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RESPONSE OF SOME SUGAR BEET VARIETY TO NITROGEN AND BIO-FERTILIZATION UNDER ASSIUT GOVERNORATE CONDITIONS

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ABSTRACT

Two field experiments were carried out in ٢٠٠٨/٢٠٠٩ and ٢٠٠٩/٢٠١٠ growing seasons at the Experimental Farm of the Faculty of Agriculture, Al-Azhar University, Assiut Governorate to study the response of two mult-germ of sugar beet varieties (Ras poly & Nejma) to different nitrogen fertilizer rates (٦٥, ٨٠, and ٩٠ kg N/fed.) and application of bio-fertilizers (control, Nitrobiene and EM). The experiments were performed in a split-split plot design where sugar beet varieties were assigned to the main plot while nitrogen rates and bio-fertilizers were distributed randomly in the sub and sub-sub plot, respectively.

The obtained results showed that sugar beet varieties exhibited significant differences in root diameter, leaves fresh weight, top yield and root yield in both seasons, except root fresh weight and total soluble solids (TSS) in the first season only and sucrose percentage in the second season only, while, root length and purity percentage not significant in both seasons. Plants of Ras poly were superior significantly than Nejma in all studied traits.

The data indicated that root length, root diameter, leaves fresh weight, root fresh weight, top yield and root

yield were significantly increased by increasing nitrogen fertilizer rates from ٦٥ to ٨٠ or ٩٠ kg N/fed. application of ٨٠ kg N/fed. gave the heights total soluble solids and sucrose percentages in both seasons and juice purity percentage in the first season only, while application of ٩٠ kg N/fed. gave the heights juice purity percentage in the second season only.

Results indicated that root length, root diameter, leaves fresh weight, root fresh weight, top yield, root yield and sucrose percentage were significantly increased by effective microorganism (EM) in both seasons, while total soluble solids and juice purity percentages increased in the first season only, while application of Nitrobiene gave the heights total soluble solids and juice purity percentages in the second season only.

The interaction between sugar beet varieties and nitrogen fertilizer rates was significant on leaves and root fresh weight, total soluble solids (TSS %), sucrose percentage and purity percentage in both seasons. The interaction between sugar beet varieties and bio-fertilizers were significant on sucrose percentage in two seasons and root length, root fresh weight and root yield in the second season only. The interaction between nitrogen fertilizer and bio-fertilizers was significant on root length, leaves and root per plant, top yield/ fed. and sucrose percentage in both seasons. The second order interaction exerted a significant influence on root fresh weight per plant, top yield/fed., TSS and sucrose percentage in both seasons and root length, leaves fresh weight per plant and purity percentage in the second season only.

INTRODUCTION

The importance of sugar beet (*Beta vulgaris* L.*)* is confined to sugar production and it's by products which are used for alcohol production and feed for livestock. Higher root yield its final goal of many factors including rarity and nitrogen fertilization with regard to bio-fertilizers. In Egypt, sugar beet could be cultivated in the newly reclaimed soil according to agricultural view. Planting of sugar beet is advised to be from the ١st of October till the third week of November. To match the environmental conditions of its origin, on other hand, the economical operating of sugar beet factory dictates that its running period should be within ٤-٦ months. Fadel (٢٠٠٢) mentioned that Viz H poly significantly surpassed Pamela and Gazelle varieties on the yield and yield component characters (root diameter, root fresh weight, top yield and root yield) and chemical characters (TSS, sucrose and purity percentages). Abo El-Ghait and Mohamed (٢٠٠٥) showed that the examined sugar beet varieties significantly varied in root fresh weight/plant, root yield in the first season only. However, they did not differ significantly in root length as well as purity percentage in both seasons. Mekdad (٢٠٠٧) indicated that highly significant and significant varietals differences were recorded to root length in the first season and leaves fresh weight per plant in the second season, respectively. Oscar poly variety produced significantly higher root length than the other varieties with exception of Hi poly ٢ and Gazelle but tended to give low value for leaves fresh weight. Khalifa (٢٠٠٩) found that sugar beet varieties had insignificant effect on root length in both seasons. Badr (٢٠٠٩) indicated that Farida cultivar significantly exceeded Athos poly in root yield in the first season.

Nitrogen fertilization is one of the most important factors affecting the yield of all field crops and it plays an important role in plant growth. It is considered the indispensable element for several vital functions in the plant. Shalaby (١٩٩٨) revealed that application of ٩٠ kg N/fed increased root length, root diameter and root fresh weight. The juice quality parameters (TSS, sucrose and purity percentages) recorded the highest values by application of ٧٥ kg N/fed yield parameters (root yield and top yield) recorded significant increment by increasing N fertilizers from ٦٠ kg to ٩٠ kg/fed. Ibrahim *et al*. (٢٠٠٥) found that increasing nitrogen levels from ٦٠ up to ١٢٠kg N/fed resulted in significant increases in root length, root diameter, root weight and leaves fresh weight as well as root yield, sucrose and purity percentages in both seasons. El-Geddawy *et al*. (٢٠٠٦) found that increasing N dose from ٦٠ up to ١٠٠ kg /fed significantly increased root length and root diameter as well as root and top yield, while sucrose, total soluble solids and purity percentages were significantly decreased. Ouda (٢٠٠٧) showed that increasing N level up to ٨٠ kg N/fed increased root length, root diameter, root weight, top weights /plant (gm), top yield, root yield and sugar yields ton /fed. Nemeat-Alla *et al*. (٢٠٠٩) deduced that application of ٩٥ kg N/fed recorded highest value in quantity characteristics (root diameter and root length) and quality parameters (TSS%, sucrose and purity percentages) in both seasons.

Bio-fertilizers drew the attention as an alternative to nitrogen fertilizer application. In addition, bio-fertilizers have many merits in supplying part of the plant nitrogen requirement that could be reaching to ٢٥ %. It also helps in increasing the availability of nutrients, reduce environmental pollution due to the over use of mineral fertilizers, control the vegetative growth and improve the yield potential. The benefits of effective microorganism (EM) consist of mixed cultures of beneficial and natural occurring microorganisms that can be applied as inoculants to increase the microbial diversity of soils and plants. Hassanein and Hassouna (٢٠٠٠) showed that sugar beet seed bio-fertilization significantly increased yield traits i.e. root and top yields. Medani *et al.* (٢٠٠٠) showed that minor differences in all morphological characters especially in root length between plants treated with N at the complete dose and those received two-thirds in combination with bio-fertilizers. Similar effects were found in root yield per plant. Kandil *et al*. (٢٠٠٢_a) deduced that, root fresh weight and leaves fresh weight in both seasons were significantly affected by bio-fertilization treatments and showed that the highest measurements were achieved from treating beet seeds with Rhizobacterin. Kandil *et al*.(٢٠٠٢$_b$) showed that treated sugar beet seeds with bio-fertilization i.e. Serialline and Rhizobacterin caused significant increase of all yield components (root length, root diameter, root fresh weight and leaves fresh weight) in the second season only, yield quality characters (TSS%, sucrose and juice purity percentages) and yield characters (root and top yields ton/fed). Ramadan *et al*. (٢٠٠٣) indicated that bio-fertilization treatments showed insignificant effect on sucrose and purity percentages in both seasons. Sucrose and purity percentages which were decreased significantly in the first season. Ouda (٢٠٠٧) showed that serialine application had improved the parameters of single root, root yield (ton / fed) and top yield (ton / fed). The objective of the present works to study the response of two-sugar beet cultivars to three levels nitrogen and bio-fertilization under Assiut, condition.

MATERIALS AND METHODS

Two field experiments were carried out at the Agriculture Experimental Farm of AL-Azhar University, Assuit during ٢٠٠٨/٢٠٠٩ and ٢٠٠٩/٢٠١٠ seasons to study the effect of bio-fertilizations and nitrogen on growth, yield and quality of two sugar beet cultivars. Each experiment included ١٨ treatments which were combinations of two sugar beet cultivars, three bio-fertilizations treatments and three N-fertilizations levels.

١- Sugar beet cultivars:

A: Ras poly. B: Nejma.

٢- N-fertilizations levels:

A: ٦٥ kg N/fed. B: ٨٠ kg N/fed. C: ٩٠kg N/fed.

٣- bio-fertilization:

A: Control. B: Nitrobiene. C: Effective microorganism (EM).

The experiment was designed as randomized complete block with split–split plot arrangement of treatments with three replications.

