J. Agric. Sci. Mansoura Univ., 32 (9): 7121 - 7131, 2007

EFFECT OF PLOUGHING DEPTH AND NITROGEN FERTILIZATION ON SOME QUALITY PARAMETERS OF SUGAR BEET UNDER FAYOUM GOVERNORATE CONDITIONS

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ABSTRACT

The present work was conducted at Tamiya Agricultural Research Station, Fayoum governorate in 2003/2004 and 2004/2005 growing seasons to study the effect of ploughing depth, nitrogen fertilizer sources and levels on some quality parameters of sugar beet (*Beta vulgaris* L.). The present study included eighteen treatments represented the combination between two plowing depths (15 and 30 cm), three nitrogen sources (urea, 46.5% N; ammonium nitrate, 33.5% N and ammonium sulphate, 20.5% N) and three nitrogen levels (60, 80 and 100 kg N/fed). Treatments were arranged in a split-split plot design with four replications. Ploughing depths were allocated in the main plots and nitrogen sources were distributed in the sub-plots, while the sub-sub plots were assigned to nitrogen levels. The obtained results showed that percentages of total soluble solids, sucrose, purity, total nitrogen, sodium and potassium in sugar beet roots did not significantly affected by both ploughing depths and nitrogen sources in both seasons. Percentages of total soluble solids, total nitrogen, sodium and potassium significantly increased while, sucrose and purity percentages significantly decreased as the applied nitrogen fertilization level raised from 60 up to 100 kg N/fed, in both seasons.

Under conditions of the present work, fertilizing sugar beet with 60 kg N/fed can be recommended to obtain the highest quality traits in terms of sucrose and purity percentages. No significant differences were noticed between ploughing depths and nitrogen sources on quality characteristics of sugar beet.

INTRODUCTION

Ploughing depth is considered as the major process in seedbed preparation and plowing may offer so many observable advantages such as creating suitable condition for seed germination and root growth, maintaining and improving the soil and creating a favorable condition for activity of useful bacteria. In common with other crops, sugar beet usually satisfies only a part of its need for each nutrient from the soil, the remainder must be obtained from fertilizer. Nitrogen is the most important major element supplied to sugar beet where the literature showed that the over-use of nitrogen fertilizer decreases both sugar percentage and juice quality. (Draycott, 1993). Agami, (2005) investigated that plowing depths at rates of 30, 40 and 50 cm). His results indicted that plowing soil at 40-cm depth gave the best results with

juice quality of sugar beet. gave the best quality traits. Regarding the nitrogen source effect, Zalat (1993) found that urea significantly increased sucrose, total soluble solids and purity percentage than calcium nitrate and ammonium sulphate. Saif (1991) noticed that nitrogen application as urea increased roots yield, and sugar than ammonium sulphate and ammonium nitrate. Also, the beneficial effect of urea was obtained on sugar beet chemical composition and quality control; i.e., percentages of T.S.S%, sucrose%, purity% and nutrients uptake. El-Essawy (1994) found that nitrogen source (urea, ammonium nitrate and ammonium sulphate) no significant effect exhibit on sugar juice purity and sucrose percentage. Application of urea or ammonium nitrate significantly decreased the concentration of K and losses sugar percentage compared with ammonium sulphate. Gutmanski and Kwishniewski (1995) showed that application 70 kg of ammonium nitrate kg N/ha before sowing did not affected root sugar content, Na or K contents compared with ammonium sulphate. Tawfik (2000) found that T.S.S, sucrose % increased when fertilizer sugar beet fertilized with ammonium nitrate compared with ammonium sulphate at rates of 30-120 kg N/fed. Abd El-Hadi *et al.,*(2002) investigated the application of nitrogen fertilizer as urea, ammonium nitrate, ammonium sulphate or calcium nitrate) on sugar beet insignificantly affected potassium and nitrogen concentration in roots. El-Shafai (2000), investigated that application of nitrogen at levels of 0, 46 and 92 Kg N/ fed. He showed that increasing N level up to 92 Kg N/ fed, decreased sucrose percentage. Serag El-Din (2000), recorded that nitrogen fertilizer significantly decreased sucrose, purity and total soluble solids percentage of sugar beet. Abd El-Hadi *et al.,* (2002) studied the effect of nitrogen fertilization at rates of 60,80 and 100kgN/fed., and they found that increasing nitrogen levels significantly increase of nitrogen concentration decreased potassium concentration in roots. Also, found the sugar yield was directly proportional to the potassium concentration and inversely proportional to nitrogen concentration in leaves during the vegetative growth. A negative correlation was observed between nitrogen concentration in roots and sugar yield and juice purity%. Abou Shady *et al.,* (2002), found that application of nitrogen fertilizer at rate of 80 Kg N/fed compared with 60 kgN/fed. significantly decreased sucrose and purity percentage. Azzazy (2004) found that increasing nitrogen level from 60 up to 90 kg N/fed, significantly increased root and sugar yields and deceased sucrose % and purity %. Ismail and Abo EL-Ghait (2005) studied the effect of nitrogen fertilization at rates of 69 and 155 kgN/fed., and found that increasing nitrogen level significantly decreased purity percentage and sucrose percentage. The aim of this investigation was to investigate the influence of Ploughing depths, nitrogen sources and rates on sugar beet to obtain the best quality characteristics under Fayoum Governorate conditions.

