RESULTS AND DISCUSSION

This research was designed and implemented to study the effect of foliar application dates and nutrients and biological activators treatments on yield and yield components, juice quality and chemical composition of sugar beet cv. Viz Sultan. Data of the studied parameters will be presented and discussed on the basis of the combined analysis of the two growing seasons (1997/1998 & 1998/1999).

Results will be discussed in the following order:

I- Effect of foliar application dates and nutrients and biological activators treatments on top, root, biological yield, harvest index and sugar yield of sugar beet:

1- Top yield (ton/fed):

Results in Table (2) and Fig. (8) represent the effect of foliar application dates and nutrients and biological activators treatments on fodder yield of sugar beet as well combined over the two growing seasons.

Delaying foliar application from 45 up to 105 days from sowing caused a significant continous increase in top fresh sugar beet yield. Increased top yield due to delaying foliar spraying date may be due to increase plant height, number of leaves/plant, leaf area index, fresh and dry weight of different plant organs as well as dry matter accumulation. Similar results were also obtained by **Fathy et al. (2000)**

Table (2) Effect of foliar application dates of some nutrients and biological activators as well as their interactions on top, root and biological yield (tons/fed) of sugar beet plants at harvest. (combined over two growing seasons 1997/1998 and 1998/1999).

Characters		Top yield (ton/fed) Days after sowing				Root yield (ton/fed) Days after sowing				Biological yield (ton/fed) Days after sowing			
Treatments		45 days	75 days	105 days	Mean	45 days	75 days	105 days	Mean	45 days	75 days	105 days	Mean
Control (distilled water)		2.66	2.77	2.77	2.73	26.56	27.69	27.61	27.28	29.22	30.46	30.38	30.01
Yeast extract (YE)	50 ml/l	3.20	3.57	3.99	3.58	31.90	35.64	39.85	35.80	35.10	39.21	43.84	39.38
	250 ml/l	3.39	3.77	4.25	3.80	33.85	37.66	42.44	37.98	37.24	41.43	46.69	41.78
Paclobutrazol (PP_{333})	5 ppm	2.83	3.16	3.53	3.17	28.25	31.56	35.26	31.69	31.08	34.72	38.78	34.86
	25 ppm	2.96	3.33	3.72	3.33	29.61	33.26	37.11	33.33	32.57	36.58	40.85	36.67
Potassium	50 ppm	4.08	4.57	4.31	4.33	40.76	45.73	52.04	46.18	44.84	50.30	56.37	50.50
	250 ppm	4.29	4.76	4.33	4.46	42.89	47.62	54.24	48.24	47.17	52.38	58.56	52.70
Magnesium	50 ppm	3.76	4.24	4.15	4.05	37.58	42.40	46.90	42.32	41.34	46.64	51.13	46.37
	250 ppm	4.00	4.42	4.28	4.23	39.97	44.23	51.64	45.28	43.96	48.65	55.92	49.51
5 ppm PP_{333} + 50 ppm K		3.52	3.93	4.43	3.96	35.19	39.28	44.27	39.58	38.71	43.20	48.70	43.54
50 ml/l YE + 50 ppm K		3.75	4.15	4.69	4.19	37.43	41.50	46.87	41.93	41.17	45.64	51.55	46.12
Total mean		3.50	3.88	4.04		34.91	38.78	43.49		38.57	42.66	47.50	42.86
L.S.D at 0.05 level of significance.													
Days after sowing(A)					0.26				2.44				2.50
Elements (B)					0.24				2.42				2.45
A X B					0.46				4.64				4.75

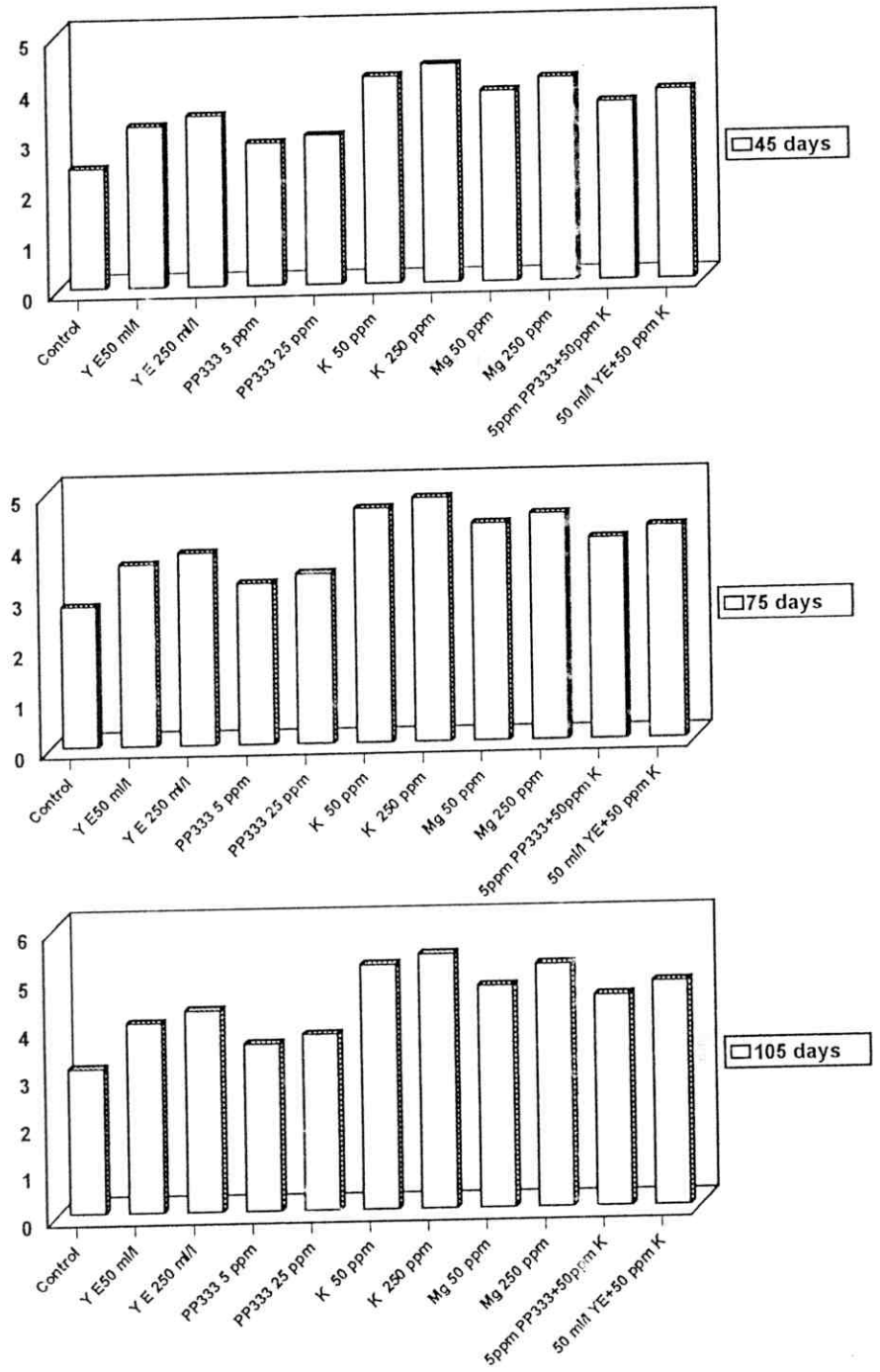

Fig (8) Effect of foliar application dates withYE, PP333 K, Mg and some their mixtures on top yield of sugar beet plants (ton/fed).

Regarding nutrients and biological activator treatments, applying the natural source of hormones (yeast extract), plant growth regulators (PP_{333}), potassium and magnesium nutrients significantly increased top fresh yield in sugar beet. Application of K gave the highest values of forage yield and it significantly increased top green yield compared with the other treatments. Such increases due to applying 50 and 250 ppm K over the controol treatment were 68.1 and 75.5 %, respectively.

The increment of top yield of sugar beet plants by adding K may be due to the role of K element in improving enzyme activation by **(Marschner 1995).** Therefore, the effect of K nutrient on top yield may be due to increasing photosynthetic area which resulted in increasing photosynthetic gains, water relations and vegetative growth by increasing cell division **(Marschner 1995).** Thus application of K induced a significant increase in the top yield. On the other hand **Shehata et al. (1986)** reported that, application of K did not induce significant effect on dry fodder bean in a soil containing very high amounts of available K (850 ug/g).

Magnesium application (50 and 250 ppm Mg) stimulated top yield above other treatments except K nutrient. Increases in top forage yield due to applying Mg over the unfertilized treatment were 54.6 and 64.8%, respectively. The soil analysis showed that soil contained only 0.09 mg/l Mg^{++} which is considered as a low level **(Ankerman and Large 1974).** Therefore, application 250 ppm Mg increased top yield asserting the jnevilal need for Mg application to sugar beet production in this soil. Mg is essential element. It has a great rol as its emplying in the chlorophyll

molecule struction and the activity of many enzymes (**Marschner 1995**)

Applying the natural source of hormones (yeast extract) significantly increased top yield of sugar beet. Foliar application with 50 and 250 ml/l YE increased top yield over the check treatment by 31.1 and 39.2 %, respectively. Such increases in top yield may be due to the yeast extract contain phytohormones, minerals (macro and micro nutrients), amino acids, enzymes and many vitamins as a biological activators (Table 1-a).

Applying the new growth regulators (5 and 25 ppm PP_{333}) caused an increases in green forage yield reached 16.1 and 22.0%, respectively above the control plants. Apparently, PP_{333} inhibits the biosynthesis of gibberellins (**Graebe, 1982**) which in turn affects the plant size **Quinlan (1981)** These results are in line with those reported by **Tian et al. (1993)** they reported that soaking sugar beet seeds in PP_{333} increased the growth of leaves, roots and root yield.

Also, a higher levels of different treatments produced the highest top yield compared with the lower levels. On the same line, application of mixture 5 ppm PP_{333} + 50 ppm K and 50 ml/l YE + 50 ppm K treatments increased green top yield over the unfertilized treatment by 45.1 and 53.5 %, respectively.

Moreover, the interaction between foliar spray dates and other treatments was significant on top yield of sugar beet. The highest top yield 5.52 ton/fed was shown by foliar application with 250 ppm K at 105 days from planting and the control treatment gave the lowest yield 2.36 ton/fed. These results may be due to delaying foliar application stimulating response for potassium.

2- Root yield (ton/fed):

Results on the effect of foliar spray dates and some nutrients and biological activator treatments on root yield are presented in Table (2) and Fig. (9). Foliar application at 105 days gave high estimate of root yield that reached 43.48 ton/fed, which ranked the first, followed by the application at 75 days that was 38.78 ton/fed and the least was 34.63 ton/fed that obtained from the application at 45 days.

Foliar spray at 105 days after sowing significantly increased the yielded beet root either when compared with that obtained at 45 or 75 days after sowing.

Foliar application with YE, PP_{333}, K, Mg, 5 ppm PP_{333} + 50 ppm K and 50 ml/l YE + 50 ppm K treatments significantly increased root yield of sugar beet over the check treatment by 32.22, 19.17, 71.96, 59.77, 45.09 and 53.70 %, respectively. It was observed that applying K produced the highest root yield compared with other treatments.

Also, spraying high concentration of YE, PP_{333}, K and Mg treatments gave the highest root yield compared with the low concentrations. Applying 250 ppm K had the highest root yield (47.91 ton/fed) asserting the vital need for K application to sugar beet production in this soil. The soil analysis showed that soil contained only 280 mg/kg soil which is considered as a low level **(Ankerman and Larger 1974).** Most plant processes, particularly the translocation of photosynthates within plant, are dependent on cell K concentration **(Archer, 1988)**.

