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EFFECT OF MAGNESIUM AND POTASSIUM APPLICATION ON YIELD AND QUALITY OF SUGAR BEET.

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ABSTRACT: Two field experiments were carried out during two winter seasons of 1997-1998 and 1998-1999 to study the effects of Mg and K as foliar and soil applications as well as their combinations on yield, its components and quality of sugar beet under south Dakahlia soils conditions.

Sugar beet yield components i.e. root length, root diameter as well as root weight and top weight per plant were increased by Mg foliar application with the two rates of 0.5 and 1.0 kg Mg/fed., The effects were significant only on root diameter at rate of 1.0 kg Mg/fed. Magnesium soil application with the two rates of 7.5 and 15 kg Mg/fed. caused significant increases in the aforementioned components. Also, root and top yields (ton/fed.) of sugar beet were significantly increased by the two rates of Mg soil application while, these yields were not affected by the two rates of Mg foliar application.

Potassium foliar application with the rate of 5 kg K_2O/fed. caused a significant increase in root weight/plant only. Raising rate of K foliar application to 10 kg K_2O/fed., root length and root diameter were significantly increased. Root yield/fed. was slightly increased by foliar application of 10 kg K_2O/fed. While, top yield was significantly decreased by the two rates of K foliar application. Root diameter was significantly increased by soil application of 48 kg K_2O/fed. Root yield/fed. was slightly increased by both rates of K soil application (24 and 48 kg K_2O/fed.).

T.S.S. % in the second season, sucrose % in both seasons and combined as well as juice purity % in the combined were significantly

increased by foliar application of 1.0 kg Mg /fed. but the rate of 0.5 kg Mg/fed. showed no effect. Soil application of both 7.5 and 15 kg Mg /fed. caused a significant increase in T. S. S. % in the second season. Meanwhile, soil application with 7.5 kg Mg/fed. gave significant increase in sucrose % in both growing seasons and their combined.

T.S.S. % positively and significantly responsed to K foliar application up to 10 kg K_2O/fed. while, juice purity % responsed up to 5 kg K_2O/fed. only. The combined analysis revealed that both T.S.S.% and juice purity % were not affected by soil application of K whereas, sucrose % was increased by adding of 24 kg K_2O/fed.

Sugar beet root and top yields (ton/fed.) as well as quality parameters of sugar beet were significantly influenced by the interaction between Mg and K applications.

Key words: Magnesium, Potassium, Sugar beet, Foliar spray and Yield quality

NTRODUCTION

Sugar beet is an important crop in Egypt and many different countries in the world. Sugar beet became the second source for sugar production, after introducing sugar beet in Egypt, more attentions has been given to grow and development this crop under environmental condition in Egypt to overlap the gab between the consumption and production of sugar. Two factories were in Kafer-El-Sheikh and Dakahlia Governorates. And the Egyptian Government pushing hard to build many factories in production areas of sugar beet crop i.e. at Nobaria and El-Fayoum.

Magnesium is an essential nutrient for plant growth and is required in the synthesis of proteins. It serves as an activator for enzyme systems including photosynthetic reactions, respiration, lipid metabolism and N accumulation and transformation (Gouch, 1972). Many studies all over the world concluded that controlling Mg and K application to improve yield of sugar beet and its quality. Mg is an essential nutrient for the translocation of sugars in potatoes (Lewin and Lewin, 1956), Mg application significantly increased root yield, sugar content or purity of the juice and increased top yield of sugar beet (Tinker, 1967).

In plant physiology, K^+ is the most cation with respect its physiological and biochemical functions. Potassium not only promotes the translocation of newly synthesized photosynthates but also a beneficial effect on the mobilization of stored material (Mengl and Kirkby, 1986). This element is known to have a beneficial effect on ATP synthesis. The activity of starch synthesis is highly dependent on univalent cations, and the K^+ is the most effective the enzyme catalyzes the transfer of glucose to starch molecules (Marschner, 1995).

Sugar beet yield and quality were increased by K foliar or soil application (Chielle *et al*., 1985), Beringer *et al*. (1988), Basha (1994) and Sohier (2001). On the other hand, Fotyma *et al*. (1984), Assey *et al*. (1985 a and b), as well as Tabl *et al*. (1986) reported that potassium fertilization had no significant effect on root yield and quality of sugar beet.

