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EFFECT OF FOLIAR SPRAYING TIMES AND LEVELS OF YEAST EXTRACT AND BORON ON PRODUCTIVITY AND QUALITY OF SUGAR BEET UNDER SANDY SOIL CONDITIONS

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ABSTRACT: In order to study the effect of foliar spraying times and levels of yeast extract and boron on productivity and quality of sugar beet cv. Hossam, a field experiment was carried out at Kalabsho Experimental Farm (sandy soil), Dakahlia Governorate, Sugar Crops Research Institute, Agricultural Research Center, Egypt, in two successive seasons of 2014/2015 and 2015/2016. Two experiment trails were laid-out in strip-split plot design with four replications. The vertical-plots were assigned with times of foliar application with yeast extract and boron (after 75 and 90 days from sowing). The horizontal-plots were occupied with foliar spraying with yeast extract levels *i.e.* without spraying (control treatment), spraying with 2, 4 and 6 g yeast/liter. The sub-plots were allocated to foliar spraying with boron levels (control, 100 and 200 mg boron/liter). The results showed that delaying spraying sugar beet plants with yeast extract and boron from 75 up to 90 days from sowing resulted in gradual and significant increases and recorded the highest value for each of root and top fresh and dry weights/plant, root dimensions, purity and sucrose percentages, root and sugar yields/fad., as well as the decrease in the values of sodium, potassium and α-amino nitrogen percentages of sugar beet juice. The best results of yield components, root juice quality parameters and yields were resulted from foliar spraying sugar beet plants with yeast extract at the rate of 6 g/liter in both seasons. The highest values of all aforementioned yield components, root juice quality parameters and yields were obtained as a result of spraying sugar beet plants with 200 mg boron/liter in both seasons. It can be recommended that spraying sugar beet plants after 90 days from sowing with 6 g yeast extract and 200 mg boron/liter to maximize sugar beet productivity and quality under the environmental conditions of sandy soils.

Key words: Sugar beet, foliar spraying times, yeast extract levels, boron levels, yields, quality, sandy soils.

INTRODUCTION

Nowadays, sugar beet crop (*Beta vulgaris* L.) has an importance position as a source for sugar production in Egypt. Sugar beet is a winter crop requires less amount of water and tolerates soil salinity too. Thus, it could be successfully grown in newly reclaimed areas of Northern Delta such as in Kalabsho region, Dakahlia Governorate. Improvement of sugar beet yield and quality can be achieved by optimizing the cultural practices such as foliar spraying times and concentrations with biostimulants like yeast extract and micronutrients such as boron.

Foliar fertilization with biostimulants and micronutrients is considering one of various techniques to improve fertilizer efficiency in order to increase productivity and improve quality of crop product. This procedure can improve nutrient utilization and lower environmental pollution through reducing the amount of fertilizer added to soil (**Romheld and El-Fouly, 1999**).

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Little information is available about the effect of application of yeast as biostimulants on the productivity and growth enhancement of sugar beet. **Ferweez and Abd El-Monem (2018)** indicated that time of yeast extract addition exhibited a significant effect on vegetative characters, quality properties of beet roots (sugar recovery (%), quality index (%), sugar loss (%), polarization (%), K, Na and α-N) and productivity traits of sugar beet (root yield and recoverable sugar yields/fad. .). On the contrary, **Awad and Moustfa (2014)** found that spraying times with yeast extract had no significant effect on beet productivity and quality characteristics.

The biostimulants like yeast extract characterized by its richness in protein (47%), carbohydrates (33%), nucleic acid (8%), as well as macro and micro-elements likes Na, Mg, K, P, S, Zn, Cu, Ni, Va and Li. In addition to thiamin, riboflavin pyridoxine, vitamins (B_1, B_2, B_3, B_5 and B_6), hormones and endogenous growth regulators (GA3 and IAA), folic acid and bitin acting as cofactors for over 60 enzymes, which catalyze many biochemical pathways involving amino acids and removing amino groups from amino acids to be used for energy that involved in several bioactivities. (**Nagodawithana, 1991; Mok and Mok, 2001**). So, yeast extract treatments as foliar application play a beneficial role in cell division and cell enlargement **(Natio *et al.*, 1981)**, synthesis of protein and nucleic acid and the formation of chlorophyll **(Castelfranco and Beale, 1983)**. Many researchers studied the effect of the foliar application of yeast, and they stated that yeast extract application significantly increased root and top fresh weights, root length, root diameter, TSS (%), sucrose (%) and apparent purity (%), top, root and gross sugar yields of sugar beet. This effect may be due to the role of yeast extract as a natural source of cytokinins, which has stimulated effects on cell division and enlargement as well as synthesis of protein nucleic acid and chlorophyll (**El-Tarabily, 2004; Shalaby and El-Nady, 2008; Essam *et al.*, 2012; Mohamed, 2012; Aly *et al.,* 2014; Awad and Moustfa, 2014; Abido and Ibrahim, 2017**). While, **Abdou (2015)** revealed that spraying sugar beet plants with yeast extract significantly increased yield and its components as well as root quality traits as compared to without yeast extract spraying, except root diameter and root juice apparent purity percentages.

