SUMMARY

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 (zero, 0.25 and 0.50 kg Mo/fed).

Treatments were arranged in a split plot design with three replications. Varieties were allocated the main plots and the combination between levels of boron and molybdenum were assigned at random within sub-plots. Plot area was 17.5 m^2 consists of five ridges 7 m in length and 2.5 m in width and the space between ridges 50 cm and between hills 20 cm.
Results could be summarized as follows:

I. Growth measurements:

a. Effect of seasons:

1. Results pointed out that root diameter as well as leaves fresh weight/ plant were insignificantly affected by the growing seasons.

2. Root fresh weight/ plant showed significantly response to the growing season at 120 and 150 days from sowing.
3. Total soluble solids (TSS %) were significantly affected by the growing seaons. Sucrose percentage, significantly affected at 120 days from sowing only. Juice purity percentage, significantly affected by growing season at 120 days from sowing as well as 180 days from sowing.

b. Varietal performance:

1. Root dimensions and root fresh weight/plant were significantly affected by the three studied varieties at the three sampling dates, except top fresh weight at 120 and 150 days from sowing. Montebianco variety gave the highest values of the studied traits followed by Kawemira, while Gloria variety gave the lowest ones.
2. Total soluble solids, sucrose and purity percentages were significantly affected by varieties at the three growth stages. Montebianco variety recorded the highest values of total soluble solids, however, it gave the lowest values of sucrose and purity percentages. On the other hand, variety Gloria gave the lowest values of total soluble solids percentage, meanwhile, it gave the highest values of sucrose and purity percentage at the three growth stages.

c. Effect of the interaction between varieties and seasons:

1. Top fresh weight in the three samples was insignificant.
2. Root length, diameter in the third stage and root fresh weight in the first and second stages were significant.

3. Total soluble solids, sucrose and purity percentages were insignificantly affected by this interaction at the three stages.

d. Effect of boron fertilizer levels:

1. Root dimensions were significantly increased as the boron level increased from 0.50 to 1.00 kg B/fed in the combined for the different growth stages.
2. Root fresh weight/plant was significantly increased in first and second seasons at the three samples with increasing boron level up to 1 kg B/fed except at 150 days in second season was insignificant.
3. Top fresh weight/plant was insignificantly affected by boron level in the first and the second seasons and their combined at 120 and 150 days from sowing, however it was increased significantly by increasing boron up to 1.00 kg B/fed at 180 days from sowing.
4. Total soluble solids percentage was significantly affected by boron fertilizer levels in the various growth stages in both seasons and their combined.
5. Sucrose and purity percentages increased statistically by increasing boron at all growth stages of the two seasons and their combined, except when the plant aged 120 days.

e. Effect of the interaction between boron fertilizer levels and seasons:

1. Root dimensions, root and top fresh weight/plant were insignificantly affected by this interaction, except at 120 days from sowing.

2. Sucrose and purity percentages were significantly affected by this interaction at 120 days from sowing.

f. Effect of molybdenum fertilizer levels:

1. The highest values of root dimensions were attained by adding 0.50 kg Mo/fed.
2. Root fresh weight/plant of the different growth stages and top fresh weight/ plant at 180 days were significantly increased in the two growing seasons and their combined.
3. The lowest values of TSS% was obtained by applied 0.50 kg Mo/fed. The same level, gave the highest values of sucrose and purity percentages.

g. Effect of the interaction between molybdenum fertilizer levels and seasons:

1. Root dimensions, root and top fresh weight were significant at 150 days from sowing.
2. Juice quality percentages of sugar beet were insignificantly affected in the three growth stages, except total soluble solids percentage was significantly decreased as the applied dose of molybdenum increased at 120 and 180 days from sowing.

h. Effect of the interaction between varieties and boron fertilizer levels:

1. Root fresh weight at 120 days as well as top fresh weight/plant at 120 and 150 days from sowing was significantly affected.
2. Application of 1.00 kg B/fed to Montebianco variety gave the highest value of root fresh weight, while applied of 0.50 kg

B/fed with Gloria variety gave the lowest value at 120 days from sowing.

3. Application of 1.00 kg B/fed to Kawemira variety gave the highest value of top fresh weight/plant, while the same level with Montebianco variety gave the lowest value in the first and second stages.

i. Effect of the interaction between varieties, boron fertilizer levels and seasons:

1. Root fresh weight was significant at 120 days from sowing.
2. Top fresh weight was insignificant in the first and second growth stages.

