INFLUENCE OF BORON SOURCES ON YIELD AND QUALITY OF SOME SUGAR BEET VARIETIES.

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ABSTRACT

Two field experiments were carried out at El-Nubaria region, Alexandria Governorate conditions, Egypt in 2010 / 2011 and 2011 / 2012 seasons to study the effect of four boron sources i.e. control (tap water) , nitrite plancer at the rate of 2 liter / feddan, borax at the rate of 2 kg / feddan and nitrite plancer at the rate of 1 liter / feddan plus borax at the rate of 1 kg / feddan on yield and juice quality of three sugar beet varieties i.e. Pamella ,Top poly and Farida. The experiments were laid out in split plot design.

The obtained results showed that boron sources had a significant effect on root yield /feddan , sugar yield /feddan , TSS%, sucrose % and α amino nitrogen %, except potassium percentage and sodium percentage in both seasons. Sugar beet plants sprayed with nitrite plancer as boron source gave the highest values of root yield / feddan , sugar yield /feddan , TSS% ,sucrose% and & amino nitrogen as compared with other sources of boron in both seasons .

Results showed.clearly that sugar beet varieties significantly differed in root yield /feddan , sugar yield /feddan , TSS% and sucrose % in both season , on other hand insignificantly differed in K% , Na% and α amino nitrogen % in both season . Sugar beet variety Farida gave the highest value of root yield /feddan , sugar yield / feddan , TSS% and sucrose % as compared with the other two sugar beet varieties in both seasons.

The obtained results showed clearly that spraying sugar beet variety Farida by nitrate palancer gave the highest values of root and sugar yields per feddan, total soluble solids % , as well as sucrose and α amino nitrogen percentages, as compared with all other interactions in both seasons.

INTRODUCTION

Sugar beet (*Beta vulgaris*, L.) ranks as second important sugar crop in the worlds. . Recently, sugar beet has an important position in Egyptian crop rotation as a winter crop not only in the fertile soils, but also in poor saline, alkaline and calcareous soils. Whereas, it could be economically grown in

the newly reclaimed soil . The great importance of sugar beet crop in not only from it's ability to grown in the newly reclaimed areas as economic crop, but also for production higher of sugar under these conditions as compared with sugar cane. The Egyptian Government encourages sugar beet crop growers to bridge the gab between sugar production and consumption. One of these attempts is likely to be increasing sugar beet yield per unit area. Increasing of sugar beet production can be achieved through applying the optimizing agricultural practices i.e. good management program concerning high yielding varieties and treated with boron elements.

Boron plays vital role during the development of sugar beet roots. The presence of boron in the plants is essential to facilitate sugar transport within plant. All plants need boron for their regular growth. It is difficult to define a limit of resistance against boron for culture plants. In agriculture, boron minerals are used in biological growth, and control chemicals to improve or prevent the growth of vegetation; **Kalimeri and Pellumbi (1982) , Hassanein *et al* .,(1986) , El-Hawary (1994) , Bondok (1996) and El-Hawary (1999)** , reported that root yield , sugar yield , sucrose percentage significantly increased with spraying sugar beet plants with boron . **Moustafa and Omran,(2006))** , found that foliar spray with B or Mg significantly increased total soluble sugars, N, Mg and B uptake, juice quality (i.e., sucrose %, purity % and K as impurity, and sugar yields).

Tripathi *et al.*, (1986) indicated that sugar beet varieties had a great variation in sugar content and root yield (tons/fed). **El-Hennawy and El-Hawary (1995)** revealed that sugar beet varieties were clearly differed in root and sugar (tons/fed) as well as sucrose percentage. **El-Sayed (1997)** found wide variation among sugar beet varieties under the experiment in top, root, sugar yield (ton/fed) and sucrose percentage. **El-Hawary and Mokadem (1999)** reported that there was a magnitude variation among sugar beet varieties on all the studied characters in both seasons .Oscar poly sugar beet variety gave the highest values of relative water content. K/Na ratio, fresh root weight, relative root yield and yields of top, root and sugar than other Mg 561 and Prisma of sugar beet varieties.

The aim of the present investigation is to study the effect of different boron sources on yield and juice quality of some

sugar beet varieties at El-Nubaria region Alexandria Governorate conditions , Egypt.

