INFLUENCE OF NITROGEN AND POTASSIUM FERTILIZATION ON YIELD AND QUALITY OF TWO SUGAR BEET VARIETIES.

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Abstract

Two field trials were carried out at Sakha Research Station (Kafr El-Sheikh Governorate) during 2002/2003 and 2003/2004 seasons. Each experiment consisted of 18 treatments repesenting two varieties (Pleno and Kawemira) and three nitrogen fertilizer levels (65, 80 and 95 kg N/fed) and three potassium fertilizer levels (zero, 24 and 48 kg K_2O/fed). Treatments were arranged in split split plot design with four replications. Varieties were assigned in the main plots, nitrogen fertilizer levels were assigned to the sub plots and potassium fertilizer levels were randomly distributed in the sub-sub plots.

Increasing N level up to 95 kg N/fed showed significant effects on root length in both seasons and higher leaf area index, total dry weight of leaves, leaf/weight ratio, root diameter, root fresh weight, root top ratio, total soluble solids% and sugar yields. On the contrary total soluble solids, sucrose and purity percentages were decreased.

Potassium fertilizer showed significant effects on total soluble solids% in the 1st season, leaf/weight ratio and top yield in the 2nd season and leaf area index, total dry weight of leaves, root length, root diameter, root sucrose%, purity%, root/top ratio sugar yield (tons/fed) in both seasons.

The highest values of root yield (45.53 and 41.96 ton/fed) and sugar yield (6.76 and 5.95 ton/fed) resulted from the interaction between Kawemira variety, along with the application of 95 kg N/fed and 48 kg K_2O/fed in both seasons.

INTRODUCTION

El-Taweel (1999) found that sugar beet varieties Top, Kawemira and Pleno did not differ significantly in dry weight of leaves as well as top and sugar yields/fed, sucrose, TSS and purity%. The variety Pleno was the highest one in this respect followed by Kawemira and Top varieties in a descending order. Ismail (2002) found that sugar beet varieties did not differ significantly in root length and diameter (cm) as well as sucrose and purity% in both seasons, while they varied significantly in root fresh weight, root and sugar yields in the 1st season only.

El-Shafai (2000) showed that increasing N level up to 92 kg N/fed significantly increased root fresh weight, root and sugar yields, while sucrose% decreased. He noticed that purity percentage was not significantly affected by the applied N levels.

Ismail (2002) found that nitrogen levels affected significantly root length, diameter cm and root fresh weight, root and sugar yields in both seasons, while, sucrose and purity% were not affected by the used N levels.

El-Taweel (1999) found that increasing K application from 0 to 24 and 48 kg K_2O/fed significantly increased leaf area index, root length, root diameter cm, fresh weight of root and leaves, total soluble solids%, sucrose%, purity%, root and sugar yields of sugar beet plants. El-Shafai (2000) showed that significant increases in root fresh weight, sugar yield and sucrose% as K level increased from zero to 48 kg K_2O/fed while root yield was insignificantly increased. Purity% was not significantly affected by K fertilizer level. Ismail *et al.* (2002) found that potassium affected significantly root fresh weight, purity%, root and sugar yields in both seasons, while sucrose% was significantly responded only in the 1st season, while the highest top yield was recorded by the application of 24 kg K_2O/fed.

The aim of the present work was to study the effect of nitrogen and potassium fertilization on yield and quality of two sugar beet varieties.

MATERIALS AND METHODS

Two field trials were carried out at Sakha Research Station (Kafr El-Sheikh Governorate) during 2002/2003 and 2003/2004 seasons. Each experiment consisted of 18 treatments repesenting two varieties (Pleno and Kawemira) and three nitrogen levels (65, 80 and 95 kg N/fed) and three potassium levels (zero, 24 and 48 kg K_2O/fed). Treatments were distributed in split split plot design with four replications. Varieties were arranged in the main plots, levels of nitrogen fertilizer were assigned to the sub plots and levels of potassium fertilizer were randomly distributed in the sub-sub plots. Nitrogen fertilizer levels was applied in the form of Urea 46% N and potassium in the form of potassium sulfate 48% K_2O was applied at 48 kg K_2O/fed applied in two equal doses; the 1st application was applied after thinning (45 days from sowing) and the 2nd two weeks later. A fixed dose of phosphours (15 kg P_2O_5/fed) in the form of calcium superphosphate 15.5% P_2O_5 at the rate of 30 kg P_2O_5/fed was added along with seed bed preparation. Sowing took place during the 1st week of November while harvest was done 7 months later in both seasons. Plot size was 14 m^2 (4 rows of 50 cm apart and 7 m in length). Distance between hills was 20 cm. The previous crop was maize in both seasons. Other agricultural practices were done as recommended by Sugar Crops Research Institute (SCRI). The physical and chemical

analysis of the upper 30 cm of soil of the experimental site showed that the soil was clay loam containing 30.10% sand, 39.2% silt and 27.7% clay and 28.8 ppm available N, 16.38 ppm P and 420 ppm K^+.

Data recorded:

I. Leaves traits at 150 days from sowing: A sample of 10 plants was taken at random to determine the following:

1. Leaf area index (LAI) which was calculated according to Watson (1958).
2. Total dry weight of leaves (g).
3. Leaf/ weight ratio (LWR g/cm^2) as described by Wareing and Philips (1981).

II. Root traits at harvest: A sample of 10 plants was taken at random to determine the following:

4. Root length (cm).
5. Root diameter (cm).
6. Root fresh weight (g).

III. Juice quality:

7. Total soluble solids% (TSS%) was determined using hand refractometer.
8. Sucrose% was determined according to Le Decote (1927).
9. Purity% was calculated according to Carruthers *et al.* (1962).