In spite of cheapness of all micronutrients and its major roles in the field of crop production, Egyptian farmers usually don`t interest in its. Among micronutrients, boron (B) is a necessary for plant growth. It plays an important roles in cell wall synthesis, cell division, cell development, auxin and Indole acetic acid (IAA) metabolism, hormones development, synthesis of amino acids and proteins, regulation of carbohydrate metabolism, sugar transport, RNA metabolism and respiration. Boron is also probably more important than any other micronutrients in obtaining high quality and crop yield (**Marschner, 1995; BARI, 2006**). Although, boron is a trace element, but sugar beet have a higher requirement for boron more than other many crops. Where, an adequate boron supply severely decreased yield and quality of roots. Moreover, boron is essential for formation of new cells in meristems and translocation sugar to roots (**Loomis and Durst, 1992**). Foliar spraying sugar beet plants with boron at suitable rate depended on soil pH and soil boron content significantly increased root length and diameter, sucrose and juice purity percentages, root, top and sugar yields, at the same time decreased Na, K, α-amino N, loss sugar percentages, harvest index and loss sugar yield **(Gobarah and Mekki, 2005; Kirstek *et al.*, 2006; Knany *et al.*, 2009; Abido, 2012; Armin and Asgharipour, 2012; Abd El-Azez, 2014; El-Sheref, 2014; Abo-Steet *et al.*, 2015; Dewdar *et al.*, 2015; Mekdad, 2015; Abdel-Nasser and Ben-Abdalla, 2019)**, seeing as roots absorbed boric acid and the role of boron in chloroplast formation, sink limitations and changes in cell wall, which lead to secondary effects in plant metabolism, development, growth and yield with good quality. However, **Hellal *et al.* (2009)** reported that boron foliar application led to significant increase in both concentration and uptake of K, Fe, Mn, Zn in sugar beet.

Therefore, this experiment aimed to study the response of sugar beet cv. Hossam to foliar spraying times and levels of yeast extract and boron to achieve maximum productivity and quality under the environmental conditions of sandy soil in Kalabsho region, Dakahlia Governorate, Egypt.

MATERIALS AND METHODS

Two field experiments were carried out at Kalabsho Experimental Farm (as sandy soil), Dakahlia Governorate, Sugar Crops Research Institute, Agricultural Research Center, Egypt, during two successive winter seasons of 2014/2015 and 2015/2016. The main objective of this study was to determine the effect of foliar spraying times and levels of yeast extract and boron on sugar beet cv. Hossam productivity and quality under sandy soil conditions.

The experiments were laid-out in strip-split plot design with four replications. The vertical-plots were assigned with the two times of foliar application with yeast extract and boron viz. at 75 and 90 days from sowing (DFS).

The horizontal-plots were occupied with four levels of foliar spraying with yeast extract as follows:

1-Without spraying (control treatment).

2- Spraying with 2 g yeast/liter.

3-Spraying with 4 g yeast/liter.

4- Spraying with 6 g yeast/ liter.

The sub-plots were allocated to three levels of foliar spraying with boron in the form of boric acid as follows: 1- Without spraying (control treatment). 2- Spraying with 100 mg boron/ liter. 3- Spraying with 200 mg boron/ liter.

The foliar solution was completed to 200 liter/fad., and spraying was conducted by hand sprayer at the aforementioned times and levels until saturation point.

Soil experimental field was sandy in texture and its mechanical and chemical properties were shown in Table 1 according to methods described by **Jackson (1973)**. Each experimental basic unit included 5 ridges, each of 60 cm apart and 3.5 m long, comprising an area of 10.5 m^2 (1/400 fad.). The preceding summer crop was sorghum in both seasons.

The experimental field well prepared by two ploughings, leveling, compaction, division and then divided to the experimental units. Calcium superphosphate (15.5% P_2O_5) was applied during soil preparation at the level of 200 kg/fad. .

Experiments were sown at the first week of November in both growing seasons. Sugar beet was hand sown 3-5 balls (seeds)/hill using dry sowing method on one side of the ridge in hills 20 cm apart. Plants were thinned to one plant/ hill (35000 plants/fad.) at the age of 35 days from sowing. Nitrogen fertilizer at the rate of 100 kg N/fad., as urea (46.5% N) was applied in three equal doses, the 1^{st} was applied after thinning (35 days from sowing) and the 2^{nd} and 3^{rd} doses were applied before the third and fourth irrigations (21-days intervals). Potassium sulphate (48% K_2O) at a rate of 100 kg/fad., was applied with the 2^{nd} dose of nitrogen fertilizer. All recommended agricultural practices for growing sugar beet were applied by Sugar Crops Research Institute recommendations, ARC, Egypt, except the factors under study.

Studied Characters

Yield components

At harvest (210 days from sowing), five plants were chosen at random from the outer ridges of each sub-plot to determine yield components as follows:

1- Root length (cm).

2- Root diameter (cm).

