POSSIBILITY OF COMPOSTED TOWN REFUSE UTILIZATION IN COMBINATION WITH MINERAL NITROGEN AND SULPHUR FOR IMPROVING NUTRIENTS STATUS IN THE SANDY SOIL AND ITS REFLECTION ON SESAME YIELD AND SEED QUALITY

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ABSTRACT:

A field experiment was conducted at Ismailia Agric. Res. Station during two successive seasons of 2006 and 2007 to evaluate possibility of composted town refuse utilization at a rate of 15 m^3/fed in combination with different rates of mineral nitrogen (20, 30, 40 and 60 kg N/fed) and elemental sulphur (0, 100 and 200 kg S/fed) for improving nutrients status of the sandy soil and its reflection on sesame (Shandawil 3 c.v.) yield and seed quality. The obtained results showed that all the applied treatments resulted in a pronounced improvement for soil nutrients status, particularly in case of the combined treatments of composted town refuse, mineral nitrogen and elemental sulphur. Also, the beneficial effects were maximized with increasing the applied rates of N and S, however, a significantly increased in soil available content of N, P, K, S, Fe, Mn, Zn, and B was occurred over the control treatment. The favourable conditions of the applied combined treatments, especially with organic compost or sulphur, commonly achieved by lowering soil pH and forming chelated organo-metalic compounds. These chelated micronutrients represent the next superior form due to a higher portion of these compounds still in maintained active forms for uptake by plant roots.

The beneficial effects of the studied treatments were actually reflected on increasing some plant parameters of the grown sesame plants, i.e., number of seed/plant, weight of 1000 seed and oil percentage. In addition, the positive effects of the studied treatments were more attributed with improving the efficiency of macro and micronutrients uptake according to their effective roles. Moreover, the nutrient responses of N, P, K, S, Fe, Mn, Zn, and B to accumulate in sesame seed tissues, were parallel closely to their corresponding available contents in the treated soils. It is worthy to mention that the beneficial effects of applied treatments on sesame yield and its components were more pronounced in the second season as compared to the first one, probably due to the residual effect of the applied treatments.

Key words: Sandy soil, composted town refuse, N–mineral fertilizer and elemental sulphur.

INTRODUCTION:

Large amounts of municipal solid waste are generated from different sources reaching 30000 ton/day, however, their potential value is almost ignored. It should be considered as a valuable renewable energy resource for recycling, composting and ensilage aerobic composting of the organic fraction. So, town refuse was carried out to raise its fertilizing value using different accelerators **(Abd El Maksoud 2002)**.

Sesame (Sesamum indicum. L) is one of the important oil seed crops widely cultivated. Sesame oil has a high oil content (46–64 % and a dietary energy of 6355 kcal/kg. The seeds serve as rich source of protein (20–28 %), sugar (14–16 %) and minerals (5–7 %) **(Thanunathan *et al*., 2001)**. **Modaihsh *et al*. (1989)** found that sulphur application generally increased DTPA extractable P, Mn, Fe and Cu, but it had no significant effect on DTPA extractable Zn and decreasing soil pH. **Brown *et al.* (2000)** studied the improvement efficiency at Halse, which suggests a permeable soil receiving high levels of N, and found that the application of S could have a large effect on nitrate leaching and its associated environmental impact. **Wadile *et al.* (2005)** reported that the highest seed yield (693 kg/ha) was achieved with 45 kg S/ha applied as elemental sulphur. The highest oil content (46.28%) was a obtained with 45 kg S / ha applied.

Kalaiselvan *et al.* (2002) found that seed yield is increased with increased rates of N and K application. **Pathak *et al.* (2002)** found that nitrogen rate at 45 kg/ha recorded the highest mean values of plant height, branches No/plant, capsule No./plant, 1000 grains weight and seed yield. **Malik *et al.* (2003)** found that nitrogen fertilization at 80 kg/ha produced the highest sesame yield (7.79 ton/ha) the highest 1000 seed weight (3.42 g) and the highest seed oil content (45.88%). **Aridoss *et al*. (2004)** reported that the beneficial effect of nitrogen for increasing production and nitrogen also increased the uptake of P and K. **Rainder and Mandeep (2007)** reported that application of organic manures with or without N fertilizers could not sustain the original levels of N. However, their application increased the available P, K and DTPA extractable Zn, Fe, Mn and Cu contents in soil. Application of P, K and micronutrients can be avoided with the application of organic manures. **Ahmed (2007)** pointed out that effect of applied town refuse on sandy soil resulted in pronounced increases in available N, P and K.

Tiwari *et al*. (2000) studied the effect of nitrogen and sulphur on sesame (Sesamum indicum. L) varieties under rain fed condition, and they found that the growth characters and yield attributes were significantly higher at the highest level of 60 kg N/ha and 30 kg S/ha. However, seed oil decreased and seed protein increased significantly due to applied N, while applied S enhanced both their contents significantly. **Amar and Meena (2004)** found that the application of S at rates of 20, 40, 60 and kg/ha resulted in an improvement in residual available S in soil, which was obviously due to poor recovery with increasing S level. The available N status of soil improved with N application over the control. Increasing level of sulphur significantly increased plant height at harvest up to 60 kg/ha over its preceding level. Nitrogen application enhanced the N contents in seed and stalk significantly increased, mainly due to the increased N supply to the plant.

