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EFFECT OF MINERAL AND BIO-FERTILIZATION ON PRODUCTIVITY OF SUGAR BEET

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ABSTRACT

Tow field experiments were conducted during 2008/2009 and 2009/2010 seasons at Sakha Agricultural Research Station , Kafer El-Sheikh, Governorate, Egypt, to study the effect of phosphorus treatments: 30 kg P_2O_5 and 300 and 600g/fed of phosphorin , *Bucillus sp*, (phosphate dissolving bacteria) and nitrogen treatments : (100 kg N, *Azotobacter sp* +60 or 80 kg N/fed, *Azospirillum sp* + 60 or 80 kg N/fed, *Azoto.* + *Azosp.* + 60 or 80 kg N/fed on yield and quality traits of sugar beet. A split plot design with four replications was used with P treatments in the main plots and N treatments in the sub plots.

Results revealed that application of 30 kg P_2O_5 produced the highest root fresh weight, plant dry weight, LAI, yields of roots, sugar and tops and improved juice quality traits in terms of TSS%, sucrose%, purity%, and recoverable sugar %, followed by phosphorin at the rate of 600g and 300 g/fed in a descending order. On the other hand biophosphatic fertilizer decreased sucrose loss to molasses.

Application of 100 kg mineral N/fed produced the highest growth traits followed by *Azot.* + *Azosp*. with 80 kgN/fed. The highest values of TSS%, sucrose%, and recoverable sugar resulted from either *Azoto*. or *Azosp*.+ 60kgN/fed. Increasing N rates from 60 to 80 kg/fed in combination with N fixing bacteria depressed beet quality and increased impurities in beet roots. The highest root and top yields resulted from 100 kg N/fed, while sugar yield was highest with the combination of *Azto.* + *Azosp*. With 60 or 80 kg N /fed followed by 100 kg N/fed.

INTRODUCTION

Sugar beet (*Beta vulgaris L.*) is considered the second important sugar crop in Egypt after sugar cane. The Egyption Government encourages sugar beet growers to increase the cultivated area of sugar beet for decreasing the gap between sugar production and consumption.

Recently, under Egyption conditions a great attention is being denoted to reduce the high rates of mineral fertilizers, the cost of production and environment pollution via reducing doses of nitrogenous fertilizers by using bio-fertilized farming system. The bio-fertilizers (microbial inoculants) are microbial preparations of rihzospheric microorganisms that process definite roles, *i.e.* contribute the transformation of one or more of the plant nutrient elements and stimulate, to a great extent, plant growth by producing growth regulators (Gomaa, 1995). In Egyption soils total phosphorus content is present in unavailable inorganic or organic forms due to increasing alkalinity of soil (Kapur and Kanwar, 1990). Generally, application of bio-fertilizers improved soil fertility and enriched its biological activity under bio-fertilized farming. Singhania and Sharma (1990) indicated that increasing phosphorus levels up to 20 or 30 kg P_2O_5/ ha increased root and sugar yields. El-Moursy *et al*. (1998) reported that raising phosphorus rates from 15 to 45 kg P_2O_5/ fed significantly increased root length and diameter, root and sugar yields as well as TSS%. Ismail *et al*. (2007) and Ouda (2007) reported that fresh and dry weights, leaf area index and root and sugar yields as well as sucrose% and sugar loss to molasses were increased as P rate increased up to 30 kg P_2O_5/ fed . while sucrose, purity and extractable sugar percentages were decreased. Baya *et al.* (1980) reported that the application of phosphate solubilizing bacteria increases the efficiency of phosphatic fertilizers through solubilizing the yield forms by acids produced from bacteria.

