RESPONSE OF YIELD AND QUALITY OF SOME SUGAR BEET VARIETIES *(Beta vulgaris, L.)* TO PLANT DENSITY AND NITROGEN FERTILIZER UNDER NEW RECLAIMED SOIL CONDITIONS

BY

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SUMMARY

Two field trials were conducted in Sandy loam soil of Faculty of Agriculture farm Demo, Fayoum University, Egypt, during the two successive seasons of 2008/09 and 2009/10. The main objective of this investigation was to study the effect of nitrogen fertilizer and plant density on plant characteristics, juice quality and yields of three multigerm sugar beet varieties viz. Kawemira, Monte Bianco and Top under Fayoum conditions. Spilt-split- plot design was used. The obtained results could be summarized as follows.

Plant characteristics.

Significant varietal differences were recorded to root/ top ratio only in the second season. Top and Kawemira varieties produced significantly higher root/ top ratio. Insignificant varietal effect on the remain agronomic traits under study was observed.

The effect of nitrogen fertilizer levels on top fresh weight per plant, root dry weight per plant, top dry weight per plant, dry weight per plant and root/ top ratio in both seasons, also root length, root diameter, root fresh weight per plant and leaf area index (LAI) in the first season were significantly differences. On the other hand, insignificant effect was found on root length, root diameter and root fresh weight per plant as well as leaf area index in the second season.

The results indicated that the highest top fresh weight i. e. 577.74 & 572.20 gm., root dry weight per plant i. e. 476.36 & 401.20 gm., top dry weight per plant i. e. 115.53 & 156.68 gm. and dry weight per plant i. e. 598.63 & 557.97 gm in the first and second season respectively, also root length i. e. 31.73 cm., root diameter i. e. 14.42 cm., root fresh weight i. e. 1659.37 gm. as well as leaf area index 5.11 in the first season were obtained by applying 140 kg N/fed. On the contrast, applying 100 kg N/ fed. produced the highest root/

top ratio i. e. 7.22 & 5.37 in the first and second season respectively.

Hill spacings had significant effect on root dimentions, root fresh and dry weight per plant, top fresh and dry weight per plant and dry weight per plant as well as leaf area index (LAI) in the first and second seasons respectively. On the other hand, insignificant effect was found on root/ top ratio in both seasons.

It is evident that in general, in the first season planting sugar beet plants at hill spacing 25 cm. gave the highest values of root length 30.31 cm., root diameter 14.36 cm., root fresh weight 1871.57 gm., top fresh weight 513.48 gm., root dry weight 488.80 gm., top dry weight 93.85 gm. and dry weight per plant 593.09 gm. also, planting sugar beet plants at hill spacing 15 cm. gave the highest values of leaf area index 4.23. On the other hand, in the second season planting sugar beet plants at hill spacing 20 cm. gave the highest values of root length 27.59 cm., root diameter 13.86 cm., root fresh weight 1463.76 gm., top fresh weight 500.92 gm., root dry weight 393.19 gm., top dry weight 120.32 gm., dry weight per plant 513.51 gm and leaf area index 4.77.

There were significant effects due to the interaction between sugar beet varieties X nitrogen fertilizer levels on root fresh weight per plant and leaf area index in the 2nd season, while the effect on root dry weight per plant in the 1st season. Results indicated that the highest value of root fresh weight 1475.36 gm/ plant, root dry weight 521.73 gm/ plant and leaf area index 5.5 were produced by 140 kg N/fed. with Kawemira, Top and Monte Bianco varieties respectively. There were no significant effects due to the same interaction on all agronomic traits under study in this investigation.

There were significant effects due to the interaction between sugar beet varieties X hill spacings on root diameter in first season as well as on dry weight per plant and leaf

area index in the second season. Results indicated that the highest value of root diameter was produced by Top variety and 25 cm. of hill spacing 15.36 cm, the highest values of plant dry weight 546.76 gm. and leaf area 5.71 were produced by 20 cm. of plant hill with Top and Monte Bianco varieties respectively. There were no significant effects due to the same interaction on all agronomic traits under study in this investigation.