Sugar beet cultivars were assigned to the main plot, nitrogen fertilization levels were distributed randomly in the sub plots and bio-fertilization were located in the sub–sub plots. The experimental unit area was ١٠.٥m٢ (١/٤٠٠fed) (one fadden = ٤٢٠٠m٢.). Seed were sown on October, ١٥ and ٢٠ in ٢٠٠٨ and ٢٠٠٩ seasons, respectively. The preceding summer crop was maize in both seasons. The physical and chemical analyses of the experimental site are presented in Table (١)

Table ١: Some physical and chemical analysis of soil field experiments

Characteristics Physical analysis	٢٠٠٨/٢٠٠٩	٢٠٠٩/٢٠١٠	Characteristics Chemical analysis	٢٠٠٨/٢٠٠٩	٢٠٠٩/٢٠١٠
Sand (%)	٢٥.٧١	٢٦.٩٠	Organic matter (%)	٠.٩٣	١.١٠
Silt (%)	٣٩.٥٠	٣٨.١٠	Available N (ppm)	٦٤.٥٠	٧٠.٢٥
Clay (%)	٣٤.٧٩	٣٥.٠٠	Available P(ppm)	٩.١٧	١٠.٣٠
Soil texture	Clay loam		Available K (ppm)	٣٤٨.٣٠	٣٥٥.٠٠
			Ph (sp. m-١)	٧.٩٠	٨.٠١
			E.C. (ds. m-١)	١.١٥	١.١٦
			Total CaCo٣ (%)	٢.٩٠	٢.٤٢

Effect of nitrogen and biofertilization on sugar beet

Seed inoculation was carried out using the biofertilizers, Nitrobiene (produced by Ministry of Agriculture, Egypt).The N-fixer bacteria (Nitrobiene) *Azotobacter sp.* and *Azospirillium*. Inoculations were performed by mixing seeds with the appropriate amounts of Nitrobiene (٦٠٠ g/fed.) using Arabic gum as adhesive material. The coated seeds were air dried in the shade for ٣٠ minutes and sown immediately. Effective microorganism (EM) is a natural combination of beneficial microbes is being used in agriculture, horticulture and waste management. Effective microorganism (EM) was provided from the Ministry of environment.

Table ٢: The main species included in Effective micro-organisms (EM).

Effective micro-organisms (EM)	
Lactic acid bacteria: **Lactobacillus plantarum** **Lactobacillus casei** **Streptococcus lactis** **Photosynthic bacteria:** **Rhodopseudomonas palustris** **Radobacter sphaeraides** **Yeasts:** **Saccharomyces cerevisiae**	**actiomycetes:** **Streptomyces albus** **Streptomyces griseus** **Fungi:** **Aspergillus oryze** **Types of microorganism:**

Bio-fertilizer effective microorganism (EM) at the rate of ٤L/fed. was applied with irrigation water and divided into four equal doses. The first one was applied with irrigation water at planting stage, while the other added after ٢٠ days from sowing the plants.

Calcium super phosphate (١٥.٥٪ $P_٢O_٥$) fertilizer at a rate of ١٠٠ kg /fed and potassium sulphate (٤٨% $K_٢O$) at a rate of ٥٠ kg /fed. were added to the soil before sowing. The studied nitrogen fertilizer levels in the form of ammonium nitrate (٣٣.٥٪) were applied according to each level in two equal splits in both seasons after thinning and before the third irrigation. Beet plants were thinned in two times i.e. ٢٥ and ٣٥ days after sowing to let one plant/hill.

A- Yield and yield component characters:

At harvest (١٨٠ days after sowing) five plants were randomly chosen from the outer ridges of each sub-sub plot to estimate yield components characters as follows:

١ - Root length (cm). ٢ - Root diameter (cm).

٣- Leaves fresh weight (g /plant). ٤- Root fresh weight (g/ plant**).**

At harvest time sugar beet plants from the two inner ridges of each sub- sub plot were collected, roots and tops were separated and weighed in kg, then converted to estimate.

٥-Top yield (ton/fed.). ٦- Root yield (ton/fed.).

B- Chemical component and quality:

١- Total soluble solids (TSS %) of roots, it was measured in juice of fresh root using hand refractometer.

٢- Sucrose %, which was determined according to Le-Decote (١٩٢٧).

٣- Juice purity%, it was calculated according to using the following equation:-

$$\text{Juice purity \%} = \frac{\text{Sucrose \%}}{\text{TSS \%}} \times ١٠٠$$

Statistical analysis:

The results were statistically analyzed according to Gomez and Gomez (١٩٨٤) using the computer MSTAT-C statistical analysis package by Freed *et al.* (١٩٨٩). The least significant differences (LSD) test at probability level of ٠.٠٥ was manually calculated compare the differences among means.

RESULTS AND DISCUSSION

Yield and yield components:-

Root length (cm).

The data in Table ٣ indicate that cultivars had no significant differences in root length in both seasons. Nejma cultivar surpassed Ras poly cultivar in root length in the first season, while, Ras poly cultivar surpassed Nejma cultivar in root length in the second season. These results agree with those obtained by Saif (٢٠٠٠) Abo El-Ghait and Mohamed (٢٠٠٥) and Khalifa (٢٠٠٩) who reported that root length was not significantly affected by cultivars.

It is clear from the data that root length significantly increased by nitrogen application to sugar beet plants in both seasons. The highest values of root length (٣٨.٤١ and ٣٧.٥٣ cm) were obtained when nitrogen was applied at its highest rate (٩٠ kg N/fed.) in both seasons. In general, the increase in root length may be due to cell division and elongation for the promotion of N on meristimic activity of plant. These results are in line with those obtained by Shalaby (١٩٩٨) Hasan (٢٠٠٠) El- Sayed (٢٠٠٥) Ibrahim *et al*. (٢٠٠٥) and Nemeat-Alla *et al*. (٢٠٠٩) who reported that root length was significantly affected by different nitrogen rates.

Table ٣: Effect of different nitrogen rates and bio-fertilizers on root length (cm) of two sugar beet cultivars in ٢٠٠٨/٢٠٠٩ and ٢٠٠٩/٢٠١٠ seasons.

Seasons		٢٠٠٨/٢٠٠٩				٢٠٠٩/٢٠١٠			
Cultivars	N levels (kg/fed.)	Bio-fertilizer			Mean	Bio-fertilizer			Mean
		Cont.	Nitrob.	EM		Cont.	Nitrob.	EM	
Ras poly	٦٥	٣٤.٩٣	٣٦.٥٣	٣٨.٧٣	٣٦.٧٣	٣٤.٧٠	٣٧.٤٠	٣٧.٨٠	٣٦.٦٣
	٨٠	٣٧.١١	٣٧.٩٣	٣٨.٧٢	٣٧.٩٢	٣٦.٨٠	٣٦.٦٠	٣٧.٤٠	٣٦.٩٣
	٩٠	٣٧.٦٥	٣٨.٣٣	٣٨.٧٤	٣٨.٢٤	٣٦.٢٠	٣٧.٣٠	٣٨.٧٠	٣٧.٤٠
Mean		٣٦.٥٦	٣٧.٦٠	٣٨.٧٣	٣٧.٦٣	٣٥.٩٠	٣٧.١٠	٣٧.٩٧	٣٦.٩٩
Nejma	٦٥	٣٥.٨٥	٣٦.٤٤	٣٨.٠٥	٣٦.٧٨	٣٤.٦٠	٣٥.٣٠	٣٧.٢٠	٣٥.٧٠
	٨٠	٣٨.٠٢	٣٧.٦١	٣٨.٣٦	٣٨.٠٠	٣٦.٩٠	٣٦.٨٠	٣٧.١٠	٣٦.٩٣
	٩٠	٣٨.٢٣	٣٨.٧٧	٣٨.٧٤	٣٨.٥٨	٣٧.٥٠	٣٧.٦٠	٣٧.٩٠	٣٧.٦٧
Mean		٣٧.٣٧	٣٧.٦١	٣٨.٣٨	٣٧.٧٩	٣٦.٣٣	٣٦.٥٧	٣٧.٤٠	٣٦.٧٧
Mean for N-levels	٦٥	٣٥.٣٩	٣٦.٤٩	٣٨.٣٩	٣٦.٧٦	٣٤.٦٥	٣٦.٣٥	٣٧.٥٠	٣٦.١٧
	٨٠	٣٧.٥٧	٣٧.٧٧	٣٨.٥٤	٣٧.٩٦	٣٦.٨٥	٣٦.٧٠	٣٧.٢٥	٣٦.٩٣
	٩٠	٣٧.٩٤	٣٨.٥٥	٣٨.٧٤	٣٨.٤١	٣٦.٨٥	٣٧.٤٥	٣٨.٣٠	٣٧.٥٣
Mean		٣٦.٩٧	٣٧.٦٠	٣٨.٥٦	٣٧.٧١	٣٦.١٢	٣٦.٨٣	٣٧.٦٨	٣٦.٨٨

L.S.D. at ٥٪ for

Cultivars(C)	NS	NS
Nitrogen (N)	٠.٨٥	٠.٢١
Bio-fertilizers (B)	٠.٥٢	٠.٢٩
C x N	NS	٠.٣٠
C × B	NS	٠.٤١
N × B	٠.٩٠	٠.٥٠
C × N × B	NS	٠.٧١

The application of bio-fertilizers to sugar beet plants exerts a significant influence on root length in both seasons. In general, root length was high when effective microorganism (EM) was applied to sugar beet plants compared to the control. Effective microorganism (EM) was more superior in increasing root length than Nitrobiene. This increase may be due to the fact that this component increased the fixed nitrogen by bacteria present in such materials and consequently, increase the activity of merestimats tissues. This leads to more growth and consequently accumulation of more photosynthesis assimilates. These results are in accordance with those obtained by Medani *et al.* (٢٠٠٠) and Kandil *et al*. (٢٠٠٢b).