Several reports showed that the inoculation of plants with *Azospirillum sp*., *Azotobacter sp*., and *Bacillus sp*., singly or in dual or in different combinations with mineral fertilizers improved the yield, yield components and root quality in treated sugar beet plants. In this connection, the biofertilizer in different combinations with mineral fertilizers increased chlorophyll a, b and carotenoids (Medani *et al*., 2000) root length and root diameter (Selim, 1998; Sultan *et al*., 1999 and Bassal *et al*., 2001); root and top yields (Favilli *et al.,* 1993 and Kandil *et al.,* 2002) and sugar yield (El-Badry and El-Bassel, 1993; Selim, 1998; Bassal *et al.,* 2001; Kandil *et al.,* 2002 and El-Hosary *et al*., 2010). On the other hand juice quality traits (TSS, sucrose and purity percentages as well as recoverable sugar percentage) were decreased with increasing nitrogen in combination with bio-fertilizers (Bassal *et al.,* 2001). Ramadan *et al.* (2003) studied the effect of inoculation of sugar beet with mixture of nitrogen fixer namely, *Azospirillum sp., Azotobacter sp.* and phosphate dissolving bacteria *(Bacillus sp.)* and different rates of mineral fertilizers (0, 25, 50, 75 and 100 %) of the recommended rates (150 kg N/fed) on yield and quality of sugar beet plants. They found that bio-fertilization treatments increased impurities (Na, K and alpha amino N), sucrose loss to molasses and root diameter as well as root and sugar yields. Aboshady *et al.* (2009) reported that microbial inoculation with *Azotobacter sp* + *Bacillus sp* increased top , root fresh weight and sugar yield, while there was no significant influence on percentages of Na, k, sucrose, recoverable sugar and amino nitrogen. Okasha (2013) using nitrogen levels (0, 30, 60 and 90 kg N/fed) and bio-fertilization (Rhizobacteren, Biogen, Microben, Nitroben and Cerialen). He found that top, root and sugar yields increased with application of Rhizobacteren + 60 kg N/fed, Nitroben + 30 kg N/fed, Biogen +60 kg N/fed, Cerialen + 90 kg N/fed and Microben +60 kg N/fed. Some workers have reported that increasing nitrogen application as soil fertilizer recorded significant increases in root, top and sugar yield (Abo-Zaeid and Osman, 2005 and Ouda, 2007). On the other hand, root quality of sugar beet i.e. TSS, sucrose, purity and recoverable sugar percentage were significantly decreased by increasing nitrogen rate (Carter and Traveller, 1981; Stevens *et al*., 2011 and Mahmoud *et al.*, 2012). In this respect, impurities in term of potassium, sodium and alpha amino N as well as sucrose loss to molasses were increased as N rate increased (Lauer, 1995; Ramadan *et al*, 2003 and Stevens *et al*.,2011). Ibrahim (2011) reported that increasing nitrogen rate up to 90 kg N/fed produced the highest values of root yield. Some workers reported that higher nitrogen rates favored beet growth in terms of leaf area index, root fresh weight and root dry weight / plant (Mahmoud *et al*., 2012). On the other hand root quality traits were decreased by increasing nitrogen rates in combination with bio-fertilizers (Bassal *et al*., 2001; Kandil *et al*., 2002 and Okasha, 2013).

MATERIALS AND METHODS

Two field experiments were carried out at Sakha Agricultural Research Station , Kafer El-Sheikh Governorate, Egypt during 2008/2009 and 2009/2010 seasons, to study the effect of mineral and bio-fertilization on growth, yield and quality of sugar beet plants. The variety used was Dema poly (Multigerm) which was obtained from the Sugar Crops Research Institute, Agriculture Research Center Egypt. The soil of the experimental site was clay in texture with 8.10 and 8.50 pH , 1.33 and 1.55 % organic matter ;32.20 and 35.40 ppm available N; 350.2 and 340.4 ppm available K; 10.3 and 9.2 ppm available P and 2.80 and 2.95 EC ds /m, in the first and second seasons, respectively.

