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EFFECT OF BIO AND MINERAL FERTILIZATION ON YIELD AND QUALITY OF SUGAR BEET

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ABSTRACT

Two field experiments were carried out at Kafr El-Hamam Research Station, Zagazig district, Sharkia Governorate, Agricultural Research Center during 2007/2008 and 2008/2009 seasons to study the effect of biofertilization treatments (control, microbin, rhizobacterin, phosphorin and their interactions) and mineral nitrogen fertilizer levels (0, 40, 80 and 120 kg N/fed) on yield and quality of sugar beet cv. Plino.

The main findings of this investigation could be summarized as follows:

1- Application the mixture of Microbeen + Rhizobacterin+ Phosphorien produced the highest values of all studied characters in both growing seasons as compared with using each bio-fertilizer alone. It was followed by application the mixture of Microbeen + Rhizobacterin then application the mixture of Rhizobacterin + Phosphorien in the two growing seasons.

2- Fertilizing sugar beet plants with 120 kg N/fed produced the highest values of root length and diameter, root and foliage fresh weights, TSS %, root and sugar yields/fed in the two seasons. However, the highest means of sucrose % and apparent purity % were resulted from control treatment (0 kg N/fed) in the two growing seasons.

3- The interaction between both studied factors had a significant effect on all studied characters in the two growing seasons.

Generally, it could be concluded that application the mixture of Microbeen + Rhizobacterin + Phosphorien as biofertilizers and adding 120 kg N/fed as a mineral fertilization for maximizing sugar beet productivity under the environmental conditions of Zagazig district,.

Keywords: Sugar beet, biofertilizers, mineral nitrogen fertilizer levels, yield, quality

INTRODUCTION

Sugar beet (*Beta vulgaris*, L.) is the second source of sucrose all over the world and also in Egypt. There are several advantages favoring sugar beet as a suitable crop to increasing sugar production in Egypt. The crop is grow annually during the winter season, with a relatively short duration period and allows for growing a summer crop during the same year. Furthermore, it is highly adapted to grow in poor saline soils, especially in the new reclaimed lands in addition to its limited water requirements when compared with sugar cane.

In recent years, the trend is to explore the possibility of supplementing chemical fertilizers with more particularly biofertilizers of microbial origin at the same time minimizing the environmental pollution which resulted from mineral fertilizers and also to reduce its coasts (Abu EL-Fotoh *et al.*, 2000 and Cakmakci *et al.*, 2001). Many studies with this respect were done *i.e.* Sprenat (1990) recorded that inoculation soil by *Azotobacter spp* caused solubilization of mineral nutrients and synthesis of vitamins, amino acids, auxins as well as gibberellins, which stimulate plant growth and induce high yields. EL-Badry and EL-Bassel (1993) and Favilli *et al.* (1993) found that inoculation sugar beet with *Azospirillum* caused a significant saving in nitrogen fertilizer (about 25-40 %). They also reported that a significant increase in root yield (from 2.8 to 6.0 t/fad) and sugar yield as a result of inoculation by *Azospirillum.* Butorac (1995) found that root yield, sugar % and sugar yield were the lowest with NPK + agrarvital + waste water treatment, while root and sugar yields were the highest with waste containing N, P, K, Ca, Na, micronutrients and organic matter treatment. Sultan *et al.* (1999) and Bassal *et al.* (2001) recorded that inoculation of sugar beet seeds with Azotobacterin significantly increased TSS %, sucrose %, purity % and root as well as sugar yields/fad. Cakmakci *et al.* (2001) and Maareg and Badr (2001) reported that Syrialin caused an increase TSS %, sucrose %, purity % and sugar yield/fad. Kandil *et al.* (2002) confirmed that biofertilization treatments significantly increased root, top and sugar yields/fad. The highest means of previously mentioned characteristics were resulted from inoculation seeds of sugar beet with Rhizobacterin. Ramadan *et al.* (2003) showed that biofertilization treatments had significant effect on root, top and sugar yields/fad. On the other hand, biofertilization treatments exhibited insignificant effect in sucrose % and purity %. Badawi *et al.* (2004) found that biofertilization treatments caused a significant effect on TSS %, sucrose %, purity %, root, top and sugar yields/fad. Rhizobacterin treatment produced the highest values of yield quality parameters, excluding TSS % (in the first and third seasons) and purity % (in the second season) as well as all yield characters in both seasons. Concerning application of the mixture of Rhizobacterin + Cerialine and Cerialine biofertilizer, its ranked after Rhizobacterin treatment, respectively with respecting their effect on quality and yield traits in both seasons. While, control treatment resulted in the lowest means ones.