The data presented in Table ٣ show that root length per plant was significantly affected by the interaction between cultivars and nitrogen in ٢٠٠٩/٢٠١٠ season only, where the highest value (٣٧.٦٧ cm) was obtained from Nejma cultivar received ٩٠ kg N/fed. Also root length per plant was significantly affected by the interaction between cultivars and bio-fertilizers in the second season only, where the highest value (٣٧.٩٧) was obtained when Ras poly cultivar treated with effective microorganism (EM). Root length was significantly affected by the interaction between nitrogen and bio-fertilizers in both seasons. The highest values (٣٨.٧٤ and ٣٨.٣٠ cm) were obtained in plants received ٩٠ kg N/fed., and treated with effective microorganism (EM) in both seasons, respectively. The second order interaction was significantly in ٢٠٠٩/٢٠١٠ season only, where the highest value (٣٨.٧٠ cm) was obtained from Ras poly cultivar fertilized by ٩٠ kg N/fed., and treated with effective microorganism (EM).

Root diameter (cm).

The data presented in Table ٤ show that root diameter was significantly affected by cultivars in both seasons. Ras poly had higher root diameter than Nejma cultivar in both seasons. The difference between the two sugar beet varieties of root diameter could be due to the variation in the gene make-up and their response to the environmental conditions. These results agree with those obtained by Sharif and Eghbal (١٩٩٤) Fadel (٢٠٠٢) Osman (٢٠٠٥) and Khalifa (٢٠٠٩).

The data revealed that increasing nitrogen fertilizer rates increased root diameter in both seasons, where the highest values (١٠.٩٥ and ١٠.١٧ cm) were obtained when nitrogen was applied at a rate of ٩٠ kg N/fed. in both seasons, respectively. The pronounced effect of nitrogen fertilizer on root diameter may be due to its distinct effect of nitrogen on cell size and number of cells and consequently root diameter increased. The previous results are in accordance with those reported by Azzazy (١٩٩٨), Abd El-Moneim (٢٠٠٠), Hasan (٢٠٠٠) ,Abo El-Ghait and Mohamed (٢٠٠٥), Ismail and Abo EL- Ghait (٢٠٠٥) Ouda (٢٠٠٧) and Nemeat-Alla *et al*. (٢٠٠٩).

Table ٤: Effect of different nitrogen rates and bio-fertilizers on root diameter (cm) of two sugar beet cultivars in ٢٠٠٨/٢٠٠٩ and ٢٠٠٩/٢٠١٠ seasons.

Seasons		٢٠٠٨/٢٠٠٩				٢٠٠٩/٢٠١٠			
Cultivars	N levels (kg/fed.)	Bio-fertilizer			Mean	Bio-fertilizer			Mean
		Cont.	Nitrob.	EM		Cont.	Nitrob.	EM	
Ras poly	٦٥	٨.٩٠	١٠.٢٠	١١.١٠	١٠.٠٧	٨.٣٠	٩.٣٠	١٠.٠٠	٩.٢٠
	٨٠	٩.٥٠	١٠.٩٠	١١.٨٠	١٠.٧٣	٩.٠٠	٩.٩٠	١٠.٦٠	٩.٨٣
	٩٠	٩.٩٠	١١.٣٠	١١.٧٠	١٠.٩٧	٩.٠٠	١٠.٧٠	١١.١٠	١٠.٢٧
Mean		٩.٤٣	١٠.٨٠	١١.٥٣	١٠.٥٩	٨.٧٧	٩.٩٦	١٠.٥٧	٩.٧٧
Nejma	٦٥	٨.٥٠	٩.٧٠	١٠.٤٠	٩.٥٣	٧.٦٠	٨.٣٠	٩.٧٠	٨.٥٣
	٨٠	٨.٩٠	١٠.٢٠	١٠.٨٠	٩.٩٧	٨.٠٠	٩.٢٠	٩.٨٠	٩.٠٠
	٩٠	١٠.٠٠	١١.١٠	١١.٧٠	١٠.٩٣	٩.١٠	١٠.٣٠	١٠.٨٠	١٠.٠٧
Mean		٩.١٣	١٠.٣٣	١٠.٩٧	١٠.١٤	٨.٢٣	٩.٢٧	١٠.١٠	٩.٢٠
Mean for N-levels	٦٥	٨.٧٠	٩.٩٥	١٠.٧٥	٩.٨٠	٧.٩٥	٨.٨٠	٩.٨٥	٨.٨٧
	٨٠	٩.٢٠	١٠.٥٥	١١.٣٠	١٠.٣٥	٨.٥٠	٩.٥٥	١٠.٢٠	٩.٤٢
	٩٠	٩.٩٥	١١.٢٠	١١.٧٠	١٠.٩٥	٩.٠٥	١٠.٥٠	١٠.٩٥	١٠.١٧
Mean		٩.٢٨	١٠.٥٧	١١.٢٥	١٠.٣٧	٨.٥٠	٩.٦٢	١٠.٣٣	٩.٤٨

L.S.D. at ٥٪ for

Cultivars(C)	٠.٣٤	٠.٣٦
Nitrogen (N)	٠.٤٣	٠.٢٩
Bio-fertilizers (B)	٠.٢٩	٢.٠٩
C x N	NS	NS
C × B	NS	NS
N × B	NS	NS
C × N × B	NS	NS

The application of bio-fertilizers to sugar beet plants exerts a significant influence on root diameter in both seasons. In general, root diameter increased when effective microorganism (EM) was applied to sugar beet plants compared to the control. Effective microorganism (EM) was more superior in increasing root diameter than Nitrobiene. The beneficial effect of bio-fertilizers on root diameter is attributed to the more growth of plants and amount of metabolites synthesized by plant and to the role of bio-fertilizers in availability of nutrients. These results are in line with those obtained by Kandil *et al*. (٢٠٠٢b).

Data in the same table show that the interaction effects between any two factors and the three factors under study were not significant on root diameter in both seasons.

Leaves fresh weight (g /plant).

The data presented in Table ٥ show that leaves fresh weight significantly affected by cultivars in both seasons. Ras poly had higher leaves fresh weight than Nejma cultivar in both seasons. The difference between the two sugar beet varieties of leaves fresh weight could be due to the variation in the gene make-up and their response to the environmental conditions. These results agree with those obtained by Saif (٢٠٠٠), Fadel (٢٠٠٢), Mekdad (٢٠٠٧) and Khalifa (٢٠٠٩).

The data revealed that increasing nitrogen fertilizer rates increased leaves fresh weight in both seasons, where the highest values (٤٤٢.١٢ and ٣٥٨.٦٥ g/plant) were obtained when nitrogen was applied at a rate of ٩٠ kg N/fed., in both seasons. The increase of leaves fresh weight may be due to the role of nitrogen in leaf initiation increment chlorophyll concentration in leaves and photosynthesis process which led to improve growth and leaf canopy. The results are in accordance with those reported by Ibrahim *et al*. (٢٠٠٥), Mohamed (٢٠٠٥), El-Sheref (٢٠٠٦) and Abdel-Motagally and Attia (٢٠٠٩).

The application of bio-fertilizers to sugar beet plants exerts a significant influence on leaves fresh weight in both seasons. In general, leaves fresh weight was high when effective microorganism (EM) was applied to sugar beet plants compared to the control.

Table ٥: Effect of different nitrogen rates and bio-fertilizers on leaves fresh weight (g/plant) of two sugar beet cultivars in ٢٠٠٨/٢٠٠٩ and ٢٠٠٩/٢٠١٠ seasons.

