J. Agric. Sci. Mansoura Univ., 29 (6): 2963 - 2978, 2004

EFFECT OF POTASSIUM FERTILIZER ON MINERAL CONTENTS AND SOME BIOLOGICAL COMPONENTS OF TEN SUGAR BEET VARIETIES

Amer, M. A*., M.Z. Attalah,M.F. Ibrahim **and Fayza El-Taweel** .**
* Soil, Water and Environment Research Institute. Agriculture Research Center.
**Sugar Crops Research Institute. Department of Physiology. Agriculture Research Center.

ABSTRACT

Two field experiments were conducted in the Agricultural Research Station Farm to study the effect of potassium fertilizer on mineral composition (Fe, Cu, Mn, and Zn), biochemical components (α amino nitrogen, sodium and Peroxidase isozyme) and some characters of sugar quality (T.S.S, sucrose and purity%). The experiments were carried out in a split plot design with 3 replicates. The treatments were 4 rates of K_2O (0, 30, 60 and 90 kg of K_2O) and two types of sugar beet; 5 monogerm (Inverse, Prisma, Del936, Sophie and Universe) and 5 multigerm (Baraka, Farida, Respoly, Pleno and Sultan).

The data showed that adding K resulted a significant increase in the concentration of N and K in both roots and leaves and that the monogerm types contained more N than the multigerm one. Phosphorus increased up to 30 units of K_2O and then began to decrease as the added K increased. Concentration of micronutrients (Fe, Cu, Mn and Zn) increased in both roots and leaves as the K added increased but by different degrees depending on the differentiating in varieties as it were affected significantly. At the same time there was great response to the varieties among the T.S.S, sucrose and purity% where they increased by about 33.4, 3.55 and 15.4%, respectively, with the increase in K added. The significant increase in α amino nitrogen and sodium revealed the effect of potassium on protein synthesis. The treatments with potassium showed also an increase in the cathode and anode band activities for the two varieties, which differed from the untreated plants.

INTRODUCTION

The global population are expected to reach eight to nine billon inhabitants within the next two or three decades. Most of the population growth will occur in developing countries, and more people need more food. Rosegrant et.al. (1995) calculated that the global demand for cereals will increase till 2020 by almost 1 billion to 2.7 billion tons, and for meat by 75% to 283 billion tons. This would require a growth rate of more than 2% per anumm to meat the demand for cereals. Root and tuber production in developed countries shows slightly negative trend with an annually decline of more than 1 million tons. The trend in production of sugar plants differs between the types. Sugar beet area and production decreased during the last decade by almost 15%. The decline in beet area was partly compensated by an overall increase in beet yield of 17%. However, in order to achieve a higher yield, the plant has to absorb more nutrients and ultimately, more nutrients are removed from the field with the harvest. In other words, the demand for vertical increase in crop output can only be met by simultaneous increase in nutrient supply to the plants. As the tuber crops and sugar beet have a relatively poor root system when compared to cereals, this restrictive the soil volume, which can be exploited and thus requires a much higher potassium concentration in soil solution to meet the demand for the crop, (Samia El-Maghraby *et al.*, 1997).

The high solubility of K in organic waste leaches K in the sewage treatment plants with the water, which is usually drained off into river systems. The remaining solid waste contains mostly N and P. The resulting N/K ratio in global fertilizers use depreciated rapidly from a fairly balanced ratio of 1.0,4 to currently 1. 0.27. This means a negative K balance and heavy soil K mining and loss in fertility, (Dobermann, 1999).

Its role in the enzymatic control of metabolism of plants renders, potassium also is a major factor in quality production. As an example, IPI sponsored field trials increased the sugar content of sugar beet from 17.5% at NP only to more than 20% at balanced fertilizer with NPK + Mg, (Perrenoud,1990).

Consequently, isozymes and genetic variation of isozymes serve as label or markers, which can be used in the study of different parts of higher organisms, in linkage studies and in population studies. Because the techniques required only a small amount of material, they are easily used in mass searching, Brewer (1970). There is considerable tissue and ontogenetic variation in bands and activity, and also considerable genetic variation in this system, (Brewer and Sing, 1969). Many investigators studied the biochemical assays to determine genetic markers in sugar beet by using peroxidase isozymes (Spettoli; 1980, Konovalov, (1991 &1992), Abd El-Hamid, Manal, (1997); Ghonema (2000) and Ghora *et al.* (2000).

The present study was established in order to investigate the effect of potassium fertilizer on mineral composition (Fe, Cu, Mn and Zn), biological components (α amino nitrogen, sodium and Peroxidase isozymes) and some characters of ten sugar beet varieties.

MATERIALS AND METHODS

Two field experiments were carried out at Agricultural Research Station, Alexandria, Agricultural research center during 1999/2000 and 2000/2001 seasons to study the effect of potassium fertilizer levels (zero, 30, 60 and 90 kg K_2O/fed.) on 5 monogerm sugar beet varieties named (Inverse, Prisma, Del936, Sophie and Universe) and 5 multigerm sugar beet varieties named (Baraka, Farida, Respoly, Pleno and Sultan). Each experiment included 40 treatments arranged in a split-plot design with three replicates. The treatments were, the combinations of 4 levels of potassium fertilizer (arranged the main plot) and the ten sugar beet varieties (arranged in the sub-plot).