A split plot design with four replications was used. The phosphorus treatments (30 kg P_2O_5 /fed, and phosphorin *Bacillus sp*. (phosphate dissolving bacteria) at the rate of 300 and 600g/fed.) were occupied in the main plots and nitrogen treatments (100 kg N, *Azotobacter sp* +60 or 80 kg N/fed, *Azospirillum sp* + 60 or 80 kg N/fed, *Azoto*. + *Azosp*. + 60 or 80 kg N/fed.) were arranged in the sub plots. Calcium super phosphate (15.5% P_2O_5) was applied during tillage and after dividing operation. The bio-fertilizer (seed inoculation) was doing before sowing directly, by soaking seed in running water at one hour and than air dried. Concerning the aim of soaking seed in water, usually, seeds of sugar beet treated with some fungicides to protect it from disease and can not be inoculated with bacterium, biofertilizer were produced by Biofertilizer Unit, Agriculture Research center(ARC). Mineral nitrogen was applied in the form of urea in two equal doses, the first after thinning (30 days after sowing) and the second dose one month later . 48 Kg K_2O/fed, in the form of potassium sulphate (48% K) was applied with the first dose of N . The sub plot area was 21 m^2 and consisted of 6 ridges 50 cm apart and 7 m in length. Distance between hills was 20 cm. Sowing date was on 4^{th} and 2^{nd} of October in the first and second seasons, respectively. Seedlings were thinned at 4-leaf stage to ensure one plant / hill. The preceding crop was rice in both seasons. Other cultural practices were carried out as recommended. Harvest took place after 200 days from sowing in both seasons.

Studied characters:

At harvest a random sample of 10 plants from each sub plot was taken to determine the following traits.

A- Growth characters :

1- Root fresh weight (g)
2- Plant dry weight (g)
3-Leaf area index (LAI)=unit leaf area per plant (cm^2)/plant ground area(cm^2).

Was determined according to Watson (1958), Leaf area was determined using the area meter, ATAGO, Model 3100.

B- Juice quality characters :

1-Total soluble solid (TSS) in roots was measured by using digital refractmeter, model PR1 (ATAGO).

2-Sucrose percentage was determined by using sacharometer on lead acetate extract of fresh macerated roots according to Carruthers and Oldfield (1960).

3-Purity percentage was calculated by dividing sucrose% by total soluble solids%.

4-Sodium (Na) and potassium (K) (millequivalent /100 g beet) according to Brown and Lilliand (1964).Alpha amino nitrogen (millequivalent /100 g beet) according to Pergel (1945).

5-Impurities % = ((Na + K) 0.343) + (0.094 amino N + 0.29), according to Carruthers and Oldfield (1960).

6- Recoverable sucrose% (R.S%). was determined according to the following formula , RS% = sucrose% – (0.343(Na +K)+ 0.094 (amino N + 0.29) was determined according to Renfield *et al.* (1974).

7- Sucrose loss to molasses percentage(SLM)
(SLM) = 0.343(Na +K) +0.094 (amino N) – 0.31 according to Renfield *et al* ,(1974).

C- Yields:

Yields were determined from the middle four ridges of each plot.

1- Root yield (ton/fed).

2-Recoverable sugar yield (ton/fed) (RSY) = root yield (ton/fed) x recoverable sugar % /100

3- Top yield (ton /fed).

Statistical analysis.

Data collected were subjected to the proper statistical analysis of variance according to the procedures outlined by Snedecor and Cochran (1981). Comparison among treatment means was done using, LSD at 5% of significance according to Steel and Torrie (1980). All statistical analysis was performed by using analysis of variance technique of computer software package (MSTATC).

RESULTS AND DISCUSSON

A: Effect of phosphorus fertilization.

1-Growth characters:

Data presented in Table 1 revealed application of 30 kg P_2O_5 produced the highest root fresh weight and plant dry weight as well as LAI followed by 600 g and 300g phosphorin/fed in a descending order. Differences among phosphorus fertilization treatments were significant only for plant dry weight in the second season and LAI in the first season. Such effect of phosphorus may be due to its role in improving plant growth in particular root development. Similar results were reported by Ismail *et al*. (2007) and Ouda, Sohier (2007).

Table 1 : Effect of phosphorus fertilization treatments on some growth traits of sugar beet plants in 2008/9 and/ 2009/10 seasons.

Characters / Treatments	Root fresh weight (g)		Plant dry weight (g)		LAI	
	2008/09	2009/10	2008/09	2009/10	2008/09	2009/10
30 Kg.P_2O_5/fed	1032	1019	467	474	8.17	7.20
300 g Phosphorin /Fed	1003	1008	451	456	7.17	6.60
600 g Phosphorin /Fed	1021	1016	457	462	7.85	6.93
LSD at 5%	NS	NS	NS	5.2	0.43	NS

2-Juice quality traits:

Data in Table 2 revealed that significant differences among phosphorus fertilization treatments in juice quality traits in terms of TSS, sucrose and recoverable sugar as well as sucrose loss to molasses percentages in both seasons, except for purity and impurities in the first season.

