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Effect of Boron Level and Time of Application on Yield and Quality of Sugar Beet

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ABSTRACT

Two field experiments were carried out in 2015/2016 and 2016/2017 seasons at Sakha Agricultural Research Station, Kafrelsheikh Governorate (latitude of 31.10^0 N and longitude 30.93^0 E, at an elevation of 14 m above sea level) to find out to the appropriate fertilization level of boron and its application time on growth, yield and quality of sugar beet crop. The present work included twelve treatments represent the combinations of four levels of boron (zero, 50, 100 and 150 ppm) and three application times of 30, 60 and 90 days after sowing. Boron was sprayed on beets as a boric acid 17% boron. The experimental design was strip plot with four replicates, where vertical plots were occupied with boron levels, while the horizontal plots were devoted to the three application times. The results showed that increasing boron application to 100 and/or 150 ppm resulted in higher values of root diameter, root fresh weight/plant, foliage fresh weight/plant, sucrose%, sugar extractable% and quality index as well as root, top and sugar yields/fed, at harvesting time in both seasons, whilst sugar lost to molasses%, Na and K contents significantly decreased.It was found that boron application time had a significant effect on root diameter, root, and foliage fresh weight/plant as well as top yield/fed of sugar beet in both seasons, as well as sugar yield/fed in the 1^{st} one, where the application time of 90 days achieved the highest values of the mentioned traits. However, root impurities (Na, K and α-amino-N) and sugar lost to molasses% were insignificantly affected by the time of boron application. The interaction between boron concentration and its application time significantly affected root fresh weight/plant in both seasons and root yield/fed in the 1^{st} season only. The combination of (150 ppm boron fertilization at 90 days of sowing) attained the highest values of root fresh weight (9, 796 g and 1, 769 g) in the two seasons respectively, as well as the maximum root yield (60, 22 ton/fed) in the first season only. Under conditions of the present work, fertilizing beets with 100 and/or 150 ppm boron as foliar application at 90 days from sowing can be recommended to get the highest root and sugar yields/fed.

Keywords: *boron, sugar beet and time of application.*

INTRODUCTION

Some experiments were previously conducted in similar areas of clay soil to find out the recommended levels and addition times of micronutrients. In spite of the important role of micronutrients for higher yield or quality of sugar beet, there is still a lack in information regarding the role of micronutrient and more specifically the effect of boron application on sugar beet in this region. In this regard, soil analysis of the present experimental site indicated that the available content of boron was under the critical level. Thus, it was necessary to find out the appropriate level and time of applying boron to the beet plants, which is considered an important nutrient not only to increase sucrose% but also to play an important function in the translocation of sucrose from leaves to roots and other roles as cell divisions, water relations, respiration, RNA, IAA and carbohydrate metabolism as shown by Marschner (1995). Several studies showed the beneficial effect of boron on the sugar beet, such as Kristek *et al*. (2006), who sprayed beets with 1.0 kg B/ha compared with the control and obtained higher values of root, sugar yields/fed and sucrose% with the application of boron. Dordas *et al*. (2007) reported that spraying sugar beets with 0.5 kg B/ha increased the concentration of boron in leaves of sugar beet and led to the best quality and higher yields. Enan (2011) showed that higher values of root diameter, fresh weight/plant, root, top and sugar yields/fed, sucrose% and boron concentration in root and leaves were obtained with increasing boron application up to 200 ppm. Abbas *et al*. (2014) cleared that application of boron up to 0.20 g/l resulted in significant increases in sucrose, sugar recovery percentages, sugar yield/fed and purity% compared to check treatment. Enan *et al*. (2016) clarified that higher values of root diameter, fresh weight/plant, root, top and sugar yields/fed, sucrose, extractable sugar, quality index percentages and boron contents in leaves and roots, at harvesting time, were obtained with spraying boron at 100 ppm/fed in sandy soil.

As for the addition times, previous studies have shown that the application of boron at 30, 45 and/or 60 days from sowing as boric acid had no significant effect on sucrose concentration, root yield/fed, K, Na and sugar lost to molasses% (Armin and Asgharipour, 2012). Dewdar *et al*. (2015) obtained higher values of root diameter, top fresh weight/plant, sucrose%, sugar lost to molasses, recoverable sugar% and top yield/fed by treating beet plants with boron at 110 days from sowing. They added the time of addition had insignificant on root yield and sugar yield. Abd El-Motagly (2015) showed that spraying of boron at 70 days from sowing on sugar beet had a significant positive effect on yield and quality traits of sugar beet, however, it had no significant effect on sugar lost to molasses%, Na and alpha amino-N contents compared with spraying boron on sugar beet at 35 days from sowing.