MATERIALS AND METHODES

The present work was conducted at Tamiya Agricultural Research Station in 2003/2004 and 2004/2005 growing seasons to study the effect of ploughing depths, nitrogen sources and levels on some quality parameters of

sugar beet (*Beta vulgaris L*.). The present study included eighteen treatments represented the combination between two plowing depths (15 and 30 cm), three nitrogen sources (urea, 46.5% N; ammonium nitrate, 33.5% N; ammonium sulphate, 20.5% N) and three nitrogen levels (60, 80 and 100 kg N/fed). Treatments were arranged in a split split plot design with four replications. Ploughing depths were allocated in the main plots, and nitrogen sources were distributed in the sub-plots, while the sub-sub plots were assigned to nitrogen levels. The preceding crop was sorghum in the two seasons. Before soil preparation, soil samples were taken at depths of 15 and 30 cm from the experimental site to determine physical and chemical properties of soil as presented in Table (1). Sub-sub plot area was 21 m^2 which included six ridges of 50-cm apart and 7 meter in length. Sugar beet seeds were sown in hills of 20 cm apart in the 1st week of October in the both seasons. Plants were thinned at the fourth leaves stage to obtain one plant per hill after 4 weeks from planting. Nitrogen fertilizer was applied in two equal doses; the first one was applied after thinning and the second was added one month later. Phosphorus was added during seed bed preparation at a rate of 30 kg P_2O_5/fed in the from of Calcium Super Phosphate (15.5 % P_2O_5). Potassium was applied with the first dose of nitrogen fertilizer at a rate of 24 kg K_2O/fed in the form of Potassium sulfate (48% K_2O).

Table 1: Soil chemical and physical analysis of the experimental site in 2003/2004 and 2004/2005 seasons.

Properties		**2003/2004**	**2004/2005**
Sand		24.80	23.60
Silt		29.00	29.90
Clay		46.20	46.50
Texture grade		Loamy	Loamy
Organic matter%		0.040	0.045
Total N %		0.210	0.219
P(ppm)		0.414	0.418
E.C.(ds/ m^{-1})		1.55	1.59
pH		7.9	7.9
$CaCO_3$ %		24.5	24.55
Soluble cations (mq/L)	Mg^{++}	1.54	1.57
	Na^{+}	4.56	4.59
	K^{+}	1.41	1.43
Soluble anions (mq/L)	HCO_3^{-}	1.41	1.42
	$SO4^{-}$	4.41	4.41
	CL^{-}	4.52	4.53

Recorded data:

At harvest, samples of twenty plants were taken to determine the following parameters:

1. Total soluble solids percentage (TSS%) in sugar beet roots using "hand refractometer".

2. Sucrose percentage was determined using Saccaremeter according to Le-Docte (1927).
3. Purity percentage was determined according to the following equation: Purity % = sucrose% / TSS% x 100.
4. Nitrogen percentage in sugar beet roots was determined using Mico-Kjeldahl apparatus according to Pergl (1945).
5. Sodium and potassium percentages in roots were determined using flame photometer according to Brown and Lilliland (1964).

The collected data were statistically analyzed according to Snedecor and Cochran (1981). Treatment means were compared using LSD at 5% level of probability as outlined by Steel and Torrie (1980).

RESULTS AND DISCUUSION

1. Total soluble solids percentage:

Results given in Table 2 point out that the values of total soluble solids (TSS %) was not significantly affected by ploughing depth. This finding was true in the two growing seasons. This result is in accordance with Agami (2005).

