EFFECT OF CHEMICAL AND BIOFERTILIZER OF NITROGEN AND BORON ON YIELD AND QUALITY OF SUGAR BEET

Ouda, Sohier M. M.
Sugar Crops Research Institute, Agric. Res. Center, Giza, Egypt

Accepted 20/11/2006

ABSTRACT: Two field experiments were conducted in the experimental farm, El-Kassasine Research Station, Ismailia Governorate, Egypt, during 2003/2004 and 2004/2005 seasons to investigation the effect of chemical and biofertilizer of N and boron as well as their interactions on yield and quality of sugar beet. This study included eight treatments two mineral nitrogen fertilizer levels (40 and 80 kg / fed.) and four treatments viz., control, serialine, boron and serialine + boron.

The obtained results showed that increasing N level up to 80 kg N / fed increased root length and diameter, root and top weights /plant (gm) and top, root and sugar yields ton / fed. The total soluble solids percentage (T.S.S.%) was also increased by increasing the application of N fertilizer.

For the effect of application of serialine, boron and serialine + boron the combined data shows that applying either serialine, boron or both has improved the parameters of single root and yield of roots ton/ fed and above ground growth in ton/ fed.

The results of interaction effects showed that significant interactions of application of nitrogen and serialine + boron, but most of them did not give additional information except root yield and sugar yield ton/ fed.

Key words: Sugar beet, nitrogen, serialine, boron.

INTRODUCTION

Sugar demand in Egypt has increased at average rapid rate during the last three decades due to the drastic growing of the population as well as the change of sugar consumption patterns. Therefore, yearly imports about 35-40% of its sugar demand. The importance of sugar beet crop to agriculture is not only confined to sugar production, but also to wide adaptability to be grown on poor sandy soil. Nitrogen, bio and boron fertilizers are considered among the important agricultural practices to impontive sugar beet productivity in the newly reclaimed lands.

Nitrogen is referred as balance wheel of plant nutrition. It has an active role to raise the efficiency of other nutrients as well as raising sugar beet productivity. El-Hennawy *et al.* (1998); El-Moursy *et al.* (1998); Basha (1999); Abd El-Moneim (2000); El-Shahawy *et al.* (2001); Ouda (2001 and 2002); Mohamed (2004) and Amin (2005) reported that increasing nitrogen levels significantly increased root length and its diameter , top and root fresh weights / gm and top, root and sugar yields ton/ fed while T.S.S., sucrose and purity percentages decreased by increasing nitrogen levels.

In the present time, great attention has been given to biofertilization as management tool for increasing crop production. The effects of inoculation by N2 – fixing bacteria for adsorption may cause yield response through playing a great role in hormonal effects, alter plant metabolism and growth. This method of bio-fertilization aims to minimize the environmental pollution of mineral fertilizers and to save its cost. Favilli *et al.* (1993) noticed that inoculation sugar beet seeds with *Azospirillum lipoferum* + 60 kg N/ ha improved the root weight compared with 100 kg N/ha alone. Butorac (1995) found that root yield, sugar content and sugar yield were lowest with NPK + Agravital + wast water. Sultan *et al.* (1999); Abu El-Fotoh (2000) and Ali (2003) reported that inoculation of sugar beet fruit with Azotobacterin significantly increased root length and its diameter, top and root yields/ fed as well as T.S.S. % . They added that positive interaction between nitrogen levels and biofertilizer treatments on root and top fresh weights/ plant, root diameter and root yield/ fed and the best results were obtained by using 40 kg N/fed + Rhizobacterin or 60 kg N/fed without Rhizobacterin. But, Amin (2005) showed that the response to the biofertilizer was positive when no mineral N-fertilizer was applied and or when 50 kg N/fed was applied, when N fertilizer increased to 100 kg N the response become negative.

Boron has a role in formation and growth of root and stem merestemic tissues and it is essential for translocation of metabolism productions from leaves to all parts of plant, metabolism of nitrogen and synthesis of nuclear acids and protein. Dahdoh *et al.* (1996) showed that the effects of micronutrients (B, Zn) on sugar beet plants may be significant or insignificant depending on combined nutrients, the rate of application and the studied organs. El-Hawary (1999) concluded that

under saline soil condition fertilized sugar beet plants with 90 kg N/fed + 48 Kg K_2O/fed as well as sprayed with 150 ppm B increased root and sugar yields ton/fed. Saif (2000) reported that sucrose and purity percentages and sugar yield appeared a positive response to boron application up to 5 kg B/ fed. Azzazy (2004) noticed that nitrogen + boron fertilization at the rate of 100 kg N + 5 kg borax are recommended to maximize quality and yields of sugar beet under the new reclaimed soils of El-Fayoum Governorate. Nafei (2004) reported that purity % and root yield were insignificantly influenced by B rates added to sugar beet plants.