Sugar beet varieties were sown on October 20th in 1999/2000 and 2000/2001 seasons, respectively. At sowing calcium super phosphate (15.5% P_2O_5) was added at a rate of 150 Kg/fed, as well as 200Kg/fed of urea (46%), which, was added at two equal doses. The first was added after thinning before the first irrigation, whereas the second was applied three weeks later. Potassium fertilizer was added in the form of potassium sulfate (48% K_2O_5) before the first irrigation. Each plot was 10.5 square meters (3.5m length and 3 m width) with 5 ridges 60 cm apart, and 20 cm between hills with one plant /hill. The agronomic practices for growing sugar beet were followed. Plots were harvested after 190 days from sowing. A random ten roots from each plot was taken for measuring sucrose % (determined according to Le Docte, 1927), purity % was calculated according to the equation:

Purity % = Sucrose/ T.S.S X 100, T.S.S. was estimated by hand refrectometer for 10 roots per plot and averaged and sodium as will as α amino nitrogen were determined according to Brown and Lilliand (1964).

For the determination of nutrients concentration in plant tissue, 1gram dry weight of the roots was grounded and digested in an oven at 450°C according to Øien and Kjerdingen (1977). Potassium was measured in the digested plant by means of phlame photometry, phosphorus was determined according to Murphy and Reliy (1962), and Fe, Zn, Mn, and Cu were determined in the digested plant by means of Atomic Spectrophotometry (Perkin Elmer 3300). Nitrogen was determined in the dry weight by Kjldahl apparatus.

Physical and chemical analysis of the soil surface layer (0-30cm) was done for the two seasons (Table 1) according to Piper, 1950.

Table (1): Physical and chemical properties of the soil surface layer (0-30 cm) during 1999/2000 and 2000/2001seasons.

Character		Season 1	Season 2
	pH	7.28	7.61
	EC (dS/m)	1.16	1.68
Soluble cations (meq/L)	Ca^{++}	15.15	22.1
	Mg^{++}	11.8	9.17
	Na^+	39.5	31
	K^+	0.32	2.24
Soluble anions meq/L	CO_3^{--}	0	0
	HCO_3^-	2.99	3.32
	SO_4^{--}	14.31	27.16
Available nutrients mg/Kg soil	N	24	28
	P	22	19
	K	762.1	763
	Total N %	0.08	0.07
	Organic Carbon %	0.83	1.08
	Organic matter %	1.93	1.9
	Texture	Clay	Clay

Electrophoreses and isozyme technique:

Peroxidase isozymes patterns of sugar beet treated with 30, 60 and 90 Kg potassium were examined using the following procedure:

1-Buffers:

A-0.23 M tris –citric acid buffer, pH 8.0 was prepared according to El- Metainy *et al.* (1977)

B- 0.01 M sodium acetate – acetic acid buffer, pH 5.0 was prepared according to Show (1969).

2-Gel medium:

Agar starch – polyvinyl pirolidine (P. V. P.) gel: 1.0 gram agar, 0.5 gm P. V. P. and 0.3 gm of hydrolyzed starch were added to 100 ml of 0.23 tris – acetic acid, pH 8.0 and then, gel plates wee prepared as described by Sabrah and El- Metainy (1985).

Staining solution:

100 ml of 0.01 M sodium acetate – acetic acid buffer, pH 5.0 containing 0.1 gm benzidine and 0.5% hydrogen peroxide (H_2O_2) was added immediately before staining.

Statistical analysis:

Data were statistically analyzed according to Snedecor and Cochran (1967). Combined analysis of the two seasons was carried out wherever homogeneity of variance was detected. Values for all studied traits were presented as an average over the two seasons and compared using L.S.D. at 0.05 percent level of significance.

RESULTS AND DISCUSSION

Data in Tables (2, 3, 4 and 5) showed the effect of increasing potassium levels on macro and micronutrients on both roots and leaves of ten varieties.

The data of macronutrient (N-P-K) in Table (2 and 3) revealed the significant effect of adding K on the concentration of N in both roots and leaves. Adding potassium at a rate of 30 Kg K_2O/fed was more effective than the other additions where they have the order 30 Kg > 60 Kg > 90 Kg >0.0 Kg K_2O. The data also clarified that N concentration was more concentrated in the leaves of monogerm types than that of the multigerm types, while the opposite was obtained in the roots. This may be due to the difficulty of moving N from leaves to roots. Sultan and Universe varieties contained the highest values in their leaves while Baraka (multigerm) and Inverse (monogerm) contained the highest N concentration in their roots. The statistical analysis showed also that the interaction among treatments was significant indicating the effect of potassium on N content in both roots and leaves.

Phosphorus in leaves significantly increased as the potassium level increased up to 30 units of K_20, then the effect of increasing rate began to be lower with the increasing rate of K. Baraka variety (multigerm) and Inverse variety (monogerm) had the highest concentration of P. The data showed that multigerm varieties were more pronounced in detecting the increasing levels of K. The statistical analysis showed that uptake of P in roots was highly significant while in leaves there were no differences between the treatments.

Table (2) Effect of Potassium treatments on nitrogen (N), phosphorus (P) and potassium (K) concentration in roots of the two types of sugar beet varieties as an average of the two seasons