II. Harvest studies:

a. Effect of seasons:

1. Growth criteria in terms of root length, root diameter and root and top fresh weight/ plant appeared insignificant influence by the growing seasons.
2. Total soluble solids and purity percentages were significantly affected by the growing seasons whereas sucrose percentage was not affected.
3. Micro (boron and molybdenum) and macro (nitrogen and potassium) contents of root, petiole and blade were not affected by the growing season, except the values of nitrogen percentage in roots and sodium percentage in blade.
4. Root, sugar and top yield of sugar beet crop were insignificantly affected by the growing seasons.

b. Varietal performance:

1. Montebianco variety recorded the highest root dimensions as well as root and top fresh weight/plant followed by Kawemira and Gloria.
2. Total soluble solids, sucrose and purity percentages were significantly differed in both seasons and their combined. Montebianco variety attained the highest value of total soluble solids percentage, while, Gloria variety produced the highest values of sucrose and purity percentages.
3. Variety Gloria recorded the highest boron concentration in root, petiole and blade in the single season and/or the combined of the two seasons.
4. Molybdenum concentrations of roots, petioles and blades of the studied varieties were insignificantly affected by the examined varieties.
5. Nitrogen percentages of the studied varieties did not reach the level of significance, except the first season for roots and petioles.
6. Montebianco variety gave the highest values of potassium concentration followed by Kawemira and Gloria variety.
7. Sodium concentration of roots was significantly differed in the first season and their combined over the two seasons.
8. Montebianco variety had the greatest root and top yields. While, Gloria variety gave the highest values of sugar yield in the two seasons and their combined.

c. Effect of the interaction between varieties and seasons:

Root diameter, nitrogen in root and petiole and sodium in root concentrations were significantly affected by this interaction.

d. Effect of boron fertilizer levels:

1. Increasing boron supply from zero (control) to 0.50 and 1.00 kg B/fed caused a significant increase in root length amounted to 2.24 and 0.89 cm, corresponding to 1.42 and 0.69 cm in root diameter, successively.
2. Applied 1.00 kg B/fed significantly increased root fresh weight/plant of the two seasons amounted to 3.08 and 0.77 % corresponding 22.22 and 6.10 % for top fresh weight/plant compared with control or application of 0.50 kg B/fed, respectively in the combined.
3. Increasing the supplied dose of boron negatively affected the values of TSS %. However, increasing the applied dose of boron caused a significant increase in sucrose and purity percentages.
4. Boron contents in root, petiole and blade varied significantly and increased as the applied dose of boron fertilizer increased up to 1.00 kg B/fed in both seasons and their combined.
5. Application of 1.00 kg B/fed attained a significant increase in the molybdenum concentration in roots in the two seasons and their combined. However application of 0.50 kg B/fed gave the highest insignificant concentration of molybdenum in the petiole and blade.
6. Nitrogen concentrations in roots, petioles and blades were insignificantly affected by the different boron fertilizer levels

in the two seasons and their combined, except blades in the combined.

7. Potassium content in roots responded significantly to the applied boron fertilizer levels in the second season, except petioles and blades in both seasons and their combined.
8. Sodium percentage content in blades was significantly affected by the applied levels of boron in the combined of the two seasons except in roots and petioles.
9. Root yield/fed was insignificantly responded to the applied levels of boron in both seasons and their combined.
10. Application of 0.50 kg B/fed attained additional increment in sugar yield over control treatment amounted by 4.43 %, 3.77 % and 4.00 % while, 7.61 %, 7.13 % and 7.37 % with 1.00 kg B/fed in both seasons and their combined, respectively.
11. Application of boron levels significantly increased top yield in the two seasons and their combined amounted by 13.83 % and 20.12 % over control by increasing level of boron to 0.50 and 1.00 kg B/fed.

e. Effect of the interaction between boron fertilizer levels and seasons:

This interaction was significantly affected on root diameter, boron and molybdenum concentrations in root and petiole and potassium content in root.

f. Effect of molybdenum fertilizer levels:

1. Root length, diameter, root and top fresh weight/plant were gradually increased as molybdenum levels increased from zero

to 0.25 up to 0.50 kg Mo/fed in the two seasons and their combined.