Table 2:Effect of phosphorus fertilization treatments on juice quality traits and impurities content of sugar beet roots in 2008/09 and/ 2009/10 seasons.

Characters / Treatments	TSS %		Sucrose %		Purity %	
	2008/09	2009/10	2008/09	2009/10	2008/09	2009/10
30 Kg.P_2O_5/fed	22.26	22.20	18.62	18.94	82.69	85.35
300 g Phosphorin /Fed	21.77	21.73	17.87	18.28	82.13	84.20
600 g Phosphorin /Fed	21.85	22.02	18.32	18.76	83.93	85.20
LSD at 5%	0.35	0.36	0.46	0.40	NS	0.22
Characters / Treatments	**Impurities %**		**Sucrose loss to molasses %**		**Recoverable sugar %**	
	2008/09	2009/10	2008/09	2009/10	2008/09	2009/10
30 Kg.P_2O_5	1.99	1.87	1.42	1.33	16.60	17.00
300 g Phosphorin /Fed	1.94	1.76	1.34	1.16	15.93	16.52
600 g Phosphorin /Fed	1.95	1.84	1.35	1.24	16.38	16.92
LSD at 5%	N S	0.04	0.05	0.06	0.20	0.14
Characters / Treatments	**Na (%)**		**K(%)**		**amino-n (%)**	
	2008/09	2009/10	2008/09	2009/10	2008/09	2009/10
30 Kg.P_2O_5	0.91	0.86	3.88	3.68	0.98	0.85
300 g Phosphorin /Fed	0.89	0.80	3.68	3.28	0.82	0.78
600 g Phosphorin /Fed	0.90	0.81	3.69	3.49	0.88	0.80
LSD at 5%	NS	0.04	NS	0.11	0.08	0.07

Application of 30 kg P_2O_5 /fed improved juice quality traits as compared to other phosphorin application, except for sucrose loss to molasses where bio-phosphatic fertilizer decreased sucrose loss to molasses. It is worth mentioning that increasing phosphorin rates from 300 up to 600 g/fed increased juice quality traits. The positive effect of the bio P fertilizer could be due to the production of bacterial photohormones resulted from microbial activity in root zone which may enhance growth of beet plants and consequently more metabolites translocated from leaves to roots. Regarding impurities data in Table 2 cleared that bio phosphatic fertilizer decreased juice impurities in term of Na, K and amino-N as compared to mineral P application in both seasons. It is worth to mention that differences between 300 and 600g/fed phosphorin in impurities were not significant in both seasons except for K in the second season. These findings are in conformity with those obtained by EL-Moursy *et al*. (1998); Ramadan *et al*. (2003) and Ismail *et al*. (2007).

3- Yield of roots, sugar and tops:

Phosphorus treatments exhibited significant effect on yields of roots, sugar and tops/fed in both seasons, except for top yield in the first season (Table 3). Application of 30kg P_2O_5/fed produced the highest yield of roots (37.8 and 39.4 tons/fed), recoverable sugar (6.28 and 6.69 tons /fed) and tops (15.9 and 17.1 ton/fed) as compared with other phosphorin application in the 1st and 2nd seasons, respectively. The beneficial effect of either mineral or phosphorus dissolving bacteria on sugar beet yields may be attributed to low content of phosphorus in the soil as mentioned before as well as to enhancing plant growth which was reflected in more dry matter accumulation and increasing LAI. Similar results were reported by Kapur and Kanwar (1990), Singhania and Sharma (1990) and Ramadan *et al*. (2003) .

Table 3: Effect of phosphorus treatments on root ,top and recoverable sugar yields of sugar beet plants in 2008/09 and/ 2009/10 seasons.