Treatments	Potassium added (K2O/Kg													
Varieties	0	30	60	90		0	30	60	90		0	30	60	90	
Multigerm	N Concentration (%)				Mean	P Concentration (%)				Mean	K Concentration (%)				Mean
Baraka	1.08	3.01	2.63	2.51	2.31	0.53	0.93	1.66	1.61	1.18	1.31	2.98	3.11	3.81	2.80
Farida	1.31	2.41	2.13	2.05	1.98	0.09	1.00	1.69	1.95	1.18	2.93	2.81	3.01	3.48	3.06
Raspoly	1.21	2.44	1.93	1.74	1.83	0.43	0.91	1.28	1.83	1.11	2.51	2.44	2.91	3.16	2.76
Pleno	1.23	3.31	1.91	1.32	1.94	0.45	0.63	1.21	1.29	0.90	2.33	5.41	5.95	6.30	5.00
Sultan	1.01	3.20	2.93	2.71	2.46	0.29	0.79	1.38	1.55	1.00	2.51	4.33	5.31	5.91	4.52
Monogerm															
Inverse	1.34	2.01	1.94	1.96	1.81	0.63	1.56	1.78	1.93	1.48	0.41	2.41	2.51	3.44	2.19
Prisma	1.21	1.89	1.61	1.32	1.51	0.25	0.78	1.41	1.43	0.97	1.65	3.81	3.83	3.92	3.30
Del936	1.05	2.30	1.91	1.83	1.77	0.13	0.72	1.49	1.48	0.96	1.43	3.51	3.64	3.96	3.14
Sophie	1.51	2.55	1.93	1.81	1.95	0.04	0.89	1.07	1.31	0.83	1.01	2.01	3.65	3.99	2.67
Universe	1.21	1.93	1.44	1.33	1.48	0.51	0.76	1.53	1.58	1.10	0.89	2.09	4.81	5.09	3.22
Mean	1.22	2.51	2.04	1.86	1.90	0.34	0.90	1.45	1.60	1.07	1.70	3.18	3.87	4.31	3.26
LSD (5%)															
K	*** (0.019)					*** (0.056)					*** (0.28)				
Varieties	*** (0.22)					*** (0.063)					*** (0.020)				
Interaction	*** (0.014)					*** (0.039)					*** (0.019)				

Table (3) Effect of Potassium treatments on nitrogen, phosphorus and potassium concentration in shoots of the two types of sugar beet varieties as an average of the two seasons

Treatments	Potassium added (K_2O/Kg)														
Varieties	0	30	60	90		0	30	60	90		0	30	60	90	
Multigerm	N Concentration (%)				Mean	P Concentration (%)				Mean	K Concentration (%)				Mean
Baraka	1.18	1.34	0.98	0.93	1.11	0.61	0.71	0.66	0.61	0.65	1.39	1.77	1.93	2.05	1.79
Farida	1.43	1.81	1.03	0.98	1.31	0.40	0.94	0.69	0.59	0.66	2.81	3.91	3.81	3.99	3.63
Raspoly	1.69	1.89	1.84	1.04	1.62	0.09	0.67	0.39	0.33	0.37	1.98	2.74	4.01	4.24	3.24
Pleno	0.93	1.37	1.20	1.04	1.14	0.38	0.69	0.43	0.38	0.47	2.08	2.89	3.06	3.93	2.99
Sultan	1.31	1.80	0.98	0.93	1.26	0.25	0.51	0.59	0.51	0.47	1.99	2.73	4.32	4.89	3.48
Monogerm															
Inverse	1.08	1.93	1.45	1.31	1.44	0.63	0.98	0.41	0.44	0.62	0.63	0.93	1.31	1.80	1.17
Prisma	0.93	1.76	0.99	0.93	1.15	0.39	0.56	0.47	0.40	0.46	1.93	2.45	2.81	3.02	2.55
Del936	0.99	1.45	1.03	0.98	1.11	0.30	0.39	0.32	0.36	0.34	1.98	2.84	3.66	3.90	3.10
Sophie	1.08	1.73	1.39	1.09	1.32	0.03	0.09	0.63	0.41	0.29	0.99	1.37	2.63	3.04	2.01
Universe	1.43	1.91	1.60	1.18	1.53	0.43	0.68	0.29	0.23	0.41	1.08	1.58	2.83	3.03	2.13
Mean	1.21	1.70	1.25	1.04	1.30	0.35	0.62	0.49	0.43	0.47	1.69	2.32	3.04	3.39	2.61
LSD (5%)*															
K	*** (0.023)					*** (0.006)					*** (0.015)				
Varieties	*** (0.026)					*** (0.007)					*** (0.017)				
Interaction	*** (0.016)					*** (0.010)					*** (0.010)				

Table (4) Effect of potassium treatments on Fe, Zn, Mn and Cu concentration in leaves of the two types of sugar beet varieties as an average of the two seasons.

Treatments	Potasum added (K_2O/kg)																			
Varieties	0	30	60	90		0	30	60	90		0	30	60	90		0	30	60	90	
Multigerm	Fe (mg/Kg)				Mean	Zn (mg/Kg)				Mean	Mn (mg/Kg)				Mean	Cu (mg/Kg)				Mean
Baraka	2.93	3.84	4.01	4.84	3.91	0.93	1.63	1.68	1.79	1.51	2.31	2.84	0.96	0.76	1.72	9.93	11.39	7.88	7.71	9.23
Farida	3.01	3.73	4.43	4.51	3.92	1.98	2.04	2.08	2.38	2.12	1.43	1.93	0.95	0.89	1.30	8.31	12.19	10.93	10.08	10.38
Raspoly	7.32	8.31	8.93	9.08	8.41	0.94	1.09	1.98	2.01	1.51	6.51	7.87	5.41	3.01	5.70	10.11	13.91	12.98	12.69	12.42
Pleno	5.40	7.87	8.31	8.99	7.64	0.41	0.93	1.04	1.38	0.94	2.81	4.39	2.08	1.39	2.67	14.16	18.14	15.29	15.03	15.66
Sultan	1.81	4.31	6.98	6.83	4.98	0.53	0.96	1.39	1.98	1.22	1.66	1.93	0.93	0.61	1.28	13.18	16.15	14.03	13.93	14.32
Monogerm																				
Inverse	4.21	5.93	6.91	6.98	6.01	1.08	1.34	1.83	1.98	1.56	0.93	1.03	0.93	0.21	0.78	12.01	14.93	9.83	9.34	11.53
Prisma	9.93	11.93	11.98	12.81	11.66	0.31	0.83	1.36	1.81	1.08	3.28	4.31	2.03	1.09	2.68	9.81	10.91	9.13	9.01	9.72
Del936	8.44	9.93	11.31	11.91	10.40	0.89	1.02	1.41	1.98	1.33	4.76	6.01	3.31	1.98	4.02	13.16	18.75	10.91	10.30	13.28
Sophie	4.93	6.91	9.41	9.04	7.57	0.93	1.39	1.43	1.61	1.34	1.38	2.03	1.31	0.93	1.41	17.01	19.83	18.60	18.01	18.36
Universe	2.01	4.31	5.43	6.38	4.53	0.91	1.55	1.71	1.07	1.31	1.00	1.46	1.01	0.91	1.10	8.42	11.41	10.93	9.43	10.05
Mean	5.00	6.71	7.77	8.14	6.90	0.89	1.28	1.59	1.80	1.39	2.61	3.38	1.89	1.18	2.26	11.61	14.76	12.05	11.55	
LSD (5%)																				
K	*** (0.017)					*** (0.047)					*** (0.005)					*** (0.071)				
Varieties	*** (0.019)					*** (0.053)					*** (0.006)					*** (0.079)				
Interaction	*** (0.012)					*** (0.033)					*** (0.004)					*** (0.050)				

