EFFECT OF BORON AND MOLYBDENUM ON GROWTH AND YIELD OF SOME SUGAR BEET VARIETIES

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Abstract

Two field experiments were conducted in Sakha Research Station, Kafr El-Sheikh, Agricultural Research Center during 2002/2003 and 2003/2004 seasons to investigate the effect of boron and molybdenum fertilizer levels on yield and quality of some sugar beet varieties. This study included 27 treatments which were the combination between three sugar beet varieties (Montebianco, Kawemira and Gloria), three boron fertilizer levels (zero, 0.50 and 1.00 kg B/fed) and three levels of molybdenum fertilizer levels (zero, 0.25 and 0.50 kg Mo/fed).

Treatments were arranged in a split plot design with three replications. Varieties were allocated in the main plots and the combination between levels of boron and molybdenum were assigned at random within the sub-plots.

Results could be summarized as follows:

Montebianco variety surpassed in root dimensions, root and top yields over the other varieties in the two seasons and their combined data. In both seasons and the combined data, respectively, appling 1.00 kg B/fed significantly increased root dimensions as well as sugar yield by 8.6 %, 9.7 % and 7.37 % and top yield by 13.83 % and 20.12 % over the control by increasing the level of boron to 0.50 and 1.00 kg B/fed in both seasons and the combined data, respectively. Appling 0.50 kgMo/fed significantly increased root dimensions as well as top and root fresh weight/plant as well as root yield by 6.17, 5.57 and 5.85% and sugar yield by 16.81, 14.53 and 15.79% and top yield by 11.82 and 23.30% by increasing the level of boron to 0.50 and 1.00 kg B/fed over the control.

INTRODUCTION

Sugar beet variety is one of the most important factors that directly affects the production of root yield. Low availability of microelements resources represents the main problem affecting agricultural development in the arid and semi-arid regions. The proper application of different microelements resources is needed. The present work was conducted to find out the relative importance of two micro-elements (Boron and Molybdenum) to some sugar beet varieties in relation to growth criteria and yield and its components. Nemeat Alla (1997) found that foliar spray with 1 g boric acid and 1 g molybdate ammonium solutions in combination surpassed in root length, root diameter, dry weight of plants, top, root and sugar yields and higher growth rate

compared with the untreated plants. Saif (2000) treated sugar beet variety Kawemira with four levels of boron (zero, 0.5, 1, and 1.5 kg B/fed). She found that the applied doses of boron fertilizer produced significant effect on root fresh weight yield, and 0.5 kg. B/fed. raised root fresh weight yield by 43.9 %, 23.4% and 32.6% over this of unfertilized treatment in the 1st and 2nd seasons and their combined data, respectively. El-Geddawy, *et al.* (2001) pointed out that sugar beet variety Lola attained superiority over the other three studied varieties with respect to root and sugar yields. Al-Labbody (2003) found significant differences among ten multigerm varietries (Toro, Lados, Vital, Gloria, Pamela, Del 937, Del 938, Del 939, kawemira and Athos poly) and five monogerm varieties (Marathon, Rhopsodie, Tellus, Vital and Helis), root traits (root length, root diameter and root fresh weight), top dry weight and root/top ratio, top, root and sugar yields. Shalaby (2003) studied the performance of six sugar beet varieties (Del 936, 937, 938 and 939, Desperespoly and Demapoly). Demapoly variety surpassed the other varieties in root length, root diameter, root and top fresh weight. Osman, *et al.* (2003) found that increasing the level of boron up to 2 kg B/fed increased leaf area, leaf area index, total dry weight, assimilation rate, root/top ratio, root length and sugar yield. He found that Gloria variety had the highest value of total dry weight of leaves compared with the other varieties, whereas Toro variety had the highest value of root length. Nafei (2004) indicated that root length (in the 2nd season only) and sugar yield were significantly increased as boron level was increased from zero to 0.50 kg sodium borate/fed, However, root fresh weight and root yield were significantly influenced by B rates added to sugar beet plants. Osman, *et al.* (2004) concluded that increasing the level of B increased significantly leaf area index, leaf area, root length, root fresh weight, the biological yield, root and sugar and top yields. Ali (2005) studied the performance of three sugar beet varieties (KWS-9422, Pamela, Recolta-poly). Pamela variety had the highest values of root length, root diameter, root and top fresh weight/plant, root, top and sugar yields however variety KWS-9422 gave the lowest ones.