Nitrogen fertilizer levels caused significant differences in all yield and quality of sugar beet. This conclusion was confirming by El-Shafai (2000), El-Harriri and Gobarh (2001), Kandil *et al.* (2002), Seadh (2004), Gomaa *et al.* (2005), Ibrahim *et al.* (2005), Leilah *et al.* (2005), Ramadan (2005), El-Geddawy *et al.* (2006), Nemeat Alla *et al.* (2007), Monreala *et al.* (2007), Seadh *et al.* (2007), Seadh (2008), Shewate *et al.* (2008), Zhang *et al.* (2009), El-Sarag (2009) and Attia *et al.* (2011).

Abou-Amou *et al.* (1996) found that the application of 80 kg N/fed resulted the highest values of purity % (78.75 %). El-Hawary (1999) reported that fertilizing sugar beet with 90 kg N/fed recorded the highest values of sucrose %. El-Harriri and Gobarh (2001) pointed out that application of 110 kg N/fed markedly increased TSS %. Seadh (2008) showed that optimum means of sucrose and purity percentages were obtained from using 75 kg N/fed in both seasons. Monreala *et al.* (2007) stated that the highest values of quality parameters were obtained from the lowest level of nitrogen (30 kg N/ha).

The objective of this study was to determine the effect of biofertilization treatments and mineral nitrogen fertilizer levels on yield and quality characters of sugar beet under the environmental conditions of Sharkia Governorate.

MATERIALS AND METHODS

Two field experiments were carried out at Kafr El-Hamam Research Station, Zagazig district, Sharkia Governorate, Agricultural Research Center during 2007/2008 and 2008/2009 seasons to deduce the effect of biofertilization treatments and mineral nitrogen fertilizer levels on yield and quality of sugar beet cv. Plino.

The field experiments were laid-out in a split plot design with four replications. In both seasons, each experiment included thirty-two treatments, eight biofertilization treatments and four nitrogen level. The main plots were assigned to the following eight biofertilization treatments:

1- Without biofertilization (control).
2- Microbin.
3- Rhizobacterin.
4- Phosphorin.
5- Microbin + Rhizobacterin.
6- Microbin + Phosphorin.
7- Rhizobacterin + Phosphorin.
8- Microbin + Rhizobacterin + Phosphorin.

Microbin, Rhizobacterin and Phosphorin as commercial products were produced by Biofertilizer Unit, Agriculture Research Center (ARC), Giza, Egypt, which included free-living bacteria able to fix atmospheric nitrogen and phosphorus in the rhizosphere of soil. Microbin and Rhizobacterin treatments were done before first irrigation directly by mixing the recommended dose of each biofertilizer with fine clay as side-dress near from hills. Phosphorin treatment was carried out by slightly wet seeds by little quantity of water and mixed by phosphorin bioferilizer and then directly sown.

The sub- plots were occupied with the following four mineral nitrogen fertilizer levels:

1- 0 kg N/fed (control)
2- 40 kg N/fed (50% from recommended dose) .
3- 80 kg N/fed (recommended dose).
4- 120 kg N/fed (150% from recommended dose).

Nitrogen fertilizer in the forms of urea (46 %N) were applied as a side-dressing in two equal doses, one half after thinning (35 days from sowing) and the other before the third watering (70 days from sowing).

Each experimental basic unit included 5 ridges, each 60 cm apart and 3.5 m length, resulted an area of 10.5 m^2 (1/400 fed). The preceding summer crop was maize (*Zea mays*, L.) in both seasons. Soil samples were taken at random from the experimental field before soil preparation to measure the following chemical and physical soil properties as shown in Table 1.

