J. Agric. Sci. Mansoura Univ., 29(7): 4281 - 4294, 2004

EFFECT OF BIOFERTILIZER, CITY GARBAGE COMPOST, MINERAL-N AND THEIR COMBINATIONS ON PRODUCTIVITY OF SUGAR BEET CULTIVARS

Attallah, M.Z.
Sugar Crops Research Institute Dept. of Physiology and Chemistry.

ABSTRACT

Experiments were conducted to evaluate the effect of biofertilizer, matured compost, mineral-N and their combinations on sugar beet varieties (*Beta vulgaris* L.). Ten sugar beet varieties growing on clay loam soil were employed. Seven treatments, control, bio-fertilizer (BF), 20.0 tons feddan $^{-1}$ of compost (OM), 60 kg N feddan^{-1} mineral-N, and BF with half of OM and/or of N feddan^{-1}. Root weight, yield, total soluble solids % (TSS%) sucrose % as well as morphological parameters of root and leaves were determined. The compost composition and soil properties were analyzed. The results indicated that the studied characters of sugar beet were increased significantly by the use of the BF, OM, N and their combinations. The integration of the three types of fertilizers showed positive effects on root yield and quality under the studied conditions. Comparing the combinations of the fertilizer types with BF, OM and N alone, the first surpassed the second in root yield by 37.70, 31.04 and 24.99% but only 7.18, 6.65 and 5.47% in sucrose %, respectively. Results revealed that the highest mean value of sucrose % (17.63) and TSS % (22.09) was obtained by bio-fertilizer plus mineral-N, while the highest root yield (24.36 tons/ feddan) was obtained by the combination of BF, OM and mineral-N.

The results indicated that the varieties varied significantly due to the treatments. The highest root weight was 2042.69 and 1821.68 g plant^{-1} obtained for Cawmera and Pamela, respectively. The two varieties showed the same trend, but Pamela surpassed Cawmera in root yield (tons/feddan) under the studied conditions. However, Cawmera was superior compared with Pamela for sucrose % and TSS %. Deprase-poly variety had the highest values of sucrose % and TSS %. Des-poly variety produced the lowest values of root weight and yield whereas; Hi-poly produced the lowest sucrose % and TSS%.

The present investigation indicated that all interactions for the all studied characters of sugar beet were significant among fertilization x cultivars x seasons except the root weight (g/plant). The interaction among seasons x fert. treatments was not significant for root yield, leaves fresh weight and leaf blade width (cm), while the other characters of leaves and roots, TSS% and sucrose% were proven to be significant.

The results, however, recommend that the best means of maintaining the soil fertility would be achieved through periodic addition of bio-fertilizer in combination with proper compost plus mineral-N fertilizer.

Keywords: Compost, biofertilizer, mineral-N, sucrose, sugar beet cultivars and TSS%.

INTRODUCTION

Sugar beet, as the second important sugar crop in Egypt after sugar cane, is growing in more than 54790 hectar which produced total crop beet of 2601270 tons yielding 317470 tons sugar in 1999 (Ministry of Agric., Sugar Crops Council, Cairo, Egypt 1999). In 2002 –2003, it has been grown in 190,000 feddan and reached to more than 200,000 feddan. In 2003-2004, it produced about half million tons of sugar (Farag, 2003). Its importance to agriculture is not confined only to sugar production, but also because it can be grown on a wide range of soils with medium to slightly heavy texture.

Moreover, in most sugar beet growing regions, nitrogen is the most important fertilizer element for normal growth and high yield of root and sugar as well. Several investigations, have oriented to optimize using of nitrogen through a better understanding of crops requirement under varying conditions of soil and climate in order to maximize sugar yields and quality as well as declining environmental pollution (Balba, 1988, El Etreiby, 1992, Abou El-Soud et al.1995, Salama and Badawi, 1996 and Ghura *et al.*, 2000). Jarvis *et al.*, (1997) reported that an additional 30-60 Kg N ha^{-1} + 6 tons ha^{-1} poultry manure applied in the autumn gave higher root yield and root sugar content and reduced root impurities. They also showed that there was a clear sugar yield response up to a level of 120 kg N ha^{-1} with inorganic nitrogen without poultry manure.

Under continuous cropping or in the newly reclaimed lands, the soils have short supplied of some elements especially nitrogen. The Egyptian soils are known to be low in organic matter less than 2% (Balba 1988). Consequently, to conserve this rather low level of organic matter Egyptian soils should additionally received about 82 million tons annually (Riad, 1982). Moreover, no mineral fertilizers are able to substitute a loss of humus, which is caused by the slow biological activity of organic matter (Pera *et al.*, 1983). In addition to the pollution of water sources and nature caused by heavy application of N- mineral fertilizers in form nitrate,(EL Etreiby, 1986). For a new source of organic manure and meanwhile from an environmental point of view, recycling of treated municipal wastes are being managed for fertilization to meet the agricultural demand. Decreasing the enormous consumption of chemical fertilizers add minimizing health and environmental risks both are prospectively fulfilled (Abou–Bakr and Omar, 1993, Omar and Abou–Bakr, 1995, Attalah *et al.*,1997 and Attalah and El-Etreiby, 2002).

Recently, biofertilization and matured compost (municipal waste) play a major role in crop production. The well-known fact that they are as organic matter improves the physical, chemical, and biological characteristics of the soil, (Crossman and Hill, 1987, Mortley and Hill, 1990, Favilli *et al.*,1993, Hassanein and Hassouna, 2000, Hassanein and El-Shebiny, 2000, Abu El-Fotoh *et al.*, 2000, Zalat and Nemeat Alla, 2001 and El-Araby, 2002). Moreover, it is being a source of plant nutrients which are reflected on increasing its productivity, (Feller and Ganry, 1980, El Etreiby, 1992, Abou–Bakr and El Maghraby,1994, Abou–El-Soud *et al.*,1995, Attallah *et al.*, 1997 and Abu El-Fotoh *et al.*,2000). Moreover, Its use reduces the dependence on mineral fertilizers and contributes in pollution-free atmosphere, which is the greatest need of the day.

