EFFECT OF SOME AGRI-PRACTICES ON THE VEGETATIVE GROWTH AND CHEMICAL CONSTITUENTS OF SUGAR BEET

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Abstract

Two field trails were conducted at Sakha Agricultural Research Station (Kafre El-Sheikh) Governorate in two successive seasons, 1995/1996 and 1996/1997 to find out the effect of fertilization and harvesting date on growth behavior and chemical constituents of sugar beet plants. Sugar beet variety viz. "Pleno" was sown during the first week of October in both seasons.

The present work included 24 treatments representing the combination between farmyard manure levels (with and without FYM application), three mineral nitrogen doses [Without application (control) 45 kg N/fed. and 90 kg N/fed.] two application date of phosphorus fertilizer [With land preparation (WLP) or band in rows at sowing (WS) and two harvesting dates (After 180 days from sowing and after 210 days from sowing). The important results could be summarized as follows:

- There was a gradual and significant increase in sugar beet root diameter with increasing the applied doses of nitrogen up to 90 kg N/fed.
- Root diameter was not affected significantly by time of phosphorus application. However, phosphorus application with land preparation mostly produced thicker sugar beet roots than the other application treatment in most cases.
- Sugar beet root length positively responded to the organic manure (FYM) application.
- The difference between the two application dates of phosphorus was not high enough to reach the level of significance in their effect on root length and root fresh weight/plant.
- Top fresh weight/plant significantly responded to the application of organic manure. 45 and /or 90 kg/fed. distinctly improved fresh weight of sugar beet top/plant and values of leaf area index (LAI) respectively.
- Application of nitrogen fertilizer attained a pronounced increase in the "a and b" chlorophyll content of sugar beet leaves as well as carotinoids.
- Increasing the applied rates of nitrogen negatively affected the total soluble solids (TSS %), however this effect was insignificant on the values of sucrose %.

- Neither the application of FYM nor the application time of phosphorus attained a significant effect on the values of TSS % and sucrose %.

INTRODUCTION

Sugar beet ranks the second sugar crop not only in Egypt but also all over the world. Vegetative growth characters as well as chemical constituents of sugar beet are greatly affected by agricultural processes and farm management techniques.

Under the open market and the continuous increase in the fertilizers prices, in addition to the increasing in the polution as a result to the contnuous use of the artificial fertilizer, the conducted work was carried out to ration the quantity applied of nitrogen by using farm yard manure and to study to what extent plant age affects vegetative growth and quality of sugar beet. Also, plant age at harvest crop has a direct effect on beet maturity and consequently the extracted sugars. Yoshizawa, *et al.* (1992) studied the effect of various rates of manure and N fertilizers on sugar beet. They noticed a decrease in sugar content with manure application accopanied by a reduction in the dry matter (DM) pecentage of roots. Leshchenko, *et al.* (1993) studied the effect of NPK fertilizers and organic phosphorus on the productivity and P. uptake of sugar beet. They found that sugar content was increased by 120 % over the control when NPK fertilizers and organic P. were applied. Ibrahim (1998) used five rates of nitrogen fertilizer (0, 25, 05, 75 and 100 kg./fed.). He found that increasing nitrogen up to 100 kg/fed. gave a significant increase in top fresh weight/plant, root length, root diameter, froot fresh weight/plant while TSS %, Sucrose % and Purity % were significantly decreased. Also, he found that P application favorably affected root length, root diameter and root fresh weight/plant at 160, 185 and 210 days.

Castillo Garica and Lopez Bellido (1986) in Spain, reported that sugar beet plants began active growth at 160 days after sowing and achieved a daily maximum DM. accumulation of 20-25 g/m^2 and LAI of 3.9-5.0. Earlier sowing increased DM. production and leaf growth resulting in higher root and sugar yield. Hassanein (1991) in Egypt, found that harvesting after 195 days from sowing markedly increased diameter, length and weight of individual root as well as root/top ratio. Sucrose and purity percentages were not affected by harvesting dates. Saif *et al.* (1997) assured that delaying harvesting date delayed juice purity % by delaying harvesting date up to 200 days. Also

sucrose % recorded the highest values by delaying harvesting date up to 200 days from sowing. The present work was initiated to study the effect of harvesting date and nitrogen fertilizers on some sugar beet characteristics.

MATERIALS AND METHODS

Two field trials were conducted at Skha Agricultural Research Station (Kafre El-Sheikh) Governorate in two successive seasons, 1995/1996 and 1996/1997 to find out the effect of fertilization and harvesting date on growth behaviour and chemical constituents of sugar beet plants. Sugar beet variety viz. "PLeno" was sown during the first week of October in both seasons.

The presented work included 24 treatments which were the combination between two FYM (with and without FYM application), three mineral nitrogen dises [Without application (control), 45 kg N/fed. and 90 kg N/fed.], two application date of phosphorus fertilizer [With land preparation (WLP) and Band in rows at sowing (WS)] and two harvesting dates (After 180 days from sowing and after 210 days from sowing).

To fix the quantity of the applied doses of nitrogen in the used FYM, the added amounts of FYM in both seasons were adjusted to its N %. Based on chemical analysis of FYM, 4.0 tons FYM/fed. (1.2%N) and 9.600 tons FYM/fed. (0.5%N) equal to 48 kg. N/fed. were added at the first and second season, respectively. Nitrogen fertilizer was applied as Urea (46%N) in two equal doses i.e. the first dose was added after thining (45 days from sowing) and the second added 21 days later. Phosphorus fertilization was applied as calcium super phosphate at 15 kg/fed. (15% P_2O_2). Physical and chemical properties of the experimental soil are presented in Table (1).

A split plot design with four replications was used where harvesting dates occupied the main plots while the combinations between the FYM levels, nitrogen and phosphorus fertilization were randomly allocated in the sub-plots. Plot size was 21 m^2 consisted 6 rows each of 7 m long and 0.5 m width. Each plot was divided into to equal parts, one of them was used for peroidical samples and the other was left for harvesting data. The normal agronomic practices were carried out as recommended by Ministry of Agriculture in sugar beet fields.