Table 1: Physical and chemical soil characteristics at the experimental sites during both growing seasons.

Soil analysis	2007/2008 season	2008/2009 season
Mechanical analysis		
Sand %	12.0	13.9
Silt%	21.6	21.5
Clay %	62.1	61.0
Chemical analysis		
$CaCo_3$ (%)	1.3	2.6
Organic matter (%)	2.0	2.1
Avialable N (ppm)	52.5	51.4
Avialable P (ppm)	16.2	15.3
Avialable K (ppm)	37.40	36.5
PH	8.1	8.0

The experimental field well prepared and then divided into the experimental units. Calcium super phosphate (15.5 % P_2O_5) at the rate of 150 kg/fed was applied during soil preparation. Potassium fertilizer in the form of potassium sulphate (48 % K_2O) at the rate of 24 kg K_2O/fed was applied before the first irrigation.

Sugar beet was hand sown 3-5 balls/hill using dry sowing method on one side of the ridge in hills 20 cm apart at the first week of November in both seasons. Plants were thinned at the age of 35 days from planting to obtain one plant/hill (35000 plants/fed).

Plants were kept free from weeds, which were manually controlled by hand hoeing at two times. The common agricultural practices for growing sugar beet according to the recommendations of Ministry of Agriculture were followed, except the factors under study.

Studied Characters

A- Yield components and quality characters:

Five guarded plants were chosen at random from the outer ridges of each sub plot to determine yield components and quality characters as follows:

1- Root length (cm).
2- Root diameter (cm).
3- Root fresh weight (g/plant).
4- Foliage fresh weight (g/ plant).
5- Total soluble solids (TSS %) in roots was measured in juice of fresh roots by using Hand Refractometer.
6- Sucrose percentage (%) was determined Polarimetrically on lead acetate extract of fresh macerated roots according to the method of Carruthers and OldField (1960).
7- Apparent purity percentage (%). It was determined as a ratio between sucrose % and TSS % of roots as the method outlined by Carruthers and OldField (1960).

B- Yield characteristics:

Plants that produced from the two inner ridges of each sub plot were collected and cleaned. Roots and tops were separated and weighted in kilograms, then converted to estimate:

1. Root yield (t/fed).

2- Sugar yield (t/fed) was calculated by multiplying root yield (t/fed) by sucrose%.

All obtained data were statistically analyzed according to the technique of analysis of variance (ANOVA) for the split – plot design by means of "MSTAT-C " computer software package as published by Gomez and Gomez (1984). Least significant of difference (LSD) method was used to test the differences between treatment means at 5 % level of probability as described by Waller and Duncan (1969).

RESULTS AND DISCUSSION

A- Effect of biofertilization treatments:

Biofertilization treatments caused a significant effect on root length and diameter, root and top fresh weights as shown in Table 2. Application the mixture of Microbeen + Rhizobacterin+ Phosphorien produced the highest values of yield attributes (root length and diameter, root and top fresh weights) in both growing seasons.

Table 2: Root length and diameter, root and top fresh weights as affected by bio-fertilization treatments, nitrogen fertilizer levels and their interaction during 2007/2008 and 2008/2009