The objective of this study is to provide further details on the effects of bio-fertilizer, city garbage compost and N- mineral fertilizer on characters of some sugar beet varieties.

MATERIALS AND METHODS

Two field experiments were conducted during two successive seasons of 2000/2001 and 2001/2002 1998/99 at Sabahia Agric. Res. Station Farm, Alex., Sugar Crops Research Institute. The soil used is clay loam in texture (42.5% clay, 32.5% silt and 25% sand) with field capacity 23.6% and chemical properties are presented in Table (2).

Ten sugar beet varieties (*Beta vulgaris* L) namely: (1) Des-poly, (2) Lola, (3) FD9222, (4) Pamela, (5) Hi-poly, (6) Kowterma, (7) Kewenter-poly, (8) Cawmera, (9) Deprase-poly and (10) FD 920220 were planted in plots on October 16 and 5 in seasons 2000/2001 and 2001/2002, respectively. Each plot had diameter 5m x 6m with 10 ridges 60 cm apart and 20cm between hills. After 4 weeks, the seedlings were thinned to one plant per hill. The *Aszoprillum lipoferum* strain is used as bio-fertilizer (BF) and all procedures of inoculation, production, microbial biomass were done according to Favilli et al. (1975); Day and Dobereiner ,(1976) and Okon et al., (1977). The biofertilizer (BF) was applied in four doses, after two weeks, one month, two months and four months, respectively. Mineral-N in the form of urea (46 % N) and matured compost (OM) of Alex. city garbage and each experiment.

Included seven treatments as follows:
(1) Control,
(2) Biofertilizer (Bf),
(3) Mineral -N, (N), (60kg N/fed.),
(4) Matured compost (OM), (20 tons/fed.),
(5) Bf + N, (1/2 mineral –N),
(6) Bf+ OM, (1/2 OM) and
(7) Bf +N +OM (1/2 mineral –N+1/2 OM)

The compost was added two weeks before sowing and mineral-N was added in two equal doses, after thinning and 4 weeks later. The plots were fertilized with the recommended doses of P and K fertilizers for sugar beet. Prior to planting, P-fertilizer was applied uniformly in the form of super phosphate (15% P_2O_5) at the rate of 20 kg P/fed. The K fertilizer as potassium sulfate (48%) was added after thinning. The recommended agronomic practices for sugar beet were applied throughout the growing seasons. Plots were harvested after 190 days from sowing. A random sample of ten plants from each plot was taken to measure the leaf and root characters as leaf blade (cm) length, leaf blade width (cm), leaf petiole length, leaves No. /plant, leaves fresh and dry weight (g), root length and diameter (cm). Yield of sugar beet in terms of fresh weight of root (gm/plant), root yield (tons/fed.), sucrose % and total soluble solids percentage (TSS %) were determined.

The experiment was arranged in a complete randomized design with three replicates. Statistical analysis was carried out over the two seasons according to Dagnelie (1975).Soil, Compost and Plant Analysis:

Soil samples were taken, the soil paste extract was analyzed for pH, EC and soluble cations, (Jackson, 1973). The compost constituents were determined as described by Chapman and Pratt, (1961). Nitrogen was determined by micro-Kjieldahl, P was determined according to Murphy and Riley (1962) and total OC % was determined as described by Walklely and Black (Chapman and Pratt, 1961). The data presented in Table (1) shows the chemical constituents of Alex. city garbage compost, as it was ready to be applied to the soil.

Table 1: Chemical composition of the organic matter used during the two seasons 2000/2001 and 2001/2002.

City garbage compost (matured)	O.C. %	T.N. %	C/N ratio	O.M. %	P (mg/kg)	K (%)	pH	Water content %	E.C. dS/m	Ash %
Season I	16.46	1.45	14:1	23.0	1800	1.62	7.03	27.0	2.4	78.0
Season II	17.93	1.64	15:1	36.0	2453	1.98	6.98	23.0	1.7	81.0

RESULTS AND DISCUSSION

Soil Properties:

Table (2) contains data pertaining to soil chemical properties of the soil samples were taken at sugar beet harvest. The soil pH was slightly decreased to 7.64 and 6.93 and 6.96 for compost alone, in combination with biofertilizer and with mineral-N fertilizer, respectively. This may be due to acidic effect of the organic matter decomposition, (El Etreiby, 1986). The EC value of the untreated soil was about 4.31 dSm-1 for the surface layer (0-30 cm), decreased to be 2.98, 2.63 and 2.11 dSm-1 for the previous treatments, respectively. This decrease may be attributed to the improvement in soil aggregates, which leads to a good drainage of soluble salts. This result agreed with that reported by Abou-Bakr and El-Maghraby, (1994) and Attallah et al., (1997). The applied bio-fertilizer and compost alone increased total N in soil to 0.18 and 0.17 %, while with mineral- N to 0.18% compared with 0.07 at control. The corresponding values of total C % were 1.00, 1.06% and 1.03 for the previous treatments, respectively. Therefore, the organic matter level in soil was increased. The values of total N and total C % for the combination of the bio-fertilizer (BF), matured compost (OM) and mineral-N(N) were relatively high than the first one.

Table 2: Chemical properties of soil surface layer (6-30 cm) affected by Biofertilizer, organic manure and nitrogen fertilizer during 2000/2001 and 2001/2002 seasons.