Table 2: Effect of ploughing depth, sources and rates of nitrogen fertilization on total soluble solids percentage of juice in 2003 /2004 and 2004/2005 seasons

Ploughing depth	N-Sources	2003/2004 season				2004/2005 season			
		Nitrogen rates kg N/fed							
		60	80	100	Mean	60	80	100	Mean
15 Cm	Urea	23.34	25.26	25.93	24.84	21.8	22.22	23.36	22.46
	Ammonium nitrate	23.67	25.34	26.35	25.12	21.86	22.19	23.27	22.44
	Ammonium sulphate	24.34	25.46	26.91	25.57	22.53	22.56	23.67	22.92
Mean		23.78	25.35	26.40	**25.18**	22.06	22.32	23.43	**22.61**
30 Cm	Urea	24.26	25.28	26.34	25.29	22.67	22.46	22.67	22.6
	Ammonium nitrate	24.34	25.34	26.30	25.33	21.76	22.33	23.06	22.38
	Ammonium sulphate	25.14	26.10	26.67	25.97	22.33	22.4	23.34	22.69
Mean		24.58	25.57	26.44	**25.53**	22.25	22.40	23.02	**22.56**
Overall Mean	Urea	23.50	25.30	26.14	24.99	21.83	22.20	23.31	22.45
	Ammonium nitrate	24.00	25.34	26.32	25.22	21.81	22.26	23.16	22.41
	Ammonium sulphate	24.74	25.78	26.79	25.77	22.43	22.48	23.50	22.80
Mean		24.08	25.47	26.42		22.02	22.31	23.33	
LSD at 0.05% level									
Ploughing depths (A)			**NS**				**NS**		
Nitrogen Sources (B)			**NS**				**NS**		
Nitrogen rates (C)			**0.44**				**0.80**		
A x B			**NS**				**NS**		
A x C			**NS**				**NS**		
B x C			**NS**				**NS**		
A x B x C			**NS**				**NS**		

There was insignificant increase in the values of TSS % when sugar beet was fertilized with nitrogen as ammonium sulphate in both seasons (Table 2

The collected data distinctly showed a positive and statistical response in the values of TSS % to the applied levels of N. The highest TSS % values (26.42 and 23.33%) were recorded by adding 100 kg N/fed in the 1st and 2nd season, respectively.

The various interactions between the studied factors had insignificant influence on TSS% in both seasons.

2. Sucrose percentage:

Data in Table 3 show that increasing depth of ploughing increased sucrose percentage in both seasons. However, this increase was insignificant.

Table (3): Effect of Ploughing depth, sources and rates of nitrogen fertilization on sucrose percentage in 2003/2004 and 2004/2005 seasons

Ploughing depth	N-Sources	2003/2004 season				2004/2005 season			
		Nitrogen rates kg N/fed							
		60	80	100	Mean	60	80	100	Mean
15 Cm	Urea	20.74	20.43	19.8	20.32	17.97	17.13	16.70	17.27
	Ammonium nitrate	21.82	20.18	19.24	20.41	18.23	17.85	16.71	17.60
	Ammonium sulphate	22.87	21.54	21.03	21.81	19.70	19.01	19.46	19.39
Mean		21.81	20.72	20.02	**20.85**	18.63	18.00	17.62	**18.08**
30 Cm	Urea	22.85	20.39	20.11	21.12	20.45	18.83	18.04	19.11
	Ammonium nitrate	22.43	21.19	20.00	21.21	19.53	17.45	16.76	17.91
	Ammonium sulphate	23.88	22.38	20.93	22.40	20.08	18.12	17.96	18.72
Mean		23.05	21.32	20.35	**21.57**	20.02	18.13	17.59	**18.58**
Overall Mean	Urea	21.79	20.41	19.95	20.72	19.21	17.98	17.37	18.19
	Ammonium nitrate	22.12	20.68	19.62	20.81	18.88	17.65	16.73	17.75
	Ammonium sulphate	23.37	21.96	20.98	22.10	19.89	18.56	18.71	19.05
Mean		21.79	20.41	19.95		19.21	17.98	17.37	

LSD at 0.05% level		
Ploughing depths (A)	NS	NS
Nitrogen Sources (B)	NS	NS
Nitrogen rates (C)	0.39	0.63
A x B	NS	NS
A x C	NS	NS
B x C	NS	NS
A x B x C	NS	NS

The results cleared that the studied N sources had no significant influence on sucrose % in both seasons. Meanwhile, it can be noticed that using ammonium sulphate as N source resulted in higher values of this trait.