Results summarized in Table (2) and Fig (9) showed that application dates x nutrients and biological activators treatments

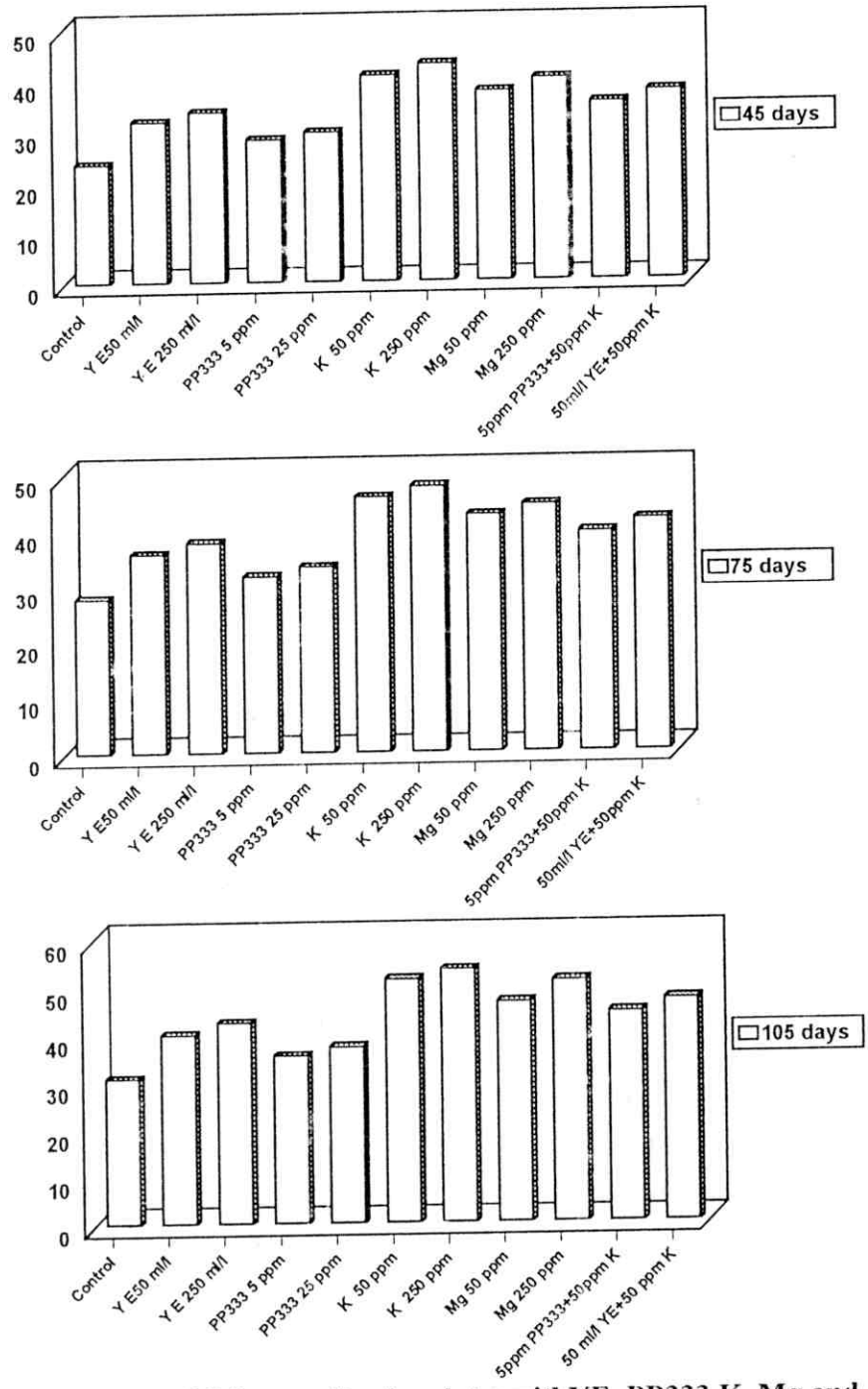

Fig (9) Effect of foliar application dates withYE, PP333 K, Mg and some their mixtures on root yield of sugar beet plants (ton/fed).

significantly increased root yield over the two growing seasons (1997/1998 & 1998/1999). Foliar application with K produced the highest root yield within different dates. Foliar application of 250 ppm K at 105 days from planting produced the higher root yield 54.24 ton/fed and the unfertilized treatment had the lowest yield 27.28 ton/fed at 45 days.

A good supply of K will lead to more better root growth and more metabolic activity in plants leading in turn to a high root yield. The present results are in agreement with those obtained by **Ramadan (1997), El- Maghraby et al. (1998), Ibrahim (1998) and El-Taweel (1999)** who stated that K application significantly increased root, biological and sugar yield of sugar beet plants. Also, he found that Mg application significantly increased root, biological and sugar yields/fed.

El-Gamal (1994) reported that spraying sweet potatoes at 60 days from sowing with 0.5 ppm PP_{333} increased total root yield as well as its contents of soluble solids. **Fathy et al. (2000)** found that spraying tomato plants cv. Super strain B with yeast preparation 25 and 50 ml/l at 20, 40, 60 and 80 days from transplanting significantly improved fruiting and total yield.

3- Bilogical yield (ton/fed):

The obtained data at 210 days after sowing (i.e. at harvest time) showed that foliar application at 105 days gave the highest estimate of biological yield that was 47.82 ton/fed which ranked the first, followed by the application at 75 days that was 42.65 ton/fed and the least was obtained from the application at 45 days that was 30.10 ton/fed. Foliar spray at 105 days after sowing significantly

increased the biological yield when compared with the values obtained at 45 and 75 days after sowing. Here, it could be concluded that delaying foiliar spray up to 105 days after sowing significantly increased the assimilates that were translocated from the tops to the roots. In addition, significant differences among treatments of nutrients were recorded as shown in Table (2). Biological yield the total dry matter being accumulated in different plant organs (top and root).

Foliar application with YE, PP_{333}, K, Mg, 5 ppm PP_{333} + 50 ppm K and 50 ml/l YE + 50 ppm K treatments significantly increased biological yield over the check treatment by 35.22, 19.18, 71.94, 59.75, 44.99 and 53.71, respectively. Applying K produced the highest values, which ranked the first, followed by Mg application and the least was obtained by PP_{333} application. Other treatments was inbetween.

Also, the higher levels produced the highest values compared with the lowest levels in the single foliar spray. It could be concluded that spraying 250 ppm K produced the highest biological yield 52.7 ton/fed and the lowest yield 30.01 ton/fed was obtained by the control treatment 30.01 ton/fed. Such increases due to delaying foliar application dates may be due to increase the assimilates that were translocated from the tops to the roots.

Such increases in sugar beet plants as a result of foliar application with K may be due to one or more of the following physiological functions for K: a) carbohydrates metabolism or formation break down and translocation of starch. b) Control and regulation of activities of various essential elements and c) activation of various enzymes **(Tisdal and Nelson 1975)**.

Many workers found positive effect of K application on yield and its components of many crops in alluvial and new reclaimed soils. K is essential to a number of plant enzyme systems and transpiration. Also, potassium application stimulation iron absorption **(Anon, 1985)**

The increment of plant fresh weight by increasing K dose may be due to the role of K element in improving enzyme activation and vegetative growth by increasing cell division **(Marschner 1995)**

4- Harvest index

Delaying foliar application with different nutrition treatments up to 105 days from sowing increased harvest index. Foliar application with YE, PP_{333}, K, Mg and some their mixture significantly increased harvest index over the check treatment (Table, 3)..

Applying the highest K level 250 ppm K had the highest harvest index 91.60%. These results most certainly due to the higher K level significantly produced the highest root yield and biological yield Table (2).

5- Sugar yield (ton/fed):

Obtained samples at 210 days after sowing i.e. at harvest time showed that foliar application at 105 days gave high mean values of sugar yield that was 7.52 ton/fed, which ranked the first, followed by the application at 75 days that gave 6.64 ton/fed and the least that was 5.89 ton/fed obtained from the application at 45 days.

Table (3) Effect of foliar application dates of some nutrients and biological activators as well as their interactions on harvest index and sugar yield (tons/fed) of sugar beet plants at harvest. (combined over two growing seasons 1997/1998 and 1998/1999).

Characters		Harvest index Days after sowing				Sugar yield (ton/fed) Days after sowing			
Treatments		45 days	75 days	105 days	Mean	45 days	75 days	105 days	Mean
Control (distilled water)		90.91	90.91	90.90	**90.91**	3.88	4.05	4.06	**4.00**
Yeast extract (YE)	50 ml/l	90.90	90.90	90.91	**90.90**	5.19	5.90	6.70	**5.93**
	250 ml/l	90.90	90.90	90.91	**90.91**	5.63	6.30	7.20	**6.38**
Paclobutrazol (PP_{333})	5 ppm	90.91	90.92	90.91	**90.92**	4.30	4.85	5.46	**4.86**
	25 ppm	90.91	90.90	90.83	**90.89**	4.65	5.26	5.96	**5.29**
Potassium	50 ppm	90.91	90.90	90.27	**90.36**	7.46	8.40	9.64	**8.50**
	250 ppm	90.92	90.90	90.43	**90.61**	8.03	8.95	10.26	**9.08**
Magnesium	50 ppm	90.90	90.91	90.80	**90.15**	6.61	7.58	8.35	**7.51**
	250 ppm	90.91	90.91	90.74	**90.52**	7.12	7.92	9.30	**8.11**
5 ppm PP_{333} + 50 ppm K		90.92	90.91	90.91	**90.91**	5.92	6.66	7.58	**6.72**
50 ml/l YE + 50 ppm K		90.90	90.91	90.91	**90.91**	6.44	7.20	8.25	**7.29**
Total mean		**90.91**	**90.91**	**90.42**	**90.91**	**5.93**	**6.64**	**7.52**	
L.S.D. at 0.05 level of significance.									
Days after sowing(A)					0-63				0.38
Elements (B)					0-48				0.35
A X B					0-81				0.71

Delaying foliar application with different treatments from 45 to 75 and 105 days from sowing significantly increased sugar yield by 118.38 and 94.25 %, respectively. Such increases due to delaying foliar spray may be increase net again vegetative growth root yield and sucrose % Table (3) and Fig. (10).

Foliar application with YE, PP_{333}, K, Mg treatments significantly increased sugar yield. Such increases in sugar yield due to the same respective treatments over the check treatment were 53.88, 26.88, 118.38 and 94.25 %, respectively.

Ahigher levels of different treatments significantly increased sugar yield compared with the lower levels of treatments. Generally, foliar application with 250 ppm K significantly increased sugar yield comparted with the other treatments. Increased sugar yield due to foliar application with YE, PP_{333}, K, Mg may be due to increase root yield and sucrose percentage in roots. The same trend was obtained as a result of applying 5 ppm PP_{333} + 50 ppm and 50 ml/l YE + 50 ppm K.

Obtained samples at 210 days after sowing i.e. at harvest time showed that foliar application at 105 days gave high mean values of sugar yield that was 7.52 ton/fed, which ranked the first, followed by the application at 75 days that gave 6.64 ton/fed and the least that was 5.89 ton/fed obtained from the application at 45 days.

Also, data presented in Table (3) revealed that foliar spray at 105 days after sowing significantly increased sugar yield either when compared with that obtained with the foliar application at 45 or 75 days after sowing. Therefore, delaying single foliar spray up to 105 days after sowing significantly increased sugar yield more than the other two application dates.