The aim of the present work was to evaluate the effects of boron concentrations along with different application times of boric acid to select the optimum dose and appropriate addition time for maximizing yield and quality of beets.

MATERIALS AND METHODS

Two field experiments were carried out in 2015/2016 and 2016/2017 seasons at Sakha Agricultural Research Station, Kafrelsheikh Governorate (latitude of 31.100 N and longitude 30.930 E, at an elevation of 14 m above sea level) to find out to the appropriate fertilization level of boron and its application time on growth, yield and quality of sugar beet crop (*Beta vulgaris* var. saccharifera, L.). The present work included twelve treatments represent the combinations of four levels of boron (zero, 50, 100 and 150 ppm) and three application times of 30, 60 and 90 days after sowing. Boron was sprayed on beets as boric acid 17% boron. The experimental design was strip plot with four replicates, where vertical plots were occupied with boron levels, while the horizontal plots were devoted to the three application times. The experimental unit was 21 m^2 including 5 ridges of 7 m in length and 60 cm in width, with 20 cm between hills. Phosphorus fertilizer was given in the form of calcium super phosphate (15% P_2O_5) at the rate of 200 kg/fed at seed bed preparation. Nitrogen fertilizer was applied as ammonium nitrate (33.5%N) at the rate of 80 kg N/fed in two equal doses; after thinning and one month later. Potassium fertilizer was added in the form of potassium sulphate (48% K_2O) at the rate of 24 kg/fed just before canopy closure. Seeds of the commercial sugar beet multi-germ variety "Hosam 15684" were sown in the 1st week of September, while harvesting was done 7 months later in both seasons. Plants were thinned at 4-leaf stage to ensure one plant per hill.

Some soil physical properties of the soil were analyzed using the procedure described by Black *et al.* (1981). Soil chemical analysis was determined according to the method of Jackson (1973). Physical and chemical analyses of the soil (the upper 30 cm) of the experimental site are given in Table 1.

Table 1. Physical and chemical properties of the experimental soil in 2015 / 2016 and 2016 / 2017 seasons.

Soil properties	2015/2016 season	2016/2017 season
Particle size distribution:		
Clay%	57.0	53.0
Silt%	32.0	34.5
Sand%	11.0	12.5
Texture class	clayey	clayey
Organic matter %	1.70	1.68
Available nitrogen (mg/kg soil)	40.25	41.17
Available P_2O_5 (mg/kg soil)	6.11	6.16
Available K_2O (mg/kg soil)	250	253
Available boron (mg/kg soil)	0.21	0.17
pH at (1:2.5) soil : water suspension	8.3	8.4
E.C dS./m^{-1}	1.29	1.31
Soluble cations (meq./l)		
K^+	0.26	0.30
Na^+	7.40	7.75
Mg^{++}	2.75	3.00
Ca^{++}	2.5	2.30
Soluble anions (meq./l)		
$SO_4^=$	0.21	0.35
Cl^-	7.0	7.2
HCO_3^-	5.7	5.8
$CO_3^=$	-	-

The recorded data:

1. Root diameter (cm).
2. Root and foliage fresh weigh/plantt (g).

Twenty roots from each plot were taken to determine root quality and technological characteristics in the “Quality Control Laboratory” at Alexandria Sugar Factory, Alexandria, Egypt.

3. Sucrose percentage (Pol%) was estimated in fresh samples of sugar beet roots, using the pol method described in A.O.A.C. (2005).
4. Root impurities%: K, Na and α-amino N contents were estimated as meq/100 g beet according to the procedure of Sugar Company using an Automated Analyzer as described by Cooke and Scott (1993).
5. Sugars lost to molasses percentage (SLM%) was calculated according to the following formula shown by Deville's (1988):

SLM% = 0.14 (Na + K) + 0.25 (α-amino N) + 0.50.