Data recorded:

I. Growth criteria:

A sample of ten sugar beet plants were collected from each plot to determine the following characters at 90, 120 and 150 days from sowing:

Root diameter (cm), Root length (cm), Root fresh weight (g/plant), Top fresh weight (g/plant) and Leaf area index (LAI).

II. Chemical constituents and juice quality:

- Chlorophyll a, Chlorophyll b and Carotinoids were determind in sugar beet leaves according to Wettstein (1957).
- Total soluble solids (TSS) was measured by using Hand referactometer.
- Sucrose percentage was determined by using Saccharimeter according to the procedure outlined by Le-Docte (1972).

Statistical analysis:

The obtained data were subjected to the proper statistical analysis for the split-plot design according to Snedecor and Cochran (1981).

RESULTS AND DISCUSSION

A. Growth criteria:

Root diameter:

The available results in Table (2) show that sugar beet root diameter positively responded to farmyard manure (FYM) applications. This finding was true at 90 days age in both seasons and at 120 days age in the second season. It could be noted that there was a general tendency towards the increase in sugar beet root diameter due to FYM application. This observation was completely true at various growth stages of both growing seasons. Concerning nitrogen fertilizer (inorganic source), the collected data in Table (2) clearly show that there was a gradual and significant increase in sugar beet

root root diameter with increasing the applied doses of nitrogen up to 90 kg N/fed. This result was fairly true not only in the various growth stages but also in the two growing seasons. This findig was in agreement with that found by El Maghraby *et al.* (1997) who mentioned that increasing nitrogen application up to 90 kg N/fed. as soil applications and 1.5% N as foliar application caused a significant increase in root diameter.

As for the effect of application dates of phosphorus on root diameter, the results obtained almost cleared that this trait insignificantly affected by time of phosphorus application. However, it is obviously shown that application of phosphorus fertilizer with land preparation in most cases produced thicker sugar beet roots than the other application treatments.

Root length:

Teh results obtained in Table (3) obviously show that sugar beet root length positively responded to the organic manure FYM application. This result was in general true at the various growth stages of the two seasons. However, this response was significant at 90 and 120 days in the second season only.

Table (3) shows that, sugar beet root length was statisitically increased by applying 45 and/or 90 kg N/fed. except age of 90 days in the 1st season compared to the unfertilized treatment (zero N-application). This finding coincides with that reported by Hassanein (1991). As for the effect of phosphorus fertilizer on root length, it could be concluded that the difference between the two application da tes of phosphorus was high not enough to reach the level of significance in their effect on this trait. This result was almost true in both growing seasons.

The interaction effects of the studied factors were mostly insignificant in r espect to their effect on root length of sugar beet.

Root fresh weight/plant:

Data illustrated in Table (4) reveal that using FYM attained a relative advantage in relation to sugar beet root weight/plant. This finding was true in both growing seasons under the studied growth stage. However, this pronounced effect was significant

at 120 days in both seasons and at 150 days in the 2nd season only. This result is in line with that obtained by Hamoud 1992.

Concerning N-effect on root fresh weight of sugar beet/plant, the presented data in Table (4) distinctly show that root fresh weight gradually increased by increasing the aplied doses of nitrogen up to 90 kg/fed. This effect was significant in all growth stages of the second season and at the age of 120 days from sowing in the 1st season. The effective role of nitrogen fertilizer on this treat was reported by El-Maghraby *et al.* (1997) who mentioned that application of nitrogen fertilizer caused a significant increase in root fresh weight of sugar beet plants.

The results obtained in Table (4) indicate that there are an insignificant effect on root fresh weight/plant due to phosphorus application dates. Moreover, the interaction between the studied factors were insignificant.

Top fresh weight/plant:

The recorded data in Table (5) show that top fresh weight/plant significantly responded to the application of organic manure. This result was true when sugar beet plants aged 90 and 120 days in the 1st season and at 90 days in the 2nd season. Regarding to the influence of nitrogen fertilizer rates on top fresh weight/plant., it could be noticed that the applied doses of nitrogen up to 90 kg/fed distinctly improved fresh weight of sugar beet top/plant. This result was fairly true at various growth stages in both growing seasons. The effective role of nitrogen element on fresh weight of sugar beet/plant was recorded by Ibrahim (1998) who found that nitrogen application at the rate of 150 kg N/fed. on five equal doses significantly increased individual top weight per plant.

The effect of application phosphorus dates on top fresh weight of sugar beet/plant mostly was insignificant. Whereas, it is clearly trend that application of phosphorus element with sowing attained a relative advantage in respect to top fresh weight/plant. The results obtained cleared that most of the used combination of the studied factors insignificantly affected top fresh weight/plant.

Leaf area index (LAI):

Data given in Table (6) show that LAI significantly responded to FYM application at 120 and 150 days in the 2nd season only. Thus that the values of LAI caused a positive increment as a result to FYM application As for, the effect of nitrogen fertilizer level on LAI, the presented data in Table (6) distinctly clear that increasing the applied doses of nitrogen produced significant and gradual increase in the values of LAI. This finding was completely true at 120 and 150 days from sowing in both growing seasons. These results are in harmony with those found by Ramadan (1986) who mentioned that nitrogen application up to 60 kg N/fed was accompanied by increasing in LAI values. It is also observed that neither phosphorus application nor the most of the different interactions of the studied factors attained a significant effect on LAI values.