Raising N fertilization level up 80 and 100 kg N/fed caused a significant reduction in sucrose percentage amounted to 1.38 and 1.84 % in the 1st season and, 1.23 and 1.84 % in the 2nd one, compared to that recorded by applying 60 kg N/fed, respectively.

None of the interactions among the studied factors had a significant effect on sucrose percentage in the first and second seasons (Table 3).

3. Purity percentage:

Data in Table 4 reveal that ploughing depths had insignificant effect on purity% in the two seasons. This result is in harmony with that found by Agami (2005).

The used nitrogen sources had insignificant influence on purity % in both seasons.

These results are similar to those obtained by EL-Essawy (1994)

Purity % in juice of sugar beet roots was significantly affected by N levels fertilizing sugar beet with 60 kg N/fed surpassed those resulted by applying 80 or 100 kg N/fed and attained an increment amounted to10.19 and 16.33 in the 1st season, and 6.43 and 11.42 in the 2nd season, successively. These results are in line with those obtained by Serag El Din (2000) and Abou Shady *et al*. (2002).

Table 4: Effect of Ploughing depth, sources and rates of nitrogen fertilization on Purity percetage in 2003 /2004 and 2004/2005 seasons.

Ploughing depth	N-Sources	2003/2004 season				2004/2005 season			
		Nitrogen rates kg N/fed							
		60	80	100	Mean	60	80	100	Mean
15 Cm	Urea	88.88	80.9	76.36	82.05	82.46	77.1	71.50	77.02
	Ammonium nitrate	92.19	79.65	73.05	81.63	83.44	80.46	71.81	78.57
	Ammonium sulphate	93.99	84.63	78.18	85.6	87.48	84.3	82.24	84.67
Mean		91.69	81.73	75.86	**83.09**	84.46	80.62	75.18	**80.09**
30 Cm	Urea	94.21	80.69	76.36	83.75	90.22	83.84	79.60	84.55
	Ammonium nitrate	92.18	83.65	76.06	83.96	89.79	78.15	72.72	80.22
	Ammonium sulphate	94.99	85.76	78.48	86.41	89.95	80.91	76.96	82.61
Mean		93.79	83.37	76.97	**84.71**	89.99	80.97	76.43	**82.46**
Overall Mean	Urea	91.54	80.79	76.36	82.90	86.34	80.47	75.55	80.79
	Ammonium nitrate	92.18	81.65	74.55	82.80	86.61	79.30	72.26	79.39
	Ammonium sulphate	94.49	85.19	78.33	86.00	88.71	82.60	79.6	83.64
Mean		92.74	82.55	76.41		87.22	80.79	75.80	

LSD at 5% level		
Ploughing depths (A)	**NS**	**NS**
Nitrogen Sources (B)	**NS**	**NS**
Nitrogen rates (C)	**2.21**	**0.24**
A x B	**NS**	**NS**
A x C	**NS**	**NS**
B x C	**NS**	**NS**
A x B x C	**NS**	**NS**

None of the interactions among the studied factors had a significant effect on purity percentage in the 1st and 2nd seasons (Table 4).

4. Nitrogen percentage in roots:

Results in Table 5 clear that nitrogen percentage was insignificantly affected by ploughing depth in both seasons.

Total nitrogen percentage in the sugar beet roots was not significantly affected by the used nitrogen sources in both seasons. Gutmanski and Kwishneiwski (1995) showed no significant differences between N sources on total N% in root of sugar beet.

Table 5: Effect of Ploughing depth, sources and rates of nitrogen fertilization on nitrogen percentage in 2003 /2004 and 2004/2005 seasons.

