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Response of Sugar Beet Yield and Quality to Fertilization with Different Nitrogen Levels Combined With Compost

Hassouna B.A., A.A. Abo El-Soud and A.M.M. Biomy

Agric. Microbiol. Dept., Soils Water Environ. Res, Inst, ARC, Giza, Egypt.

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ABSTRACT
Two field experiments were carried out at Mallawi Agriculture Research Station Farm, Minia governorate, Egypt, within two successive winter seasons of 2016/2017 and 2017/2018 to deduce the effect of nitrogen mineral fertilizer combined with compost treatments on yield and quality of sugar beet. Compost was prepared by utilizing a mixture of farm residues (Corn stalks and soybean straw) inoculated with special bio-decomposer strains of bacteria and fungi under aerobic conditions. The mixture received 10% rock-phosphate and 20% bentonit. After maturity the compost was amended with nitrogen fixing bacteria, phosphate dissolving bacteria and potassium dissolving bacteria. Four doses of nitrogen mineral fertilizer (0, 50, 75 and 100 kg N Fed^{-1}) as ammonium nitrate 33.5% N per Fed were used. Four levels of compost (0, 2, 4 and 6 Ton Fed^{-1}) were used. Generally, mineral fertilization with 75 kg nitrogen combined with 4 Ton Fed^{-1} compost gave the best values for root length, root weight, root weight and yield. Data of top sugar beet plant (fresh, dry weight and yield) reveals that there are significant difference among fertilized with 0, 50,75 and 100 kg N Fed^{-1} in the presence of 0, 2, 4 and 6 Ton Fed^{-1} compost. The best values of fresh, dry weight and top yield were recorded in the treatment received 75 kg N Fed^{-1} in the presence of 4 Ton Fed^{-1} compost. Significant differences in sucrose extractable, carotenoids, chlorophylls a+b, potassium and ∞-amino N (meq 100g^{-1}) were observed according to fertilization treatment levels. These results suggest that sugar beet fertilization by 75% N RD (67.5 kg N) fed^{-1} of nitrogen combined with 4 Ton compost is highly recommended to obtain the highest yield of sugar beet.

Keywords: Compost, Nitrogen, sugar beet, fertilization

1. Introduction
Sugar beet (*Beta vulgaris* l.) crop is considered the second source for sugar production in Egypt and in many countries. It is a vital crop as a source of high energy and as an important source of feed to livestock. About 45% of sugar in the world is produced from sugar beet. The Egyptian government encourages sugar beet growers to increase the cultivated area of sugar beet and consequently the sugar beet factories. In Egypt the sugar beet total production exceed 3.47 million Tons of sugar beet roots with an average of 19.31 ton per Fadden.

The root of the beet contains 75% water, 5% pulp and about 20% sugar. The exact sugar content can vary between 12% and 21% depending on the cultivar and growing conditions.

Mineral fertilization with nitrogen fertilizer is an essential element for building up protoplasm and carbohydrates of leaves (Taha, 1985). Production of high quality sugar beet is especially important to growers being paid on the extract able sucrose content and root yield (James *et al.,* 1978 and Halvorson and Hartman 1980).

The numerous experiments defining that Nitrogen application as the soil fertilizer increased length and diameter of roots (Abo El –Wafa, 2002 and Badr, 2004), dry mater accumulation/plant (Aboushady *et al*., 2007 and Essam *et al.,* 2012), root, top and sugar yields Ton/fad (Allam, 2008).

On the other hand, total soluble solids TSS, sucrose and juice purity percentages were decreased by increasing nitrogen rates (Allam, 2008 and Aboushady *et al.,* 2007).

Corresponding Author: Hassouna B.A., Agric. Microbiol. Dept., Soils Water Environ. Res, Inst, ARC, Giza, Egypt.