MATERIALS AND METHODS

Two field experiments were carried out at the Experimental farm of El-Nubaria Agriculture Research Station, Alexandria Governorate conditions, Egypt in 2010 / 2011 and 2011 / 2012 seasons to study the effect of four boron sources on yield and juice quality of three sugar beet varieties. Chemical and mechanical analysis of the soil at the experimental site according to the standard method of **Page (1982)** and **Arnold (1986)** are presented in Table (1).

Table (1): Chemical and mechanical analysis of the experimental sites in 2010/2011 and 2011/2012 seasons.

Soil analysis	Season	
	2010/2011	2011/2012
A- Chemical analysis:		
PH	7.19	7.48
E.C.	1.41	1.58
Total N%	0.41	0.43
Available P (ppm)	13.03	12.96
Available Zn (ppm)	5.35	5.27
Available K (ppm)	1.41	1.22
B- Mechanical analysis:		
Sand %	42 %	40%
Silt %	33%	37%
Clay %	25%	23%
Soil texture	Sandy	Sandy

Studied Factors:

A – Boron sources treatments:

1- Control, spraying sugar beet plants with tap water.

2- Spraying sugar beet plants with nitrite plancer **(B 11.7% and Mo 0.007%)** at the rate of 2 liter / feddan.

3- Spraying sugar beet plants with borax at the rate of 2 kg / feddan.

4- Spraying sugar beet plants with nitrite plancer at the rate of 1 liter / feddan plus borax at the rate of 1 kg / feddan.

All sugar beet plants were sprayed by boron sources treatments at one month before harvesting .

B- Sugar beet varieties:

Three sugar beet varieties studied were as following:

1- Pamella 2- Top poly 3- Farida

The experiments were laid out in a split plot design with three replications. The main plots were devoted to boron sources and sub plots were allocated to sugar beet varieties. The area of each sub plot was 21 m^2 (10.00 rows x 0.60 m width x 3.5 m long).

Friuts of sugar beet were sown on18th and 22nd October by hand sown in hills 20 cm apart in 2010 / 2011 and 2011 / 2012 seasons, respectively. All other agronomic practices were followed as usually done for the sugar beet crop.

At harvest time after 190 days from sowing plants of the six middle rows were harvested to determine the following data:

1- Root yield / feddan (tons).
2- Sugar yield / feddan (tons).
3- Root sucrose percentage.
4- Total soluble solids percentage
5- Root potassium percentage.
6- Root sodium percentage.
7- Alpha amino nitrogen percentage.

The data were statistically analyzed according to **Gomeze and Gomeze (1984).**

RESULTS AND DISCUSSION

Average root yield feddan , sugar yield feddan ,total soluble solids percentage (TSS%), sucrose percentage ,potassium percentage ,sodium percentage and & amino nitrogen percentage of the three sugar beet varieties as affected by boron sources and their interaction are shown in Tables 2 to 7 .

Results recorded Tables (2- 8) indicate that boron source had a significant effect on all studied traits, except potassium percentage and sodium percentage in both seasons. Sugar beet plants sprayed with nitrite plancer gave the highest value of root yield / feddan (32.40 and 32.28 tons) , sugar yield /feddan (6.30 and 6.19 tons) , TSS% (21.30 and 21.67%) ,sucrose% (19 .45 and 19 .16 %) and & amino nitrogen (2.18 and 2.07 %) as compared with other treatments in 2010/2011 and 2011/2012 reasons, respectively .

The increase in sugar yield /feddan caused by nitrite plancer may be attributed to the enhancing of root yield /feddan and sucrose percentage (Tables 2 and 4), therefore increasing sugar yield /feddan. These results are in harmony with those of

Bondok (1996) and El-Hawary (1999), Mustafa and Omran, (2006) and Hellal *et al.*, (2009).