Apparent purity % = Sucrose % x 100/TSS %.

IV. Yield and yield components: At harvest plants of each plot for various treatments were uprooted and topped to estimate:

10. Biological yield = Root yield + Top yield (tons/fed).
11. Root/top ratio.
12. Top yield (tons/fed).
13. Root yield (tons/fed).
14. Sugar yield (tons/fed) was calculated according to the following:

Sugar yield (tons/fed) = Root yield x sucrose %.

The collected data were statistically analyzed according to Snedecor and Cochran (1981).

RESULTS AND DISCUSSION

1. Leaf area index after 150 days from sowing (LAI):

Data in Table (1) showed significant differences in leaf area index as affected by varieties only in the 2nd season. The highest leaf area index (6.33) was obtained by variety Kawemira.

The result in Table (1) showed no differences in leaf area index as affected by nitrogen fertilizer in both seasons.

The effect of potassium fertilizer rates on leaf area index was significant in both seasons. Adding 24 kg K_2O/fed increased the leaf area index by about (16.96 and 11.05%) of the control treatment. These results are in agreement with that obtained by El-Taweel (1999).

The effect of the interaction between varieties and nitrogen fertilizer levels (AxB) on leaf area index was significant only in the 1st season. The highest leaf area index (6.81 and 6.97) were recorded by growing variety Pleno along with the application of 80 kg N/fed and variety Kawemira with 65 kg N/fed.

The effect of the interaction between varieties, nitrogen and potassium fertilizer rates (AxBxC) on leaf area index was significant only in the 1st season. The highest leaf area index (7.87 and 7.42) were recorded by growing variety Kawemira at 80 kg N/fed and 48 kg K_2O/fed and variety Pleno along with 80 kg N/fed and 24 kg K_2O/fed, respectively. Other interactions showed no significant effect on that trait.

2. Leaves total dry weight/plant (g) after 150 days from sowing:

Data in Table (1) showed no differences in leaves total dry weight/plant as affected by varieties and nitrogen fertilizer rates in both seasons. These results are in agreement with that obtained by El-Taweel (1999).

The effect of potassium fertilizer levels on leaves total dry weight/plant was significant in both seasons. Adding 24 kg K_2O/fed increased leaves total dry weight/plant by about (23.75 and 35.42%) of the control treatment.

The effect of the interaction between varieties and nitrogen fertilizer levels (AxB) on leaves total dry weight/plant was significant only in the 2nd season. The highest rate of N fertilizer (95 kg N/fed) achieved the highest (59.80 g) and the lowest (51.10 g) values of leaves total dry weight/plant with variety Kawemira and Pleno, respectively. Other interactions showed no significant effect on that trait.

3. Leaf/weight ratio after 150 days from sowing (LWR g/cm^2):

Results given in Table (2) showed no differences in leaf/weight ratio as affected by varieties in both seasons.

The effect of nitrogen fertilizer levels on leaf/weight ratio was significant only in the 2nd season. The two rates of N fertilizer (80 and 60 kg N/fed) achieved the highest (11.89) and the lowest (10.44) values of leaf/weight ratio, respectively.

The effect of potassium fertilizer rates on leaf/weight ratio was significant only in the 2nd season. Adding 24 kg K_2O/fed increased that leaf/weight ratio by about (23.17%) of the control treatment. Other interactions showed no significant effect on that trait.

The effect of the interaction between varieties and nitrogen fertilizer levels (AxB) on leaf/weight ratio was significant only in the 2nd season. The two rates of N fertilizer (95 and 65 kg N/fed) achieved the highest (13.11) and the lowest (10.44) values of leaf/weight ratio with variety Pleno and Kawemira, respectively. Other interactions showed no significant effect on that trait.

4. Root length (cm):

Results in Table (2) showed no differences in root length as affected by varieties in both seasons. These results are in agreement with that obtained by Ismail (2002).

The effect of nitrogen fertilizer rates on root length was significant in both seasons. Adding 95 kg N/fed increased that root length by about (6.99 and 4.27%) of the control treatment. These results are in harmony with those reported by Ismail (2002).

The effect of potassium fertilizer levels on root length was significant in both seasons. Adding 24 kg K_2O/fed increased root length by about (10.05 and 6.51%) of the control treatment. These results are in harmony with that reported by El-Taweel (1999). Other interactions showed no significant effect on that trait.

5. Root diameter (cm):

Data in Table (3) showed no differences in root diameter as affected by varieties and nitrogen fertilizer rates in both seasons. These results are in agreement with those obtained by Ismail (2002) and Ismail *et al.* (2002).

The effect of potassium fertilizer rates on root diameter was significant in both seasons. Adding 48 kg K_2O/fed increased the root diameter by about (2.41 and 0.40

cm) of the control treatment. These results are in agreement with that obtained by El-Taweel (1999).

The effect of the interaction between varieties and nitrogen fertilizer levels (AxB) on root diameter was significant in both seasons. The highest values (13.14 and 12.13) of root diameter was achieved by variety Kawemira with (95 and 80 kg N/fed) of the control treatment., respectively. Other interactions showed no significant effect on that trait.

6. Root fresh weight (g):

Table (3) showed no differences in root fresh weight as affected by varieties and nitrogen fertilizer levels in both seasons. These results are in agreement with that obtained by El-Shafai (2000), Ismail (2002) and Ismail *et al.* (2002).

The effect of potassium fertilizer levels on root fresh weight was significant in both seasons. Adding 48 kg K_2O/fed increased root fresh weight by about (20.91 and 27.47 g) of the control treatment., respectively. These results are in line with those obtained by El-Taweel (1999), El-Shafai (2000) and Ismail *et al.* (2002).

