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SUGAR BEET YIELD AND QUALITY AS AFFECTED BY SOWING PATTERNS AND NITROGEN LEVELS

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ABSTRACT

This investigation was carried out at the Experimentals farm of Sakha Agricultural Research Station, Kafr El-Sheikh Governorat during 2004/2005 and 2005/2006. This study was conducted to find out the effect of five plant population in terms of five planting patterns i.e. Three ridges 90 cm in width and hill spacing (15, 18 and 22.5 cm apart on the two sides of ridge) thus presents (56.000, 46.666 and 37. 333 plants/fad. respectively), row 50 cm in width and hill spacing of 20 cm apart. (42000 plant/fad.) and ridges 50 cm in width and hill spacing of 20 cm apart (42000 plant/fad.) as well as three nitrogen rates i.e. (80, 100 and 120 kg N/fad.) on yield and quality of sugar beet.

Growing sugar beet plants in ridges of 50 cm and hill space of 20 cmcaused a significant increase in root diameter, root/top ratio, sucrose percentage as well as root, top and sugar yields/fad. in both seasons. On the other hand, there was no significant effect on root length, total soluble solids and juice purity percentages; parameters.

Application of 120 kg N/fad. significantly increased root diameter, dry matter/plant, root/top ratio, sucrose percentage as well as root; top and sugar yields/fad. in the first season only. No significant effects were found on root length, total soluble solids (T.S.S.) and juice purity percentage in both seasons due to nitrogen fertilizer.

It could be concluded that planting sugar beet on ridges 50 cm in with and hill spacing of 20 cm apart and application of nitrogen fertilizer at the rate of 120 kg N/fad. could be recommended for optimum root and sugar yields per unit area under the condition of this study.

INTRODUCTION

Nowadays, sugar beet (*Beta vulgaris*, L.) has been introduced as a new sugar crop in Egypt to be the second source for sugar production after sugar can. In fact, here exits a national desire for increasing sugar production to meet the increasing demand for sugar consumption. Growing sugar beet as a field crop, affected by many factors, which have a direct effect on root and sugar yield. Plant densities and nitrogen fertilization are ones of these factors.

Therefore, sowing patterns and nitrogen levels became the main for target many investigators. Assy *et al.* (1992) found that increasing row distance from 35 to 55 cm. was followed by respective significant increase in root dry weight at 100, 115 and 130 days from sowing. Mahmoud *et al.* (1999) concluded that 20 cm. plant spacing significantly increased size and weight of the individual roots, root and sugar yields. Rady *et al.* (2000) reported that plant spacing 10 cm. between plants increased top, root and sugar yields compared with 30 cm. between hills. Abo El-Wafa (2002)

showed that increasing hill spacing from 20 to 30 cm. significantly increased length, diameter and weight of root as well as sucrose percentage, root and sugar yields.

With respect to nitrogen level, several investigators showed that excessive nitrogen doses resulted in a significant decrease in sucrose content (El-Geddawy, 1979; Mahmoud, 1979; Assy, *et al.* 1985; Emara, 1990; Abu El-Wafa, 2002) they added reported that top yield was increased with increasing nitrogen rates.

MATERIALS AND METHODS

Two field experiments were conducted at the Experimental Farm of Sakha Agricultural Research Station in two successive seasons, of 2004/2005 and 2005/2006. The preceding crop was cron in both seasons. Chemical analysis of the experimental soils in the two seasons are presented in Table (1).

Table (1): Chemical analysis of the experimental soils (0-30 cm. dept) in 2004/2005 and 2005/2006.

Seasons	PH 1 : 2.5	EC m mhas cm.	Organic matter %	Availabie			Anions Meq/L.			
				N ppm	P ppm	K ppm	HCo_3^-	el^-	So^{--}	Co_3^{--}
2004/2005	8.3	3.33	1.88	16.25	6.20	289.20	6.2	5.7	0.15	0.0
2005/2006	8.1	3.26	1.84	15.98	6.31	281.67	6.4	6.0	0.21	0.0

Phosphors fertilizations was applied at land preparation in form of super phosphate (15.5% P_2O_5) with a rate of 30 kg P_2O_5/fad. and Potassium sulphate at a rate of 50 kg/fad. (48% K_2O) was added with the 1st dose of nitrogen.

A split plot design with four replication was used. The main plots were assigned to sowing pattern.

