EFFECT OF SOME ORGANIC MANURES AND MINERAL FORMS OF NITROGEN ON GROWTH, YIELD AND PHYSIOLOGICAL CHARACTERS OF SUGAR BEET GROWN ON A CALCAREOUS SOIL

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ABSTRACT:

A field experiment was conducted on a calcareous soil at Noubaria region to identify response of sugar beet to fresh or composted farmyard manures (FFYM or CFYM) at rate 10 of ton/fed in combination with 40 kg N/fed added from different sources, i.e., urea, ammonium nitrate and diluted nitric acid. Plant samples were taken after 16 and 25 weeks from planting to define vegetative parameters (plant height, leaf numbers, root length and diameter). Shoots and roots were chemically analyzed to determine chlorophyll A, B, carotene, total soluble sugar and reducing sugar contents.

Data obtained showed that applying organic manures (FFYM and CFYM) led to improve many of soil variables such as organic matter content, soil pH, soil salinity, CEC and available NPK, with superiority for CFYM. The combination of CFYM and ammonium nitrate exhibited the best results of vegetative growth parameters, yield, sugar concentration and its purity. Also, a positive correlation was found between sugar purity and potassium content in leaves. Reducing sugar content was more affected by the studied treatments as compared to the total soluble sugar content.

Key Words: Calcareous soil, FYM, N-mineral fertilizers and sugar beet.

INTRODUCTION:

Sugar beet is the second crop for sugar production in Egypt and it is widely planted in the newly reclaimed areas such as the calcareous soil at Noubaria region. Therefore, more attention must be paid to increase its yield and to improve its sugar production. In fact, this crop is sensitive for timing of nitrogen fertilization, which should be available during the period of 4 to 8 weeks from planting (Dragovic *et al.*, 1996). On the other hand, excessive nitrogen application after middle season increases impurities in produced sugar (Carter, 1986a), moisture content in root (Carter, 1986b), and consequently lowering in extractable sucrose and sucrose percent (Carter and Traveller, 1981). Urea was incorporated by disking into sandy clay loam soil of pH 8 in a rate of 0, 75 and 150 kg N/ha during sugar beet seedbed preparation in a trial conducted by Oliveira *et al.* (1993). They found that N significantly increased root yield, sucrose concentration and sugar yield, but NO_3 concentrations in petioles were not significantly affected by fertilization.

Negm *et al.* (2003) found that just after organic manure application to calcareous soil, slight increase in cation exchange capacity, and reduction of soil pH occurred, then their values lowered with advancing time. Available N, P and K in soil increased after the application of manure and then reduced gradually till time up to harvest. Moreover, soil organic matter content was increased due to organic matter application, where the curve reaching its peak after harvest.

Regarding sugar and carbohydrate contents (the main products of sugar beet), Petrovic and Kastori (1992) reported that leaf may synthesize at optimum condition 30 g of sugar/m^2. Dragovic *et al.* (1996) emphasized also that leaf area and photosynthetic activity were primary factors in sugar beet and sugar yields.

Mahmoud *et al.* (1990) and Saif (1991) indicated that nitrogen fertilizer increased photosynthetic leaf area, which resulted in increasing photosynthesis in sugar beet plant. Selim and El-Ghinbihi (1999) indicated that adding nitrogen in high rate (120 kg N/fed) caused a significant increase in the concentration of chlorophylls A, B and carotenoids in sugar beet leaves.

The aim of the present work is to evaluate the role of organic manure in combination with N-mineral fertilizer for improving soil properties and increasing the production of sugar beet grown on a calcareous soil at Noubaria region.

MATERIALS AND METHODS:

A field experiment was conducted on a calcareous soil cultivated with sugar beet at Noubaria experimental Farm, Agric. Res. Station, Egypt. The main soil properties of the experimental field were determined according to the methods described by Black (1965) and Page *et al.* (1982), as shown in Table (1).

Table (1): Some physico-chemical characteristics of the studied soil (0-30 cm).

Soil characteristics	Value	Soil characteristics.	Value
Particle size distribution %:		*Soil water extract(1:1):*	
Coarse sand	20.18	T.S.S. %	0.28
Fine sand	28.90	*Soluble ions (meq/L)*	
Clay	29.00	Ca^{++}	4.48
Textural class	SCL	Mg^{++}	1.98
Saturation percent (SP)	35.80	Na^{+}	6.79
$CaCO_3$ %	23.95	K^{+}	0.66
Soil fertility status:		CO_3^{--}	0.00
Available nutrients (mg/kg soil):		HCO_3^{-}	2.73
N	37.59	Cl^{-}	7.14
P	8.80	SO_4^{--}	4.04
K	390.80	pH (1:5 soil water suspension)	8.18
Fe	3.90	Organic matter %	0.75
Mn	1.20	Total N %	0.05
Zn	0.76	Organic carbon %	0.55
Cu	0.63	C/N ratio	11.00

A split plot design, with 4 replicates, was used. The studied treatments were carried out on plots of 3.5× 6 m^2, the main treatments were (A), (B) application of 10 ton/fed bulk weight of fresh (FFYM) or composted (CFYM) farmyard manures as well as (C) which represents the control treatment without manuring. The sub-main ones were (1), (2), (3) and (4), which represents a N rate of 40 kg/ fed added in the forms of ammonium nitrate, urea, diluted HNO_3 and control, respectively. The main characters of both fresh and composted organic manures are presented in Table (2).