The interaction between nitrogen fertilizer levels X hill spacings with respect to root length and top dry weight per plant in the second season, while root diameter in the first season were significant. Results indicated that the highest root length and diameter were obtained by 140 kg N/ fed. with 20 cm. hill spacing between plants 29.89 and 16.09 cm. respectively, highest values of top dry weight 190.21 gm/plant was produced by 140 kg N /fed. with planting sugar beet plants at hill spacing 25 cm.

The interaction between the three factors sugar beet varieties X nitrogen fertilizer levels X hill spacing on all agronomic traits under study in this investigation was insignificant in both seasons.

Quality traits:

Results showed that there were significant differences due to the tested sugar beet varieties in all juice quality characters under study. Sucrose percentage ranged from 20.40 to 18.89 % and 21.01 to 19.12 % as well as extractable sugar percent ranged from 18.36 to 16.38 and from 19.04 to 16.71 for Monte Bianco and Top varieties in the 1st and 2nd season respectively. During the two seasons of experimentation, Monte Bianco variety tended to give significant the higher value for sucrose and extractable percentage. Sugar beet varieties exhibited significant differences on sucrose percentage, purity percentage, potassium content, extractable sugar percent, extractability

percentage and sugar loss to molasses percentage in both seasons, while sodium content and alpha amino nitrogen content in only the first season. Monte Bianco variety produced significant the higher purity 95.07 % and extractability 89.89 % than the two other varieties in the first season. On the other hand, Monte Bianco and Kawemira varieties significant produced the higher purity and extractability percentages in the second season. On the contrast, Top variety produced the lowest purity percent 93.02 & 93.57 %, extractability percent 86.55 & 87.34 % in the first and second season, respectively.

Top variety gave the highest values of potassium 4.26 & 3.78 content and sugar loss to molasses 1.92 & 1.80 % in the first and second season respectively. Top variety significant produced the higher content of sodium 2.67 and α- amino nitrogen 1.77.

The effect of nitrogen fertilizer levels on purity, extractability and sugar loss to molasses percentages in both seasons, sodium and alpha amino nitrogen content in the first season as well as potassium content and extractable sugar percent in the second season were significantly differences. On the other hand, insignificant effect was found on sucrose percentage in both seasons, extractable sugar percentage and potassium content in the first season as well as sodium and alpha-amino nitrogen content in the second season.

Fertilization with 100 kg nitrogen /fed. gave the highest percentages of purity (94.67 & 95.24) and extractability (88.84 & 89.66) in the first and second seasons, respectively as well as percentage of extractable sugar 18.30 % in the second season. On the other hand, lowest value of sugar loss to molasses 1.59 & 1.49 was obtained by the same level of nitrogen in the first and second season respectively.

Concerning juice impurities percentages, the results indicated that, increasing apply nitrogen levels to 140 kg/fed.

resulted significant large content of sodium, potassium and alpha-amino nitrogen.

Appling nitrogen levels to 140 kg/fed. significantly decreased all juice quality traits except impurities in terms of sodium, potassium and alpha-amino nitrogen content as well as sugar loss to molasses which were significantly increased.

The results indicated that the differences in all juice quality and impurities traits in terms of sucrose, purity, sodium, potassium, α- amino nitrogen, extractable sugar, extractability and sugar loss to molasses percentage in sugar beet roots induced by changing in hill spacing were significant in both seasons of experimentation.

Juice quality traits i.e. sucrose, purity, extractable sugar and extractability percentages were increased up to 20.61 %, 95.46 %, 18.64 %, and 90.41 in the first season as well as to 20.94 %, 95.76 %, 18.94 % and 90.55 % in the second season, respectively. Percentages of sucrose loss to molasses and impurities in terms of sodium, potassium and alpha-amino nitrogen contents decrease up to 1.37 %, 1.29 %, 3.54 % and 0.76 % in the first season, as well as to 1.37 %, 1.13 %, 2.85 % and 1.24 % in the second season, respectively as decreasing hill spacing from 25 to 15 cm. or increasing plant density to reach 46666 plant/fed.