A_1- Ridges 90 cm. and hill spacing of 15 cm apart. (56000 plants/fad.).
A_2- Ridges 90 cm. and hill spacing of 18 cm apart. (46666 plants/fad.).
A_3- Ridges 90 cm. and hill spacing of 22.5 cm apart. (37333 plants/fad.).
A_4- Rows 50 cm and hill spacing of 20 cm apart. (42000 plants/fad.).
A_5- Ridges 50 cm and hill spacing of 20 cm apart. (42000 plants/fad.).

Three nitrogen rates i.e. 80, 100 and 120 kg N/fad. in the form of urea (46% N) distributed in the sub plots. Nitrogen fertilizer was applied in two equal doses at 4-leaf stage (30 days from sowing) and 8-leaf stage (45 days from sowing) 35 days and 55 days after sowing.

Plot area was 31.5 m^2 represent five ridges (90 cm in width × 7 m in length) and nine row orinitly (50 cm. in width and 7 m in length). Sowing took place on 25 October 2004 and 6 November 2005. Multigerm cultivar "Farida" was sown at rate of 3-4 seeds/hill. At four true leaves, sugar beet plants were thinned into one plant/hill. Other cultural practices were done as recommended.

At maturity (200 days from sowing), the area of 31.5 m^2 of each plot were harvested to estimate root top yields. ten guarded plants were taken at randam to estimate root dimensions (Length and diameter) as well as yield components and its quality. Total soluble solids (T.S.S.%) percentage was determined using hand refractometer. Sucrose percentage was determined using the method described by Le Docte (1927) and Juice purity was estimated using method of Silin and Silina (1977).

Theoretical sugar yield/fad. was calculated according the following equation

sugar yield = Root yield tons/fad. × sucrose %

Statistical analysis :

Data obtained were subjected to the procedures of split plot design out lined by Gomez and Gomez (1984) by using analysis of variance Technique by means of "IRRISTAT" computer software package. to compare between means of significance was LSD at 0.05 level used.

RESULTS AND DISCUSSION

Root dimension :

Data in Tables (2 and 3) revealed that sowing pattern exhibited a significant effect on root diameter and insignificant effect on root length in both seasons.

Sowing sugar beet on ridges 50 cm and hill spacing 20 cm apart gave maximum root diameter (12.58 and 12.49 cm.) in the two seasons, respectively, compared to ridges 90 cm and hill spacing 15 cm apart, which gave the lowest root diameter (10.28 and 10.5 cm.) in both seasons, respectively. Similar same trend was found with respect to root length, however, the differences between sowing pattern did not reach the level of significance. These results are in full agreement with those obtained by Kamel *et al.*, (1981) and El-Shafei (1991). While, Abo El-Wafa (2002) reported that 30 cm between hills gave the thickest root compared with 20 cm between hills under Asuit environmental condition.

Results given in Tables (2 and 3) showed that root length insignificantly affected by the studied levels of nitrogen, mean while, these was a significant response in the values of root diameter was accompanied to the increasing in the applied nitrogen doses. this observation was time in both seasons. Application of 120 kg N/fad. surpassed the other rates and gave the thickest roots without significant differences with 100 kg N/fad. in the second season. These results regarding the effect of N on such parameters are in harmony with those obtained by Taha *et al.* (1991) and Abo El-Wafa (2002).

There was no difference significant due to the interactions between sowing patterns and N/levels on root dimensions in both seasons (Tables 2 and 3).

Data presented in Table (4) cleared that the differences among sowing pattern with respect to their effect on dry matter accumulation/plant were significant in both seasons. The highest accumulated dry matter (210.15 and 201.96 gm./plant) were obtained when the plant grown in ridges of 50 cm and

hill spacing at 20 cm apart and/or 90 cm and hill spacing 22.5 cm apart in both seasons respectively. Similar results were obtained by Assy *et al.* (1992).

Table (2): Root length of sugar beet as affected by sowing pattern and nitrogen rate in 2004/2005 and 2005/2006 seasons.