Table (2): Analysis of the used bio-compost.

Composition	Composted FYM	Fresh FYM
Organic matter %	38.38	43.64
Organic carbon %	22.26	25.37
Total nitrogen %	0.65	0.44
C/N ratio	34.25	57.65
Total P %	0.85	0.23
Total K %	0.68	1.09
Available N (mg/kg)	420.00	223.00
Available P (mg/kg)	280.00	179.00
Available K (mg/kg)	1695.00	1080.00
EC (1:5 water extract)	8.30	7.40
pH (1:5 water suspension)	7.30	8.50

On November 10^{th} 2001, fresh and composted (FFYM and CFYM) quantities were added. Sugar beet (*Beta vulgaris L*) seeds were sown on the day later. Irrigation was executed every 15 days through flooding system. The common cultivation practices were followed till plant harvesting on May 5^{th} 2002. Ammonium nitrate and urea were added in equal two doses at 5^{th} and 7^{th} week from planting, while diluted HNO_3 solution was added in eight equal doses along with irrigation every 15 days starting from the 3^{rd} irrigation day, as fertigation technique.

Plant samples were taken after 16 weeks from planting and also at harvest (after 25 weeks). Plant samples were transferred immediately to the laboratory, washed with tap water to get rid of adhering soil particles, air-dried, separated into leaves and roots and weighed to determine the fresh weight of both. Samples of leave and root were oven dried at 70 ºC till constant weights to determine total dry matter of leaves and roots. Contents of chlorophyll A, B and carotene were measured according to Talling and Driver (1963). N, P and K contents were estimated using Micro-Kjeldahl procedure, stannous chloride method, for the former nutrients and flame photometer for the latter one (Black, 1965).

Total carbohydrates in both dried leaves and roots were determined according the methods described by Dubios *et al.* (1951). Sucrose percentage was plametrically determined using lead acetate extract of fresh root according to the method of Le Docte (1927), and the total soluble solids (T.S.S) were measured by hand refractometer (A.O.A.C., 1990). The results obtained were statistically analyzed according to Steel and Torrie (1960).

RSULTS AND DISCUSSION:

I. Soil properties as affected by applied organic manures:

Data in Table (3) represent most of soil properties that are controlling soil fertility of the experimental field under sugar beet cultivation. These soil properties are discussed in brief notes, as follows.

a. Organic matter content:

Soil organic matter content tended to increase due to FYM application in both forms (FFYM & CFYM), with superiority for CFYM. These findings are illustrated data present in Table (3), which indicated that the application of organic manures increased soil organic contents with 6.58 and 30.26 %, as mean values, over the control treatment for FFYM and CFYM, respectively. Concerning the effect of applied mineral forms on nitrogen on soil organic matter content, the obtained data in Table (3) indicate that the organic matter values were affected slightly. These beneficial effects were more obvious with urea application, however, the soil was still poor in organic matter content, since it ranged 0.76- 0.99, as mean values.

b. Available water range:

Regarding soil available water range, it could be noticed that a pronounced increase occurred due to FYM application, especially in case of CFYM, which could be due to its ability to retain a relatively high content of moisture. Also, the positive effect of CFYM may be associated with a favourable condition of soil aggregation, and in turn increasing water holding pores that increasing the range of available water.

c. Soil pH:

Data present in Table (3) indicate that the application of organic manure led to reduce soil pH, where applying FYM slightly decreased its value as compared to the control treatment. The relative decrease in soil pH was more pronounced in the soil treaded with CFYM, this finding is expected due to the released organic acids the composition of FYM. Therefore, such added materials should be recommended for improving pH of soil media. Similar results were obtained by Abdel Aziz *et al.* (1996) and Mohamed *et al.* (1998).

d. Soil Salinity:

Data present in Table (3) reveal that the values of soil salinity (T.S.S.) tended to decrease due to addition of manures as compared to the untreated soil by 13.18 and 29.46%, as mean values for FFYM and CFYM, respectively. The decrease in T.S.S may be related to salt removal due to creation of conductive pores associated with favourable soil aggregation. These results are in harmony with those reported by Abdel- Aziz *et al.* (1996) and Aziz *et al.* (1998)

e. Soil CEC:

With respect to the values of cation exchange capacity (CEC), data presented in Table (3) reveal that the application of organic manures showed a positive effect on CEC, where its values increased as a result of FYM addition as compared to the control treatment. The increment in CEC values reached 2.34 and 9.88, as mean values, for FFYM and CFYM, respectively. This trend may be due to demonstrated CEC of manure composted profoundly increased as colloidal organic material increased. These results are in agreement with those reported by Saharinen *et al.* (1996).

f. Available macronutrient status:

As indicated in Table (3) the positive effects of applied organic manures on available contents of N, P and K followed the order of: CFYM > FFYM > control. This trend is more related to the initial contents of these nutrients in both FFYM and CFYM. It could be noticed that soil treated with CFYM gained N, P and K with about 47, 11and 472 mg/kg vs about 41, 10 and 418 mg/kg for soil treated with FFYM and about 39, 9 and 39.5 mg/kg for untreated soil. This is due to composting activation and bacteria or fungi activities during that period increased the released nutrients from organic substances in soil into available forms. Moreover, the formation of organic acids could be responsible for releasing nutrients in available forms in soil

(Badran *et al.*, 2000). These results are in agreement with those obtained by Awad (1994).

Table (3): Some soil properties after sugar beet harvest.

FYM manure types	Mineral N	Organic matter %	Available water range %.	pH (1-2.5 water suspension)	T.S.S %	CEC (mg/100g soil)	Available contents of macronutrients (mg/kg soil)		
							N	P	K
Fresh FYM	Dil. HNO_3	0.809	14.3	7.96	0.227	17.81	40.95	9.70	413.64
	Amm. nitrate	0.806	14.1	8.03	0.210	18.01	43.01	10.02	437.52
	Urea	0.839	15.9	8.07	0.228	17.72	41.84	9.75	414.44
	Control	0.793	13.6	8.10	0.231	15.16	38.65	9.85	408.28
	Mean	0.810	14.5	8.04	0.224	17.06	41.11	9.83	418.47
Compost FYM	Dil. HNO_3	0.954	17.8	7.69	0.190	18.65	45.78	10.75	475.20
	Amm .nitrate	0.986	18.3	7.81	0.184	18.85	52.09	11.15	492.88
	Urea	1.063	19.6	7.96	0.171	18.56	49.40	10.80	480.60
	Control	0.969	18.1	8.09	0.184	19.08	40.18	1050	439.08
	Mean	0.990	18.5	7.84	0.182	18.79	46.86	10.80	471.94
Control	Dil. HNO_3	0.757	12.1	8.16	0.258	16.96	39.72	8.60	393.68
	Amm nitrate	0.750	12.8	8.13	0.265	17.16	41.08	10.40	401.08
	Urea	0.766	13..9	8.15	0.252	16.98	40.11	8.80	395.24
	Control	0.750	12.0	8.11	0.255	17.30	36.10	8.40	391.40
	Mean	0.760	12.7	8.14	0.258	17.10	39.25	9.04	395.35

Regarding the effect of N-mineral fertilizers used, it could be noticed that the soil N, P and K contents followed: Amm. nitrate > Urea > Dil.HNO_3 > control. The aforementioned trend may be due to amm. nitrate as a source of N could have affected rhizospher pH via the cation/anion uptake balance H^+/ OH^- (Florijn *et al*., 1992).The obtained results are in agreement with those obtained by Antoun and Besada., (1990) who showed that soil NPK increased with the application of different organic manures as well as the N, P and K increased gradually during the whole period. El-Ghazoli (1998) indicated that application of different organic manures increased soil available P.

II. <u>Sugar beet characters as affected by applied organic manures</u>:

a. Vegetative characters:

Table (4) reveal that organic manuring gave a positive significant effect on plant height either after 16 or 25 weeks from planting as compared to the control treatment. Composted FYM increased plant height at both ages and the difference was significant at 25 weeks from planting. Mineral nitrogen fertilization also significantly increased plant height at both ages regardless of the source of added nitrogen. The interaction of FYM manuring and mineral N fertilization followed the previous trend under both applied manure forms, where the highest value was 32 cm for the composted FYM combined with ammonium nitrate treatment at the two ages, while the lowest one (20 cm) resulted from the control without FYM-N treatment.

Concerning leaf number, manuring with FFYM or CFYM was significantly effective in increasing leaf number per plant with significant difference between both FYM forms at the two ages. Mineral nitrogen application also increased leaf number significantly at both ages as compared with N untreated plots. An exception in urea at 16 weeks age, where it resulted in an average value of 20.67 leaves/plant. It was observed that no significant differences among the used N sources for leaf number/plant in both ages, with one exception of diluted HNO_3 that was surpassed urea at 25 weeks age. Generally, the highest values of leaf number were obtained from combination of FFYM either with amm. nitrate after 16 weeks or with Dil. HNO_3 after 25 weeks from planting.