Ploughing depth	N-Sources	2003/2004 season				2004/2005 season			
		Nitrogen rates kg N/fed							
		60	80	100	Mean	60	80	100	Mean
15 Cm	Urea	0.76	0.9	0.95	0.87	0.85	0.93	1.02	0.93
	Ammonium nitrate	0.79	0.88	0.97	0.88	0.75	0.9	0.98	0.88
	Ammonium sulphate	0.74	0.88	0.99	0.87	0.79	0.86	0.93	0.86
Mean		0.76	0.89	0.97	**0.87**	0.80	0.90	0.98	**0.89**
30 Cm	Urea	0.81	0.89	0.90	0.87	0.7	0.85	0.94	0.83
	Ammonium nitrate	0.68	0.87	0.94	0.83	0.83	0.86	0.97	0.89
	Ammonium sulphate	0.69	0.8	0.93	0.81	0.76	0.86	0.96	0.86
Mean		0.73	0.85	0.92	**0.83**	0.76	0.86	0.96	**0.86**
Overall Mean	Urea	0.78	0.89	0.92	0.87	0.77	0.89	0.98	0.88
	Ammonium nitrate	0.74	0.87	0.95	0.85	0.79	0.88	0.97	0.88
	Ammonium sulphate	0.71	0.84	0.96	0.84	0.77	0.86	0.94	0.86
Mean		0.74	0.87	0.95		0.78	0.88	0.97	

LSD at 0.05% level		
Ploughing depths (A)	**NS**	**NS**
Nitrogen Sources (B)	**NS**	**NS**
Nitrogen rates (C)	**0.19**	**0.15**
A x B	**NS**	**NS**
A x C	**NS**	**NS**
B x C	**NS**	**NS**
A x B x C	**NS**	**NS**

Increasing N application from 60 to 80 and to 100 kg N/fed recorded a gradual and significant increase in the values of N% in both seasons. These results are in agreement with that reported by Abd El-Hadi *et al.* (2002).

None of the various combinations of the studied factors attained a significant influence on N% of sugar beet roots.

5. Sodium percentage in roots:

Data in Table 6 showed that ploughing depth had insignificant affect on sodium percentage of sugar beet roots in both seasons. These results are in harmony with that reported by Gutmanski and Kwishneiwski (1995

Nitrogen sources had insignificant effect on sodium percentage of sugar beet roots in both seasons.

Increasing the applied dose of N significantly increased the values of sodium percentage from 0.14 to 0.27% in the 1st season and from 0.14 to 0.24%, respectively in the second one.

The different interactions between the examined factors had insignificant effect on the values of Na%.

Table 6: Effect of ploughing depth, sources and rates of nitrogen fertilization on sodium percentage in 2003/2004 and 2004/2005 seasons

Ploughing depth	N-Sources	2003/2004 season				2004/2005 season			
		Nitrogen rates kg N/fed							
		60	80	100	Mean	60	80	100	Mean
15 Cm	Urea	0.72	0.85	0.95	0.84	0.68	0.82	0.94	0.81
	Ammonium nitrate	0.75	0.86	1.00	0.87	0.72	0.86	0.94	0.84
	Ammonium sulphate	0.72	0.86	0.94	0.84	0.71	0.85	0.93	0.83
Mean		0.73	0.86	0.96	**0.85**	0.70	0.84	0.94	**0.83**
30 Cm	Urea	0.63	0.76	0.92	0.77	0.78	0.93	1.05	0.92
	Ammonium nitrate	0.70	0.83	1.01	0.85	0.83	1.04	1.16	1.01
	Ammonium sulphate	0.64	0.83	0.94	0.80	0.83	0.9	1.00	0.91
Mean		0.66	0.81	0.96	**0.81**	0.81	0.96	1.07	**0.95**
Overall Mean	Urea	0.67	0.80	0.93	0.80	0.73	0.87	0.99	0.87
	Ammonium nitrate	0.72	0.84	1.00	0.86	0.77	0.95	1.05	0.92
	Ammonium sulphate	0.68	0.84	0.94	0.82	0.77	0.87	0.96	0.87
Mean		0.69	0.83	0.96		0.76	0.90	1.00	

LSD at 0.05% level		
Ploughing depths (A)	**NS**	**NS**
Nitrogen Sources (B)	**NS**	**NS**
Nitrogen rates (C)	**0.22**	**0..18**
A x B	**NS**	**NS**
A x C	**NS**	**NS**
B x C	**NS**	**NS**
A x B x C	**NS**	**NS**

6. Potassium percentage in roots:

Data in Table 7 clear that potassium percentage in sugar beet roots was insignificantly influenced by ploughing depth in the 1st and 2nd seasons.

The tested nitrogen sources had insignificant effect on potassium percentage in sugar beet roots in both seasons.

The applied doses of N fertilizer show a positive and significant effect on the values of K% in juice of sugar beet roots in both seasons. Increasing nitrogen rate from 60 to 100 kg/fed caused a considerable increase in potassium percentage of juice of sugar beet roots. The results clear that that the interactions between the studied factors had insignificant effect on the values of K% in both seasons.