Potassium concentrations in both roots and leaves were significantly affected by the K treatments. Increasing potassium levels up to 90 Kg/fed significantly affected its concentration in both roots and leaves. The multigerm varieties were more affected than the monogerm and that Raspoly variety and Del936 (mono) had the greatest values of K in leaves, while Sultan (poly) and Universe (mono) were more pronounced in accumulating K in roots. The effect of increasing level of potassium on micronutrient concentration in roots and leaves are shown in Tables (4 and 5).The data showed that the potassium treatment was significant on all the varieties and varieties used. The effect of treatments on Fe and Zn concentration in leaves declared that increasing potassium up to 90 Kg/fed increased their concentration. While the effect of treatments on Mn, Zn and Cu concentration increased only up to 30 Kg and then the increase was less pronounced.It was found that, Fe and Cu concentration in leaves of monogerm varieties had the highest concentrations while Zn and Mn had the highest concentration in leaves of multigerm.Roots of monogerm varieties had the highest micronutrient concentrations than multigerm varieties(Table 5).

The effect of K on both yield and elements concentration was studied by many investigators. Lynd *et al.* (1981) found that the best results with K fertilization was obtained when available soil P was not limiting, Smith and Smith (1977), found that K fertilization had a great response especially when crops are grown on K-deficit soils. While, Amer *et al.* (1993) found that bean grown in calcareous soil did not response to K fertilization except in the high rates of application and they added that K fertilization encourage Zn uptake by leaves. Therefore, the data refers that, the micronutrients contents affected by the concentration of K fertilizer by different degrees according to the variety used and also to the different parts analyzed (leaves or roots)

Effect of potassium treatments on sugar quality:

The effect of increasing rate of potassium added to soil on total soluble salts (T.S.S), sucrose and purity are presented in Table (6). The data revealed that the genotype (multigerm or monogerm) was not affected by the K treatments. The showed that the T.S.S increased due to K addition and also the varieties showed the same trend indicating the effect of K on them. The same trend also was shown for both sucrose and purity. The maximum effect of potassium happened on the variety Pleno where the increase in sucrose reached 33.4% and in purity it reached 3.33%. The variety Sophie (monogerm) had the highest increase in purity where it reached 15.4%. The data can emphasize the role of potassium in plant's transport system, which use energy in the form of ATP (Orlovius, 1993). The increasing of α amino-N and sodium (Table- 7) in roots gave a good idea to the role of potassium in protein synthesis. Transport of α amino nitrogen to the sites of protein synthesis, energy activation and balancing of electrical charges are among the key roles of potassium (Masfis and Simoni, 1994; Delma, 1999; Maslaris, 2000 and Alavez *et al.*, 2000).

Effect of K treatments on peroxidase isozymes:

Figures 1 and 2 showed a descriptive zymogram of peroxidase isozymes extracted from sugar beet untreated leaves and K fertilizer treated

Table (5) Effect of potassium treatments on Fe, Zn, Mn and Cu concentration in roots of the two types of sugar beet varieties as an average of the two seasons.

Treatments	Potassium added (K_2O / kg)																			
Varieties	0	30	60	90		0	30	60	90		0	30	60	90		0	30	60	90	
Multigerm	Fe (mg/Kg)				Mean	Zn (mg/Kg)				Mean	Mn (mg/Kg)				Mean	Cu (mg/Kg)				Mean
Baraka	3.21	5.43	5.93	5.99	5.14	1.82	1.89	2.11	2.78	2.18	1.08	1.33	1.03	0.93	1.09	1.11	20.23	18.60	17.10	14.26
Farida	3.51	3.33	3.89	3.99	3.68	1.01	1.29	1.49	2.98	1.69	1.39	0.69	0.51	0.43	0.76	8.73	16.50	15.30	15.00	13.88
Raspoly	6.83	6.03	6.47	8.43	6.94	1.32	1.51	1.93	2.83	1.90	1.00	0.61	0.53	0.55	0.69	11.81	11.78	12.50	10.30	11.6
Pleno	3.51	3.96	6.43	8.46	5.59	1.53	1.59	1.96	2.14	1.81	0.54	0.61	0.53	0.65	0.85	13.13	20.04	20.00	17.00	17.54
Sultan	3.91	3.41	5.57	5.93	4.71	0.99	1.35	1.93	2.54	1.70	0.09	0.03	0.02	0.02	0.04	14.18	14.00	10.38	10.00	12.14
Monogerm																				
Inverse	5.01	9.31	9.81	12.15	9.07	0.98	1.79	2.31	2.15	1.81	0.98	1.63	1.31	0.98	1.32	12.10	16.00	15.93	15.00	14.76
Prisma	5.11	6.17	6.93	7.54	6.44	0.81	2.01	2.39	2.61	1.96	0.71	0.56	0.41	0.39	0.52	8.71	18.00	16.91	10.30	14.98
Del936	3.39	4.33	4.55	4.03	4.08	0.93	2.31	3.41	3.93	2.65	0.76	0.42	0.53	0.31	0.51	14.19	16.05	15.41	15.30	15.24
Sophie	5.31	5.45	5.39	5.69	5.46	0.95	2.48	2.93	3.40	2.44	1.03	0.71	0.65	0.60	0.57	16.31	18.31	18.13	13.10	16.46
Universe	3.01	6.39	6.99	8.03	5.11	0.97	1.98	2.81	2.91	2.17	0.84	0.74	0.53	0.43	0.64	9.83	14.50	11.73	10.80	11.72
Mean	4.28	5.38	6.20	7.02	5.62	1.14	1.82	2.33	2.83	2.03	0.85	0.73	0.61	0.53	0.70	11.01	16.54	15.49	13.99	14.26
LSD (5%)																				
K	*** (0.18)					*** (0.017)					*** (0.014)					*** (0.841)				
Varieties	*** (0.20)					*** (0.018)					*** (0.016)					*** (0.941)				
Interaction	*** (0.013)					*** (0.011)					*** (0.011)					* (0.595)				