Seasons		٢٠٠٨/٢٠٠٩				٢٠٠٩/٢٠١٠			
Cultivars	N levels (kg/fed.)	Bio-fertilizer			Mean	Bio-fertilizer			Mean
		Cont.	Nitrob.	EM		Cont.	Nitrob.	EM	
Ras poly	٦٥	٣٠١.٥٠	٣٤٣.٠٠	٣٧٦.٣٠	٣٤٠.٢٧	٢٩٣.٩٠	٣٠٩.٥٠	٣٣٦.٧٠	٣١٣.٣٧
	٨٠	٣٥٣.١٠	٣٩١.٧٠	٤٠٩.٥٠	٣٨٤.٧٧	٣٢٠.٢٠	٣٧٠.٥٠	٣٧٣.١٠	٣٥٤.٦٠
	٩٠	٤٤٩.٥٠	٤٧٣.٠٠	٤٨٩.٥٠	٤٧٠.٦٧	٣٣٤.٢٠	٣٥٦.٧٠	٣٧٣.٩٠	٣٥٤.٩٣
Mean		٣٦٨.٠٣	٤٠٢.٥٧	٤٢٥.١٠	٣٩٨.٥٧	٣١٦.١٠	٣٤٥.٥٧	٣٦١.٢٣	٣٤٠.٩٧
Nejma	٦٥	٢٧٨.٠٠	٣١٤.٩٠	٣٤٦.٩٠	٣١٣.٢٧	٢٧٥.٦٠	٢٨٧.٠٠	٣٠٣.٦٠	٢٨٨.٧٣
	٨٠	٣٢٩.٤٠	٣٥٧.٢٠	٣٧٨.٦٠	٣٥٥.٠٧	٣١١.٤٠	٣٣٤.٨٠	٣٤٧.٢٠	٣٣١.١٣
	٩٠	٣٩٧.١٠	٤١٠.٦٠	٤٣٣.٠٠	٤١٣.٥٦	٣١٦.٣٠	٣٧٨.٠٠	٣٩٢.٨٠	٣٦٢.٣٧
Mean		٣٣٤.٨٣	٣٦٠.٩٠	٣٨٦.١٧	٣٦٠.٦٣	٣٠١.١٠	٣٣٣.٢٧	٣٤٧.٨٧	٣٢٧.٤١
Mean for N-levels	٦٥	٢٨٩.٧٥	٣٢٨.٩٥	٣٦١.٦٠	٣٢٦.٧٧	٢٨٤.٧٥	٢٩٨.٢٥	٣٢٠.١٥	٣٠١.٠٥
	٨٠	٣٤١.٢٥	٣٧٤.٤٥	٣٩٤.٠٥	٣٦٩.٩٢	٣١٥.٨٠	٣٥٢.٦٥	٣٦٠.١٥	٣٤٢.٨٧
	٩٠	٤٢٣.٣٠	٤٤١.٨٠	٤٦١.٢٥	٤٤٢.١٢	٣٢٥.٢٥	٣٦٧.٣٥	٣٨٣.٣٥	٣٥٨.٦٥
Mean		٣٥١.٤٣	٣٨١.٧٣	٤٠٥.٦٣	٣٧٩.٦٠	٣٠٨.٦٠	٣٣٩.٤٢	٣٥٤.٥٥	٣٣٤.١٩

L.S.D. at ٥٪ for

	٢٠٠٨/٢٠٠٩	٢٠٠٩/٢٠١٠
Cultivars(C)	٩.٦٨	٧.٩٥
Nitrogen (N)	٨.٥١	٦.٣٢
Bio-fertilizers (B)	٤.٣٩	٦.٦٢
C x N	١٢.٠٣	٨.٩٤
C × B	NS	NS
N × B	٧.٦٠	١١.٤٩
C × N × B	NS	١٦.٢٠

Effective microorganism (EM) was superior in increasing leaves fresh weight than Nitrobiene. This increase may be due to the fact that this component increased the fixed nitrogen by bacteria consequently, increase the activity of merestimats tissues of leaves fresh weight. These results are in line with those obtained by Kandil *et al*. (٢٠٠٢a).

The data revealed that leaves fresh weight was significantly affected by the interaction between cultivars and nitrogen in both seasons, where the highest value (٤٧٠.٦٧ g/plant) was obtained from Ras poly cultivar when received ٩٠ kg N/fed. in the first season. The highest value (٣٦٢.٣٧ g/plant) was obtained from Nejma cultivar when received ٩٠ kg N/fed. in the second season. Also, leaves fresh weight was significantly affected by the interaction between nitrogen and bio-fertilizers in both seasons, where the highest values (٤٦١.٢٥ and ٣٨٣.٣٥ g/plant) were obtained when plants received ٩٠ kg N/fed. and treated with effective microorganism (EM) in both seasons, respectively. The second order interaction was significant in ٢٠٠٩/٢٠١٠ season only, where the highest value (٣٩٢.٨٠ g/plant) was obtained from Nejma cultivar received ٩٠ kg N/fed., and treated with effective microorganism (EM).

Root fresh weight (g /plant).

Results in Table ٦ show that root fresh weight significantly affected by cultivars in ٢٠٠٨/٢٠٠٩ season only. Nejma cultivar had higher leaves fresh weight than Ras poly cultivar in the first season.

Table ٦: Effect of different nitrogen rates and bio-fertilizers on root fresh weight (g/plant) of two sugar beet cultivars in ٢٠٠٨/٢٠٠٩ and ٢٠٠٩/٢٠١٠ seasons.

Seasons		٢٠٠٨/٢٠٠٩				٢٠٠٩/٢٠١٠			
Cultivars	N levels (kg/fed.)	Bio-fertilizer			Mean	Bio-fertilizer			Mean
		Cont.	Nitrob.	EM		Cont.	Nitrob.	EM	
Ras poly	٦٥	٦٦٧.٨٠	٧٠٨.٩٠	٧٧٣.٠٠	٧١٦.٥٧	٦٤٦.٤٠	٦٧٧.٠٠	٦٩٣.٩٠	٦٧٢.٤٣
	٨٠	٧٥١.٠٠	٧٨٤.٢٠	٨١٠.٤٠	٧٨١.٨٧	٧٣٣.٤٠	٧٤٢.٨٠	٧٦٥.٧٠	٧٤٧.٣٠
	٩٠	٩٤٣.٠٠	٩٦٧.١٠	٩٧٦.٣٠	٩٦٢.١٣	٨٨٣.٢٠	٨٩٨.٧٠	٩١٣.٠٠	٨٩٨.٣٠
Mean		٧٨٧.٢٧	٨٢٠.٠٧	٨٥٣.٢٣	٨٢٠.١٩	٧٥٤.٣٣	٧٧٢.٨٣	٧٩٠.٨٧	٧٧٢.٦٨
Nejma	٦٥	٦٣٤.٠٠	٦٦٨.٧٠	٧١٣.٣٠	٦٧٢.٠٠	٦١٧.٧٠	٦٦٣.٢٠	٦٧١.٩٠	٦٥٠.٩٣
	٨٠	٧٩٦.٣٠	٨٢٢.٧٠	٨٨١.١٠	٨٣٣.٣٧	٧٨٣.٤٠	٧٩٦.٥٠	٨٥٣.٨٠	٨١١.٢٣
	٩٠	٨٥٤.٨٠	٨٧٣.٥٠	٨٧٩.٨٠	٨٦٩.٣٧	٨٩٣.٦٠	٨٣٠.٧٠	٩١٨.٠٠	٨٨٠.٧٧

Mean		٧٦١.٧٠	٧٨٨.٣٠	٨٢٤.٧٣	٧٩١.٥٩	٧٦٤.٩٠	٧٦٣.٤٦	٨١٤.٥٧	٧٨٠.٩٨
Mean for N-levels	٦٥	٦٥٠.٩٠	٦٨٨.٨٠	٧٤٣.١٥	٦٩٤.٢٨	٦٣٢.٠٥	٦٧٠.١٠	٦٨٢.٩٠	٦٦١.٦٨
	٨٠	٧٧٣.٦٥	٨٠٣.٤٥	٨٤٥.٧٥	٨٠٧.٦٢	٧٥٨.٤٠	٧٦٩.٦٥	٨٠٩.٧٥	٧٧٩.٢٧
	٩٠	٨٩٨.٩٠	٩٢٠.٣٠	٩٢٨.٠٥	٩١٥.٧٥	٨٨٨.٤٠	٨٦٤.٧٠	٩١٥.٥٠	٨٨٩.٥٣
Mean		٧٧٤.٤٨	٨٠٤.١٨	٨٣٨.٩٨	٨٠٥.٨٨	٧٥٩.٦٢	٧٦٨.١٥	٨٠٢.٧٢	٧٧٦.٨٣

L.S.D. at ٥% for

Cultivars(C)	١٦.٦٤	NS
Nitrogen (N)	٩.٢٥	١٣.٥٤
Bio-fertilizers (B)	٤.٤١	١٠.٩٦
C x N	١٣.٠٨	١٩.١٤
C × B	NS	١٥.٥١
N × B	٧.٦٤	١٨.٩٨
C × N × B	١٠.٨١	٢٦.٨٥

These results agree with those obtained by Saif (٢٠٠٠), El- Sayed (٢٠٠٥) ,Osman (٢٠٠٥), El-Sheikh *et al*. (٢٠٠٩) and Khalifa (٢٠٠٩) .

The data revealed that increasing nitrogen fertilizer rates increased root fresh weight in both seasons, where the highest values (٩١٥.٧٥ and ٨٨٩.٥٣ g) were obtained when nitrogen was applied at a rate of ٩٠ kg N/fed. in both seasons. This may be due to the role of nitrogen in developing root dimensions by increasing division elongation cells consequently increased root fresh weight. These results are in accordance with those reported by Shalaby (١٩٩٨), Abd El- Moneim (٢٠٠٠), Mohamed (٢٠٠٥) and Nemeat-Alla *et al*. (٢٠٠٩).