The effect of the interaction between varieties and nitrogen fertilizer levels (AxB) on root fresg weight was significant in both seasons. The two rates of N fertilizer (95 and 65 kg N/fed) achieved the highest (1363.8 g) and the lowest (1243.9 g) values of root fresh weight with variety Kawemira and Pleno, respectively. Other interactions showed no significant effect on that trait.

7. Total soluble solids percentage (TSS %):

Data in Table (4) showed no differences in total soluble solids% as affected by varieties and nitrogen fertilizer levels in both seasons. These results are in agreement with that obtained by El-Taweel (1999).

The effect of potassium fertilizer levels on total soluble solids was significant in the 1st season. The highest rate of potassium fertilizer (48 kg K_2O/fed) achieved the highest (20.13%) of total soluble solids%. The same conclusion was recorded by **El-**Taweel (1999).

The effect of the interaction between varieties and potassium fertilizer levels (AxC) on total soluble solids was significant in both seasons. The two rates of potassium fertilizer (48 and 24 kg K_2O/fed) achieved the highest (19.44 %) and the lowest (19.5%) values of total soluble solids with variety Kawemira, respectively. Other interactions showed no significant effect on that trait.

8. Sucrose percentage:

Table (4) showed no differences in sucrose% as affected by varieties and nitrogen fertilizer levels in both seasons. These results are in agreement with that obtained by El- Taweel (1999), El-Shafai (2000) and Ismail (2002).

The effect of potassium fertilizer levels on sucrose% was significant in both seasons. The highest rate of potassium fertilizer (48 kg K_2O/fed) increased sucrose% by about (2.41 and 2.84%) of the control treatment., respectively. The same conclusion was obtained by El-Shafai (2000).

The effect of the interaction between varieties and nitrogen fertilizer levels (AxB) on sucrose% in both seasons. The two rates of N fertilizer (65 and 80 kg N/fed) achieved the highest (15.64 and 15.29) values of sucrose% with variety Kawemira and Pleno., respectively. Other interactions showed no significant effect on that trait.

9. Purity percentage:

Table (5) showed no differences in purity% as affected by varieties and nitrogen fertilizer levels in both seasons. These results are in agreement with those obtained by El-Shafai (2000) and Ismail (2002).

The effect of potassium fertilizer rates on purity% was significant in both seasons. Adding 24 kg K_2O/fed increased the purity% by about (12.24 and 14.52%) of the control treatment. The same conclusion was showen by Ismail *et al.* (2002).

The effect of the interaction between varieties and potassium fertilizer levels (AxC) on purity% was significant only in the 2nd season. The highest rate of potassium fertilizer (48 and 24 kg K_2O/fed) achieved the highest (82.76 and 77.85) values of purity% with variety Kawemira and Pleno, respectively. Other interactions showed no significant effect on that trait.

10. Root/top ratio:

Table (5) showed no differences in root/top ratio as affected by varieties and nitrogen fertilizer levels in both seasons.

The effect of potassium fertilizer levels on root/top ratio was significant in both seasons. The lowest rate of potassium fertilizer levels (24 kg K_2O/fed) achieved the highest (3.01 and 3.07) values of root/top ratio., respectively.

The effect of the interaction between varieties and nitrogen fertilizer levels (AxB) on root/top ratio was significant in both seasons. The highest rate of N fertilizer (95 kg N/fed) achieved the highest (3.06 and 3.15) values of root/top ratio with variety Pleno, respectively. Other interactions showed no significant effect on that trait.

11. Top yield (tons/fed):

Data in Table (6) showed no differences in top yield as affected by varieties and nitrogen fertilizer rates in both seasons. These results are in agreement with that obtained by El-Taweel (1999).

The effect of potassium fertilizer levels on top yield was significant only in the 2nd season. The highest rate of potassium fertilizer (48 kg K_2O/fed) achieved the highest (13.05) values of top yield. These results are in agreement with that obtained by Ismail *et al.* (2002).

The effect of the interaction between varieties and nitrogen fertilizer levels (AxB) on top yield was significant in both seasons. In the 1st season the two rates of nitrogen fertilizer (95 and 80 kg N/fed) achieved the highest top yields (13.62 and 13.20 ton/fed) values of top yield with variety Kawemira and Pleno. In the 2nd season the highest rate of nitrogen fertilizer (95 kg N/fed) achieved the highest top yields (12.40 ton/fed) values of top yield with variety Kawemira., respectively. Other interactions showed no significant effect on that trait.

The effect of the interaction between varieties and potassium fertilizer levels (AxC) on top yield was significant only in the 1st season. The top yield of Pleno variety was the same under the applied to rates of K2O, and this was not the case with Kawemira variety. Other interactions showed no significant effect on that trait.

12. Biological yield (ton/fed):

Table (6) showed no differences in biological yield (ton/fed) as affected by varieties and nitrogen fertilizer rates in both seasons. These results are in agreement with those obtained by El-Taweel (1999) and Ismail (2002).

The effect of potassium fertilizer levels on biological yield was significant in both seasons. The highest rate of potassium fertilizer (48 kg K_2O/fed) achieved the highest (55.66 and 52.56 ton/fed) values of biological yield., respectively. Other interactions showed no significant effect on that trait. Tha same conclusion was obtained by Ismail *et al.* (2002).