3- Root fresh weight (kg/plant).

4- Root dry weight (kg/plant).

5- Top fresh weight (kg/plant).

6- Top dry weight (kg/plant).

To determine root and top dry weights, all plant fractions were air-dried, then oven dried at 105^0C till constant weight obtained.

Root Juice Quality Parameters

All root juice quality parameters were determined in Dakahlia Sugar Company, Bilkas Sugar Factory Laboratories, Dakahlia Governorate, Egypt. The root juice quality parameters were determined in fresh root using an automatic French System called (HYCEL) as follows:

1- Sodium percentage (%).

2- Potassium percentage (%).

3- α-amino nitrogen percentage (%).

4- Sucrose percentage (%).

5- Quality percentage (%).

Table 1. Mechanical and chemical properties of the experimental site in 2014/2015 and 2015/2016 seasons

Season	Sand (%)	Silt (%)	Clay (%)	Texture	$CaCO_3$ (%)	EC dS m^{-1}	pH	OM (%)	Available Boron (mg kg^{-1})	Available mg L^{-1} N	P	K
2014/2015	92.08	4.54	3.38	Sandy	0.81	2.81	7.83	0.21	0.20	18.25	2.73	81.00
2015/2016	91.88	4.6	3.52	Sandy	0.72	2.85	7.95	0.19	0.22	17.35	2.55	80.00

Yields

Plants produced from the three inner ridges of each sub-plot at harvesting time were collected and cleaned, and then roots and tops were separated and weighted in kilograms and converted to estimate:

1- Root yield (ton/fad.).

2- Sugar yield (ton/fad.). It was calculated by multiplying root yield by sucrose percentage.

All obtained data were statistically analyzed according to the technique of analysis of variance (ANOVA) for the strip-split plot design as published by **Gomez and Gomez (1984)**, using MSTAT statistical package (MSTAT-C with MGRAPH version 2.10, Crop and Soil Sciences Department, Michigan State University, USA). Least significant difference (LSD) method was used to test the differences among treatment means at 5% level of probability as described by **Snedecor and Cochran (1980)**.

RESULTS AND DISCUSSION

Times of Foliar Spraying Effect

Results listed in Tables 2, 3 and 4 clear that, foliar spraying times with yeast extract and boron markedly affected yield components, root juice quality parameters and yields of sugar beet in both seasons, with exception top dry weight in the second season and quality percentage in the first season. Delaying spraying sugar beet plants with yeast extract and boron from 75 up to 90 days from sowing resulted in gradual significant increases and the highest value for each of root and top fresh and dry weights/plant, root dimensions (length and diameter), quality and sucrose percentages in juice, root and sugar yields/fad., and the lowest value for each of sodium, potassium and α-amino nitrogen percentages of sugar beet juice in both seasons. On the other side, spraying sugar beet plants with yeast extract and boron at 75 days from sowing resulted in gradual significant increases and the maximum values of sodium, potassium and α-amino nitrogen percentages of sugar beet juice and the minimum values of root and top fresh and dry weights/plant, root dimensions (length and diameter), quality and sucrose percentages in juice, root and sugar yields/fad. , in both seasons. The enhancement in yield components, root juice quality parameters and yields associated with the delay of yeast extract and boron foliar application up to 90 days from sowing may be due to the fact that delaying spraying sugar beet plants with yeast extract and boron increased the period of duration life that beet plants can grow well using of yeast extract and boron, where beet plants tended to increase its vegetative growth and photosynthates, which translocated to roots. **Ferweez and Abd El-Monem (2018)** confirmed these results whom stated that time of yeast extract addition exhibited a significant effect on vegetative characters, physical and chemical constituents and productivity of sugar beet. While, converse results were stated by **Awad and Moustfa (2014)**.

Yeast Extract Levels Effect

Foliar spraying with yeast extract (as biostimulants) levels *i.e.* without spraying (control treatment), spraying with 2, 4 and 6 g yeast/liter spraying water significantly affected yield components *i.e.* root and top fresh and dry weights/plant and root dimensions (Table 2), root juice quality parameters *i.e.* sodium, potassium, α-amino nitrogen, quality and sucrose percentages of sugar beet juice (Table 3) and yields *i.e.* root and sugar yields/fad., (Table 4) in both seasons. The obtained results indicated that all aforementioned characters were increased

Table 2. Root and top fresh and dry weights/plant and root dimensions of sugar beet as affected by foliar spraying times of yeast extract and boron levels during 2014/2015 and 2015/2016 seasons