MATERIALS AND METHODS

Two field experiments were carried out at private farm at Dundit Village, Mit-Ghamr District, Dakahlia Governorate, during the two winter seasons of 1997-1998 and 1998-1999, in two different sites to study the effects of Mg and K foliar and soil applications and their combination on sugar beet yield and quality.

The rates of Mg application ($Mg\ SO_4\text{-}7H_2O$) were 0.5 and 1.0 Mg kg/fed. as foliar (in three equal doses at 60, 80 and 100 DAS) as well as 7.5 and 15 kg Mg/fed. in soil (in two equal doses at 60 and 80 DAS), in addition to zero Mg as a check treatment. The rates of K application (K_2SO_4) were 5 and 10 kg K_2O/fed. as foliar as well as 24 and 48 kg K_2O/fed. in soil (at the same adding of Mg times), in addition to zero K_2O as a cheek treatment.

The experiment included 25 treatments were resulted from the combinations between five levels of both nutrients and arranged in a complete randomized block design with three replicates.

Soil of the experimental fields was clay in texture, physical and chemical proprieties of the soil are presented in Table (1).

Belnio cultivar of sugar beet was used and sown on Oct. 10^{th} in both seasons. Each plot has 5 ridges of 4 m length and 0.5 m width (plot area = $10m^2$). Seeds were planted in hills of 25 cm apart.

The phosphorous fertilizer was added as super phosphate (15.5 % P_2O_5) at the rate of 100 kg/fed. before sowing. While the nitrogen fertilizer was added as urea (46.5 % N) at rate of 125 kg/fed., respectively.

Table 1. Physical and chemical properties of the experimental soil for the tow seasons.

Soil components	1997/1998	1998/1999
Physical properties		
Coarse sand %	5.6	5.0
Fine sand %	10.4	11.4
Silt %	29.0	24.0
Clay %	55.0	59.6
$CaCO_3$ %	2.8	2.5
Chemical properties		
PH	7.64	7.40
Ca^{2+} mg/100 g soil	0.60	0.49
Mg^{2+} mg/100 g soil	0.47	0.35
K^+ mg/100 g soil	0.40	0.30
Na^+ mg/100 g soil	0.46	0.58
HCO_3^- mg/100 g soil	0.50	0.60
Cl^- mg/100 g soil	0.51	0.44
SO_4^{2-} mg/100 g soil	0.92	0.68
EC ds/m	1.60	1.71

At harvesting time (180 day after sowing), the two outer ridges (1st and 5th) were considered as border, 5 plants from the each plot were taken in random to determine the yield components i.e. root length, root diameter, top weight per plant. Also, root yield and top yield of the 3rd and 4th ridges per plot were recorded and calculated for fedden.

T.S.S.% was determined by hand refractometer in fresh root samples. Sucrose percent was determined polarimetrically using Pol-400 Saccharimeter on a lead acetate of fresh root, according to the method of Le Docte (1927). Also, juice purity % was calculated as ratio of sucrose % / T.S.S. %.

The obtained data of both seasons were subjected to the proper statistical analysis according to Snedecor and Cochran (1967).

RESULTS AND DISCUSSION

A. Yield and its components:

1- Root length:

Results are presented in Table (2) revealed that root length of sugar beet only was increased by Mg foliar application with rates of 0.5 kg and 1.0 kg Mg/fed. since, the effect was significant in the second season and slight in the combined. The application of Mg at rates of 7.5 and 15 kg Mg /fed. in soil significantly increased root length of sugar beet in the two seasons their with combined. In general, Mg soil application had higher positive effect on root length of sugar beet with both. In the case of potassium application as foliar with rates of 5 and 10 kg K_2O/ fed. in the first season did not affect the root length. Whereas, in the second season and combined

Table 2: Root length and diameter (cm) at harvest as affected by Mg and K applications in sugar beet.