The superior vegetative growth resulted in superior plant fresh and dry weights as shown in Table (4). Each of applied manure form or N-mineral fertilizers significantly increased the shoot fresh and dry weights. Among treatments, CFYM was superior in affecting both shoot fresh and dry weights at both ages. The corresponding fresh and dry weights were 1.3-2.1 kg, 377-609g for CFYM + amm. Nitrate at 16 – 25 weeks, respectively. On the other hand, ammonium nitrate was superior to the other two nitrogen forms in both ages, and diluted HNO_3 to urea in the middle plant age (16 weeks). Amm. nitrate resulted in the highest fresh weight values through all plant ages.

The enhancing effect of N on plant growth, in general, was associated with the combined treatment of CFYM and ammonium nitrate could be attributed to its beneficial effects on stimulation of the meristimatic activity for producing more tissues and organs. Moreover, N plays a major role on protein, nucleic acids synthesis, and protoplasm formation (Marschner, 1986). Similar results were obtained by Habib *et al.* (2001), Tugnoli (2002) and Moursi *et al.* (1984) who found that nitrogen application was increased significantly the fresh and dry weights of sugar beet plants.

b. Bio chemical composition of leaves:

The effect of organic manure and N-mineral fertilizers on chlorophyll A, B and carotene could be identified from the data of Tables (4 a and b) for the samples of 16 and 25 weeks ages, respectively. CFYM was significantly superior to FFYM, which was also significantly superior to control for increasing chlorophyll A and carotene contents in leaves of both 16 and 25 weeks ages, while both CFYM and FFYM were superior significantly for increasing chlorophyll B as compared to the control treatment. The effects of mineral nitrogen forms were statistically the same effect at 16 weeks age, but 1 > 2 > 3 were significantly different at 25 weeks age in their effects on chlorophyll A, B and carotene.

Table (4): Effect of FYM and mineral nitrogen treatments on some growth characters of sugar beet plants.

Parameters	Age (week)	FYM	Nitrogen sources				Mean	L.S.D. at 0.05	
			(1)	(2)	(3)	(4)			
Plant height (cm)	16	A	28	26	27	24	26.25	FYM	3.40
		B	32	30	29	28	29.75	N	3.30
		C	20	22	23	18	20.75	FYMN	5.72
		Mean	26.7	26.0	26.3	17.5			
	25	A	55	58	53	46	53.00	FYM	4.90
		B	64	58	60	54	59.00	N	2.98
		C	52	50	46	40	47.00	FYMN	5.16
		Mean	57.00	55.30	53.00	46.70			
Number of leaves	16	A	24	23	28	20	23.75	FYM	2.40
		B	28	27	25	24	26.00	N	3.40
		C	15	12	14	10	12.75	FYMN	5.89
		Mean	22.3	20.67	22.33	18.00			
	25	A	44	42	46	33	41.25	FYM	5.82
		B	46	45	48	43	45.50	N	2.99
		C	32	33	35	27	31.75	FYMN	5.18
		Mean	40.60	40.00	43.00	34.33			
Fresh weight (leaves) in kg	16	A	1.20	1.05	1.10	0.75	1.03	FYM	0.07
		B	1.30	1.12	1.17	0.94	1.13	N	0.07
		C	0.90	0.80	0.85	0.37	0.73	FYMN	0.11
		Mean	1.13	0.95	1.04	0.69			
	25	A	1.80	1.60	1.56	1.23	1.55	FYM	0.07
		B	2.10	2.05	2.00	1.87	2.00	N	0.07
		C	1.20	1.11	1.10	0.83	1.06	FYMN	0.14
		Mean	1.70	1.59	1.55	1.31			
Dry weight (leaves) in g	16	A	348.0	304.5	319.0	217.5	297.3	FYM	69.86
		B	377.0	324.8	339.3	272.6	328.4	N	86.30
		C	261.0	232.0	246.5	107.3	211.7	FYMN	149.0
		Mean	328.0	287.1	301.6	198.9			
	25	A	522.0	464.0	452.4	356.7	448.8	FYM	88.24
		B	609.0	594.5	580.0	542.3	581.5	N	116.5
		C	348.0	321.9	319.0	240.7	307.2	FYMN	201.0
		Mean	493.0	459.9	450.5	379.9			

A: FFYM, B: CFYM, C: Control, 1: Amm. Nitrate, 2: Urea, 3: Diluted HNO_3 and 4: Control

Table (4a): Effect of FYM and mineral nitrogen treatments on some biological and chemical components of sugar beet leaves at 16 weeks age.