Main effect and interaction	Root fresh weight (kg/plant)		Root dry weight (kg/plant)		Top fresh weight (kg/plant)		Top dry weight (kg/plant)		Root length (cm)		Root diameter (cm)	
Season	2014/ 2015	2015/ 2016	2014/ 2015	2015/ 2016	2014/ 2015	2015/ 2016	2014/ 2015	2015/ 2016	2014/ 2015	2015/ 2016	2014/ 2015	2015/ 2016
A - Times of spraying												
75 days from sowing	0.685	0.668	0.191	0.187	0.249	0.232	0.029	0.055	21.08	19.36	12.36	10.64
90 days from sowing	0.756	0.761	0.211	0.210	0.279	0.264	0.033	0.078	21.64	19.90	12.49	10.78
F. test	*	*	*	*	*	*	*	NS	*	*	*	*
B- Yeast extract levels												
Without	0.626	0.639	0.175	0.178	0.225	0.209	0.027	0.057	20.32	18.60	10.62	8.91
2 g\L	0.685	0.680	0.191	0.190	0.251	0.235	0.030	0.064	21.15	19.36	12.35	10.68
4 g\L	0.727	0.719	0.203	0.198	0.268	0.252	0.032	0.068	21.74	20.02	12.84	11.08
6 g\L	0.844	0.820	0.236	0.229	0.312	0.295	0.037	0.079	22.22	20.54	13.88	12.16
F. test	*	*	*	*	*	*	*	*	*	*	*	*
$LSD_{0.05}$	0.021	0.028	0.010	0.011	0.003	0.003	0.002	0.02	0.40	0.41	0.02	0.06
C- Boron levels												
Without	0.623	0.626	0.174	0.176	0.227	0.212	0.027	0.057	16.95	15.22	11.67	9.95
100 mg/L	0.757	0.748	0.212	0.205	0.278	0.262	0.033	0.070	23.48	21.76	12.73	10.99
200 mg/L	0.781	0.769	0.218	0.215	0.287	0.270	0.034	0.073	23.65	21.91	12.87	11.18
F. test	*	*	*	*	*	*	*	*	*	*	*	*
$LSD_{0.05}$	0.019	0.024	0.008	0.010	0.002	0.003	0.002	0.002	0.34	0.36	0.02	0.05
D- Interactions												
A × B	*	NS	*	NS	*	NS	NS	NS	NS	NS	*	*
A × C	*	NS	*	NS	*	*	NS	*	*	NS	*	NS
B × C	*	*	*	*	*	*	*	*	NS	NS	*	*
A × B × C	*	NS	*	NS	*	*	NS	NS	*	*	*	NS

Where; * and NS refers to significant and not significant at 0.05 level of significance, respectively.

Table 3. Sodium, potassium, α-amino nitrogen and quality percentages of sugar beet juice as affected by foliar spraying times of yeast extract and boron levels during 2014/2015 and 2015/ 2016 seasons

Main effect and interaction	Sodium (%)		Potassium (%)		α-amino nitrogen (%)		Quality (%)	
Season	2014/ 2015	2015/ 2016	2014/ 2015	2015/ 2016	2014/ 2015	2015/ 2016	2014/ 2015	2015/ 2016
A - Times of spraying								
75 days from sowing	4.37	4.00	6.70	5.76	1.884	1.576	79.61	80.83
90 days from sowing	3.64	3.27	4.39	3.44	1.530	1.224	82.94	82.48
F. test	*	*	*	*	*	*	NS	*
B- Yeast extract levels								
Without	4.29	3.92	6.15	5.22	1.837	1.530	72.06	74.90
2 g\L	4.05	3.69	5.67	4.72	1.748	1.441	82.47	82.03
4 g\L	3.91	3.54	5.28	4.34	1.674	1.367	84.84	84.41
6 g\L	3.78	3.41	5.08	4.12	1.569	1.262	85.74	85.29
F. test	*	*	*	*	*	*	*	*
$LSD_{0.05}$	0.06	0.06	0.14	0.13	0.031	0.030	2.08	1.88
C- Boron levels								
Without	4.06	3.69	5.70	4.74	1.728	1.421	78.50	78.04
100 mg/L	4.01	3.64	5.55	4.61	1.704	1.397	80.33	82.35
200 mg/L	3.95	3.58	5.38	4.45	1.689	1.382	85.01	84.58
F. test	*	*	*	*	*	*	*	*
$LSD_{0.05}$	0.05	0.05	0.12	0.11	0.027	0.026	1.90	1.63
D- Interactions								
A × B	*	NS	*	*	NS	NS	NS	NS
A × C	NS	NS	NS	NS	NS	NS	NS	NS
B × C	NS	NS	NS	NS	NS	NS	NS	*
A × B × C	NS	NS	NS	NS	NS	NS	NS	NS

Where; * and NS refers to significant and not significant at 0.05 level of significance, respectively.