Treatments Kg /fed.		Root length (cm)			Root diameter (cm)		
		97/1998	98/1999	Comb.	97/1998	98/1999	Comb.
Mg	0.0	31.24	31.11	31.18	10.92	10.41	10.66
	0.5	31.41	32.60	32.05	10.70	10.31	10.50
	1.0	31.85	33.42	32.63	10.78	11.06	10.92
	7.5	32.68	33.94	33.31	10.64	10.69	10.66
	15.0	33.72	33.62	33.77	10.24	11.27	11.25
L.S.D. 0.05		1.38	0.88	0.78	N.S.	0.35	0.27
K_2O	0	32.06	32.76	32.41	10.75	10.48	10.61
	5	32.29	33.46	32.87	10.60	10.66	10.63
	10	32.41	34.46	33.83	10.60	11.22	10.91
	24	32.84	31.92	32.38	11.30	10.27	10.78
	48	31.81	31.98	31.90	11.03	11.10	11.06
L.S.D. 0.05		N.S.	1.24	0.76	0.34	0.41	0.26

the rate of 5 kg K_2O/fad., slightly increased root length, but 10 kg K_2O/fad. significantly increased root length of sugar beet. Potassium soil applications at 24 kg and 48 kg K_2O/fed. showed no significant effect on the root length in the two seasons and combined. These results are in agreement with those obtained by Hammam (1969), El-Geddawy (1979), Assey *et al.* (1985 a) and Sorour *et al.* (1992). On the other hand, Sobhy *et al.* (1992), El-Harriry and Gobarh (2001) who found in the newly loamy sandy soil which suffer from deficiency of available K, the root characters i.e. root length and diameter were responded to K fertilization.

2. Root diameter:

Root diameter of sugar beet as shown in Table (2) only was significantly increased by soil application of 15 kg Mg/fed. in the second season and combined while this trait not affected by the other rates of Mg in the two seasons and combined.

Data in Table (2) show that potassium foliar application at rate of 5.0 kg K_2O/fed. did not affect the root diameter of sugar beet in the two seasons and combined, but rate of 10.0 kg K_2O /fed. only in the second season and combined significantly increased this character. K soil application with rate of 24 kg/fed. significantly increased root diameter in the first season only and did not affect it in the second one and combined. However, the rate of 48 kg K_2O only in the second season and combined significantly increased this diameter. The results of combined analysis show that the higher rates of K foliar and soil application had a positive effect on root diameter. Similar results were obtained by Hassanien (1979) and Basha (1994) under sandy soil condition, as well as El-Essawy (1996), Sayed *et al.* (1998) and El-Harriry and Gobarah (2001) found that increasing K rate up to 48 kg K_2O/fed. increased root diameter of sugar beet. On the other hand, Hammam (1969), El-Geddawy (1979) and Assey *et al..*, (1985 a) found that there was no significant effect of K fertilization on yield characters of sugar beet.

Data in Table (4) show that there are an increase in values of root diameter at harvest, the highest value of root diameter was obtained by combination of 15 kg Mg as soil application+ 10 kg K_2O/fed. as foliar application. (11.85 cm) and the smallest value occurred in the control treatment (9.81cm).

3. Root weight (kg)/plant:

Data in Table (3) show that root weight /plant was significantly increased by the two rates of 0.5 kg and 1.0 kg Mg/fed. as foliar application only in the first season and combined but in the second season, this trait was not affected by the two rates of K foliar.

In the two growing seasons and their combined, root weight of sugar beet plants was significantly increased by application of 7.5 kg and 15 kg Mg/fed. in soil. Application of 7.5 kg and 15 kg Mg /fed. in soil achieved an increase in root weight about 8.67 and 8.77% comparing the control treatment, respectively.

Potassium application as foliar or soil application did not affect the root weight/plant in the first season, but in the second season root weight/plant was significantly increased by rates of 5 kg K_2O as foliar and 48 kg K_2O/fed. as soil application. In the combined, only the rate of 5 kg K_2O/fed. slightly root weight/plant was increased in sugar beet. These results are in agreement with those obtained by Bringer *et al.* (1987), Ramadan (1997) who found that root weight/plant was not affected by K application. On the other hand Basha (1998), Hassanien (2001) and Sohier (2001) found that root weight/plant in sandy soils was increased by application of 48 kg K_2O/fed. In general, Mg application with the two methods and rates had higher effect on root weight/plant of sugar beet but K application did not affect.