	2000/2001 season					2001/2002 season				
Constituent Treatments	pH	EC dS/m	Total N %	Organic carbon %	Organic matter %	pH	EC dS/m	Total N %	Organic carbon %	Organic matter %
Control	7.87	4.83	0.05	0.60	1.23	7.83	4.31	0.07	0.60	1.48
BF	7.76	4.36	0.06	0.60	1.38	7.69	4.01	0.18	1.00	1.49
O.M.	7.65	3.01	0.08	0.85	1.77	7.64	2.98	0.17	1.06	2.01
N	7.66	4.39	0.08	0.80	1.39	7.61	3.43	0.18	1.03	1.40
BF +O.M.	7.58	2.81	0.09	0.90	1.78	6.93	2.36	0.16	1.06	1.98
BF + N	7.59	2.91	0.09	0.80	1.69	7.28	2.71	0.14	1.02	1.86
BF+O.M. +N	7.03	2.33	0.09	1.43	1.93	6.96	2.11	0.18	1.08	2.25

Sugar beet Yield and Quality:

On average variety, the root yield and sugar quality in Table (3) and Fig.(1) showed significant and appreciable increase due to the treatments as compared with the control. For evaluating the effect of (BF), (OM) and (N) and their combinations on sugar yield, sucrose %and TSS%, significant responses were obtained. The biofertilizer, matured compost and mineral–N each one alone was adequate to sustain yields while their combination was sufficient to meet the requirement of nitrogen. Comparing the combination of the three fertilizer types with BF, OM and N alone, the first surpassed the second in root yield by 37.70, 31.04 and 24.99% but only 7.18, 6.65 and 5.47% in sucrose %, respectively. Therefore, the combination of bio-fertilizer with compost or mineral-N was more proven to be effective than each of any

one alone. As expected, combination biofertilizer with compost and mineral-N with compost was more affective and produced the highest root yield of sugar beet. The highest mean value of sucrose % (17.63) and TSS % (22.09) was obtained by biofertilizer plus mineral-N, while the highest root yield (24.36 tons/ fed.) was obtained by the combination of BF, OM and mineral-N. Relative to the untreated soil, the root yield, leaves dry weight, sucrose and TSS% were increased as affected by fertilization treatments as demonstrated in Fig. (1). For mineral –N, the percentages were 10.42 and 10.45 %, respectively. However, the percentages were 15.71 and 15.73 %, respectively for compost with mineral–N. Compost and/ or nitrogen fertilization had marked positive effect on average of root and sugar yield as demonstrated in Fig. (1). This may be due to that OM permits good soil aeration and nutrients and BF and urea permits sufficient mineral–N for sugar beet plants (Favilli *et al.*,1993, Attallah *et al.*, 1997, Hassanein and Hassouna, 2000, Hassanein and El-Shebiny, 2000, Abu El-Fotoh *et al.*, 2000 and Zalat and Nemeat Alla,2001).

The results given in Table (3) and illustrated in Fig. (2) revealed that the varieties varied significantly due to the treatments. The highest root weight was 2042.69 and 1821. 68 g plant-1 obtained by Cawmera and Pamela, respectively. The two varieties gave the same trend, but Pamela surpassed Cawmera in root yield under the studied conditions. However, Cawmera was found to be superior compared with Pamela for sucrose % and TSS %. Deprase-poly variety had the highest values of sucrose % and TSS %. Des-poly variety produced the lowest values of root weight and yield whereas, Hi-poly produced the lowest sucrose % and TSS%.

The highest effect on the studied characters obtained from the treatment with (BF+OM+N) is illustrated in Table (4). The result shows the differences between the sex nutritive treatments and the control group in these characters. From Table (4) the increase of all characters was significantly higher by using the mentioned treatment (the addition of bio-fertilizer in the presence of organic manure and nitrogen fertilizer) could help in increasing nutrient availability. Similar findings have been reported by Favilli *et al.* (1993) and Abo El-Fautoh *et al.* (2000).

Results in Tables (5) and (6) show that all interactions for the all studied characters of sugar beet were significant among fertilizer x cultivars x seasons except the root weight (g/plant). However, the interaction among

Table(3):The effect of Biofertilizer, organic and /or inorganicnitrogen on some characters of ten sugar beet varieties.

Factor	Leaf blade length (cm)	Leaf blade width (cm)	Leaf petiol length (cm)	Leaves No.	Leaves fresh weight (g)	Leaves dry weight (g)	Root length (cm)	Root diameter (cm)	Root weight (g)	Root yield (Ton/Fed)	T.S.S.	Sucrose %
Season I	16.29	16.00	19.22	40.87	474.81	112.90	29.27	28.89	1659.21	20.47	20.38	16.24
Season II	16.80	16.89	20.39	41.18	477.26	114.65	29.78	29.36	1698.69	20.55	21.05	16.79
LSD0.05	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
Control	11.76	11.92	10.96	36.65	250.77	67.04	20.91	23.56	258.58	16.54	19.32	15.41
BF	12.96	13.68	19.57	40.71	436.11	104.68	22.82	25.48	922.51	17.69	20.11	16.01
OM	13.28	14.56	20.07	40.83	448.90	109.03	27.92	25.52	1181.32	18.59	20.18	16.09
N	13.84	13.24	20.42	41.16	457.45	111.62	28.53	26.03	998.99	19.49	20.41	16.27
BF + OM	18.89	18.48	21.34	42.65	541.86	127.44	31.93	32.31	2787.30	23.00	21.36	17.02
BF + N	21.39	19.14	22.55	42.17	570.26	129.53	33.44	33.59	2633.33	23.89	22.09	17.63
BF + OM + N	23.66	24.51	23.76	42.99	606.84	143.22	36.12	37.39	2971.55	24.36	21.51	17.16
LSD0.05	0.689	0.6322	6.4964	0.8773	8.1450	3.5390	0.1821	0.2543	363.10	0.8731	0.2238	0.1820
Control	11.77	11.29	10.96	33.66	250.77	67.05	20.92	23.56	258.58	16.54	19.33	15.42
Des-poly	16.59	14.61	19.26	39.48	441.40	113.78	26.93	26.99	1383.19	18.64	20.17	16.06
Lola	14.44	15.50	18.66	43.31	509.99	116.85	29.84	30.00	1434.96	18.78	20.49	16.34
FD222	17.20	17.01	18.70	36.92	439.32	124.84	28.52	29.47	1575.34	20.34	20.37	16.23
Pamela	16.62	14.96	19.36	36.32	454.96	118.18	29.94	29.15	1821.68	21.79	20.24	16.13
Hi-poly	15.96	16.61	18.36	44.75	425.94	110.67	31.08	28.72	1756.39	20.87	20.10	16.04
Kaweterma	16.77	16.43	20.43	41.22	996.90	110.47	30.75	29.83	1681.51	20.50	20.89	16.66
Kawenter-poly	16.89	17.93	20.53	47.08	508.11	107.14	29.86	29.66	1626.08	21.13	21.38	17.04
Cawmera	15.89	17.96	20.43	48.67	514.92	117.17	28.96	29.34	2042.69	21.06	21.09	16.2
Deprase-poly	17.46	16.16	21.50	39.65	514.54	112.48	29.49	29.84	1695.69	20.74	21.24	18.95
FD920220	16.60	17.27	20.32	40.83	454.98	102.13	29.08	29.96	1773.06	21.23	21.13	18.5
LSD.005	0.799	0.6576	0.5403	0.9764	7.0570	3.7666	0.1736	0.2058	303.88	0.4588	0.1611	0.1298