MATERIALS AND METHODS

Two field trials were carried out in Sakha Agricultural Research Station, Kafr EL-Sheikh Governorate on sugar beet crop in two successive seasons of 2002/2003 and 2003/2004. Each experiment included 27 treatments which were the combination between three varieties of sugar beet (Montebianco, Gloria, Kawemira), three boron fertilizer levels (zero, 0.50 and 1.00 kg/fed) which applied as sodium borate ($Na_2B_4O_7.10\ H_2O$) (11% B) and three molybdenum fertilizer levels (zero, 0.25 and 0.50 kg/fed) which applied as ammonium molybdate $(NH_4)_6\ Mo_7\ O_{24}.\ 4\ H_2O$ (54% Mo).

The experiments were laid out in a split plot design with three replications, where varieties were allocated in the main plots and the combination between boron and molybdenum levels were distributed at random in the sub-plots. All micronutrients treatments were added singly or in combination with each other and were mixed with an appropriate amount of sand and applied once as soil application with the second dose of nitrogen fertilizer (after 75 days from sowing).

Nitrogen fertilizer was applied at the rate of 80 kg N/fed as Urea (46% N), in two equal doses, the first one after thinning (45 days from sowing) and the second one month later. Phosphorus fertilizer at 30 kg P_2O_5/fed as calcium super phosphate at the rate of (15 % P_2O_5) and potassium fertilizer at 48 kg K_2O/fed as potassium sulphate at the rate of (48% K_2O) were applied in both seasons. Phosphorus fertilizer was applied at seedbed preparation, whereas potassium fertilizer was applied once with the first dose of nitrogen.

Plot area was 17.5 m^2 (5 ridges which were 7 meter in length, 50 cm in width and 20 cm between hills). Sowing date was on the 5th of October in both seasons and harvesting date was after 7 months.

The preceding crop was rice in both seasons. Other agricultural practices were done as recommended by Sugar Crops Research Institute (SCRI). The mechanical and chemical analysis of the experimental soil is presented in Table (1).

Table 1. Mechanical and chemical analysis of the experimental soil (2002/2003 and 2003/2004 seasons)

Season	2002/2003	2003/2004
Soil depth (cm)	0-30	0-30
Mechanical analysis		
Sand %	26.75	33.50
Silt %	40.90	38.80
Clay %	31.30	26.50
Chemical analysis in soil extraction		
a) Cations mg/L		
Ca^{++}	0.18	0.16
Na^{+}	0.22	0.42
K^{+}	0.08	0.16
b) Anions mg/L		
Cl^{-}	0.15	0.18
SO_4^{--}	0.10	0.13
$CaCO_3$	0.15	0.21
HCo_3^{-}	1.25	1.18
Available B ppm	0.41	0.45
Available Mo ppm	9.55	10.00
Available N ppm	38.20	39.40
Available P ppm	18.20	19.80
Available K ppm	395.2	385.40
pH	8.00	8.20
E.C ds m	2.18	2.25

Soil physical and chemical properties were determined according to Jackson (1956).

Data recorded:

I. Growthtraits and juice quality:

At harvest (210 days from sowing), samples of five plants were taken at random from each sub plot to determine the following:

1. Root length (cm).
2. Root diameter (cm).
3. Root fresh weight /plant (g).
4. Top t fresh weight /plant (g).

II. Yield and its components:

Sugar beet plants of the guarded rows in each plot were harvested, topped, cleaned and weighed to determine:

5. Yield of fresh roots (ton/fed).
6. Yield of tops (ton/fed).
7. Sugar yield (ton/fed) was calculated according the following equation:

Sugar yield (ton/fed) = root yield (ton/fed) x sucrose %.

Statistical analysis:

The data of both experiments (each year) were subjected to the proper statistical analysis of variance according to Sendecor and Cochran (1967). The heterogeneity of error variances across seasons indicated that error terms were homogeneous. The combined analysis was conducted for the data of the two seasons according to Gomez and Gomez (1984). For comparison between means, Duncan's multiple range test was used (Duncan, 1955).

RESULTS AND DISCUSSION

1. Varietal performance:

a. Growth traits:

Results in Table (2) showed that Montebianco variety had the greatest root dimensions and surpassed Kawemira and Gloria. However, it could be noted that this superiority was statistically significances for root length and root diameter in the first season and the combined over the two seasons. Meanwhile differences between the studied varieties for root diameter in the second season did not reach the level of significance.