Data in Table (4) show that root weight (kg)/plant in sugar beet was affected by the application of Mg and K combination. The heaviest root per sugar beet plant was recorded by application of 7.5 kg Mg + 48 kg K_2O/fed. was 1.196 kg, the lightest root weight /plant was 0.919 kg in the control (zero Mg and K).

4- Top weight (kg)/plant:

Data in Table (3) show that top weight (kg)/plant was significantly increased by as Mg foliar or soil application with both rates in the first season. Whereas, this trait was significantly decreased by 0.5 and 1.0 kg Mg as foliar and 15 kg Mg/fed. as soil applications whereas, the decrease was slight by 7.5 kg Mg/fed. soil rate in the second season. The combined analysis revealed that, top weight /plant was significantly increased by the two rates of Mg, in soil application. While, foliar application of Mg did not affect on the top weight /plant of sugar beet.

Top weight/plant was not affected by K foliar or soil

Table 3: Root and top weight (kg) /plant and root /top ratio at harvest as affected by Mg and K applications in sugar beet.

Treatments	Kg /fed.	Root weight (kg)/plant			Top weight (kg)/plant			Root /top ratio		
		97/1998	98/1999	Comb.	97/1998	98/1999	Comb.	97/1998	98/1999	Comb.
Mg	0.0	0.996	1.032	1.014	0.491	0.522	0.506	1.907	1.981	1.944
	0.5	1.060	1.036	1.048	0.542	0.481	0.511	1.964	2.141	2.052
	1.0	1.029	1.052	1.041	0.542	0.498	0.520	1.907	2.099	2.003
	7.5	1.107	1.098	1.102	0.559	0.511	0.535	1.985	2.165	2.075
	15.0	1.083	1.122	1.103	0.570	0.482	0.528	1.904	2.318	2.116
L.S.D. 0.05		0.036	0.041	0.027	0.041	0.019	0.021	N.S.	0.161	0.080
K_2O	0	1.065	1.043	1.054	0.552	0.508	0.530	1.948	2.026	1.987
	5	1.056	1.094	1.075	0.531	0.509	0.520	1.948	2.200	2.079
	10	1.045	1.068	1.056	0.533	0.510	0.521	1.904	2.108	2.006
	24	1.036	1.039	1.037	0.559	0.478	0.518	1.867	2.173	2.020
	48	1.073	1.092	1.048	0.531	0.492	0.512	2.001	2.197	2.099
L.S.D. 0.05		N.S.	0.045	0.027	N.S.	N.S.	N.S.	N.S.	0.105	0.079

Table 4 : Effect of Mg and K interaction on yield components of sugar beet at harvest.

Treatments kg /fed.		Root length (cm)	Root diameter (cm)	Root weight (kg)	Top weight (kg)	Root/top ratio
Mg	K_2O					
0.0	0	30.33	9.81	0.919	0.491	1.840
	5	31.13	10.88	1.171	0.578	1.395
	10	32.26	11.06	1.006	0.512	1.802
	24	31.65	10.87	0.969	0.491	2.000
	48	30.50	10.70	1.005	0.461	2.185
0.5	0	30.26	10.46	0.975	0.483	2.028
	5	31.42	10.46	1.095	0.521	2.127
	10	32.81	10.36	1.007	0.551	1.827
	24	33.38	10.31	1.111	0.525	2.123
	48	31.63	10.91	1.050	0.491	2.138
1.0	0	32.21	11.34	1.126	0.536	2.105
	5	32.38	10.85	0.986	0.525	1.906
	10	32.38	10.08	1.144	0.546	2.100
	24	32.80	11.15	0.958	0.501	1.907
	48	31.15	11.18	0.982	0.494	1.992
7.5	0	32.65	10.35	1.104	0.554	2.006
	5	33.00	9.98	1.074	0.544	1.972
	10	34.18	11.20	1.050	0.514	2.088
	24	33.91	10.51	1.089	0.534	2.075
	48	32.81	11.28	1.196	0.538	2.233
15.0	0	33.11	11.16	1.143	0.586	1.951
	5	33.68	10.98	1.045	0.481	2.445
	10	32.51	11.85	1.076	0.494	2.213
	24	33.37	11.08	1.060	0.542	1.995
	48	33.38	11.27	1.189	0.585	1.927
L.S.D. 0.05		1.70	0.93	0.062	0.049	0.178

Foliar application	Soil applications rates
Mg 0.5 and 1.0 kg	2.5 and 15 kg
K_2O 5 and 10.0kg	2.4 and 45 kg

application in both the growing seasons and the combined. These findings are in agreement with those obtained by Hammam (1969), El-Geddawy (1979), Assey *et al.* (1985 a) and Sorour *et al.* (1992).