The application of bio-fertilizers to sugar beet plants exerts a significant influence on root fresh weight in both seasons. In general, root fresh weight was high when effective microorganism (EM) was applied to sugar beet plants compared to the control. Effective microorganism (EM) was superior in increasing root fresh weight than Nitrobiene. This increase may be due to the fact that this componend increased fixed nitrogen by bacteria consequently, increase the activity of merestimats tissues. This lead to more growth and subsequent accumulation of more photosynthesis assimilates. These results are in line with those obtained by Kandil *et al*. (٢٠٠٢a)

The data revealed that root fresh weight was significantly affected by the interaction between cultivars and nitrogen in both seasons, where the highest values (٩٦٢.١٣ and ٨٩٨.٣٠ g/plant) were obtained from Ras poly cultivar when received ٩٠ kg N/fed., in both seasons. Also, it was significantly affected by the interaction between cultivars and bio-fertilizers in the second season only, where the highest value (٨١٤.٥٧ g/plant) was obtained when Nejma cultivar was treated with effective microorganism (EM). While, root fresh weight was significantly affected by the interaction between nitrogen and bio-fertilizers in both seasons, where the highest values (٩٢٨.٠٥ and ٩١٥.٥٠ g/plant) were obtained when ٩٠ kg N/fed., was applied and treated with effective microorganism (EM) in both season, respectively. The second order interaction was significantly in both seasons, where the highest value (٩٧٦.٣٠ g/plant) was obtained from Ras poly cultivar treated with ٩٠ kg N/fed., and effective microorganism (EM) in the first season, where the highest value (٩١٨.٠٠ g/plant) was obtained from Nejma cultivar treated with ٩٠ kg N/fed., and effective microorganism (EM) in the second season.

Top yield (ton/fed).

The data presented in Table ٧ show that top yield was significantly affected by cultivars in both seasons. Ras poly cultivar had higher top yield (١٠.٩٢ and ١٠.٧٧ ton /fed. in both seasons respectively) than Nejma cultivar. These results agree with those obtained by Sharif and Eghbal (١٩٩٤), Fadel (٢٠٠٢) Hassan *et al.* (٢٠٠٥), Mekdad (٢٠٠٧) and Khalifa (٢٠٠٩).

Table ٧: Effect of different nitrogen rates and bio-fertilizers on top yield (ton/fed.) of two sugar beet cultivars in ٢٠٠٨/٢٠٠٩ and ٢٠٠٩/٢٠١٠ seasons.

Seasons		٢٠٠٨/٢٠٠٩				٢٠٠٩/٢٠١٠			
Cultivars	N levels (kg/fed.)	Bio-fertilizer			Mean	Bio-fertilizer			Mean
		Cont.	Nitrob.	EM		Cont.	Nitrob.	EM	
Ras poly	٦٥	٧.٢٨	٨.٣١	٩.٥٥	٨.٣٨	٦.٨٩	٧.٩٣	٨.٩٥	٧.٩٢
	٨٠	٩.٢٠	١٠.١٥	١٠.٩٥	١٠.١٠	٩.٢٧	١٠.١٦	١٠.٨٢	١٠.٠٨
	٩٠	١٣.٧٨	١٤.٢٢	١٤.٨٧	١٤.٢٩	١٤.٥٤	١٣.٩٣	١٤.٤٨	١٤.٣٢
Mean		١٠.٠٩	١٠.٨٩	١١.٧٩	١٠.٩٢	١٠.٢٣	١٠.٦٧	١١.٤٢	١٠.٧٧
Nejma	٦٥	٦.١٧	٧.٢٩	٨.٠٠	٧.١٥	٧.١٨	٦.٩٤	٧.٧١	٧.٢٨
	٨٠	٨.١٠	٨.٩٦	٩.٨٥	٨.٩٧	٩.٨٨	٩.٦٣	٩.٣٧	٩.٦٢
	٩٠	١١.٩٥	١٢.٤٢	١٣.٦٧	١٢.٦٨	١١.٤٧	١٣.٥١	١٤.٦٦	١٣.٢١
Mean		٨.٧٤	٩.٥٦	١٠.٥١	٩.٦٠	٩.٥١	١٠.٠٣	١٠.٥٨	١٠.٠٤
Mean for N-levels	٦٥	٦.٧٣	٧.٨٠	٨.٧٨	٧.٧٧	٧.٠٤	٧.٤٤	٨.٣٣	٧.٦٠
	٨٠	٨.٦٥	٩.٥٦	١٠.٤٠	٩.٥٤	٩.٥٨	٩.٩٠	١٠.١٠	٩.٨٥
	٩٠	١٢.٨٧	١٣.٣٢	١٤.٢٧	١٣.٤٩	١٣.٠١	١٣.٧٢	١٤.٥٧	١٣.٧٦
Mean		٩.٤١	١٠.٢٣	١١.١٥	١٠.٢٦	٩.٨٧	١٠.٣٥	١١.٠٠	١٠.٤١

L.S.D. at ٥٪ for

	٢٠٠٨/٢٠٠٩	٢٠٠٩/٢٠١٠
Cultivars(C)	٠.١٦	٠.٤٠
Nitrogen (N)	٠.١٤	٠.٢٦
Bio-fertilizers (B)	٠.١٠	٠.٢٦
C x N	٠.٢١	NS
C × B	NS	NS
N × B	٠.١٦	٠.٤٥
C × N × B	٠.٢٢	٠.٦٣

Table ٧ shows that varying applied nitrogen levels had a significant effect on this trait in both seasons. The highest top yield values (١٣.٤٩ and ١٣.٧٦ ton/fed.) were obtained when nitrogen was applied at a rate of ٩٠ kg N/fed. in both seasons, respectively. The enhancing influence of nitrogen on top yield could be due to its distinct role as an essential constructive element of protein and chlorophyll which in turn was reflected on an increase in leaf area and weight of sugar beet plants. These results coincided with those obtained by Sharif and Eghbal (١٩٩٤), Shalaby (١٩٩٨), Hasan (٢٠٠٠), El- Sayed (٢٠٠٥) and Ouda (٢٠٠٧) who reported that top yield increased by increasing nitrogen rates.

Bio-fertilizers treatments had significant influence on top yield in both seasons. In general, top yield was high when effective microorganism (EM) was applied to sugar beet plants compared to the control. Effective microorganism (EM) was more superior in increasing top yield than Nitrobiene. In this respect, it could be concluded that inoculation of sugar beet seeds by bio-fertilizers could be recommended to obtain maximum top yield. These results are in line with those obtained by Hassanein and Hassouna (٢٠٠٠), Kandil *et al.* (٢٠٠٢b) and El-Dsouky and Attia (٢٠٠٤).

Table ٧ reveals that top yield was significantly affected by the interaction between cultivars and nitrogen fertilizer in ٢٠٠٨/٢٠٠٩ season only, where the highest value (١٤.٢٩ ton/fed.) was obtained from Ras poly cultivar when received ٩٠ kg N/fed. Also, top yield was significantly affected by the interaction between nitrogen and bio-fertilizers in both seasons, where the highest values (١٤.٢٧ and ١٤.٥٧ ton/fed.) were obtained when ٩٠ kg N/fed., was applied treated with effective microorganism (EM) in both seasons, respectively. The second order interaction was significant in both seasons, where the highest value (١٤.٨٧ ton/fed.) was obtained from Ras poly cultivar treated with ٩٠ kg N/fed. and effective microorganism (EM) in the first season. The highest value (١٤.٦٦ ton/fed.) was obtained from Nejma cultivar treated with ٩٠ kg N/fed. and effective microorganism (EM) in the second season.

Root yield (ton/fed).

Results presented in Table ٨ show that root yield was significantly affected by cultivars in both seasons. Ras poly cultivar had higher root yield (٢٦.١٤ and ٢٦.٠٢ ton /fed., respectively) than Nejma cultivar. The difference between the two sugar beet varieties of root yield could be due to the variation in the gene make-up and their response to the environmental conditions. These results are in agreement with those obtained by Abou-Salama and El-Syiad (٢٠٠٠), Saif (٢٠٠٠), Fadel (٢٠٠٢), Osman (٢٠٠٥),Badr (٢٠٠٩) and Khalifa (٢٠٠٩).

Table ٨: Effect of different nitrogen rates and bio-fertilizers on root yield (ton/fed.) of two sugar beet cultivars in ٢٠٠٨/٢٠٠٩ and ٢٠٠٩/٢٠١٠ seasons.