N.S. = Not significant

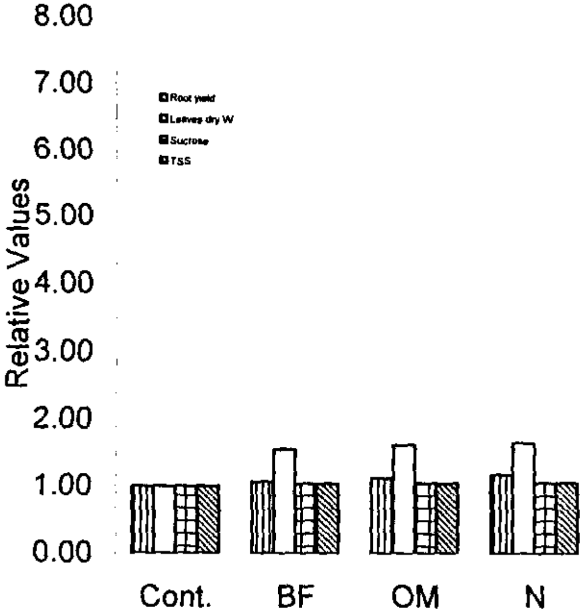

Fig.1:Effect of biofertilizer, mineral-N and/or compost on sugar beet yield and quality

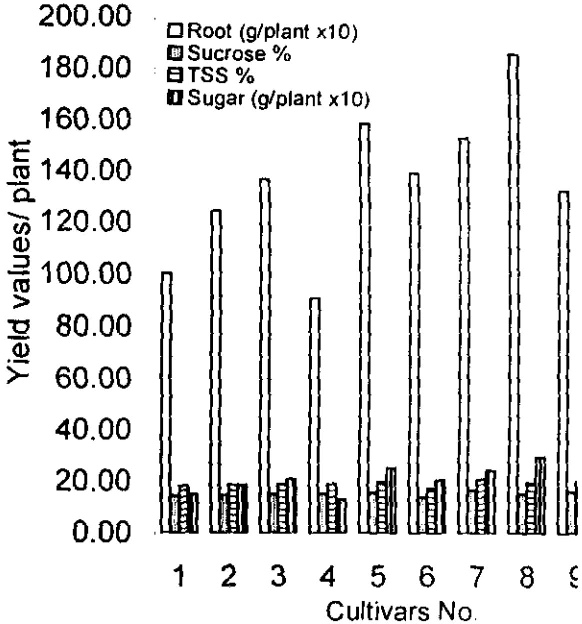

Fig. 2: Sugar beet root yield and quality as affected by the va

Table 4: The effect of B.F., O.M.,N,BF+OM,BF+OM+N on leaf and root characters of ten sugar beet varieties as combng in the seasons 2000/2001 and 2001/2002