Results presented in Tables (2-8) show clearly that sugar beet varieties significantly differed in root yield /feddan , sugar yield /feddan , TSS% and sucrose % in both season , but, insignificantly differed in K% , Na% and &amino nitrogen % in both season . Sugar beet variety Farida gave the highest value of root yield /feddan (30 .06 and 30.06 tons) , sugar yield / feddan (5.48 and 5.49 tons) , TSS% (20.23 and 20.25 %) and sucrose % (18.10 and 18.33%) compared to other sugar beet varieties in 2010/2011 and 2011/2012 seasons, respectively. On the contrary the lowest values were recorded with sugar beet variety Top poly and the corresponding values were (25.55 and 25.77 tons), (4.47 and 4.46 tons), (19.35 and 19.19%) and (17.34 and 17.22 %) in the same respect.

The superiority of sugar beet variety Farieda in sugar yield /feddan may be due to the fact that it have the highest root yield/feddan and sucrose % , hence it gave the highest sugar yield. These results are in agreement with those of **Tripathi *et al*** **(1986), El-Hennawy and El-Hawary (1995), El-Sayed (1997) and Bundinienė (2009).**

Results recorded in Tables (2-8) indicated that the interaction effect between boron source and sugar beet variety was significant on all studied trials in both seasons, except sodium percentage in 2011/2012 season. The obtained results show clearly that sprayed sugar beet variety Farida by nitrate palancer gave the highest values of root yield per feddan (35.50 and 34.23 tons), sugar yield per feddan (7.19 and 6.83 tons), total soluble solids (22.30 and 22.26 %) , sucrose percentage (20.26 and 19.96 %) as well as α amino nitrogen percentage (2.23 and 2.13 %) as compared with all other interactions in 2010/2011 and 2011/2012 seasons, respectively. While treated sugar beet variety Pamella with nitrate palancer gave the highest potassium percentage (6.43%) in the first season. Spraying variety Farieda with borax gave the highest sodium percentage 1.83 % in 2011/2012 season compared to all other interactions. On the other hand when untreated sugar beet variety Top poly by boron sucrose gave the lowest value of root yield/feddan 20.36 and 24.10 tons sugar yield/feddan 3.23 and 3.81 tons, TSS % 17.90 and 17.66 % as well as sucrose percentage 15.90 and 15.83 % compared to all other interactions in 2010/2011 and 2011/2012 seasons ,respectively.

Vice versa it had the highest Na % 1.93 % in 2011/2012 season.

Abido (2012) displayed that, the application of 80 ppm boron significantly improved root yield and its attributes and root quality, on contrarily harvest index was decreased.

Boron application increased root yield and sucrose concentration by 12.12% and 26.35%, respectively, decreasing k+, Na+, α amino nitrogen and molasses sugar compared with those of the control. They added, no significant differences were found to exist between boron application times. On the other hand, the highest root yield and sucrose concentration were obtained by spraying with 12‰ boric acid (**Armin and Asgharipour, 2012**).

Generally, it could be concluded that spraying sugar beet variety Farida with nitrate palancer as a boron source enhanced yield of root and sugar percentage under El-Nubaria conditions, Alexandria Governorate, Egypt.

Table 2: Average root yield/ fed (tons) of some sugar beet varieties as affected by the different boron source in 2010/2011 and 2011/2012 seasons

Boron source (B)	2010/2011 season				2011/2012 season			
	Variety (V)			Mean	Variety (V)			Mean
	Pamella	Top poly	Farieda		Pamella	Top poly	Farieda	
Control	22.06	20.36	24.80	22.40	25.43	24.10	25.56	25.03
Nitrite palancer	31.76	29.96	35.50	32.40	32.50	30.13	34.23	32.28
Borax	27.43	26.10	30.06	27.86	27.80	26.63	28.60	27.67
Nitrite palancer 50%+ borax 50%	28.06	26.16	29.90	28.04	25.63	22.23	30.76	26.21
Mean	27.33	25.64	30.06	27.67	27.84	25.77	29.78	27.80

L.S.D at 5% for:

Boron source (B)	0.597	0.460
Variety (V)	0.517	0.399
Interaction (B) × (V)	1.25	0.797

Table (3): Average sugar yield/ fed (ton) of some sugar beet varieties as affected by the different boron source in 2010/2011 and 2011/2012 seasons