Data in Table (4) show that top weight (kg) /plant of sugar beet was affected by application of Mg and K combination, the heaviest top weight (kg)/plant (0.586 kg) was recorded by 15 kg Mg/fed. in soil and without K fertilization. Whereas, the lightest top weight/plant of sugar beet was obtained by 48 kg K_2O/fed. application.

5. Root/top ratio:

Data in Table (3) show that root/top ratio in the first season was not affected by Mg foliar or soil application rates, while in the second season and the combined this character was slightly increased by 1.0 kg Mg foliar application and significantly by the other foliar or soil Mg rates application.

Potassium foliar or soil application in the first season did not affect the root /top ratio whereas, in the second season this ratio was slightly increased by 10 kg K_2O foliar rate and significantly by the others (K foliar or both soil rates application). In the combined, root /top ratio only was significantly increased by 5 kg K_2O foliar rate and 48 kg K_2O/fed. as soil application. These results are in agreement with those obtained by El-Geddawy (1979) and Assey *et al.*, (1985a).

Data in Table (4) show that root/top ratio was significantly affected by the combination between Mg and K application. The highest value (1.951) was achieved by 15 kg Mg as soil + K_2Oas foliar /fed. combination and the lowest value of root /top ratio was recorded by zero Mg + 5 kg K_2O as foliar application.

6- Root yield (ton/fed.):

Data in Table (5) show that Mg foliar application with the rate of 0.5 kg Mg/fed. in both season and combined did not affect the root yield/fed. of sugar beet. While rate of 1.0 kg Mg/fed. as foliar application significantly increased root yield/fed. of sugar beet in the second season only. In this respect, Domska (1996) found that root yield of sugar beet after foliar feeding with 2 kg Mg /ha. increased root yield. In addition to root yield/fed. of sugar beet was significantly increased by the application of 7.5 kg Mg or 15 kg Mg in soil in the two seasons and combined. These results are in agreement with those obtained by

Table 5: Root and top yields (ton/fed.) as affected by Mg and K applications in sugar beet.

Treatments Kg /fed.		Root yield (ton/fed.)			Top yield (ton/fed.)		
		97/1998	98/1999	Comb.	97/1998	98/1999	Comb.
Mg	0.0	37.205	38.657	37.931	18.89	19.60	19.20
	0.5	37.458	37.963	37.710	18.49	18.97	18.73
	1.0	37.188	39.836	38.512	19.32	19.35	19.33
	7.5	40.653	40.099	40.376	19.72	19.58	19.65
	15.0	40.000	40.813	40.406	21.00	19.99	20.50
L.S.D. 0.05		1.603	1.176	0.961	0.65	0.29	0.33
K_2O	0	38.055	38.013	38.034	19.81	19.60	19.70
	5	38.511	38.966	38.738	18.92	19.32	19.12
	10	38.700	40.011	39.355	18.56	19.64	19.10
	24	38.407	39.814	39.110	20.08	19.42	19.75
	48	38.831	40.564	39.697	19.96	19.52	19.74
L.S.D. 0.05		N.S.	N.S.	N.S.	0.71	N.S.	0.39

Draycott and Durant (1969) and Klosswski and Debska (1985).

Also, in general, K foliar or soil application slightly affected the root yield of sugar beet. In general, Mg soil application gave the highest root yield/fed. of sugar beet, however, Mg (foliar) and K application rates showed a slight effect on root yield of sugar beet.

Data in Table (7) show that the highest root yield /fed. (44.791 ton) was obtained by the application of 15 kg Mg + 48 kg K_2O/fed. in soil, but the lowest root yield (33.118 ton) was recorded by zero Mg x zero K_2O application. Similar results were obtained by Jaszczolt (1990). On the other hand, Zalewska *et al.* (1994) found that K application with or without Mg showed no significant increase in sugar beet and leaf yields by the application less than 33 kg K_2O/ha.