Good yield also, depends on photosynthetic efficacy of leaves, which is not only controlled by light intensity and temperature, but also by mineral nutrition. Increasing nitrogen fertilizer significantly enhances length and diameter of roots, as well as sugar yield productivity (Nemeat-Alla, 2005, Ramadan, 2005).The application of N-P-K fertilizers, at optimum level, are necessary to meet the requirements of sugar beet, these requirements should be achieved by applying the recommended favourable cultural practices with reducing the environmental pollution by using the biological fertilizer or organic matter (compost).

In Egypt, The available amount of farmyard manure to the Egyptian farm offer not only insufficient but also decreasing with increasing tendency towards the mechanization of agriculture. An alternative way to meet the growing needs for organic manure is by composting plant and animal residues (Abd El-Ghaffar, 1978). Compost is an eco-friendly fertilizer, it is positively improves soil structure, aggregate formation, drought protection, stopping erosion, buffering, reduces fertilizer requirements and gives nutrients when plants need them as well as inoculates the soil with vast numbers of beneficial microbes. Thus, compost can modify soil properties and strongly affects its chemical and biological ones (Martin and Gershuny, 1992; Mekail, 1998 and Fontaine *et al.,* 2003). Many investigators reported that using compost with several crops almost duplicated the observed yields besides controlling numerous of soil born diseases (Hoitik *et al.,* 1993).The results of (Basma *et al.,* 2021) suggest that sugar beet inoculated with a mixture of *Azospirllium* ssp, *Pseudomonas ssp* combined with 75 % of nitrogen and phosphorus fertilizers (204.5 &150 kg/fed respectively) is highly recommended to obtain the highest yield of sugar beet.

The current study was carried out to evaluate the effect of different doses of mineral nitrogen fertilizer combined with different levels of compost on roots yield and quality of sugar beet.

2. Material and Methods

Two field experiments were carried out at Mallawi Agriculture Research Station Farm, Minia Governorate, Egypt, within two successive winter seasons of 2016/2017 and 2017/2018 to deduce the effect of different doses of mineral nitrogen fertilizer, compost (as an organic fertilizer) and their combinations on sugar beet yield and quality of sugar beet.

2.1. Microbial strains and preparation of compost:

All microorganisms used in preparing the compost, such as cellulose decomposers, (*Trichoderma ressie*), nitrogen fixing bacteria (*Azotobacter chrooococcum*), phosphate dissolving bacteria (*Bacillus megatherium* var *phosphaticum*) and potassium dissolving bacteria *Bacillus circulant* were prepared in Biofertlizers Production Unit, Microbiology Department, SWERI, ARC, Giza, Egypt.

2.2. Preparation of compost

Enriched compost was prepared using raw materials of farm residues shredded into 2.0 cm and farmyard manure collected from Mallawi Agriculture Research Station Farm, Minia Governorate, Egypt. Moreover, some microbial inoculants such as cellulose decomposing bacteria were added to the mixture. To set up the heap, the remain raw materials were mixed with farmyard manure and inoculated with microbial then built in successive layers tamped well over the bed mixture of raw materials up to 1.0 m high. Moisture was maintained to 60 % and the moistening was satisfactory considered when a hand full of composted materials would wet the hand but not drip. This heap was turned up down every 15 days (till maturation). Samples were taken at maturation of heap construction, mixed thoroughly, air dried and ground to chemical, physical and microbiological analysis (Table 1). The mixture received 10 % rock-phosphate and 20 % bentonite, then they composted for 30 days. After elapsing of composting period, the product was bore with some beneficial microorganisms (PGPR) such as nitrogen fixing bacteria, phosphate and potassium dissolving bacteria.