Seasons		٢٠٠٨/٢٠٠٩				٢٠٠٩/٢٠١٠			
Cultivars	N levels (kg/fed.)	Bio-fertilizer			Mean	Bio-fertilizer			Mean
		Cont.	Nitrob.	EM		Cont.	Nitrob.	EM	
Ras poly	٦٥	٢٣.٨٥	٢٤.٥١	٢٦.٦٠	٢٤.٩٩	٢٢.٦٢	٢٣.٣٦	٢٥.٤٩	٢٣.٨٢
	٨٠	٢٥.٩٢	٢٥.٣٦	٢٦.٠٠	٢٥.٧٦	٢٥.٦٧	٢٦.١٧	٢٦.٢٣	٢٦.٠٢
	٩٠	٢٧.٧٤	٢٧.٤١	٢٧.٩١	٢٧.٦٩	٢٧.٨٦	٢٨.٢١	٢٨.٥٣	٢٨.٢٠
Mean		٢٥.٨٤	٢٥.٧٦	٢٦.٨٤	٢٦.١٤	٢٥.٣٨	٢٥.٩١	٢٦.٧٥	٢٦.٠٢
Nejma	٦٥	٢١.٤٤	٢٢.٣٨	٢٣.٦٧	٢٢.٥٠	٢١.٦٩	٢٢.٦٠	٢٣.٧٣	٢٢.٦٧
	٨٠	٢٣.٥١	٢٣.٨٨	٢٤.٣٩	٢٣.٩٣	٢٣.٦٤	٢٥.٠١	٢٥.٤٨	٢٤.٧١
	٩٠	٢٤.٢٩	٢٥.٧٣	٢٦.١٤	٢٥.٣٩	٢٤.٣٧	٢٦.٥٣	٢٥.٨٧	٢٥.٥٩
Mean		٢٣.٠٨	٢٤.٠٠	٢٤.٧٣	٢٣.٩٣	٢٣.٢٣	٢٤.٧١	٢٥.٠٣	٢٤.٣٢
Mean for N-levels	٦٥	٢٢.٦٥	٢٣.٤٥	٢٥.١٤	٢٣.٧٤	٢٢.١٦	٢٢.٩٨	٢٤.٦١	٢٣.٢٤
	٨٠	٢٤.٧٢	٢٤.٦٢	٢٥.٢٠	٢٤.٨٤	٢٤.٦٦	٢٥.٥٩	٢٥.٨٦	٢٥.٣٧
	٩٠	٢٦.٠٢	٢٦.٥٧	٢٧.٠٣	٢٦.٥٤	٢٦.١٢	٢٧.٣٧	٢٧.٢٠	٢٦.٩٠
Mean		٢٤.٤٥	٢٤.٨٨	٢٥.٧٩	٢٥.٠٤	٢٤.٣١	٢٥.٣١	٢٥.٨٩	٢٥.١٧

L.S.D. at ٥٪ for

Cultivars(C)	٠.٨٨	٠.٥١
Nitrogen (N)	٠.٢٦	٠.٤٣
Bio-fertilizers (B)	٠.٤٢	٠.٤٨
C x N	NS	٠.٦٠
C × B	NS	٠.٦٨
N × B	٠.٧٤	٠.٨٣
C × N × B	NS	NS

Data in Table ٨ show that varying the applied nitrogen rates had a significant effect on this trait in both seasons, where the highest root yield values (٢٦.٥٤ and ٢٦.٩٠ ton/fed.) were obtained when nitrogen was applied at a rate of ٩٠ kg N/fed., in both seasons, respectively.

The effective impact of nitrogen on root yield could be attributed to its distinct role as an essential constituent of protein, amide, amino acid, co-enzymes and chlorophyll as well as its effect on the assimilatory system (sugar beet leaves) and in turn plant capacity of photosynthesis and dry matter accumulation. The role of nitrogen in increasing root yield may be partially due to increasing water content of beet roots. These results coincided with those obtained by Shalaby (١٩٩٨), Hasan (٢٠٠٠), Abo El-Ghait and Mohamed (٢٠٠٥), Ibrahim *et al*. (٢٠٠٥) and Ouda (٢٠٠٧) who reported that root yield increased by increasing nitrogen rates.

The application of bio-fertilizers to sugar beet plants exerts a significant influence on root yield in both seasons. In general, root yield was high when effective microorganism (EM) was applied to sugar beet plants compared to the control. Effective microorganism (EM) was more superior in increasing root yield than Nitrobiene. The beneficial effect of bio-fertilizers, on root yield could be attributed to the more growth of plants the amount of metabolites synthesized by plant and to the role of bio-fertilizers in absorbing nutrients. These results are in line with those obtained by Medani *et al.* (٢٠٠٠), Cakmakc *et al.* (٢٠٠١), Kandil *et al*. (٢٠٠٢b) and Ouda, (٢٠٠٧).

The data revealed that root yield was significantly affected by the interaction between cultivars and nitrogen in ٢٠٠٩/٢٠١٠ season only, where the highest value (٢٨.٢٠ ton/fed.) was obtained from Ras poly cultivar when received ٩٠ kg N/fed. Also, root yield was significantly affected by the interaction between cultivars and bio-fertilizers in the second season only. The highest value (٢٦.٧٥ ton/fed.) was obtained when Ras poly cultivar was treated with effective microorganism (EM). Root yield was significantly affected by the interaction between nitrogen and bio-fertilizers in both seasons, where the highest value (٢٧.٠٣ ton/fed.) was obtained when ٩٠ kg N/fed., was applied and treated with effective microorganism (EM) in the first season, while, the highest value (٢٧.٣٧ ton/fed.) was obtained when ٩٠ kg N/fed. treated with Nitrobiene in the second season.

Chemical component and quality:

Total soluble solids percentage (TSS %).

The data presented in Table ٩ show that TSS was significantly affected by cultivars in the first season only. Ras poly cultivar had higher total soluble solids (١٩.٩٣ %) than Nejma cultivar. The difference between the two studied varieties in TSS content could be due to the variation in the gene make-up and their response to the environmental conditions. These results agree with those obtained by Shalaby (١٩٩٨), Fadel (٢٠٠٢), Hassan, *et al.* (٢٠٠٥) and Osman (٢٠٠٥).

Table ٩: Effect of different nitrogen rates and bio-fertilizers on total soluble solids (TSS %) of two sugar beet cultivars in ٢٠٠٨/٢٠٠٩ and ٢٠٠٩/٢٠١٠ seasons.

Seasons		٢٠٠٨/٢٠٠٩				٢٠٠٩/٢٠١٠			
Cultivars	N levels (kg/fed.)	Bio-fertilizer			Mean	Bio-fertilizer			Mean
		Cont.	Nitrob.	EM		Cont.	Nitrob.	EM	
Ras poly	٦٥	٢٠.٣٨	٢٠.٤٣	٢٠.٣٣	٢٠.٣٨	١٨.٦٩	١٨.٨٥	١٩.٤٢	١٨.٩٩
	٨٠	٢٠.٩٣	٢٠.٧١	٢٠.٦٧	٢٠.٧٧	٢٠.٥١	٢٠.٦٣	٢١.٨٦	٢١.٠٠
	٩٠	١٨.٩١	١٨.٦٣	١٨.٤١	١٨.٦٥	٢٠.٣٠	٢٠.٢٩	٢٠.٣٩	٢٠.٣٣
Mean		١٩.٨٠	١٩.٩١	٢٠.٠٩	١٩.٩٣	١٩.٨٣	١٩.٩٢	٢٠.٥٦	٢٠.١١
Nejma	٦٥	١٨.٤٤	١٩.٤٦	١٩.٨٣	١٩.٢٤	١٨.٣١	١٩.٣٣	١٩.٩٠	١٩.١٨
	٨٠	٢٠.٧٢	٢١.٠٠	٢٠.٩٠	٢٠.٨٧	٢٠.٧٧	٢٠.٨٥	٢٠.٩٧	٢٠.٨٦
	٩٠	١٨.٦٤	١٨.٩٣	١٨.٨٠	١٨.٦٨	١٨.٨٣	١٨.٨٩	١٨.٩٣	١٧.٨٨
Mean		١٩.٣٢	١٩.٧٦	١٩.٧١	١٩.٦٠	١٩.٣٠	١٩.٦٩	١٨.٩٣	١٩.٣١
Mean for N-levels	٦٥	١٩.٣٩	١٩.٩٢	٢٠.١٣	١٩.٨١	١٨.٥٠	١٩.٠٩	١٩.٦٦	١٩.٠٨
	٨٠	٢٠.٧٠	٢٠.٨١	٢٠.٩٧	٢٠.٨٢	٢٠.٦٤	٢٠.٧٤	٢١.٤٢	٢٠.٩٣
	٩٠	١٨.٦٠	١٨.٧٨	١٨.٦١	١٨.٦٦	١٩.٥٦	١٩.٥٩	١٨.١٦	١٩.١٠
Mean		١٩.٥٦	١٩.٨٤	١٩.٩٠	١٩.٧٧	١٩.٥٧	١٩.٨١	١٩.٧٤	١٩.٧١

L.S.D. at ٥٪ for

Cultivars(C)	٠.٣١	NS
Nitrogen (N)	٠.١٢	١.١٥
Bio-fertilizers (B)	٠.١٧	٠.٩٤
C x N	٠.١٧	١.٦٣
C × B	NS	NS
N × B	NS	NS
C × N × B	٠.٤١	٢.٢٩

Results in the Table ٩ indicate that nitrogen fertilizer levels significantly increased the TSS content in both seasons. The highest sugar yield values (٢٠.٨٢ and ٢٠.٩٣ %) were obtained when nitrogen was applied at a rate of ٨٠ kg N/fed. in both seasons, respectively. The increase may be due to the fact that nitrogen encourages elongation and cell division leading to an overall increase in total soluble solids percentage. These results are in accordance with those obtained by Sharif and Eghbal (١٩٩٤), Shalaby (١٩٩٨), Abd El- Moneim (٢٠٠٠), El- Sayed (٢٠٠٥), Ouda (٢٠٠٧) and Nemeat-Alla *et al*. (٢٠٠٩) .