The current work aims to identify the integrated effect of composted town refuse in combination with mineral nitrogen and sulphur on the nutrients status in the sandy soil as well as sesame seed yield, seed quality and its chemical composition.

MATERAIALS AND METHODS:

To achieve the previous objectives, a field experiment was conducted on sesame plants (Sesamum indicum. L, Shandawil 3 c.v.) grown on a sandy soil at Agriculture Research Station of El Ismailia during two successive seasons of 2006 and 2007. Some soil properties of the experimental field were determined according to the standard methods described by **Black *et al,* (1965)** and **Page *et al.* (1982)**, and are presented in Table (1).

Table (1): Some physical and chemical properties of the studied soil* before planting.

Particle size distribution %				Texture class	Organic matter %	$CaCO_3$ %	Soil pH** (1:2.5)	ECe*** (dS/m)
C. sand	F. sand	Silt	Clay					
16.17	76.18	3.35	4.30	Sand	0.45	0.78	7.86	0.88

Some macro and micronutrient contents (mg/kg soil)							
Macronutrients				Micronutrients			
N	P	K	S	Fe	Mn	Zn	B
42.00	5.68	86.92	3.45	2.35	1.27	0.69	0.05

* Soil analysis was carried out on the surface 0-30 cm, ** Soil pH was determined using a 1:2.5 soil water suspension, *** Soil paste extract

Available macronutrients of N, P, K and S in soil were extracted according the methods described by **Soltanpour and Schwab (1977)** and their contents were determined according to **Jackson (1973)**. Available micronutrients of Fe, Mn, Zn, and Cu in soil were extracted using ammonium bicarbonate DTPA extract according to **Lindsay and Norvell (1978)** and their contents were measured by using Atomic Absorption Spectrophotometer.

The experiment was laid out in split plot design, with three replicates and an area of 5 x 10 m for each plot. Organic manure (composted town refuse) was added to the main plots at a rate of 15 m^3/fed during tillage practices. Some properties of the composted town refuse were determined according to **Black *et al,* (1965)** and **Jackson (1973)**, and are presented in Table (2).

Table (2): pH, organic carbon, organic matter and some nutritive and non-nutritive element of the composted town refuse.

pH	Organic carbon %	Organic matter %	N %	Some nutritive and non-nutritive elements (mg/kg)					
				P	K	Fe	Mn	Zn	B
7.91	24.21	40.36	1.54	17.86	260	42.08	16.54	12.62	1.59

The applied nitrogen rates of 20, 40 and 60 kg/fed were added to the sub plots in form of ammonium nitrate (33 % N); each one was added in two doses (one quarter at 30 days after sowing and 3 quarters at 45 days after sowing). Elemental sulphur was added to the sub sub plots before sowing seed sesame during tillage practices in three rates of 0, 100 and 200 kg S/fed. Moreover, 100 kg/fed of superphosphate (15.5 % P_2O_5) was added during tillage practices, besides 200 kg/fed of potassium fertilizer (48 % K_2O) was added in two equal doses, i.e., after one and two months of cultivation. Under the sprinkler irrigation system, sesame seeds were sown during May 2006 and 2007, and harvested during October 2006 and 2007. At harvest, straw and seeds of sesame were wet disgusted by mixture of $HClO_4$ and H_2SO_4 acids **(Sommers and Nelson (1972)**. N was determined using semi micro Kheldahl, as well as, P by spectrophemetecally using sulphomolybdate stannus chloride reagent, K by Flame Photomaerically, Mn, Zn and B by Atomic Absorption Immersion **(Chapman and Pratt, 1961)**. The results obtained were statistically analyzed according to **Gomez and Gomez (1984)**.

RESULTS AND DISCUSSION:

I. Available macronutrient contents in soil as affected by applied S and N under either with or without composted town refuse addition:

The effects of composted town refuse in combination with the applied different rates of mineral nitrogen and sulphur on the nutrients status in the sandy soil are presented in Table (3). The obtained data show that the available contents of N, P, K and S in the soil were significantly increased in the treated soil. Also, the extractable amounts of N, P, K and S tended to increase with increasing N and S rates, particularly under soil treated with composted town refuse as compared to either the control treatment or that untreated with organic compost during the growing summer seasons of 2006 and 2007. The effectiveness of applied S considerably greater than in the presence of organic compounds because of more mobility of S could be associated with the microbial activity and released active acids in the soil **(Eriksen and Mortensen, 2002)**. Moreover, increasing the applied rate from 0 up to 200 kg S/fed represents an improvement in residual available S in the soil, which was obviously due to poor recovery with increasing S rate **(Amar and Meena, 2004)**. This is emphasized by a low available amount of sulphur in the year of application, probably several years of application may be required to make sufficient sulphur available.