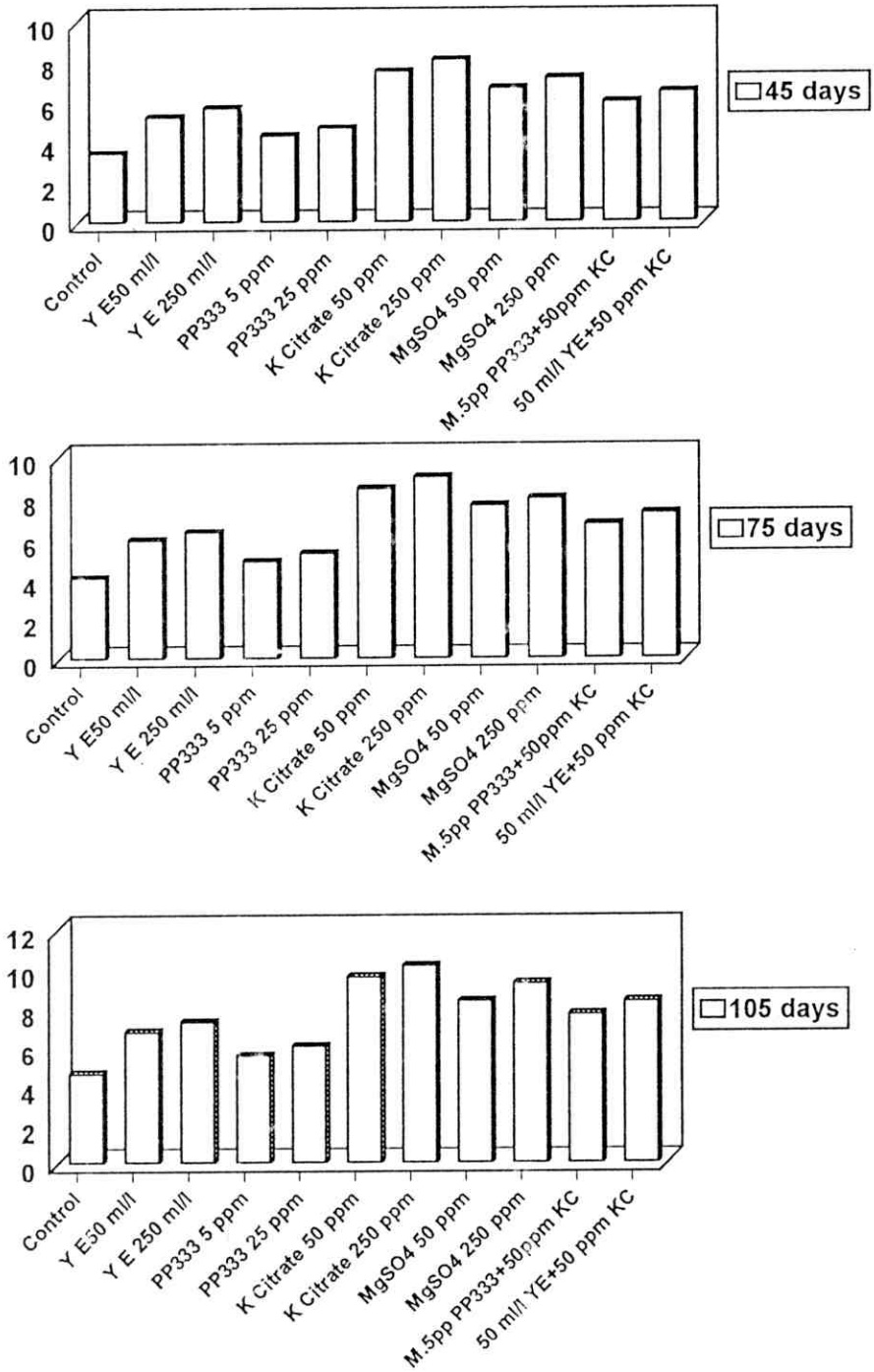

Fig (10) Effect of foliar application dates withYE, PP333 K, Mg and some their mixtures on sugar yield of sugar beet plants (ton/fed).

Moreover, The interaction between single foliar spray treatments at harvest time were significant. The highest values was of 10.07 ton/fed resulted from beets at harvested after foliar spray at 105 days after sowing with 250 ppm of K, while the least value 3.42 ton/fed resulted from untreated treatment. The other treatments occupied inbetween positions.

Dolya and Ostrovskii (1971) found that preplanting treatment of sugar beet seeds with vitamin B_1 at 5 mg/l increased yield of the crop produced. Meanwhile, **Atawia and El-Desouky (1997)** found that foliar application to washington navel orange tree at full bloom stage with yeast extract at 100 and 200 ml/l showed significant increase of the total fruit numbers and yield in kg/tree. While, **Shadia et al. (1998)** studied the effect of active dry yeast application as foliar spray with the three concentrations of 0, 1 and 2 gm/l on the growth, fruiting and active substances of roselle plant (*Hibiscus sobdariffa, L.)* at flowering and fruiting stages improved statistically yield of calyxes and **Rabeh et al. (1994)** noticed that in washington navel orange trees, fruit-set and yield were significantly increased as a result of raising the PP_{333} concentration from 250 upto 1000 ppm. Whereas, **Ismaeil (1995)** found that in broad beans cv. Giza 402, PP_{333} treatments at 10, 50 and 100 ppm significantly increased the yield of the main stem, the yield of branches and the total seed yield/plant as well and **Fathy et al. (2000)** reported that spraying tomato plants cv. super strain B with PP_{333} (25 and 50 ppm) at 20, 40, 60 and 80 days after transplanting significantly increased both fruit number and yield.

In this respect, **Muller (1994)** found that application of 54 kg P_2O_5 + 240 kg K_2O + 240 kg K_2O/ha to Luvisol soils was the best interaction between P and K for maximizing yield of sugar beet plants. While, **Ramadan (1997)** found that increasing K rate up to 72 kg/fed favoured beet growth in terms of increase yields of shoots, roots and sugar/fed. Also, **El-Maghraby et al. (1998)** showed that K at the rate of 0, 24 and 48 K_2O/fed as soil fertilizer as well as the foliar application significantly increased sugar/ plant root and sugar yields t/fed of sugar beet plants and

In this respect, **Orlovius (1993)** noted that applied 5 % solution of MgO as foliar applications applied shortly before and after anthesis in potatoes. The tuber yields of Mg sprayed crops were up to 5.7 t/ha higher than those of control crops. The mean yield increases averaged 2.2 t/ha. While, **Denesova and Andres (1995)** studied the effect of K-Mg fertilizer Kamex granules, 200 kg K_2O/ha and 30 kg MgO/ha and Mg fertilizer Bittersalz, 2 applications of 2.6 kg MgO/ha on sugar beet plants. Results showed that sugar beet plants were good affected regarding sugar yield. The economic returns of Bittersalz fertilizer were higher than those resulted from Kamex granules fertilizer application. Also, **Domska (1996)** found that application of 100 kg N, 60 kg Mg as soil application and 40 kg foliar + 2 kg Mg + 0.6 kg boron/ha to sugar beet plants gave the highest sugar yield and **El-Taweel (1999)** reported that Mg application from 0 to 9 and 18 kg MgO/fed significantly increased root yield, biological yield and sugar yield of sugar beet plants.

II. Juice quality in beet roots at harvest time:

Effect of foliar application dates with YE, PP_{333}, K, Mg and some of their mixtures on total soluble solids, sucrose and purity percentages of sugar beet roots at harvest (combined over the two growing seasons 1997/1998 and 1998/1999). are presented in Table (4).

The statistical analysis of the obtained results revealed significant differences among the mean values of total soluble solids, sucrose and purity percentages among the three foliar application dates as affected by the two applied concentrations of each treatment. This significant effect indicate that each experimental factor acted independently on this character.

1- Total soluble solids (TSS %):

Foliar application at 105 days gave the highest mean values of TSS% that reached 25.64 %, which ranked the first, followed by the application at 75 days that was of 25.46 % and the least was obtained from the application at 45 days which was 25.32 %.

Also, it could be noticed that foliar spray at 105 days after sowing significantly increased TSS % compared with those obtained at 45 or 75 days after sowing. The existed enhancement of TSS % with single foliar spray at 105 days after sowing could be interpreted on the basis that more assimilates were translocated from the photosynthetic tops of the plant (source) to the storage roots (sink).

Table (4) Effect of foliar application dates of some nutrients and biological activators as well as their interactions on total soluble solids (TSS), sucrose and purity percentages of sugar beet roots at harvest. (combined over two growing seasons 1997/1998 and 1998/1999).

Characters		Total soluble solids (TSS %) Days after sowing				Sucrose % Days after sowing				Purity % Days after sowing			
Treatments		45 days	75 days	105 days	Mean	45 days	75 days	105 days	Mean	45 days	75 days	105 days	Mean
Control (distilled water)		23.32	23.50	23.67	**23.50**	14.58	14.58	14.68	**14.61**	62.14	62.09	62.51	**62.25**
Yeast extract (YE)	50 ml/l	24.79	24.87	25.02	**24.89**	16.27	16.53	16.80	**16.53**	65.65	66.50	67.17	**66.44**
	250 ml/l	25.04	25.19	25.32	**25.18**	16.62	16.73	16.97	**16.77**	66.39	66.46	67.03	**66.63**
Paclobutrazol (PP_{333})	5 ppm	24.00	24.13	24.37	**24.17**	15.20	15.33	15.47	**15.33**	63.35	63.56	63.49	**63.47**
	25 ppm	24.50	24.63	24.87	**24.67**	15.68	15.82	16.05	**15.85**	64.03	64.22	64.56	**64.27**
Potassium	50 ppm	26.73	26.92	27.15	**26.93**	18.27	18.35	18.52	**18.38**	68.34	68.19	68.23	**68.25**
	250 ppm	26.97	27.17	27.33	**27.16**	18.72	18.80	18.92	**18.81**	69.43	69.22	69.23	**69.29**
Magnesium	50 ppm	26.05	26.13	26.27	**26.15**	17.58	17.85	17.78	**17.74**	67.52	68.33	67.72	**67.86**
	250 ppm	26.23	26.33	26.53	**26.37**	17.80	17.90	18.00	**17.90**	67.87	67.99	67.86	**67.91**
5 ppm PP_{333} + 50 ppm K		25.19	25.35	25.54	**25.36**	16.82	16.97	17.12	**16.97**	66.79	66.94	67.05	**66.93**
50 ml/l YE + 50 ppm K		25.69	25.82	25.99	**25.83**	17.20	17.35	17.58	**17.38**	66.98	67.22	67.69	**67.30**
Total mean		**25.32**	**25.46**	**25.64**	**25.47**	**16.79**	**16.93**	**17.09**	**16.93**	**66.23**	**66.43**	**66.59**	**63.92**
L.S.D at 0.05 level of significance.													
Days after sowing(A)					0.03				0.05				0.24
Elements (B)					0.14				0.08				0.44
A X B					N.S				N.S				N.S

In addition, the superiority of the applying different treatments biological activators and nutrients treatments when applied at 105 days regarding juice quality and/or other traits aspects it may interpreted on the basis that: the time of 105 days represent that period directly preceded the storage stage. Since, storage stage in sugar beet roots commonly starts at 150 days of plant age **(Lenton and Milford 1977; Cooke and Scott 1995).** Hence, enhancement of plant growth strongly could be reflected upon the next growth stage i.e. storage one. On the other hand, earlier treatments (i.e. at 45 and 75 days) appeared to enhance other stages of growth (i.e. top growth).

Thereby, enhancement of beet growth with different applied treatments at 45 and 75 days after sowing being gradually minimized with the advancing of plant age. That could be more acceptable especially when values obtained from plants were treated either at 45 or 75 days of plant age were considered. Since, treatment at 105 days was more pronounced and effective compared with the other two dates regarding different estimated aspects.

Moreover, significant differences among treatments were existed in Table (4). The treatment of 250 ppm K nutrition gave the highest value followed by 50 ppm K, 250 ppm Mg, 50 ppm Mg, respectively, in a descending order. Applying, 250 ppm of K was 27.16 % which ranked the first and the least was 23.50 % of untreated plants.

The interaction between foliar spray dates and other treatments were not significant. The highest value of TSS % that was 27.33 % resulted from beets at harvest after foliar spray at 105 days after sowing with 250 ppm K, while the lowest value resulted from

untreated plants that reached to 23.32 %. The other treatments ranked inbetween.

2-Sucrose percentage:

As shown in Table (4) taken samples at 210 days after sowing at harvest exhibited that foliar application at 105 days gave the highest mean values that was of 17.09 %, which ranked the first, followed by the application at 75 days that was 16.93 % and the least was obtained from the application at 45 days that reached 16.79 %.

Also, these data revealed that foliar spray at 105 days after sowing significantly increased sucrose % compared with that obtained at 45 or 75 days after sowing that was true for each treatment. In addition, delaying foliar spray up to 105 days after sowing significantly increased sucrose % more than the other two dates of treatments. This could be of interest as the econimic value is considered.

In addition, significant differences among biological activators and nutrients treatments treatments of elements in sucrose % were also existed in Table (4). In this respect, the application of 250 K gave the highest value of sucrose % followed by 50 ppm K, 250 ppm Mg and 50 ml/l YE + 50 ppm K of mixture in a descending order. Meanwhile, 250 ppm of K gave the value of 18.81 % which ranked the first and the lowest was 14.62 % that of untreated plants.

Moreover, the interaction between single foliar spray dates and the different applied treatments at harvest time were not significant. The highest value of sucrose % that was 18.92 % resulted from beets at harvest after foliar spray with 250 ppm K at 105 days after

sowing. While the lowest value resulted from untreated treatment as it decreased 14.48 %. The other treatments ranked inbetween.

3- Purity percentage:

As indicated in Table (4) taken samples at 210 days after sowing i.e. at harvest time exhibited that foliar application at 105 days caused the highest mean values of purity % that reached 66.59 %, which ranked the first, followed by the application at 75 days that was 66.43 % and the lowest was obtained from the application at 45 days that was 66.23 %.