Characters	Root length (cm)		Root diameter (cm)		Root fresh weight (g)		Top fresh weight (g)	
Treatments	2007/ 2008	2008/ 2009	2007/ 2008	2008/ 2009	2007/ 2008	2008/ 2009	2007/ 2008	2008/ 2009
A- Bio-fertilization treatments:								
1- Without	16.17	16.28	10.66	10.35	510.5	522.4	229.7	235.1
2- Microbeen	18.16	17.93	11.47	11.45	582.1	572.5	261.9	257.6
3- Rhizobacterin	19.67	19.67	12.82	12.20	841.0	842.6	378.4	379.2
4- Phosphorien	18.15	17.90	11.04	11.03	564.8	590.6	254.1	265.8
5-Microbeen+ rhizobacterin	19.96	20.30	13.23	12.79	857.0	861.8	385.6	387.8
6-Microbeen+ phosphorien	18.97	18.98	13.24	13.06	848.1	849.8	377.0	382.4
7-Rhizobacterin+ phosphorien	19.19	19.29	13.05	13.00	853.0	854.3	383.8	384.4
8-Microbeen+ rhizobacterin+ phosphorien	27.26	26.05	14.48	15.22	895.0	937.2	419.7	421.7
F. test	*	*	*	*	*	*	*	*
LSD at 5 %	0.20	0.56	0.17	0.97	18.6	15.5	20.0	9.7
B- Nitrogen fertilizer levels:								
0 kg N/fed	17.69	17.07	11.17	10.91	419.0	426.0	188.5	191.7
40 kg N/fed	18.79	18.39	11.53	11.69	622.7	639.2	288.7	287.6
80 kg N/fed	20.29	20.49	12.46	12.37	847.4	859.8	381.3	386.8
120 kg N/fed	21.99	22.25	14.84	14.58	1086.7	1090.7	486.7	490.8
F. test	*	*	*	*	*	*	*	*
LSD at 5 %	0.17	0.28	0.13	0.52	16.8	14.6	15.1	6.6
C- Interaction:								
A X B	*	*	*	*	*	*	*	*

It was followed by application the mixture of Microbeen + Rhizobacterin then application the mixture of Rhizobacterin + Phosphorien with regard its effect on yield attributes in the two growing seasons. From obtained results under the environmental conditions of this research, it could be observed that using of Rhizobacterin biofertilizer either alone or in the mixture with Microbeen or Phosphorien surpassed other treatment during both seasons. However, the lowest values of root length and diameter, root and top fresh weights were resulted from control treatment (without biofertilization) in both seasons. This increase in yield attributes as a result of application biofertilizers particularly Rhizobacterin may be due to its role in nitrogen fixation via free living bacteria which reduce the soil pH especially in the rhizosphere which led to increase the availability of most essential macro and micro-nutrients as well as excretion some growth substances such as IAA and GA_3 which play an important role in formation a large and active root system and therefore increasing nutrient uptake, which stimulating establishment and vegetative growth, hence increasing root and foliage fresh weights and also root length and diameter. Many investigators confirming this conclusion *i.e.* Kandil *et al*. (2002), Ramadan *et al*. (2003) and Badawi *et al*. (2004)

Data in Table 3 clear that application of biofertilization treatments were associated with significant effect on total soluble solids (TSS), sucrose and apparent purity percentages in the two growing seasons. Application the mixture of three studied biofertilizers (Microbeen + Rhizobacterin + Phosphorien) significantly improved quality traits of sugar beet and induced the highest values of them in the two growing seasons, with exception apparent purity percentage in the second season which resulted from using the mixture of Rhizobacterin+ phosphorien. Generally, it can be observed that biofertilization treatments especially that included Rhizobacterin biofertilizers led to gradual tendency to improve all quality determinations as compared with control treatment in both seasons. This increase in quality determinations due to biofertilization treatments especially Rhizobacterin may be due to its role in improving growth and dry matter accumulation by increasing the uptake and availability of most nutrients, consequently enhancement sucrose content in roots. Similar results were reported by many workers *i.e.* Sultan *et al*. (1999), Bassal *et al*. (2001), Cakmakci *et al*. (2001) and Maareg and Badr (2001).

Data in Table 4 show that root and sugar yields/fed were significantly responded due to biofertilization treatments in both seasons. Noteworthy, application the mixture of Microbeen + Rhizobacterin + Phosphorien biofertilizers yielded the highest values of root yield (25.062 and 26.242 t/fed) and sugar yield (5.435 and 5.316 t/fed) in the first and second seasons, respectively. Concerning application the mixture of Microbeen + Rhizobacterin and Rhizobacterin + Phosphorien, its ranked after aforementioned treatment, respectively with respecting their effect on root and sugar yields/fed in the two seasons.

Table 3: Total soluble solids (TSS), sucrose and apparent purity percentages as affected by bio-fertilization treatments, nitrogen fertilizer levels and their interaction during 2007/2008 and 2008/2009 seasons.