Table 4. Sucrose percentage in juice, root and sugar yields/fad., of sugar beet as affected by foliar spraying times of yeast extract and boron levels during 2014/2015 and 2015/2016 seasons

Main effect and interaction	Sucrose (%)		Root yield (ton/fad.)		Sugar yield (ton/fad.)	
Season	2014/ 2015	2015/ 2016	2014/ 2015	2015/ 2016	2014/ 2015	2015/ 2016
A - Times of spraying						
75 days from sowing	19.60	18.21	16.425	16.035	3.230	2.926
90 days from sowing	20.41	19.04	18.158	18.270	3.723	3.490
F. test	*	*	*	*	*	*
B- Yeast extract levels						
Without	19.20	17.81	15.011	15.332	2.894	2.741
2 g\L	19.94	18.60	16.450	16.323	3.287	3.043
4 g\L	20.34	18.95	17.439	17.264	3.554	3.274
6 g\L	20.54	19.15	20.267	19.690	4.171	3.774
F. test	*	*	*	*	*	*
LSD $_{0.05}$	0.28	0.26	0.038	0.041	0.050	0.061
C- Boron levels						
Without	19.51	18.12	14.958	15.032	2.935	2.735
100 mg/L	20.14	18.71	18.175	17.957	3.668	3.365
200 mg/L	20.36	19.05	18.742	18.467	3.827	3.524
F. test	*	*	*	*	*	*
LSD $_{0.05}$	0.24	0.22	0.033	0.028	0.043	0.056
D- Interactions						
A × B	NS	NS	*	*	*	*
A × C	NS	NS	*	*	*	*
B × C	NS	NS	*	*	*	*
A × B × C	NS	NS	*	*	*	*

Where; * and NS refers to significant and not significant at 0.05 level of significance, respectively.

due to foliar spraying with yeast extract at different levels (2, 4 and 6 g yeast/liter) as compared with control treatment in both growing seasons. The highest results of these characters were resulted from foliar application sugar beet plants with yeast extract at the rate of 6 g yeast/liter in both growing seasons. While, foliar spraying with yeast extract at the rate of 4 g yeast/liter came in the second rank, followed by foliar spraying with yeast extract at the rate of 2 g yeast/liter and finally control treatment in both seasons.

It could be noticed that foliar spraying with yeast extract at the rate of 6 g yeast/liter significantly increased root fresh weight/plant (by 15.08, 21.90 and 31.54%), root dry weight/ plant (by 15.96, 22.05 and 31.73%), top fresh weight/plant (by 16.73, 24.90 and 39.86%), top dry weight/plant (by 16.00, 23.40 and 38.10%), root length (by 2.39, 5.55 and 9.87%), root diameter (by 8.86, 13.07 and 33.33%), quality (%) (by 1.05, 3.97 and 16.38%), sucrose (%) (by 1.02, 2.98 and 7.24%), root yield/fad., (by 15.14, 21.92 and 31.68%) and sugar yield/fad., (by 16.36, 25.51 and 40.99%) and decreased sodium (%) (by 3.49, 7.11 and 12.42%), potassium (%) (by 4.37, 11.45 and 19.09%), α-amino nitrogen (%) (by 6.91, 11.23 and 15.92%), as an average over both growing seasons as compared with foliar application with 4 and 2 g yeast/liter and control treatment, respectively.

The substantial effect of foliar spraying of sugar beet plants with yeast extract on yields and its attributes and quality may be ascribe to yeast extract plays a vital role as inductor of endogenous hormones, rich sources of phytohormones (cytokinins), vitamins, enzymes, amino acids and minerals (**Natio *et al.*, 1981; Mok and Mok, 2001**). Also yeast extract had beneficial effects on the processes of cell division, the synthesis of protein and nucleic acid and chlorophyll formation (**Castelfranco and Beale, 1983**). These findings are in a good line with those confirmed by **Essam *et al.* (2012), Mohamed (2012), Aly *et al.* (2014), Awad and Moustfa (2014), Abdou (2015) and Abido and Ibrahim (2017)**.