Characters / Treatments	Root yield ton/ fed		Recoverable sugar yield ton/ fed		Top yield ton/ fed	
	2008/09	**2009/10**	**2008/09**	**2009/10**	**2008/10**	**2009/10**
30 Kg.P_2O_5 /fed	37.8	39.4	6.28	6.69	15.9	17.1
300 g Phosphorin /Fed	36.1	37.3	5.74	6.16	14.9	15.6
600 g Phosphorin /Fed	36.6	38.5	5.60	6.52	15.3	16.1
LSD $_{at\ 5\%}$	0.40	0.42	0.20	0.14	NS	0.8

B: Effect of nitrogen fertilization:

1-Growth characters :

Data in Table 4 revealed significant differences among N treatments in both seasons. Application of 100 kg N/fed produced the highest growth traits followed by *Azoto*. + *Azosp.* +80 kg N/fed in a descending order with out any significant differences between them in both seasons. It is worth to mention that increasing N rate from 60 to 80 kg with *Azotobacter* and / or *Azosprillum* either alone or in combination improved growth traits in both seasons. The increase in growth traits may be mainly due to the role of N in stimulating merisetmatic activity which contributed to the increase in number of cells in addition to cell enlargement. Similar findings were reported by Ramadan *et al*. (2003), Ibrahim (2011) and Stevens *et al*. (2011).

Table 4: Effect of nitrogen fertilization on growth traits of sugar beet plants during 2008/09 and 2009/10 seasons.

Characters / Treatments	Root fresh weight (g)		Plant dry weight (g)		LAI	
	2008/09	2009/10	2008/09	2009/10	2008/09	2009/10
100 kg N/fed.	1068	1038	481	477	8.27	7.62
Azotobacter + 60 kg N/fed	976	995	439	452	7.29	6.39
Azotobacter + 80 kg N/fed	997	1015	454	462	7.69	6.75
Azospirillum + 60 kg N/fed	1001	997	449	457	7.42	6.67
Azospirillum + 80 kg N/fed	1022	1010	455	462	7.62	6.91
Azoto. + Azosp. +60 kg N/fed	1026	1015	460	467	7.73	6.72
Azoto. + Azosp. +80 kg N/fed	1039	1031	472	472	8.09	7.31
LSD at 5%	22.0	17.1	7.5	6.3	0.34	0.33

2-Juice quality traits :

Data in Table 5 revealed significant effect of N treatments on TSS% in the 2nd season, sucrose% in both seasons, sugar recovery% in the 2nd season and sucrose loss to molasses in both seasons, while juice purity was not significantly affected in both seasons. The highest values of TSS (22.22 and 22.44%), sucrose (18.54 and 18.78%) and recoverable sugar (16.62 and16.99%) in the first and second seasons, respectively resulted from *Azospirillum*+ 60 kg N/fed Differences between *Azosp*. and *Azoto*. +60kg N/fed. were not significant in this respect in both seasons. It is worth to mention that increasing N rates from 60 to 80 kg N/fed + Azoto and/ or *Azosp*. depressed juice quality traits and the lowest values of quality traits resulted from 100 kg N/fed as a single dose. Similar trend of results was reported by Carter and Traveler (1981), Ramadan *et al*. (2003) and Mahmoud *et al*. (2012).

Data in Table 5 revealed that impurities content in terms of Na, K and amino-N were significantly affected by N treatments in both seasons. The highest impurities resulted from 100 kg N as a single dose followed by *Azoto.* + *Azosp*. + 80 kg N/fed, while the lowest one resulted from *Azoto.* + 60 kg N/fed. It is worth mentioning that increasing N rates from 60 to 80 kg/fed either with *Azoto.* or *Azosp*. increased impurities in beet roots as reported by Lauer (1995), Ramadan *et al*. (2003), Stevens *et al*. (2011) and Mahmoud *et al.* (2012)

Table5:Effect of nitrogen fertilization treatments on quality and impurities content traits of sugar beet roots in 2008/ 09 and 2009/10 seasons.