Characters / Treatments	TSS (%)		Sucrose (%)		Apparent purity (%)	
	2007/ 2008	2008/ 2009	2007/ 2008	2008/ 2009	2007/ 2008	2008/ 2009
A- Bio-fertilization treatments:						
1- Without	23.11	22.77	17.27	17.05	74.98	75.13
2- Microbeen	25.61	25.30	20.18	19.76	78.84	78.16
3- Rhizobacterin	25.55	25.61	20.28	20.28	79.41	79.20
4- Phosphorien	25.75	25.25	20.05	19.85	77.90	78.64
5-Microbeen+ rhizobacterin	25.81	26.02	20.53	20.51	79.54	78.85
6-Microbeen+ phosphorien	25.57	25.74	20.40	20.35	79.77	79.09
7-Rhizobacterin+ phosphorien	25.76	25.70	20.41	20.35	79.24	79.22
8-Microbeen+ rhizobacterin+ phosphorien	26.29	26.45	22.02	20.79	83.85	78.67
F. test	*	*	*	*	*	*
LSD at 5 %	0.26	0.17	0.09	0.09	0.88	0.59
B- Nitrogen fertilizer levels:						
0 kg N/fed	25.20	25.10	21.80	21.71	86.44	86.42
40 kg N/fed	25.26	25.24	21.29	20.65	84.25	81.83
80 kg N/fed	25.59	25.46	19.19	18.80	74.90	73.77
120 kg N/fed	25.67	25.62	18.29	18.32	71.18	71.46
F. test	*	*	*	*	*	*
LSD at 5 %	0.12	0.03	0.06	0.06	0.47	0.25
C- Interaction:						
A X B	*	*	*	*	*	*

Table 4: Root and sugar yields/fed as affected by bio-fertilization treatments, nitrogen fertilizer levels and their interaction during 2007/2008 and 2008/2009 seasons.

Characters / Treatments	Root yield (t/fed)		Sugar yield (t/fed)	
	2007/2008	2008/2009	2007/2008	2008/2009
A- Bio-fertilization treatments:				
1- Without	14.296	14.629	2.410	2.440
2- Microbeen	16.300	16.031	3.224	3.111
3- Rhizobacterin	23.549	23.595	4.654	4.680
4- Phosphorien	15.815	16.539	3.077	3.221
5-Microbeen+ rhizobacterin	23.997	24.131	4.802	4.835
6-Microbeen+ phosphorien	23.747	23.797	4.725	4.734
7-Rhizobacterin+ phosphorien	23.886	23.923	4.749	4.757
8-Microbeen+ rhizobacterin+ phosphorien	25.062	26.242	5.435	5.316
F. test	*	*	*	*
LSD at 5 %	0.522	0.435	0.102	0.092
B- Nitrogen fertilizer levels:				
0 kg N/fed	11.734	11.929	2.587	2.625
40 kg N/fed	17.437	17.898	3.742	3.734
80 kg N/fed	23.727	24.074	4.600	4.557
120 kg N/fed	30.428	30.541	5.609	5.631
F. test	*	*	*	*
LSD at 5 %	0.471	0.411	0.093	0.076
C- Interaction:				
A X B	*	*	*	*

On the other hand, control treatment (without biofertilization) resulted in the lowest means of these yield traits. This effect of biofertilization treatments expressly Rhizobacterin biofertilizer may be ascribed to its role in improving plant growth, vigor of plant and yields through fixing atmospheric nitrogen and mineralization and/or mineralizing organic compounds as well as release of certain growth regulators, stimulatory compounds and nutrients in soil by the introduced organisms. Similar results were in coincidence with those fixed by Favilli *et al*. (1993) and Badawi *et al*. (2004).