The interaction between varieties X nitrogen fertilizer levels was insignificant in both seasons with respect to all juice quality in terms of sucrose, purity, extractable sugar and extractability percentages and impurities traits in terms of sodium, potassium and alpha-amino nitrogen contents as well as sucrose to molasses of sugar beet.

Sodium content, α- amino nitrogen content, extractability percentage and sugar loss to molasses percentage were significantly affected by the interaction between tow factors sugar beet varieties X plant hill spacing in only the first

season. It is evident that the highest value of sugar loss to molasses 2.33 %, α- amino nitrogen 2.66 % and sodium 3.43 % were produced by Top variety and planting at 25 cm. hill spacing. On the contract, the highest value of extractability percentage was produced by Monte Bianco variety and planting at 15 cm. hill spacing 91.47 %.

There were no significant effects due to the interaction between tow factors nitrogen fertilizer levels X plant hill spacing on all juice quality traits and impurities traits in both seasons in this investigation.

The interaction between the three factors sugar beet varieties X nitrogen fertilizer levels X plant hill spacings was not significant with respect to these traits in both seasons.

Yields:

The differences in root, top, gross sugar and recoverable sugar yields per feddan due to sugar beet varieties were insignificant in both seasons of experimentation. However, Monte Bianco variety tended to give the highest yield of root, gross sugar and recoverable sugar per feddan and Top variety tended to give the lowest yields in both seasons.

Nitrogen fertilizer levels exhibited significant effect on root, top, gross sugar and recoverable yield per feddan over the two seasons of experimentation. The results indicated that the highest root yield per feddan i. e. 41.43 & 43.70, top yield i. e. 10.68 & 13.07, gross sugar yield i. e. 8.03 & 8.60, recoverable sugar yield i. e. 7.06 & 7.63 tons were obtained by applying 140 kg N/fed. in the first and second season, respectively. It is obvious that in general, in both seasons of experimentation, applying 100 kg N/fed. gave significantly the lowest root, top, gross sugar and recoverable sugar yields per feddan.

The results indicated that the differences in root, top, gross sugar and recoverable sugar yield per feddan in sugar beet induced by changing in plants hill spacings were significant in both seasons of experimentation. In the first season, the moderate plant hill spacing 20 cm. produced significant highest root and top yield, planting sugar beet plants at hill spacing 20 cm. gave root yield 40.06 and top yield 9.41 ton/fed. On the other hand, in the second season, the narrow plant hill spacing 15 cm. produced significant highest root yield per feddan 41.62 tons, but the widest plant hill spacing 25 cm. produced significant highest top yield per feddan 11.80 ton. During the two seasons of the experiment, in general, planting sugar beet plants at hill spacing 15 cm. gave significant highest gross sugar per feddan 7.97 & 8.71 tons and highest recoverable sugar per feddan 7.20 & 7.90 tons in the first and second seasons respectively. It is obvious that in general, in both seasons of experimentation except top yield per feddan in the second season, planting sugar beet plants at hill spacing 25 cm. gave significant lowest root, top, gross and recoverable sugar per feddan.

The interaction between the tow factors varieties X nitrogen fertilizer levels was insignificant in both seasons with respect to all sugar beet yields.

The interaction between the tow factors varieties X plant hill spacing was no significant in both seasons with respect to all sugar beet yields.

The interaction between the tow factors nitrogen fertilizer levels X hill spacing had significant effect on root, gross sugar and recoverable sugar yields per feddan only in the 1st season of experimentation. It is evident that in general, the highest value of root yield 46.52, gross sugar yield 9.03 and recoverable sugar yield 7.90 ton/fed. were produced by applying 140 kg N/fed. and planting sugar beet

plants at 20 cm. hill spacing (at moderate of plant density 35000 plant/fed.).

Root, top, gross sugar and recoverable sugar yields per feddan were insignificantly affected by the interaction of the three factors sugar beet varieties X nitrogen fertilizer levels X plant hill spacings in both seasons of the experiment.