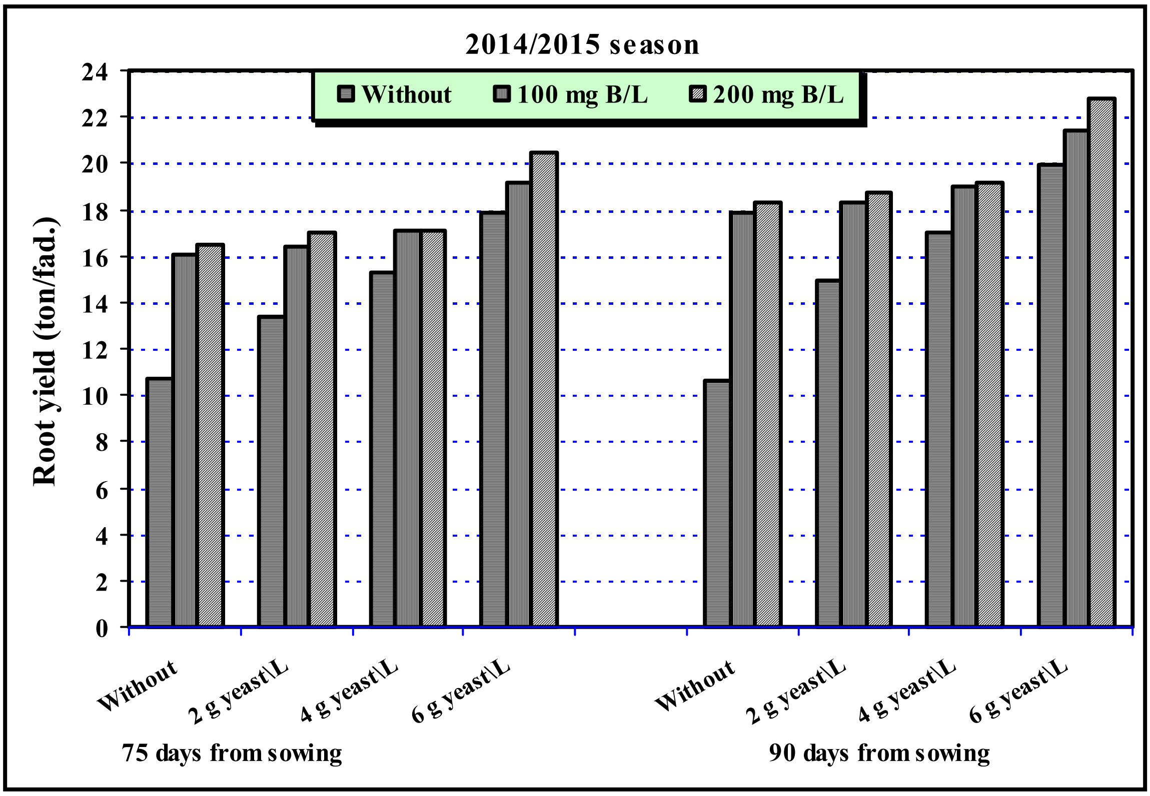
Boron Levels Effect

Foliar spraying sugar beet plants with boron levels (without spraying, spraying with 100 and 200 mg boron/liter) significantly affected yield components *i.e.* root and top fresh and dry weights/plant and root dimensions (Table 2), root juice quality parameters *i.e.* sodium, potassium, α-amino nitrogen, quality and sucrose percentages of sugar beet juice (Table 3) and yields *i.e.* root and sugar yields/fad. (Table 4) in both seasons. It could be observed that spraying sugar beet plants with 100 and 200 mg boron/ liter caused a gradual increases in all aforementioned characters compared with control treatment in the two growing seasons. The highest values of all studied yield components, root juice quality parameters and yield were obtained as a result of spraying sugar beet plants with 200 mg boron/liter in both seasons under the environmental conditions of studied region. In addition, spraying sugar beet plants with 100 mg boron/liter ranked after previously mentioned treatment in the two growing seasons. On the other hand, control treatment (without spraying with boron) gave the lowest values of these characters in both seasons.

The desirable effect of spraying sugar beet plants with boron may be ascribed to the role of boron in cell wall synthesis, cell division and development, auxin and IAA metabolism, hormones development, synthesis of amino acids and proteins, regulation of carbohydrate metabolism, sugar transport, RNA metabolism and respiration. Boron is also probably more important than any other micronutrients in obtaining high quality and crop yields (**Marschner, 1995, BARI, 2006). Abd El-Azez (2014), El-Sheref (2014), Abo-Steet *et al.* (2015), Dewdar *et al.* (2015), Mekdad (2015) and Abdel-Nasser and Ben-Abdalla (2019)** they pointed out that foliar spraying sugar beet plants with boron significantly increased yield components, root juice quality parameters and yields.

Effect of Interactions

There are many significant effects of the interactions among studied factors (foliar spraying times and levels of yeast extract and boron) on the studied yield components, root juice quality parameters and yields as presented in Tables 2, 3 and 4.