The effect of the interaction between varieties and nitrogen fertilizer levels (AxB) on biological yield was significant in both seasons. In the 1st season the two rates of N fertilizer (95 and 80 kg N/fed) achieved the highest (54.53 and 53.07 ton/fed) values of biological yield with variety Kawemira and Pleno. In the 2nd season the highest rate of nitrogen fertilizer (95 kg N/fed) achieved the highest (50.29 ton/fed) values of biological yield with variety Kawemira., respectively.

13. Root yield (ton/fed):

Table (7) showed no differences in root yield (ton/fed) as affected by varieties and nitrogen fertilizer levels in both seasons. These results are in agreement with those obtained by El-Shafai (2000) and Ismail *et al.* (2002).

The effect of potassium fertilizer levels on root yield was significant in both seasons. The highest rate of potassium fertilizer (48 kg K_2O/fed) achieved the highest (41.72 and 39.51 ton/fed) values of root yields., respectively. The same conclusion was reported by Ismail *et al.* (2002).

The effect of the interaction between varieties and nitrogen fertilizer levels (AxB) on root yield was significant in both seasons. The two rates of N fertilizer (95 and 80 kg N/fed) achieved the highest (40.91 and 39.87 ton/fed) values of root yield with variety Kawemira and Pleno, respectively. Other interactions showed no significant effect on that trait.

14. Sugar yield (ton/fed):

Data in Table (7) showed no differences in sugar yield as affected by varieties and nitrogen fertilizer rates in both seasons. These results are in agreement with those obtained by El-Shafai (2000) and Ismail (2002).

The effect of potassium fertilizer levels on sugar yield was significant in both seasons. The highest rate of potassium fertilizer (48 kg K_2O/fed) achieved the highest (6.67 and 6.02 ton/fed) values of sugar yield., respectively. Tha same conclusion was obtained by Ismail *et al.* (2002).

The effect of the interaction between varieties and nitrogen fertilizer levels (AxB) on sugar yield was significant in both seasons. In the 1st season the highest rate of N fertilizer (95 and 80 kg N/fed) achieved the highest (6.46 and 6.15 ton/fed) values of sugar yield with variety Kawemira and pleno. In the 2nd season the highest rate of nitrogen fertilizer (95 kg N/fed) achieved the highest (5.59 ton/fed) values of sugar yield with variety Kawemira., respectively. Other interactions showed no significant effect on that trait.

Table 1. Effect of nitrogen and potassium fertilizer levels on leaf area index (LAI) and total dry weight of leaves/plant (g) of two sugar beet varieties after 150 days from sowing in 2002/2003 and 2003/2004 growing seasons.

Traits		Leaf area index (LAI)								Total dry weight of leaves/plant (g)							
Sugar beet	Nitrogen levels	2002/2003 Potassium (Kg K_2O/fed)			Mean	2003/2004 Potassium (Kg K_2O/fed)			Mean	2002/2003 Potassium (Kg K_2O/fed)			Mean	2003/2004 Potassium (Kg K_2O/fed)			Mean
Varieties	(Kg N/fed)	zero	24	48		zero	24	48		zero	24	48		zero	24	48	
Pleno	65	5.67	6.08	5.64	5.80	5.24	6.52	6.30	6.02	42.47	50.70	51.59	48.25	50.00	67.49	60.64	59.38
	80	5.96	7.42	7.04	6.81	5.44	6.17	6.42	6.01	48.07	60.93	58.34	55.78	43.20	74.54	60.48	59.40
	95	5.30	5.74	6.22	5.75	5.38	5.84	5.76	5.66	43.80	53.62	49.13	48.85	45.13	53.27	54.89	51.10
Average		5.64	6.41	6.30	6.12	5.36	6.18	6.16	5.90	44.78	55.08	53.02	50.96	46.11	65.10	58.67	56.38
Kawemira	65	5.73	7.30	6.29	6.97	5.36	6.46	6.09	5.97	42.85	57.61	51.72	50.73	47.39	61.16	65.00	57.85
	80	5.57	6.03	7.87	5.96	6.43	7.06	6.46	6.65	44.70	56.65	57.36	52.93	43.63	53.86	56.97	51.49
	95	6.07	7.32	7.11	6.83	6.36	5.95	6.83	6.38	46.12	52.22	65.25	54.53	49.26	66.99	63.16	59.80
Average		5.79	6.89	7.09	6.59	6.05	6.49	6.46	6.33	44.58	55.49	58.11	52.73	46.76	60.67	61.71	56.63
NxK	65	5.70	6.69	6.76	6.38	5.30	6.49	6.19	6.00	42.66	54.16	51.65	49.49	48.69	64.33	62.82	55.45
	80	5.77	6.73	6.66	6.29	5.94	6.62	6.44	6.02	46.42	58.79	57.85	51.69	43.42	64.20	58.72	55.45
	95	5.69	6.53	6.66	6.39	5.87	5.90	6.29	6.33	44.96	52.92	57.19	54.35	47.20	60.13	59.03	58.61
Total average		5.72	6.65	6.69	6.35	5.70	6.33	6.31	6.12	44.68	55.29	55.57	51.85	46.44	62.89	60.19	56.50
L.S.D. at 5% level of significant																	
Varieties (A)					N.S				0.37				N.S				N.S
Nitrogen (B)					N.S				N.S				N.S				N.S
Potassium (C)					0.38				0.48				5.02				5.85
A x B					0.47				N.S				N.S				5.77
A x C					N.S				N.S				N.S				N.S
B x C					N.S				N.S				N.S				N.S
A x B x C					0.92				N.S				N.S				N.S

Table 2. Effect of nitrogen and potassium fertilizer levels on leaf area/total dry weight of leaves/plant ratio (LWR g/cm^2) after 150 days from sowing and root length (cm) at harvest of two sugar beet varieties in 2002/2003 and 2003/2004 growing seasons.