7- Top yield (ton/fed.).

Data in Table (5) show that Mg foliar application at rate of 0.5 kg Mg decreased top yield /fed., the effect was significant in the second season and combined. While the rate of 1.0 kg Mg as foliar slightly increased top yield of sugar beet. Mg soil application at rate of 7.5 kg Mg/fed. significantly increased top yield/fed. in sugar beet in the first season and combined. The top yield was significantly increased in the two seasons and the combined at rate of 15 kg Mg soil application. Similar results were obtained by Klosowski and Debska (1985), Sdowski and Wisniewski (1991) and Domska (1996) found the Mg foliar feeding with 2 kg Mg/ha. gave the highest shoot yield in sugar beet.

The effect of K foliar application on top yield was significant in the first season and the combined. Results in Table (5) show that top yield was significantly decreased by the two rates of 5 and 10 kg K_2O/fed.Meanwhile, the effect of K soil application did not affect. Similar results were obtained by Assey *et al.* (1985 a) and Tabl *et al.* (1986).

Data in Table (7) show that the highest top yield (21.332 ton/fed.) was recorded by 15 kg Mg + 24 kg K_2O/fed. in soil and the lowest top yield (19.406) was obtained by 0.5 kg Mg foliar application only.

B- Quality of sugar beet.

1- Total soluble solids percentage (T.S.S. %):

Data in Table (6) show that Mg foliar or soil application significantly increased the T.S.S. % in the second season only by the rates of 1.0 kg Mg as foliar and 7.5

Table 6: Sugar beet quality as affected by Mg and K applications.

Treatments Kg /fed.		T.S.S.%			Sucrose %			Juice purity %		
		97/1998	98/1999	Comb.	97/1998	98/1999	Comb.	97/1998	98/1999	Comb.
Mg	0.0	20.87	21.36	21.11	17.50	17.86	17.68	84.07	84.53	84.30
	0.5	21.10	21.46	21.28	18.16	17.91	18.04	86.10	84.26	85.18
	1.0	21.47	21.80	21.64	18.13	18.77	18.45	84.56	86.67	85.61
	7.5	21.31	21.73	21.52	18.60	18.08	18.34	87.30	82.24	84.77
	15.0	21.09	21.70	21.39	17.97	17.80	17.89	85.62	81.27	83.45
L.S.D. 0.05		N. S.	0.34	N.S.	0.56	0.54	0.46	N. S.	N.S.	1.27
K_2O	0	21.44	21.10	21.27	17.89	18.18	18.04	84.10	84.98	84.54
	5	20.94	21.26	21.10	18.30	17.86	18.08	87.90	84.47	86.19
	10	21.22	21.63	21.43	18.00	18.16	18.08	84.43	83.87	84.15
	24	21.34	21.08	21.21	18.55	18.06	18.30	86.94	83.35	85.14
	48	20.91	21.83	21.37	17.61	18.12	17.87	84.28	83.51	84.89
L.S.D. 0.05		N.S.	0.46	0.34	0.46	N.S.	0.36	2.19	N.S.	1.86

kg and 15 kg Mg in soil. T.S.S. % was not affected by K foliar or soil application in the first season and the combined. T.S.S.% significantly was increased by 10 kg K_2O as foliar and 48 kg K_2O/fed. in soil application in the second season. Similar results were obtained by Assey *et al.* (1985 b), Tabl *et al.*(1986), Sahota *et al.* (1988) and Chochola (1989).

Results in Table (7) show that the interaction between Mg and K application affected the T.S. S. % in root of sugar beet, the T. S. S. % reached the maximum (22.216 %) by the combination of 0.5 kg Mg as foliar + 24 kg K_2O as soil application and the minimum (20.524 %) by the combination of 1.0 kg Mg + 5 kg K_2O as foliar applications.