Four levels of nitrogen mineral fertilizer (0, 50, 75 and 100 kg N Fed^{-1}) as Ammonium nitrate (33.5 % N Fed^{-1}) were used as well as Four levels of compost (0, 2, 4 and 6 Ton Fed^{-1}) were used. Treatments were arranged in a split plot design with three replications. Compost treatments allocated in the main plots, whereas, the levels of nitrogen were randomly distributed in the sub plots. Compost levels were weighed for each plot (0, 10, 20 and 30 kg plot $^{-1}$) and manually spread, one week before the strip-tillage operation. Individual plots were included 5 ridges, each 60 cm apart and 7 m length, resulted in an area of 21 m^2 (1/200 Fed.). A dose of super phosphate fertilizer (200 kg Fed^{-1}) was applied at seed bed preparation. Sugar beet seeds (*Beta vulgaris*, L.) Primer variety were sown in hills of 20 cm apart in the first week of October in both seasons. Half dose of potassium fertilizer (50 kg Fed^{-1}) was added at two equal doses, one after thinning (45days after sowing) and the other after 60 days of planting. Soil of the experimental area of both studied seasons were randomized collected from different area of experiment and analyzed according to Page *et al.,* (1982). The data of the soil properties were recorded in Table (2).

Table 1: Some physical and chemical properties of treated compost in the studied two seasons.

Properties	Values
pH (1:2.5 water suspension)	7.40
E.C. (dS/m)	5.16
Organic matter %	38.45
Organic carbon %	22.34
C/N ratio %	17.87
Total N	1.25
Total P %	1.15
Total K %	0.62
Total soluble N ppm	675.38
Available P ppm	325.60
Available K ppm	534.28
Total count of bacteria	28 X 10^7
Total count of Fungi	18 X 10^6
Total count of actinomycetes	14 X 10^6

Table 2: Some physical and chemical properties of the surface layer of the studied soil at two seasons.

Properties	First season 2016/2017	Second season 2017/2018
Particles size distribution		
Sandy %	19.80	18.95
Silt %	39.45	38.55
Clay %	40.75	42.50
Texture grade	Clay-loam	Clay-loam
pH (1:2.5 water suspension)	7.80	7.75
E.C. (dS/m)	1.54	1.64
Organic matter %	0.84	0.92
Soluble Cations (meq/L)		
Ca^{++}	4.15	5.12
Mg^{++}	2.45	2.58
Na^{+}	6.57	5.84
K^{+}	2.32	2.72
Soluble Anions (meq/L)		
CO_3^{--}	0.00	0.00
HCO_3^{-}	1.75	2.65
Cl^{-}	2.45	3.56
SO_4^{--}	11.29	10.05

After three months, 3 roots were randomly taken from each plot to evaluation of the growth and Chlorophyll a+b (mg/g) as described by Cooke and Scott (1993).

At a harvest time (210 days from sowing), 3 root samples were, also randomly taken from each plot to evaluate the growth, yield and quality parameters of sugar beet root length (cm), root diameter (cm) and root fresh and dry weight (g plant^{-1}) as described by Cooke and Scott (1993). Juice quality prepared and Sucrose % were determined as described by A.O.A.C. (2000). Potassium (meq 100g $^{-1}$) determined using Flam photometer as described by Page *et al.,* (1982) and alpha-amino-N content was determined using Hydrindnation method according to Carruthers *et al.,* (1962). Collected data were subjected to the proper analysis of variance (ANOVA). Differences among treatments were evaluated by the least significant difference (LSD) at 5% level (Gomez and Gomez, 1984).

3. Results and Discussion

3.1. Interaction effects between different levels of nitrogen fertilizer and compost application

Statistical means of two seasons presented in Table (3) show the effect of different levels of nitrogen fertilizer combined with compost application. Generally, mineral fertilization with 75 kg N Fed^{-1} combined with 4 Ton of compost Fed^{-1} gave the best values for root length 42.08 cm, root diameter 21.07 cm, root fresh weight 1.59 kg, root dry weight 527.5 g $plant^{-1}$ and root yield at maturation 31.22 Ton Fed^{-1} On the other hand, there is difference in yields between application of 75 or 100 kg N Fed^{-1} in the present of 0, 2, 4 or 6 Ton Fed^{-1} compost.