Traits		Leaf/weight ratio (LWR g/cm^2) after 150 days from sowing								Root length (cm)							
Sugar beet Varieties	Nitrogen levels (Kg N/fed)	2002/2003 Potassium (Kg K_2O/fed)			Mean	2003/2004 Potassium (Kg K_2O/fed)			Mean	2002/2003 Potassium (Kg K_2O/fed)			Mean	2003/2004 Potassium (Kg K_2O/fed)			Mean
		zero	24	48		zero	24	48		zero	24	48		zero	24	48	
Pieno	65	13.45	12.34	11.13	12.31	10.73	10.18	10.41	10.44	22.43	25.87	28.57	25.62	29.23	30.80	30.21	30.08
	80	13.22	12.83	12.93	12.99	12.63	8.56	10.81	10.67	23.87	25.47	27.30	25.54	28.66	31.31	31.06	30.34
	95	12.21	10.98	12.82	12.01	11.96	11.22	10.53	11.24	24.77	26.97	29.50	27.08	30.49	32.08	31.60	31.39
Average		12.96	12.05	12.29	12.44	11.78	9.99	10.58	10.78	23.69	26.10	28.46	26.08	29.46	31.40	30.96	30.40
Kawemira	65	13.50	13.55	15.51	14.19	11.35	10.59	9.39	10.44	23.00	25.67	27.33	25.33	28.71	30.57	30.40	29.90
	80	13.15	11.54	10.96	11.88	14.75	13.23	11.36	13.11	25.00	27.00	28.00	26.67	29.38	30.81	30.27	30.15
	95	13.26	14.51	10.94	12.90	13.04	8.86	11.21	11.04	25.33	28.00	29.00	27.44	30.07	31.92	31.44	31.14
Average		13.30	13.20	12.47	12.99	13.05	10.89	10.65	11.53	24.44	26.89	28.11	26.48	29.39	31.10	30.70	30.61
NxK	65	13.48	12.95	13.32	13.25	11.04	10.39	9.99	10.44	22.72	25.77	27.95	25.48	28.97	30.69	30.31	29.99
	80	13.19	12.19	11.94	12.44	13.69	10.89	11.09	11.89	24.43	26.23	27.65	26.11	29.02	31.06	30.66	30.25
	95	12.73	12.75	11.88	12.45	12.50	10.04	10.87	11.14	25.05	27.48	29.25	27.26	30.28	32.00	31.52	31.27
Total average		13.13	12.63	12.38	12.71	12.41	10.44	10.62	11.16	24.07	26.49	28.28	26.28	29.34	31.25	30.83	30.50
L.S.D. at 5% level of significant																	
Varieties (A)					N.S				N.S				N.S				N.S
Nitrogen (B)					N.S				1.24				1.08				0.84
Potassium (C)					N.S				1.41				0.67				0.74
A x B					N.S				1.61				N.S				N.S
A x C					N.S				N.S				N.S				N.S
B x C					N.S				N.S				N.S				N.S
A x B x C					N.S				N.S				N.S				N.S

Table 3. Effect of nitrogen and potassium fertilizer levels on root diameter and root fresh weight of two sugar beet varieties at harvest in 2002/2003 and 2003/2004 growing seasons.

Traits		Root diameter (cm)								Root fresh weight (g)							
Sugar beet Varieties	Nitrogen levels (Kg N/fed)	2002/2003 Potassium ($Kg K_2O$/fed)			Mean	2003/2004 Potassium ($Kg K_2O$/fed)			Mean	2002/2003 Potassium ($Kg K_2O$/fed)			Mean	2003/2004 Potassium ($Kg K_2O$/fed)			Mean
		zero	24	48		zero	24	48		zero	24	48		zero	24	48	
Pleno	65	10.38	12.73	12.70	11.94	9.01	11.72	11.58	10.77	1088.0	1323.3	1320.3	1243.9	951.2	1222.0	1208.0	1127.1
	80	11.36	13.46	13.55	12.79	9.80	12.20	12.87	11.62	1185.7	1396.3	1405.3	1329.1	1030.3	1269.7	1337.0	1212.3
	95	10.42	13.16	13.23	12.27	9.42	12.20	12.39	11.34	1092.3	1366.0	1373.3	1277.2	992.7	1269.7	1289.0	1183.6
Average		10.72	13.12	13.16	12.33	9.41	12.04	12.28	11.24	1122.0	1361.9	1366.3	1283.4	991.3	1253.8	1278.0	1174.4
Kawemira	65	12.00	12.74	14.68	12.35	11.09	11.81	12.93	11.43	1250.0	1323.7	1354.7	1285.4	1158.7	1231.0	1243.0	1193.0
	80	11.09	12.74	13.23	12.35	9.87	11.67	12.75	12.13	1158.7	1324.3	1373.3	1363.8	1037.0	1216.7	1325.3	1262.8
	95	10.77	13.25	13.05	13.14	9.79	12.29	13.49	11.67	1127.0	1374.7	1517.7	1285.4	1028.7	1278.7	1398.7	1216.8
Average		11.29	12.91	13.65	12.62	10.25	11.92	13.06	11.74	1178.6	1340.9	1415.2	1311.6	1074.8	1242.1	1355.7	1224.2
NxK	65	11.19	12.74	13.69	12.54	10.05	11.77	12.53	11.45	1169.0	1323.5	1419.0	1303.8	1054.9	1226.5	1303.3	1194.9
	80	11.22	13.10	13.39	12.31	9.84	11.93	12.81	11.50	1172.2	1360.3	1389.3	1281.3	1033.7	1243.2	1331.2	1200.2
	95	10.60	13.20	13.14	12.57	9.61	12.24	12.66	11.53	1109.6	1370.3	1364.0	1307.3	1010.5	1274.2	1316.0	1202.7
Total average		11.00	13.01	13.41	12.48	9.83	11.89	13.67	11.49	1150.3	1351.4	1390.8	1297.5	1033.0	1247.9	1316.8	1119.3
L.S.D. at 5% level of significant																	
Varieties (A)					N.S				N.S				N.S				N.S
Nitrogen (B)					N.S				N.S				N.S				N.S
Potassium (C)					0.67				0.62				67.48				62.25
A x B					0.89				0.77				88.61				76.68
A x C					N.S				N.S				N.S				N.S
B x C					N.S				N.S				N.S				N.S
A x B x C					N.S				N.S				N.S				N.S