The relative increase percentages for the available contents of N, P, K and S during the first & second seasons in soil treated with the highest rates of 60 kg N/fed and 200 kg S/fed only were 28.37 & 39.31, 7.91 & 13.91, 25.84 & 37.89 and 31.25 & 40.19 %, respectively. In case of soil treated with N, S and composted town refuse tended to increase, where the corresponding percentages reached 39.98 & 51.40, 525.79 & 42.78, 44.94 & 58.95 and 57.75 & 69.74 %, respectively.

Concerning the effect of N and S application, either solely or together, data exhibited a significant increase of nitrogen in soil during second season, while it was usefulness at the first one, yet its relative increases were significant for all treatments. Regarding P, K and S, results showed that their amounts were significant in case of soil treated with N, S, organic compost or their combinations during the studied two seasons, with a superiority for the second one for all applied treatments. These results are in harmony with those obtained by **Rainder and Mandeep (2007)** and **Ahmed (2007)**.

II. Available micronutrient contents in soil as affected by S and N under either with or without composted town refuse addition:

It is evident from data presented in Table (4) that there were pronounced increases in soil available micronutrient contents for Fe, Mn, Zn and B, which were achieved as a result of applying S and N rates, particularly under composted town refuse application. This is more related to the effectiveness of organic compounds that released directly from town refuse, besides the activation of microbial system that enhancing active biochemical and chemical changes, which leads to released more available micronutrients. This is more obvious from the relative increases of these nutrients in soil treated with composted town refuse in combination with S and N at the different rates as compared to soil treated both N and S at the different rates but without town refuse addition. This may be due to the accumulation of the active organic acids that derived from composted town refuse and chelating the free nutrients as well as saving them in form of organo-metalic compounds. Such chelated micronutrients represented the next superior form due to a higher portion of these compounds still in maintained active forms for uptake by plant roots **(Wahdan *et al.,* 2006)**.

Table (3): Available macronutrients in the experimental soil after harvest during the studied two seasons.

Composted town refuse	N (kg/fed)	S (kg/fed)	Macronutrients (2006) (mg/kg)				Macronutrients (2007) (mg/kg)			
			N	P	K	S	N	P	K	S
0	20	0	50.47	6.32	89	4.00	52.12	7.76	95	4.23
		100	55.36	6.48	93	4.20	56.23	7.85	102	4.54
		200	59.67	6.67	97	4.40	62.67	7.89	113	4.71
	40	0	51.89	6.52	92	4.10	55.39	8.02	108	4.47
		100	57.95	6.61	96	4.22	60.35	8.12	120	4.82
		200	60.76	6.77	102	5.01	66.28	8.15	125	5.35
	60	0	56.78	6.63	106	4.40	60.57	8.14	113	4.73
		100	61.39	6.68	108	4.75	69.49	8.25	124	5.26
		200	64.79	6.82	112	5.25	72.61	8.84	131	5.93
15 m^3/fed	20	0	58.91	7.35	115	5.14	65.81	9.59	121	5.40
		100	59.67	7.44	117	5.50	71.69	9.64	132	5.81
		200	60.23	7.53	124	5.81	74.32	9.72	139	6.24
	40	0	61.41	7.51	119	5.36	68.62	9.66	129	5.73
		100	63.57	7.62	122	5.83	73.34	9.75	135	6.85
		200	65.35	7.68	130	6.12	76.12	9.84	143	7.09
	60	0	64.25	7.69	121	5.76	70.54	10.89	132	6.92
		100	67.39	7.89	125	6.14	75.69	10.94	146	7.12
		200	70.65	7.95	129	6.31	78.91	11.08	151	7.18
Statistical analysis										
F. test Organic			***	ns	***	*	ns	*	***	***
F. test N			***	***	***	***	***	***	***	***
F. test S			***	***	***	***	***	***	***	***
F. test Organic x N			***	ns	***	*	ns	*	***	***
F. test Organic x S			***	***	***	ns	ns	ns	***	***
F. test N x S			***	ns	***	ns	***	*	***	ns
F. test Organic x S x N			***	ns	***	ns	ns	ns	***	***
LSD at 5% Organic			0.19	2.83	0.59	0.29	2.50	0.24	0.45	0.001
LSD at 5% N			0.17	2.27	0.68	0.37	1.60	0.15	0.15	0.330
LSD at 5% S			0.43	4.41	0.95	0.35	7.27	0.33	1.15	0.430

Table (4): Available micronutrients in the experimental soil after harvest during the studied two seasons.