6. Exteactable sugar percentage (Ex.S%) was calculated according the formula of Dexter *et al.* (1967) as follows:

Extractable sugar % = Sucrose% - SLM% - 0.6

7. Juice quality percentage (QI %) was calculated according to Cooke and Scott, (1993) using the following equation:

Quality index (QI) = (Extractable sugar% / sucrose%) × 100.

At harvest, plants of five guarded ridges were counted, uprooted, topped and weighed to determine the following parameters:

8. Root yield/fed (ton).
9. Top yield/fed (ton).
10. Sugar yield/fed (ton), which was calculated according to the method of Deville's (1988) as follows:

Sugar yield(ton) = root yield/fed (ton)× extractable sugar%/100.

Data of the determined traits were statistically analyzed according to the technique of analysis of variance (ANOVA) for the strip plot design as published by Gomez and Gomez (1984) by means of “MSTAT-c” computer software package. Least significant differences between treatment means at 5% level of probability as were calculated as described by Snedecor and Cochran (1980).

RESULTS AND DISCUSSION

1. Root diameter, root fresh weight and foliage fresh weight:

Data in Table 2 cleared that fertilizing sugar beet with 100 and/or 150 ppm of boron as foliar application led to positive effects on root diameter, root and foliage fresh weights/plant, in both seasons. These results may be due to role of boron element in cell elongation and its role for the formation of new leaves, where it was found that beet plants suffer from boron deficiency had smaller, stiff and thick leaves. Moreover, boron has an active role in translation of assimilation product of the leaves and roots. Similar results were reported by Kristek *et al*. (2006), Enan (2011) and Abbas *et al*. (2014).

The results in the same Table indicate that root diameter, root fresh weight and foliage fresh weight significantly increased with delaying the time of boron application to 90 days compared with 30 days from planting. Meanwhile, there was insignificant difference between 60 and 90 days from sowing in their effect on root diameter (in the 2nd season) and foliage fresh weight/plant (in both seasons). These results may be due to capability of plant to absorb the full dose which was sprayed at age of 90 efficiently, hence benefit from it compared to the other application times of (30 and 60). These finding are in agreement with those recorded by Abd El–Motgally (2015).

The interaction between boron fertilization level and its time of application had a significant influence on root fresh weight/plant, while root diameter and foliage fresh weight/plant were not affected by the studied factors, in both seasons (Table 2).

Interaction effect:

Data in Table 3 show that root fresh weight (g/plant) was significantly affected by the interaction between boron concentration and its application time in both seasons. The highest weight was recorded when sugar beet sprayed with 150 ppm boron and its application time in 90 days from sowing (796.87 and 769.10 g/plant) in both seasons respectively. This finding may be due to the boron role in increased of leaf area and delayed its application time to 90 days from sowing, in terms of increased ease of absorption of it (Enan 2011).

Table 2. Root diameter (cm), root fresh weight (g) / plant and foliage fresh weight (g) / plant as affected by boron concentrations and its application times in 2015/2016 and 2016/2017 seasons.

Treatments	Root diameter (cm)		Mean	Root fresh weight (g) / plant		Mean	foliage fresh weight (g) / plant		Mean
	1st season	2nd season		1st season	2nd Season		1st season	2nd season	
Boron concentrations (ppm)									
Zero	7.80	8.91	8.36	536.8	573.0	554.9	216.7	241.9	229.3
50	8.93	9.71	9.32	644.7	629.9	637.3	236.2	267.9	252.0
100	9.90	10.32	10.11	715.8	700.4	708.1	338.9	332.1	335.5
150	10.23	10.84	10.54	749.1	735.7	742.1	358.4	344.5	351.4
LSD at 5%	1.27	0.77	-	90.54	67.04	-	86.56	57.64	-
Times application (days from sowing)									
30	8.76	9.43	9.10	621.0	615.9	618.5	236.8	243.9	240.3
60	9.02	10.02	9.52	655.2	656.1	655.6	318.4	318.3	318.3
90	9.94	10.40	10.17	708.5	707.5	708.0	307.6	327.5	317.6
LSD at 5%	0.50	0.45	-	50.01	50.72	-	37.10	49.86	-
AxB	NS	NS	-	98.52	113.35	-	NS	NS	-

Table 3. Root fresh weight (g) / plant as affected by the interaction between boron concentrations and time of its application in 2015/2016 and 2016/2017seasons.