Parameters		FYM	Nitrogen sources (1)	(2)	(3)	(4)	Mean	L.S.D. at 0.05	
Photosynthetic pigments (mg/g F.W.)	Chloro-phyll A	A	9.90	8.65	9.6	7.89	9.00	FYM	0.93
		B	13.63	13.33	12.0	9.40	12.30	N	1.10
		C	8.70	7.88	7.2	6.66	7.60	FYMN	2.12
		Mean	10.70	9.90	9.9	7.90			
	Chloro-phyll B	A	3.44	3.12	3.7	2.88	3.30	FYM	0.95
		B	4.93	4.50	4.0	3.10	4.10	N	0.74
		C	3.30	3.20	2.2	2.14	2.70	FYMN	1.28
		Mean	3.89	3.60	3.3	2.70			
	Carotene	A	1.87	1.62	1.6	1.53	1.67	FYM	0.13
		B	1.75	1.70	1.7	1.65	1.71	N	0.21
		C	1.24	1.28	1.2	1.13	1.23	FYMN	0.37
		Mean	1.60	1.50	1.6	1.50			
Sugars	T.S.S. %	A	1.23	1.10	0.8	0.52	0.93	FYM	0.64
		B	1.43	1.32	1.2	0.68	1.20	N	0.48
		C	0.66	0.65	0.4	0.38	0.54	FYMN	0.83
		Mean	1.10	1.00	0.8	0.52			
	R.S. %	A	0.48	0.40	0.3	0.28	0.39	FYM	0.10
		B	0.65	0.59	0.5	0.38	0.54	N	0.06
		C	0.35	0.25	0.2	0.24	0.28	FYMN	0.13
		Mean	0.49	0.42	0.4	0.30			
Nitrogen %		A	2.00	2.10	2.1	1.47	1.90	FYM	0.15
		B	2.30	2.22	2.2	2.00	2.30	N	0.29
		C	1.58	1.50	1.7	1.36	1.50	FYMN	0.50
		Mean	1.96	1.94	2.0	1.61			
Phosphorus %		A	0.30	0.20	0.3	0.20	0.25	FYM	0.08
		B	0.30	0.30	0.3	0.20	0.26	N	0.05
		C	0.20	0.20	0.3	0.20	0.23	FYMN	0.09
		Mean	0.27	0.24	0.3	0.20			
Potassium %		A	1.40	1.20	1.5	1.00	1.30	FYM	0.19
		B	1.60	1.50	1.3	1.10	1.40	N	0.16
		C	1.20	1.10	1.3	0.80	1.10	FYMN	0.28
		Mean	1.40	1.30	1.4	0.96			

A: FFYM, B: CFYM, C: Control, 1: Amm. Nitrate, 2: Urea, 3: Diluted HNO_3 and 4: Control

Mineral nitrogen fertilization was significantly superior to the control treatment of (4) in all cases, with exception of carotene content in 16 weeks age. This may be due to increasing photosynthetic activity in sugar beat leaf area by N fertilization as reported by Mahmoud *et al.* (1990) and Saif (1991). The higher chlorophyll contents of leaves increased activity of key stomata enzymes of the Calvin cycle (Roob and Terry, 1994 and Mostafa, 1996).

Concerning total soluble sugar (T.S.S.) and reducing sugar (R.S.) concentrations (Tables 4 a and b), data show that both the 16 and 25 weeks ages responded similarity. CFYM was significantly superior to the control in increasing T.S.S%, while the differences between CTYM, FFYM and control were significant in the case of R.S.%. The effects of mineral nitrogen forms failed to show any significant increase over the control treatment. Amm. nitrate (treatment 1) being an exception, where it showed significant difference over the control treatment (4) in the case of T.S.S.%.

Table (4b): Effect of FYM and nitrogen treatments on some biological and chemical components of sugar beet leaves at 25 weeks age.