B. Chemical constituents and juice quality

1. Chlorophyll "a":

The collected data in Table (7) obviously show that the effect of FYM application on Chlorophyll "a" content was negligible and insignificant. It is well known that nitrogen element is considered as one of the major elements which forms the molecules of chlorophyll 'a'. Based on that fact, the application of nitrogen fertilizer attained a pronounced increase in the chlorophyll content of sugar beet leaves This increment was true and significant in both growing seasons. Regarding the effect of phosphorus application dates on chlorophyll 'a' content of sugar beet leaves, the results obtained revealed that there was no clear cut trend could be observed in this respect. As for the effect of the interaction effects of the studied factors. The results appeared that chlorophyll 'a' content of sugar beet leaves was not affected by the different combination between the studied factors.

Chlorophyll "b":

The available results in Table (8) reveal that the values of chlorophyll 'b' content of sugar beet leaves were significantly affected by "FYM" at the age of 90 and 150 days after sowing in the second season only. Regardless the significant effect of "FYM" on this trait, it could be detected that FYM was more effective on the values of chlorophyll 'b' at the 1st period of growth, i.e. 90 days from sowing of the sowing, whereas

this effect became negligible in the later stages. In relation to nitrogen effect on the values of chlorophyll 'b', the results obtained showed that application of nitrogen fertilizer attained a gradual and significant: increment in the values of this components in the second season. However, the differences between nitrogen levels in their effect on chlorophyll 'b' were not great enough to reach the level of significance in the first season Once more, the collected data obviously shows that phosphorus application date insignificantly affected chlorophyll 'b' content of sugar beet leaves. This finding was true at the various growth stages of the two growing seasons. Concerning the interactions effect of the different combinations of the studied factors on chlorophyll 'b' content of sugar beet leaves, was of no approachable effect due to the different interactions on this trait.

Carotinoids:

The presented data in Table (9) clear that application of FYM to sugar beet plants had no positive role in respect to carotinoids content of sugar beet plant. On the contrary application of FYM reduced the leaf content of this component.

Regarding the effect of nitrogen fertilizer on this trait ,the results showed similar trend to that obtained for chlorophyll "a" and "b". Thus the increasing the applied doses of nitrogen increased the values of carotinoids content in sugar beet leaves This increment was true in both seasons and significant in the second season only. Regarding the phosphorus application effect on the carotinoids content, the available data in Table (9) clear that neither application date of phosphorus nor the different combination between the studied factors gave a significant effect on sugar beet leaf content of carotinoids.

Total soluble solids (T.S.S%):

Data collected in Table (10) show that application of FYM attained a relative advantage in the values of TSS % in both seasons. These results are in disagreement with those reported by Abd El Ghaffar (1981) who concluded that T.S S% was insignificantly decreased by increasing nitrogen and organic manure application The obtained data in Table (10) indicate that increasing the applied rates of nitrogen negatively affected TSS%. This observation was true at the different growth stages in the two growing

seasons. It is worth mentioning that the recorded reduction in the values of TSS % was significant only at the age of 90 days from sowing when the applied dose was 90 kg N/ fed. The negligible effect of nitrogen on TSS % has been reported by El -Geddawy *et al.* (1992) who pointed out that TSS% did not show much response to N -application. In regard to the effect of the date of phosphorus application; the results indicated that there was no clear cut trend could be noticed in the values of TSS % due to these treatments. The results obtained cleared that the effect of the different combinations of the studied factors on TSS % was insignificant .

Sucrose percentage:

Regarding the influence of organic and inorganic fertilizers on sucrose percentage of sugar beet roots, results in Table (11) revealed that sucrose % was not affected significantly by FYM or nitrogen application. On the contrary, Hamoud (1992) found that applying FYM to clay soil increased sugar percentage. This result is partially in line with Vales and Strnad (1991) who claimed that sugar content was not affected by using FYM . Raising nitrogen level up 90 kg N/fed. mostly depressed the values of sucrose % not only at the various growth stages in both seasons. This finding is in line with that found by Halvorson and Hartman (1988) who mentioned that increasing nitrogen fertilizer up 96 kg/ha reduced sucrose content of sugar beet roots. Regarding the influence of phosphorus application dates on sucrose percentage, the results obtained pointed out that sucrose % was insignificantly affected by these treatments. Concerning the interaction effects on sucrose %, it could be noted that the 1^{st} order interaction between nitrogen and FYM as well as the 2^{nd} order interaction among nitrogen, FYM and phosphorus application dates was only significant on sucrose % when sugar beet plants at the age of 90 days.

Table 1. Physical and chemical properties of the experimental soil.

Analysis	Season	
	1995/1996	1996/1997
Mechanical analysis		
Coarse sand %	1.45	1.72
Fine sand %	16.6	15.18
Silt %	20.3	19.0
Clay %	60.1	62.1
Texture	Clay	Clay
$CaCo_3$	1.6	1.6
Chemical analysis		
Organic matter %	1.8	2.0
Available nitrogen ppm	16.25	17.3
Available phosphorus pp (Jackson, 1958)	6.53	6.68
Available postassium ppm	290.36	274.35
Saturation Water %	60	70
P^H	8.3	8.2
Ec ds/m	3.40	3.3
Cations & anions, meq/L		
Na^+	6.60	6.88
K^+	0.33	0.50
Ca^{++}	2.2	2.7
Mg^{++}	2.6	2.94
HCO_3^- meq/L	6.0	6.8
Cl^-	5.6	6.00
$SO_4^=$	0.13	0.22

Table 2. Effect of farmyard manure (FYM), nitrogen levels and phosphorus fertilizers on root diameter (cm) after 90, 120 and 150 days from sowing in 1995/96 and 1996/97 seasons.