Sowing pattern	N-rate (kg N/fad.)							
	2004/2005				2005/2006			
	80	100	120	Mean	80	100	120	Mean
90 x 15 cm on two sides	28.70	28.88	28.25	28.61	28.20	28.75	27.75	28.23
90 x 18 cm on two sides	29.25	28.63	28.75	28.88	28.80	27.40	27.55	27.92
90 x 22.5 cm on two sides	30.00	28.50	29.13	29.21	29.35	28.45	29.05	28.95
Rows 50 cm.	29.63	29.13	27.38	28.71	29.70	29.15	27.30	28.72
Ridge 50 cm	29.50	29.38	30.13	29.67	29.85	29.20	30.25	29.77
Mean	29.42	28.90	28.73		29.18	28.59	28.38	

L.S.D. at 5% level (1st & 2nd season) for (A) – & –
(B) – & –
(A x B) – & –

Table (3): Root diameter of sugar beet as affected by sowing pattern and nitrogen rate in 2004/2005 and 2005/2006 seasons.

Sowing pattern	N-rate (kg N/fad.)							
	2004/2005				2005/2006			
	80	100	120	Mean	80	100	120	Mean
90 x 15 cm on two sides	10.05	10.30	10.50	10.28	10.73	10.45	10.33	10.50
90 x 18 cm on two sides	10.80	11.05	11.43	11.09	10.13	10.88	10.83	10.61
90 x 22.5 cm on two sides	10.75	11.13	11.88	11.25	10.45	10.78	12.03	11.08
Rows 50 cm.	11.20	11.40	12.30	11.63	11.00	11.68	12.50	11.73
Ridge 50 cm	12.18	12.58	13.00	12.58	12.05	12.50	12.93	12.49
Mean	11.00	11.29	11.82		10.87	11.26	11.72	

L.S.D. at 5% level (1st & 2nd season) for (A) 0.87 & 0.89
(B) 0.27 & 0.61
(A x B) – & –

Concerning the effect of N level on dry matter and root/top ratio, data in Table 4 clearly show that there were significant differences on both traits in the two seasons. Increasing N-level from 80 to 120 kg N/fad. gradually and significantly increased dry matter and root/top ratio. This fact was true in both seasons. Assy *et al.* (1992) reported that excessive nitrogen rate up to 90 N/fad. resulted in a significant increase in both characteristics.

The interaction between sowing pattern and N-level had a significant effect only on root/top ratio in the second season Table (4). Data presented in Table (5) show that the highest value was obtained 5.81, 5.85 and 5.86 when sugar beet planted by sowing pattern ridges 50 cm in width and hill spacing of 20 cm, ridges 90 cm in width and hill spacing of 15 cm as well as ridges 90 in width and hill spacing of 22.5 and fertilizer with 120 kg N/fad. respectively. Sowing pattern of ridges 90 cm and hill spacing 15 cm as well as 90 kg N/feed. recorded the lowest root/top ratio in the second season.

Table (4): Dry matter of sugar beet as affected by sowing pattern and nitrogen rate in 2004/2005 and 2005/2006 seasons.

Sowing pattern	N-rate (kg N/fad.)							
	2004/2005				2005/2006			
	80	100	120	Mean	80	100	120	Mean
90 × 15 cm on two sides	191.35	203.84	212.29	202.49	195.67	198.73	204.11	199.50
90 × 18 cm on two sides	197.58	207.79	213.38	206.25	196.19	199.56	204.06	199.93
90 × 22.5 cm on two sides	195.52	207.16	261.30	206.33	198.40	200.94	206.55	201.96
Rows 50 cm.	198.37	204.22	213.02	205.20	196.67	198.76	201.61	199.01
Ridge 50 cm	203.34	212.29	215.89	210.51	197.05	199.15	208.59	201.60
Mean	197.23	207.06	214.18		196.80	199.42	204.98	

L.S.D. at 5% level (1st & 2nd season) for (A) 3.66 & 2.22
(B) 2.94 & 1.39
(A × B) – & –

Table (5): Root/Top ratio diameter of sugar beet as affected by sowing pattern and nitrogen rate in 2004/2005 and 2005/2006 seasons.

Sowing pattern	N-rate (kg N/fad.)							
	2004/2005				2005/2006			
	80	100	120	Mean	80	100	120	Mean
90 × 15 cm on two sides	5.36	5.64	5.88	5.63	4.64	4.97	5.85	5.15
90 × 18 cm on two sides	5.48	5.69	6.25	5.81	4.69	5.11	5.86	5.22
90 × 22.5 cm on two sides	5.61	5.75	6.16	5.84	4.77	5.18	5.68	5.21
Rows 50 cm.	5.46	5.73	5.99	5.73	5.08	5.16	5.22	5.16
Ridge 50 cm	5.56	5.53	6.07	5.72	5.47	5.64	5.81	5.54
Mean	5.49	5.67	6.07		4.93	5.21	5.68	