The main target of this work aimed to study the effect of N-chemical, serialine and boron fertilizer on yield and quality of sugar beet grown on newly reclaimed sandy soil under drip irrigation system in El-Kassasine, Ismailia Governorate.

MATERIALS AND METHODS

The present work was carried out at El-Kassasine Research Station Ismaillia Governorate, Egypt, in the two growing seasons of 2003/ 2004 and 2004/2005 to study the effect of mineral nitrogen fertilizer levels, biofertilizer and boron on yield and quality of sugar beet variety Sultan on sandy soil under drip irrigation system. This study included 8 treatments. A split – plot design with four replicates was used, where two nitrogen fertilizer levels were in the main plots, while four treatments of biofertilizer and boron in the sub-plots. Plot area was 21 m^2 including 6 rows of 7 long and 50 cm apart. Spacing between hills was 20 cm. The two nitrogen fertilizer levels i.e., 40 and 80 kg N/fed. The four treatments of biofertilizer and boron viz, control, serialine, boron and serialin + boron. Serialin was applied as the recommended rate in sandy soil (1200 gm = 3 pakets) before sowing directly by soaking seeds in running water at on hour and then dried. Concerning the aim of soaking seeds in water, usually, seeds of sugar beet treated with some fungicides to protect them from diseases and can not be with bacterum. Seeds were treated with serialine as the recommended method. Boron was applied as the recommended rate in sandy soil (5kg borox / fed containing 11% boron. Nitrogen fertilizer was applied as ammonium sulphate (20.6% N) in the three equal doses, the 1st was 35 days after sowing (after thinning), the 2nd was 15 days from the 1st and the rest was

applied 15 days later. In addition, 46, 5kg P_2O_5 in the form calcium superphosphate and 48 kg K_2O as potassium sulphate (48% K_2O)/fed were added before sowing. Boron fertilizer was applied with the 3rd dose of nitrogen. Planting date was in the 1st week of September in the 1st and the 2nd seasons. The plants were thinned to one plant/ hill after 35 days from sowing. All normal agricultural practices with the exception of the studies factors were carried out as usually done by farmers in the district. At harvest (190 days from sowing), five plants were taken at random from each plot to estimate the following characters:

1. Root length (cm).
2. Root diameter (cm).
3. Root weight / plant (gm).
4. Top weight/ plant (gm).
5. Total soluble solids in beet roots percentage (T.S.S.%) which was determined by hand refractometer.
6. Sucrose percentage was determined by polarimetrically on lead acetate extract of fresh macerated roots according to Le Doct's method (1927).
7. Juice purity percentage: it was calculated according to the following equation : Juice purity % $= \frac{\text{Sucrose \%}}{\text{T.S.S.\%}} \times 100$.
8. Root yield ton/ fed.
9. Top yield ton/fed.
10. Sugar yield ton/ fed was calculated by multiplying root yield by root sucrose percentage.

Two inner rows from each plot were harvested to determine the yield and its attributes:

Analysis of variance and combined analysis for the two seasons were carried out as described by Snedecor and Cochran (1981). For comparison between means, Duncan's new multiple range test was applied (Duncan 1955).

The soil of the experimental site was sandy containing as follows in Table 1.

Table 1. Some soil physical and chemical properties of the experimental sites

Characters	Seasons	
	2003/ 2004	2004/ 2005
Texture	Sandy	Sandy
pH	8.90	8.37
Available nutrients (ppm)		
N	20.5	26.0
P	5.30	7.40
K	120	128
B	0.13	0.18

RESULTS AND DISCUSSION

Effect of Nitrogen

It is clear from Tables 2,3 and 4 that root length, root diameter, root weight and above ground growth responded significantly to

the increase in nitrogen fertilizer level from 40 to 80 kg N/ fed. This increase in single plant traits led to the significantly increase in both root and above ground growth yields recorded in ton/fed. The sucrose content percentage was also increase by the increasing in nitrogen level resulted in increase in sugar yield in ton/fed. The total soluble solids percentage (T.S.S. %) was also increased by increasing the applied N fertilizer. The juice purity percentage was the only trait, which did not show response to increasing N level though there was response in only one season. These results were expected since this experiment was conducted only light texture soil, which is characterised, by being poor fertile soil. These results are in full agreement with those obtained by El-Hawary (1999); Ouda (2000, 2001 and 2002); Ramadan *et al.* (2003) Mohamed (2004); Amin (2005) and Ouda (2005).