The highest values of these traits were recorded for Montebianco sugar beet variety followed by Kawemira then Gloria.

Results indicated that the effect of the interaction between varieties and seasons was insignificant for root length and root and top fresh weight/plant. However, it was significant for root diameter.

These results are in line with AL-Labbody (2003), Osman *et al.* (2003) and Ali (2005).

Table 2. Varietal performance with relation to growth traits of some sugar beet varieties at harvest {2002/03, 2003/04 seasons and their combined data}

Variety (V)	Root length (cm)			Root diameter (cm)		
	2002/03	2003/04	combined	2002/03	2003/04	combined
Montebianco	28.27 a	28.16 a	28.22 a	14.45 a	13.88 a	14.16 a
Kawemira	26.90 b	27.11 b	27.01 b	13.19 b	13.13 a	13.16 ab
Gloria	24.84 c	24.83 c	24.83 c	11.42 c	13.77 a	12.60 b
F.test (VXS)			NS			S
Variety (V)	Root fresh weight (gm)			Top fresh weight (gm)		
	2002/03	2003/04	combined	2002/03	2003/04	Combined
Montebianco	997.6 a	1000.0a	999.0 a	407.4 a	440.0 a	423.7 a
Kawemira	951.0 b	952.6 b	951.8 b	397.5 a	400.4 b	399.0 a
Gloria	934.3 b	937.3 c	935.8 c	335.4 b	332.4 c	334.0 b
F.test (VXS)			NS			NS

S : significant , NS : not significant

b. Yield and its components:

Data Table (3) showed that the tested geno varieties types widly and significantly varied in their sugar beet yield.

The relative increase on the average of the two seasons in root yield of variety Montebianco amounted by 4.86 % and 7.18 % over that Kawemira and Gloria varieties, respectively.

Table 3. Varietal performance with relation to yield of some sugar beet varieties at harvest {2002/03, 2003/04 seasons and their combined data}

Variety (V)	Root yield (ton/fed)			Top yield (ton/fed)		
	2002/03	2003/04	combined	2002/03	2003/04	combined
Montebianco	29.93 a	30.01 a	29.97 a	13.22 a	14.20 a	13.71 a
Kawemira	28.58 b	28.58 b	28.58 b	12.87 a	13.01 b	12.94 a
Gloria	27.81 c	28.12 c	27.96 c	11.06 b	10.98 c	11.02 b
F.test (VXS)			NS			NS
Variety (V)	Sucrose %			Sugar yield (ton/fed)		
	2002/03	2003/04	combined	2002/03	2003/04	combined
Montebianco	14.97 c	15.00 c	14.98 c	4.48 c	4.50 c	4.49 c
Kawemira	17.06 b	17.01 b	17.04 b	4.88 b	4.87 b	4.87 b
Gloria	19.44 a	19.42 a	19.43 a	5.41 a	5.46 a	5.43 a
F.test (VXS)			NS			NS

NS : not significant

However, the increments in top yield of Montebianco amounted 5.95 % and 24.41 % comparing with the other two varieties. Similar trends were obtained by EL-Geddawy, *et al.* (2001), AL-Labbody (2003) and Ali (2005). Sugar yield recorded on inverse relationship with respect to the effect of varieties on roots and tops fresh yields.

Gloria variety recorded the lowest root yield/fed. However, it produced the highest sugar yield/fed. The highest root yield (Montebianco) was the lowest sugar yield.

Montebianco variety recorded the lowest values of sucrose as compared with the other two varieties, while, Gloria produced the highest values in the two seasons and the combined data. The distinguished increase in the values of sugar yield for the lowest root yield variety, mainly due to the high value of sucrose percentage for this variety. The relative increase in sugar yield of Gloria variety as a result to its high value of sucrose percentage amounted 11.49% and 20.94% over those of Kawemira and Montebianco respectively. The same trends were obtained by EL-Geddawy, *et al.* (2001), AL-Labbody (2003) and Ali (2005).

Variety Montebianco surpassed the other two varieties and recorded the highest root yield/fed followed by Kawemira, while Gloria variety gave the lowest one.

This result may be considered a good indication for the growers and the policy maker take in consideration the relative importance of sucrose percentage in addition to root yield to decrease the gap of sugar between the consumption and the production.

2. Effect of boron fertilizer levels:

a. Growth traits:

Results in Table (4) revealed that the above mentioned traits positively and significantly responded to the applied boron fertilizer levels.