Factor	Leaf blade length (cm)	Leaf blade width (cm)	Leaf petlol length (cm)	Leaves No.	Leaves fresh weight (g)	Leaves dry weight (g)	Root length (cm)	Root diameter (cm)	Root weight (g)	Root yield (Ton/Fed)	T.S.S.	Sucrose %
Control												
Des-poly	9.72	9.5	15.15	35.69	235.10	73.75	19.86	24.21	253.73	16.25	18.54	14.78
Lola	9.12	10.48	10.62	45.09	249.32	64.61	19.77	23.01	263.81	15.15	19.75	15.75
FD222	13.29	13.55	9.46	32.17	237.73	75.78	21.39	23.24	250.23	16.00	19.42	15.48
Pamela	13.43	8.72	10.30	30.04	296.30	75.90	22.18	25.02	294.16	18.80	18.71	14.98
Hi-poly	13.71	12.66	8.82	38.55	240.29	66.10	19.12	22.76	229.34	14.65	16.92	13.48
Kaweterma	7.64	12.06	13.08	32.56	228.18	59.69	20.89	23.36	237.38	15.18	19.65	15.68
Kawenter-poly	12.75	14.57	11.86	44.49	246.15	74.96	21.28	24.39	286.84	18.35	20.44	16.30
Cawmera	12.50	13.35	12.31	37.83	253.10	64.63	21.84	22.84	255.33	16.33	20.52	16.35
Deprase-poly	13.60	8.16	8.54	32.11	254.68	62.97	21.94	23.55	244.99	15.68	19.98	15.90
FD920220	11.88	9.84	9.49	38.01	266.81	52.10	20.89	23.27	297.04	19.03	19.31	15.43
BF												
Des-poly	11.69	11.84	18.38	41.68	29.48	105.24	22.90	24.18	875.93	16.68	19.00	15.10
Lola	11.66	13.23	17.80	39.52	455.92	108.53	22.81	24.91	924.34	17.55	20.16	16.08
FD222	12.42	12.99	18.88	36.33	388.36	118.17	26.34	25.90	989.90	18.80	19.76	15.75
Pamela	13.16	12.27	19.00	39.96	389.71	111.77	28.20	24.44	917.43	17.45	18.33	14.40
Hi-poly	12.74	14.38	19.60	41.56	433.69	102.56	31.21	24.27	894.33	17.00	19.73	15.73
Kaweterma	1.78	15.72	19.77	43.37	482.12	111.12	28.26	24.92	925.32	17.58	20.84	16.60
Kawenter-poly	14.23	15.81	20.21	46.06	491.92	107.73	26.99	26.14	980.91	18.28	20.85	16.60
Cawmera	13.61	15.48	19.84	40.65	493.36	93.89	25.43	27.08	963.62	18.33	20.63	16.45
Deprase-poly	13.65	13.52	21.63	38.68	434.16	95.77	22.26	26.05	885.45	18.35	20.84	16.71
FD920220	13.68	11.66	20.60	39.32	362.38	92.01	29.63	26.96	887.91	16.85	20.95	16.68
OM												
Des-poly	12.55	13.07	19.24	41.69	434.83	115.27	27.49	24.41	855.93	16.70	19.65	15.68
Lola	12.41	13.96	19.18	40.49	453.09	119.46	27.87	25.94	928.03	18.08	19.85	15.85
FD222	13.03	14.16	19.77	35.00	395.18	121.76	26.39	26.70	994.31	19.40	19.92	15.88
Pamela	13.97	12.97	19.80	40.62	397.37	114.44	29.39	25.41	1058.25	20.40	19.33	15.43
Hi-poly	10.95	14.03	20.31	41.46	446.48	110.69	31.84	24.73	929.42	18.13	20.15	16.13
Kaweterma	13.80	15.07	19.24	41.40	490.53	121.07	28.22	25.16	951.75	18.58	20.62	16.40
Kawenter-poly	14.84	15.96	19.17	46.48	501.15	104.67	28.04	25.07	971.48	18.55	20.83	16.58
Cawmera	14.15	16.48	20.97	42.39	508.75	91.66	27.93	25.61	3288.30	18.83	20.52	16.36
Deprase-poly	14.18	14.25	22.54	39.75	457.46	99.43	28.13	25.66	963.61	18.70	21.05	16.83
FD920220	13.42	15.67	20.72	39.08	404.79	94.51	29.55	25.97	951.99	18.58	19.85	15.83
N												
Des-poly	14.06	12.5	1.41	39.36	360.72	118.84	26.21	25.74	846.43	16.50	19.31	15.40
Lola	11.64	12.32	19.29	45.78	511.77	112.82	29.31	24.96	895.55	17.53	19.44	15.50
FD222	15.58	14.76	18.79	37.98	388.70	123.95	27.15	26.62	1002.18	19.55	20.02	15.95
Pamela	11.70	10.38	19.90	36.76	385.94	120.03	27.21	25.56	1046.95	20.46	19.79	15.93
Hi-poly	12.06	14.02	19.59	47.45	375.65	108.48	30.47	26.27	1009.12	19.68	20.13	

Table (4) continued :

Factor	Leaf blade length (cm)	Leaf blade width (cm)	Leaf petiol length (cm)	Leaves No.	Leaves fresh weight(g)	Leaves dry weight(g)	Root length (cm)	Root diameter (cm)	Root weight (g)	Root yield (Ton/Fed)	T.S.S.
Kaweterma	15.42	13.88	20.03	39.57	501.15	105.91	30.31	26.15	1051.16	20.50	20.44
Kawenter-poly	15.15	16.20	20.58	46.35	507.46	107.34	27.08	26.44	1058.35	20.65	21.01
Cawmera	13.97	16.09	20.54	38.88	502.55	115.00	27.31	26.00	1015.73	19.80	21.21
Deprase-poly	15.18	11.81	23.21	39.36	542.44	111.53	22.11	26.19	1023.03	19.98	20.80
FD920220	13.62	12.40	22.73	40.16	498.18	92.31	27.04	25.41	1041.50	20.30	21.76
Des-poly	19.18	15.42	20.20	39.77	435.70	126.42	29.27	28.31	2175.25	22.46	21.90
Lola	18.93	14.64	21.21	44.78	651.40	133.68	33.53	31.64	2587.50	20.76	21.73
FD222	19.18	18.98	20.38	37.98	425.96	143.85	33.16	33.41	2865.00	22.92	21.16
Pamela	19.16	16.54	22.25	34.81	441.38	129.20	32.22	30.47	3482.50	27.86	21.01
Hi-poly	18.73	18.66	18.87	48.42	459.68	124.74	32.96	31.46	2575.00	21.56	21.54
Kaweterma	21.19	17.73	22.38	42.80	596.68	116.25	33.96	35.56	2772.50	21.75	20.54
Kawenter-poly	18.40	18.65	21.92	48.63	575.16	115.46	31.20	32.09	3032.50	24.26	21.30
Cawmera	15.18	20.06	21.12	44.03	609.10	144.73	30.22	31.75	2727.50	22.81	21.13
Deprase-poly	20.32	21.22	23.67	21.11	611.25	128.84	31.04	33.61	2850.00	22.80	21.58
FD920220	18.65	22.16	21.46	43.07	513.17	111.77	31.21	35.08	2855.25	22.84	21.78
Des-poly	22.44	14.59	21.11	38.2	564.15	125.46	29.03	30.59	2177.50	21.89	22.53
Lola	21.55	18.96	21.16	44.46	639.11	139.79	33.97	35.57	1955.00	21.32	21.26
FD222	22.63	19.82	20.94	39.56	602.57	142.03	31.69	35.04	2000.75	22.33	21.09
Pamela	22.71	19.44	22.70	35.73	591.42	134.13	33.86	32.44	3050.00	24.40	22.99
Hi-poly	21.34	19.64	22.85	48.13	486.51	128.61	34.64	33.76	2755.00	23.84	21.53
Kaweterma	20.58	15.14	22.97	44.28	566.39	120.25	34.97	35.42	2765.00	24.98	22.59
Kawenter-poly	19.98	20.65	24.13	48.46	619.91	101.27	35.39	33.57	2742.50	24.16	22.13
Cawmera	20.40	20.67	22.64	36.52	618.71	151.02	33.70	32.81	2865.00	25.36	22.07
Deprase-poly	21.80	20.66	25.57	42.07	688.71	135.13	34.45	33.03	2871.50	25.51	22.19
FD920220	20.52	21.88	21.55	43.64	525.35	117.30	32.75	33.65	3145.00	25.16	22.63
Des-poly	26.47	25.36	21.35	39.33	531.53	131.53	22.55	31.48	2497.50	19.98	20.30
Lola	22.78	24.94	21.40	43.21	609.36	139.05	36.64	34.47	2517.50	21.17	21.25
FD222	24.23	24.78	22.49	39.44	636.71	148.35	33.51	35.35	2925.00	23.40	21.30
Pamela	22.20	24.38	21.61	36.35	682.64	141.78	36.54	39.68	3902.50	23.22	21.44
Hi-poly	22.22	22.93	22.62	47.69	539.28	133.54	32.31	37.85	3902.50	31.22	20.69
Kaweterma	26.46	25.49	25.57	44.47	607.49	138.92	38.58	38.26	3117.50	24.94	21.58
Kawenter-poly	22.93	23.73	25.68	49.06	615.23	138.64	38.71	39.31	2350.00	23.69	23.10
Cawmera	21.45	23.51	25.63	44.34	618.84	159.59	38.31	39.44	3245.00	25.96	21.58
Deprase-poly	23.48	23.48	25.34	43.49	613.17	153.69	36.50	38.68	3025.25	24.20	22.26
FD920220	24.45	26.51	25.61	42.53	614.18	154.85	37.59	39.34	3232.75	25.86	21.65
LSD.005	4.275	4.603	3.312	9.155	8.458	20.076	3.051	1.959	N.S.	3.617	1.713