Composted town refuse	N (kg/fed)	S (kg/fed)	Micronutrients (2006) (mg/kg)				Micronutrients (2007) (mg/kg)			
			Fe	Mn	Zn	B	Fe	Mn	Zn	B
0	20	0	2.30	1.28	0.63	0.018	2.54	1.45	0.74	0.025
		100	2.36	1.31	0.67	0.021	2.57	1.49	0.76	0.026
		200	2.42	1.36	0.71	0.027	2.60	1.51	0.78	0.029
	40	0	2.46	1.34	0.67	0.025	2.85	1.52	0.79	0.027
		100	2.68	1.38	0.72	0.029	3.04	1.61	0.81	0.031
		200	2.94	1.42	0.78	0.032	3.09	1.64	0.85	0.037
	60	0	2.58	1.41	0.72	0.038	2.94	1.56	0.81	0.043
		100	2.79	1.45	0.77	0.047	3.12	1.68	0.92	0.056
		200	2.99	1.49	0.84	0.055	3.16	1.85	0.98	0.061
15 m^3/fed	20	0	3.55	1.46	1.03	0.046	4.25	1.84	1.08	0.059
		100	3.67	1.54	1.08	0.058	4.28	1.89	1.15	0.062
		200	3.89	1.58	1.12	0.065	4.32	1.94	1.19	0.073
	40	0	3.85	1.52	1.07	0.066	6.12	2.24	1.26	0.069
		100	3.99	1.57	1.15	0.078	6.20	2.35	1.29	0.079
		200	4.05	1.66	1.22	0.088	6.35	2.41	1.38	0.094
	60	0	3.94	1.59	1.17	0.074	6.17	2.27	1.29	0.081
		100	4.09	1.64	1.25	0.098	6.39	2.37	1.36	0.103
		200	4.18	1.83	1.37	0.107	6.48	2.45	1.46	0.114
Statistical analysis										
F. test Organic			ns	ns	ns	ns	ns	ns	ns	ns
F. test N			*	ns	ns	*	*	ns	ns	*
F. test S			**	*	ns	*	**	*	ns	*
F. test Organic x N			ns	ns	ns	ns	ns	ns	ns	ns
F. test Organic x S			ns	ns	ns	ns	ns	ns	ns	ns
F. test N x S			ns	ns	ns	ns	ns	ns	ns	ns
F. test Organic x S x N			ns	ns	ns	ns	ns	ns	ns	ns
LSD at 5% Organic			0.32	0.07	0.13	0.019	0.32	0.07	0.13	0.019
LSD at 5% N			0.43	0.09	0.29	0.024	0.43	0.09	0.29	0.024
LSD at 5% S			0.48	0.12	1.11	0.032	0.48	0.12	1.11	0.032

In addition, soil management practices and microorganisms activities in topsoil represented positively effects on the availability of these nutrients, especially in soil treated with the composted town refuse on long-term during the summer seasons of 2006 and 2007. The distribution pattern of available Fe, Mn, Zn and B were more clearly obvious in the studied soil, may be due to it was suffering from soil organic matter deficient in surface layers. These results are in agreement with those obtained by **Modaihsh *et al.* (1989) and Rainder and Mandeep (2007)**. It is worthy to mention that soil content of all the studied available micronutrients, in general, showed a relatively increase in the second season, may due to the residual effects of the applied treatments among the two successive seasons. Although the pronounced increases in these micronutrients, yet their levels lay within the safe limits according to the critical limits identical division for the **(FAO, 1992)**.

III. Nutrient contents in sesame seed as affected by the applied treatments:

Effects of the applied different rates of nitrogen and sulphur, with or without composted town refuse application, on some macro and micronutrient contents of sesame seed are presented in Tables (5 and 6).

Table (5): Macronutrient concentrations in sesame seed at the studied two seasons.

Composted town refuse	N (kg/fed)	S (kg/fed)	Macronutrients % (2006)				Macronutrients % (2007)			
			N	P	K	S	N	P	K	S
0	20	0	2.61	0.35	0.60	0.41	2.73	0.44	0.77	0.55
		100	2.75	0.39	0.64	0.53	2.80	0.48	0.80	0.59
		200	2.79	0.46	0.67	0.60	2.85	0.52	0.85	0.63
	40	0	2.77	0.40	0.61	0.72	2.79	0.47	0.81	0.75
		100	2.85	0.42	0.68	0.80	2.88	0.54	0.85	0.84
		200	2.92	0.49	0.71	0.84	2.96	0.57	0.89	0.89
	60	0	2.88	0.45	0.63	0.79	2.93	0.51	0.87	0.83
		100	2.96	0.49	0.71	0.88	2.99	0.56	0.91	0.97
		200	3.04	0.52	0.73	0.90	3.12	0.61	0.94	0.99
15 m^3/fed	20	0	2.92	0.48	0.75	0.85	3.18	0.55	0.90	1.00
		100	3.15	0.52	0.77	0.96	3.29	0.58	0.94	1.03
		200	3.24	0.55	0.79	0.99	3.32	0.62	0.97	1.06
	40	0	3.18	0.53	0.78	0.88	3.23	0.57	0.95	1.04
		100	3.29	0.60	0.81	1.00	3.35	0.62	0.98	1.07
		200	3.34	0.62	0.84	1.02	3.41	0.67	1.09	1.08
	60	0	3.26	0.55	0.80	0.95	3.37	0.60	1.07	1.06
		100	3.36	0.62	0.97	1.04	3.42	6.66	1.18	1.09
		200	3.47	0.66	1.01	1.06	3.49	0.69	1.25	1.11
Statistical analysis										
F. test Organic			ns	*	ns	ns	ns	ns	***	***
F. test N			ns	ns	**	***	***	**	***	***
F. test S			ns	*	*	***	***	**	***	***
F. test Organic x N			ns	ns	***	***	**	ns	***	ns
F. test Organic x S			ns	ns	ns	ns	ns	ns	*	*
F. test N x S			ns	ns	ns	*	ns	ns	***	***
F. test Organic x S x N			ns	ns	ns	ns	ns	ns	*	**
LSD at 5% Organic			0.55	0.11	0.27	0.008	0.02	0.34	0.018	0.017
LSD at 5% N			0.68	0.20	0.03	0.009	0.04	0.35	0.021	0.018
LSD at 5% S			0.67	0.43	0.08	0.002	0.03	0.04	0.090	0.072

Table (6): Micronutrient concentrations in sesame seeds at the studied two seasons.