Table 4. Effect of nitrogen and potassium fertilizer levels on total soluble solids (TSS%) and sucrose% of two sugar beet varieties at harvest in 2002/2003 and 2003/2004 growing seasons.

Traits		Total soluble solids (TSS%)								Sucrose%							
Sugar beet Varieties	Nitrogen levels (Kg N/fed)	2002/2003 Potassium (Kg k_2O/fed)			Mean	2003/2004 Potassium (Kg k_2O/fed)			Mean	2002/2003 Potassium (Kg k_2O/fed)			Mean	2003/2004 Potassium (Kg k_2O/fed)			Mean
		zero	24	48		zero	24	48		zero	24	48		zero	24	48	
Pleno	65	18.24	20.34	19.72	19.43	17.67	18.69	19.33	18.56	12.88	15.23	15.20	14.44	11.51	14.22	14.08	13.27
	80	18.43	20.07	20.40	19.64	20.23	18.75	19.85	19.61	13.86	15.96	16.05	15.29	12.30	14.70	15.37	14.12
	95	18.63	19.65	20.54	19.61	20.04	19.79	19.13	19.32	12.92	15.66	15.73	14.77	11.92	14.70	14.89	13.84
Average		18.43	20.02	20.22	19.34	19.31	18.74	19.44	18.84	13.22	15.62	15.66	14.83	11.91	14.54	14.78	13.74
Kawemira	65	20.17	18.38	20.56	19.70	17.80	19.47	18.25	18.51	14.50	15.24	17.18	15.64	13.59	14.31	15.99	14.63
	80	18.81	18.13	20.08	19.01	17.87	19.75	18.74	18.79	13.59	15.24	15.73	14.85	12.37	14.17	15.25	13.93
	95	19.25	19.22	19.46	19.31	18.65	19.40	19.64	19.23	13.27	15.75	15.55	14.85	12.29	14.79	15.43	14.17
Average		19.41	18.58	20.03	19.56	18.11	19.54	18.88	19.17	13.79	15.41	16.15	15.12	12.75	14.42	15.56	14.24
NxK	65	19.20	19.36	20.14	19.57	17.74	19.08	18.79	18.54	13.69	15.24	16.19	15.04	12.55	14.27	15.03	14.00
	80	18.62	19.10	20.24	19.32	19.05	19.25	19.30	19.20	13.72	15.60	15.89	15.07	12.34	14.43	15.31	14.03
	95	18.94	19.44	20.00	19.46	19.35	19.10	19.38	19.28	13.10	15.70	15.64	14.81	12.11	14.74	15.16	13.95
Total average		18.92	19.30	20.13	19.45	18.71	19.14	19.16	19.00	13.50	15.51	15.91	14.98	12.33	14.48	15.17	13.99

L.S.D. at 5% level of significant				
Varieties (A)	N.S	N.S	N.S	N.S
Nitrogen (B)	N.S	N.S	N.S	N.S
Potassium (C)	0.82	N.S	0.67	0.62
A x B	N.S	N.S	0.89	0.77
A x C	1.16	1.09	N.S	N.S
B x C	N.S	N.S	N.S	N.S
A x B x C	N.S	N.S	N.S	N.S

Table 5. Effect of nitrogen and potassium fertilizer levels on purity% and root/top ratio of two sugar beet varieties at harvest in 2002/2003 and 2003/2004 growing seasons.

Traits		Purity%								Root/top ratio							
Sugar beet Varieties	Nitrogen levels (Kg N/fed)	2002/2003 Potassium (Kg K_2O/fed)			Mean	2003/2004 Potassium (Kg K_2O/fed)			Mean	2002/2003 Potassium (Kg K_2O/fed)			Mean	2003/2004 Potassium (Kg K_2O/fed)			Mean
		zero	24	48		zero	24	48		zero	24	48		zero	24	48	
Pleno	65	70.76	75.20	77.11	74.35	65.17	76.12	73.12	71.47	3.17	3.03	3.03	3.05	3.29	3.08	3.09	3.12
	80	76.56	79.59	79.10	78.41	60.93	78.39	77.68	72.33	3.10	2.99	2.99	3.03	3.22	3.05	3.02	3.10
	95	69.59	80.09	76.75	75.48	59.53	79.05	78.18	72.25	3.17	3.01	3.01	3.06	3.25	3.05	3.04	3.15
Average		72.30	78.29	77.65	76.08	61.88	77.85	76.33	72.02	3.14	3.01	3.01	3.04	3.26	3.06	3.05	3.09
Kawemira	65	72.94	82.82	83.58	79.78	76.60	73.44	88.12	79.39	3.06	3.03	2.95	3.01	3.12	3.08	2.99	3.06
	80	72.34	84.35	78.65	78.45	69.41	71.98	81.63	74.34	3.12	3.03	3.00	3.05	3.21	3.08	3.03	3.11
	95	69.03	81.95	79.94	76.97	65.89	76.30	78.53	73.57	3.14	3.00	3.01	3.05	3.22	3.05	3.02	3.10
Average		71.43	83.04	80.72	78.40	70.63	73.91	82.76	75.77	3.11	3.02	2.99	3.05	3.19	3.07	3.01	3.12
NxK	65	71.85	79.01	80.34	77.07	70.89	74.78	80.62	75.43	3.12	3.03	2.99	3.04	3.21	3.08	3.04	3.11
	80	74.45	81.97	78.87	78.43	65.17	75.18	79.66	73.33	3.11	3.01	3.00	3.04	3.22	3.07	3.03	3.10
	95	69.31	81.02	78.35	76.23	62.71	77.67	78.36	72.91	3.16	3.00	3.01	3.06	3.24	3.05	3.03	3.11
Total average		71.87	80.67	79.19	77.24	66.26	75.88	79.54	73.89	3.13	3.01	3.00	3.05	3.22	3.07	3.03	3.11