N.S. = Not significant

Table 5: The interaction between years and fertilizers and its effects on ten sugar beet varieties.

Factor	Leaf blade length (cm)	Leaf blade width (cm)	Leaf petiol length (cm)	Leaves No.	Leaves fresh weight (g)	Leaves dry weight (g)	Root length (cm)	Root diameter (cm)	Root weight (g)	Root yield (Ton/Fed)	T.S.S. %	Sucrose %
Year X Fertilizer 2000/2001												
Control	11.56	11.02	11.11	37.21	251.09	66.83	20.55	23.30	257.48	16.47	19.04	15.19
BF	12.72	13.03	18.67	40.46	429.45	99.70	24.80	24.80	912.21	17.33	19.55	15.56
OM	13.19	14.46	19.64	41.15	448.57	105.69	28.09	25.30	937.35	18.19	19.54	15.56
N	13.58	13.20	19.82	40.66	461.05	110.43	27.56	25.95	987.66	19.28	20.07	16.00
BF + OM	18.75	17.72	20.35	41.61	536.49	126.96	31.78	32.12	2781.55	22.64	21.13	16.82
BF + N	21.29	18.33	21.32	42.09	590.67	131.66	33.23	33.42	2715.55	24.64	22.01	17.56
BF + OM + N	22.92	24.20	23.70	42.90	606.36	143.44	35.98	37.37	3022.55	24.73	21.31	17.01
Year X Fertilizer 2001/2002												
Control	11.97	11.55	10.81	30.10	250.44	67.26	21.28	23.82	259.68	16.61	19.61	15.64
BF	13.20	14.32	20.47	40.96	442.77	102.66	27.96	26.17	932.82	18.04	20.67	16.46
OM	13.37	14.66	20.51	40.52	449.35	112.91	28.96	25.74	1425.27	19.00	20.82	16.63
N	14.10	13.67	21.03	41.67	453.86	112.81	28.28	26.11	1010.33	19.70	20.74	16.55
BF + OM	19.03	19.24	22.34	43.70	547.23	127.97	32.08	32.50	2793.05	23.36	21.60	17.23
BF + N	21.50	19.96	23.78	42.25	589.84	127.41	33.66	33.76	2551.00	23.15	22.18	17.69
BF + OM + N	24.41	14.82	23.82	43.08	607.33	144.54	36.27	34.40	2920.55	24.00	21.71	17.32
LSD0.05	N.S.	N.S.	0.702	1.241	N.S.	5.005	0.258	0.360		N.S.	0.331	0.1396

seasons X fert. treatments was not significant for root yield, leaves fresh weight and leaf blade width (cm), while the other characters of leaves and root, TSS% and sucrose was found to be significant. This may be due to the residual effect of treatments in the second season as it is mentioned earlier.

It may be concluded that the best means of maintaining the soil fertility would be achieved through periodic addition of biofertilizer in combination with proper compost plus mineral-N fertilizer. The results, however, recommend that the integrated of the three types of fertilizers showed positive effects on root yield and quality under the studied conditions. The sugar beet varieties, Cawmera and Pamela displayed more productivity and the most appropriate ones to cultivate under the experiment condition.

Table 6: Significancy of the interaction effect (Fertilizer X Variety X Year) on the different studied characters.

Characters	d.f.	S.S.	M.S.	F Value
Leaf blade length(cm)	54	244.2727	4.5236	1.9828***
Leaf blade width (cm)	54	283.1796	5.2400	3.3925***
Leaf petiol length (cm)	54	146.6391	2.155	2.6021***
Leaves No./plant	54	1120.3160	20.7466	6.0876***
Leaves fresh weight (g)	54	104587.2177	1936.8003	10.8772***
Leaves dry weight (g)	54	5387.1507	99.7621	1.9669**
Root length (cm)	54	124.4200	2.3041	21.3803***
Root diameter (cm)	54	51.2951	0.9499	6.27203***
Root weight (g)	54	17623465.71	326360.4761	N.S.
Root yield (Ton)	54	174.886	3.2386	4.3047***
T.S.S (%)	54	39.2094	0.7261	7.82459***
Sucrose (%)	54	24.36005	0.4511	7.4858***

ACKNOWLEDGMENTS

The writer wishes to express his sincere thanks to heads and members of Sugar Crops Research Institute for supplying the sugar beet cultivars and Soil, Water and Environment. Research Institute, Dept. of Microbiology for bio-fertilizer strain.