Composted town refuse	N (kg/fed)	S (kg/fed)	Micronutrients (2006) (mg/kg)				Micronutrients (2007) (mg/kg)			
			Fe	Mn	Zn	B	Fe	Mn	Zn	B
0	20	0	123	42	27	18	125	44	29	20
		100	127	46	31	19	129	47	34	24
		200	129	48	34	21	130	49	36	26
	40	0	126	44	29	22	127	47	31	26
		100	128	47	32	24	129	49	35	27
		200	131	51	35	27	134	53	38	29
	60	0	132	48	30	25	133	51	33	28
		100	134	52	34	28	136	56	37	32
		200	135	54	37	30	138	58	39	35
15 m^3/fed	20	0	129	53	35	32	132	57	38	36
		100	134	55	38	35	136	59	41	38
		200	136	57	40	38	139	61	43	41
	40	0	142	56	42	37	145	57	44	39
		100	145	59	45	42	147	62	48	47
		200	148	62	47	44	150	65	49	48
	60	0	147	61	44	47	148	63	47	52
		100	152	63	47	49	154	65	49	54
		200	155	65	49	51	158	67	53	57
Statistical analysis										
F. test Organic			*	***	ns	ns	ns	ns	*	***
F. test N			***	***	*	ns	*	**	*	***
F. test S			***	***	***	ns	*	***	***	***
F. test Organic x N			*	ns	ns	ns	ns	ns	ns	**
F. test Organic x S			***	***	**	ns	*	*	***	*
F. test N x S			***	ns	ns	ns	*	ns	ns	***
F. test Organic x S x N			ns	*	ns	ns	*	ns	ns	ns
LSD at 5% Organic			0.77	0.49	1.79	15.8	2.37	1.95	1.93	0.83
LSD at 5% N			1.43	1.01	7.39	25.8	9.57	6.03	9.07	1.65
LSD at 5% S			0.98	1.02	1.94	20.2	3.07	1.95	2.39	0.97

From the obtained results, it could be noticed that the soil treated with composted town refuse showed a positive effect on the seed content of N, P, K, Fe, Mn, Zn and B as compared with the untreated one among the different applied rates of S and N either in the first or the second seasons. These findings are in agreement with those obtained by **Khater *et al.* (2004)**. On the other hand, the beneficial effect was maximized for all the studied uptake nutrients by sesame seed with increasing the applied rates of either S or N, particularly in the presence of composted town refuse during the tested two seasons. These findings are in agreement with those obtained by **Tiwari *et al.* (2000) and Adridoss *et al.* (2004)**. Also, it is concluded that the concentrations of N, P, K, Fe, Mn, Zn and B in sesame seed as affected by the applied treatments could be reflected the parallel trend of their available contents in the soil as affected by the same applied treatments under the conditions of the tested two seasons.

Such surpassed effect being dependent on the nature of concerned material types, especially its chemical composition and applied method (solely or combined). So, the combined treatments of organic compost and mineral N or S fertilization in such relatively coarse textured soil caused the superior effect due to their more adhesion for chelating micronutrients, and enhancing their absorption and transportation inside the plant in easier status. Therefore, the beneficial effects of the treatments under investigation were extended to the plant content of micronutrients. It could be also noticed that the combined treatments resulted in a markedly positive effect on seed content of the tested nutrients as compared to the solely ones. Also, the micronutrient contents were extending parallel close to their corresponding available contents in the soil, as shown in Tables (5 and 6). This means that micronutrient responses of Fe, Mn, Zn and B to accumulate in the sesame seed tissues showed a parallel closely relationship to their corresponding available contents in the treated soils.

IV. Sesame yield, its components and seed content of oil:

Concerning the influence of applied treatments on sesame yield, its components and seed content of oil, data in Table (7) showed a markedly positive and significant effect on sesame seed yield, with a superior effect was achieved upon treating the soil with the combined treatments of composted town refuse, mineral nitrogen and sulphur, where the significance was confirmed by the values of L.S.D. at 0.05. The beneficial effects of these treatments, either solely or combined, are mainly attributed with the highly humified organic materials and elemental sulphur, where active organic acids can chelate the micronutrients forming organo-metalic forms as a storehouse as well as increasing their availability and mobility for uptake by plant roots. In addition, the effect of sulphur added solely or combined treatments on decreasing the pH value in the soil.