The application of bio-fertilizers to sugar beet plants exerts a significant effect on total soluble solids percentage in the two studied seasons. In general, TSS content was high when effective microorganism (EM) was applied to sugar beet plants compared to the control. Effective microorganism (EM) was superior in increasing total soluble solids percentage than Nitrobiene in the first season. Total soluble solids content was high when was applied to sugar beet plants compared to the control. Nitrobiene was more superior in increasing sucrose percentage than effective microorganism (EM) in the second season. These results are in line with those obtained by Hassanein and Hassouna (٢٠٠٠), Kandil *et al*. (٢٠٠٢b) and Ramadan *et al*. (٢٠٠٣).

Results in Table ٩ show that TSS content was significantly affected by the interaction between cultivars and nitrogen in both seasons. The highest value (٢٠.٨٧ %) was obtained from Nejma cultivar received ٨٠ kg N/fed. in the first season. The highest value (٢١.٠٠ %) was obtained from Ras poly cultivar received ٨٠ kg N/fed. in the second season. The second order interaction was significant in both seasons, where the highest value (٢١.٠٠ %) was obtained from Nejma cultivar with ٨٠ kg N/fed. and Nitrobiene in the first season, while, the highest value (٢١.٨٦ %) was obtained from Ras poly cultivar treated with ٨٠ kg N/fed. and effective microorganism (EM) in the second season.

Sucrose percentage.

The data presented in Table ١٠ show that sucrose percentage was significantly affected by cultivars in the second season only. Ras poly cultivar had higher sucrose percentage than Nejma cultivar. The differences in this trait are mainly due to gene make-up . These results agree with those obtained by Shalaby (١٩٩٨), Fadel (٢٠٠٢), Hassan, *et al*. (٢٠٠٥), Osman (٢٠٠٥),Badr (٢٠٠٩) and El-Sheikh *et al*. (٢٠٠٩) who reported that sucrose percentage was significantly affected by cultivars.

Results in Table ١٠ indicate that nitrogen fertilizer levels significantly increased sucrose percentage in both seasons.

Table ١٠: Effect of different nitrogen rates and bio-fertilizers on sucrose percentage of two sugar beet cultivars in ٢٠٠٨/٢٠٠٩ and ٢٠٠٩/٢٠١٠ seasons.

Seasons		٢٠٠٨/٢٠٠٩				٢٠٠٩/٢٠١٠			
Cultivars	N levels (kg/fed.)	Bio-fertilizer			Mean	Bio-fertilizer			Mean
		Cont.	Nitrob.	EM		Cont.	Nitrob.	EM	
Ras poly	٦٥	١٤.٣٠	١٤.٤١	١٤.٧١	١٤.٤٧	١٢.٥٧	١٢.٩٤	١٣.١٣	١٢.٨٨
	٨٠	١٤.٠٠	١٤.٣٦	١٤.٨٢	١٤.٣٩	١٤.١١	١٤.٥٣	١٤.٦٠	١٤.٤١
	٩٠	١٢.٣٠	١٣.٠٠	١٣.١٦	١٢.٨٢	١٤.٣٩	١٤.٥٨	١٤.٦٣	١٤.٥٣
Mean		١٣.٥٣	١٣.٩٢	١٤.٢٣	١٣.٩٠	١٣.٦٩	١٤.٠٢	١٤.١٢	١٣.٩٤
Nejma	٦٥	١٢.٨٩	١٣.٢٠	١٣.٢٢	١٣.١٠	١٢.٦٢	١٢.٧٣	١٢.٩٣	١٢.٧٦
	٨٠	١٤.٧٥	١٤.٨٢	١٥.٠٠	١٤.٨٦	١٤.٥٣	١٤.٦٩	١٤.٩٥	١٤.٧٢
	٩٠	١٢.٣١	١٢.٤٥	١٢.٦٦	١٢.٤٧	١٣.٠٠	١٣.٣٤	١٣.٣٧	١٣.٢٤
Mean		١٣.٣٢	١٣.٤٩	١٣.٦٣	١٣.٣٨	١٣.٣٨	١٣.٥٩	١٣.٧٥	١٣.٥٧
Mean for N-levels	٦٥	١٣.٦٠	١٣.٨١	١٣.٩٧	١٣.٧٩	١٢.٦٠	١٢.٨٤	١٣.٠٣	١٢.٨٢
	٨٠	١٤.٣٨	١٤.٥٩	١٤.٩١	١٤.٦٣	١٤.٣٢	١٤.٦١	١٤.٧٨	١٤.٥٧
	٩٠	١٢.٣١	١٢.٧٣	١٢.٩١	١٢.٦٥	١٣.٧٠	١٣.٩٦	١٤.٠٠	١٣.٨٩
Mean		١٣.٤٣	١٣.٧١	١٣.٩٣	١٣.٦٩	١٣.٥٤	١٣.٨٠	١٣.٩٤	١٣.٧٦

L.S.D. at ٥٪ for

Cultivars(C)	NS	٠.٢٢
Nitrogen (N)	٠.٢٨	٠.٠٩
Bio-fertilizers (B)	٠.٢٩	٠.١٣
C x N	٠.٤٠	٠.١٣
C × B	٠.٤٠	٠.١٨
N × B	٠.٤٩	٠.٢٢
C × N × B	٠.٧٠	٠.٣١

The highest sucrose percentage (١٤.٦٣ and ١٤.٥٧ %) were obtained when nitrogen was applied at a rate of ٨٠ kg N/fed. in both seasons, respectively. This may be due to that increasing nitrogen rates increased non- sucrose substance such as Na, K and alpha amino nitrogen and thane decrease sucrose content in roots. These results are in accordance with those repotted by Abd El- Moneim (٢٠٠٠), Ismail and Abo EL- Ghait (٢٠٠٥), Osman (٢٠٠٥) and Nemeat-Alla *et al*. (٢٠٠٩) .

The application of bio-fertilizers to sugar beet plants had significant effect on sucrose percentage in both seasons. In general, sucrose percentage was high when effective microorganism (EM) was applied to sugar beet plants compared to the control. Effective microorganism (EM) was more superior in increasing sucrose percentage than Nitrobiene, where maximum values were obtained. This means that the application of bio-fertilizers was more active in increasing sugar yield/fed. and consequently sucrose percentage. These results are in line with those obtained by Medani *et al.* (٢٠٠٠) Hassanein and Hassouna (٢٠٠٠) Kandil *et al*. (٢٠٠٢b) and El-Kholi *et al.* (٢٠٠٤) who found that sucrose percentage increased by inoculation with bio-fertilizers.

The data presented in Table ١٠ show that sucrose percentage was significantly affected by the interaction between cultivars and nitrogen in both seasons. The highest values (١٤.٨٦ and ١٤.٧٢ %) were obtained from Nejma cultivar received ٨٠ kg N/fed. in both seasons, respectively. Also, sucrose percentage was significantly affected by the interaction between cultivars and bio-fertilizers in both seasons. The highest values (١٤.٢٣ and ١٤.١٢ %) were obtained when Ras poly cultivar treated with effective microorganism (EM) in both seasons. Sucrose percentage was significantly affected by the interaction between nitrogen and bio-fertilizers in both seasons, where the highest values (١٤.٩١ and ١٤.٧٨ %) were obtained when ٨٠ kg N/fed., was applied treated with effective microorganism (EM) in both seasons, respectively. The second order interaction was significant in the two seasons, where the highest values (١٥.٠٠ and ١٤.٩٥ %) was obtained from Nejma cultivar received ٨٠ kg N/fed., and effective microorganism (EM) in both seasons, respectively.

Juice purity.

Data in Table ١١ clearly indicate that cultivars had no significant effect on purity percentage in both seasons. However, Ras poly cultivar surpassed Nejma cultivar in purity percentage in both seasons. The difference between the two sugar beet varieties of purity percentage could be due to the variation in the gene make-up and their response to the environmental conditions. These results agree with that obtained by Saif (٢٠٠٠), Abo El-Ghait and Mohamed (٢٠٠٥) and Mekdad (٢٠٠٧) who that purity percentage was no significantly affected by cultivars.

Table ١١: Effect of different nitrogen rates and bio-fertilizers on purity percentage of two sugar beet cultivars in ٢٠٠٨/٢٠٠٩ and ٢٠٠٩/٢٠١٠ seasons.