Treatments			1995/1996 season			1996/1997 season		
	N	P	Days after sowing					
	Kg/fed.	kg/fed.	90	120	150	90	120	150
Without FYM	0	*WLP	2.50	4.13	4.55	2.81	4.28	5.28
		**WS	2.38	3.93	4.38	2.63	4.05	5.08
	Mean		2.44	4.03	4.46	2.72	4.17	5.18
	45	*WLP	3.78	6.78	7.05	4.05	6.78	8.03
		**WS	3.58	6.78	7.35	3.50	7.28	7.43
	Mean		3.68	6.63	7.20	3.78	7.03	7.73
	90	*WLP	6.40	9.58	10.10	6.68	7.28	8.88
		**WS	5.03	7.55	8.93	5.10	7.13	8.93
	Mean		5.71	8.56	9.51	5.89	7.20	8.90
Mean			3.94	6.40	7.06	4.13	6.13	7.27
FYM	0	*WLP	2.95	4.13	4.78	3.25	4.68	5.95
		**WS	2.60	4.95	5.20	2.91	5.73	4.95
	Mean		2.78	4.54	4.99	3.08	5.20	5.45
	45	*WLP	5.03	7.20	7.75	5.03	7.05	8.33
		**WS	4.45	6.10	6.78	5.01	7.70	7.63
	Mean		4.75	6.65	7.26	5.02	7.38	7.98
	90	*WLP	8.00	9.68	10.63	8.18	9.90	9.98
		**WS	7.18	9.13	9.80	7.53	10.13	10.03
	Mean		7.59	9.40	10.21	7.85	10.01	10.00
Mean			5.03	6.86	7.49	5.31	7.53	7.81
Overall Mean	N	0	2.61	4.28	4.73	2.90	4.68	5.31
		45	4.21	6.64	7.23	440	7.20	7.85
		90	6.65	8.98	9.86	6.87	8.61	9.45
	P	WLP	4.78	6.86	7.48	5.00	6.66	7.74
		WS	4.20	6.40	7.07	4.45	7.00	7.34
LSD at 0.05 level for:								
FYM (F)			0.49	NS	NS	1.16	0.43	NS
Nitrogen (N)			0.60	0.70	0.84	1.42	0.53	0.69
Phosphorus (P)			0.49	NS	NS	NS	NS	NS
F x N			0.85	NS	NS	NS	0.75	NS
F x P			NS	NS	NS	NS	NS	NS
F x N x P			NS	NS	NS	NS	NS	NS

* WLP: With Land Preparation

** WS: Band in rows at sowing

Table 3. Effect of farmyard manure (FYM), nitrogen levels and phosphorus fertilizers on root length (cm) after 90, 120 and 150 days from sowing in 1995/96 and 1996/97 seasons.

Treatments			1995/1996 season			1996/1997 season		
	N	P	Days after sowing					
	Kg/fed.	kg/fed.	90	120	150	90	120	150
Without FYM	0	*WLP	32.50	33.50	37.48	33.10	34.60	40.03
		**WS	32.55	32.90	35.40	33.33	33.88	36.53
	Mean		32.53	33.20	36.44	33.21	34.24	38.28
	45	*WLP	33.78	37.68	40.00	34.20	41.80	42.85
		**WS	34.52	36.58	41.80	35.43	37.50	42.83
	Mean		34.15	37.13	40.90	34.81	39.65	42.84
	90	*WLP	34.83	35.90	40.93	36.73	34.70	41.85
		**WS	35.46	36.93	42.50	36.63	37.15	44.58
	Mean		35.14	36.41	41.71	36.68	35.93	43.21
Mean			33.94	35.58	39.68	34.90	36.60	41.44
FYM	0	*WLP	32.78	34.85	34.33	33.08	36.35	37.18
		**WS	32.07	34.30	37.00	33.53	37.73	38.93
	Mean		32.42	34.58	35.66	33.30	37.09	38.05
	45	*WLP	34.66	38.10	40.58	35.23	40.73	41.63
		**WS	34.25	37.60	38.73	35.93	38.80	40.00
	Mean		34.15	37.85	39.65	35.58	39.76	40.81
	90	*WLP	36.46	37.58	42.40	37.73	39.75	44.38
		**WS	37.28	37.35	41.70	38.35	38.90	43.03
	Mean		36.92	37.46	42.05	38.04	39.33	43.70
Mean			34.50	36.63	39.12	35.64	38.73	40.85
Overall Mean	N	0	32.47	33.89	36.05	33.26	35.66	38.16
		45	34.15	37.49	40.28	35.19	39.71	41.83
		90	36.03	36.94	41.88	37.36	37.63	43.46
	P	WLP	34.07	36.27	39.28	35.01	38.00	41.32
		WS	34.37	35.94	39.52	35.53	37.33	40.98
LSD at 0.05 level for:								
FYM (F)			NS	NS	NS	0.35	1.70	NS
Nitrogen (N)			NS	2.05	2.71	0.43	2.09	2.89
Phosphorus (P)			NS	NS	NS	0.35	NS	NS
F x N			NS	NS	NS	0.61	NS	NS
F x P			NS	NS	NS	NS	NS	NS
F x N x P			NS	NS	NS	NS	NS	NS

* WLP: With Land Preparation

** WS: Band in rows at sowing

Table 4. Effect of farmyard manure (FYM), nitrogen levels and phosphorus fertilizers on root fresh weight (g)/plant after 90, 120 and 150 days from sowing in 1995/96 and 1996/97 seasons.