Moreover, data presented in Table (4) also revealed that single foliar spray at 105 days after sowing significantly increased purity % compared with that obtained at 45 or 75 days after sowing. That means that foliar spray at 105 days after sowing significantly increased purity % more actively as compared with the other two dates of treatments.

Furthermore, significant differences among biological activators and nutrients treatments treatments of elements for the purity % were existed as shown in Table (4). The treatment of K element that reached 69.29 % and 68.25 % with 50 ppm of the same element, yet it was 62.25 % in control plants. The other treatments gave mean values of purity % ranked inbetween. In addition the interaction between single foliar spray treatments of different elements and the application dates upon purity % at harvest time were not significant.

In general, the highest value of purity % was of 69.43 % resulted from beet roots at harvest time (i.e. at 210 days after sowing) after foliar spray at 45 days after sowing + 250 ppm K

treatment. While, the lowest of purity % was of 62.09 % resulted from untreated treatment at the harvest time of different dates. The other treatments ranked inbetween.

It could be concluded that, foliar application with 250 ppm K produced the highest juice quality and the check treatment had the lowest quality of sugar beet roots. In this respect, **Dolya and Ostrovskii (1971)** found that preplanting treatment of sugar beet seeds with vitamine B_1 at 5 ppm increased the sugar content of plants grown up from treated seeds. Also, **Atawia and El-Desouky (1997)** found that foliar application to washington navel orange trees at fullbloom stage with yeast extract at 100 and 200ml/l significantly increased the juice % in addition, total soluble solids (TSS %) and ascorbic acid contents. The accumulation of both macro and micro nutrient elements were obviously increased in leaves and fruits with the two applied concentrations. Moreover, **Fathy et al. (2000)** reported that spraying tomato plants cv. super strain B with yeast preparation (25 and 50 ml/l) at 20, 40, 60 and 80 days after transplanting significantly improved sugar content and fruit quality.

In this respect, **Tian et al. (1993)** reported that soaking sugar beet seeds in PP_{333}, increased sugar content. Also, **Rabeh et al. (1994)** noticed that raising the PP_{333} concentration 250 up to 1000 ppm in washington navel orange trees led to reduction in total soluble solids and total sugars. Meanwhile, **Ismaeil (1995)** found that in broad beans cv, Giza 402, PP_{333} treatments at 10, 50 and 100 ppm highly increased seed contents of non reducing and total sugars as well. While, the reducing sugars were not affected with PP_{333} treatment. Thereafter, **Mehouachi et al. (1996)** found that

involvement of monostructural sugars in shoot growth of citrus root stocks seedlings. They also reported that PP_{333} treatment reduced sucrose by 43 % and increased starch by 36 % and **Fathy et al. (2000)** reported that spraying tomato plants cv. super strain B with PP_{333} (25 and 50 ppm), at 20, 40, 60 and 80 days after transplanting were significantly improved sugar content.

In this respect, **Basha (1994)** illustrated the effect of K fertilizer levels as 25, 50, 75 and 100 kg K_2O/fed. on quality of sugar beet plants. Results showed that adding K fertilizer at rate of 100 kg K_2O/fed resulted in increasing significantly sucrose, TSS and apparent purity %. Also, **Abd-El-Rahman (1996)** showed that increase in K level significantly increased TSS and sucrose % of sugar beet plants by increasing potassium level up to 48 kg K_2O/fed. Meanwhile, **Ramadan (1997)** reported that increasing K rate up to 72 kg/fed favoured beet growth in terms of improved quality of sucrose, purity and recoverable sugar, lowered impurities. Thereafter, **El-Maghraby et al. (1998)** found that K at a rate of 0, 24 and 48 K_2O/fed fertilizer increased significantly sucrose and purity % of sugar beet plants and **El-Taweel (1999)** mentioned that K application at sugar beet plants from 0 to 24 and 48 kg K_2O/fed significantly increased total soluble solids, sucrose and purity %.

In this respect, **Sitohy et al. (1992)** found the foliar spray of wheat plants cv. Sakha 69 with kinetin, Mg and Mo on free sugars contents in wheat shoots and grains showed more positive response to the individual treatment when compared with different combinations. While, **Bizik (1993)** reported that a liquid fertilizer spray containing Mg nitrate Dumag, Ca, Mg nitrate or Mg nitrate + Cacl applied to sugar beet plants in early July at 80 l/ha. increased

sugar content. Also, **Domska (1996)** mentioned that application of 100 kg N, 60 kg Mg as soil application and 40 kg foliar + 2 kg Mg + 0.6 kg boron/ha. gave the highest root sugar content of sugar beet plants and **El-Taweel (1999)** reported that Mg application from 0 to 9 and 18 kg MgO/fed. significantly increased sucrose and purity percentages of sugar beet plants.

III. Chemical composition at harvest:

A. Some elements and bioconstituents content in beet leaves:

Effect of foliar application dates with YE, PP_{333}, K, Mg and some their mixtures on total soluble sugars, reducing sugars, non reducing sugars (mg/g); nitrogen, phosphorus, potassium percentages; carbohydrates (mg/g); sodium, protein percentages; nitrogen, phosphorus and potassium uptake in sugar beet leaves at harvest (combined over the two growing seasons of 1997/1998 and 1998/1999). Tables (5,6,7 and 8).

The statistical analysis of the results revealed significant differences among the mean values of total soluble sugars, reducing sugars, non reducing sugars (mg/g); nitrogen, phosphorus, potassium percentages; carbohydrates (mg/g); sodium, protein percentages; nitrogen, phosphorus and potassium uptake in sugar beet leaves at harvest time and among the three foliar application dates as affected by the two applied concentrations. Also, significanct effects indicated that each experimental factor acted independently on each character.

1- Total soluble sugars (mg/g) in leaves:

As indicated in Table (5) at harvest time the obtained data clearly revealed that single foliar application at 105 days gave the highest mean values of total soluble sugars that was 0.75 mg/g, which ranked the first, followed by the application at 75 days that reached 0.72 mg/g and the lowest was 0.69 mg/g that obtained from the application at 45 days.

So, data presented in Table (5) revealed that foliar spray at 105 days after sowing significantly increased total soluble sugars in leaves as compared with that obtained at the other two dates i.e. at 45 or 75 days after sowing. That means that sugar beet plants were positively responded to foliar spray of different elements at this stage of growth (i.e. at 105 days) more than the other ones (i.e. at 45 and 75 days of plant age. That could be also interpreted on the basis that more assimilates being synthesized in leaves of plants sprayed once at 105 days of plant age more efficiency than in leaves of plants either treated at 45 or 75 days after sowing.

Since, the treatment of 25 ppm PP_{333} gave the highest value of total soluble sugars 1.08 mg/g. In addition, The interaction between foliar spray dates and other treatments was significant. The highest value was 1.13 mg/g resulted from foliar spray at 105 days after sowing with 25 ppm paclobutrazol. While the lowest value of total soluble sugars was 0.35 mg/g resulted from untreated treatment. The other treatments ranked inbetween.

Table (5) Effect of foliar application dates of some nutrients and biological activators as well as their interactions on total soluble sugar, reducing and non reducing sugars (mg/g) at harvest. (combined over two growing seasons 1997/1998 and 1998/1999).

Characters		Total soluble sugar in leaves (mg/g) Days after sowing				Reducing sugar in leaves (mg/g) Days after sowing				Non reducing sugar in leaves (mg/g) Days after sowing			
Treatments		45 days	75 days	105 days	Mean	45 days	75 days	105 days	Mean	45 days	75 days	105 days	Mean
Control (distilled water)		0.38	0.39	0.39	**0.39**	0.12	0.12	0.13	**0.12**	0.27	0.27	0.28	**0.27**
Yeast extract (YE)	50 ml/l	0.67	0.69	0.72	**0.70**	0.25	0.27	0.28	**0.27**	0.42	0.43	0.44	**0.43**
	250 ml/l	0.73	0.76	0.79	**0.76**	0.27	0.29	0.30	**0.29**	0.46	0.47	0.48	**0.47**
Paclobutrazol (PP_{333})	5 ppm	0.99	0.99	1.02	**1.00**	0.41	0.42	0.43	**0.42**	0.58	0.58	0.59	**0.58**
	25 ppm	1.03	1.07	1.13	**1.08**	0.43	0.46	0.49	**0.46**	0.60	0.61	0.65	**0.62**
Potassium	50 ppm	0.45	0.48	0.52	**0.48**	0.15	0.16	0.18	**0.17**	0.30	0.31	0.34	**0.32**
	250 ppm	0.52	0.55	0.59	**0.55**	0.18	0.20	0.21	**0.20**	0.34	0.35	0.38	**0.36**
Magnesium	50 ppm	0.77	0.79	0.82	**0.79**	0.27	0.29	0.31	**0.29**	0.46	0.50	0.51	**0.49**
	250 ppm	0.84	0.91	0.96	**0.91**	0.30	0.31	0.32	**0.31**	0.54	0.60	0.63	**0.59**
5 ppm PP_{333} + 50 ppm K		0.57	0.60	0.62	**0.60**	0.22	0.23	0.24	**0.23**	0.35	0.37	0.38	**0.37**
50 ml/l YE + 50 ppm K		0.62	0.65	0.67	**0.65**	0.22	0.24	0.25	**0.24**	0.40	0.41	0.42	**0.41**
Total mean		**0.69**	**0.72**	**0.75**	**0.72**	**0.26**	**0.27**	**0.29**	**0.27**	**0.43**	**0.45**	**0.46**	**0.45**
L.S.D at 0.05 level of significance.													
Days after sowing(A)					0.01				0.01				0.01
Elements (B)					0.01				0.01				0.01
A X B					0.02				0.02				0.02

2- Reducing sugars (mg/g) in leaves:

As shown in Table (5) obtained samples at 210 days after sowing (i.e. at harvest time revealed that foliar application at 105 days gave the highest mean values of reducing sugars that reached 0.29 mg/g, which ranked the first, followed by the application at 75 days that was 0.27 mg/g and the lowest was 0.26 mg/g that obtained from the application at 45 days.

Therefore, as presented in Table (5) single foliar spray at 105 days after sowing significantly increased reducing sugars content as compared with the other two application dates 45 and 75 days after sowing. That means that sugar beet plants at the age of 105 days being with high responsibility for foliar treatment more than either at 45 or at 75 days of plant age.

Besides, the treatment of 25 ppm PP_{333} gave 46 mg/g the highest value. Moreover, data also revealed that the interaction between biological activators and nutrients treatments single foliar spray treatment at harvest time were significant. The highest value was of 0.49 mg/g resulted from beets at harvest after single foliar spray at 105 days after sowing with 25 ppm PP_{333}. While the lowest value of reducing sugars was of 0.11 mg/g resulted from untreated treatment. The other treatments lied inbetween.

3- Non reducing sugars (mg/g) in leaves:

Foliar application at 105 days exhibited the highest mean values of non reducing sugars that reached 0.46 mg/g, which ranked the first, followed by the application at 75 days which gave 0.45

mg/g and the lowest was of 0.43 mg/g obtained from the application at 45 days.

While, 25 ppm of PP_{333} gave 0.62 mg/g which ranked the first and the lowest was of 0.27 mg/g in the case of untreated treatment. These data confirm that foliar spray at 105 days after sowing significantly increased non reducing sugars content in leaves more than the other two dates of application (i.e. 45 and 75 days after sowing).

Moreover, significant differences among biological activators and nutrients treatments treatments of elements were also existed (Table, 5). The treatment of 25 ppm PP_{333} gave the highest value and the other ranked inbetween.

Furthermore, the interaction between foliar spray treatments at harvest time were significant. The highest value was of 0.65 mg/g resulted from beets at harvest after single foliar spray at 105 days after sowing with 25 ppm Paclobutrazol. While the lowest value of non reducing sugars that was 0.25 mg/g obtained in case of untreated treatment. The other treatments ranked inbetween.

It could be concluded that foliar application with 25 ppm PP_{333} produced the highest values of TSS, reducing sugars and non reducing sugars in sugar beet leaves at harvest. On the other hand, the check treatment gave the lowest values of the same respective characters.

4- Nitrogen (N %) in leaves:

Obtained samples at 210 days after sowing at harvest time showed that foliar application at 105 days gave highest mean values

of N % that was 3.42 %, which ranked the first, followed by the application at 75 days that was 3.08 % and the least was 2.72 % obtained from the application at 45 days.

Foliar spray at 105 days after sowing significantly increased N % as compared with that existed at 45 or 75 days after sowing. In addition, delaying foliar spray up to 105 days after sowing significantly increased the absorbtion and translocation of N.