L.S.D. at 5% level of significant				
Varieties (A)	N.S	N.S	N.S	N.S
Nitrogen (B)	N.S	N.S	N.S	N.S
Potassium (C)	0.26	4.58	0.03	0.04
A x B	N.S	N.S	0.02	0.03
A x C	N.S	6.48	N.S	N.S
B x C	N.S	N.S	N.S	N.S
A x B x C	N.S	N.S	N.S	N.S

Table 6. Effect of nitrogen and potassium fertilizer levels on top and biological yields (ton/fed) of two sugar beet varieties at harvest in 2002/2003 and 2003/2004 growing seasons.

Traits		Top yield (ton/fed)								Biological yield (ton/fed)							
Sugar beet Varieties	Nitrogen levels (Kg N/fed)	2002/2003 Potassium (Kg K_2O/fed)			Mean	2003/2004 Potassium (Kg K_2O/fed)			Mean	2002/2003 Potassium (Kg K_2O/fed)			Mean	2003/2004 Potassium (Kg K_2O/fed)			Mean
		zero	24	48		zero	24	48		zero	24	48		zero	24	48	
Pleno	65	10.31	13.13	13.09	12.18	8.66	11.91	11.75	10.78	42.95	52.83	52.70	49.49	37.20	48.57	47.99	44.59
	80	11.48	14.01	14.11	13.20	9.61	12.49	13.29	11.80	47.05	55.90	56.27	53.07	40.52	50.58	53.40	48.17
	95	10.36	13.64	13.73	12.58	9.16	12.49	12.72	11.45	43.13	54.62	54.93	50.89	38.93	50.58	51.39	46.96
Average		10.71	13.59	13.65	12.65	9.15	12.30	12.59	11.34	44.37	54.45	54.64	51.15	38.88	49.91	50.93	46.57
Kawemira	65	12.25	13.13	13.51	12.68	11.15	12.02	13.37	11.85	49.75	52.84	54.15	51.24	45.91	48.95	53.66	48.36
	80	11.15	13.14	13.73	12.68	9.69	11.85	13.15	11.57	45.91	52.87	54.93	51.24	40.80	48.35	52.91	47.36
	95	10.77	13.75	15.46	13.62	9.59	12.59	14.03	12.40	44.58	54.99	60.99	54.53	40.45	50.95	55.99	50.29
Average		11.39	13.34	14.23	12.99	10.15	12.16	13.52	11.94	46.75	53.57	56.69	52.34	42.39	49.42	54.19	48.67
NxK	65	11.28	13.13	14.28	12.90	9.91	11.97	12.89	11.59	46.35	52.84	56.85	52.01	41.56	48.76	51.99	47.44
	80	11.32	13.57	13.92	12.63	9.65	12.17	13.22	11.65	46.48	54.38	55.60	51.07	40.66	49.46	53.16	47.66
	95	10.57	13.69	13.62	12.94	9.38	12.54	13.04	11.68	43.86	54.80	54.54	52.16	39.69	50.77	52.52	47.76
Total average		11.05	13.47	13.94	12.82	9.65	12.23	13.05	11.64	45.56	54.01	55.66	51.74	40.64	49.66	52.56	47.62

L.S.D. at 5% level of significant				
Varieties (A)	N.S	N.S	N.S	N.S
Nitrogen (B)	N.S	N.S	N.S	N.S
Potassium (C)	N.S	0.75	2.84	2.61
A x B	1.06	0.92	3.72	3.22
A x C	0.81	N.S	N.S	N.S
B x C	N.S	N.S	N.S	N.S
A x B x C	N.S	N.S	N.S	N.S

Table 7. Effect of nitrogen and potassium fertilizer levels on root and sugar yields (ton/fed) of two sugar beet varieties at harvest in 2002/2003 and 2003/2004 growing seasons.