Treatments			1995/1996 season			1996/1997 season		
	N	P	Days after sowing					
	Kg/fed.	kg/fed.	90	120	150	90	120	150
Without FYM	0	*WLP	256.58	306.20	470.43	298.65	384.43	451.88
		**WS	294.45	322.23	481.58	309.33	392.33	412.00
	Mean		275.51	314.21	476.00	303.99	388.38	431.94
	45	*WLP	366.95	390.60	657.45	322.90	396.38	622.98
		**WS	372.25	390.68	455.25	399.70	472.13	507.73
	Mean		369.60	390.64	556.35	361.30	434.25	565.35
	90	*WLP	370.18	411.10	626.00	404.55	684.88	890.20
		**WS	345.63	425.29	677.63	423.08	694.85	892.43
	Mean		357.90	418.13	651.81	413.81	689.86	891.31
Mean			334.34	374.35	561.39	359.70	504.16	629.53
FYM	0	*WLP	321.00	380.83	574.58	373.45	405.08	438.80
		**WS	257.35	301.66	498.90	355.45	457.80	581.70
	Mean		289.18	341.24	536.74	364.45	431.44	510.25
	45	*WLP	366.99	388.88	651.00	403.15	576.05	672.05
		**WS	382.65	423.05	561.48	466.85	579.10	633.48
	Mean		472.25	465.96	606.24	435.00	577.58	652.76
	90	*WLP	400.85	556.15	629.75	479.50	717.63	981.85
		**WS	400.85	543.10	672.30	578.48	700.78	947.15
	Mean		436.55	549.63	651.03	528.99	709.20	964.50
Mean			366.85	432.28	598.00	442.81	572.74	709.17
Overall Mean	N	0	282.34	327.73	506.37	334.22	409.91	471.09
		45	372.21	398.30	581.29	398.15	505.91	609.06
		90	397.23	483.91	651.42	471.40	699.53	927.91
	P	WLP	358.99	405.63	601.53	380.37	527.40	676.29
		WS	342.20	400.99	557.85	422.15	549.50	662.41
LSD at 0.05 level for:								
FYM (F)			NS	25.14	NS	NS	35.15	51.96
Nitrogen (N)			NS	30.79	NS	2.85	43.05	48.61
Phosphorus (P)			NS	NS	NS	NS	NS	NS
F x N			NS	43.54	NS	NS	60.88	NS
F x P			NS	NS	NS	NS	NS	NS
F x N x P			NS	NS	NS	NS	NS	NS

* WLP: With Land Preparation

** WS: Band in rows at sowing

Table 5. Effect of farmyard manure (FYM), nitrogen levels and phosphorus fertilizers on top fresh weight (g)/plant after 90, 120 and 150 days from sowing in 1995/96 and 1996/97 seasons.

Treatments			1995/1996 season			1996/1997 season		
	N	P	Days after sowing					
	Kg/fed.	kg/fed.	90	120	150	90	120	150
Without FYM	0	*WLP	303.65	373.68	195.70	310.55	379.80	200.78
		**WS	295.62	389.58	214.50	265.33	370.50	216.60
	Mean		299.64	381.63	205.10	287.94	375.15	208.69
	45	*WLP	377.50	606.25	251.90	443.58	616.03	256.40
		**WS	347.98	615.38	288.95	435.53	615.45	302.70
	Mean		362.74	610.81	270.43	439.55	615.74	279.55
	90	*WLP	495.45	765.76	357.63	464.90	760.55	351.75
		**WS	505.33	795.13	269.85	508.43	797.68	301.43
	Mean		500.39	780.44	313.74	486.66	779.11	326.59
Mean			387.59	590.96	263.09	404.72	590.00	271.61
FYM	0	*WLP	330.67	462.10	200.63	332.38	458.70	205.78
		**WS	312.02	556.13	217.70	317.28	531.73	226.48
	Mean		321.34	509.11	209.16	324.83	495.21	216.13
	45	*WLP	376.26	615.18	261.33	383.60	647.95	268.33
		**WS	525.50	620.10	277.43	522.28	622.90	285.95
	Mean		450.88	617.64	269.38	452.94	635.43	277.14
	90	*WLP	538.88	752.30	314.68	541.08	755.75	310.10
		**WS	529.39	769.50	286.03	529.53	720.60	296.13
	Mean		534.14	760.90	300.35	535.30	738.18	303.11
Mean			435.45	629.22	259.63	437.69	622.94	265.46
Overall Mean	N	0	310.49	445.37	207.13	306.38	435.18	212.41
		45	406.81	614.22	269.90	446.24	625.58	278.34
		90	517.26	770.67	307.04	510.98	758.64	314.85
	P	WLP	403.73	595.88	263.64	412.68	603.13	265.52
		WS	419.31	624.30	259.08	429.73	609.81	271.55
LSD at 0.05 level for:								
FYM (F)			7.90	36.50	NS	23.88	NS	NS
Nitrogen (N)			9.68	44.70	60.31	29.25	43.33	57.33
Phosphorus (P)			7.90	NS	NS	NS	NS	NS
F x N			13.68	63.21	NS	NS	61.28	NS
F x P			NS	NS	NS	NS	NS	NS
F x N x P			NS	NS	NS	58.49	NS	NS

* WLP: With Land Preparation

** WS: Band in rows at sowing

Table 6. Effect of farmyard manure (FYM), nitrogen levels and phosphorus fertilizers on leaf area index (LAI) after 90, 120 and 150 days from sowing in 1995/96 and 1996/97 seasons.

Treatments			1995/1996 season			1996/1997 season		
	N	P	Days after sowing					
	Kg/fed.	kg/fed.	90	120	150	90	120	150
Without FYM	0	*WLP	1.26	1.45	1.40	1.45	2.21	1.45
		**WS	1.32	1.65	1.25	1.69	1.99	1.33
	Mean		1.30	1.55	1.33	1.57	2.10	1.39
	45	*WLP	1.72	2.82	2.18	2.00	2.90	2.20
		**WS	1.80	2.72	2.26	2.02	3.02	2.51
	Mean		1.76	2.77	2.22	2.01	3.00	2.35
	90	*WLP	1.95	2.99	2.78	2.09	3.10	2.17
		**WS	2.05	3.25	2.97	2.04	2.45	2.01
	Mean		2.00	3.12	2.88	2.07	2.77	2.09
Mean			2.69	2.48	2.14	2.71	2.61	1.94
FYM	0	*WLP	1.33	1.92	1.81	1.62	2.04	2.42
		**WS	1.30	1.88	1.67	1.65	2.15	2.09
	Mean		1.32	1.90	1.74	1.64	2.09	2.26
	45	*WLP	1.81	2.91	2.62	2.13	3.41	2.03
		**WS	1.79	3.07	2.89	1.89	3.42	2.22
	Mean		1.80	2.99	2.76	2.00	3.28	2.12
	90	*WLP	2.35	3.65	3.14	2.85	3.90	3.14
		**WS	2.14	3.71	3.47	2.42	3.93	3.67
	Mean		2.25	3.68	3.31	2.64	3.91	3.40
Mean			2.79	2.83	2.60	2.09	3.10	2.59
Overall Mean	N	0	1.30	1.73	1.53	2.85	2.10	1.82
		45	1.78	2.88	2.49	2.01	3.12	2.24
		90	1.12	3.40	3.09	2.35	3.34	2.75
	P	WLP	1.74	2.62	2.32	2.86	2.88	2.23
		WS	1.73	2.71	2.42	1.95	2.82	2.30
LSD at 0.05 level for:								
FYM (F)			NS	NS	NS	NS	0.34	0.32
Nitrogen (N)			NS	1.15	0.94	NS	0.41	0.39
Phosphorus (P)			NS	NS	NS	NS	NS	NS
F x N			NS	NS	NS	NS	0.59	0.32
F x P			NS	NS	NS	NS	NS	NS
F x N x P			NS	NS	NS	NS	NS	NS