Effect of Application of Serialine and Boron

Results in Tables 2 and 3 show that applying either serialine, boron or both has improved the parameters of single root and yield of roots (ton/fed) and above ground growth in ton/fed, also. Root length responded positively to serialine alone and boron alone. The same was observed with root diameter. Single root weight showed response to serialine alone. More response to boron alone and when both were applied more positive response was observed. Above ground growth responded also to these application in almost similar pattern. These responses of single plant characters were reflected in positive response of both root and above ground yields in ton/ fed. Boron was more effective than serialine and application of both them together was more effective than the application of any of them. Serilaine alone did not affect sucrose % but when applied in combination with boron, sucrose content responded significantly and positively sugar yield which is a function of both root yield and sucrose content responded to any of serialine or boron significantly and the response to both of them was significantly more serialine application did not effect significantly on T.S.S.%, while application of boron alone was more effective on T.S.S.% and application of both increased the T.S.S.%, significantly as compared with either the control or serialine alone. last, purity was not affected by either boron or serialine alone but when both were applied , the response was observed. Similar results were recorded by Selime (1998) who found that biofertilizer

Table 2. Effect of chemical and biofertilizers nitrogen as well as boron on yield components of sugar beet

Main effects and interaction	Root length (cm)			Root diameter (cm)			Root weight / plant (g)			Top weight / plant (g)		
	1st season	2nd season	Combined	1st season	2nd season	Combined	1st season	2nd season	Combined	1st season	2nd season	Combined
N Level (kg / fed):												
40	24.91^{b}	22.85^{b}	23.88^{b}	12.09^{b}	10.38^{b}	11.23^{b}	0.85^{b}	0.63^{b}	0.74^{b}	0.19^{b}	0.18^{b}	0.18^{b}
80	29.70^{a}	26.39^{a}	28.04^{a}	14.05^{a}	13.24^{a}	13.64^{a}	1.17^{a}	1.01^{a}	1.09^{a}	0.28^{a}	0.25^{a}	0.26^{a}
F. test	*	**	**	*	**	**	**	**	**	**	**	**
Biogertilizer and boron :												
Control	24.41^{c}	22.94^{c}	23.67^{c}	12.47^{b}	10.38^{c}	11.43^{c}	0.91^{b}	0.64^{d}	0.77^{d}	0.20^{c}	0.19^{c}	0.20^{c}
Serialine	26.91^{b}	24.01^{b}	25.46^{b}	12.73^{b}	11.42^{b}	12.07^{b}	1.00^{ab}	0.75^{c}	0.87^{c}	0.22^{bc}	0.20^{bc}	0.21^{c}
Boron	28.41^{a}	25.57^{a}	26.99^{a}	13.44^{a}	12.66^{a}	13.05^{a}	1.05^{a}	0.90^{b}	0.97^{b}	0.25^{ab}	0.21^{b}	0.23^{b}
Serialine + Boron	29.49^{a}	25.95^{a}	27.72^{a}	13.66^{a}	12.77^{a}	13.21^{a}	1.08^{a}	0.98^{a}	1.03^{a}	0.27^{a}	0.25^{a}	0.26^{a}
F. test	**	**	**	**	**	**	*	**	**	**	**	**
Interaction												
N x B	NS	*	*	NS	*	*	**	NS	*	*	*	**

Table 3. Effect of chemical and biofertilizers nitrogen as well as boron on yield and quality of sugar beet