Increasing boron supplies from zero (control) to 0.50 and 1.00 g B/fed caused a significant increase in root length by 2.24 and 0.89 cm, corresponding to 1.42 and 0.69 cm in root diameter, successively. Similar trends were obtained by Osman *et al.* (2003), Nafei (2004) and Osman *et al.* (2004).

Appling 1.00 kg B/fed caused increment in the values of the average of the two seasons by 3.07 and 0.76 % root fresh weight/plant corresponding to 22.22 % and 6.10 % for top fresh weight/plant compared with the control or application of 0.50 kg B/fed, respectively.

Fresh weight/plant of root in the average of the two seasons had the greatest fresh weight of root/plant and outyielded the control and 0.50 kg B/fed by 29.10 and 7.40 gm, respectively. In this respect, Osman *et al.* (2004) mentioned that raising boron level applied to sugar beet plants increased root fresh weight. The results showed no significant difference in this trait between 0.50 and 1.00 kg B/fed in the two seasons and their combined data.

Table 4. Effect of boron fertilizers on growth traits of sugar beet at harvest {2002/03, 2003/04 seasons and their combined data}

Boron levels (kg B/fed	Root length (cm)			Root diameter (cm)		
	2002/03	2003/04	combined	2003/04	2002/03	combined
zero	25.59 c	25.38 b	25.49 c	11.99 c	13.19 b	12.59 c
0.50	26.63 b	27.05 a	26.84 b	13.07 b	13.57ab	13.32 b
1.00	27.79 a	27.67 a	27.73 a	14.00 a	14.02 a	14.01 a
F.test (BxS)			NS			S
Boron levels (kg B/fed	Root fresh weight (gm)			Top fresh weight (gm)		
	2002/03	2003/04	combined	2003/04	2002/03	combined
zero	942.1 b	948.4 b	945.3 b	339.1 c	346.5 b	342.8 c
0.50	967.1 a	967.0 a	967.0 a	384.3 b	405.4 a	394.9 b
1.00	973.7 a	975.1 a	974.4 a	416.9 a	421.0 a	419.0 a
F.test (BxS)			NS			NS

S : significant , NS : not significant

b. Yield and its components:

The results in Table (5) elucidated that there was a positive response of root yield to the applied levels of boron fertilization. However, it could be noted that both levels of boron element surpassed the check treatment statistically. Meanwhile the difference between the examined two levels of boron i.e. 0.50 and 1.00 kg B/fed did not reach the level of significance. Once more, the additional increase in the value of root yield as a result to apply 0.50 kg B/fed amounted 2.47 %, 1.96 % and 2.18 % in the first, second season and the combined data respectively, Corresponding 3.18 %, 2.81 % and 2.96 % when the level of boron fertilizer was increased to 1.00 kg B/fed. Similar trends were obtained by Nafei (2004) and Osman *et al.* (2004).

Results in Table (5) pointed out that sucrose% and sugar yield were distinctly and positively responded to boron fertilizer application. With respect to the additional benefit to boron application, it could be noticed that the additional increment in sugar yield as a results to application of 0.50 kg B/fed reached 4.43 %, 3.77 % and 4.00 % for the first and second seasons and their combined data respectively, corresponding to 7.61 %, 7.12 % and 7.36 % when the applied dose of boron fertilizer was 1.00 kg B/fed. These results coincide with those found by Nafei (2004).

Concerning the influence of boron element on yield of top fresh weight, it was significantly increased as the applied dose of boron increased. Application of 1.00 kg B/fed recorded the highest significant value of top fresh weight yield. Both levels of boron fertilizer i.e. 0.50 and/or 1.00 kg B/fed surpassed the check treatment (unfertilized treatment) with respect to top fresh weight yield. This finding was true in the two seasons and their combined data. The amount of increment in the value of top fresh weight yield of the combined over the two seasons amounted 13.82 % and 20.12 % over the control by increasing the supplied level of boron to 0.50 and 1.00 kg B/fed successively. These results coincide with those found by Osman *et al.* (2004).