Parameters		FYM	Nitrogen sources				Mean	L.S.D. at 0.05	
			(1)	(2)	(3)	(4)			
Photosynthetic pigments (mg/g F.W.)	Chloro-phyll A	A	11.50	11.00	10.77	8.9	10.50	FYM	0.08
		B	13.45	13.77	13.00	11.50	12.90	N	0.08
		C	10.70	9.75	9.00	8.87	9.58	FYMN	0.01
		Mean	11.90	11.50	10.90	9.80			
	Chloro-phyll B	A	4.34	4.18	3.88	3.00	4.48	FYM	0.21
		B	4.88	4.72	4.60	3.88	4.52	N	0.12
		C	3.80	3.75	3.22	2.66	3.40	FYMN	0.21
		Mean	4.34	4.20	3.90	3.18			
	Carotene	A	2.72	2.70	2.68	2.36	2.60	FYM	0.02
		B	3.98	3.90	3.85	3.20	3.70	N	0.23
		C	2.63	2.55	2.60	2.00	2.40	FYMN	0.04
		Mean	3.11	3.05	3.00	2.52			
Sugars	T.S.S. %	A	11.76	10.48	10.00	8.82	10.3	FYM	1.40
		B	12.00	11.82	11.57	10.00	11.40	N	1.80
		C	11.00	9.80	9.68	9.56	10.00	FYMN	3.10
		Mean	11.60	10.70	10.40	9.50			
	R.S. %	A	2.69	1.64	1.53	1.45	1.80	FYM	0.14
		B	2.86	1.77	1.68	1.58	2.00	N	0.10
		C	1.66	1.45	1.42	1.25	1.40	FYMN	0.17
		Mean	2.40	1.62	1.50	1.40			
Nitrogen %		A	2.37	2.25	2.45	2.00	2.30	FYM	0.16
		B	2.40	2.30	2.37	1.79	1.70	N	0.11
		C	1.89	1.55	1.97	1.42	1.70	FYMN	0.19
		Mean	2.22	2.00	2.30	1.70			
Phosphorus %		A	0.30	0.30	0.30	0.30	0.300	FYM	0.08
		B	0.30	0.40	0.40	0.30	0.35	N	0.08
		C	0.30	0.30	0.30	0.30	0.29	FYMN	0.13
		Mean	0.30	0.34	0.30	0.28			
Potassium %		A	1.70	1.80	1.60	1.30	1.60	FYM	0.03
		B	1.70	1.90	1.50	1.30	1.60	N	0.09
		C	1.40	1.30	0.90	0.60	1.60	FYMN	0.15
		Mean	1.60	1.70	1.30	1.07			

A: FFYM, B: CFYM, C: Control, 1: Amm. Nitrate, 2: Urea, 3: Diluted HNO_3 and 4: Control

On the contrary mineral N-forms were of significant effects on R.S.%, as shown in the order 1> 2> 3> 4. Thus, reducing sugars was tended to be more sensitive to the used treatments than T.S.S.%. The results indicated that the usage of organic manure significantly enhanced leaf chlorophyll, carotene, total carbohydrates and mineral contents over the control treatment at both ages. The effect of organic manure on photosynthetic pigments and nutritional status of sugar beet leaves could be attributed to the role of non symbiotic N_2-

fixing bacteria, the availability of nutrients, the modification of root growth morphology and physiology through hormonal exudates of organic fertilizer bacteria, which resulting in more efficient absorption of available nutrients. The aforementioned factors are considered main components of photosynthetic pigments (Jagnow *et al.,* 1991). The same authors concluded that the high levels of glucose in plant grown with N and supplied by bio-fertilizer or N-mineral was derived from photosynthesis and not degradation of starch. High N treatments reduced CO_2 incorporation process into starch by 50%. The reducing sugar or sucrose percentage was increased by increasing N rate up to 90 kg/fed (Kandil, 1993).

c. Nutrient uptake by leaves:

Data in Tables (4a and b) represent N, P and K uptake by sugar beet leaves, and application of organic manures significantly increased N, P and K uptake over the control treatment after 16 weeks, as well as, N and K after 25 weeks. Nitrogen fertilization also significantly raised the amounts of N, P and K uptake at both ages of 16 and 25 weeks. Combination of FYM manuring and N-mineral fertilizers also was generally of positive significant effect. These results are in agreement with those obtained by Dragovic *et al.*(1996); Steven (1998) and Guiping *et al.* (1998) who reported that N contents of leaves and roots of sugar beet were greater with nitrogen fertilizer than without it (control) and increased up to a plateau at 120 kg N/fed. Such effect may be attributed to a positive correlation between N supply and plant growth. The positive influences on leaf N and K contents of sugar beet plant could be resulted from increasing N dose (Wiedenfeld, 1986).

d. Root characters and yield:

Table (5) represents root length, diameter and yield as affected by manures and N-mineral fertilizers. The statistical analysis of data revealed that organic manuring significantly increased root length and diameter with superiority of CFYM to FFYM along growth periods of 16 and 25 weeks. The significant increases in both characters were observed also by N-mineral application at the end of the two studied growth periods. Among nitrogen forms, ammonium nitrate was significantly superior to diluted HNO_3 in 16 weeks for root length, urea and diluted HNO_3, also in 25 weeks for root length. Urea also was superior to diluted HNO_3 in 25 weeks for root length. In case of root diameter, all nitrogen sources were statistically as the same at 16 week age, but at 25 the effective trend was as follows: ammonium nitrate> diluted HNO_3 > urea for the significance.

Farmyard manure either fresh or composted increased significantly both fresh and dry weight of roots over the control at 16 or 25 weeks age. In all cases, however, CFYM was significantly superior to FFYM. Nitrogen application reflected also significant increases in fresh and dry root weights in general.

Table (5): Effect of FYM and nitrogen treatments on some growth parameters of sugar beet roots.