Table (6): Effect of potassium treatments on TSS, Sucrose% and Purity% in roots of the two types of sugar beet varieties as an average of the two seasons

Treatments	Potassium added (K_2O /Kg)														
Varieties	0	30	60	90		0	30	60	90		0	30	60	90	
Multigerm	TSS				Mean	Sucrose%				Mean	Purity%				Mean
Baraka	18.13	18.96	19.31	20.01	19.10	14.50	15.17	15.44	16.00	15.28	82.21	83.33	83.93	84.01	83.37
Farida	19.43	18.53	20.41	22.93	20.33	15.54	15.62	16.32	18.34	16.46	81.41	82.23	82.83	83.41	82.47
Raspoly	18.01	18.83	18.93	21.41	19.30	14.40	15.06	15.14	17.12	15.43	83.11	83.94	84.51	84.99	84.14
Pleno	17.93	18.91	19.03	23.91	19.95	14.34	15.12	15.22	19.13	15.95	83.33	84.03	84.39	86.11	84.47
Sultan	18.19	18.30	19.44	20.40	19.08	15.19	15.14	15.55	16.32	15.55	82.91	83.03	83.68	83.49	83.28
Monogerm															
Inverse	17.18	18.01	14.83	21.41	17.86	13.74	14.40	15.86	17.12	15.28	81.41	82.03	82.91	83.41	82.44
Prisma	17.93	19.03	20.51	21.93	19.85	14.34	15.22	16.40	17.54	15.88	82.43	82.05	82.66	82.98	82.53
Del936	18.41	19.09	21.61	21.93	20.26	14.72	15.27	17.28	17.54	16.20	81.05	82.31	83.41	83.91	82.67
Sophie	18.93	19.33	20.31	24.81	20.85	15.14	15.46	16.24	19.84	16.67	81.44	82.71	83.01	83.98	82.79
Universe	18.84	19.63	20.93	21.03	20.11	15.07	15.70	16.74	16.82	16.08	82.93	82.21	83.82	83.97	83.23
Mean	18.30	18.86	19.53	21.98	19.67	14.70	15.22	16.02	17.58	15.88	82.22	82.79	83.52	84.03	83.14
LSD (5%)															
K	*** (0.844)					*** (0.154)					*** (0.175)				
Varieties	*** (0.944)					*** (0.173)					*** (0.196)				
Interaction	NS					*** (0.109)					*** (0.124)				

Table (7) Effect of potassium treatments on amino nitrogen and Na concentration in roots of two varieties of sugar beet as an average of two seasons

Treatments	Potassium added (K_2O /Kg)									
Varieties	0	30	60	90	Mean	0	30	60	90	Mean
Multigerm	α-amino N					Na				
Baraka	1.17	1.173	1.173	1.179	1.1738	0.241	0.243	0.252	0.258	0.2485
Farida	1.161	1.165	1.172	1.178	1.169	0.221	0.266	0.233	0.238	0.2395
Raspoly	1.173	1.177	1.178	1.178	1.1765	0.265	0.269	0.273	0.281	0.272
Pleno	1.163	1.167	1.169	1.171	1.1675	0.251	0.267	0.263	0.279	0.265
Sultan	1.172	1.175	1.167	1.177	1.1728	0.256	0.254	0.273	0.278	0.2653
Monogerm										
Inverse	1.18	1.183	1.188	1.189	1.185	0.244	0.248	0.251	0.269	0.253
Prisma	1.174	1.176	1.176	1.177	1.1758	0.227	0.238	0.238	0.243	0.2365
Del936	1.17	1.171	1.165	1.178	1.171	0.231	0.238	0.243	0.249	0.2403
Sophie	1.161	1.166	1.169	1.169	1.1663	0.221	0.236	0.263	0.288	0.252
Universe	1.161	1.172	1.179	1.178	1.1725	0.241	0.251	0.253	0.289	0.2585
Mean	1.1685	1.1725	1.1736	1.1774	1.173	0.2398	0.251	0.2542	0.2672	0.2531
LSD (5%)										
K	*** (0.001)					*** (0.0017)				
Varieties	*** (0.001)					*** (0.0019)				
Interaction	*** (0.009)					*** (0.0010)				