Table 3: Effect of different levels nitrogen fertilizer combined with compost applied on some parameters of sugar beet root

Nitrogen levels (Kg/Fed)	Length (cm)	Diameter (cm)	FW (kg/plant)	DW (g/plant)	Yields (Ton/Fed)
		Without compost			
Unfertilized	30.00	10.93	0.83	297.50	26.21
50	35.07	14.00	1.09	312.5	27.21
75	36.00	16.57	1.26	357.5	28.24
100	37.37	16.17	1.34	367.5	28.96
		2 Ton compost/Fed			
Unfertilized	32.37	13.03	0.95	275.00	27.22
50	35.27	15.57	1.15	347.50	28.58
75	37.00	17.10	1.26	417.50	29.07
100	38.03	18.17	1.34	451.00	29.55
		4 Ton compost/Fed			
Unfertilized	37.88	15.07	1.14	362.50	29.44
50	38.22	17.62	1.32	426.50	29.94
75	42.08	21.07	1.59	527.5	31.22
100	39.03	19.72	1.51	462.6	30.21
		6 Ton compost/Fed			
Unfertilized	35.07	14.07	1.11	357.50	28.60
50	37.17	16.57	1.25	430.00	29.31
75	40.07	19.4	1.46	505.00	30.01
100	38.33	17.97	1.33	467.50	29.82
$LSD_{0.05}$	1.329	0.477	0.080	5.028	0.242

FW: Fresh weight, DW: Dry weight

Data in Table (4) showed the fresh, dry weight and yield characteristics of top sugar beet plant. The results reveals that there are significantly differences among fertilizers concentrations (0, 50, 75 and 100 kg N Fed^{-1}). In the presence of 0, 2, 4 and 6 Ton compost Fed^{-1}. The best values of fresh, dry and top yield were noticed in the treatment which received 75 kg N Fed^{-1} in the and 4 Ton compost Fed^{-1}. The recorded values were recorded 747.50, 80.55 g $plant^{-1}$ and 5.26 Ton Fed^{-1} for fresh, dry weight and yield of top plants, respectively. Beet yield for fertilization with 75 kg N Fed^{-1} combined with 4 Ton compost Fed^{-1} was 5.26 Ton Fed^{-1} compared to control (2.90 Ton Fed^{-1}).

The data of Chlorophyll $_{a+b}$ (Table 4) reveal that the highest value was 5.69 mg g^{-1} by 75 kg N Fed^{-1} with 4 Ton compost Fed^{-1} compared with other treatments.

The results of sucrose extractable (%), Carotenoids (%), Potassium (meq $100g^{-1}$) and ∞-amino N (meq $100g^{-1}$) in Table (5) showed a significant difference among treatments, which fertilized with different levels of nitrogen combined with applied compost in these parameters. The data revealed that the highest value of sucrose (%) was found in plants received 75 kg N Fed^{-1} in and 4 Ton compost Fed^{-1} 17.93%.

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Table 4: Effect of different levels of nitrogen fertilizer combined with compost applied on some parameters of sugar beet plant top

Nitrogen levels (Kg/Fed)	Fresh weight of top plant (g/plant)	Dry weight of top plant (g/plant)	Chlorophyll a+b (mg/g)	Yields (ton/Fed)
		Without Compost		
Unfertilized	375.60	44.00	3.26	2.90
50	497.50	56.00	3.83	3.84
75	610.00	60.00	4.14	4.11
100	622.50	67.55	4.23	4.35
		2 Ton compost/Fed		
Unfertilized	482.50	49.50	3.56	3.27
50	602.50	58.00	3.96	3.65
75	665.00	62.00	4.18	4.35
100	680.50	69.00	4.80	4.64
		4 Ton compost/Fed		
Unfertilized	562.50	53.50	3.56	4.01
50	672.50	61.00	4.23	4.24
75	747.50	80.55	5.69	5.26
100	727.50	72.55	4.80	4.96
		6 Ton compost/Fed		
Unfertilized	542.50	54.00	3.76	3.84
50	635.00	67.50	5.08	4.68
75	710.00	73.50	5.11	5.12
100	695.00	70.2	4.55	4.78
LSD $_{0.05}$	6.038	0.730	0.539	0.240

Table 5: Effect of different levels of nitrogen fertilizer combined with compost applied on some parameters of sugar beet.