Table 5. Effect of boron fertilizers on yield of sugar beet at harvest {2002/03, 2003/04 seasons and their combined data}

Boron levels (kg B/fed	Root yield (ton/fed)			Top yield (ton/fed)		
	2002/03	2003/04	2002/03	2003/04	2002/03	2003/04
zero	28.24 b	28.45 b	28.35 b	11.17 c	11.40 b	11.28 c
0.50	28.94 a	29.01 a	28.97 a	12.51 b	13.16 a	12.84 b
1.00	29.14 a	29.25 a	29.19 a	13.47 a	13.63 a	13.55 a
F.test (BxS)			NS			NS
Boron levels (kg B/fed	Sucrose %			Sugar yield (ton/fed)		
	2002/03	2003/04	2002/03	2003/04	2002/03	2003/04
zero	16.79 b	16.83 b	16.81 b	4.73 c	4.77 c	4.75 c
0.50	17.13ab	17.11ab	17.12 b	4.94 b	4.95 b	4.94 b
1.00	17.54 a	17.50 a	17.52 a	5.09 a	5.11 a	5.10 a
F.test (BxS)			NS			NS

NS : not significant

3. Effect of molybdenum fertilizer levels:

a. Growth traits:

Results in Table (6) clarified the above mentioned root and top traits in terms of root length and diameter as well as root and top fresh weights/plant were statistically and positively affected by molybdenum fertilizer levels. It could be remarked that these traits whether in the two seasons and/or their combined data gradually were increased as molybdenum levels increased from zero to 0.25 up to 0.50 kg Mo/fed. These results coincide with those found by Nemeat-Alla (1997).

The combined analysis data showed that addition of 0.50 kg Mo/fed gave the tallest and the thicknest roots, as well as greatest root and top fresh weights and surpassed 0.25 kg Mo/fed and check treatment by 3.55 and 1.77 cm in length, 1.47 and 0.65 cm in diameter, 51.80 and 23.50 gm in root fresh weight and 87.60 and 44.20 gm in top fresh weight, respectively. These results may be considered a good indication with respect to the effective role of micro-elements on plant growth.

Table 6. Effect of molybdenum fertilizers on growth traits of sugar beet at harvest {2002/03, 2003/04 seasons and their combined data}

Molybdenum levels (kgMo/fed)	Root length (cm)			Root diameter (cm)		
	2002/03	2003/04	combined	2003/04	2002/03	combined
zero	24.77 c	25.06 c	24.91 c	12.44 c	12.75 c	12.60 c
0.25	26.62 b	26.75 b	26.68 b	13.03 b	13.47 b	13.25 b
0.50	28.63 a	28.28 a	28.46 a	13.59 a	14.56 a	14.07 a
F.test (MoxS)			NS			NS
Molybdenum levels (kgMo/fed)	Root fresh weight (gm)			Top fresh weight (gm)		
	2002/03	2003/04	combined	2002/03	2003/04	combined
zero	935.2 c	939.1 c	937.1 c	345.7 c	337.5 c	341.6 c
0.25	961.2 b	960.0 b	960.6 b	375.3 b	396.3 b	385.8 b
0.50	986.6 a	991.3 a	988.9 a	419.3 a	439.1 a	429.2 a
F.test (MoxS)			NS			NS

NS : not significant

b. Yield and its components:

Results in Table (7) elucidated that there was a positive response in the values of root yield to the applied levels of molybdenum fertilization. However, it could be noted that both of molybdenum element levels surpassed the check treatment statistically, meanwhile the difference between the examined levels of molybdenum i.e. 0.25 and 0.50 kg Mo/fed reached the level of significance. Once more, the additional increase in the value of root yield as a result of applying 0.25 kg Mo/fed amounted to 3.44 %, 2.23 % and 2.81 % in the first, second seasons and their combined, respectively, corresponding 6.16 %, 5.57 % and 5.85 % when the level was increased to 0.50 kg Mo/fed. These results are in the same trend with those found by Nemeat-Alla (1997).

Table (7) showed that molybdenum fertilizer level of 0.50 kg Mo/fed gave the highest values of root yield followed by 0.25 kg Mo/fed, while zero gave the lowest. These results are in the same trend with those found by Nemeat (1997).