It could be concluded that applied organic compost resulted in improving soil hydro-physical, chemical and biological characteristics as well as its fertility status, which are positively reflected on soil productivity and returned on increasing the sesame seed yield and seed quality. Also, such materials enrichment in both organic and mineral substances that are essential to plant growth and activating the bio-chemical processes in plants, i.e., respiration, photosynthesis and chlorophyll content that increased the crop quality and quantity **(Hegazi, 2004)**. It is worthy to mention that these increases were attributed to a higher portion of released active organic acids which forming chelated micronutrients that still in maintained active forms for uptake by plant roots. Such results are in agreement with those obtained by **Soliman (1980)** for Zn, **Baza *et al.* (1989)** for Fe and **Basyouny (2005)** for Mn and Cu.

The optimum sesame seed yield was extending parallel close to the corresponding contents of available nutrient in soils, as shown in Tables (3 and 7). Thus, the positive roles of composted town refuse are more attributed to improve the efficiency of nutrients released or uptake and enhancing dry matter yield, and in turn the seed quality of sesame. Moreover, the beneficial effects of the studied treatments were actually extended to the other studied plant parameters, i.e., weight of seed/plant, number of seed/capsule, weight of 1000 seed and seed oil content %, which showed significantly increased. These findings are in agreement with those obtained by **Abd El Mawgoud *et al.* (2005)**.

Table (7): Yield, yield components and oil content in sesame seeds at the studied two seasons.

Composted town refuse	N (kg/fed)	S (kg/fed)	Yield components: Seed yield (kg/fed)		Weight of 1000 seed (g)		Weight seed/plant (g)		No. of seed/capsule		Oil (%)	
			2006	2007	2006	2007	2006	2007	2006	2007	2006	2007
0	20	0	432	441	2.78	2.80	2.8	3.1	37	40	42.3	434
		100	451	464	2.85	3.10	3.1	3.3	41	43	43.5	45.8
		200	479	505	2.88	3.16	3.2	3.5	42	45	45.7	46.0
	40	0	482	490	3.28	3.33	3.3	3.7	43	44	45.6	46.5
		100	495	528	3.35	3.39	3.4	3.9	47	50	45.8	46.9
		200	534	555	3.82	3.91	3.6	4.1	50	53	46.5	47.3
	60	0	480	507	3.74	3.82	3.8	4.3	45	47	45.9	46.8
		100	536	545	380	3.95	4.3	4.6	51	55	46.7	48.4
		200	559	590	4.12	4.22	4.5	4.9	55	60	47.4	52.8
15 m^3/fed	20	0	496	511	3.50	3.34	4.3	4.5	43	45	50.0	52.1
		100	556	562	3.69	3.55	4.6	4.7	45	48	53.0	53.4
		200	598	626	3.74	4.19	4.8	4.9	48	50	53.1	53.3
	40	0	567	589	4.14	4.21	4.9	5.2	44	49	53.4	53.7
		100	622	611	4.26	4.33	5.1	5.4	48	52	53.7	53.9
		200	649	667	4.30	4.35	5.3	5.7	54	56	53.9	54.3
	60	0	606	623	4.22	4.36	5.0	5.6	50	53	54.2	54.2
		100	663	677	4.44	4.50	5.3	5.8	52	58	54.3	56.7
		200	678	7.05	4.48	4.65	5.7	6.4	56	62	54.6	57.9
Statistical analysis												
F. test Organic			ns	ns	ns	*	ns	*	ns	ns	*	ns
F. test N			ns	**	***	***	**	***	ns	ns	***	*
F. test S			***	**	***	***	**	***	ns	*	***	*
F. test Organic x N			ns	ns	ns	***	ns	*	ns	**	ns	ns
F. test Organic x S			ns	ns	***	**	ns	ns	ns	ns	ns	ns
F. test N x S			ns	ns	***	***	ns	*	ns	ns	***	ns
F. test Organ. x S x N			ns	ns	**	***	ns	ns	ns	ns	ns	ns
LSD at 5% Organic			55.2	30.84	0.07	0.08	0.21	0.13	5.52	3.50	0.78	3.98
LSD at 5% N			67.6	39.28	0.10	0.09	0.24	0.17	6.76	4.45	0.99	4.49
LSD at 5% S			67.6	47.57	0.13	0.12	0.90	0.22	6.76	5.67	1.26	6.67

The pronounced increases in sesame seed yield and its content of oil reflected the important role of mineral and organic fertilizers. However, nitrogen is required for healthy stems and leaves as well as it is an essential part of the amino acids. The latter represent an essential part of both proteins and chlorophyll molecules that has the main role in photosynthesis. Also, sulphur is taken up as sulphate ions ($SO_4^{=}$), which form part of all proteins as well as it activates enzymes and involves in the flavor factors of mustards and alliums. The obtained data showed that the relative increase percentages in seed yield at the highest rate of N and S without organic compost during the first & second seasons were 29.40 &33.79 % vs 56.94 &59.86 % with organic compost, respectively. The corresponding seed oil contents were 10.20 & 11.17 % vs

11.91 & 12.34%, respectively. These findings are in agreement with those obtained by **Malik *et al.* (2003)** and **Amar and Meena (2004)**.

REFERENCE:

Abd El Maksoud, M.F. (2002). Response of some wheat cultivars to bio-fertilizer and nitrogen fertilizer levels. Zagazig J. Agric. Res., 29 (3): 891-905.