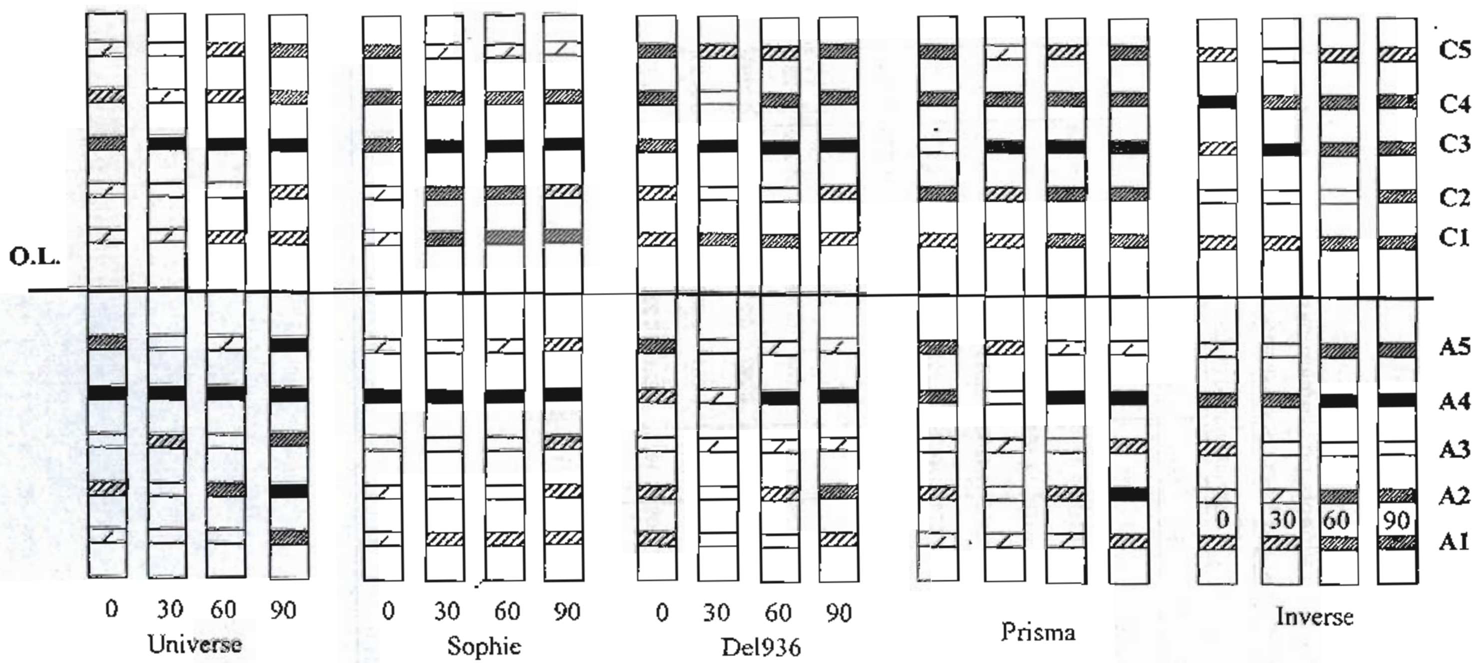

Figure (1). Descriptive digram of peroxidase isozyme patterns of leaves sugar beet monogerm varieties (Universe, Sophie, Del936, Prisma and Inverse) treated with 0, 30, 60 and 90 kg of potassium.

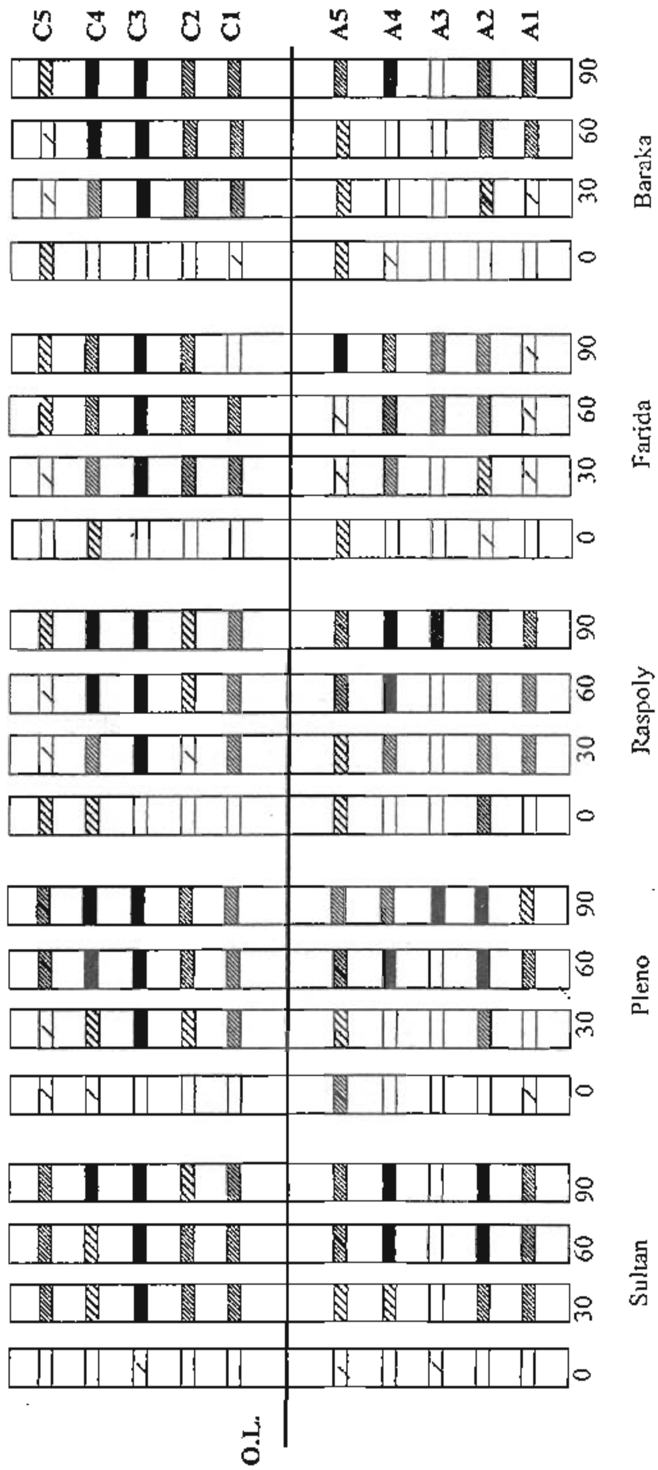

Figure (2). Descriptive digram of peroxidase isozyme patterns of leaves sugar beet polygerm varieties (Sultan, Pleno, Raspoly, Farida and Baraka) treated with 0, 30, 60 and 90 kg of potassium.