Significant differences among biological activators and nutrients treatments were also recorded in Table (6). Applying, 50 ml/l YE + 50 ppm K gave the highest value 4.17 % that was and the lowest value was 1.82 % of the untreated treatment.

The interaction between foliar spray dates and different treatments were significant. The highest mean value was 3.82 % resulted from harvest beets after foliar spray at 105 days after sowing with 50 ml/l YE + 50 ppm K, while the lowest mean value was 2.17% resulted from untreated treatment. The other treatments were inbetween.

5- Phosphorus (P %) in leaves:

Foliar application at 105 days gave the highest mean values that was 0.27 %, which ranked the first, followed by the application at 75 days that was 0.26 % and the lowest was 0.25 % obtained from the application at 45 days.

Foliar spray at 105 days after sowing significantly increased P % as compared with that obtained either at 45 or 75 days after sowing. Also, delaying foliar spray up to 105 days after sowing significantly increased phosphorus % indicating that the delay of

Table (6) Effect of foliar application dates of some nutrients and biological activators as well as their interactions on NPK % of sugar beet leaves at harvest. (combined over two growing seasons 1997/1998 and 1998/1999).

Characters		N % in leaves Days after sowing				P % in leaves Days after sowing				K % in leaves Days after sowing			
Treatments		45 days	75 days	105 days	Mean	45 days	75 days	105 days	Mean	45 days	75 days	105 days	Mean
Control (distilled water)		2.17	2.19	2.15	**2.17**	0.17	0.18	0.18	**0.17**	3.00	3.00	3.00	**3.00**
Yeast extract (YE)	50 ml/l	2.72	3.07	3.42	**3.07**	0.27	0.28	0.29	**0.28**	4.00	4.40	4.80	**4.40**
	250 ml/l	3.32	3.57	3.92	**3.60**	0.29	0.29	0.30	**0.29**	4.10	4.50	4.90	**4.50**
Paclobutrazol (PP_{333})	5 ppm	2.45	2.80	3.15	**2.80**	0.26	0.27	0.28	**0.27**	3.80	4.20	4.60	**4.20**
	25 ppm	2.95	3.30	3.65	**3.30**	0.27	0.28	0.29	**0.28**	3.90	4.30	4.70	**4.30**
Potassium	50 ppm	2.20	2.70	2.90	**2.60**	0.24	0.25	0.26	**0.25**	3.60	4.00	4.40	**4.00**
	250 ppm	2.70	3.20	3.40	**3.10**	0.24	0.26	0.27	**0.26**	3.70	4.10	4.50	**4.10**
Magnesium	50 ppm	2.45	2.80	3.15	**2.80**	0.20	0.21	0.22	**0.21**	3.35	3.80	4.25	**3.80**
	250 ppm	2.95	3.30	3.65	**3.30**	0.22	0.22	0.24	**0.23**	3.50	3.93	4.35	**3.93**
5 ppm PP_{333} + 50 ppm K		2.97	3.18	3.67	**3.27**	0.30	0.31	0.32	**0.31**	4.20	4.60	5.00	**4.60**
50 ml/l YE + 50 ppm K		3.47	3.82	4.17	**3.82**	0.32	0.32	0.33	**0.32**	4.30	4.70	5.10	**4.70**
Total mean		**2.72**	**3.08**	**3.42**	**3.08**	**0.25**	**0.26**	**0.27**	**0.26**	**3.75**	**4.14**	**4.53**	**4.14**
L.S.D at 0.05 level of significance.													
Days after sowing(A)					0.02				0.001				0.01
Elements (B)					0.06				0.004				0.02
A X B					0.11				N.S				0.03

foliar spray up to 105 days after sowing enhanced phosphours absorption by roots and also increased its translocation to the leaves. Significant differences among treatments of elements and biological activators was recorded Table (6). Applying 50 ml/l YE + 50 ppm K gave the highest value of 0.33% which ranked the first and the least was 0.17% P was obtained by the check treatment.

The interaction between the two factors were not significant. The highest value was 0.33 % resulted from foliar spray at 105 days after sowing with the second type of mixture 50 ml/l YE + 50 ppm K, while the lowest value was 0.17 % resulted from untreated treatment. The other treatments were inbetween.

6- Potassium (K %) in leaves:

Foliar application at 105 days gave the highest mean values that was 4.53 %, which ranked the first, followed by the application at 75 days that was 4.14 % and the least was 3.75 % obtained from the application at 45 days.

Foliar spray at 105 days after sowing significantly increased K % when compared with that obtained either at 45 or 75 days after sowing. Delaying single foliar spray up to 105 days after sowing significantly increased K % indicating that the delay to 105 days led to more K absorption by roots and also its translocation to leaves.

Significant differences among biological activators and nutrients treatments treatments of elements was recorded Table (6). Applying 50 ml/l YE + 50 ppm K gave the highest value that reached 5.10 % and the lowest one 3.00 % was obtained by the check treatment.

The interaction between foliar spray dates with different treatments was significant. The highest value was 5.10 % resulted from foliar spray at 105 days after sowing with 50 ml/l YE + 50 ppm K, while the lowest value resulted from untreated treatment as it was 2.80%. The other treatments fell inbetween.

Generally, foliar application with 50 ml/l YE + 50 ppm K treatment had the highest % of NPK in sugar beet leaves. Whereas, the lowest one, were obtained by the check treatment.

7- Total carbohydrates (mg/g) in leaves:

Results in Table (7) showed that foliar application at 105 days gave the highest mean values that was 13.05 mg/g, which ranked the first, followed by the application at 75 days that was 12.73 mg/g and the lowest was of 12.40 mg/g obtained from the application at 45 days after sowing.

Foliar spray at 105 days after sowing significantly increased carbohydrate content when compared with that obtained at 45 and 75 days after sowing. Delaying single foliar spray up to 105 days after sowing significantly increased the carbohydrate content in leaves indicating that it may lead to more assimilates being translocated from the tops to the roots.

Significant differences among biological activators and nutrients treatments were also existed in Table (7). Spraying, 250 ml/l YE gave 15.43 mg/g which ranked the first and the lowest was of 9.31 mg/g in case of untreated treatment.

Table (7) Effect of foliar application dates of some nutrients and biological activators as well as their interactions on total carbohydrates mg/g, sodium (Na) and crude protein percentages of sugar beet leaves at harvest. (combined over two growing seasons 1997/1998 and 1998/1999).

Characters		Total carbohydrate in leaves (mg/g) Days after sowing				Sodium in leaves (%) Days after sowing				Crude protein in leaves (%) Days after sowing			
Treatments		45 days	75 days	105 days	Mean	45 days	75 days	105 days	Mean	45 days	75 days	105 days	Mean
Control (distilled water)		8.92	9.60	9.42	**9.31**	2.15	2.17	2.20	**2.17**	13.54	13.66	13.44	**13.54**
Yeast extract (YE)	50 ml/l	14.43	13.30	13.70	**13.81**	3.51	3.79	4.07	**3.88**	16.98	19.17	21.35	**19.17**
	250 ml/l	15.13	15.48	15.68	**15.43**	3.66	3.98	4.24	**3.96**	20.73	22.29	24.48	**22.50**
Paclobutrazol (PP_{333})	5 ppm	12.17	12.33	12.55	**12.35**	3.06	3.33	3.44	**3.28**	15.31	17.50	19.69	**17.50**
	25 ppm	14.12	14.50	14.70	**14.44**	3.28	3.58	3.81	**3.56**	18.44	20.63	22.81	**20.63**
Potassium	50 ppm	9.13	9.47	9.65	**9.42**	2.69	2.99	3.27	**2.98**	13.75	16.88	18.13	**16.25**
	250 ppm	11.23	11.43	11.67	**11.44**	2.88	3.19	3.46	**3.18**	16.88	20.00	21.25	**19.38**
Magnesium	50 ppm	7.57	8.82	9.09	**8.49**	2.28	2.58	2.88	**2.58**	15.31	17.50	19.69	**17.50**
	250 ppm	10.28	10.42	10.63	**10.44**	2.49	2.81	3.07	**2.79**	18.44	20.63	22.81	**20.63**
5 ppm PP_{333} + 50 ppm K		16.10	16.48	16.68	**16.42**	3.88	4.19	4.43	**4.17**	18.54	19.90	22.92	**20.45**
50 ml/l YE + 50 ppm K		18.25	18.40	18.65	**18.43**	4.03	4.36	4.62	**4.34**	21.67	23.85	26.04	**23.85**
Total mean		**12.40**	**12.73**	**13.05**	**12.73**	**3.07**	**3.36**	**3.60**	**3.34**	**17.04**	**19.27**	**21.35**	**19.22**
L.S.D at 0.05 level of significance.													
Days after sowing(A)					0.27				0.04				0.15
Elements (B)					0.45				0.05				0.38
A X B					0.78				N.S				0.66

The interaction between foliar spray dates and treatments were significant. The highest value was of 16.68 mg/g resulted from foliar spray at 105 days after sowing with the 50 ml/l YE + 50 ppm K of mixture. While the least value resulted from the untreated treatment was of 8.02 mg/g. The other treatments ranked inbetween.

8- Sodium (Na %) in leaves:

Data presented in Table (7) revealed that single foliar spray at 105 days after sowing significantly increased sodium percentage compared with that existed at 45 and 75 days after sowing. Also, it could be noticed that delaying single foliar spray up to 105 days after sowing significantly increased Sodium percentage indicating that the delay led to enhance both Na absorption by roots and also translocation into leaves.

Significant differences among biological activators and nutrients treatments treatments were recorded in Table (7). Applying 50 ml/l YE + 50 ppm K gave the highest value of 4.62 %.

The interaction between single foliar spray treatments at harvest time were not significant. The highest value 4.62 % resulted from foliar spray at 105 days after sowing with 50 ml/l YE + 50 ppm K treatment, while the lowest value was 1.97 % resulted from untreated treatment. The other treatments fell inbetween.

9- Crude protein % in leaves:

Foliar application dates, nutrients and biological activators and their interaction on cp % in leaves of sugar beet are shown in Table (7).

Foliar spray at 105 days after sowing significantly increased cp % content compared with that obtained at 45 and 75 days after sowing. Delaying single foliar spray up to 105 days after sowing significantly increased this content indicating that this delay led to more assimilates to be synthesized in leaves in these treatments.

Also, Significant differences among biological activators and nutrients treatments were recorded in Table (7). The second type of mixture 50 ml/l YE + 50 ppm K gave the highest value that of 26.04 % and check treatment had the lowest % 13.54 %.

The interaction between dates of foliar spray and other factors were significant. The highest value was 26.04 % resulted from beet leaves at foliar spray at 105 days after sowing with 50 ml/l YE + 50 ppm K treatment, while the lowest value was 11.35 % resulted from untreated treatment. The other treatments fell inbetween.

It could be concluded that, foliar application with 50 ml/l YE+ 50 ppm K treatment had the highest values of total carbohydrates, Na and crude protein % in sugar beet leaves at harvest. On the other hand, the check treatment gave the lowest ones.

A_1- NPK uptake in beet leaves (kg/fed):

1- Nitrogen uptake:

Foliar application dates, biological activators and nutrients and their interaction are shown in Table (8). Foliar spray at 105 days after sowing significantly increased N uptake in comparison with the other two dates of application i.e. at 45 and 75 days after sowing. So, delaying single foliar spray up to 105 days after sowing

Table (8) Effect of foliar application dates of some nutrients and biological activators as well as their interactions on NPK-uptake of sugar beet leaves (kg/fed) at harvest. (combined over two growing seasons 1997/1998 and 1998/1999).