Characters / Treatments	TSS %		Sucrose %		Purity %	
	2008/09	**2009/10**	**2008/09**	**2009/10**	**2008/09**	**2009/10**
100 kg N/fed	21.43	22.67	17.92	18.38	81.52	83.17
Azotobacter + 60 kg N/fed	22.06	22.37	18.44	18.75	83.62	84.23
Azotobacter + 80 kg N/fed	21.70	21.63	18.12	18.63	83.60	86.10
Azospirillum + 60 kg N/fed	22.22	22.87	18.54	18.78	83.47	83.69
Azospirillum + 80 kg N/fed	22.04	22.40	18.31	18.43	83.10	84.11
Azoto. + Azosp. +60 kg N/fed	22.21	22.51	18.48	18.93	83.20	84.81
Azoto. + Azosp. +80 kg N/fed	22.04	21.93	18.47	18.72	82..03	84.17
LSD at 5%	NS	0.61	0.28	0.22	NS	NS
Characters / Treatments	Impurities %		Sucrose loss to molasses %		Recoverable Sugar %	
	2008/09	2009/10	2008/09	2009/10	2008/09	2009/10
100 kg N/fed	2.15	1.85	1.56	1.31	15.76	16.47
Azotobacter + 60 kg N/fed	1.88	1.81	1.29	1.23	16.56	16.91
Azotobacter + 80 kg N/fed	1.92	1.84	1.35	1.25	16.18	16.78
Azospirillum + 60 kg N/fed	1.91	1.78	1.31	1.19	16.62	16.99
Azospirillum + 80 kg N/fed	1.89	1.77	1.35	1.22	16.37	16.61
Azoto. + Azosp. +60 kg N/fed	1.97	1.82	1.35	1.23	16.53	17.10
Azoto. + Azosp. +80 kg N/fed	1.98	1.88	1.39	1.28	16.08	16.85
LSD at 5%	0.20	0.10	0.04	0.04	NS	0.28
Characters / Treatments	Na (%)		K(%)		Amino-N (%)	
	2008/09	2009/10	2008/09	2009/10	2008/09	2009/10
100 kg N/fed.	1.23	0.93	3.94	3.55	0.98	0.87
Azotobacter + 60 kg N/fed	0.81	0.78	3.62	3.53	0.81	0.70
Azotobacter + 80 kg N/fed	0.84	0.81	3.74	3.51	0.86	0.82
Azospirillum + 60 kg N/fed	0.81	0.78	3.68	3.38	0.92	0.78
Azospirillum + 80 kg N/fed	0.84	0.82	3.74	3.42	0.91	0.78
Azoto. + Azosp. +60 kg N/fed	0.85	0.79	3.75	3.46	0.85	0.85
Azoto. + Azosp. +80 kg N/fed	0.91	0.85	3.80	3.54	0.91	0.85
LSD at 5%	0.07	0.02	0.30	0.10	0.06	0.04

3- Yields of roots, sugar and tops:

Nitrogen treatments exhibited significant effect on root, recoverable sugar and top yields in both seasons, (Table 6). The highest yield of roots and tops resulted from application of 100 kg N followed by *Azoto. + Azosp*. with 80 or 60 kg N/fed in a descending order, however differences among these treatments were not significant in both seasons, while the highest sugar yield resulted from *Azoto. + Azosp*. with 60 or 80 kg N/fed (without any significant difference between thim) followed by 100 kg N/fed. It is worth to mention that the reduction in root yield accompanying seed inoculation with *Azoto*. and *Azosp*. was compensated by the increase in sucrose, purity and recoverable sugar percentage as well as to the reduction in impurities and finally sugar yield increased. It can be concluded that inoculating beet seeds with a mixture of *Azoto.* and *Azosp*. with 60 or 80 kg N/fed could save about 20 to 40 kg N with minimizing pollution resulting from high N rate. These results are in coincide with those obtained by Ramadan *et al*. (2003), Abou Zaid and Osman (2005) and EL-Hosary *et al.* (2010).

Table 6 : Effect of nitrogen fertilization treatments on root ,top and sugar yields in 2008/09 and/ 2009/10 seasons.