L.S.D. at 5% level (1st & 2nd season) for (A) 0.15 & 0.41
(B) 0.09 & 0.11
(A × B) – & 0.25

Data obtained in Table (6, 7 and 8) revealed that sowing pattern affected significantly root, top and sugar yields/fad. in both seasons. Sowing sugar beet in ridges 50 cm and hill spacing of 20 cm apart significantly increased values of the above mentioned traits. It is clearly show that, sowing sugar beet in ridges of 50 cm. and hill space of 20 cm. attained a statistical superiority in root and sugar yield over these plants grown under the various sowing pattern of wide rows or even with rous of 50 cm. and hill space of 20 cm., however, the difference between the plant grown in ridges or rows of 50 cm and hill space of 20 cm did not reach the level of significance with respect to top yield.

Results given in Table (6 and 7) cleared that both of root and top yield positively significantly responded to the addional doses of nitrogen up to 120

kg. N/fad. with insignificant difference between 80 and 100 kg N/fad. in this respect. However, it could be noted that the differences between the high of nitrogen (120 kg N/fad.) and the low dose (80 kg n/fad.) from on side as well the differences between the mild dose of nitrogen (100 kg N/fad.) and the low dose (80 kg N/fad.) were insignificant with respect to their effect on sugar yield. This result may be due to the relative influence of nitrogen treatments on root yield (Table 6) and both of sucrose and purity percentages (Table 7 and 8).

Table (6): Root yield (ton/fad.) of sugar beet as affected by sowing pattern and nitrogen rate in 2004/2005 and 2005/2006 seasons.

Sowing pattern	N-rate (kg N/fad.)							
	2004/2005				2005/2006			
	80	100	120	Mean	80	100	120	Mean
90 × 15 cm on two sides	27.41	27.86	28.28	27.85	27.56	27.79	28.01	27.79
90 × 18 cm on two sides	29.68	29.96	29.99	29.87	29.68	29.90	30.03	29.87
90 × 22.5 cm on two sides	26.01	26.41	27.73	26.72	25.68	29.90	30.01	28.53
Rows 50 cm.	27.57	28.14	29.15	28.29	27.08	28.00	29.34	28.14
Ridge 50 cm	32.08	32.00	32.05	32.04	32.60	32.54	32.55	32.56
Mean	28.55	28.87	29.44		28.52	29.63	29.99	

L.S.D. at 5% level (1st & 2nd season) for (A) 1.29 & 1.16
(B) 0.49 & 0.35
(A × B) – & 0.78

Table (7): Top yield (ton/fad.) of sugar beet as affected by sowing pattern and nitrogen rate in 2004/2005 and 2005/2006 seasons.

Sowing pattern	N-rate (kg N/fad.)							
	2004/2005				2005/2006			
	80	100	120	Mean	80	100	120	Mean
90 × 15 cm on two sides	13.90	15.41	16.53	15.28	14.03	15.37	16.27	15.22
90 × 18 cm on two sides	16.10	15.58	16.63	16.10	16.42	15.51	14.70	15.54
90 × 22.5 cm on two sides	15.16	15.65	18.03	16.28	14.75	14.63	18.12	15.84
Rows 50 cm.	16.48	16.96	17.15	16.86	16.39	16.73	17.79	16.97
Ridge 50 cm	16.85	18.20	18.03	17.69	16.55	17.44	17.95	17.31
Mean	15.70	16.36	17.27		15.63	15.94	16.97	

L.S.D. at 5% level (1st & 2nd season) for (A) 1.33 & 1.48
(B) 0.82 & 0.86
(A × B) – & 1.90

Table (8): Sugar yield (ton/fad.) of sugar beet as affected by sowing pattern and nitrogen rate in 2004/2005 and 2005/2006 seasons.

Sowing pattern	N-rate (kg N/fad.)							
	2004/2005				2005/2006			
	80	100	120	Mean	80	100	120	Mean
90 × 15 cm on two sides	4.80	4.86	4.88	4.84	4.81	4.93	4.89	4.88
90 × 18 cm on two sides	5.18	5.12	5.22	5.17	5.27	5.22	5.27	5.25
90 x 22.5 cm on two sides	4.62	4.51	4.70	4.61	4.63	4.48	4.70	4.60
Rows 50 cm.	4.81	4.82	5.10	4.91	4.80	4.89	5.22	4.97
Ridge 50 cm	5.72	5.60	5.78	5.70	5.93	5.77	5.89	5.86
Mean	5.03	4.98	5.13		5.09	5.06	5.19	

L.S.D. at 5% level (1st & 2nd season) for (A) 0.26 & 0.33
(B) 0.12 & 0.12
(A × B) - & -

These results are in harmony with those obtained by Moustafa *et al.* (2000).