Table 7. Effect of the molybdenum fertilizers on yield of sugar beet at harvest {2002/03, 2003/04 seasons and their combined data}

Molybdenum levels (kgMo/fed)	Root yield (ton/fed)			Top yield (ton/fed)		
	2002/03	2003/04	2002/03	2003/04	2002/03	2003/04
zero	27.88 c	28.17 c	28.03 c	11.35 c	11.12 c	11.24c
0.25	28.84 b	28.80 b	28.82 b	12.25 b	12.89 b	12.57 b
0.50	29.60 a	29.74 a	29.67 a	13.55 a	14.17 a	13.86 a
F.test(MoXS)			NS			NS
Molybdenum levels (kgMo/fed)	Sucrose %			Sugar yield (ton/fed)		
	2002/03	2003/04	2002/03	2003/04	2002/03	2003/04
zero	16.31 c	16.41 c	16.36 c	4.52 c	4.61 c	4.56 c
0.25	17.26 b	17.22 b	17.24 b	4.96 b	4.94 b	4.95 b
0.50	17.90 a	17.81 a	17.85 a	5.28 a	5.28 a	5.28 a
F.test(MoXS)			NS			NS

NS : not significant

Combined analysis clarified that the addition of 0.50 kg Mo/fed gave 1.64 and 0.85 ton of roots/fed higher than that produced by zero and 0.25 kg Mo/fed, respectively. In addition, applying 0.50 kg Mo/fed gave the greatest top yield/fed and out-yielded zero and 0.25 kg Mo/fed by 2.62 and 1.29 ton/fed, respectively. Meantime, the same level gave the highest values of sugar yield/fed followed by 0.25 kg Mo/fed and the control.

Results obtain in Table (7) pointed out that sucrose % and sugar yield were distinctly and positively responded to molybdenum fertilizer application. With respect to the additional benefit to molybdenum application, it could be noticed that the additional increment in sugar yield as a result to application of 0.25 kg Mo/fed reached 9.73 %, 7.15 % and 8.55 % for the first and second seasons and their combined respectively, corresponding to 16.81 %, 14.53 % and 15.78 % when the applied dose of molybdenum fertilizer was 0.50 kg Mo/fed. The relative effect of molybdenum element on sugar yield was recorded before by Nemeat-Alla (1997).

Application of 0.50 kg Mo/fed recorded the highest significant value of top fresh weight yield. Both of the used level of molybdenum fertilizer i.e. 0.25 and/or 0.50 kg Mo/fed surpassed check treatment (unfertilized treatment) with respect to top fresh weight yield. The amount of increment in the value of top fresh weight yield of the combined over the two seasons amounted to 11.82 % and 23.30 % over control by increasing the supplied level of molybdenum to 0.25 and 0.50 kg Mo/fed, respectively. The effective role of molybdenum element in its effect on top fresh weight has been reported by Nemeat-Alla (1997).

4. Effect of interaction between varieties and molybdenum fertilizer levels:

Results in (Table,8) revealed a significant effect on root length. The highest value of root length was found by application 0.50 kg Mo/fed with the sugar beet variety Montebianco.

Table 8. Effect of the interaction between varieties and molybdenum fertilizer levels on root length (cm)of some sugar beet varieties at harvest {2002/03, 2003/04 seasons and their combined data}

Variety (V)	2002/03			2003/04			combined		
	Molybdenum level (kg Mo/fed)			Molybdenum level (kg Mo/fed)			Molybdenum level (kg Mo/fed)		
	zero	0.25	0.50	Zero	0.25	0.50	zero	0.25	0.50
Montebianco	25.63 cd	28.22 b	30.96 a	26.07 de	28.26 bc	30.15 a	25.85 d	28.24 b	30.56 a
Kawemira	25.04 d	26.70 c	28.96 b	25.44 e	27.15 cd	28.74 b	25.24 de	26.93 c	28.85 b
Gloria	23.63 e	24.93 d	25.96 cd	23.67 f	24.85 ef	25.96 de	23.65 f	24.89 e	25.96 d
F.test (V X Mo X S)	-			-			NS		