Characters / Treatments	Root yield ton/ fed		Sugar yield ton/ fed		Top yield ton/ fed	
	2008/09	2009/10	2008/09	2009/10	2008/09	2009/10
100 kg N/fed	38.37	39.72	6.05	6.55	16.9	17.4
Azotobacter + 60 kg N/fed	35.88	37.83	5.94	6.40	15.3	15.4
Azotobacter + 80 kg N/fed	36.20	38.55	5.85	6.47	14.9	15.8
Azospirillum + 60 kg N/fed	35.40	37.28	5.89	6.33	14.1	15.4
Azospirillum + 80 kg N/fed	36.40	38.26	5.95	6.36	14.5	16.0
Azoto. +Azosp. +60 kg N/fed	37.60	38.22	6.22	6.54	15.2	16.5
Azoto. +Azosp. +80 kg N/fed	38.10	38.88	6.13	6.55	16.5	17.2
LSD at 5%	1.05	0.87	0.17	0.13	0.74	0.55

C- Interaction effects:

Only the highest values of the significant interaction between phosphorus and nitrogen fertilization treatments for studied traits are presented in Table 7 the highest LAI 8.77 in the second season, sodium content 1.34 and 1.04 %, α amino-N 1.24 and 0.98 %, sucrose loss to molasses 1.66 and 1.47 % and root yields 40.16 and 42.40 ton/fed in the first and second seasons, respectively resulted from30 kg P_2O_5/fed and 100 kg N/fed, while the highest recoverable sugar yield (6.54 t/fed) only in the first season , resulted from 600 g phosphorin + Azoto.+ Azosp. with 80 kg N/fed.

Table 7 : LAI, Na, Amino-N, sucrose loss to molasses, root yield and sugar yield as affected by interaction between nitrogen and phosphorus treatments in 2008/09 and 2009/10 seasons.

Characters / Treatments		LAI	Na (%)		Amino-N (%)		Sucrose loss to molasses %		Root yield ton/ fed		sugar yield ton/ fed
N	P	2009/10	2008/09	2009/10	2008/09	2009/10	2008/09	2009/10	2008/09	2009/10	2008/09
100 kg N/fed	P1	8.77	1.34	1.04	1.24	0.98	1.66	1.47	40.16	42.38	6.46
	P2	6.72	1.20	0.87	0.79	0.81	1.51	1.19	37.46	38.00	5.83
	P3	7.36	1.16	0.89	0.92	0.84	1.51	1.27	37.50	38.77	5.86
Azoto.+60 Kg N/fed	P1	6.71	0.80	0.81	0.80	0.66	1.38	1.28	36.54	38.57	6.17
	P2	6.25	0.80	0.77	0.77	0.70	1.21	1.20	34.53	36.66	5.60
	P3	6.20	0.83	0.77	0.86	0.75	1.27	1.23	36.57	38.26	6.06
Azoto.+80 kg N/fed	P1	6.92	0.85	0.87	0.88	0.81	1.40	1.33	37.69	39.03	6.20
	P2	6.70	0.82	0.78	0.84	0.85	1.30	1.19	35.65	37.30	5.66
	P3	6.62	0.86	0.78	0.86	0.80	1.32	1.23	35.16	39.30	5.70
Azosp.+60 kg N/fed	P1	6.60	0.82	0.79	0.99	0.86	1.36	1.28	36.34	38.35	6.15
	P2	6.57	0.79	0.76	0.88	0.73	1.30	1.11	36.35	36.39	5.94
	P3	6.85	0.81	0.77	0.89	0.74	1.28	1.18	33.59	37.12	5.57
Azosp.+80 kg N/fed	P1	6.99	0.83	0.84	1.14	0.86	1.39	1.29	37.86	39.22	6.40
	P2	6.82	0.86	0.81	0.79	0.72	1.33	1.14	35.37	37.36	5.58
	P3	6.93	0.83	0.79	0.80	0.78	1.32	1.22	35.81	38.20	5.88
Azoto.+Azosp. +60 kg N/fed	P1	6.73	0.83	0.80	0.85	0.87	1.37	1.29	38.16	38.52	6.46
	P2	6.43	0.84	0.79	0.84	0.84	1.33	1.16	36.60	37.46	5.86
	P3	6.99	0.88	0.77	0.86	0.83	1.34	1.23	38.12	38.67	6.35
Azoto.+Azosp. +80 kg N/fed	P1	7.67	0.87	0.87	0.95	0.89	1.41	1.35	38.18	39.47	6.12
	P2	6.71	0.95	0.82	0.84	0.83	1.37	1.16	36.48	37.91	5.75
	P3	7.54	0.92	0.85	0.94	0.84	1.38	1.32	39.67	39.26	6.54
LSD at 5%		0.94	0.11	0.05	0.10	0.07	0.07	0.06	1.81	1.51	0.29

P1: 30 kg. P2O5/fed P2: 300 gm phosphorin /fed. P3 : 600gm phosphorin / fed

CONCLUSION

It could be concluded that application of 100 kg N/fed and/or 600 g phosphorin + Azoto. + Azosp. With 80 kg N/fed could optimize root and sugar yield/fed and decrease mineral fertilizer costs and environmental pollution.