Boron source (B)	2010/2011 season				2011/2012 season			
	Variety (V)			Mean	Variety (V)			Mean
	Pamella	Top poly	Farieda		Pamella	Top poly	Farieda	
Control	3.64	3.23	4.20	3.68	4.01	3.81	4.30	4.04
Nitrite palancer	6.11	5.64	7.19	6.30	6.03	5.71	6.83	6.19
Borax	4.96	4.61	5.63	5.06	4.97	4.52	5.27	4.92
Nitrite palancer 50%+ borax 50%	4.99	4.42	4.91	4.77	4.68	3.80	5.55	4.67
Mean	4.92	4.47	5.48	4.95	4.92	4.46	5.49	4.95

L.S.D at 5% for:

Boron source (B)	0.33	0.24
Variety (V)	0.35	0.32
Interaction (B) × (V)	0.47	0.55

Table 4: Average total soluble solids % of some sugar beet varieties as affected by the different boron source in 2010/2011 and 2011/2012 seasons

Boron source (B)	2010/2011 season				2011/2012 season			
	Variety (V)			Mean	Variety (V)			Mean
	Pamella	Top poly	Farieda		Pamella	Top poly	Farieda	
Control	18.70	17.90	19.10	18.57	17.86	17.66	18.83	18.12
Nitrite palancer	20.63	20.30	22.30	21.30	21.10	21.66	22.26	21.67
Borax	21.13	19.66	21.00	20.60	19.93	19.03	21.10	20.02
Nitrite palancer 50%+ borax 50%	18.50	18.90	18.50	18.63	20.20	18.40	18.80	19.13
Mean	19.74	19.35	20.23	19.77	19.77	19.19	20.25	19.73

L.S.D at 5% for:

Boron source (B)	0.513	0.520
Varieties (V)	0.458	0.444
Interaction (B) × (V)	0.916	0.888

Table 5: Average sucrose% of some sugar beet varieties as affected by the different boron source in 2010/2011 and 2011/2012 seasons

Boron source (B)	2010/2011 season				2011/2012 season			
	Variety (V)			Mean	Variety (V)			Mean
	Pamella	Top poly	Farieda		Pamella	Top poly	Farieda	
Control	16.53	15.90	16.96	16.46	15.84	15.83	16.83	16.15
Nitrite palancer	19.26	18.83.	20.26	19.45	18.56	18.96	19.96	19.16
Borax	18.10	17.70	18.76	18.18	17.90	17.00	18.46	17.78
Nitrite palancer 50%+ borax 50%	17.80	16.93	16.43	17.05	18.26	17.10	18.06	17.81
Mean	17.92	17.34	18.10	17.79	17.64	17.22	18.33	17.73

L.S.D at 5% for:

Boron source (B)	0.511	0.294
Variety (V)	0.443	0.254
Interaction (B) × (V)	0.885	0.508

Table 6: Average potassium percentage of some sugar beet varieties as affected by the different boron source in 2010/2011 and 2011/2012 seasons

Boron source (B)	2010/2011 season				2011/2012 season			
	Variety (V)			Mean	Variety (V)			Mean
	Pamella	Top poly	Farieda		Pamella	Top poly	Farieda	
Control	5.43	6.30	5.66	5.73	6.20	5.93	5.56	5.90
Nitrite palancer	6.43	5.73	5.76	5.97	6.03	6.06	5.93	6.01
Borax	6.20	5.16	6.26	5.87	5.40	5.70	6.10	5.73
Nitrite palancer 50%+ borax 50%	5.86	5.66	6.13	5.88	5.36	6.16	5.36	5.63
Mean	5.98	5.66	5.95	5.86	5.75	5.96	5.74	5.81

L.S.D at 5% for:

Boron source (B)	NS	NS
Variety (V)	NS	NS
Interaction (B) × (V)	0.527	0.551

Table 7: Average sodium percentage of some sugar beet varieties as affected by the different boron source in 2010/2011 and 2011/2012 seasons

Boron source (B)	2010/2011 season				2011/2012 season			
	Variety (V)			Mean	Variety (V)			Mean
	Pamella	Top poly	Farieda		Pamella	Top poly	Farieda	
Control	2.00	1.80	1.66	1.82	1.76	1.93	1.80	1.83
Nitrite palancer	1.66	1.66	1.56	1.63	1.80	1.76	1.56	1.71
Borax	1.70	1.73	1.60	1.67	1.80	1.50	1.83	1.71
Nitrite palancer 50%+ borax 50%	1.66	1.73	1.83	1.74	1.63	1.60	1.73	1.76
Mean	1.75	1.73	1.72	1.73	1.75	1.78	1.73	1.75
L.S.D at 5% for:								
Boron source (B)					NS		NS	
Variety (V)					NS		NS	
Interaction (B) × (V)					NS		0.236	