Table 7: Effect of ploughing depth, sources and rates of nitrogen fertilization on potassium percentage in 2003/2004 and 2004/2005 seasons.

Ploughing depth	N-Sources	2003/2004 season				2004/2005 season			
		Nitrogen rates kg N/fed							
		60	80	100	Mean	60	80	100	Mean
15 Cm	Urea	3.17	3.30	3.69	3.39	2.91	3.21	3.60	3.24
	Ammonium nitrate	3.19	3.47	3.70	3.45	2.88	3.16	3.43	3.16
	Ammonium sulphate	3.23	3.39	3.89	3.50	3.14	3.31	3.62	3.36
Mean		3.20	3.39	3.76	**3.45**	2.98	3.23	3.55	**3.25**
30 Cm	Urea	3.10	3.28	3.62	3.33	3.04	3.24	3.66	3.31
	Ammonium nitrate	3.07	3.35	3.53	3.32	2.81	3.07	3.51	3.13
	Ammonium sulphate	3.14	3.31	3.51	3.32	2.93	3.16	3.41	3.17
Mean		3.10	3.31	3.55	**3.32**	2.93	3.17	3.53	**3.20**
Overall Mean	Urea	3.135	3.29	3.65	3.36	2.97	3.22	3.63	3.28
	Ammonium nitrate	3.12	3.32	3.61	3.35	2.86	3.14	3.55	3.18
	Ammonium sulphate	3.185	3.35	3.70	3.41	3.03	3.23	3.51	3.26
Mean		3.15	3.32	3.65		2.96	3.20	3.57	

LSD at0.0 5% level		
Ploughing depths (A)	**NS**	**NS**
Nitrogen Sources (B)	**NS**	**NS**
Nitrogen rates (C)	**0.07**	**0.13**
A x B	**NS**	**NS**
A x C	**NS**	**NS**
B x C	**NS**	**NS**
A x B x C	**NS**	**NS**

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تأثير عمق الحرث والتسميد النيتروجينى على بعض صفات الجودة لبنجر السكر تحت ظروف محافظة الفيوم

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نفذ هذا البحث بمحطة البحوث الزراعية بطامية بمحافظة الفيوم فى موسمى ٢٠٠٣/٢٠٠٤ و٢٠٠٤/٢٠٠٥ لدراسة تأثير عمق الحرث ومصادر ومستويات السماد النيتروجينى على بعض صفات جودة جذور بنجر السكر.

تضمنت الدراسة ثمانية عشر معاملة مثلت التوافق بين عمقين للحرث (١٥ و٣٠ سم) وثلاث مصادر للسماد النينروجينى (يوريا ٤٦,٥ %ن، نترات الأمونيوم ٣٣,٥% ن وسلفات الأمونيوم ٢٠,٥ % ن) وثلاث مستويات للسماد النيتروجينى (٦٠، ٨٠ و ١٠٠ كجم ن/فدان). وزعت المعاملات فى نظام القطع المنشقة مرتين فى أربع مكررات حيث وضعت معاملات الحرث فى القطع الرئيسية ، ووزعت مصادر النيتروجين فى القطع الشقية الأولى بينما وزعت مستويات السماد النيتروجينى فى القطع الشقية الثانية.

أوضحت النتائج أن النسبة المئوية لكل من المواد الصلبة الذائبة الكلية ، السكروز ، النقاوة ، النيتروجين ، الصوديوم و البوتاسيوم لم تتأثر معنويا بأعماق الحرث أو مصادر السماد النيتروجينى المستعملة فى الموسم الأول والثانى. ازدادت النسب المئوية لكل من المواد الصلبة الذائبة الكلية ، النيتروجين ، الصوديوم و البوتاسيوم معنويا بزيادة مستوى التسميد النيتروجينى من ٦٠ وحتى ١٠٠ كجم ن/فدان- في حين نقصت النسبة المئوية لكل من للسكروز والنقاوة معنويا فى الموسمين.

تحت ظروف هذا البحث يمكن التوصية بتسميد بنجر السكر بمعدل ٦٠ كجم ن/فدان للحصول على أفضل صفات للجودة متمثلة فى أعلى نسبة مئوية للسكروز و النقاوة . بينما لا توجود فروق معنوية بين أعماق الحرث وصور الاسمدة النيتروجينية المستعملة فى التأثير على صفات جودة جذور بنجر السكر.