Main effects and interaction	Root yield (t/fed)			Top yield (t/fed)			Sucrose %			Sugar yield (t/fed)		
	1st season	2nd season	Combined	1st season	2nd season	Combined	1st season	2nd season	Combined	1st season	2nd season	Combined
N Level (kg / fed):												
40	29.919^{b}	22.047^{b}	25.983^{b}	6.530^{b}	4.219^{b}	5.375^{b}	16.00^{b}	16.150^{b}	16.075^{b}	4.808^{b}	3.590^{b}	4.199^{b}
80	41.049^{a}	35.469^{a}	38.259^{a}	9.913^{a}	7.815^{a}	8.864^{a}	17.666^{a}	18.700^{a}	18.183^{a}	7.251^{a}	6.700^{a}	6.975^{a}
F. test	**	**	**	**	**	**	*	*	**	**	**	**
Biogertilizer and boron :												
Control	31.875^{c}	22.633^{d}	27.254^{d}	6.685^{d}	4.625^{c}	5.655^{d}	16.250^{b}	15.966^{c}	16.108^{c}	5.248^{c}	3.696^{d}	4.472^{d}
Serialine	35.301^{b}	26.275^{c}	30.788^{c}	7.530^{c}	5.386^{b}	6.458^{c}	16.333^{b}	17.083^{b}	16.708^{c}	5.810^{b}	4.521^{c}	5.165^{c}
Boron	36.926^{ab}	31.586^{b}	34.256^{b}	8.783^{b}	7.148^{a}	7.966^{b}	17.000^{ab}	17.750^{b}	17.375^{b}	6.305^{ab}	5.675^{b}	5.990^{b}
Serialine + Boron	37.833^{a}	34.538^{a}	36.185^{a}	9.923^{a}	6.910^{a}	8.416^{a}	17.750^{a}	18.900^{a}	18.325^{a}	6.735^{a}	6.689^{a}	6.722^{a}
F. test	**	**	**	**	**	**	*	**	**	**	**	**
Interaction												
N x B	**	NS	*	**	**	**	NS	**	**		**	*

treatments significantly increased top, root and sugar yields of sugar beet. Ali (2003) Ramadan *et al.* (2003); Mohamed (2004) and Amin (2005) also concluded that biofertilization treatments had significant effect on root length and diameter, root , top and sugar yields/fed, while T.S.S.% and Juice purity percentage did not affect in all biofertilization treatments.

For the effect of boron Rizk *et al.* (1995) reported that application of 25 kg N + 1 kg B/ fed resulted in a good juice purity and a higher increase of fresh and dry weights of the top and root /plant . El-Hawary (1999) concluded that spraying sugar beet plants with 150 ppm B (as a boric acid) under saline soil condition gave the highest values of all studied characters. Saif (2000); Azzazy (2004) and Nafei (2004) found that the qualities measurements in terms of sucrose %, purity % and sugar yield appeared a positive response to boron application up to 5kg B/ fed.

Effect of Interaction

Most of the traits presently earlier showed significant interactions of application of nitrogen and serialine + boron , but most of them did not give additional information except root yield and sugar yield, seen in Tables (3-a) and (3-c) respectively.

Table 3.a. Interaction effect of nitrogen and serialine + boron on root yield ton/fed

Biofertilizer and boron	Nitrogen fertilizer levels kg / fed	
	40	80
Control	B 19.501[d]	A 35.006[c]
Serialine	B 24.970[c]	A 36.606[c]
Boron	B 28.938[b]	A 39.575[b]
Serialine + Boron	B 30.523[a]	A 41.848[a]

Table 3.c.Interaction effect of nitrogen and serialine + boron on sugar yield ton/fed

Biofertilizer and boron	Nitrogen fertilizer levels kg / fed	
	40	80
Control	B 2.973[c]	A 5.971[c]
Serialine	B 3.969[b]	A 6.362[c]
Boron	B 4.776[a]	A 7.204[b]
Serialine + Boron	B 5.079[a]	A 8.365[a]

On one way 80 kg N/ fed increased root yield over 40 kg N under any treatment of the other factor. When serialine + boron were applied with any levels of N significantly attained the highest values of root yield Ali (2003)

Table 4. Effect of chemical and biofertilizers nitrogen as well as boron on quality of sugar beet

Main effect and interaction	T.S.S. %			Purity %		
	1st season	2nd season	Combined	1st season	2nd season	Combined
N Level (kg / fed):						
40	24.916[b]	25.166[b]	25.041[b]	64.258	64.158b	64.208
80	27.500[a]	27.666[a]	27.583[a]	64.283	67.466a	65.874
F. test	*	**	**	N.S.	*	N.S
Biogertilizer and boron:						
Control	25.00	25.666[b]	25.333[c]	64.950	62.116c	63.533b
Serialine	26.000	25.833[b]	25.916[bc]	62.816	66.083b	64.449b
Boron	26.833	26.833[ab]	26.833[ab]	63.583	66.083b	64.833b
Serialine + Boron	27.000	27.333[a]	27.166[a]	65.733	68.966a	67.349a
F. test	N.S	*	**	N.S	**	**
Interaction						
N x B	N.S	N.S	N.S	N.S	**	*

reported that root yield ton/ fed increased when inoculation sugar beet with nitrogen fixing bacteria and mineral nitrogen. While Amin (2005) showed that the response to the biofertilizer was positive when no mineral N- fertilizer was applied.