REFERENCES

Abou-Bakr, M.A. and A.Omar, 1993. Contribution of municipal waste as organic fertilizer to sunflower production. Egypt. Sci. 4th Nat. Congress Nov., 24-25, 1993. Cairo.

Abou-Bakr, M.A. and S. El-Maghraby. 1994. Sugar beet response to city garbage compost and mineral fertilizer application. Annals of Agric. Sci. Moshthor, Vol. 32(2): 1310-1321.

Abu El-Fotoh, H.G.; A.A.Abd El-Magid and R.E. Knany. 2000. Effect of biofertilization on sugar beet yield quality andoptimization of the chemical fertilizers. Proc.9th conf., Agron., Minufiya Univ.,1-2 Sept.2000:561-567.

Abou-El Soud, M.A., K.M. Sayed and A.A. Amer. 1995. Sugar beet yield and sugar quality as affected by the application of organic manure, gypsum and nitrogen. Com. In Soil and Dev. Res. Vol. 50: 179-190.

Attallah, M.Z. and F.El Etreilb. 2002. The effect of compost and mineral-N on soil properties, ten sugar beet varieties and nutrient contents. Alex. Sci. Exch., 23 (1): 109-120.

Attallah, M.Z., M.H. El-Deeb, N. Z. Younan and N.S. Ghura. 1997. Response of eight sugar beet varieties to city garbage compost in combination with chemical fertilizer. J. Agric. Sci. Mansoura Univ. 22(3): 941-950.

Balba, A.M. 1988. Soil fertility and fertilization, pp.642, Dar El-Matbouat AL Gadidah. Alex. Egypt. (In Arabic).

Chapman, H. D. and P. E. Pratt. 1961. Methods of analysis for soils, plants and water. Univ. of California, Div. of Agric. Sci. Amer. J. Vol. 45 (7).

Crossman,S.M. and W.A. Hill. 1987. Inoculation of sweet potato with Azosprillum. Hort. Sci.,22:420-422.

Dagnelie, P.1975. Théorie et methodes statistiques. Vol. 2, Press Agron. Gembloux, Belgique.

Day, J.M. and J. Dobereiner. 1976. Physiological aspects of nitrogen fixation by Spirillum from Digitaria roots. Soil Biol. Biochem., 8:45-50.

El-Araby,E.S.R. 2002. Response of sweet potato *(Ipomoea botatos L.)* to K and biofertilizer under varous water stress conditions. M.Sc.Thesis , Vegetable crops dept., Fac. Of Agric., Alex. Univ.

El Etreiby, F.1992. Maintien et amélioration de la fertilité des sols. Les amendements. Quatrieme seminaire de formation. Project d´appui au service maraicher et fruitier. ISABU, Burundi.

El Etreiby, F.1986. Computer modeling of solutes movement and soil –N transformation. Ph. D. Thesis, Soil and Water Sciences, Catholic University of Louvain. Belgium.

Farag, M.A. 2003. Sugar beet. Ministry of Agriculture and Land Reclamation, Agricultural Research Center, Central Administration of Agricultural Extension. No. 823.

Favilli, F.,S.Caroppo,L. Brighigna and G.Picciurro. 1975. Batteri azotofissatori association a Tillandsia spp. Proc. XVI Congresso Nazionale della Societa Italiana di Microbiologia, Vol. 2 Padova, p 793-799.

Favilli, R$.; R. Postorei and A. Gari .1993. Response of sugar beet to Azospirillum bacterization in field experiments . Agricoltura Mediterranea,124:281-285.

Feller, C. and F. Ganry. 1980. Effect of nitrogen fertilizer (urea) and organic matters (compost) on the suitability of organic matter in a millet monoculture on semi-arid tropical conditions. In: Organic recycling in Africa. FAO soils bulletin n(43, pp 160-167. Rome, Italy.

Ghura, N.S., M.Z. Attallah and M. Amer. 2000. Effect of NPK treatments on yield, differential gene action and chemical composition of three sugar beet varieties. Alex. Sci. Exch., Vol. 21(4): 293-310.

Hassanein,M.A. and M.G. Hassouna.2000. Effect of bio-and mineral nitrogen fertilization on sugar beet yield and quality in the new reclaimed areas at Nubaria region. Alex. Sci. Exch.,Vol.21(2):153-161.

Hassanein,M.A. and G.M. El-Shebiny .2000. Contribution of bio-and mineral nitrogen fertilization in sugar beet yield. Alex. Sci. Exch.,21(2):129-143.

Jackson, M. L. 1973. Soil chemical analysis. Prentice Hall, Indian Private limited, New Delhi.

Jarvis, P.J., P.M. J. Eclestcae, M.J. Armstrong. 1997. Rates and timing of poultry manure to maximize sugar beet yield and quality, optimize fertilizer inputs and reduce nitrate leaching. Proceedings of the 60th IIRB congress, Cambridge, UK, 1-3 July 1997, 55-61.

Murphy, J. and J.P. Riley. 1962. A method single solution for determining phosphate in nataral water. Annal Chem. Acta. 27:31-36.2

Mortley, D.G. and W.A. Hill. 1990. Sweet potato growth and nitrogen content following nitrogen application and inoculation with Azosprillum. Hort. Sci., 25(7): 758-769.

Okon, Y., S.L. Albrecht and R.H. Barris. 1977. Methods for growing *Spirillum lipoferum* and for counting it in pure culture and in association with plants. Appl. Environ. Microbiol., 33: 85-88.