Table 8: Average α amino nitrogen of some sugar beet varieties as affected by the different boron source in 2010/2011 and 2011/2012 seasons

Foliar spraying	2010/2011 season				2011/2012 season			
	Variety (V)			Mean	Variety (V)			Mean
	Pamella	Top poly	Farieda		Pamella	Top poly	Farieda	
Control	2.00	2.03	1.73	1.92	2.16	2.06	1.97	2.06
Nitrite palancer	2.13	2.20	2.23	2.18	2.06	2.03	2.13	2.07
Borax	1.90	1.86	2.13	1.96	1.80	1.66	2.03	1.83
Nitrite palancer 50%+ borax 50%	2.20	1.73	2.13	2.03	1.76	1.90	1.73	1.80
Mean	2.05	1.96	2.05	2.02	1.95	1.91	1.96	1.94
L.S.D at 5% for:								
Boron source (B)					0.162		0.133	
Variety (V)					NS		NS	
Interaction (B) × (V)					0.28		0.23	

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الملخص العربى

تأثير مصادر البورون على المحصول و جودته فى بعض أصناف بنجر السكر

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اجريت تجربتان حقليتان بمنطقة النوبارية محافظة الاسكندرية خلال موسمى الزراعة ٢٠١٠/ ٢٠١١ و٢٠١١/ ٢٠١٢ لدراسة تأثير اربع مصادر للبورون وهى :- (كنترول بدون , نيتريت بلانسر بمعدل ٢ لتر / فدان , البوراكس بمعدل ٢ كجم / فدان , نيتريت بلانسر ١لتر / فدان + بوراكس ١ كجم / فدان) على ثلاثة اصناف من بنجر السكر وهى باميلا وتوب بولى وفريدا بأستخدام تصميم القطع المنشقة مره واحده .

أظهرت النتائج أن تأثير مصادر البورون كان معنوياً على محصول الجذور / فدان محصول السكر / فدان والنسبة المئوية للمواد الصلبة الذائبة وكذلك النسبة المئوية للسكروز ونسبة الألفا أمينو

نيتروجين ماعدا النسبة المئوية للصوديوم والنسبة المئوية للبوتاسيوم فى كلا موسمى الدراسة.حيث ادت معاملة رش نباتات بنجر السكر بالنيتريت بلانسر الى زيادة معنوية فى محصول الجذور / فدان ومحصول السكر / فدان والنسبة المئوية للسكروز والنسبة المئوية للمواد الصلبة الذائبة ونسبة الألفا أمينو نيتروجين مقارنة بمعاملات الرش الاخرى المدروسة فى كلا موسمى الدراسة .

اوضحت النتائج ان تأثير اصناف بنجر السكر كان معنوياً على كلا من محصول الجذور / فدان محصول السكر / فدان والنسبة المئوية للمواد الصلبة الذائبة وكذلك النسبة المئوية للسكروز فى كلا موسمى الدراسة وعلى الجانب الاخر كان غير معنوياً على كلا من النسبة المئوية للبوتاسيوم والنسبة المئوية للصوديوم ونسبة الألفا أمينو نيتروجين فى كلا موسمي الدراسة.
وقد أعطى الصنف فريدا أعلى محصول فى كلا من محصول الجذور / فدان ومحصول السكر / فدان والنسبة المئوية للمواد الصلبة الذائبة والنسبة المئوية للسكروز فى كلا موسمى الدارسة .
وعموماً توصى الدراسة بأن رش نباتات بنجر السكر صنف فريدا بالنيتريت بلانسر كمصدر للبورون اعطت أعلى محصول من الجذور / فدان وأعلى محصول سكر / فدان وكذلك النسبة المئوية للمواد الصلبة الذائبة والنسبة المئوية للسكروز ونسبة الألفا أمينو نيتروجين تحت ظروف منطقة النوبارية بمحافظة الاسكندرية .