ones after 90 days from sowing. In general, bands of isoperoxidase were both migrating towards the cathode and anode. There were five bands in the cathode side C1, C2, C3, C4 and C5 and there were five bands at the anode side A1, A2, A3, A4 and A5. Peroxidase isozymes bands in all untreated sugar beet varieties (five monogram varieties in addition to five polygram varieties) showed differences in bands number and densities.

Considering the five monogram varieties as shown in Figure 1, it can be seen that the band numbers of untreated plants which migrated to the anode were 5 in; Inverse (mono), and Del936, and 4 bands in Prisma, Universe, and Sophie. The bands migrating towards the cathode were 4 in: Inverse (mono) and Prisma while in Universe, Sophoie and Del936 were five.

Again, the band numbers and density of peroxidase isozymes of sugar beet monogram varieties were differed after potassium treatments (30, 60 and 90 Kg/fed). These differences were somewhat decreased or increased in the band number and density from one variety to the other and from concentration to other. Furthermore, the anode and cathode bands activity increased after all treatments.

Regarding the five multigerm varieties as shown in Figure 2, it can be noticed that the band numbers of untreated plants which migrated towards the anode were 2 in all untreated varieties. But, the bands migrating towards the cathode were 2 in Baraka, Raspoly and Plimo and one in Farida and Sultan.

On the other hand, the five-multigerm varieties showed an increase in cathode and anode numbers after treatments with all concentration of potassium fertilizer. However, the activity of bands increased compared with their controls. Such a result are in accordance with those obtained by Debowski and Dalke,(1986), Abe and Shimamoto, (1990); , Manal (1997); Ghonema,(2000)and Ghora *et al.* (2000).

As the obtained data, sugar beet breeders have to pay more attention to the efficiency of fertilizer used. In the long-term farmers should satisfy plant requirements precisely, other wise they will not obtain the optimum yield.

REFERENCES

Abe,J, and Y. Shimamoto (1990). Isozyme variation in sugar beet and its wild relatives. Proceedings of the Japanese Soc. Sugar beet Tech. 32: 107-112.

Alavez, S.; D.Pedreze and J. Morch (2000). Role of heat shock protiens in the effect of N M D A and KCl on cerebellar granule nearons in culture. Neurochem. Res., 25: 341-347.

Amer, M.A.; O.M.Z El-Keiy and E.H. El-Haddad (1993). Effect of potassium and zinc interaction on bean grown in calcareous soil. J. Agric. Sci. . Mansoura Univ., 18 (11): 3491- 3497.

Brewer, G. J. (1970). An Introduction to isozymes techniques. Academic Press, Inc., New York & London.

Brewer, G. J. and C. F. Sing (1969). In Biochemical Methods in Red Cells. Genetics (J. Yunis, ed) Academic Press,Inc., Neww York, pp. 377-390.

Brown,J.D. and O. Lilliand (1964). Rapid determination of K and Na by phlamephotometer. Proc.Amer.Soc. Hort. Sci., 48: 341- 346.

Debowski, W. and Dalke (1986). Investigation of the Peroxidase isozymes polymorphism of sugar beet lines and their hybrids. Hodowia Roslin, Aklimatyzacja I Nasiennivtwa. 25: 1- 17. [Pl. Breed Abs., 53 (1): 706].

Delma, D. (1999). Effect of potassium nitrate on yield and quality of vegetable Soybeen. Asian Regional Center- AVRDC.

Dobermann, A. (1999).Reversing diminishing growth of rice yields in Asia. 6^{Th} Annual conference of the international fertilizer industry association, IFA, May 17-20, Manila, Philippines.

El- Metainy, A.Y.; A.Y. Abou- Yossef; I. Sherif and M. A. Sahrigy (1977). Isozymes variation in lycoperiscan species. Egypt. J. Genet. Cytol., 6 (2): 360-369.

Fayza El- Taweel. (1999). Response of some sugar beet varieties to potassium and magnesium fertilizers. PH.D., Fac. Agric., Zagazig (Banha Branch).

Ghonema, M.A. (2000). Genetic studies on sugar beet plants M.Sc. Thesis. Fac. Agric., Univ. Alex.

Ghora, S.A. Nabwia, M.Z. Attallah and M.A. Amer (2000). Effect of NPK treatments on yield, differential gene action and chemical composition of three sugar beet varieties. Alex. Sci. Exch., 21(4): 293- 310.

Konovalove, A.A. (1991). Relative position of the Idnl and saloci in the third linkage group in sugar beet (*Beta vulgaris* L.) Sov. Genet. New York. IV.Y. Consultants Bureau Mars 26: 1056- 1060.

Konovalove, A.A. (1992). Linked inheritance of alcohol dehydrogenase isozyme and monogram/ multigram character in sugar beet. Genetika. Musk, 28: 123- 128.

Le-Docte, A. (1927). Commercial determination of sugar beet in the beet root using Sachr-Le- Docte process. Int. Sug. J. 29: 488-492.

