Summary

Two field experiments were conducted in the Research and Experimental Farm of Nubaria Agricultural Research Station during 1997/ 98 and 1998/ 99 seasons. The aim of this study was to investigate the response of sugar beet crop variety "Tarios" to different levels and application time of phosphorus and potassium in calcareous soil. Each experiment included 36 treatments which were the combination of 3 levels of P, 4 levels of K and 3 times of fertilizer application .

Factors under study were :

I- Phosphorus fertilizer at 0, 16 and 32 Kg P_2O_5/ fad.

II- Potassium fertilizer at 0, 40, 80 and 120 Kg K_2O/ fad.

III- Application time at sowing (T_1), after thinning (T_2) and after 30 days from thinning (T_3) .

The design was a randomized complete plock with four replications in both seasons. Results could be summarized as follow:

I- Effect of phosphorus fertilizer :

1-The total number of leaves/ plant after six months from sowing did not affect by different levels of P fertilizer until 32 Kg P_2O_5/ fad. in both growing seasons .

2- Phosphorus fertilizer until 32 Kg P_2O_5/ fad. significantly increased root length, root diameter, fresh and dry weight of leaves/ plant, fresh and dry weight of root/ plant, total fresh and total dry weight/ plant after 6 months from sowing in both growing seasons .

3- Phosphorus fertilizer significantly increased LA, LAI and SLA as compared with unfertilized treatment in both growing seasons. High level of applied P (32 Kg P_2O_5/ fad.) significantly decreased LWR and had no significant effect on LAR in both growing seasons .

4- At harvesting time, increasing the level of applied phosphorus from 0 to 16 and 32 Kg P_2O_5/ fad. caused a significant continuous increase in root length, root diameter, fresh weight of root/ plant, root yield (Ton/ fad.), top yield (Ton/ fad.), biological yield (Ton/ fad.) and sugar yield (Ton/ fad.) in both growing seasons .

5- The highest root yield (Ton/ fad.) was obtained by using 32 Kg P_2O_5/ fad. and increased the root yield by about 39% and 46% in the first and second season, respectively as compared with control treatment .

6- The average increases in biological yield (Ton/ fad.) by using P fertilizer at rates of 16 and 32 Kg P_2O_5/ fad. amounted to 16.5% and 28% over unfertilized treatment, respectively .

7- The highest rate of P fertilizer (32 Kg P_2O_5/ fad.) gave the highest value of sugar yield (Ton/ fad.). This increment reached 48% and

52% over the control treatment in the first and second season, respectively .

8- Phosphorus fertilizer significantly increased sucrose% in both seasons and purity% in the first season only. Total soluble solids% did not affect by increasing P level up to 32 Kg P_2O_5/ fad. in both growing seasons .

II- Effect of potassium fertilizer :

1- All potassium levels had no significant effect on number of leaves/ plant as compared with control treatment after 6 months from sowing in both growing seasons .

2- Root length, root diameter, fresh and dry weight of leaves/ plant, fresh and dry weight of root/ plant, total fresh and total dry weight/ plant increased gradually and significantly with increasing K-fertilizer levels up to 120 Kg K_2O/ fad. after 6 months from sowing in both growing seasons. The highest values were resulted from higher potassium rate (120 Kg K_2O/ fad.) .

3- Potassium fertilizer significantly increased LA, LAI and SLA as compared with unfertilized treatment in both growing seasons. The highest values were obtained by the highest K- fertilizer level .

4- All level of K- fertilizer had no effect on LAR and significantly decreased LWR in both growing seasons as compared with check treatment .

5- All potassium rates, i, e., 40, 80 and 120 Kg K_2O/ fad. significantly increased root length, root diameter, fresh weight of root/ plant, root yield (Ton/ fad.), top yield (Ton/ fad.), biological yield (Ton/ fad.) and sugar yield (Ton/ fad.) at harvesting time in both growing seasons .

6- Application of K at rates 40, 80 and 120 Kg K_2O/ fad. increased the root yield (Ton/ fad.) over the control treatment by more than 37%, 48% and 61% in the first season and 24%, 35% and 48% in the second season, respectively .

7- Potassium at 40, 80 and 120 Kg K_2O/ fad. increased biological yield (Ton/ fad.) over the control treatment by about 25%, 33% and 40% in the first season and about 16%, 25% and 33% in the second season, respectively .