Nitrogen levels (Kg/Fed)	Sucrose (%)	Carotenoids (%)	Potassium (meq/100g)	α-amino N (meq/100g)
		Without Compost		
Unfertilized	15.79	1.22	5.24	1.27
50	17.71	1.68	5.47	1.55
75	17.32	1.87	5.56	1.71
100	16.42	2.10	5.60	1.66
		2 Ton compost/Fed		
Unfertilized	15.93	1.43	5.32	1.33
50	16.61	1.78	5.47	1.63
75	17.32	2.03	5.57	1.73
100	17.91	2.12	6.28	1.92
		4 Ton compost/Fed		
Unfertilized	16.38	1.53	5.38	1.35
50	17.71	1.82	5.48	1.63
75	18.23	2.34	6.62	2.02
100	17.93	2.26	5.77	1.91
		6 Ton compost/Fed		
Unfertilized	16.52	1.67	5.40	1.52
50	17.68	1.87	5.50	1.65
75	18.00	2.20	5.81	1.95
100	17.50	2.13	5.83	1.86
LSD $_{0.05}$	0.006	0.005	1.028	0.031

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Data in the same table declared that nitrogen fertilization combined with compost levels recorded significantly increases in some parameters. The highest value of Carotenoids (%), Potassium (meq $100g^{-1}$) and ∞-amino N (meq $100g^{-1}$) were 2.34%, 6.62 (meq $100g^{-1}$) and 2.02 (meq $100g^{-1}$), respectively. These values were recorded when the plants were fertilized with rate of 75 kg N Fed^{-1} fertilizer in the present of 4Ton Fed^{-1} compost. These results are in agreement with those obtained by Ramadan & Nassar (2004), Aboushady *et al.,* (2007), Nemeat-Alla *et al.,* (2009), Salim *et al.,* (2012) and Basma *et al.,* (2021) who reported that the high levels of nitrogen or micronutrients gave the lowest values of characters quality such as sucrose, total soluble solids and purity percentages of sugar beet plants.

3.2. Statistical main effect of nitrogen fertilizer

Statistical means data of nitrogen fertilizer (Table 6) show different significant increases in root length (cm), diameter (cm), root fresh and dry weight (g $plant^{-1}$). The increases in root length due to applied of 50, 75 and 100 kg N Fed^{-1}, were 7.69, 13.60 and 14.66 %, respectively over the un-fertilizer treatment. The increases in root diameter due to applied of 50, 75 and 100 kg N Fed^{-1}, were 20.03, 35.54 and 37.05 %, respectively over the un-fertilizer treatment. The recorded root fresh weight were significant 7.34, 18.35 and 27.52 % due to fertilized with of 50, 75 and 100kg N Fed^{-1} compare with un-fertilizer treatment. Applied of 50, 75 and 100kg N Fed^{-1} recorded significant increases in root dry weight by 17.33, 35.29 and 39.84% respectively over the un-fertilizer treatments. These data are agreement with those obtained by (Abo El –Wafa, 2002, Badr, 2004 and Basma *et al.,* 2021) who found increases in length and diameter of sugar beet roots due to Nitrogen application as soil fertilizer.

Data illustrated in Table (6) showed that addition of nitrogen fertilizer 50, 75 and 100 kg N Fed^{-1} treatments have a positive effect and a significant increase in root yield (Ton Fed^{-1}) which recorded 28.76, 29.63 and 29.64 Ton Fed^{-1}, respectively as compared to un fertilizes which recorded 27.87 Ton Fed^{-1}. Also, the dry mater accumulation per plant increased due to increases of nitrogen fertilizer (Aboushady *et al*., 2007 and Basma *et al.,* 2021).

