari and Namdeo (1997), Subrahmaniyan and Arulmozhi (1999), Basavarai *et al* (2000), Subrahmaniyan *et al* (2001) and Abdel-Wahab *et al*. (2005). Moreover, Venkateswaran *et al* (1983), Moorthy, *et al.* (1997) and Tiwari, *et al.* (2000) recorded significant varietal differences in seed oil content, while Ibrahim, *et al.* (1987) and Mendez-Natera, *et al.* (1999) did not find significant differences in oil content among sesame cultivars.

The aim of this investigation was to study the effect of micronutrients, biofertlizer and Humix singly or in combination on yield and its components of three sesame varieties namely, Giza 32, Toushki 1 and Shandoweel 3 under condition of southern Egypt.

Materials and methods

Two field experiments were carried out during the successive seasons (2004 and 2005) in the Experimental Farm, Faculty of Agriculture, South Valley University, Qena, Egypt. The aim of this experiments was study the response of some sesame cultivars i.e., Giza 32, Toushki 1 and Shandaweel 3 to fertilization treatments including micronutrient, biofertilizer and Humix. The experimental design was a split- plot with four replicates. Cultivars were assigned in the main plots, while the fertilization treatments were distributed randomly in the sub-plots as follows:

T_0-Control (without micronutrient, humic acid or biofertilizer). T_1- Micronutrient . T_2- Humix. T_3- Biofertilizer. T_4- Micronutrient + Humix. T_5-Micronutrient + Bio-fertilizer. T_6- Biofertilizer + Humix. T_7- Micronutrient + Biofertilizer + Humix.

The sub- plot consisted of five rows, 3.5 m long and 60 cm wide (plot area 10.5 m^2). The experimental

soil was loamy sand in texture with pH value of 7.9, organic mater content of 0.09; total N 0.50%; and available P, K, Fe, Zn and Mn 8.2, 150.3, 6.4, 1.2 and 4.0 ppm, respectively. The preceding crop was wheat in both seasons. Sowing date was carried out on the 13 th and 15 th of May for 2004 and 2005 seasons, respectively. Planting distance was 15 cm between hills within the row. Hills were over seeded and thinned to two plants /hill after one month from sowing. The basic recommended rates of major elements (60 kg N, 31 kg P_2O_5 and 50 kg K_2O fad^{-1}) were applied.

In the biofertilizer treatment, seeds were coated by Arab gum and inoculated with microbien four hours before sowing. Microbien is a multi-strains with various functional groups including biological nitrogen fixers, nutrients mobilizaing microorganisms, root growth promoting micro-organisms and soil born diseases biopesticides, product in catchall 300 gm/fad mixed with seeds, innovated and identified by Saber (1993) and commercially produced and released by the Ministry of Agriculture. Micronutrients EDTA (Fe-Mn-Zn) were applied as foliar spray at the rate of 3g /l twice after thinning and 15 days later. The Humix (humic acid 12%, Zn 1%, Mn 1%, Fe 1%, Mg 0.5%, Cu 200 ppm and Ca 200 ppm) was sprayed on the soil surface after sowing. Harvesting took place on 120 day from sowing.

The following data were recorded at harvest time:

1-Yield attributes, namely plant height (cm), height of the first capsule (cm), number of fruiting branches/plant, number of capsules/plant, seed yield /plant (g) and 1000-seed weight (g) recorded on 10 random plants $plot^{-1}$.

2-Seed oil content (%) was determined by using Soxhelt apparatus and petroleum ether as a solvent was used according to the Official Method (A.O.A.C.1980).

3- The seed and straw yields of two rows per plot were weighed and used to calculate to seed and straw yields (kg). Oil yield (kg/ fed.)[= seed yield (kg/fad) × seed oil content (%) /100] was calculated.

Combined analysis of variance for data of the two seasons was undertaken according to Gomez and Gomez (1984). Means of treatments were compared by the LSD test at 5% probability.