B- Effect of nitrogen fertilizer levels:

All yield attributes (root length and diameter as well as root and foliage fresh weights,) significantly increased as a result of increasing nitrogen fertilizer levels from 0 to 40, 80 and 120 kg N/fed in both seasons (Table 2). Fertilizing sugar beet plants with 120 kg N/fed produced the highest values of all studied yield attributes in the two seasons. Application of 80 kg N/fed resulted in the best findings after the highest level of nitrogen fertilizer with significant differences comparison with other levels. While, the lowest ones were obtained due to plant did not received any amount of nitrogen fertilizer (0 kg N/fed) in both seasons. Such effect of nitrogen on these characteristics may be returned to its role in building up metabolites and activation of enzymes that associate with accumulation of carbohydrates, which translated from leaves to developing roots as well as increasing division and elongation of cells, consequently increasing root size. The present results are in line with those obtained by Ramadan (2005), El-Geddawy *et al*. (2006), Nemeat Alla *et al*. (2007), Monreala *et al*. (2007), Seadh *et al*. (2007), Seadh (2008).

Significant differences in all yield quality determinations were noticed due nitrogen fertilizer levels in both growing seasons (Table 3). The highest values of TSS % were obtained by application of 120 kg N/fed in the first and second seasons. However, the highest means of sucrose % and apparent purity % were resulted from control treatment (0 kg N/fed) in the two growing seasons. The decrease in quality parameters due to excessive nitrogen application can be ascribed to its role in increasing root weight and diameter, tissue water content as well as increasing non-sucrose substances such as proteins and alpha amino acid, and hence decreasing sucrose content in roots. Confirming this conclusion El-Hawary (1999), El-Harriri and Gobarh (2001), Monreala *et al*. (2007) and Seadh (2008).

Nitrogen fertilizer levels caused significant effect on all yield characters in the two growing seasons (Table 4). The highest values of root (30.428 and 30.541t/fed) and sugar yield (5.609 and 5.631t/fed) were produced from fertilizing beet plants with 120 kg N/fed in the first and second seasons, respectively. However, application of 80 kg N/fed induced the best root and sugar yields/fed after formerly nitrogen level in both seasons. The lowest values of root and sugar yields/fed were obtained from control treatment (0 kg N/fed) in the two growing seasons. The increase in yield characters due to application of nitrogen fertilization can be explained through the fact that nitrogen has a vital role in building up metabolites, activating enzymes and enhanced root length, diameter as well as root fresh weight and finally root and sugar yields per unit area. Seadh (2008), Shewate *et al*.

(2008), Zhang *et al*. (2009), El-Sarag (2009) and Attia *et al*. (2011) recorded similar tendency.

C- Effect of interaction:

The interaction between both studied factors (biofertilization treatments and nitrogen fertilizer levels) had a significant effect on all studied characters in the two growing seasons. We have reported enough the interaction with regard root and sugar yields only.

The effect of the interaction between biofertilization treatments X nitrogen fertilizer levels on root and sugar yields was significant in the two growing seasons (Table 5).

Table 5: Root and sugar yields/fed as affected by the interaction between bio-fertilization treatments and nitrogen fertilizer levels during 2007/2008 and 2008/2009 seasons.

Characters N-levels *Bio-fertilization*	Root yield (t/fed)				Sugar yield (t/fed)			
	0 kg N/fed	40 kg N/fed	80 kg N/fed	120 kg N/fed	0 kg N/fed	40 kg N/fed	80 kg N/fed	120 kg N/fed
2007/2008 season								
1- Without	7.803	11.704	16.386	21.293	1.451	2.154	2.666	3.371
2- Microbeen	8.895	13.342	18.681	24.282	1.912	2.842	3.568	4.573
3- Rhizobacterin	13.020	19.535	26.992	34.647	2.851	4.239	5.210	6.317
4- Phosphorien	8.549	12.824	17.950	23.937	1.864	2.766	3.416	4.261
5-Microbeen+ rhizobacterin	13.487	20.267	27.477	34.757	3.021	4.418	5.349	6.419
6-Microbeen+ phosphorien	13.207	20.020	27.098	34.664	2.918	4.351	5.231	6.402
7-Rhizobacterin+ phosphorien	13.393	20.048	27.375	34.729	2.987	4.357	5.284	6.366
8-Microbeen+ rhizobacterin+ phosphorien	15.521	21.756	27.860	35.112	3.694	4.808	6.073	7.164
F. test	*				*			
LSD at 5 %	1.330				0.264			
2008/2009 season								
1- Without	7.980	11.975	16.766	21.796	1.455	2.171	2.699	3.437
2- Microbeen	8.745	13.123	18.372	23.884	1.863	2.646	3.491	4.442
3- Rhizobacterin	13.029	19.553	27.095	34.701	2.862	4.145	5.211	6.501
4- Phosphorien	9.025	13.538	18.953	24.639	1.934	2.753	3.614	4.583
5-Microbeen+ rhizobacterin	13.776	20.664	27.263	34.823	3.113	4.408	5.271	6.547
6-Microbeen+ phosphorien	13.393	20.090	26.983	34.720	2.973	4.272	5.199	6.492
7-Rhizobacterin+ phosphorien	13.515	20.281	27.222	34.673	3.000	4.327	5.254	6.449
8-Microbeen+ rhizobacterin+ phosphorien	15.969	23.963	29.941	35.093	3.795	5.152	5.719	6.597
F. test	*				*			
LSD at 5 %	1.162				0.215			