From Table 3-c, it could be seen that when 80 kg N/fed was applied there was significant deferences for any treatment of the other factor on sugar yield ton/fed. The highest sugar yield ton/fed was obtained when 40 or 80 kg N/fed with serialine + boron.. Similar results were recorded by Ali (2004); Ramadan (2003); Mohamed (2004) and Amin (2005).

The experimental soil was poor fertile sandy soil. The response to nitrogen fertilizer is expected. Also, boron application was effective on such soil since the contents in different nutrient elements are poor. The need of sugar beet to boron was shown by El-Hawary (1999); Saif (2000); Azzazy (2004) and Nafei (2004). So the response to boron application mainly of nitrogen, was effective when lower nitrogen fertilizer level was applied but when 80 kg N was applied, there was no need for serialine.

REFERENCES

Abd-El-Moneim, S.A. 2000. Effect of preceding crop and nitrogen fertilizer level on yield and quality of some sugar beet varieties grown in fayoum region Ph. D Thesis, Fac. Agric., El-Fayoum, Cairo Univ.

Abu El-Fotoh, H. G.; A. A. Abd El-Magid and R. E. Kanany 2000. Effect of biofertilization on sugar beet yield, quality and optimization of the chemical fertilizer. Proc., 9th Conf. Agron., Minufiya Univ., (1-2): 561-567.

Ali, M. H. A. 2003. Microbiological and chemical studies on the rhizosphere of sugar beet plants. Ph. D. Thesis, Fac. of Agric., Al-Azhar Univ.

Amin, Gehan A. M. 2005. Study of some agricultural practices on sugar beet. M. Sc. Thesis, Fac. of Agric., Zagazig Univ.

Azzazy, N. B. 2004. Effect of nitrogen and boron fertilization on yield and quality of sugar beet under new reclaimed soil conditions. Egypt. J. Appl. Sci., 19 (8) : 230-238.

Basha, H. A. 1999. Response of two sugar beet cultivars to level and method of nitrogen application in sandy soil. Zagazig, J. Agric. Res., 26 (1) : 11-26.

Butorac, A. 1995. Response of sugar beet to agravital and waste water fertilizing : II-Heavy metals toxic elements and boron content in sugar beet root and leaf. Polyjoprivvedna Znanstrena smotra, 60 (1) : 81-94 (C.F.: CD Rom Computer system).

Dahdoh, M.S.A., Moussa, B.I.M. and Tag El-Deen, A.S.1996. Sugar beet response to fertilization with nitrogen and some micronutrients in sandy soil under sprinkler irrigation. Egypt. J. Appel. Sci., 11 (11) : 262-275.

Duncan, D.B. 1955. Multiple range and multiple. F-test. Biometrics, 11 : 1-42.

El-Hawary, M.A. 1999. Influence of nitrogen, potassium and boron fertilizer levels on sugar beet under salin soil condition. J. Agric. Sci., Mansora Uinv., 24 (4): 1573-1581.

El-Hennawy, H.H.; B. S. H. Ramadan and E.A. Mahmoud. 1998. Response of sugar beet to nitrogen fertilization levels and its time of application. J. Agric. Sci., Mansoura Uinv., 23 (3) : 969-978.

El-Shahawy, M.L.; M.S. El-Yamani; Maani, Z. M. Abou Amou and Asmaa, A. El-Bassuony. 2001. Influence of

tiilage methods and nitrogen fertilization levels on yield, quality and chemical composition of the sugar beet crop. J. Agric. Sci. Mansoura Univ., 26 (2) : 1177-1190.

Favilli, F; R. Pastorri and A. Gori. 1993. Response of sugar beet to Azospirillim bacterization in field experiments. Agric. Med., 123 : 281-285 (C.F.: CD Rom Computer system).

Le-Docte, A. 1927. Commercial determination of sugar beet root using the sachr Le-Docta process. Int. Sugar J. 929 : 488-492 (C.F. sugar beet nutrition, Applied sciences publishers LTD, London, A.P. Draycott).

Mohamed, Alaa, I. B. 2004. Response of sugar beet plant to mineral and biological fertilization in North Delta. Ph.D. Thesis, Fac. of Agric., Al-Azhar Univ.

Nafei, A. I. 2004. Effect of nitrogen and boron fertilization levels on yield and quality of sugar beet grown in upper Egypt. Egypt. J. Appl. Sci., 19 (2) 48-57.