2-Sucrose %:

Data in Table (6) showed that sucrose % in root of sugar beet in the first season was significantly increased by Mg foliar application at both rates of 0.5 kg and 1.0 kg Mg/fed. while in the second season and the combined, sucrose % was increased only by the rate of 1.0 kg Mg/fed., Mg soil application at rate of 7.5 kg Mg/fed. increased sucrose % in the root of sugar beet, the effect was significant in the first season and the combined. Whereas, Mg application in soil at rate of 15 kg Mg/fed., slightly increased sucrose % in root of sugar beet. In the same trend, Draycott and Durant (1969) found that Mg application increased sucrose % in root sugar beet, on the other hand, Sdowski and Wisniewski (1991) found that Mg foliar application did not affect the sugar yield in sugar beet.

Data in Table (6) stated that K foliar application with the two rates of 5 kg and 10 kg K_2O/fed. did not affect the sucrose % in the two seasons and the combined, there is a slight increase in this character in the first season by the rate of 5 kg K_2O/fed. as foliar application. K soil application (24 kg K_2O/fed) only, increased sucrose % in the first season, but did not affect sucrose % in the second season and combined. Also, K soil application (48 kg K_2O/fed.) did not affect sucrose % in the two season and the combined comparing with the control treatment. Meanwhile sucrose % was significantly decreased by raising the rate of K soil application from 24 up to 48 kg K_2O/fed. in the first season and the combined. These results are in agreement with those obtained by Draycott *et al.* (1970), Bizik (1993), Domska (1996) and Kristek *et al.*(1999).

Table 7: Effect of Mg and K interaction on sugar beet yields and quality in sugar beet.

Treatments kg /fed. Mg	K_2O	Root yield (ton/fed.)	Top yield (ton/fed.)	T.S.S. %	Sucrose %	Juice purity
0.0	0	33.118	19.413	20.846	18.12	84.216
	5	40.141	19.406	20.996	17.75	84.540
	10	40.996	18.546	21.000	17.95	85.838
	24	37.615	19.339	20.750	18.31	87.486
	48	37.788	19.296	21.333	16.66	77.958
0.5	0	35.730	18.213	20.836	17.78	85.913
	5	37.001	18.640	20.810	17.85	85.086
	10	38.316	18.985	21.088	17.75	83.835
	24	39.700	19.914	22.216	18.72	83.608
	48	37.805	17.923	20.682	18.08	87.446
1.0	0	36.787	20.020	22.167	18.20	81.738
	5	38.382	18.758	20.524	18.52	89.181
	10	40.963	18.802	21.500	18.41	84.246
	24	37.728	19.666	21.915	18.92	86.601
	48	38.700	19.450	21.667	18.70	86.336
7.5	0	42.908	20.183	21.880	18.54	84.783
	5	39.143	19.356	22.063	18.49	83.786
	10	39.191	19.458	22.061	18.95	85.906
	24	41.233	18.516	21.226	17.91	85.528
	48	39.403	20.758	21.250	17.79	83.860
15.0	0	41.630	20.703	21.417	18.09	84.548
	5	39.025	19.467	21.433	18.36	85.846
	10	37.310	19.722	21.447	17.68	80.902
	24	39.275	21.332	21.415	17.75	82.520
	48	44.791	21.266	21.593	18.10	84.014
L.S.D. 0.05		1.667	0.888	0.77	0.810	4.17

Data in Table (7) show that the highest positive effect on sucrose % (18.95 %) was achieved by soil application of 7.5 kg Mg + foliar application of 10 kg K_2O combination and the highest negative effect was recorded by 48 kg K_2O/fed. in soil application.

3- Juice purity%:

Data in Table (6) show that Mg foliar application at rates of 0.5 and 1.0 kg Mg/fed. did not affect juice purity in the two growing seasons. The combined analysis revealed that foliar application of 1 kg Mg /fed. significantly increased this trait. Mg soil application did not affect juice purity % by the rates of 7.5 and 15 kg /fed. in both seasons and the combined.

Results in the same Table show that juice purity % was significantly increased by foliar application of 5 kg K_2O rate only in the first season and combined. While rate of 10 kg K_2O/fed. as foliar application did not affect juice purity % in root of sugar beet. K soil application at rate of 24 kg K_2O/fed. increased juice purity % in the first season only but K soil application with the rate of 48 kg K_2O did not affect the juice purity % in the two seasons and combined. The same trends were obtained by Draycott and Cooke (1966) and Draycott *et al.* (1970) Ramadan (1997) and El-Harriry and Gobarah (2001).