Abd El Mawgoud, A.S.; Zhran, F.; El Aref, Kh.A; Faragallah, M.A. and Abo El Hamd (2004). Sesame yield response to nitrogen fertilizer forms under different irrigation systems. Egypt. J. Appl . Sci., 20 (6A): 313–128.

Ahmed, M.A. (2007). Evaluation of some amendments in new reclaimed soils. M. Sc. Thesis, Fac. of Agric., Zagazig Univ., Egypt.

Amar, S. and Meena, N. (2004). Effect of nitrogen and sulphur on growth, yield attributes and seed yield of mustard (Brassica Juncea) in eastern plains of rajasthan .India. J..of Agro., 49 (3): 166-188.

Aridoss, G.; Sasikumar, K. and Euadoos, T. (2004). Comparative efficacy of oil cakes and NPK in combination with Azospirillum on growth and yield enhancement of sesame (sesame indicum L.). Sesame and Safflower News Letter, (19): 113: 116.

Basyouny, E.A. (2005). Effect of chelated micronutrients combined with sulphur or organic manures on wheat production grown on calcareous soil. Egypt. J. Appl. Sci., 20 (9): 375-387.

Baza, M.S.; Monged, N.O. and Mohamed, K.S. (1989). Response of faba bean to foliar application of some micronutrient treatments. J. Agric. Sci., Mansoura Univ., 14; 884-892.

Black, C.A.; D.D. Evans; L.E. Ensminger; J.L. White and F.E. Clark (1965). Methods of Soil Analysis. Amer. Soc. Agron. Inc., Pub., Madison, Wisc., USA.

Brown, L.; Scholefied, D.; Jewkes, E.; Preedy, N.; Wadge, K. and Butler, M. (2000). The edict of sulphur application on the efficiency of nitrogen use in two contrasting grassland soils. J. Agric. Sci., 135: 131-138.

Chapman, H.D. and P.F. Pratt, (1961). Methods of Analysis for Soils, Plants and Waters. Univ. of California, Division of Agric.Sci.

Eriksen, J. and Mortensen, J.V. (2002). Effect of timing of sulphur application on yield, S uptake and quality of barley. J. Plant and Soil, 242 (2): 283-289.

FAO (1992). Waste water treatment and use in agriculture. FAO Bull. No. 47, Rome.

Gomez, K.A. and Gomez, A.A. (1984). Statistical Procedures for Agricultural Research. John Wiley and Sons, Inc., New York, USA.

Hegazi, I.M.A. (2004): Maximizing wheat production in sandy soil by using some natural soil amendments. Egypt. J. Appl. Sci., 19 (4): 214-226.

Jackson, M.L. (1973). Soil Chemical Analysis. Prentice Hall of India Private Limited, New Delhi, Indian.

Kalaiselvan, P.; Subramaniyan, K. and Subramanian, B. (2002). Effect of split application of N and K on growth, yield attributes and yield of sesame. Sesame and Safflower News Letter, 17: 62-64.

Khater, E.A.; Ibrahim, S.B. and Wadalla , A.A. (2004). Utilization of some farm organic wastes for improving soil productivity of newly reclaimed areas at El-Fayoum Governorate Egypt. Egypt. J. Soil Sci., 44 (3): 333-354.

Lindsay, W.L. and Norvell, W.A. (1978). Development of DTPA soil test for Zn, Fe, Mn and Cu Soil Sci. Soc. Am. J., 42: 421.

Malik, M.A.; Saleem, M.F.; Chemma, M.A. and Shamim. M.A. (2003). Influence of different nitrogen levels on productivity of sesame (Sesamum indicum L.) under varying planting patterns. Inter. J. Agric. and Biology, 5: 490-492.

Modaihsh, A.S.; Al Mustafa, W.A. and Metwally, A.I. (1989). Effect of elemental sulphur on chemical changes and nutrient availability in calcareous soils. J. Plant and Soil, 116 (1): 95-101.

Page, A.I. ; Miller, R.H. and Keeney, D.R. Eds. (1982). Methods of Soil Analysis. Part 2: Chemical and Microbiological Properties. 2 nd Edition, Amer. Soc. of Agron., Madison, Wisconsin, USA.

Pathak, K.; Barman, V.; Kalita, M. and Hazarika. K. (2002). Effect of nitrogen levels on growth and yield of sesame (Sesamum indicum) in Barak valley zone of Assam. Advances in Plant. Sci., 15: 341-343.

Rainder, S. and Mandeep, S. (2007). Effect of organic manures and fertilizers on organic matter and nutrients status of the soil. Agronomy and Soil Sci.. 53 (5): 519 – 528.

Richards , L.A. (1954) Diagnosis and Improvement of Saline and Alkali Soils. U.S. Dept. Agric Hand Book, 60, U.S. Govt. Printing Office, Washington.

Soliman, M.F. (1980). Zinc uptake by wheat plants as influenced by nitrogen fertilizers and calcium carbonate. Agric. Res. Rev., 58: 113.

Sommers, L.E. and Nelson, D.W. (1972). Determination of total phosphorus in soil. A rapid perchloric acid digestion procedure. Soil Sci. Soc. Amer. Proc., 36: 902- 904 .