Parameters	Age (week)	FYM	Nitrogen sources				Mean	L.S.D. at 0.05	
			(1)	(2)	(3)	(4)			
Plant height (cm)	16	A	22.5	20.8	17.4	17.0	19.55	FYM	2.88
		B	25.0	23.5	24.4	18.9	22.95	N	2.79
		C	19.5	17.8	14.5	12.5	16.10	FYMN	4.80
		Mean	22.3	20.5	18.9	16.1			
	25	A	39.5	36.7	34.6	31.6	35.6	FYM	0.14
		B	38.2	36.8	37.0	35.8	36.9	N	0.15
		C	33.5	31.0	28.7	26.8	31.0	FYMN	0.26
		Mean	37.1	34.8	33.4	31.4			
Root width (cm)	16	A	28.0	25.5	24.0	20.0	24.25	FYM	1.20
		B	30.0	36.0	32.5	28.4	31.70	N	1.90
		C	18.0	20.5	24.0	14.0	19.25	FYMN	--
		Mean	25.5	27.2	26.8	20.8			
	25	A	28.7	46.0	48.0	44.7	46.90	FYM	0.22
		B	50.0	47.9	49.0	44.0	47.90	N	0.18
		C	39.0	37.0	38.0	34.0	37.00	FYMN	0.31
		Mean	45.9	43.6	45.2	40.0			
Fresh weight (g)	16	A	1.0	0.95	1.05	0.85	0.96	FYM	0.19
		B	1.8	1.60	1.56	1.30	1.57	N	0.15
		C	0.7	0.50	0.60	0.20	0.50	FYMN	0.26
		Mean	1.17	1.00	1.07	0.78			
	25	A	1.85	1.76	1.64	1.11	1.59	FYM	0.07
		B	2.60	2.35	2.30	1.70	2.20	N	0.07
		C	1.40	1.30	1.45	0.80	1.24	FYMN	0.11
		Mean	2.00	1.80	1.80	1.20			
Dry weight (kg)	16	A	242.0	225.4	251.4	212.5	232.8	FYM	1.00
		B	365.7	308.2	384.5	289.1	336.9	N	0.99
		C	135.3	98.2	145.9	56.7	109.0	FYMN	1.70
		Mean	247.7	210.6	260.6	186.1			
	25	A	448.0	416.0	369.0	278.0	377.7	FYM	53.00
		B	528.0	464.0	566.0	378.0	484.0	N	63.00
		C	271.0	255.0	352.0	227.0	267.3	FYMN	109.0
		Mean	415.7	378.3	429.0	294.0			

A: FFYM, B: CFYM, C: Control, 1: Amm. Nitrate, 2: Urea, 3: Diluted HNO_3 and 4: Control

Concerning N forms, the effect of ammonium nitrate was significantly higher than urea at the 16 weeks sampling time, as well as, urea and diluted HNO_3 after 25 weeks in case of fresh yield. Diluted HNO_3 was the highest followed by ammonium nitrate and urea with significant difference among them in case of dry yield after 16 weeks, but all forms were statistically same after 25 weeks. These results are in agreement with those obtained by Eckhoff (1995), Azzazy (1998) and Basha (1999) who found that nitrogen application enhanced root enlargement which respecting to increments both of root length and diameter of sugar beet. Also, Goyal *et al.* (1982) and Moursi *et al.* (1984) demonstrated that nitrogen application increased significantly the fresh and dry yield of roots.

e. Sugar parameters:

Table (6) represents the values of total soluble solids, total soluble sugars, reducing sugar, sucrose, juice purity percentages and sugar yield. As for all these parameters, organic manuring caused significant increases, with superiority of CFYM to FFYM with exception of total soluble solids and reducing sugar, where the effect of CFYM was statistically similar to that of FFYM.

Table (6): Effect of FYM and mineral nitrogen treatments on sugar content, purity and yield in juice of sugar beet roots.

Parameters	FYM	Nitrogen sources					L.S.D. at 0.05	
		(1)	(2)	(3)	(4)	Mean		
Total soluble Solids (%)	A	18.00	20.0	18.2	20.0	19.10	FYM	0.64
	B	19.80	22.4	17.0	19.0	19.60	N	0.48
	C	20.40	15.0	15.0	18.8	17.30	FYM.N	0.83
	Mea	19.40	19.1	16.7	19.3	18.67		
Total soluble sugars (%)	A	56.50	53.2	46.5	32.6	47.20	FYM	2.24
	B	63.20	59.9	53.4	33.2	52.40	N	2.17
	C	39.90	29.8	23.3	20.6	28.40	FYM.	3.76
	Mea	52.90	47.6	41.0	28.8	42.67		
Reducing sugars (%)	A	1.70	1.50	1.30	0.90	1.35	FYM	0.36
	B	1.90	1.60	1.40	1.20	1.53	N	0.62
	C	1.30	1.20	1.00	0.70	1.05	FYM.	1.07
	Mea	1.60	1.40	1.25	0.93	1.31		
Sucrose (%)	A	14.82	14.5	14.2	13.6	14.29	FYM	0.24
	B	17.63	16.6	14.0	14.6	15.74	N	0.17
	C	12.66	11.0	11.3	10.3	11.33	FYM.	0.92
	Mea	15.00	14.0	13.2	12.9	13.7		
Juice purity (%)	A	82.30	71.8	78.0	68.2	75.08	FYM	4.76
	B	86.90	74.2	82.4	77.0	80.13	N	2.41
	C	62.00	73.3	75.5	55.0	66.45	FYM.	4.17
	Mea	77.07	73.1	78.6	66.7	73.89		
Sugar yield (g/plant)	A	218.0	197.	183.	187.	196.7	FYM	124.8
	B	234.4	223.	210.	198.	216.9	N	124.1
	C	189.72	174.00	122.10	113.28	149.76	FYM.N	214.96
	Mea	214.0	198.	172.	166.	187.8		