Traits		Root yield (ton/fed)								Sugar yield (ton/fed)							
Sugar beet Varieties	Nitrogen levels (Kg N/fed)	2002/2003 Potassium (Kg K_2O/fed)			Mean	2003/2004 Potassium (Kg K_2O/fed)			Mean	2002/2003 Potassium (Kg K_2O/fed)			Mean	2003/2004 Potassium (Kg K_2O/fed)			Mean
		zero	24	48		zero	24	48		zero	24	48		zero	24	48	
Pleno	65	32.64	39.70	39.61	37.32	28.54	36.60	36.24	33.81	4.20	6.08	6.02	5.44	3.29	5.23	5.10	4.54
	80	35.57	41.89	42.16	39.87	30.91	38.09	40.11	36.37	4.93	6.69	6.81	6.15	3.81	5.61	6.21	5.21
	95	32.77	40.98	41.20	38.32	29.77	38.09	38.67	35.51	4.24	6.43	6.52	5.73	3.56	5.60	5.78	4.98
Average		33.66	40.86	40.99	38.50	29.74	37.61	38.34	35.23	4.46	6.40	6.45	5.77	3.55	5.48	5.70	4.91
Kawemira	65	37.50	39.71	40.64	38.56	34.76	36.93	40.29	36.50	5.45	6.10	6.39	5.78	4.75	5.82	5.89	5.24
	80	34.76	39.73	41.20	38.56	31.11	36.50	39.76	35.79	4.73	6.08	6.51	5.77	3.85	5.18	6.09	5.04
	95	33.81	41.24	45.53	40.91	30.86	38.36	41.96	37.88	4.51	6.51	6.76	6.46	4.80	5.69	5.95	5.59
Average		35.36	40.23	42.46	39.35	32.24	37.26	40.67	36.73	4.90	6.23	6.89	6.00	4.14	5.39	6.35	5.29
NxK	65	35.07	39.71	42.57	39.12	31.65	36.80	39.10	35.85	4.83	6.09	6.92	5.95	4.02	5.27	5.91	5.07
	80	35.17	40.81	41.68	38.44	31.01	37.30	39.94	36.01	4.83	6.38	6.66	5.76	3.83	5.39	6.15	5.11
	95	33.29	41.11	40.92	39.12	30.31	38.23	39.48	36.08	4.38	6.47	6.43	5.96	3.68	5.65	6.01	5.12
Total average		34.51	40.54	41.72	38.92	30.99	37.44	39.51	35.98	4.68	6.31	6.67	5.89	3.84	5.44	6.02	5.10
L.S.D. at 5% level of significant																	
Varieties (A)					N.S				N.S				N.S				N.S
Nitrogen (B)					N.S				N.S				N.S				N.S
Potassium (C)					2.02				1.87				0.58				0.50
A x B					2.66				2.30				0.76				0.62
A x C					N.S				N.S				N.S				N.S
B x C					N.S				N.S				N.S				N.S
A x B x C					N.S				N.S				N.S				N.S

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تأثير التسميد بعنصر النيتروجين والبوتاسيوم على حاصل وجودة صنفين من بنجر السكر

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أقيمت تجربتان حقليتان بمحطه البحوث الزراعيه بسخا بمحافظه كفر الشيخ لدراسه تأثير التسميد بالنيتروجين والبوتاسيوم على حاصل وجوده صنفين من بنجر السكر خلال موسمى الزراعه ٢٠٠٢/٢٠٠٣ و٢٠٠٣/٢٠٠٤ وإشتملت الدراسه على صنفين من اصناف بنجر السكر عديد الاجنة كاوميرا وبلينو وثلاثة معدلات من التسميد النيتروجينى ٦٥ و٨٠ و ٩٥ كجم نيتروجين للفدان وثلاثة مستويات من التسميد بعنصر البوتاسيوم صفر و ٢٤ و ٤٨ كجم بوتاسيوم بو٢أ للفدان. وزعت المعاملات فى تصميم قطع منشقه مرتين فى أربع مكررات حيث وضعت الاصناف فى القطع الرئيسيه ووضعت معدلات التسميد الازوتى فى القطع الفرعية ووضعت معدلات التسميد البوتاسى فى القطع تحت الفرعية.

- **أوضحت النتائج المتحصل عليها ما يلى :**

تفوق الصنف كاوميرا على الصنف بلينو معنويا فى صفة دليل مساحة الاوراق فى الموسم الثانىفقط. بينما زادت صفات المادة الجافة الكلية للاوراق ونسبة الاوراق/الوزن وطول الجذر وقطر الجذر ووزن الجذر الطازج والنسبة المئوية لكلا من المادة الصلبة الذائبة الكلية والسكروز والنقاوة ونسبة وزن الجذر الى العرش وحاصل كل من العرش والبيولوجى والجذور والسكر.

أوضحت النتائج تفوق معاملات التسميد الازوتى حتى ٩٥ كجم ازوت للفدان معنويا فى صفة طول الجذر فى كلا الموسمين. بينما زادت صفات دليل مساحة الاوراق والمادة الجافة الكلية للاوراق ونسبة الاوراق/الوزن وقطر الجذر ووزن الجذر الطازج ونسبة وزن الجذر الى العرش وحاصل كل من العرش والبيولوجى والجذور والسكر. بينما قلت صفات الجودة وهى النسبة المئوية لكلا من المادة الصلبة الذائبة الكلية والسكروز والنقاوة.

أوضحت النتائج تفوق معاملات التسميد بعنصر البوتاسيوم بو٢أ معنويا فى الموسم الاول فى صفة النسبة المئوية للمواد الصلبة الذائبة الكلية وصفتى ونسبة الاوراق/الوزن و حاصل العرش فى الموسم الثانى و صفات دليل مساحة الاوراق و المادة الجافة الكلية للاوراق وطول الجذر وقطر الجذر ووزن الجذر الطازج والنسبة المئوية للسكروز والنقاوة ونسبة الجذر/العرش والحاصل البيولوجى والجذور والسكر فى كلا الموسمين.

تم الحصول على أعلى حاصل من الجذور (٤٥,٥٣ و ٤١,٩٦ طن للفدان) وكذلك احسن حاصل من السكر (٦,٧٦ و ٥,٩٥ طن للفدان) فى كلا الموسمين عند زراعة الصنف كاوميرا مع اضافة ٩٥ كجم نيتروجين للفدان و٤٨ كجم بوأ للفدان.٢٠