Results and Discussion

1.Fertilization treatments (Micro-nutrient, Biofertilizer and Humix):

1.1. Yield components:

Data in Table (1) indicated that the combined application of T_7 (Micro-nutrient + Biofertilizer + Humix) significantly increased plant height (20.1%), number of capsules /plant (48.6%), 1000-seed weight (35.9%) and seed yield /plant (53.0%) above the T_0 (control) treatment. For the

height of first capsule, data show that T_6 (Biofertilizer + Humix) and T_7 (Micronutrient + Biofertilizer + Humix) had the lowest significant value (25.3 and 23.6 cm, respectively). In most cases, T_7 (Micronutrient + Biofertilizer + Humix) did not differ significantly from T_6 (Biofertilizer + Humix). The increases in these yield parameters may be due to the fact that these treatments play an important role in the metabolism of plants by increasing photosynthetic activity and consequently increase the metabolites required for growth and development of sesame plants. The increase in vegetative growth was accompanied by increase in number of capsules /plant as well as other yield components. These results are in agreement with Galal and El-Nagar (1997), Jan *et al.* (1999) and Surahmaniyan *et al*. (1999) and El-Karamany *et al* (2000).

Table(1): Effect of fertilization with micronutrient , biofertilizer and humix on traits of three sesame cultivars (data combined over two seasons).

Treatments / Cultivars	Plant height (cm)	Height of first capsule(cm)	Number of capsules/ plant	1000-seed weight (g)	Seed yield/plant (g)
Giza 32	119.0	29.3	60.4	4.18	11.23
Toushki 1	120.6	30.0	60.9	4.35	11.10
Shandaweel 3	102.1	34.4	53.5	4.08	8.65
L.S.D at 5%	*7.9*	*3.8*	*3.5*	*NS*	*1.55*
Fertilization					
T_0 (control)	106.1	44.9	47.9	3.48	8.17
T_1 (Micronutrient)	110.0	37.6	53.6	4.03	9.67
T_2 (Biofertilizer)	111.7	29.9	52.8	4.00	9.50
T_3 (Humix)	112.2	31.3	53.3	4.02	9.56
T_4 (T_1+T_2)	112.8	28.4	59.0	4.28	10.56
T_5 (T_1+T_3)	112.8	29.1	61.2	4.44	10.78
T_6 (T_2+T_3)	120.6	25.3	67.1	4.61	11.89
T_7 (T_1+T_2+T_3)	125.0	23.6	71.2	4.73	12.50
L.S.D	*8.9*	*2.6*	*3.8*	*0.52*	*1.14*
Interaction	*NS*	*S*	*NS*	*NS*	*S*

1.2. Biological, straw, seed and oil yields kg/fad:

Over varieties, data given in Table(2) show that application of micronutrient, biofertilizer microbien and Humix alone or in different combinations significantly increased biological, straw, seed and oil yields (kg/fad.) over control. T_7 (Micronutrient + Biofertilizer + Humix) and T_6 (Biofertilizer + Humix) gave the best results for the above traits without significant differences between them.

Application of T_7 (Micronutrient + Biofertilizer + Humix) increased significantly biological, straw, seed and oil yields (kg/fad.) by 27.0, 20.6, 53.0 and 54%, respectively compared with T_0 (control). The increase in the studied characters due to the T_7 might be attributed to the increase in plant height, number of capsules, 1000-seed weight and seed yield /plant. These results are in harmony with those found by Galal and El-Nagar (1997), Jan *et al*. (1999) and Surahmaniyan *et al*. (1999) for micronutrient, El-Mandoh and Abdel-Magid (1996), Ghosh (2000), Imayavaramban *et al*. (2002) and Sarala *et al.* (2002) for biofertilizer and by Singaravel and Govindasamy (1998) for biofertilizer and humic acid. However, these results are in contrast with Abdel-Wahab *et al*. (2005) who reported that application of micronutrients and the biofertlizer (cerealin) had no effect on yield and yield components of sesame crop.

Table(2): Effect of fertilization with micronutrient , biofertilizer and humix on biological yield, Straw yield, Seed yield, Oil yield and Seed oil content of three sesame cultivars (data combined over two seasons).