Characters		N-uptake in leaves (kg/fed) Days after sowing				P-uptake in leaves (kg/fed) Days after sowing				K-uptake in leaves Days after sowing			
Treatments		45 days	75 days	105 days	Mean	45 days	75 days	105 days	Mean	45 days	75 days	105 days	Mean
Control (distilled water)		5.48	5.55	5.96	**5.66**	0.46	0.51	0.50	**0.49**	7.69	8.02	8.53	**8.08**
Yeast extract (YE)	50 ml/l	9.07	13.01	17.78	**13.29**	0.90	1.17	1.51	**1.19**	13.21	18.38	24.61	**18.74**
	250 ml/l	12.51	17.32	23.44	**17.76**	1.09	1.41	1.80	**1.43**	15.41	21.63	28.98	**22.01**
Paclobutrazol (PP_{333})	5 ppm	7.75	11.58	15.51	**11.61**	0.82	1.10	1.35	**1.09**	11.95	17.18	22.32	**17.15**
	25 ppm	8.74	13.30	17.99	**13.34**	0.79	1.11	1.40	**1.10**	11.51	17.20	22.97	**17.23**
Potassium	50 ppm	9.92	15.29	19.96	**15.06**	1.08	1.40	1.76	**1.41**	16.14	22.45	29.89	**22.83**
	250 ppm	13.51	19.95	25.61	**19.69**	1.22	1.60	2.01	**1.61**	18.45	25.26	33.42	**25.71**
Magnesium	50 ppm	10.13	14.30	19.49	**14.64**	0.85	1.07	1.37	**1.10**	13.81	19.28	25.98	**19.69**
	250 ppm	13.64	18.85	25.58	**19.36**	1.02	1.28	1.67	**1.32**	16.19	22.30	30.11	**22.69**
5 ppm PP_{333} + 50 ppm K		11.04	15.27	20.61	**15.64**	1.10	1.48	1.77	**1.45**	15.42	21.99	27.68	**21.70**
50 ml/l YE + 50 ppm K		15.47	20.45	26.23	**20.72**	1.41	1.71	2.07	**1.73**	19.04	24.85	31.60	**25.16**
Total mean		**10.53**	**15.07**	**20.09**	**15.23**	**0.97**	**1.26**	**1.58**	**1.27**	**14.29**	**19.93**	**26.24**	**20.15**
L.S.D at 0.05 level of significance.													
Days after sowing(A)					0.75				0.04				0.84
Elements (B)					0.76				0.05				0.85
A X B					1.29				0.09				1.47

significantly increased N uptake in leaves indicating that more N were translocated from the roots to the tops.

Biological activators and nutrients significantly increased uptake in beet leaves are recorded in Table (8). The second type of mixture 50 ml/l YE + 50 ppm K gave the highest value that was 26.23 and the least was 6.43 kg/fed of untreated treatment.

The interaction between foliar spray dates and other treatments on uptake were significant. The highest value was 26.23 kg/fed that resulted from beet leaves at harvest time after single foliar spray at 105 days after sowing with 50 ml/l YE + 50 ppm K treatment, while the lowest value that was 4.02 kg/fed resulted from the results are due to increase N % and dry matter content in leaves of sugar beet untreated treatment. The other treatments fell inbetween.

2- Phosphorus uptake:

Foliar spray dates, biological activators and nutrients and their interaction on P uptake in beet leaves are presented in Table (8). Foliar spray at 105 days after sowing significantly increased Phosphorus uptake comparing with that obtained at 45 and 75 days after sowing. Indicating that the delay of foliar application to 105 days enhanced the accumulation of Phosphorus in leaves.

In addition, significant differences among biological activators and nutrients treatments treatments of elements were recorded in Table (8). Applying 50 ml/l YE + 50 ppm K gave the highest value that was of 2.07 and the least was in the case of untreated treatment that was of 0.49 kg/fed.

The interaction between foliar spray dates and other were significant. The highest value that was 2.07 kg/fed resulted from beet leaves at harvest time after foliar spray at 105 days after sowing with 50 ml/l 50 ml/l YE + 50 ppm K treatment, while the lowest value 0.36 kg/fed resulted from untreated treatment. The other treatments fell inbetween.

3- Potassium uptake:

Foliar application dates, nutration treatmentsand their interaction on K uptake in beet leaves are presented in Table (8). Obtained samples at 210 days after sowing (i.e. at harvest time) showed that foliar application at 105 days gave the highest mean values of Potassium uptake in leaves that was 26.24 kg/fed, which ranked the first, followed by the application at 75 days that was 19.93 kg/fed and the least was 14.29 kg/fed obtained from the application at 45 days after sowing.

Foliar spray at 105 days after sowing significantly increased Potassium uptake when compared with 45 and 75 days after sowing. Delaying single foliar spray up to 105 days after sowing significantly increased Potassium uptake in leaves indicating that the delay to 105 days enhanced Potassium translocation and accumulation in leaves.

Significant differences among biological activators and nutrients treatments treatments of elements were recorded in Table (8). While, 250 ppm of K gave 25.16 kg/fed which ranked the first and the least was 8.62 kg/fed in case of untreated treatment.

The interaction between foliar spray treatments was significant. The highest value was 31.60 kg/fed resulted from beet at

harvest time after foliar spray at 105 days after sowing with 50 ml/l YE + 50 ppm K, while the lowest value 6.08 kg/fed resulted from untreated treatment. The other treatments fell inbetween.

Generally, foliar application with 50 ml/l YE + 50 ppm K treatment had the highest values of N, P. On the same line, 250 ppm K level gave the highest value of K uptake. On the other hand, the check treatment produced the lowest uptake from NPK in leaves of sugar beet.

In this respect, **Dolya and Ostrovskii (1971)** found that treatment of the sugar beet seed or root with 0.01% solution of vitamin B_1 increased the peroxides activity and the chlorophyll contents of growing plants. Meanwhile, **Armanios et al. (1991)** found that inoculation with certain micro organism (including candida) in the presence or absence of N fertilizer showed significant effect on dry weight, N, P-content, and protein % of barley grains. and **Fathy et al. (2000)** reported that spraying tomato plants cv. super strain B with yeast preparation (25 and 50 ml/l) at 20, 40, 60 and 80 days after transplanting increased mineral (P, K, Ca and Mg) and carbohydrate contents.

In this respect, **Bandara and Tanino (1995)** showed that greenhouse-grown potatoes cv. Norland were treated with 450 mg PP_{333} doubled the number of usable tubers/plant. Also, **Ismaeil (1995)** found that in broad beans cv. Giza 402, PP_{333} treatments at 10, 50 and 100 ppm increased N and protein content especially that of 100 ppm. Also, P and K were increased with the increase of PP_{333} concentration and the content of K was inversely proportional to PP_{333} concentrations. Thereafter, **Xun et al. (1995)** noticed that PP_{333} was applied to soil at 6-15 mg/pot and the effects on sugar

beet seedlings were determined after 1 month. The content of photosynthetic pigments photosynthesis rates and eroxide (DOS) dismutase and peroxide (POD) activities in all the PP_{333} treatments were significantly higher than those in controls. The malon aldehyde (MDA) content and cell membrane permeability of leaves were lower than in controls indicating that PP_{333} treatment improved stress resistance of Sugar beet seedlings. Meanwhile, **Okuda et al. (1996)** mentioned that PP_{333} was applied to the soil at 0, 500-1000 mg/potted five year old satsuma mandarin tree. The carbohydrate contents in the leaves and roots<2mm, PP_{333} increased the total carbohydrates in the roots and decreased them in the leaves, but the percentages in the leaves were unchanged. So, **Salazar-Garcia and Vazquez-Valdinia (1996)** reported that a single application of PP_{333}, PBZ 0, 2.5, 5, 10, 15, 20 and 40 g/tree each dosage was dissolved in two litres of water and applied in a 15cm depth drench at 1.5m around the tree of *Mango mangifera indica L.* The concentrations at 10 g/tree and above drastically reduced P leaf and Ca content and **Fathy et al. (2000)** reported that spraying tomato plants cv. super strain B with PP_{333} (25 and 50 ppm) at 20, 40, 60 and 80 days after transplanting on branching, leaf area, dry matter accumulation, mineral content (P, K, Ca and Mg) and carbohydrate all of these were significantly increased with different applied treatments.

In this respect, **Alshevskii (1990)** found that potatoes grown in sandy soil were given no fertilizers, 90 kg N + 90 kg P/ha or NP + 120 kg K/ha as Kcl 60.4 % K_2O or K magnesia 30.4 % K_2O, 10 % MgO and 2.3 % Cl or 3:1, 1:1 or 1:3 mixtures of the two increased total and protein N of sugar beet plants. So, **Milcheva (1990)**

noticed the effect of K fertilization on chemical composition on sugar beet plants. In general K-fertilization increased K content in sugar beet plants, particularly on K-deficient soils. Thereafter, **El-Shafie (1996)** observed that spraying Fodder beet plants 4 times with K increased N and P content of root, leaves and whole plant and **El-Taweel (1999)** found that increasing K application from 0 to 24 and 48 kg K_2O/fed did not significantly increase Na and alfa amino N of sugar beet plants.

In this respect, **Sitohy et al. (1992)** studied the biochemical effects of foliar spray of wheat plants cv. Sakha 69 with kinetin, Mg and Mo on carbohydrates metabolism. The application of kinetin to wheat plants either individually or in combinations with other tested factors showed the major increases concerning soluble, non soluble and total carbohydratre. While, **Zorn (1993)** reported that Mg contents in Potatoes leaves were positively correlated with the ratio of soil K : Mg at 0.20 cm depth. An increase of K fertilizer resulted in reduction of Mg uptake by the roots. The highest soil K:Mg ratio can reduce the beneficial effects of Mg fertilizer application to Mg deficient potato crops. Also, **Yu et al. (1994)** mentioned that distribution of Mg concentration in sugar beet plants were the highest during the seedling stage, then decreased at later stages. The uptake rate of Mg was in accordance with vegetative growth, the amount of Mg absorbed was lowest at the seedlings stages, at only 83.6 g/mu . Whereas, **Saleh et al. (1998)** found that in sugar beet plants increasing the concentration of both Ca and Mg in the nutrient solution attenuated the degree of inhibition of root growth by Zn, but not Cu. Mg ameliorated the toxicity effects of Zn without effecting the Zn concentration in the roots. An increase supply of

Mg lowered the percentage decrease in root Mg concentration due to Zn toxicity. The maintenance of an adequate Mg level in the roots may be critical to prevent Zn induced inhibition of root growth in sugar beet plants and **El-Taweel (1999)** showed that Mg application from 0 to 9 and 18 kg MgO/fed significantly increased Na and alfa amino N of sugar beet plants.

B. Some elements and bioconstituents content in beet roots:

Effect of foliar application dates with YE, PP_{333}, K, Mg and some their mixtures on total soluble sugars, reducing sugars, non reducing sugars (mg/g); nitrogen, phosphorus, potassium percentages; carbohydrates (mg/g); sodium, protein percentages; nitrogen, phosphorus and potassium uptake in sugar beet roots at harvest (combined over the two growing seasons of 1997/1998 and 1998/1999). Tables (5,6,7 and 8).

The statistical analysis of the results revealed significant differences among the mean values of the same respective traits as affected by foliar spray dates with different biological activators and nutrients. Also, significanct effects indicated that each experimental factor acted independently in affecting each character.

1- Total soluble sugars (mg/g) in roots:

As shown in Table (9) the obtained samples at 210 days after sowing (i.e. at harvest time) revealed that foliar application at 105 days gave the highest mean values of total soluble sugars in roots that was 10.13 mg /g , which ranked the first , followed by the

Table (9) Effect of foliar application dates of some nutrients and biological activators as well as their interactions on total soluble sugar, reducing and non reducing sugar (mg/g) of sugar beet roots at harvest. (combined over two growing seasons 1997/1998 and 1998/1999).

Characters		Total soluble sugar in roots (mg/g) Days after sowing				Reducing sugar in roots (mg/g) Days after sowing				Non reducing sugar in roots (mg/g) Days after sowing			
Treatments		45 days	75 days	105 days	Mean	45 days	75 days	105 days	Mean	45 days	75 days	105 days	Mean
Control (distilled water)		4.55	4.56	4.52	**4.54**	1.75	1.76	1.83	**1.78**	2.75	2.71	2.83	**2.76**
Yeast extract (YE)	50 ml/l	5.84	6.39	6.71	**6.31**	1.98	2.16	2.20	**2.11**	4.02	4.23	4.51	**4.25**
	250 ml/l	6.87	7.09	7.20	**7.05**	2.20	2.21	2.23	**2.21**	4.67	4.87	4.97	**4.84**
Paclobutrazol (PP_{333})	5 ppm	10.55	11.68	12.16	**11.46**	2.73	3.49	3.50	**3.24**	7.82	8.18	8.66	**8.22**
	25 ppm	11.57	11.80	12.57	**11.98**	3.46	3.50	3.52	**3.49**	8.11	8.31	9.22	**8.54**
Potassium	50 ppm	11.90	12.53	13.46	**12.63**	3.52	3.56	3.59	**3.56**	8.39	8.97	9.87	**9.07**
	250 ppm	12.16	12.76	13.85	**12.92**	3.66	3.77	3.91	**3.78**	8.50	8.99	9.93	**9.14**
Magnesium	50 ppm	7.76	8.36	8.49	**8.20**	2.24	2.26	2.33	**2.28**	5.52	6.10	6.21	**5.94**
	250 ppm	8.65	9.14	9.34	**9.04**	2.25	2.27	2.30	**2.27**	6.46	6.87	7.04	**6.79**
5 ppm PP_{333} + 50 ppm K		9.08	9.80	10.55	**9.81**	2.31	2.32	2.36	**2.33**	7.16	7.48	8.19	**7.61**
50 ml/l YE + 50 ppm K		10.67	11.12	12.07	**11.29**	2.34	2.39	2.43	**2.39**	8.33	8.74	9.55	**8.87**
Total mean		**8.99**	**9.57**	**10.13**	**9.57**	**2.54**	**2.72**	**2.77**	**2.68**	**6.51**	**6.86**	**7.37**	**6.91**
L.S.D at 0.05 level of significance.													
Days after sowing(A)					0.13				0.05				0.07
Elements (B)					0.16				0.07				0.12
A X B					0.28				0.11				0.21

application at 75 days that was 9.57 mg/g and the lowest was 8.99 mg/g obtained from the application at 45 days of plant age.