Results of the interaction between Mg and K applications (Table 7) show that the highest increase in juice purity % was achieved by foliar application of 1.0 kg Mg + 5 kg K_2O combination and the lowest juice purity % was recorded by 48 kg K_2O in soil only.

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تأثير إضافة المغنيسيوم والبوتاسيوم علي محصول وجودة بنجر السكر

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**الإدارة المركزية للتدريب – وزارة الزراعة – الدقي – جيزة.

أقيمت تجربتان حقليتان خلال الموسمين الشتويين ١٩٩٨/٩٧ و ١٩٩٩/٩٨ في تصميم القطاعات الكاملة العشوائية لدراسة تأثيرإضافة كل من المغنيسيوم والبوتاسيوم رشاً علي المجموع الخضري (بعد ٦٠،٨٠ و ١٢٠ يوم من الزراعة) بمعدل ٠,٥ و ١,٠ كجم مغنيسيوم و ٥ و ١٠ كجم بو٢أ/ فدان أو عن طريق التربة (بعد ٦٠ و ٨٠ يوم من الزراعة) بمعدلات٧,٥ ، ١٥ كجم مغ و ٢٤ ، ٤٨ كجم بو٢أ/ فدان مقارنة بعدم الإضافة وتوليفاتها علي محصول بنجر السكر ومكوناته وصفات الجودة تحت ظروف أراضي جنوب محافظة الدقهلية.

ويمكن تلخيص أهم النتائج المتحصل عليها كما يلي:

١- ازداد كل من طول وقطر الجذر وكذلك وزن الجذر والعرش للنبات عند إضافة المغنيسيوم رشا بمعدليه ٠,٥ ، ١,٠ كجم / فدان ، وكانت الزيادة في طول الجذر معنوية والزيادة في قطر الجذر معنوية عند معدل ١كجم / فدان فقط.

٢- حققت الإضافة الأرضية للمغنيسيوم بمعدلي٧,٥ ، ١٥كجم /فدان زيادة معنوية في مكونات المحصول السابق ذكرها. كما ازداد محصول الجذور والعرش لبنجر السكر زيادة معنوية بإضافة المغنيسيوم عن طريق التربة بالمعدلين السابقين في حين لم تكن للإضافة رشا علي المجموع الخضري أي تأثير.

٣- أدت إضافة البوتاسيوم رشا علي المجموع الخضري بمعدل ٥ كجم بو٢أ/ فدان إلي زيادة وزن الجذر / نبات بدرجة معنوية وعند مضاعفة الجرعة(١٠ كجم بو٢أ/ فدان) ازداد معنويا كل من طول وقطر الجذر. إلي حد ما زاد محصول الجذور (طن/ فدان) عند رش البوتاسيوم بمعدل ١٠ كجم بو٢أ/ فدان بينما نقص معنويا محصول العرش (طن / فدان) بإضافة البوتاسيوم رشا بمعدليه السابقين.

٤- ازداد معنويا قطر الجذر بإضافة ٤٨ كجم بو٢أ/ فدان عن طريق التربة أما محصول الجذور/ فدان ازداد زيادة طفيفة، في حين كانت الزيادة في محصول الجذور / فدان طفيفة بإضافة أي من جرعتي البوتاسيوم إلي التربة.

٥- إضافة ١ كجم مغ /فدان رشا أدت إلي زيادة نسبة كل من المواد الصلبة الذائبة الكلية ونقاوة العصير وإضافة ٧,٥ ، ١٥ كجم مغ /فدان للتربة أدت إلي زيادة النسبة المئوية للمواد الصلبة الذائبة الكلية ومعدل ٧,٥ أدي إلي زيادة نسبة السكروز.

٦- زادت نسبة المواد الصلبة الذائبة الكلية بإضافة ١٠ كجم بو٢أ /فدان رشا علي الأوراق بينما ذادت نسبة النقاوة بإضافة ٥ كجم بو٢ أ /فدان رشاً أيضا وزادت نسبة السكروز بإضافة ٢٤ كجم بو٢أ /فدان للتربة.

٧- استجاب محصول جذور وعرش بنجر السكر وصفات الجودة لمعظم التداخلات بين معدلات إضافة كل من المغنسيوم والبوتاسيوم .