Lynd, J.Q.; A.H.Jr. Edward and V.O.Jr. George. (1981). Potassium effects on improved growth, nodulation and nitrogen fixation of hairy Vetch. Soil Sci. Soc. Amer J. 45: 302- 306.

Manal Abd El-Hamid (1997). Biochemical and genetical studies on sugar beet. M.Sc. Thesis, Faculty Agric. Alex. Univ., Egypt.

Maslaris, N. (2000). Some strategic quidelmes of sugar beet fertilizing with nitrogen in Mediterranean conditions. Convegno Bieticalo Internazionale, Bardolino, Verona, Italy.

Maslis, N and A.D. Simonis (1994). Soil nutrient effect on sugar beet yield performance. Proc. 3^{rd} Eur. Soc. Agr. Abano, Padova.

Murphy, J. and J. P. Riley. (1962). A modified single solution for determination of phosphate in natural waters. Anal. Chem. Acta. 27: 31- 36.

Øien, A. and K. Kjerdingen (1977).Determination of Cd and Pb in soils by means of solvent extraction and atomic absorption. Acta. Agric. Scand. 27: 67- 70.

Orlovius, K. (1993). Sugar beet quality, the importance of potassium. Potash Review, 2: 1-6.

Perrenoud, S. (1990) Potassium and Plant Health. IPI-Research Topics No.3, 2nd rev.edition. Basel, Switzerland.

Piper,M.T. (1950). Effect of nitrogen and potassium fertilization on the yield, sucrose percentage and juice purity of sugar beet . Potach Review. pp . 2-17.

Rosegrant, M.W., Agcaoili-Sombilla, A. and Perez, N.D. (1995). Global of food projections to 2020: Implications for investment, Food, agriculture, and the environment, Discussion paper 5, International Food Policy Research Institute.

Sabrah, N.S. and A.Y. El- Metainy (1985). Genetic distances between local and exotic cultivars of *Vicia faba* based on esterase isozyme variation. Egypt. Genet. Cytol. 14: 301- 307.

Samia El-Maghraby; Mona M. Shehata and Yussreya H. Tawfik (1997). Effect of soil and foliar application of nitrogen and potassiumfertilization on sugar beet. Adv. Agric. Res., 2(1):161-175.

Show, C.R. (1969). Isozymes: classification, frequency and significance. International Review of Cytology. 25:297-332.

Smith, O. and R.R. Smith. (1977). Response of red clover to increasing rates of top dressed potassium fertilizer. Agron. J. 69: 45-48.

Snedecor, G.W. and G. Cochran (1967). Statistical Methods. 6th Ed. Iowa State Univ. Press, Ames. Iowa, USA.

Spettoli, P. (1980). Correlation between isozymes polymorphism and technological characters in sugar beet at different ploidy levels. Saccarifera Itel. 73: 13- 17. [Pl. Breed. Abs. 53 (1): 704].

تأثير التسميد البوتاسى على المكونات المعدنية وبعض المكونات البيولوجية لعشرة أصناف من بنجر السكر

محمد عامر عمر عامر* محمد زهدى عطاالله** محمد فـؤاد ابـراهيم** فـايزة الطويل**

*معهد بحوث الأراضى والمياه والبيئة- مركز البحوث الزراعية

**معهد بحوث المحاصيل السكرية- قسم الفسيولوجى- مركز البحوث الزراعية

أجريت تجربتان حقليتان فى مزرعة محطة البحوث الزراعية بالإسكندرية معهد بحوث المحاصيل السكرية- مركز البحوث الزراعية لدراسة تأثير التسميد البوتاسى لعشرة أصناف من البنجر على المكونات المعدنية (حديد ، نحاس ، منجنيز ، زنك) والمكونات البيولوجية (الحامض الأمينى ألفا ، الصوديوم ، انزيم البيروكسيديز) وبعض خواص محصول السكر (الأملاح الكلية الذائبة، السكروز ، النقاوة) وأجريت التجربة فى تصميم القطع المنشقة فى ٣ مكررات وكانت المعاملات عبارة عن ٤ معدلات من البوتاسيوم (أكسيد بوتاسيوم) هى صفر ، ٣٠ ، ٦٠، ٩٠ كيلو جرام وقد قسمت العشرة أصناف من البنجر المستخدمة فى هذه الدراسة إلى ٥ اصناف أحادية الأجنة (الفرز ، بريزما ، د ى ل ٩٣٦ ، سوفى ، يونيفرس) و ٥ عديدة الأجنة (بركة ، فريدة ، راسبولى ، بلينو ، سلتن).

أظهرت النتائج أن إضافة البوتاسيوم نتج عنها زيادة معنوية فى تركيز النيتروجين والبوتاسيوم فى كلا من الجذور والأوراق وأن النباتات أحادية الجنين احتوت على نسبة من النيتروجين أعلى مما تحتويه النباتات عديدة الأجنة وزاد تركيز الفوسفور فى النباتات حتى تركيز إضافة ٣٠ وحدة بوتاسيوم ثم بدأ فى الانخفاض وزاد تركيز كلا من الحديد والنحاس والمنجنيز والزنك بزيادة إضافة البوتاسيوم ولكن بدرجات متفاوتة معتمدة على الصنف وكلها تأثرت معنويا وفى نفس الوقت كانت متوسط استجابة الأصناف المنزرعة من الأملاح الكلية الذائبة والسكروز والنقاوى عالية حيث زادت بمقدار ٣٣،٤ ، ٣،٥٥ ، ١٤،٥ % على الترتيب بزيادة البوتاسيوم المضاف وأظهرت الزيادة فى الحامض الأمينى ألفا والصوديوم وكذلك فإن المعاملة بالبوتاسيوم أظهرت زيادة فى النشاط الكاثودى والأنودى للمشابة الإنزيمى (البيروكسيديز) للإصناف المعاملة مقارنة بتلك الغير معاملة.