Boron concentrations (ppm)	1st season			2nd season		
	Application times (DYS)					
	30	60	90	30	60	90
Zero	546.78	413.43	650.10	588.33	439.40	691.67
50	603.57	653.43	676.97	580.37	639.10	670.33
100	633.63	793.63	710.20	610.07	792.37	698.73
150	698.20	750.20	796.87	684.70	753.33	769.10
LSD at 5%		98.52			113.35	

2.Sucrose, potassium, sodium and alpha amino-N contents:

Data in Table 4 pointed to a significant effect of boron levels on sucrose%, potassium, sodium and alpha amino-N contents/beet. Fertilizing sugar beet with 100 and/or 150 ppm boron gave higher values of sucrose% compared to those fertilized with 50 ppm boron and check treatments in both seasons. These results may be due to the hypothesis is that boron combines with sugar to form a sugar-borate complex (ionized) which is translocation with greater facility than are non-borate. On the other hand, fertilization of beet plants with studied boron levels had a significant effect sodium, potassium and alpha amino-N contents in roots. Spraying beet plants with 100 and/or 150 ppm of boron led to lower quantities of potassium and sodium contents in root as compared to that gained by fertilized with 50 ppm boron and unfertilized. Meantime, higher values of alpha amino-N contents in beet roots were recorded by increasing the applied boron level to 100 and/or 150 ppm in both seasons. These results may be due to that boron levels significantly increased glucose levels in phloem sap and the balance in sodium uptake and nitrogen consumption. These finding are in agreement with that mentioned by Enan *et al.* (2016) they added that increasing the amount of boron to150 ppm boron can reduce molasses sugar as a result of decreased in impurities in terms of Na and K contents in beet roots.

Delaying application time of boron failed to reach the level of significance in their effect on sucrose%, potassium, sodium and alpha amino-N contents in both seasons.

The interactions between boron fertilization levels and application times of boron were insignificance in their effect on the above-mentioned traits in both seasons (Table 4).

Table 4. Sucrose, potassium, sodium and alpha amino–N as affected by boron concentrations and its application times in 2015/2016 and 2016/2017 seasons.

Treatments	Sucrose %		Mean	Potassium (meq/100 g beet)		Mean	Sodium (meq/100 g beet)		Mean	α-amino N (meq/100 g beet)		Mean
	1st season	2nd season		1st season	2nd season		1st season	2nd season		1st season	2nd season	
Boron concentrations (ppm)												
Zero	16.29	16.28	16.29	5.30	5.53	5.42	2.29	2.39	2.34	1.77	1.65	1.71
50	16.59	16.40	16.50	4.57	4.72	4.65	2.19	2.03	2.11	1.71	1.68	1.69
100	17.16	16.90	17.03	3.06	3.61	3.33	1.37	1.72	1.55	2.05	2.22	2.13
150	17.25	17.20	17.23	2.85	3.45	3.15	1.21	1.30	1.25	2.27	2.31	2.29
LSD at 5%	0.42	0.46	-	1.36	0.49	-	0.49	0.40	-	0.27	0.42	-
Application times (days from sowing)												
30	16.65	16.57	16.61	4.08	4.60	4.34	1.80	1.89	1.85	2.16	2.04	2.1
60	16.84	16.71	16.73	3.98	4.16	4.07	1.79	1.92	1.85	1.90	2.01	1.95
90	16.99	16.81	16.90	3.77	4.23	4.00	1.71	1.76	1.74	1.80	1.84	1.82
LSD at 5%	NS	NS	-	NS	NS	-	NS	NS	-	NS	NS	-
AxB	NS	NS	-	NS	NS	-	NS	NS	-	NS	NS	-

3. Sugar lost to molasses, extractable sugar percentages and quality index:

Data in Table 5 show sprayed beet plants by100 and/or 150 ppm of boron recorded the highest values of extractable sugar %, quality index and lowest quantities of sugar lost to molasses% in both seasons, compared to other treatments. Adding boron at the rate of 150 ppm achieved an increase in extractable sugar amounted to 1.33, 1.19 in

1st and 2nd season, respectively, meanwhile attained an increase in quality index amounted to 2.38 in 2nd one only, over those unfertilized. On the other hand, the lowest quantities of sugar lost to molasses% was recorded by supplying 100 and 150 ppm boron application compared with the check treatment and 50 ppm boron in both seasons. These results may be due to that boron element is important to many vital metabolic processes especially those that associated in transports produced sugars to the storage organ. This view is an agreement with those conduced by Ismail *et al*., (2002).