* WLP: With Land Preparation

** WS: Band in rows at sowing

Table 7. Effect of farmyard manure (FYM), nitrogen levels and phosphorus fertilizers on chlorophyll a (mg/g fresh weight of !eaves) after 90, 120 and 150 days from sowing in 1995/96 and 1996/97 seasons.

Treatments			1995/1996 season			1996/1997 season		
	N	P	Days after sowing					
	Kg/fed.	kg/fed.	90	120	150	90	120	150
Without FYM	0	*WLP	6.07	4.65	3.39	6.54	4.76	3.41
		**WS	5.78	3.71	3.16	6.00	3.75	3.23
	Mean		5.93	4.19	3.28	6.27	4.26	3.32
	45	*WLP	7.01	6.15	4.87	7.21	6.19	4.88
		**WS	7.10	6.12	4.99	7.23	6.20	4.99
	Mean		7.05	6.13	4.93	7.22	6.19	4.93
	90	*WLP	7.90	6.97	6.13	8.32	7.21	6.44
		**WS	7.95	7.04	6.45	8.89	7.22	6.55
	Mean		7.93	7.01	6.38	8.61	7.21	6.50
Mean			6.97	5.78	4.86	7.37	5.89	4.92
FYM	0	*WLP	5.72	3.98	3.24	5.58	4.24	3.34
		**WS	5.91	3.82	3.48	5.13	3.84	3.32
	Mean		5.81	3.90	3.36	5.35	4.04	3.33
	45	*WLP	7.52	6.22	4.91	7.81	6.41	4.99
		**WS	7.57	6.31	4.99	7.81	6.46	4.99
	Mean		7.54	6.27	4.95	7.81	6.43	4.99
	90	*WLP	8.34	6.88	6.19	8.62	7.03	6.45
		**WS	8.48	7.22	6.23	8.64	7.16	6.58
	Mean		8.41	7.05	6.21	8.63	7.09	6.51
Mean			7.26	5.74	4.84	7.26	5.86	4.94
Overall Mean	N	0	5.87	4.04	3.32	5.81	4.15	3.32
		45	7.30	6.20	4.94	7.52	6.31	4.96
		90	8.17	7.03	6.40	8.62	7.15	6.50
	P	WLP	7.09	5.81	4.82	7.35	5.97	4.92
		WS	7.13	5.71	4.88	7.28	5.77	4.94
LSD at 0.05 level for:								
FYM (F)			NS	NS	NS	NS	NS	NS
Nitrogen (N)			0.76	0.65	1.08	0.60	0.33	0.49
Phosphorus (P)			NS	NS	NS	NS	NS	NS
F x N			NS	NS	NS	NS	0.46	NS
F x P			NS	NS	NS	NS	NS	NS
F x N x P			NS	NS	NS	NS	NS	NS

* WLP: With Land Preparation

** WS: Band in rows at sowing

Table 8. Effect of farmyard manure (FYM), nitrogen levels and phosphorus fertilizers on chlorophyll b (mg/g fresh weight of leaves) after 90, 120 and 150 days from sowing in 1995/96 and 1996/97 seasons.

Treatments			1995/1996 season			1996/1997 season		
	N	P	Days after sowing					
	Kg/fed.	kg/fed.	90	120	150	90	120	150
Without FYM	0	*WLP	3.42	2.07	2.06	2.86	2.51	2.16
		**WS	4.15	4.49	1.95	2.83	2.60	2.22
	Mean		3.78	3.28	2.01	2.84	2.56	2.19
	45	*WLP	3.22	2.37	2.16	3.05	2.78	2.32
		**WS	3.19	2.301	2.10	3.11	2.81	2.41
	Mean		3.21	2.33	2.13	3.08	2.79	2.36
	90	*WLP	3.22	3.94	2.31	3.27	3.31	2.41
		**WS	3.20	3.74	2.45	3.48	3.31	2.46
	Mean		3.21	3.84	2.38	3.38	3.31	2.44
Mean			3.40	3.15	2.17	3.10	2.89	2.33
FYM	0	*WLP	3.72	2.46	1.95	3.34	2.05	1.94
		**WS	3.79	2.48	2.49	3.47	2.09	2.06
	Mean		3.75	2.47	2.22	3.40	2.07	2.00
	45	*WLP	4.20	2.65	2.02	4.19	3.26	2.17
		**WS	4.26	2.74	2.16	4.19	3.15	2.29
	Mean		4.23	2.70	2.09	4.19	3.21	2.23
	90	*WLP	4.61	2.98	2.73	4.50	3.50	2.33
		**WS	4.62	2.95	2.60	4.44	3.47	2.45
	Mean		4.61	2.97	2.67	4.47	3.49	2.39
Mean			4.20	2.71	2.33	4.02	2.92	2.21
Overall Mean	N	0	3.77	2.87	2.11	3.12	2.31	2.09
		45	3.72	2.52	2.11	3.63	3.00	2.30
		90	3.91	3.40	2.52	3.92	3.40	2.41
	P	WLP	3.73	2.74	2.20	3.06	2.90	2.22
		WS	3.87	3.12	2.29	3.14	2.90	2.31
LSD at 0.05 level for:								
FYM (F)			NS	NS	NS	0.24	NS	0.11
Nitrogen (N)			NS	NS	NS	0.29	0.33	0.14
Phosphorus (P)			NS	NS	NS	NS	NS	NS
F x N			NS	NS	NS	NS	0.46	NS
F x P			NS	NS	NS	NS	NS	NS
F x N x P			NS	NS	NS	NS	NS	NS