Treatments Cultivars	Biological yield /fad. (kg)	Straw yield /fad. (kg)	Seed yield /fad. (kg)	Oil yield /fad. (kg)	Seed oil content(%)
Giza 32	2854	2214	640	334	52.8
Toushki 1	2857	2224	633	336	53.5
Shandaweel 3	2412	1919	493	259	53.3
L.S.D at 5%	186	*111*	*493*	*42*	*NS*
Fertilization					
T_0 (control)	2333	1868	465	246	52.8
T_1 (Micronutrient)	2578	2027	551	292	53.1
T_2 (Biofertilizer)	2629	2087	542	287	53.2
T_3 (Humix)	2625	2081	544	294	53.4
T_4 (T_1+T_2)	2786	2184	602	312	51.8
T_5 (T_1+T_3)	2801	2187	614	317	51.7
T_6 (T_2+T_3)	2946	2268	678	353	52.3
T_7 (T_1+T_2+T_3)	2964	2251	713	379	53.2
L.S.D	*174*	*135*	*65*	*41*	*NS*
Interaction	*S*	*S*	*S*	*NS*	*NS*

1.3. Seed oil content (%)

Data in Table (2) indicated that seeds from plants treated with T_1 (Micronutrient), T_4 (Micronutrient + Humix), T_5 (Micronutrient + Biofertilizer) or T_7 (Micronutrient + Biofertilizer + Humix) had more oil content than other treatments without significant differences between them.

This may be due to the increase in metabolites required for oil bio-synthesis in the activity of some enzymes required for oil accumulation. These results agree with Galal and El-Nagar (1997) who found that foliar spray with micronutrients increased seed oil content. However, El-Hariri (1988) and Abdel-Wahab *et al*. (2005) indicated that oil % in sesame seeds was not affected by micronutrients treatment.

2. Varietal differences

2.1. Yield components:

Data in table (1) indicate that on average, Toushki 1 and Giza 32 plants recorded higher significant values of all studied yield attributes (plant height, number of capsules /plant and seed yield /plant) than Shandaweel 3, without significant differences between them except for 1000-seed weight. However, Toushki 1 and Giza 32 gave the lowest values (29.3 cm) and (30.0 cm) for the height of the first capsule compared to Shandaweel 3 (34.4 cm). Differences among sesame cultivars in yield attributes were mentioned by Tiwari and Namdeo (1997), Subrahmaniyan and Arulmozhi (1999), Basavarai *et al*. (2000), Subrahmaniyan *et al.* (2001) and Abdel-Wahab *et al*. (2005).

2.2. Biological, straw, seed and oil yields (kg/fad.):

Toushki 1 and Giza 32 cvs. surpassed significantly Shandaweel 3 in biological, straw, seed and oil yields (kg/fad.) without significant differences between them (Table 2). Toushki 1 overcame Shandaweel 3 in the above traits respective by 18.4, 15.9, 28.4 and 29.7%, whereas Giza 32 overcame Shandaweel 1 by 18.3, 15.4, 30.0 and 29.0% for the same traits. This could be mainly due to differences in the genetic make-up of the three studied cultivars. These results are in line with those of El-Hifny *et al*. (1988), Subrahmaniyan and Arulmozhi (1999), Basavarai *et al.* (2000), Subrahmaniyan *et al*. (2001) and Abdel-Wahab *et al*. (2005).

2.3. Seed oil content (%)

Over fertilization treatments, Table (2) illustrates that seeds of Giza 32 were significantly higher in their oil content than those of Toushki 1 and Shandaweel 3 without differences between them. These results are in line with Venkateswaran *et al*. (1983), Moorthy *et al*. (1997) and Tiwari *et al.* (2000), but are in contrast with Ibrahim *et al*. (1987) and Mendez-Natera *et al.* (1999) who reported insignificant differences in oil content among sesame cultivars.

3. Interaction effects:

Data in Tables (1 and 2) show that the effect of interaction between fertilization treatments (micro-nutrient, biofertilizer and Humix) and cultivars was not significant on plant height, number of capsules /plant, 1000-seed weight, oil% and oil yield /fad. On the other hand results showed that this interaction exerted a

significant influence on height of first capsule, seed yield /plant, biological yield /fad, straw yield /fad and seed yield /fad. The data in Table (3) showed that Toushki 1 receiving T_7 (Micronutrient + Biofertilizer + Humix) produced the highest values of seed yield /plant (14.5 g), biological yield /fad (3246 kg), and seed yield /fad (826 kg) and showed the lowest value of the height of the first capsule (21.0 cm), while the highest straw yield (2475 kg /fad.) was produced from this cultivars from the application of T_4 (Micronutrient + Biofertilizer).