The results in the same Table cleared that sugar lost to molasses, extractable sugar percentages and quality index were not affected by the studied application times in both seasons.

The interactions between boron fertilization levels and application times of boron failed to reach the level of significance in their effect on sugar lost to molasses, extractable sugar percentages and quality index in both seasons (Table 5).

Table 5. Sugar lost to molasses, extractable sugar percentages and quality index as affected by boron concentrations and its application times in 2015/2016 and 2016/2017 seasons.

Treatments	Sugar lost to molasses		Mean	Extractable sugar		Mean	Quality index		Mean
	1st season	2nd season		1st season	2nd season		1st season	2nd season	
Boron concentrations (ppm)									
Zero	2.00	2.02	2.01	13.68	13.67	13.68	84.00	83.90	83.95
50	1.88	1.86	1.87	14.12	13.94	14.03	85.08	84.69	84.89
100	1.63	1.80	1.72	14.93	14.50	14.72	85.97	85.78	85.88
150	1.64	1.74	1.69	15.01	14.86	14.94	87.01	86.38	86.70
LSD at 5%	0.20	0.14	-	0.52	0.52	-	NS	1.02	-
Application times (days from sowing)									
30	1.86	1.92	1.89	14.19	14.06	14.13	85.17	84.78	84.98
60	1.78	1.85	1.82	14.45	14.26	14.36	85.80	85.30	85.55
90	1.72	1.80	1.76	14.67	14.41	14.54	85.58	85.68	85.63
LSD at 5%	NS	NS	-	NS	NS	-	NS	NS	-
AxB	NS	NS	-	NS	NS	-	NS	NS	-

4. Root, top and sugar yields/fed (ton):

Data in Table 6 manifested a significant effect of boron levels on root, top and sugar yields/fed of sugar beet, where were increased significantly by 1.87, 1.44 and 0.56 tons/fed in the 1st season correspond to 1.47, 1.13 and 0.47 tons/fed in 2nd one, respectively, when boron level was raised from zero up to 150 ppm compared to that gained by the check treatment. This finding may be due to the increase in root diameter, root foliage and fresh weights/plant (Table 2), which may be attributed to the enhancing role of boron element on photosynthetic translocation from leaves to roots, which in turn was reflected on the final root and sugar yields/fed at harvest. In addition to that may be due to the hypothesis is that boron combines with sugar to form a sugar-borate complex (ionized) which is translocation with greater facility than are non-borate. The beneficial effects of boron on growth and yield of sugar beet was emphasized by previous studies carried by Kristek *et al.* (2006), Enan (2011) and Armin and Asgharipour (2012).

The results in the same Table cleared that top yield/fed of beet was increased significantly by increasing application time of boron up to 90 days after sowing, while, the difference between 30 to 90 days from sowing failed to reach the level of significance in their effect on root yield/fed in both seasons, and sugar yield/fed in 2nd one.

The interactions between boron fertilization levels and application times of boron failed to reach the level of significance in their effect on the above–mentioned traits, with the exception of root yield/fed in 1st season only (Table 6).

Table 6. Root, top and sugar yields/fed (tons) as affected by boron concentrations and its application times in 2015/2016 and 2016/2017 seasons.

Treatments	Root yield/fed (ton)		Mean	Top yield/fed (ton)		Mean	Sugar yield/fed (ton)		Mean
	1st season	2nd season		1st season	2nd season		1st season	2nd season	
Boron concentrations (ppm)									
Zero	20.44	20.85	20.65	7.42	7.54	7.48	2.79	2.85	2.82
50	21.64	21.59	21.62	8.01	8.26	8.14	3.06	3.02	3.04
100	22.12	22.14	22.13	8.67	8.41	8.54	3.30	3.21	3.26
150	22.31	22.32	22.32	8.86	8.67	8.77	3.35	3.32	3.34
LSD at 5%	0.82	0.71	-	0.59	0.50	-	0.11	0.17	-
Application times (days from sowing)									
30	21.58	21.26	21.42	7.17	7.38	7.28	2.99	2.99	2.99
60	21.27	21.93	21.60	8.60	8.43	8.52	3.15	3.13	3.14
90	22.04	21.98	22.01	8.95	8.84	8.90	3.23	3.18	3.21
LSD at 5%	NS	NS	-	0.76	0.37	-	0.17	NS	-
AxB	1.45	NS	-	NS	NS	-	NS	NS	-

Interaction effect:

Data in Table 7 show that delaying application time from 30 to 90 days from sowing resulted in an increase in root yield/fed amounted to 0.69 ton when beets was fertilized with 150 ppm boron. However, this increase was only 0.22 ton, when beets unfertilized with boron in the 1st season. Fertilizing beets with 150 ppm boron in addition to delaying its application time to 90 days from sowing significantly increased root yield/fed amounted by 1.50 ton/fed over that gained by untreated plants.