Concerning the interaction effect between sowing pattern and nitrogen levels on root, top and sugar yields. The available data in Tables (6, 7 and 8) pointed out that this interaction was insignificant with respect to its effect on root and top yield in the 1st season and sugar yield in both seasons.

Results given in Tables (6 and 7) revealed that these was a significant effect on root and top yield/fad. due to the interaction between the studied factors.

Sowing sugar beet on ridges 50 cm in width and hill spacing of 20 cm apart gave the highest root yields under 120 kg N/fad. Meanwhile the highest value of top yield (18.12 t/fad.) was recorded when sugar beet was cultivated in ridges at 90 cm in width and hill spacing of 22.5 cm under by 120 kg N/fad.

Juice quality in terms of total soluble solids (T.S.S.%), sucrose and juice purity percentages as affected by planting pattern and nitrogen level are presented in Tables (9, 10 and 11). The available data cleared that both of T.S.S. and juice purity percentages insignificantly affected by sowing pattern in both seasons, whereas, sucrose percentage was significantly affected by swoing pattern in both seasons. Growing sugar beet in ridges of 50 cm and hill spacing of 20 cm recorded the highest value of sucrose percentage in both seasons. These findings are in agreement with those obtained by Moustafa *et al.* (2000).

Table (9): Total soluble solids (T.S.S.) of sugar beet as affected by sowing pattern and nitrogen rate in 2004/2005 and 2005/2006 seasons.

Sowing pattern	N-rate (kg N/fad.)							
	2004/2005				2005/2006			
	80	100	120	Mean	80	100	120	Mean
90 × 15 cm on two sides	21.00	21.35	21.65	21.33	21.20	22.20	22.30	21.90
90 × 18 cm on two sides	21.35	21.35	21.30	21.33	21.55	21.70	21.35	21.53
90 x 22.5 cm on two sides	21.70	21.65	20.60	21.32	22.05	21.75	21.25	21.68
Rows 50 cm.	21.75	21.20	21.60	21.52	22.10	22.15	22.25	22.17
Ridge 50 cm	21.40	21.45	21.15	21.33	21.95	21.95	22.35	22.08
Mean	21.44	21.40	21.26		21.77	21.95	21.90	

L.S.D. at 5% level (1st & 2nd season) for (A) - & -
(B) - & -
(A × B) - & -

Table (10): Sucrose percentage of sugar beet as affected by sowing .pattern and nitrogen rate in 2004/2005 and 2005/2006 seasons.

Sowing pattern	N-rate (kg N/fad.)							
	2004/2005				2005/2006			
	80	100	120	Mean	80	100	120	Mean
90 x 15 cm on two sides	17.48	17.42	17.26	17.38	17.43	17.74	17.48	17.55
90 x 18 cm on two sides	17.43	17.09	17.39	17.30	17.75	17.45	17.55	17.58
90 x 22.5 cm on two sides	17.76	17.15	16.95	17.29	18.00	17.31	17.18	17.50
Rows 50 cm.	17.43	17.11	17.49	17.43	17.69	17.46	17.80	17.65
Ridge 50 cm	17.83	17.49	18.03	17.78	18.18	17.73	18.09	18.00
Mean	17.58	17.25	17.42		17.81	17.54	17.62	

L.S.D. at 5% level (1st & 2nd season) for (A) 0.31 & 0.31
(B) 0.27 & –
(A x B) – & –

Table (11): Juice purity percentage of sugar beet as affected by sowing pattern and nitrogen rate in 2004/2005 and 2005/2006 seasons.