8- The increments of sugar yield (Ton/ fad.) by increasing K level from 40, 80 and 120 Kg K_2O/ fad were 45%, 58% and 75% in the first season and 27%, 41% and 55% in the second season as compared with unfertilized treatment, respectively .

9- Total soluble solids% and sucrose% significantly increased by all K levels as compared with unfertilized treatment in both growing seasons .

10- Potassium fertilizer had no significant effect on purity% in both seasons .

III- Effect of application time of fertilizer :

1- The application of P and K fertilizer after thinning (40 days from sowing, T_2) gave the highest values of root length, root diameter, fresh weight of leaves/ plant, fresh weight of root/ plant and total fresh weight after 6 months from sowing as compared with T_1 (at sowing) and T_3 (70 days from sowing) in both growing seasons .

2- After 6 months from sowing, number of leaves/ plant, dry weight of root/ plant and total dry weight/ plant were insignificant affected by different application date of P and K fertilizer in both growing seasons.

3- The difference between T_1 and T_3 was not significant on leaf characters .

4- The highest value of LAI was obtained by T_2 treatment and significantly higher as compared with T_3 .

5- Concerning LA, LWR, LAR and SLA did not significantly affected by different application time of P and K fertilizer .

6- At harvesting time, the highest values of root length, root diameter, fresh weight of root/ plant, root yield (Ton/ fad.), top yield (Ton/ fad.),

biological yield (Ton/ fad.) and sugar yield (Ton/ fad.) were obtained by the application of P and K fertilizer after thinning (T_2, 40 days from sowing) in both growing seasons .

7- The difference between the applied of P and K at sowing (T_1) and 70 days from sowing (T_3) was not significant on root length and diameter, fresh weight of root/ plant, root yield, (Ton/ fad.) top yield, (Ton/ fad.) biological yield (Ton/ fad.) and sugar yield (Ton/ fad.) in both growing seasons .

8- The effect of applied date of P and K fertilizer on technological quality, namely, total soluble solids%, sucrose% and purity% was not significant in both growing seasons .

IV- Effect of the interaction :

1- After 6 months from sowing the greatest values of root length, root diameter, fresh weight of leaves/ plant, fresh weight of root/ plant, total fresh weight/ plant, dry weight of leaves/ plant (in second season only), dry weight of root/ plant and total dry weight/ plant (in both growing seasons) were obtained by high levels of applied P (32 Kg P_2O_5/ fad.) with the high two levels of applied K (120 and 80 Kg K_2O/ fad.) .

2- The highest values of LA in both growing seasons, LAI and SLA in first season were obtained by the highest rate of P (32 Kg P_2O_5/ fad.) and highest two levels of K (120 and 80 Kg K_2O/ fad.) .

3- The greatest value of leaf weight ratio (LWR) was reported by unfertilized treatment (0 P_2O_5 + 0 K_2O/ fad.) in the second season only .

4- At harvesting time, fertilization with highest levels of both fertilizers, P + K recorded the greatest values of root length, root diameter, root weight/ plant, root yield (Ton/ fad.), biological yield (Ton/ fad.) and sugar yield (Ton/ fad.) in both growing seasons .

5- Phosphorus and potassium at highest rate (32 Kg P_2O_5+ 120 Kg K_2O/ fad.) gave about double values from root diameter, root yield (Ton/ fad.), biological yield (Ton/ fad.) and sugar yield (Ton/ fad.) as compared with unfertilized treatment .

6- Sucrose% was higher by applied highest levels from P and K fertilizers in first season only .

7- The treatments with high levels of both P and K gave higher values of purity% as compared with lower rates of P and K, except only the unfertilized treatment in the first season only .

8- Higher level of P fertilizer (32 Kg P_2O_5/ fad.) with the application time after thinning (T_2, 40 days from sowing) gave the higher values

of total fresh weight/ plant in the second season, root yield (Ton/ fad.) in the first season and biological yield (Ton/ fad.) in the both growing seasons .

9- The greatest values of fresh weight of leaves/ plant, total fresh weight/ plant, LAI, root yield (Ton/ fad.) and biological yield (Ton/ fad.) were obtained by highest level of K (120 Kg K_2O/ fad.) and application time after thinning (T_2, 40 days from sowing) in the first season only .

10- The greatest values of root yield (Ton/ fad.) in the first season and biological yield (Ton/ fad.) in the both seasons were obtained by treatments of high levels of P and K with application time of fertilizer after thinning (T_2, 40 days from sowing) .