2. Application of 0.50 kg Mo/fed gave the tallest and thicknest roots, root and top fresh weight.
3. Sucrose and purity percentages were significantly increased with increasing molybdenum levels. On the contrary, total soluble solids percentage negatively responded to application.
4. Increased molybdenum fertilizers up to 0.50 kg Mo/fed significantly affected roots, petioles and blades in the two seasons and their combined except boron content in petioles in their combined. Application of 0.50 kg Mo/fed gave the highest value of boron contents in root, petiole and blade.
5. Increased molybdenum fertilizers up to 0.50 kg Mo/fed significantly affected molybdenum contents in roots, petioles and blades in the two seasons and their combined.
6. Increasing the applied dose of molybdenum decreased nitrogen percentages in roots, petioles and blades.
7. Potassium concentrations in root, petiole and blade were significantly influenced by molybdenum treatment in the first season and the combined, except petiole and blade in the second season.
8. Sodium concentrations in root and blade were significantly affected by molybdenum fertilizer in the combined, except petiole.
9. Increasing molybdenum up to 0.25 and 0.50 kg Mo/fed significantly increased root yield/fed in both seasons and their combined. The increases in root yield over the control by applying 0.25 kg Mo/fed amounted to 3.44 %, 2.24 % and 2.82%, while it reached 6.17 %, 5.57 % and 5.85 % when

molybdenum level increased to 0.50 kg Mo/fed in the first, second seasons and their combined, respectively.

10. Sugar yield/fed had significantly responded to molybdenum application in the two seasons and their combined. Application of 0.25 kg Mo/fed increased sugar yield over control amounted to 9.73 %, 7.16 % and 8.55% and to 16.81 %, 14.53 % and 15.79 % at 0.50 kg Mo/fed in the first and second seasons and their combined, respectively.
11. Application of 0.25 and 0.50 kg Mo/fed significantly increased of top yield/fed in the combined over the two seasons; the increment amounted to 11.82 % and 23.30 % over control, respectively.

g. Effect of the interaction between molybdenum fertilizer levels and seasons:

Concerning the interaction between molybdenum fertilizer levels and seasons, it was insignificant effects on all traits, except boron content on blade.

h. Effect of the interaction between varieties and boron fertilizer levels:

1. The interaction had significant effects on boron and nitrogen contents in blade and molybdenum concentration in petiole and blade.
2. The highest values of boron content and nitrogen percentage in blade were obtained with 1.00 kg B/fed for varieties Gloria and Kawemira, respectively.
3. Fertilizing variety Kawemira with 0.50 kg B/fed gave the highest values of molybdenum concentration in blade.

4. Variety Kawemira with 0.50 and 1.00 kg B/fed gave the lowest nitrogen percentages in petiole and blade, respectively.

i. Effect of the interaction between varieties, boron levels and seasons:

The interaction between varieties, boron levels and seasons, had significant effects on all traits, except both boron and molybdenum concentrations in blade.

j. Effect of the interaction between varieties and molybdenum fertilizer levels:

1. The interaction applied had a significant effects on root length, total soluble solids percentage, potassium and sodium percentages in sugar beet roots.
2. Application 0.50 kg Mo/fed with variety Montebianco recorded the highest value of root length.
3. Variety Gloria gave the lowest values of total soluble solids and potassium percentages with 0.50 kg Mo/fed.

k. Effect of the interaction between varieties, molybdenum fertilizer levels and seasons:

The interactions were insignificantly affected on total soluble solids, potassium, sodium percentages and root length.

l. Effect of the interaction between boron and molybdenum fertilizers:

1. Total soluble solids percentage recorded the lowest percentage by applying fertilizers mix (0.50 kg B/fed + 0.50 kg Mo/fed)

compared with control in the second growing season and the combined.

2. Sodium percentage in blade was significantly influenced by applying boron and molybdenum fertilizer levels. The lowest percentage was obtained by applying 0.50 kg B/fed and with 0.50 kg Mo/fed in the first season and the combined.

m. Effect of the interaction between boron and molybdenum fertilizers and seasons:

The interaction boron and molybdenum fertilizers and seasons had insignificant effects on sodium percentage in blade.

n. Effect of the interaction between varieties, boron and molybdenum:

1. Results revealed that the values of total soluble solids percentage were statistically affected between boron, molybdenum fertilizers and varieties.
2. The highest values of total soluble solids percentage were recorded for the unfertilized treatment.

o. Effect of the interaction between varieties, boron and molybdenum and seasons:

This interaction between varieties, boron and molybdenum and seasons, had insignificant effects on total soluble solids percentage (Tables, 51).