Table (3): Interaction effects between fertilization treatments (micronutrient , biofertilizer and humix) and cultivars on traits of sesame (data combined over two seasons).

Treatments		Height of first capsule (cm)	Seed yield/ plant (kg)	Biological yield / fad. (kg)	Straw yield/ fad. (kg)	Seed yield/ fad. (kg)
fertilization	varieties					
T_0 (control)	Giza 32	36.0	9.0	2457	1944	513
	Toushki 1	46.0	9.0	2476	1963	513
	Shandaweel 3	52.7	6.5	2066	1696	370
T_1 (Micronutrient)	Giza 32	33.0	11.5	2748	2093	655
	Toushki 1	35.0	9.5	2628	2086	542
	Shandaweel 3	44.7	8.0	2356	1900	456
T_2 (Biofertilizer)	Giza 32	36.0	12.0	2994	2310	684
	Toushki 1	25.7	9.5	2727	2185	542
	Shandaweel 3	28.0	7.0	2166	1767	399
T_3 (Humix)	Giza 32	29.3	11.0	3051	2424	627
	Toushki 1	34.0	10.0	2538	1968	570
	Shandaweel 3	30.7	7.7	2287	1850	437
T_4 (T_1+T_2)	Giza 32	31.0	11.0	2767	2140	627
	Toushki 1	24.0	11.7	3140	2475	665
	Shandaweel 3	30.3	9.0	2449	1936	513
T_5 (T_1+T_3)	Giza 32	25.0	11.0	2767	2140	627
	Toushki 1	30.3	11.0	2926	2299	627
	Shandaweel 3	32.0	10.3	2709	2120	589
T_6 (T_2+T_3)	Giza 32	23.3	11.7	3060	2395	665
	Toushki 1	24.0	13.7	3174	2395	779
	Shandaweel 3	28.7	10.3	2603	2014	589
T_7 (T_1+T_2+T_3)	Giza 32	21.2	12.7	2990	2268	722
	Toushki 1	21.0	14.5	3246	2420	826
	Shandaweel 3	28.3	10.3	2656	2067	589
L.S.D		*1.61*	*0.72*	*109*	*84*	*41*

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استجابة بعض أصناف السمسم لمعاملات التسميد بالعناصر الصغرى والسماد الحيوي وسماد الهيومكس.

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أجريت هذه الدراسة بمحطة التجارب بكلية الزراعة جامعة جنوب الوادي بقنا في الموسم الصيفي لعامي 2004-2005 لدراسة مدى استجابة ثلاثة أصناف من السمسم (جيزة 32 ، توشكي 1 ، شندويل 3) لمعاملات التسميد بالعناصر الصغرى ، التسميد الحيوي (ميكروبين) ، الهيومكس. وتتلخص النتائج كالأتي:

1- أدت المعاملة بالعناصر الصغرى ، التسميد الحيوي بمستحضر الميكروبين ، التسميد بالهيومكس مجتمعة الى الزيادة في ارتفاع النبات ، عدد كبسولات النبات ، وزن الألف بذرة ، محصول النبات الفردي من البذور ، المحصول البيولوجي ، القش ، البذور ، الزيت للفدان وكذلك محتوى البذور من الزيت مقارنة بمعاملة الكنترول كما أدت هذه المعاملة بهذه الأسمدة ألي انخفاض أول كبسولة على النبات.

2- تفوق الصنفين توشكي 1 ، جيزة 32 على الصنف شندويل 3 لصفات المحصول ومكوناته دون وجود فروق معنوية بينهما في المحصول ومكوناته. لم تكن هناك فروق معنوية بين الأصناف الثلاثة لصفة وزن الألف بذرة. تفوق الصنف جيزة 32 على الصنفين توشكي 1 ، شندويل 3 في محتوى البذور من الزيت.

3- أدى التفاعل بين المعاملات السمادية والأصناف ألي زيادة المحصول و أعلى محصول بذور تم الحصول عليه عند زراعة الصنف توشكي 1 و المعاملة بالعناصر الصغرى ، التسميد الحيوي (ميكروبين) ، الهيومكس مجتمعة.