Regarding to fresh, dry weight and yield of sugar beet top plant, Table (7) showed a significant difference due to fertilized with 0, 50, 75 and 100 kg N Fed^{-1}. The highest value with 100 kg N Fed^{-1} were 683.13, 69.45 and 5.88 for fresh weight, dry weight and yield of sugar beet top plant, respectively. Fertilization with 0, 50, 75 and 100 kg N Fed^{-1} recorded significant different in chlorophyll (a+b) and the values were 3.69, 4.08, 4.64 and 4.75 mg g^{-1}, respectively. These data agreed with those obtained by Holmes (1982) and Sharif and Eghbal (1994) Basma *et al.,* (2021) who reported that the higher sugar beet root production, leaf area index and sugar yield obtained by higher levels nitrogen applied.

Data illustrated in Table (8) showed that addition of nitrogen fertilizer at 50, 75 and 100 kg N Fed^{-1} have a positive effect and a significant increase in carotenoids (%) potassium (meq/100g), and ∞-amino N (meq $100g^{-1}$). The highest values of carotenoids, potassium and ∞-amino N were 2.11 %, 5.89 meq $100g^{-1}$ and 1.88 meq 100 g^{-1}, respectively in the treatment received 100 kg N Fed^{-1}. The un fertilized treatment recorded 1.46 %, 5.48 meq $100g^{-1}$ and 1.38 meq $100g^{-1}$ at the same order of carotenoids, potassium and ∞-amino N. On the other hand, the results revealed that the highest value of Sucrose was recorded 17.49 % in the treatment received 100 kg N Fed^{-1} compared with other treatments.

3.3. Statistical main effect of compost applied

Regarding the response of sugar beet plants to addition of compost, results in Table (9) indicated that the increase of compost achieved application significant increases in root length (cm), root diameter (cm) root fresh and dry weight (g $plant^{-1}$). The increases in root length due to application of 2, 4 and 6 Ton compost Fed^{-1} were 3.73, 8.81 and 13.58 %, respectively over the without compost treatment. The increases in root diameter due to applied 2, 4 and 6 Ton compost Fed^{-1} were 13.21, 20.74 and 30.47 %, respectively over the without compost treatment. The root fresh weight recorded increases (9.90, 27.72 and 35.64%) due to applied of 2, 4 and 6 Ton compost Fed^{-1} compare with unfertilized treatment. Applied of 2, 4 and 6 Ton compost Fed^{-1} recorded significant increases in root dry weight by 11.68, 31.71 and 33.39%, respectively over the unfertilized treatments.

Table 6: Statistical main effect of nitrogen fertilizer combined with compost applied on some parameters of sugar beet root.

Nitrogen levels (Kg/Fed)	Length (cm)	Diameter (cm)	FW (kg/plant)	DW (g/plant)	Root yields (Ton/Fed)
Unfertilized	33.83	13.28	1.09	323.13	27.87
50	36.43	15.94	1.17	379.13	28.76
75	38.43	18.00	1.29	437.15	29.63
100	38.79	18.20	1.39	451.88	29.64
LSD $_{0.05}$	0.857	0.483	0.040	4.442	0.116

FW: Fresh weight, DW: Dry weight

Table 7: Statistical main effect of nitrogen fertilizer combined with compost applied on some parameters of sugar beet top plant.

Nitrogen levels (Kg/Fed)	Fresh weight of top plant (g/plant)	Dry weight of top plant (g/plant)	Chlorophyll a+b (mg/g)	Top yields (Ton/Fed)
Unfertilized	490.78	50.75	3.69	3.39
50	601.88	60.50	4.08	3.93
75	681.38	69.01	4.64	4.91
100	683.13	69.45	4.75	5.88
LSD $_{0.05}$	4.015	0.433	2.206	2.190

Table 8: Statistical main effect of nitrogen fertilizer combined with compost applied on some parameters of sugar beet plant at harvest.

Nitrogen levels (Kg/Fed)	Sucrose (%)	Carotenoids (%)	Potassium (meq/100g)	α-amino N (meq/100g)
Unfertilized	16.16	1.46	5.48	1.38
50	17.12	1.85	5.56	1.63
75	16.64	2.07	5.66	1.83
100	17.49	2.11	5.89	1.88
LSD $_{0.05}$	0.004	0.003	0.500	0.011

Table 9: Statistical main effect of compost treatments combined with nitrogen levels on some parameters of sugar beet root.