* WLP: With Land Preparation

** WS: Band in rows at sowing

Table 9. Effect of farmyard manure (FYM), nitrogen levels and phosphorus fertilizers on Carotinoids (mg/g fresh weight of leaves) after 90, 120 and 150 days from sowing in 1995/96 and 1996/97 seasons.

Treatments			1995/1996 season			1996/1997 season		
	N	P	Days after sowing					
	Kg/fed.	kg/fed.	90	120	150	90	120	150
Without FYM	0	*WLP	2.19	2.59	2.17	2.21	1.91	2.05
		**WS	2.16	2.96	2.17	2.26	1.98	1.84
	Mean		2.17	2.77	2.17	2.24	1.94	1.95
	45	*WLP	2.59	2.24	2.96	2.71	2.07	2.57
		**WS	2.52	2.01	2.88	2.83	2.04	2.48
	Mean		2.56	2.12	2.92	2.77	2.06	2.52
	90	*WLP	2.42	2.22	2.97	2.93	2.34	2.94
		**WS	2.47	2.20	2.99	2.97	2.51	2.65
	Mean		2.44	2.21	2.98	2.95	2.43	2.80
Mean			2.39	2.37	2.69	2.65	2.14	2.42
FYM	0	*WLP	2.44	1.91	2.08	2.13	1.74	1.82
		**WS	2.59	1.92	2.15	2.17	1.88	1.84
	Mean		2.52	1.91	2.12	2.15	1.81	1.83
	45	*WLP	2.53	2.45	2.28	2.26	2.09	1.94
		**WS	2.58	2.44	2.26	2.33	2.04	2.00
	Mean		2.55	2.44	2.27	2.29	2.07	1.9
	90	*WLP	2.91	2.62	2.44	2.51	2.19	2.19
		**WS	2.91	2.65	2.43	2.56	2.24	2.26
	Mean		2.91	2.63	2.44	2.53	2.21	2.22
Mean			2.66	2.33	2.27	2.33	2.03	2.01
Overall Mean	N	0	2.35	2.34	2.14	2.19	1.88	1.89
		45	2.56	2.28	2.59	2.53	2.06	2.24
		90	2.68	2.42	2.91	2.74	2.32	2.51
	P	WLP	2.51	2.34	2.48	2.46	2.06	2.25
		WS	2.54	2.36	2.48	2.52	2.12	2.18
LSD at 0.05 level for:								
FYM (F)			NS	NS	NS	0.17	NS	0.24
Nitrogen (N)			NS	NS	NS	0.21	0.26	0.30
Phosphorus (P)			NS	NS	NS	NS	NS	NS
F x N			NS	NS	NS	NS	NS	NS
F x P			NS	NS	NS	NS	NS	NS
F x N x P			NS	NS	NS	NS	NS	NS

* WLP: With Land Preparation

** WS: Band in rows at sowing

Table 10. Effect of farmyard manure (FYM), nitrogen levels and phosphorus fertilizers on total soluble solids % (T.S.S. %) after 90, 120 and 150 days from sowing in 1995/96 and 1996/97 seasons.

Treatments			1995/1996 season			1996/1997 season		
	N	P	Days after sowing					
	Kg/fed.	kg/fed.	90	120	150	90	120	150
Without FYM	0	*WLP	14.50	18.75	18.50	14.43	18.60	18.68
		**WS	14.08	18.75	17.75	14.25	18.98	18.93
	Mean		14.29	18.75	18.13	14.34	18.79	18.80
	45	*WLP	14.13	18.25	18.50	14.15	19.33	19.23
		**WS	13.78	18.25	19.25	13.65	18.43	19.23
	Mean		13.95	18.50	18.88	13.90	18.88	19.23
	90	*WLP	13.93	18.75	17.75	13.75	18.68	18.45
		**WS	13.00	18.00	18.25	13.23	18.13	19.48
	Mean		13.46	18.38	18.00	13.49	18.40	18.96
Mean			13.90	18.54	18.33	13.91	18.68	19.00
FYM	0	*WLP	14.90	19.50	19.00	14.73	19.43	19.85
		**WS	13.75	19.50	19.00	13.88	19.38	19.65
	Mean		14.33	19.50	19.00	14.30	19.40	19.75
	45	*WLP	14.18	19.25	18.00	14.13	19.28	19.23
		**WS	14.50	19.50	19.00	14.38	19.93	20.53
	Mean		14.34	19.38	19.00	14.25	19.60	19.88
	90	*WLP	14.75	17.25	18.25	14.00	17.65	18.83
		**WS	13.58	19.00	17.88	13.30	19.08	18.08
	Mean		13.66	18.13	18.06	13.65	18.36	18.45
Mean			14.11	19.00	18.69	14.07	19.12	19.36
Overall Mean	N	0	14.31	19.13	18.56	14.32	19.09	19.28
		45	14.14	18.94	18.94	14.08	19.24	19.55
		90	13.56	18.25	18.03	13.57	18.38	18.71
	P	WLP	14.23	18.71	18.42	14.20	18.83	19.04
		WS	13.78	18.83	18.60	13.78	18.98	19.31
LSD at 0.05 level for:								
FYM (F)			NS	NS	NS	NS	NS	NS
Nitrogen (N)			0.45	NS	NS	0.53	NS	NS
Phosphorus (P)			0.37	NS	NS	NS	NS	NS
F x N			NS	NS	NS	NS	NS	NS
F x P			NS	NS	NS	NS	NS	NS
F x N x P			NS	NS	NS	NS	NS	NS

* WLP: With Land Preparation

** WS: Band in rows at sowing

Table 11. Effect of farmyard manure (FYM), nitrogen levels and phosphorus fertilizers on sucrose (%) after 90, 120 and 150 days from sowing in 1995/96 and 1996/97 seasons.