Foliar spray at 105 days after sowing significantly increased total soluble sugars compared with 45 and 75 days after sowing. This means that delaying single foliar spray up to 105 days of plant age significantly increased total soluble sugars and that could be attributed to the high rates of assimilates translocation from the photosynthetic tops to the storage roots.

Significant differences among nutrition treatments on total soluble sugars were also existed in (Table 9). While, 250 ppm of K gave 12.92 mg/g which ranked the first and the lowest was 4.54 mg/g in case of untreated treatment.

The interaction between foliar spray treatments at harvest time were significant. The highest value of 13.85 mg/g existed in beets at harvest after foliar spray, 105 days after sowing with 250 ppm K, while the lowest value of total soluble sugars was of 3.89 mg/g in untreated treatment. The other treatments fell inbetween.

2- Reducing sugars (mg/g) in roots:

Foliar application at 105 days caused a highest mean values of reducing sugars that was 2.77 mg/g, which ranked the first, followed by the application at 75 days that was 2.72 mg/g and the least that was 2.54 mg/g obtained from the application at 45 days of plant age. Table (9).

Foliar spray at 105 days after sowing significantly increased the content of reducing sugars in roots than those obtained from the application at 45 and 75 days after sowing. So, delaying single foliar

spray up to 105 days after sowing significantly increased the reducing sugars indicating that more assimilates being translocated from the tops to the roots. Also, it could be noticed that significant among different treatments in reducing sugars were existed in (Table 9). The treatments of 250 ppm K gave the highest value 3.78 mg/g and the lowest was of 1.78 mg/g in the case of untreated treatment.

The interaction between single foliar spray treatments at harvest time was significant. The highest value was 3.91 mg/g resulted from beets at harvest after single foliar spray 105 days after sowing with 250 ppm Potassium Citrate, while the lowest value of reducing sugars was 1.25 mg/g resulted from untreated treatment. The other treatments occupied inbetween position.

3- Non reducing sugars (mg/g) in roots:

Foliar application at 105 days exhibited the highest mean values of non reducing sugars that reached 7.37 mg/g, which ranked the first, followed by the application at 75 days which gave 6.86 mg/g and the lowest was of 6.51mg/g obtained from the application at 45 days of plant age. Table (9).

These data confirm that foliar spray at 105 days after sowing significantly increased non reducing sugars content in roots more than the other two dates of application at 45 and 75 days after sowing.

Moreover, significant differences among nutration treatments were also existed in Table (9). While, 250 ppm of K gave 9.14 mg/g which ranked the first and the lowest was of 2.76 mg/g in the case of untreated treatment.

Furthermore, the interaction between foliar spray dates and other treatments at harvest time were significant. The highest value was of 9.93 mg/g resulted from foliar spray 105 days after sowing with 250 ppm K, while the lowest value of non reducing sugars 2.64 mg/g obtained in case of untreated treatment. The other treatments occupied inbetween position.

Generally, foliar application with K at 105 days from sowing significantly increased TSS, reducing and non reducing sugars mg/g in sugar beet roots. A higher concentration of K 250 ppm produced the highest values of these characters and the unfertilized treatment gave the lowest values.

4- Nitrogen (N %) in roots:

Foliar application at 105 days gave high mean values of N % that was 1.90 %, which ranked the first, followed by the application at 75 days that was 1.71 % and the least was 1.51 % obtained from the application at 45 days. Table (10).

Foliar spray at 105 days after sowing significantly increased N % compared with either those obtained at 45 or 75 days after sowing. Significant differences among nutration treatments were recorded in Table (10). The second type 50 ml/l YE + 50 ppm K treatment gave the highest value 2.45%.

The interaction between foliar spray dates and other treatments at harvest time was not significant. The highest value was 2.45 % resulted from beet roots at harvest time after single foliar spray at 105 days after sowing with the second type of mixture 50 ml/l YE + 50 ppm K, while the lowest value was 0.80 % resulted from untreated treatment. The other treatments had inbetween position.

Table (10) Effect of foliar application dates of some nutrients and biological activators as well as their interactions on NPK % of sugar beet roots at harvest. (combined over two growing seasons 1997/1998 and 1998/1999).

Characters		N % in roots Days after sowing				P % in roots Days after sowing				K % in roots Days after sowing			
Treatments		45 days	75 days	105 days	Mean	45 days	75 days	105 days	Mean	45 days	75 days	105 days	Mean
Control (distilled water)		1.00	1.00	0.99	**1.00**	0.10	0.10	0.11	**0.10**	1.48	1.50	1.53	**1.50**
Yeast extract (YE)	50 ml/l	1.65	1.85	2.05	**1.85**	0.14	0.15	0.16	**0.15**	1.65	1.85	2.05	**1.85**
	250 ml/l	1.85	2.05	2.25	**2.05**	0.15	0.16	0.17	**0.16**	1.85	2.05	2.25	**2.05**
Paclobutrazol (PP_{333})	5 ppm	1.45	1.65	1.85	**1.65**	0.13	0.13	0.14	**0.14**	1.52	1.75	2.00	**1.76**
	25 ppm	1.65	1.85	2.05	**1.85**	0.13	0.14	0.16	**0.14**	1.78	2.00	2.25	**2.01**
Potassium	50 ppm	1.25	1.45	1.65	**1.45**	0.11	0.12	0.13	**0.12**	1.50	1.77	1.98	**1.75**
	250 ppm	1.45	1.65	1.85	**1.65**	0.12	0.13	0.14	**0.13**	1.70	1.90	2.15	**1.92**
Magnesium	50 ppm	1.15	1.35	1.55	**1.35**	0.17	0.18	0.18	**0.17**	2.17	2.42	2.68	**2.42**
	250 ppm	1.40	1.60	1.80	**1.60**	0.18	0.18	0.20	**0.18**	2.43	2.68	2.90	**2.67**
5 ppm PP_{333} + 50 ppm K		1.85	2.05	2.25	**2.05**	0.15	0.16	0.17	**0.16**	1.95	2.15	2.35	**2.15**
50 ml/l YE + 50 ppm K		2.08	2.25	2.45	**2.26**	0.16	0.17	0.18	**0.17**	2.18	2.38	2.60	**2.39**
Total mean		**1.51**	**1.71**	**1.90**	**1.71**	**0.14**	**0.15**	**0.16**	**0.15**	**1.83**	**2.04**	**2.26**	**2.04**
L.S.D at 0.05 level of significance.													
Days after sowing(A)					0.01				0.002				0.02
Elements (B)					0.01				0.004				0.04
A X B					N.S				N.S				N.S

Table (11) Effect of foliar application dates of some nutrients and biological activators as well as their interactions on total carbohydrates (mg/g), sodium (Na) and crude protein percentages of sugar beet roots at harvest. (combined over two growing seasons 1997/1998 and 1998/1999).

Characters		Total carbohydrate in roots (mg/g) Days after sowing				Sodium in roots (%) Days after sowing				Crude protein in roots (%) Days after sowing			
Treatments		45 days	75 days	105 days	Mean	45 days	75 days	105 days	Mean	45 days	75 days	105 days	Mean
Control (distilled water)		21.39	21.34	21.67	**21.44**	0.30	0.32	0.33	**0.35**	6.26	6.26	6.16	**6.22**
Yeast extract (YE)	50 ml/l	26.50	29.50	32.50	**29.50**	0.50	0.55	0.62	**0.55**	10.31	11.56	12.81	**11.56**
	250 ml/l	28.50	31.50	34.50	**31.50**	0.57	0.64	0.70	**0.63**	11.56	12.81	14.06	**12.81**
Paclobutrazol (PP_{333})	5 ppm	25.50	28.50	31.17	**28.39**	0.39	0.46	0.52	**0.45**	9.06	10.31	11.56	**10.31**
	25 ppm	27.50	30.50	32.33	**30.11**	0.46	0.52	0.58	**0.52**	10.31	11.56	12.81	**11.56**
Potassium	50 ppm	22.50	25.50	28.50	**25.50**	0.30	0.36	0.42	**0.36**	7.81	9.06	10.31	**9.06**
	250 ppm	24.50	27.50	30.50	**27.50**	0.34	0.40	0.46	**0.40**	9.06	10.31	11.56	**10.31**
Magnesium	50 ppm	21.50	24.50	27.33	**24.44**	0.78	0.84	0.90	**0.84**	7.19	8.44	9.69	**8.44**
	250 ppm	23.50	26.50	29.50	**26.50**	0.86	0.92	1.03	**0.93**	8.75	10.00	11.25	**10.00**
5 ppm PP_{333} + 50 ppm K		27.50	30.50	33.50	**30.50**	0.64	0.68	0.74	**0.68**	11.56	12.81	14.06	**12.81**
50 ml/l YE + 50 ppm K		28.50	31.51	34.51	**31.51**	0.72	0.76	0.82	**0.76**	13.02	14.06	15.31	**14.13**
Total mean		**24.94**	**27.99**	**30.77**	27.90	**0.53**	**0.58**	**0.67**	**0.59**	**9.42**	**10.65**	**11.89**	**10.66**
L.S.D at 0.05 level of significance.													
Days after sowing(A)					0.23				0.05				0.04
Elements (B)					0.41				0.08				0.06
A X B					N.S				N.S				N.S

significantly increased the assinilates that were translocated from the tops to the roots.

In addition, significant differences among nutration treatments also existed in Table (11). Since, 50 ml/l YE + 50 ppm K treatment gave the highest value that was 34.50 mg/g and the lowest 21.44 mg/g of unfertilized treatment.

However, the interaction between dates of foliar spray dates and other treatments at harvest time were not significant. The highest value was 34.50 mg/g resulted from beets at harvest time after foliar spray at 105 days after sowing with 50 ml/l YE + 50 ppm K treatment, while the lowest value was 18.33 mg/g existed in the control treatment. The other treatments occupied inbetween positions.

8- Sodium (Na %) in roots:

Foliar application at 105 days gave high mean values that was 0.67 %, which ranked the first, followed by the application at 75 days that was 0.58 % and the least 0.53 % that obtained from the application at 45 days.

Foliar spray at 105 days after sowing significantly increased sodium content in roots compared with 45 and 75 days after sowing. So, delaying single foliar spray up to 105 days after sowing increased Na absorption in roots. In addition, significant differences among treatments of elements were also recorded Table (11). Applying 250 ppm Mg gave the highest value that was 1.03 % and the lowest was of 0.35% of the check treatment.

The interaction between date of single foliar spray dates and nutration treatments and different elements at harvest time were not significant. The highest values was 1.03 % resulted from beets at harvest time after single foliar spray at 105 days after sowing with 250 ppm of Mg, while the lowest values was 0.22 % resulted from control treatment. The other treatments had inbetween positions.

9- Crude protein (%) in roots:

Obtained samples at 210 days after sowing (i.e. at harvest time) exhibited that foliar application at 105 days gave the highest mean values of cp % in roots that was 11.89 %, which ranked the first, followed by the application at 75 days that was 10.65 % and the least was 9.42 % that was obtained from the application at 45 days after sowing. Table (11).

Foliar spray at 105 days after sowing significantly increased cp % in roots compared with the other two dates of application i.e. 45 and 75 days after sowing. In addition, it could be concluded that delaying single foliar spray up to 105 days after sowing increased the assimilates that were translocated from the tops to the roots.