The optimum treatment that produced the highest values of root and sugar yields was utilization the mixture of Microbeen + Rhizobacterin + Phosphorien beside mineral fertilizing beets plants with 120 kg N/fed, where its results were 35.112 and 35.093 t/fed, 7.164 and 6.597 t/fed in the first and second seasons, respectively. It was followed by the treatment of using the mixture of Microbeen + Rhizobacterin and 120 kg N/fed with without any significant differences in both growing seasons. Whereas, the lowest values of root yield (7.803 and 7.980 t/fed) and (1.451 and 1.455 t/fed) were resulted from control treatment of both factors (without biofertilization and nitrogen fertilizer) in the first and second seasons, respectively.

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تأثير التسميد الحيوى والمعدنى على المحصول وصفات جودة بنجر السكر

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أجريت تجربتان حقليتان بمحطة البحوث الزراعية بكفر الحمام – مركز الزقازيق – محافظة الشرقية خلال موسمى2006/2007 و2007/2008 بهدف دراسة تأثير معاملات التسميد الحيوى ومستويات التسميد النيتروجينى على صفات الجودة والمحصول فى بنجر السكر صنف بلينو. ويمكن تلخيص أهم النتائج المتحصل عليها فيما يلى:

1- أدت معاملة التسميد الحيوى بخليط من كل من الميكروبين و الريزوباكترين والفوسفورين إلى الحصول على أعلى القيم لجميع الصفات تحت الدراسة فى كلا الموسمين. أما المعاملة بخليط الميكروبين والريزوباكترين أوخليط الريزوباكترين والفوسفورين فقد جاءت فى المرتبة الثانية والثالثة على الترتيب من حيث تأثيرهما على صفات الجودة والمحصول ومكوناته تحت الدراسة فى كلا الموسمين.

2- نتجت أعلى القيم لصفات طول وقطر الجذر ، الوزن الغض للجذر والعرش والنسبة المئوية للمواد الكلية الصلبة الذائبة (TSS %) ومحصولى الجذور والسكر للفدان عند التسميد المعدنى لبنجر السكر بمعدل 120 كجم نيتروجين/فدان فى كلا موسمى الزراعة. بينما أعلى القيم لصفتى النسبة المئوية للسكروز والنقاوة فقد تم الحصول عليهما من معاملة المقارنة (بدون تسميد نيتروجينى) فى كلا موسمى الزراعة.

3- أظهر التفاعل بين معاملات التسميد الحيوى ومستويات السماد النيتروجينى تأثيراً معنوياً على جميع الصفات تحت الدراسة فى كلا موسمى الزراعة.

عموماً يوصى بالتسميد الحيوى بخليط من كل من الميكروبين و الريزوباكترين والفوسفورين بالإضافة إلى التسميد النيتروجينى المعدنى بـمعدل 120 كجم نيتروجين/فدان للحصول على أعلى إنتاجية لمحصول بنجر السكر تحت ظروف محافظة الشرقية.

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