Soltanpour, P.N. and Schwab, A.B. (1977). A new soil test for simultaneous extraction of macronutrients in alkaline soils. Comm. Soil Sc. and Plant Annal., 8: 195.

Tiwari, R.K.; Namdeo, K.N. and Girish, H.A. (2000). Effect of nitrogen and sulphur on growth, yield and quality of sesame (Sesmum indicum) varieties. Res. on Crops, I (2): 163- 167, India.

Thanvanathan, K.; Ganapathy, M.; Parkash, M. and Imayavaramban, V. (2001). Nutrient uptake and quality characters of sesame (Sesamum indicum L.) as influenced by micronutrient, Bio-fertilizer and phytohormanes. Sesame and Safflower News Letter, 16: 1013-1015.

Wadile, S.C.; Patil, S.S.; Jadhav, M.G.; Chaudhari, G.B; Bahale, T.M.; Surywanshi, R.T. and Rajput, S.D. (2005). Effect of sulphur application through different sources on seed yield and oil content in sesame (Sesamum indicum L). Food and Agriculture Organization of the United Nations. Sesame and Safflower News Letter, 20: 1015–1018.

Wahdan, A.A.A., Awadalla, A.A. and Mahmoud, M.M. (2006). Response of some wheat-maize cropping sequence in a calcareous soil to some mineral or chelated micronutrients forms added to soil in combination with sulphur and organic manures. Fayoum J. Agric. Res. & Dev., 20 (1): 25-39.

إمكانية إستغلال مكمورة مخلفات المدن بالإشتراك مع النتروجين والكبريت المعدنى فى تحسين حالة المغذيات فى التربة الرملية وإنعكاساتها على محصول السمسم وجودة البذور

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أجريت تجربة حقلية خلال الموسم الصيفى لعامين متعاقبين هما ٢٠٠٦، ٢٠٠٧ بمحطة البحوث الزراعية بالإسماعلية لتقييم إمكانية الإنتفاع بمكمورة مخلفات المدن (بمعدل ١٥ م^{٣}/فدان) بالإشتراك مع معدلات مختلفة من النتروجين (٢٠، ٤٠، ٦٠ كجم نتروجين/فدان في صورة نترات أمونيوم) والكبريت (بمعدلات ٠، ١٠٠، ٢٠٠ كجم كبريت/فدان فى صورة كبريت معدنى) فى تحسين حالة المغذيات النباتية فى التربة الرملية وزيادة محصول السمسم (صنف شندويل ٣) وجودة بذوره.

وتشير النتائج المتحصل عليها إلى أن جميع المعاملات تحت الدراسة، خاصة المشتركة منها (مكمورة مخلفات المدن + النتروجين + الكبريت المعدنى)، قد أدت إلى تأثيرات إيجابية مع تعاظم هذا التأثير بزيادة معدلات الإضافة من كلا النتروجين والكبريت المعدنى، تتمثل فى تحسين صفات التربة الرملية خاصة فيما يتعلق بمحتواها من المغذيات النباتية الميسرة كالنتروجن، الفوسفور، البوتاسيوم، الكبريت، الحديد، المنجنيز، الزنك، البورون، مع تحسن نسبى فى القطع المضاف إليها مكمور مخلفات المدن. وقد تحققت تلك الظروف المحسنة للتربة الرملية والناجمة عن إستخدام المعاملات المشتركة خاصة مع المكمور العضوى لمخلفات المدن أو الكبريت المعدنى كنتيجة لإنخفاض فى قيم Soil pH وتكوين معقدات معدنية-عضوية مخلبية Organo-metalic compounds مبسرة للنبات – ناتجة من خلب الأحماض العضوية النشطة لتلك المغذيات - وحفظها فى صورة مركبات غير حساسة للتأثير المعوق أو المعاكس فى التربة، وكذلك لأن جزء كبير منها يظل محتفظا بحالته النشطة مما يسهل من حركته فى التربة وإمتصاصه بواسطة جذور النباتات.

وقد إنعكس هذا التأثير الإيجابى فى تحسين حالة المغذيات النباتية الميسرة فى تربة التجربة الرملية على الزيادة الملحوظة فى محتوى بذور السمسم من عناصر النتروجين، الفوسفور، البوتاسيوم، الكبريت، الحديد، المنجنيز، الزنك، البورون، بالإضافة إلى زيادة معنوية فى وزن الألف بذرة، عدد البذور/نبات، النسبة المئوية للزيت فى البذور، مع حدوث زيادة نسبية فى هذه الصفات النباتية بزيادة معدلات الإضافة من كلا النتروجين والكبريت المعدنى. وقد تلاحظ وجود زيادة نسبية فى إنتاجية المحصول وبعض القياسات النباتية فى حالة الموسم الثانى ٢٠٠٧ مقارنة بالموسم الأول ٢٠٠٦، وربما يعزى ذلك إلى التأثير المتبقى للمعاملات تحت الدراسة المضافة خلال الموسم الأول على تحسين حالة المغذيات النباتية باللإضافة إلى التأثير الإيجابى والمتراكم لتلك المعاملات المضافة فى الموسم الثانى.