Seasons		٢٠٠٨/٢٠٠٩				٢٠٠٩/٢٠١٠			
Cultivars	N levels (kg/fed.)	Bio-fertilizer			Mean	Bio-fertilizer			Mean
		Cont.	Nitrob.	EM		Cont.	Nitrob.	EM	
Ras poly	٦٥	٧٠.٣٤	٧٠.٧٠	٧٢.٠١	٧١.٠٢	٦٧.٣٧	٦٨.٦٨	٦٧.٦١	٦٧.٨٩
	٨٠	٦٧.٧٣	٦٩.٣٤	٧٠.٦٨	٦٩.٢٥	٦٨.٨٢	٧٠.٤٤	٦٦.٨٠	٦٨.٦٩
	٩٠	٦٦.٧٥	٦٩.٧٨	٦٩.٦٣	٦٨.٧٢	٧١.٤٨	٧١.٨٦	٧١.٧٥	٧١.٧٠
Mean		٦٨.٢٧	٦٩.٩٤	٧٠.٧٧	٦٩.٦٦	٦٩.٢٣	٧٠.٣٣	٦٨.٧٢	٦٩.٤٣

Nejma	٦٥	٦٩.٩٠	٦٨.٥٠	٦٦.٦٧	٦٨.٣٥	٦٨.٨١	٦٥.٨٥	٦٤.٩٩	٦٦.٥٥
	٨٠	٧١.١٠	٧٠.٩١	٧١.٤٣	٧١.١٤	٦٩.٩٦	٧٠.٤٦	٧١.٢٩	٧٠.٥٧
	٩٠	٦٥.٤٨	٦٥.٧٧	٦٩.١٤	٦٦.٨٠	٦٩.٠٤	٧٠.٦٢	٦٩.٤٣	٦٩.٧٠
Mean		٦٨.٨٣	٦٨.٣٩	٦٩.٠٨	٦٨.٧٧	٦٩.٢٧	٦٨.٩٨	٦٨.٥٧	٦٨.٩٤
Mean for N-levels	٦٥	٧٠.١٢	٦٩.٦٠	٦٩.٣٤	٦٩.٦٩	٦٨.٠٩	٦٧.٢٧	٦٦.٣٠	٦٧.٢٢
	٨٠	٦٩.٤١	٧٠.١٢	٧١.٠٦	٧٠.٢٠	٦٩.٣٩	٧٠.٤٥	٦٩.٠٥	٦٩.٦٣
	٩٠	٦٦.١١	٦٧.٧٨	٦٩.٣٨	٦٧.٧٦	٧٠.٢٦	٧١.٢٤	٧٠.٥٩	٧٠.٦٩
Mean		٦٨.٥٥	٦٩.١٧	٦٩.٩٣	٦٩.٢١	٦٩.٢٥	٦٩.٦٥	٦٨.٦٥	٦٩.١٨

L.S.D. at ٥٪ for

Cultivars (C)	NS	NS
Nitrogen (N)	١.٣١	١.٢٢
Bio-fertilizers (B)	١.٠٨	NS
C x N	١.٨٦	١.٧٢
C × B	NS	NS
N × B	NS	NS
C × N × B	NS	٣.١٢

Results in the Table ١١ indicate that nitrogen fertilizer rates significantly increased purity percentage in both seasons. The highest purity percentage value (٧٠.٢٠ %) was obtained when nitrogen was applied at a rate of ٨٠ kg N/fed. in the first season. The highest purity percentage value (٧٠.٦٩ %) was obtained when nitrogen was applied at a rate of ٩٠ kg N/fed. in the second season. The increase of purity percentage could be due to the increase in the amount of metabolites synthesized by plants as a result of increasing nitrogen rates. This could be attributed to the favorable effect of nitrogen fertilizer levels on the metabolic processes and physiological activities of meristimic tissues, which are responsible for cell division and elongation in addition to the formation of plant organs. This leads to more growth and consequently accumulation of more photosynthesis assimilates. These results are in accordance with those found by Sharif and Eghbal (١٩٩٤), Shalaby (١٩٩٨), Ibrahim *et al*. (٢٠٠٥) and Nemeat-Alla *et al*. (٢٠٠٩) who reported that purity percentage increased by increasing nitrogen rates.

The application of bio-fertilizers to sugar beet plants exerts a significant influence on purity percentage in ٢٠٠٨/٢٠٠٩ only season. In general, purity percentage was high when effective microorganism (EM) was applied to sugar beet plants compared to the control. Effective microorganism (EM) was superior in increasing sucrose percentage than Nitrobiene. These results are in line with those obtained by Hassanein and Hassouna (٢٠٠٠), Cakmakc *et al.* (٢٠٠١) and Kandil, *et al*. (٢٠٠٢b).

The data presented in Table ١١ show that purity percentage was significantly affected by the interaction between cultivars and nitrogen in both seasons. The highest value (٧١.١٤ %) was obtained from Nejma cultivar received ٨٠ kg N/fed. in the first season. The highest value (٧١.٧٠ %) was obtained from Ras poly cultivar received ٩٠ kg N/fed. in the second season. The second order interaction was significant in the second season only. Where, the highest value (٧١.٨٦ %) was obtained from Ras poly cultivar with ٩٠ kg N/fed. and Nitrobiene in the second season.

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استجابة بعض أصناف بنجر السكر للتسميد النيتروجينى والحيوى تحت ظروف محافظة أسيوط

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أقيمت تجربتان حقليتان بمزرعة كلية الزراعة جامعة الأزهر بأسيوط خلال موسمي الزراعة ٢٠٠٨/٢٠٠٩ و ٢٠٠٩/ ٢٠١٠ لدراسة استجابة صنفين من بنجر السكر راس بولى و نجمه (عديد الأجنة) لمعدلات مختلفة من التسميد النيتروجينى (٦٥، ٨٠ و ٩٠ كجم ن/فدان) و التسميد الحيوى (بدون تلقيح (كنترول)، نتروبين وEM) وكان التصميم المستخدم القطع المنشقة مرتين ، حيث وزعت الأصناف على القطع الرئيسية والتسميد الأزوتى على القطع المنشقة الأولى ومعاملات التسميد الحيوي على القطع المنشقة الثانية.

وكانت أهم النتائج المتحصل عليها:

١– تفوق الصنف راس بولى معنويا في قطر الجذر و الوزن الطازج للأوراق/نبات ومحصول الأوراق والجذور/فدان والنسبة المئوية للمواد الصلبة الذائبة الكلية ونسبة السكروز والنقاوة في كلا الموسمين، والوزن الطازج للجذر/نبات في الموسم الأول فقط.

٢– أدى زيادة معدلات التسميد النيتروجين إلي زيادة معنوية في كل من قطر الجذر والوزن الطازج للأوراق والجذور/نبات، ومحصول الأوراق والجذور/فدان في كلا الموسمين. بينما أدى إضافة ٨٠ كجم ن /فدان أعلي نسبة للمواد الصلبة الذائبة الكلية والسكروز في كلا الموسمين ونسبة النقاوة في الموسم الأول فقط ، وكانت أعلي نسبة للنقاوة عند اضافة ٩٠ كجم ن /فدان في الموسم الثاني.

٣– تشير نتائج التسميد الحيوي إلي أن هناك زيادة معنوية في كل من قطر الجذر والوزن الطازج للأوراق والجذور/نبات ومحصول الأوراق والجذور/فدان والنسبة المئوية للسكروزعند استخدام معاملة ال EM في كلا الموسمين، والنسبة

المئوية للمواد الصلبة الذائبة الكلية ونسبة النقاوة في الموسم الأول فقط ، بينما أدى إضافة معاملة النتروبين أعلي نسبة مئوية للمواد الصلبة الذائبة الكلية والنقاوة في الموسم الثاني فقط .

٤- كان للتفاعل المشترك بين الأصناف والتسميد النيتروجين تأثير معنوى على الوزن الطازج للأوراق والجذور/نبات، TSS% ونسبة السكروز والنقاوة في كلا الموسمين. أما بالنسبة للتفاعل بين الأصناف والتسميد الحيوي كان معنوى على نسبة السكروز في الموسمين وعلى طول الجذر والوزن الطازج للجذور/نبات ومحصول الجذور/فدان في الموسم الثاني فقط . أدى التفاعل بين التسميد النيتروجيني والحيوي الى تأثير معنوى على كل من طول الجذر والوزن الطازج للأوراق والجذور/نبات ومحصول الأوراق والجذور/فدان والنسبة المئوية للسكروز لكلا الموسمين. أما بالنسبة للتفاعل الثلاثى بين الأصناف والتسميد النيتروجين والحيوي فكان له تأثير معنوى على الوزن الطازج للجذور/نبات ومحصول الأوراق والجذور/فدان،TSS% والنسبة المئوية للسكروز فى الموسمين. بينما كان التأثير معنوى على صفة طول الجذر والوزن الطازج للأوراق/نبات والنسبة المئوية للنقاوة فى الموسم الثانى فقط .