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تأثير التسميد المعدنى والحيوى على إنتاجية بنجر السكر

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****مركز البحوث الزراعيه - الجيزه – مصر**

اقيمت تجربتان حقليتان خلال موسمى الزراعه٢٠٠٨/٢٠٠٩ و ٢٠٠٩/٢٠١٠ فى محطه البحوث الزراعيه بسخا بمحافظه كفر الشيخ لدراسه تأثير التسميد الفوسفاتى (٣٠ كجم فو٢أ٥ للفدان , ٣٠٠.٦٠٠ جم فوسفورين /فدان (***Bucillus sp***) والتسميد الأزوتـى (١٠٠كجم أزوت للفدان و ألأزوتوبـاكتير + ٦٠ أو ٨٠ كجم ن/فدان ألازوسبيريلليم+ ٦٠ او٨٠ كجم/ فدان والأزوتوبـاكتير + الأزوسبريليم +٦٠ أو ٨٠كجم ن/فدان) على محصول وجودة بنجر السكر.

أستخدم تصميم القطع المنشقة مرة واحدة في أربع مكررات حيث تم وضع معاملات الفوسفور في القطع الرئيسية ومعاملات التسميد الأزوتى في القطع الشقية و أظهرت النتائج مايلى:

أعطـى إضـافة التسميد الفوسفاتى بمعدل ٣٠ كجم فو٢ أ٥ أعلى وزن جاف للجذر ودليل مساحه الأوراق وكذلك محصول كل من الجذور والسكرو العرش (طن/فدان)، كما أدى إلى تحسين صفات الجودة الممثلة فى نسب كل من السكروز والمواد الصلبة الكلية والنقاوة والسكروز المستخلص، تلاه معاملة البذور بإضافة ٣٠٠ و ٦٠٠ جرام فوسفورين على الترتيب ، ومن ناحية أخرى أدى إضافة التسميد الحيوي الفوسفاتى إلى إنخفاض نسبة السكروز المفقود في المولاس.

أدى التسميد الأزوتـى المعدنى بمعدل ١٠٠ كجم أزوت للفدان إلى تحسين صفات النمو تلاه في الترتيب إضافة الأزوتوباكتير + ألازوسبريليم + ٨٠ كجم أزوت للفدان . ونتجت أعلى قيم من كل من المواد الصـلبة الكليـة والسـكروز والسـكر المسـتخلص مـن معاملـة بـذور بنجـر السـكر ببكتريـا الأزوتوبـاكتر أو الأزوسبريليم + ٦٠كجم أزوت للفدان . بينما أدت زيادة التسميد الأزوتى المعدنى من ٦٠ الى ٨٠ كجم أزوت للفدان مع معاملة البذور بالبكتريا المثبتة للأزوت إلى إنخفاض صفات الجودة وزيادة نسبة الشوائب في الجذور . أيضاً نتجت أعلى قيمة من محصول الجذور والعرش (طن للفدان) من إضـافة ١٠٠كجم أزوت للفدان و نتج أعلى محصول من السكر(طن/ فدان) من معاملة البذور بالأزوتوباكتر+ ٦٠ أو ٨٠ كجم أزوت للفدان،تلاه في ذلك معاملة ١٠٠ كجم ازوت للفدان كتسميد ارضى..

ويمكـن التوصـيه باضـافة ٦٠٠ جـم فوسـفورين + الازوتوبـاكتر + الازوسـبيريليم مـع ٨٠ كجـم نيتروجين للفدان للحصول على أعلى محصول للسكر من جذور بنجر السكروذلك تحت ظروف الدراسة.

قام بتحكيم البحث

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