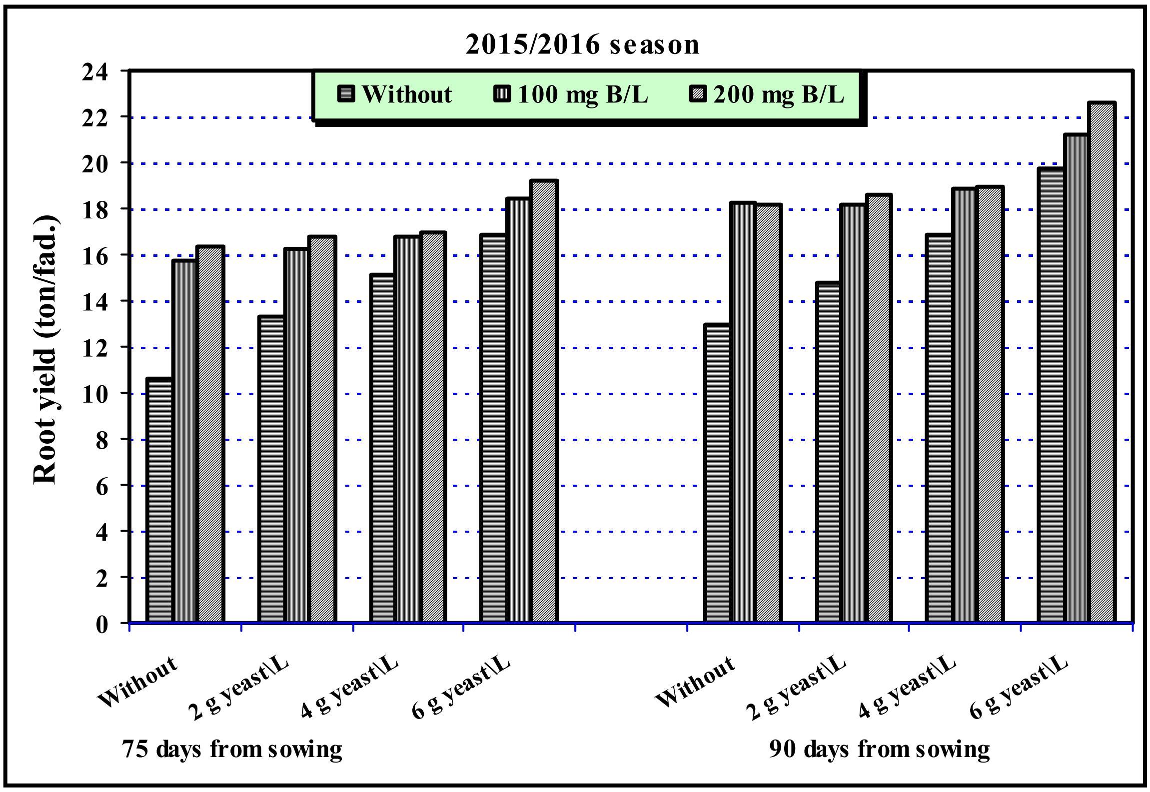


Fig. 1. Root yield/fad., of sugar beet as affected by the interaction among foliar spraying times and levels of yeast extract and boron during 2014/2015 and 2015/2016 seasons

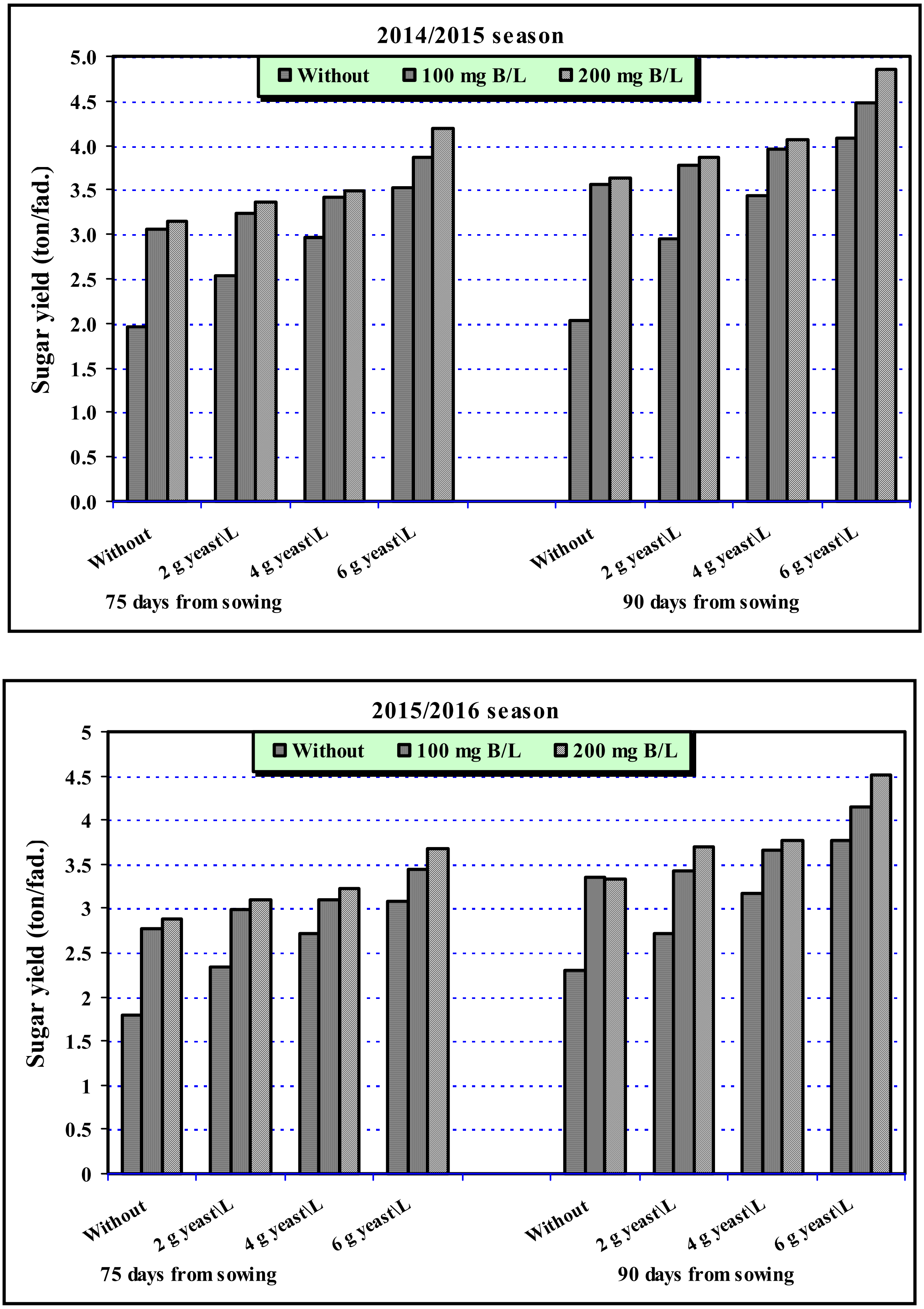


Fig. 2. Sugar yield/fad., of sugar beet as affected by the interaction among foliar spraying times and levels of yeast extract and boron during 2014/2015 and 2015/2016 seasons