Treatments			1995/1996 season			1996/1997 season		
	N	P	Days after sowing					
	Kg/fed.	kg/fed.	90	120	150	90	120	150
Without FYM	0	*WLP	10.73	10.88	14.50	10.60	10.58	13.45
		**WS	9.33	10.30	14.35	9.43	9.58	13.28
	Mean		10.03	10 59	14.43	10.01	10.08	13.36
	45	*WLP	10.35	10.15	13.90	10.28	11.28	12.93
		**WS	10.75	12.70	14.73	10.60	12.33	14.05
	Mean		10.55	11.43	14.31	10.44	11.80	13.49
	90	*WLP	9.33	10.43	14.40	9.78	10.33	13.40
		**WS	10.48	11.06	14.60	10.250	10.28	13.55
	Mean		9.90	10.75	14.50	9.99	10.30	13.48
Mean			10.16	10.92	14.41	10.15	10.73	13.44
FYM	0	*WLP	10.25	10.95	14.35	10.18	10.95	13.43
		**WS	9.93	11.15	15.05	9.63	10.65	14.70
	Mean		10.09	10.05	14.70	9.90	10.80	14.06
	45	*WLP	9.98	10.23	14.35	8.85	9.28	13.90
		**WS	9.45	10.80	14.55	9.00	10.00	14.15
	Mean		9.71	10.51	14.45	8.93	9.64	14.03
	90	*WLP	9.83	11.40	14.10	9.78	10.90	13.08
		**WS	10.13	11.10	12.80	9.50	10.43	12.23
	Mean		9.98	11.25	13.45	9.64	10.66	12.65
Mean			9.93	10.94	14.20	9.49	10.37	13.58
Overall Mean	N	0	10.06	10.82	14.56	9.96	10.44	13.71
		45	10.13	10.97	14.38	9.68	10.72	13.76
		90	9.94	10.99	13.98	9.81	10.48	13.06
	P	WLP	10.08	10.67	14.27	9.91	10.55	13.36
		WS	10.01	11.19	14.35	9.73	10.54	13.66
LSD at 0.05 level for:								
FYM (F)			NS	NS	NS	NS	NS	NS
Nitrogen (N)			NS	NS	NS	NS	NS	NS
Phosphorus (P)			NS	NS	NS	NS	NS	NS
F x N			0.46	NS	NS	0.36	NS	NS
F x P			NS	NS	NS	NS	NS	NS
F x N x P			0.65	NS	NS	0.51	NS	NS

* WLP: With Land Preparation

** WS: Band in rows at sowing

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تأثير بعض العمليات الزراعية على نمو بنجر السكر ومكوناته الكيميائية

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٢ *كلية الزراعة، جامعة الأزهر*

أقيمت تجربتان حقليتان بمحطة بحوث سخا الزراعية بمحافظة كفر الشيخ فى موسمين متتاليين ١٩٩٧/٩٦ و١٩٩٨/٩٧ لدراسة تأثير التسميد ومواعيد الحصاد على سلوك النمو والمكونات الكيماوية لمحصول بنجر السكر. وقد استخدم الصنف Pelino وتمت الزراعة فى الأسبوع الأول من أكتوبر.

اشتملت الدراسة على ٢٤ معاملة هى التوافيق بين معاملتين سماد عضوى (إضافة سماد، بدون إضافة) وعدد ثلاث معاملات سماد أزوتى معدنى (بدون إضافة، ٤٥ كجم/فدان - ٩٠ كجم/فدان) وميعادين إضافة للسماد الفوسفاتى (الإضافة أثناء الخدمة، الإضافة سرسبة مع الزراعة) وميعادين حصاد (الحصاد بعد ١٨٠ يوم، الحصاد بعد ٢١٠ يوم).

وفيما يلى أهم النتائج المتحصل عليها:

- أدت زيادة الجرعات المستخدمة من السماد الأزوتى إلى ٩٠ كجم ن/فدان إلى زيادة تدريجية ومعنوية فى قطر جذور بنجر السكر. كما تأثر قطر الجذور أيضاً بموعد إضافة السماد الفوسفاتى وقد أعطت الإضافة مع الخدمة جذور أكثر سمكاً من المعاملة الأخرى.
- استجاب طول الجذر إيجابياً لإضافة السماد العضوى ولم يكن لمواعيد إضافة السماد الفوسفاتى تأثير معنوى على طول الجذر وكذلك الوزن الغض للجذر/نبات.
- استجاب الوزن الغض للأوراق/نبات معنوياً لإضافة السماد العضوى كما أن إضافة ٤٥ أو ٩٠ كجم ن/فدان حسن بوضوح هذه الصفة وكذلك قيم دليل مساحة الأوراق.
- حققت إضافة النيتروجين زيادة واضحة فى محتوى الأوراق من كلوروفيل "أ" و "ب" وكذلك الكروتين.
- استجابة النسبة المئوية للمواد الصلبة الذائبة الكلية لجذور بنجر السكر سلبياً لإضافة السماد الأزوتى غير أن هذا التأثير كان غير معنوياً على نسبة السكروز.
- لم يكن لإضافة السماد العضوى أو موعد إضافة السماد الفوسفاتى تأثير على نسبة المواد الصلبة الذائبة أو السكروز.