Omar,A.M. and M.A. Abou-Bakr. 1995. The influence of organic matter and inorganic nitrogen fertilizer on wheat crop *(triticum aestivium L.)* in salt afffected soil.J.Agric. Res. Tanta Univ.,21(2):273-283.

Pera,A.V.G., M.LS. Lorella and M.de Bertoldi. 1983. Effect of organic matter on rhizosphere micro organisms and root development of sorghum plants in two different soils. Plant and Soil. 74:3-18.

Riad, A. 1982. Potential sources of organic matter in Egypt. FAO. Roma, Italy. Soils Bull., 45: 22-25

Salama, A.A and M.A. Badawi.. 1996. Evaluation of six sugar beet cultivars under nitrogen levels and harvesting dates. J. Agric. Sci. Mansoura Univ., Vol. 21(1): 139-153.

Zalat, S. S. and E.A.E. Nemeat Alla. 2001. Yield and quality of sugar beet as affected by inorganic and organic fertilizer. Minufiya J. Agric. Res. Vol. 26 (5): 1187-1193.

تأثير التسميدالبيولوجى ، المادة العضوية والنيتروجين المعدنـــى علـــى إنتاجيـــة عشرة أصناف من بنجر السكر

محمد زهدى عطا الله
معهد بحوث المحاصيل السكرية*-قسم الفسيولوجي والكيمياء

أجريت هذه الدراسة بمزرعة محطة البحوث الزراعية بالأسكندرية -معهد بحـــوث المحـــاصيل السكرية -مركز البحوث الزراعية على أرض طينية طميية لتقييم تأثير التسميد العضوى (كومبوست قمامـــة المدن المتخمرة تامة النضج) والمعدنى (اليوريا) وخليط منهما علي خواص التربة ومحصول عشره أصنـاف من بنجر السكر و العناصر الغذائية . وكانت المعـــاملات كـالأتي: (١) بـدون تسـميد (مقارنـــة) ، (٢) كومبوست (CM 11,90ميجا جرام /هكتار، (٣) سماد اليوريا ١٠٧,٧١ كجم ن / هكتار و (٤)نصف الكميـــة من الكومبوست و من اليوريا . تم تقدير محصول الجذور والسكر، النسبة المئوية للسكر و المـــواد الصلبـــة الكلية وكذا محتوى الجذور والأوراق من العناصر الغذائية وخواص التربة.

وقد بينت النتائج تحسن بعض خواص التربة ممثلا فى خفض التوصيـــل الكـــهربائى (EC) وال pH من ٥,٤٥ و٧,٧ للأرض الغير معاملة ى إلى ٤,٣١ ديسى سيمنز/م و ٧,٢ مع المادة العضوية علـــى التوالى. أيضا انخفض الصوديوم ١٣,٥% بالنسبة إلي معاملة المقارنة . بينما زاد النـــتروجين الكلـــى إلـــى ٠,١٥ % و الكربون الكلى إلى ١,٣٤ % مع المادة العضوية وأيضا البوتاسيوم الميسر والعنـــاصر الغذائيـــة الصغرى على عكس الفوسفور الميسر.

وأوضحت النتائج أن المادة العضوية أما منفردة أو مخلوطة مع السماد المعدنى (يوريا) أدت إلـــى زيادة الصفات المدروسة معنويا . تفوقت معاملة مخلوط السماد العضوي مع ا المعدنى حيث زاد محصـــول الجذور، النسبة المئوية للسكر و المواد الصلبة الكلية (486.45 %TSS، ١٥,٧١و ١٥,٧٣ %)بالنســبة إلـــى معاملة المقارنة على التوالى. بينما كانت القيم المتماثلـــة مـــع معاملـــة المـــادة العضويـــة بمفردهـــا هـــى ١٨٥,٩٤، ٣,٨٩ و٣,٨٩%والسماد المعدنى ٢٨٧,٩٢، ١٠,٤٢ و١٠,٤٥% على التوالى.

وتشير النتائج أيضا إلى وجود اختلافات معنوية بين الأصناف فى معظم الصفات المدروسة حيـــث أنتج الصنف كاوميرا أعلى متوسط محصول الجذور (١٨٦٣،٥٠جم نبـــات-١) يليـــه الصنـــف هيلمـــون (١٥٨٩،٨٣جم نبات-١) بينما تميز الصنف هيلمون بصفات جودة فىالنسبة المئويـــة للســـكروز والمـــواد الصلبة الكلية. وكان الصنف تريوس اقلهم إنتاجية لكل الصفات المدروسة.

أوضحت النتائج تباين محتوى الجذور والأوراق من العناصر الغذائية معنويـــا بيـــن معـــاملات التسميد وبين الأصناف . وسجلت معاملة مخلوط السماد العضوى مع المعدنـــي أعلـــى محتـــوى مـــن تلـــك النيتروجين والبوتاسيوم بينما أنخفض الفوسفور. بالنسبة إلى امتصاص العناصر الصغرى كان المحتوى فـــى الجذور أعلي من الأوراق بنسبية تتراوح بين ١,٦٨ إلى ٤,٧٤ . وكان أعلى محتـــوى منـــها فـــى الصنـــف كاوميرا الذى أعطى أعلى محصول من الجذور. أيضا لوحظ زيادة المنجنيز فى الجذر بينما انخفـــض فـــى الأوراق مع معاملة المادة العضوية .و على عكس الحديد كان تركيز النحاس أقـــل فـــى كـــلا مـــن الجـــذر والأوراق. الصنف هاى بولى سجل أعلى تركيز من الزنك والنحاس وكذا النسبة المئوية للســـكر و المـــواد الصلبة الكلية. مما سبق يفضل استخدام التسميد العضوى مع اليوريا حيث أعطى نسبيا أعلى وأفضل جـــودة فى المحصول مع الأصناف كاوميرا ، هيلمون وهاى بولى تحت ظروف التجربة.