Sowing pattern	N-rate (kg N/fad.)							
	2004/2005				2005/2006			
	80	100	120	Mean	80	100	120	Mean
90 x 15 cm on two sides	83.23	81.57	79.80	81.53	82.27	79.91	78.54	80.24
90 x 18 cm on two sides	81.61	80.16	81.73	81.17	82.44	80.61	82.30	81.78
90 x 22.5 cm on two sides	81.94	79.28	82.38	81.20	81.85	79.11	80.84	80.60
Rows 50 cm.	80.13	80.78	81.03	80.64	80.06	78.86	79.67	79.53
Ridge 50 cm	83.31	81.54	85.33	83.39	82.80	80.77	80.97	81.51
Mean	82.04	80.66	82.05		81.88	79.85	80.64	

L.S.D. at 5% level (1st & 2nd season) for (A) – & –
(B) – & –
(A x B) – & –

Once more, the influence of nitrogen fertilization on juice quality parameters exhibited a significant effect on sucrose percentage only in the first season (Table 10). Application of 80 kg N/fad. resulted in the highest sucrose percentage in the first season. the same trend was found by Moustafa *et al.* (2000) and Zalat *et al.* (2002).

No significant effect was found due to the interaction effect between wowing pattern nitrogen level on T.S.S., sucrose and purity percentages in both seasons (Tables 9, 10 and 11).

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تأثر محصول وجودة بنجر السكر بنظم الزراعة ومعدلات التسميد الآزوتى

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أقيمت تجربة حقلية بالمزرعة البحثية لمحطة البحوث الزراعية بسخا – محافظة كفرالشيخ فى الموسمين الزراعيين ٢٠٠٤/٢٠٠٥، ٢٠٠٥/٢٠٠٦ وذلك لدراسة تأثير خمس نظم لزراعة بنجر السكر (ثلاث نظم كانت الزراعة فيها على مساطب بعرض ٩٠سم والزراعة على الريشتين والمسافة بين الجور ١٥، ١٨، ٢٢,٥سم) ، الزراعة فى سطور ٥٠سم والمسافة بين الجور ٢٠سم والزراعة على خطوط بعرض ٥٠سم والمسافة بين الجور ٢٠سم. وتمثل كل هذه النظم الكثافات التالية على الترتيب ٥٦٠٠٠، ٤٦,٦٦٦، ٣٧,٣٣٣ ألف نبات فى الثلاثة نظم الأولى، ٤٢٠٠٠ ألف نبات فى النظامين الأخيرين، كما اشتملت التجربة على ثلاث معدلات للسماد الآزوتى وهى (٨٠، ١٠٠، ١٢٠كجم نيتروجين/فدان). وقد استخدم تصميم القطع المنشقة مرة واحدة فى ثلاث مكررات فى تنفيذ هذه التجربة حيث وضعت نظم الزراعة (الكثافات الخمس) فى القطع الرئيسية ومعدلات السماد الأزوتى فى القطع الشقية وتمت زراعة التجربة بالصنف فريدا عديد الأجنه.
ويمكن تلخيص أهم النتائج المتحصل عليها لهذا البحث فيما يلى :

- حققت الزراعة باتباع طريقة السطور أو الخطوط بعرض ٥٠سم والمسافة بين الجور ٢٠سم الى زيادة معنوية فى كل من قطر الجذر والوزن الجاف للجذور ونسبة الجذر للعرش ومحصول العرش والجذور والسكر بالطن/فدان ونسبة السكروز فى موسمى الزراعة ومن ناحية أخرى لم يكن لهذه الكثافات المختلفة أو طرق الزراعة المختلفة اى تأثير معنوى على كلا من طول الجذر ونسبة المواد الصلبة الذائبة الكلية وكذلك النسبة المئوية لنقاوة العصير.
- أدت زيادة معدلات التسميد النيتروجين من ٨٠ حتى ١٢٠كجم/فدن الى زيادة معنوية فى قطر الجذر والمادة الجافة ونسبة الجذر للعرش ومحصول كلا من العرش والجذور والسكروز (طن/فدان) ونسبة السكروز فى الموسم الأول فقط فى حين لم يكن لزيادة معدلات السماد الآزوتى حتى ١٢٠كجم نيتروجين/فدان أى تأثير معنوى على طول الجذر أو نسبة المواد الصلبة الكلية الذائبة أو نقاوة العصير للبنجر فى كلا الموسمين.

وعامة يمكن أن نستخلص أن زراعة بنجر السكر على خطوط بعرض ٥٠سم والمسافة بين الجور ٢٠سم وإضافة السماد الأزوتى بمعدل ١٢٠كجم/أزوت للفدان يعطى أعلى محصول من الجذور والسكر لوحدة المساحة تحت ظروف هذه الدراسة.