NS : not significant

REFERENCES

1. Ali, S. A. M. 2005. Agricultural studies on sugar beet in newly reclaimed lands of Sohag Governorate. M. Sc. Thesis, Fac. of Agric. Minia Univ.
2. Al-Labbody, A.H. 2003. Evaluation of some multigerm and monogerm sugar beet varieties under Fayoum Governorate conditions. Ph.D. Thesis. Fac. of Agric. Al-Azhar Univ. Egypt.
3. Duncan, D. B. 1955. Multiple ranges and multiple F. test Biometrics, 11: 1- 24.
4. El-Geddawy, I.H.M., Laila, M. Saif and F.A. Abd El- Latief. 2001. Hoeing and nitrogen fertilization with respect to quality yield components of some sugar beet varieties grown in upper Egypt. J. Agric. Sci. Mansoura Univ., 26 (8): 4607-4621.
5. Gomez, K. A. and A. A. Gomez. 1984. Statistical Procedures For Agricultural Research. A Wiley- Inter- Science Publication, John Wiley and Sons, New York.
6. Jackson, K.I. 1956. Soil chemical analysis advanced course (4th printing, 1968). Published by the author. Soil Sci., Dept. Wisconsin Univ., USA.
7. 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.
8. Nemeat Alla. E. A. E. 1997. Agronomic studies on sugar beet. Ph.D. Thesis, Agron Dept. Agric. Fac., Kafr El-Sheikh Tanta Univ.
9. Osman, A.M.H., G.S. El-Sayed and A.I. Nafei. 2004. Effect of foliar application date of B and bioconstituents (Yeast Extraction) on yield and quality of sugar beet. Egypt. J. Appl. Sci., 19 (2): 76-98.
10. Osman, A.M.H., G.S. El-Sayed, M.S.H. Osman and K.S. El-Sogheir. 2003. Soil application of some microelements with relation to yield and quality of sugar beet varieties. Ann. Agric. Sci., Moshtohor, Zagazig Univ. 41 (3): 1135-1152.
11. Saif, Laila. M. 2000. Stepwise regression and path coefficient analysis for some sugar beet characters under levels of boron and nitrogen fertilization.Proc. 9th Conf. Agronomy., Minufiya Univ.,: 569–581.
12. Shalaby, N.M. 2003. Effect of enviromental conditions on the behaviour of different genotypes of sugar beet root yield and quality. Ph.D. Thesis Fac. of Agric., AL-Azhar Univ.
13. Snedecor, G.V. and W.G. Cochran. 1967. Statistical methods 6 th Ed Iowa State Univ. Press, Amess, Iowa, USA.

تأثير البورون والموليبدنيوم علي صفات النمو والحاصل لبعض أصناف بنجر السكر

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أقيمت تجربتان حقليتان بمحافظة كفر الشيخ لدراسة تأثير مستويات التسميد بكلا من البورون والموليبدنيوم علي صفات النمو الخضرية والحاصل لبعض أصناف بنجر السكر خلال موسمى الزراعه ٢٠٠٢/٢٠٠٣ و ٢٠٠٣/٢٠٠٤ – وقد اشتملت الدراسة علي ٢٧ معاملة هي عبارة عن التوافيق بين ٣ أصناف من بنجر السكر (مونت بيانكو، كاوميرا و جلوريا)، ٣ مستويات من البورون (صفر ، ٠,٥٠ ، ١,٠٠ كجم بورون/فدان) و ٣ مستويات من الموليبدنيوم (صفر، ٠,٢٥، ٠,٥٠ كجم موليبدنيوم/فدان) وذلك باستخدام تصميم القطع المنشقة مرة واحدة ذو ثلاث مكررات حيث وضعت الأصناف في القطع الرئيسية ووضعت مستويات البورون والموليبدنيوم في القطع الشقية.

تفوق الصنف مونت بيانكو في طول وقطر الجذر والحاصل الجذور والعرش بالفدان علي باقي الأصناف في كلا الموسمين والتحليل التجميعي علي الترتيب.

أدت اضافة البورون بمعدل ١ كجم /فدان إلي زيادة معنوية في طول الجذر وقطر الجذر كما زاد حاصل السكر بمقدار ٧,٦١ ، ٧,١٣، ٧,٣٧% مقارنة بالمقارنة زاد حاصل العرش بمقدار ١٣,٨٣ ، ٢٠,١٢% بإضافة مستويات البورون من ٠,٥٠ الي ١ كجم /فدان مقارنة بالمقارنة استجاب حاصل الجذر/فدان معنويا.

أدت اضافة الموليبدنيوم بمعدل ٠,٥٠كجم /فدان إلي زيادة معنوية في طول الجذر وقطر الجذر والوزن الغض للجذر والعرش/نبات كما زاد حاصل الجذر بمقدار ٦,١٧ ، ٥,٥٧، ٥,٨٥ % وزاد حاصل السكر بمقدار ١٦,٨١ ، ١٤,٥٣، ١٥,٧٩ % مقارنة بالمقارنة في كلا الموسمين والتحليل التجميعي علي الترتيب وزاد حاصل العرش بمقدار ١١,٨٢ ، ٢٣,٣٠% بإضافة مستويات الموليبدنيوم من ٠,٢٥ الي ٠,٥٠ كجم /فدان مقارنة بالمقارنة.