A: FFYM, B: CFYM, C: Control, 1: Amm. Nitrate, 2: Urea, 3: Diluted HNO_3 and 4: Control

Mineral nitrogen application increased these parameters with exception of total soluble solids and reducing sugar, as follows in a descending order of ammonium nitrate > urea > diluted HNO_3, with a significant difference between each other being their effects on total soluble sugar, sucrose percentage and sugar yield. Diluted HNO_3, however, reduced total soluble solids significantly than the other two N-forms and control as well as increased juice purity significantly over urea.

f. Juice purity and sugar yield as affected by leaf chemical composition:

Leaf contents of chlorophyll A, B, carotene, total soluble solids, reducing sugar, nitrogen, phosphorus and potassium were put under consideration. Concerning their relation with juice purity or total sugar yield, correlation coefficients were calculated as Table (7) clarifies. It is obvious that the only significant coefficient was that between juice purity and potassium content in leaves whether at 16 or 25 weeks age. Therefore, juice purity could be calculated by knowing the K% in leaves at 16 or 25 weeks age from the following regression equations:

J.P.%=50.86+14.93K_{16}% or =54.12+10.82K_{25}%, respectively

Table (7): Correlation coefficients of juice purity and total sugar yield with some effective factors.

The affected factors (Y):	Plant age (weeks)			
	Juice purity		Total sugar yield	
	16	25	16	25
Chlorophyll A	-0.023	0.158	-0.060	-0.026
Chlorophyll B	0.107	0.188	-0.097	-0.007
Carotene	0.135	0.011	-0.126	-0.035
Reducing sugars	0.088	-0.229	-0.075	-0.143
Total soluble solids	-0.229	0.269	-0.018	-0.045
N content	0.157	0.140	-0.019	-0.190
P content	0.043	-0.003	-0.206	-0.251
K content	0.297*	0.296*	-0.082	-0.169
The significant limit or Table (r) at df 46=± 0.285				

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تأثير بعض المخصبات العضوية ومصادر النتروجين المعدني على نمو ومحصول وبعض صفات بنجر السكر النامي في ارض جيرية

رأفت نظمى زكى
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أجريت تجربة حقلية على أرض جيرية بمنطقة النوبارية لاستبيان مدى استجابة بنجر السكر لإضافات من كلا السماد البلدي الطازج أو المكمور بمعدل ١٠ طن/ فدان بالاشتراك مع ٤٠ كجم نتروجين/ فدان في صور مختلفة (يوريا، نترات أمونيوم، محلول مخفف من حمض النيتريك). وقد أخذت عينات نباتية بعد ١٦، ٢٥ أسبوع من الزراعة لتحديد حالة النمو الخضري (طول النبات، عدد الأوراق، طول وعرض الجذور)، وقد تم تحليل العرش والجذور كيميائيا لتقدير المحتوى من كلوروفيل B&A، الكاروتين، السكر الكلى الذائب والسكريات المختزلة.

وتشير النتائج المتحصل عليها إلى أن إضافة السماد البلدي في صورتية (الطازجة والمكمورة) قد أدى إلى تحسين كثير من صفات التربة ممثلة في المحتوى من المادة العضوية، Soil pH، ملوحة التربة، السعة التبادلية الكاتيونية، المحتوى الميسر من عناصر النتروجين، الفسفور، البوتاسيوم، مع أفضلية للسماد البلدي المكمور، إما بالنسبة للقياسات النباتية (النمو الخضري، المحصول، تركيز السكر ونقاوتة) فقد أتضح إن أفضل المعاملات تأثيرا كانت تلك المشتركة ما بين السماد البلدي المكمور ونترات الأمونيوم، كما وجد أن هناك علاقة إيجابية موكدة ما بين نقاوة السكر وتركيز البوتاسيوم في الاورق. وتدل النتائج على أن المحتوى من السكريات المختزلة كان أكثر تأثرا بالمعاملات تحت الدراسة مقارنة بالمحتوى من السكريات الكلية الذائبة.