Compost levels (Ton/Fed)	Length (cm)	Diameter (cm)	FW (kg/plant)	DW (g/plant)	yields (Ton/Fed)
Without	34.61	14.08	1.01	333.75	27.65
2	35.90	15.94	1.20	372.75	28.60
4	37.66	17.00	1.36	439.58	29.43
6	39.31	18.37	1.37	445.19	30.20
LSD $_{0.05}$	0.664	0.239	0.060	0.993	0.121

FW: Fresh weight, DW: Dry weight

Data illustrated in Table (10) showed that application of compost at rate of 2, 4. 6 Ton Fed^{-1} have a positive effect and a significant increase in fresh, dry weight and yield of top plants. The highest values of fresh, dry weight and yield of top plants were 677.50 g Fed^{-1}, 69.53 g Fed^{-1} and 4.82 Ton Fed^{-1} in the treatment received 6 Ton compost Fed^{-1}, respectively. The treatment recorded 526.40 g plant^{-1}, 56.38 g plant^{-1} and 3.61 Ton Fed^{-1}. Moreover, the results revealed that the highest value of Chlorophyll (a+b) recorded 4.88 mg g in the treatment received 6 Tons compost Fed^{-1} compared with other treatments.

Table (11) shows the effect of the compost treatments on Sucrose (%), carotenoids (%), potassium (meq 100g^{-1}) and α -amino N (meq 100g^{-1}) of sugar beet plant. Results revealed that the application compost significantly affected these parameters. These results may emphasize that the rate of phosphate, potassium and micronutrients released from compost into the root zone of sugar beet.

The above mentioned results, the beneficial role of nitrogen fertilizer combined with compost in increasing the solubility and availability of potassium, phosphorus and micronutrients in the soil to compensate the needs of this element to the plants. This result was previously achieved by Louis and Nelson (2004) who found that the PGPR (Plant Growth Promoting Rhizobacteria) enhance plant growth by direct and indirect means. Direct mechanism includes production of plant phytohormones, siderophore that chelate iron makes it available to plant root and solublization of minerals such as phosphorus and enhancement of mineral up take, (Suslow and Schroth, 1982).

Table 10: Statistical main effect of compost treatments combined with nitrogen levels on some parameters of sugar beet top plant.

Compost levels (Ton/Fed)	Fresh weight of top plant (g/plant)	Dry weight of top plant (g/plant)	Chlorophyll a+b (mg/g)	Top yields (Ton/Fed)
Without	526.40	56.38	3.70	3.61
2	607.63	59.93	4.18	3.99
4	645.63	63.89	4.41	4.63
6	677.50	69.53	4.88	4.82
LSD $_{0.05}$	3.018	0.365	0.291	0.231

Table 11: Statistical main effect of compost treatments combined with nitrogen levels on some parameters of sugar beet plant.

Compost levels (Ton/Fed)	Sucrose (%)	Carotenoids (%)	Potassium (meq/100g)	α-amino N (meq/100g)
Without	16.81	1.70	5.43	1.54
2	17.00	1.80	5.54	1.67
4	17.21	1.92	5.54	1.70
6	17.39	2.09	5.84	1.80
LSD $_{0.05}$	0.003	0.002	0.514	0.015

It can be concluded that using enriched organic fertilizers as a natural phosphate and potassium sources, instead of the artificial superphosphate or potassium sulphate in presence bacteria and compost can increase the quantity and quality of sugar beet yield and could decline the hazard of some contaminated heavy metals accompanied with superphosphate fertilizer. Further research is needed to evaluate economic and environmental aspects of compost management in beet production.

Under the conditions of present study, addition of 75% N RD (67.5 kg N) fed^{-1} of nitrogen combined with 4 Ton compost is highly recommended to obtain the highest yield of sugar beet.

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