Ouda, Sohier, M.M. 2000. Effect of nitrogen fertilization with micronutrients on yield and quality of sugar beet in newly reclaimed land. Zagazig J. Agric. Res.27 (1).

Ouda, Sohier, M. M. 2001. Response of sugar beet to N and K fertilizers levels under sandy soil conditions. Zagazig J. Agric. Res., 28 (2): 275-297.

Ouda, Sohier, M. M. 2002. Effect of nitrogen and sulpher fertilization levels on sugar beet in newly cultivated sandy soil. Zagazig J. Agric. Res., 29 (1) : 33-50.

Ouda, Sohier, M. M. 2005. Yield and quality of sugar beet as affected by planting density and nitrogen fertilizer levels in the newly reclaimed soil. Zagazig J. Agric. Res., 32 (3) : 701-715.

Ramadan, B. S. H.; H. R. Hassan and Fatma A. Abdo. 2003. Effect of minerals and biofertilizers on phoo synthetic pigments, root quality, yield components and anatomical structure of sugar beet (*Beta vulgaris*, L.) plants grown under reclaimed soils. J. Agric. Sci., Mansoura Univ., 28 (7): 5139-5160.

Rizk, S.A.M.; M.A.M. Sherif; A. A. Sakr. 1995. Effect of nitrogen and boron supply in highly calcareous soil on the growth and yield of sugar beet. Zagazig J. Agric. Res. 22 (4) 1154-1166.

Saif, Laila M. 2000. Stepwise regression and path coefficient analysis for some sugar beet

characters under levels of boron and nitrogen fertilization. Pro. 9th Conf. Agron, Minufiy Univ., 1-2 Sept. 596-581.

Selim, S. H. H. 1998. Effect of some agricultural treatments on sugar beet (*Beta vulgaris*, L.) Ph. D. Thesis Fac. Agric. Mansoura Univ.

Snedecor, G. W. and W.G. Cochran. 1981. Statistical methods. Seventh Ed. Iowa State Univ. Press, Ames., Iowa, USA.

Sultan, M. S.; A. N. Attia; A. M. Salama; A. E. Sharief and E. H. Selim. 1999. Biological and mineral fertilization of sugar beet under weed control: 1- Sugar beet productivity, proc. 1st Intern. Conf. on sugar and Integrated Industries "present & Future", 15-18th Feb. Luxor, Egypt, (1):170-181.

تأثير النيتروجين الكيماوى والحيوى والبورون على محصول وجودة بنجر السكر

سهير محمود محمد عوده
معهد بحوث المحاصيل السكرية – مركز البحوث الزراعية
الجيزة – جمهورية مصر العربية

أقيمت تجربتان حقليتان خلال كل من موسمى الزراعة ٢٠٠٣/٢٠٠٤ و ٢٠٠٤/٢٠٠٥ بمحطة بحوث القصاصين بمحافظة الإسماعيلية وذلك لدراسة تأثير مستويين من السماد النيتروجينى : ٤٠، ٨٠ كجم ن / فدان وأربع معاملات من السماد النيتروجينى الحيوى والبورون (بدون إضافة سيريالين أو بورون ، سيريالين فقط، بورون فقط وسيريالين + بورون) بالمعدلات الموصى بها فى الأراضى الرملية على صفات المحصول والجودة لبنجر السكر صنف سلطان باستخدام تصميم القطع المنشقة مرة واحدة .

وفيما يلى أهم النتائج المتحصل عليها:

١- أدت زيادة معدل التسميد النيتروجينى إلى ٨٠ كجم ن /فدان إدى إلى زيادة معنوية فى كل من محصول الجذر طن/ فدان والعرش طن /فدان والسكر طن / فدان وكذلك طول الجذر وقطره / سم ووزن الجذر جم / نبات ، ووزن العرش جم / نبات والنسبة المئوية للمواد الصلبة الذائبة الكلية (T.S.S. %) .

٢-إضافة السيريالين أو البورون أو السيريالين + البورون يحسن صفات كل من وزن الجذر جم / نبات ، وزن العرش جم/ نبات ، محصول الجذور طن/ فدان ، محصول العرش طن /فدان ومحصول السكر طن/ فدان .

٣- بالنسبة لتأثير التفاعل بين عوامل الدراسة : يوصى البحث بأن إضافة السيريالين والبورون مع النيتروجين المعدنى أدى إلى زيادة معنوية فى محصول الجذور طن / فدان والسكر طن/فدان والعرش طن / فدان وجميع الصفات التكنولوجية لنبات بنجر السكر .