Moreover, significant differences among treatments of elements were recorded Table (11). Applying 50 ml/l YE + 50 ppm K treatment gave the highest value that was 14.13% resulted from foliar spray at 105 days after sowing with the 50 ml/l YE + 50 ppm K treatment, while the lowest mean value was 6.22% resulted from untreated treatment.

The interaction between date of single foliar spray treatments and elements at harvest time were not significant. The highest values was 15.31 % resulted from foliar spray at 105 days after

sowing with the 50 ml/l YE + 50 ppm K, while the lowest values was 5.00 % resulted from untreated treatment. The other treatments occupied inbetween positions.

Generally, foliar application with 50 ml/l YE + 50 ppm K treatment produced the highest values of total carbohydrates, Na and crude protein % in sugar beet roots. Whereas, the lowest values of these characters was obtained by the check treatment.

B_1- NPK uptake in beet roots (kg/fed):

Results in Table (12) represented the effect of foliar application dates, biological activators and nutrients as well as their interaction on NPK uptake in sugar beet roots at harvest.

1- Nitrogen uptake:

Foliar application at 105 days gave high mean values that was 135.90 kg/fed, which ranked the first, followed by the application at 75 days that was 102.40 kg/fed and the least was 73.50 kg/fed that obtained from the application at 45 days after sowing.

Foliar spray at 105 days after sowing significantly increased N uptake either when compared with that existed at 45 or 75 days after sowing. Therefore, delaying single foliar spray up to 105 days after sowing significantly increased N uptake in roots.

Moreover, significant differences among treatments were recorded in Table (12). Applying, 50 ml/l YE + 50 ppm K gave 149.89 kg/fed which ranked the first and the least was 37.57 kg/fed of untreated treatment.

Table (12) Effect of foliar application dates of some nutrients and biological activators as well as their interactions on NPK-uptakeof sugar beet roots (kg/fed) at harvest. (combined over two growing seasons 1997/1998 and 1998/1999).

Characters		N-uptake in roots (kg/fed) Days after sowing				P-uptake in roots (kg/fed) Days after sowing				K-uptake in roots (kg/fed) Days after sowing			
Treatments		45 days	75 days	105 days	Mean	45 days	75 days	105 days	Mean	45 days	75 days	105 days	Mean
Control (distilled water)		36.83	37.63	37.44	**37.30**	3.88	3.96	4.19	**4.01**	54.45	56.58	56.55	**56.53**
Yeast extract (YE)	50 ml/l	69.64	96.61	129.64	**98.63**	6.43	8.11	10.48	**8.34**	69.64	96.61	129.64	**98.63**
	250 ml/l	88.11	121.86	162.29	**124.09**	6.54	8.22	10.51	**8.42**	87.63	121.35	161.75	**123.58**
Paclobutrazol (PP_{333})	5 ppm	57.50	82.84	109.30	**83.22**	5.37	6.91	9.11	**7.13**	60.35	88.35	118.95	**89.21**
	25 ppm	63.25	92.58	123.41	**93.08**	4.60	6.31	7.89	**6.27**	68.16	99.97	135.54	**101.22**
Potassium	50 ppm	70.66	100.99	137.47	**103.04**	6.96	9.01	11.53	**9.16**	86.26	123.83	166.52	**125.54**
	250 ppm	90.75	125.45	167.68	**127.96**	9.81	12.74	16.03	**12.86**	107.95	146.46	196.36	**150.26**
Magnesium	50 ppm	60.88	86.36	117.76	**88.33**	9.32	11.65	14.72	**11.90**	113.00	153.09	201.75	**155.94**
	250 ppm	82.25	113.15	153.87	**116.42**	9.07	11.60	14.69	**11.79**	141.84	188.54	232.13	**187.50**
5 ppm PP_{333} + 50 ppm K		86.72	121.77	154.49	**120.99**	7.69	10.08	12.15	**9.97**	91.55	127.83	161.56	**126.98**
50 ml/l YE + 50 ppm K		115.61	147.08	186.99	**149.89**	6.56	8.12	9.47	**8.05**	121.08	155.77	198.37	**158.41**
Total mean		**73.50**	**102.40**	**135.90**	**103.93**	**6.92**	**8.92**	**11.22**	**9.02**	**89.71**	**123.47**	**161.36**	**124.85**
L.S.D at 0.05 level of significance.													
Days after sowing(A)					4.26				0.57				6.24
Elements (B)					4.23				0.76				8.08
A X B					7.32				N.S				14.00

The interaction between single foliar spray treatments at harvest time were significant. The highest values was 186.99 kg/fed that resulted from roots beet at harvest time after single foliar spray at 105 days after sowing with 50 ml/l YE + 50 ppm K, while the lowest values was of 23.07 kg/fed resulted from untreated treatment. The other treatments had inbetween positions.

2- Phosphorus uptake:

Foliar application at 105 days gave high mean values that was 11.22 kg/fed, which ranked the first, followed by the application at 75 days that was 8.92 kg/fed and the least was 6.92 kg/fed that obtained from the application at 45 days after sowing.

Foliar spray at 105 days after sowing significantly increased Phosphorus uptake either than when compared with that obtained at 45 or 75 days after sowing. Therefore, delaying single foliar spray up to 105 days after sowing also significantly increased P uptake in beet roots.

Moreover, significant differences among nutration treatments were recorded in Table (12). Applying, 250 ppm of K gave 12.86 kg/fed which ranked the first and the least was 5.31 kg/fed in the case of untreated treatment.

The interaction between single foliar spray treatments and elements at harvest time were not significant. The highest values that was of 16.03 kg/fed resulted in beet leaves at harvest time after single foliar spray at 105 days after sowing with 250 ppm of K, while the lowest values of 3.73 kg/fed resulted from untreated treatment. The other treatments occupied inbetween positions.

3- Potassium uptake:

Obtained samples at 210 days after sowing (i.e. at harvest time) showed that foliar application at 105 days gave the highest mean values of Potassium uptake that reached 161.36 kg/fed, which ranked the first, followed by the application at 75 days which gave 123.47 kg/fed and the least of 89.71 kg/fed that was obtained from the application at 45 days after sowing.

Foliar spray at 105 days after sowing significantly increased K uptake in beet roots either when compared with that existed 45 or 75 days after sowing.

So, it could be concluded that delaying single foliar spray up to 105 days after sowing significantly increased K uptake. Moreover, significant differences among treatments of elements were recorded in Table (12). Applying 250 ppm Mg gave 187.50 kg/fed which ranked the first and the least was of 56.04 kg/fed in case of untreated treatment.

The interaction between single foliar spray treatments of different elements at harvest time was significant. The highest values was 232.13 kg/fed that resulted from beet roots at harvest time after single foliar spray at 105 days after sowing with 250 ppm of Mg, while the lowest value 39.34 kg/fed resulted from untreated treatment. The other treatments had inbetween position.

Generally, foliar application at 105 days from sowing with 50 ml/l YE + 50 ppm K treatment produced the highest values of N uptake in roots and a higher K level 250 ppm gave the highest values of P and K uptake. On the other hand, the unfertilized

treatment gave the lowest values of NPK uptake in sugar beet roots at harvest.

In this respect, **Dolya and Ostrovskii (1971)** found that treatment of the sugar beet seed or root with 0.01% solution of vitamin B_1 increased the peroxides activity and the chlorophyll contents of growing plants. Meanwhile, **Armanios et al. (1991)** found that inoculation with certain micro organism (including candida) in the presence or absence of N fertilizer showed significant effect on dry weight, N, P-content, and protein % of barley grains. and **Fathy et al. (2000)** reported that spraying tomato plants cv. super strain B with yeast preparation (25 and 50 ml/l) at 20, 40, 60 and 80 days after transplanting increased mineral (P, K, Ca and Mg) and carbohydrate contents.

In this respect, **Bandara and Tanino (1995)** showed that greenhouse-grown potatoes cv. Norland were treated with 450 mg PP_{333} doubled the number of usable tubers/plant. Also, **Ismaeil (1995)** found that in broad beans cv. Giza 402, PP_{333} treatments at 10, 50 and 100 ppm increased N and protein content especially that of 100 ppm. Also, P and K were increased with the increase of PP_{333} concentration and the content of K was inversely proportional to PP_{333} concentrations. Thereafter, **Xun et al. (1995)** noticed that PP_{333} was applied to soil at 6-15 mg/pot and the effects on sugar beet seedlings were determined after 1 month. The content of photosynthetic pigments photosynthesis rates and eroxide (DOS) dismutase and peroxide (POD) activities in all the PP_{333} treatments were significantly higher than those in controls. The malon aldehyde (MDA) content and cell membrane permeability of leaves were lower than in controls indicating that PP_{333} treatment improved

stress resistance of Sugar beet seedlings. Meanwhile, **Okuda et al. (1996)** mentioned that PP_{333} was applied to the soil at 0, 500-1000 mg/potted five year old satsuma mandarin tree. The carbohydrate contents in the leaves and roots<2mm, PP_{333} increased the total carbohydrates in the roots and decreased them in the leaves, but the percentages in the leaves were unchanged. **Fathy et al. (2000)** reported that spraying tomato plants cv. super strain B with PP_{333} (25 and 50 ppm) at 20, 40, 60 and 80 days after transplanting on branching, leaf area, dry matter accumulation, mineral content (P, K, Ca and Mg) and carbohydrate all of these were significantly increased with different applied treatments.

In this respect, **Alshevskii (1990)** found that potatoes grown in sandy soil were given no fertilizers, 90 kg N + 90 kg P/ha or NP + 120 kg K/ha as Kcl 60.4 % K_2O or K magnesia 30.4 % K_2O, 10 % MgO and 2.3 % Cl or 3:1, 1:1 or 1:3 mixtures of the two increased total and protein N of sugar beet plants. So, **Milcheva (1990)** noticed the effect of K fertilization on chemical composition on sugar beet plants. In general K-fertilization increased K content in sugar beet plants, particularly on K-deficient soils. Thereafter, **El-Shafie (1996)** observed that spraying Fodder beet plants 4 times with K increased N and P content of root, leaves and whole plant and **El-Taweel (1999)** found that increasing K application from 0 to 24 and 48 kg K_2O/fed did not significantly increase Na and alfa amino N of sugar beet plants.

In this respect, **Sitohy et al. (1992)** studied the biochemical effects of foliar spray of wheat plants cv. Sakha 69 with kinetin, Mg and Mo on carbohydrates metabolism. The application of kinetin to wheat plants either individually or in combinations with other tested

factors showed the major increases concerning soluble, non soluble and total carbohydratre. Also, **Yu et al. (1994)** mentioned that distribution of Mg concentration in sugar beet plants were the highest during the seedling stage, then decreased at later stages. The uptake rate of Mg was in accordance with vegetative growth, the amount of Mg absorbed was lowest at the seedlings stages, at only 83.6 g/mu . Whereas, **Saleh et al. (1998)** found that in sugar beet plants increasing the concentration of both Ca and Mg in the nutrient solution attenuated the degree of inhibition of root growth by Zn, but not Cu. Magnesium ameliorated the toxicity effects of Zn without effecting the Zn concentration in the roots. An increase supply of Mg lowered the percentage decrease in root Mg concentration due to Zn toxicity. The maintenance of an adequate Mg level in the roots may be critical to prevent Zn induced inhibition of root growth in sugar beet plants and **El-Taweel (1999)** showed that Mg application from 0 to 9 and 18 kg MgO/fed significantly increased Na and alfa amino N of sugar beet plants.

General conclusion

1- Delaying foliar application with different treatments produced the highest values of yield and yield components, juice quality and chemical composition of leaves, roots of sugar beet

2- Potassium applications looks to the most efficient treatments among the others. This is very true since, such elements plays an important role in roots crops concerning the synthesis and translocation of sugars and its derivatives. Moreover, it is well known that sugar beet root formation and development is very well controled by K as an essential nutrient.

3- Results also indicate that Mg application ranked the second in its effect on top, root, biological, and sugar yield (ton/fed). This could be due to the extra high requirments of sugar beet to such element (250 ppm K).

4- An important central components of chlorophyll molecule that capture light energy and its photochemical action on photosynthetic aperatus. The net result is the formation of carbohydrates and other nutrient products which reflect its effect on sugar beet yield.

5- Data in Tables showed that yeast extract ranked the third after K and Mg application in its effect on sugar beet yield. However, the components of yeast extract (Table (1-a) proved to be great potentialities in stimulated the growth and development of sugar beet roots which should be reflected on the obtained yield.