Concerning the second order interaction among foliar spraying times and levels of yeast extract and boron on root and sugar yields in both seasons as accessible in Table 4, the results cleared that the highest values of root yield/fad. (Fig. 1) and sugar yield/fad., (Fig. 2) were produced from spraying sugar beet plants after 90 days from sowing with 6 g yeast/liter in addition to 200 mg boron/liter in both seasons of 2014/2015 and 2015/2016. The second best interaction treatment that increased sugar beet root and sugar yields was spraying sugar beet plants after 90 days from sowing with 6 g yeast extract besides 100 mg boron/liter, followed by spraying sugar beet plants after 75 days from sowing with 6 g yeast extract and 200 mg boron/liter in both seasons. While, the lowest value for each of root and sugar yields were resulted from control treatment (without spraying sugar beet plants with yeast extract and boron) in both seasons.

Conclusion

Maximum sugar beet yield components, root juice quality parameters and yield were achieved by spraying sugar beet plants after 90 days from sowing with 6 g yeast extract plus 200 mg boron/liter under the environmental conditions of sandy soil in Kalabsho region, Dakahlia Governorate, Egypt.

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تأثير مواعيد ومستويات الرش الورقى بالخميرة والبورون على إنتاجية وجودة بنجر السكر تحت ظروف الأراضى الرملية

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من أجل دراسة تأثير مواعيد ومستويات الرش الورقى بالخميرة والبورون على إنتاجية وجودة محصول بنجر السكر صنف حسام، تم إجراء تجربتين حقليتين بالمزرعة البحثية بمنطقة قلابشو (كمثال للتربة الرملية)، محافظة الدقهلية، معهد بحوث المحاصيل السكرية، مركز البحوث الزراعية، مصر، خلال موسمى ٢٠١٥/٢٠١٤ و ٢٠١٦/٢٠١٥، وقد صممت التجارب في تصميم الشرائح المتعامدة المنشقة فى أربع مكررات، تم تخصيص الشرائح الرأسية لمواعيد الرش الورقى بالخميرة والبورون (بعد ٧٥ و ٩٠ يومًا من الزراعة)، بينما احتلت الشرائح الأفقية الرش الورقي بمستويات الخميرة وهى؛ بدون رش (معاملة المقارنة)، والرش بالخميرة بتركيز ٢ ، ٤ و ٦ جم/لتر ماء، كما تم تخصيص القطع المنشقة للرش الورقي بمستويات البورون (بدون رش، والرش بتركيز ١٠٠ و ٢٠٠ ملجم بورون/لتر ماء)، أظهرت النتائج المتحصل عليها أن تأخير رش نباتات بنجر السكر بالخميرة والبورون من ٧٥ إلى ٩٠ يومًا من الزراعة أدى إلى الحصول على أعلى القيم لصفات الوزن الطازج والجاف للجذور والعروش، طول وقطر الجذر، النسبة المئوية للنقاوة والسكروز، محصول الجذور والسكر للفدان وأقل نسبة مئوية للصوديوم والبوتاسيوم وألفا أمينو نيتروجين فى عصير جذور بنجر السكر، تم الحصول على أفضل النتائج لمكونات المحصول وصفات جودة عصير الجذور نتيجة للرش الورقى لنباتات بنجر السكر بالخميرة بمعدل ٦ جم/لتر ماء، يليها الرش الورقي بالخميرة بمعدل ٤ جم/لتر ماء، ثم الخميرة بمعدل ٢ جم/لتر ماء وأخيرا معاملة المقارنة في كلا الموسمين، كما تم الحصول على أعلى القيم لجميع مكونات المحصول المدروسة، وصفات جودة عصير الجذور ومحصولي الجذور والسكر نتيجة للرش الورقى لنباتات بنجر السكر بـ ٢٠٠ ملجم بورون/لتر ماء، يليها الرش بـ١٠٠ ملجم بورون/لتر، وأخيرا معاملة المقارنة (بدون رش ورقى بالبورون) في كلا الموسمين، من النتائج المتحصل عليها في هذه الدراسة يوصى بالرش الورقى لنباتات بنجر السكر بعد ٩٠ يومًا من الزراعة بالخميرة بمعدل ٦ جم/لتر ماء بالإضافة للرش الورقى بالبورون بمعدل ٢٠٠ ملجم/لتر ماء لزيادة إنتاجية وجودة بنجر السكر تحت الظروف البيئية فى التربة الرملية.

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