Table 7. Root yield/fed (ton) as affected by the interaction between boron levels and time of its application in 2015/2016 season

Boron concentrations (ppm)	1st season		
	Application times (days from sowing)		
	30	60	90
Zero	20.88	19.32	21.10
50	21.77	21.09	22.06
100	21.73	22.25	22.38
150	21.91	22.42	22.60
LSD at 5%		1.45	

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تأثير مستوي التسميد بالبورون وميعاد إضافته على حاصل وجودة بنجر السكر

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أقيمت تجربتان حقليتان بمحطة بحوث سخا - محافظة كفر الشيخ (دائرة عرض١٠٣٠,٣١° شمالاً و خط طول ٣٠,٩٣٩٧ ° شرقاً) في موسمي ٢٠١٦/٢٠١٥ و ٢٠١٧/٢٠١٦ م لدراسة تأثير أربعة مستويات من البورون تم إضافتهم رشاً هي: ١- الرش بالماء بدون بورون (مقارنةٍ) ، ٢- الرش بالبورون بتركيز ٥٠ جزء في المليون ، ٣- الرش بالبورون بتركيز ١٠٠ جزء في المليون و ٤- الرش بالبورون بتركيز ١٥٠ جزء في المليون، باستخدام حمض البوريك ١٧% بورون ، وثلاث مواعيد لتطبيق رش البورون وهي : الرش علي عمر ٣٠ ،٦٠ , ٩٠ يوماً من الزراعة ، وذلك لدراسة تأثيرها على بعض صفات النمو وحاصل وجودة بنجر السكر. استخدم تصميم الشرائح المتعامدة في أربعة مكررات في الموسمين ، حيث وزعت معدلات التسميد الورقي بالبورون في الشرائح الرأسية ، في حين اشتملت الشرائح الأفقية علي مواعيد تطبيق الرش بالبورون. أوضحت النتائج ما يلي: -1 دلت النتائج علي أن الرش بإضافة ١٠٠ أو ١٥٠ جزء في المليون/ بورون أدي إلي زيادة معنوية في قطر ووزن كلا من الجذور والأوراق الطازجة والنسبة المئوية للسكروز ، والسكر المستخلص بالجذور ، وكذلك حاصل الجذور والأوراق والسكر/فدان والجودة ، كذلك مع نقص في كمية السكر المفقود في المولاس في الموسمين. -2 كان لميعاد إضافة البورون تأثيرا موجبا علي قطر ووزن كلا من الاوراق والجذورالطازجة/ نبات ، وكذلك حاصل الأوراق/فدان في الموسمين وايضاً حاصل السكر/ فدان في الموسم الأول فقط , بينما لم يكن لة أي تأثير علي باقي الصفات المدروسة -3. أظهر التفاعل بين معاملات التسميد بمستويات البورون المختلفة ومواعيد إضافته تأثيراً معنوياً علي متوسط وزن الجذر وكذلك حاصل الجذور/ فدان في الموسم الأول فقط ، حيث أعطت التوليفة (التسميد الورقي بتركيز ١٥٠ جزء في المليون بورون علي عمر ٩٠ يوماً من الزراعة) أعلي القيم لمتوسط وزن الجذر (٧٩٦,٩جرام و ٧٦٩,١جرام) في الموسمين علي الترتيب ، وكذلك أعلي القيم لحاصل الجذور/ فدان (٢٢,٦٠ طن/ فدان) في الموسم الأول فقط. توصي الدراسة بتسميد بنجر السكر باستخدام التسميد الورقي للبورون بتركيز ١٠٠ أو١٥٠ جزء في المليون ، علي عمر ٩٠ يوماً من الزراعة تحت ظروف محافظة كفر الشيخ.