# Response of some Sugar Beet (Beta Vulgaris L.) Cultivars to Bio and Nitrogen Fertilization

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## ABSTRACT

Two field experiments were conducted, at the Experimental Farm Sakha Agricultural Research Station, Governorate of Kafer El-Sheikh, during 2004/2005 and 2005/2006 growing seasons. The main objective of this study was to investigate the effects of nitrogen fertilizer from two sources (mineral and bio) where nitrogen fertilizer with two levels, 90 kg N/fed. as the recommended dose and 45 kg N/fed. with addition bio fertilizer bio for both Rhizobactrine and phosphorine and added to them or without addition of organic fertilizer. The experimental layout was conducted in split plot design with three replications. The results could be summarized as follows: Application of nitrogen fertilization and bio fertilization increased yield and quality characters. That using lower mineral nitrogen fertilizer and N- bio fertilizer revealed increased sugar beet yield and quality characters, so to keep our environment clean and decrease the environment pollution, also decrease fertilizers costs from high fertilization dose. However, we recommended by the three types for genotypes multigerm, monogerm and Egyptian multigerm genotype under application of 45 kg N/fed as mineral with Rhizobactrine , phosphorine with or with out manure as bio fertilizers to obtain high sugar beet yield and quality characters.

## INTRODUCTION

Sugar beet (*Beta vulgaris* L.) is considered the second source for sugar production in Egypt and in many countries all over the world after sugar cane (*Saccharium officinarium* L.). It is a vital crop to man as a source of high energy and as an important source of feed to livestock. About 45 percent of sugar in the world is produced from sugar beet. The Egyptian government plan encourages sugar beet growers to increase the cultivated area of sugar beet and consequently the sugar beet factories to minimize the gap between sugar production and consumption which reached to1.2 million ton every year imported from abroad. The total cultivated area of sugar beet in Egypt reached about 180.000* feddan and the total production exceeded 3.47 million-ton of sugar beet roots with an average of 19.31 ton / feddan.

* Egyptian society of sugar technology (2007).

Nitrogen is considered to be the most important mineral element of those supplied to sugar beet as fertilizer. Over the past 20 years , progress has been made towards optimizing the use of nitrogen through a better understanding of the crops requirement under varying conditions of soils and climates. In Egypt, nitrogen fertilization of sugar beet differ from one site to another, the optimum rate of applied nitrogen for maximum root yield varied, from 45kg N/feddan to120kg/feddan. (Mahmoud *et al.* 1990 and Ramadan, 1997).Ouda (2000) at ismailia governorate, observed that sugar beet, which fertilized by 80,100 and 120 kg N/fed, gave the highest root and top yield. Badr (2004), found that increasing nitrogen rate from 60 up to 90 kg N/fed produced the highest leaves, root weight, sugar yield and T.S.S.% but decreased sucrose and juice purity percentages.

The application of N and P fertilizers, at optimum rate or levels, are necessary to meet the requirements of sugar beet. These requirements should be achieved by applying the recommended favorable cultural practices with reducing the environmental pollution by using the biological fertilizers, such as, nitrogen and phosphorus bio–fertilizers under the commercial names Rhizobactrine and Phosphorine or others .The role of biofertilizer , especially Rhizobactrine which contains active biofertilizer nitrogen fixation bacteria (*Azotobacter chrococcum*) and Phosphorine which contains a highly active dissolving bacteria (*Bacillus megaterium* var. phosphaticum) is to convert the insoluble di and tri calcum phosphate to the soluble mono calcum phosphate to supply the plants with its mineral requirement during growth .Published data demonstrated that the significant increase of yields of sugar beet were possible when inoculated with Phosphorus dissolvers. Zalat *et al.* (2002) studied the effect of decreasing nitrogen application from 90 to 60 and 30kg N/fed. with application of one or two recommended doses of bio-fertilizers Cerealine and Phosphorine. The results indicated significant decrease in root yield, leaves yield, purity percentage and sucrose percentage, Assey *et al.* (2005) studied the effect of bio and mineral nitrogen on yield and quality of three cultivars of sugar beet.at Kalubia, Egypt , (Baraka, Dema poly and Shemis).They found that Rizobactrine and application of about 60kg N/ fed produced the maximum sugar yield of about 5250kg sugar / fed. The purpose of the present investigation was to study the effect of two nitrogen fertilizer rates and eight bio-fertilizer treatments on three different sugar beet genotypes to improve the yield, yield components and quality characters of sugar beet plant.

## 3. MATERIALS AND METHODS

Two field experiments were carried out the Sakha Agricultural Research Station, Agriculture Research Center, Egypt during 2004/2005 and 2005/2006 growing seasons, to study the effect of nitrogen and biofertilizer on yield components and quality characters of two commercial sugar beet cultivars ( Strube-Dieck and Teriy ) and one local produced genotype (EG.26).The experimental layout was conducted in split plot design with three replicates. Genotypes were assigned to the main plots whereas fertilizers treatments were arranged randomely in the sub- plots. the treatment means were compared using L.S.D. test at 0.05 and 0.01 level of probability. accoriding to Steel and Torrie (1986)

The combinations between the mineral nitrogen fertilizer treatment and the type of bio-fertilizer for both seasons of this study were as follows:

1- 90 kg N /fed.
2- 45 kg N/fed + Rizobactrine (380g / fed.)
3- 45 kgN/fed. + Phosphorine (380g / fed.)
4- 45 kgN/fed. + Manure (3200kg / fed.).
5- 45 kgN/fed. + Rhizobactrine + Phosphorine.
6- 45 kgN/fed. + Rhizobactrine + Manure (3200kg / fed.).
7- 45 kgN/fed. + Phosphorine + Manure (3200kg / fed.).
8- 45 kgN/fed. + Rhizobactrine + Phosphorine + Manure (3200kg / fed.).

Mineral nitrogen treatments and application system were as follows:

1- Application of 90kg N/fed which was split into two equal doses, each 45kg N/fed, the first one was applied after six weeks from planting (after thinning), whereas the second was applied four weeks later.
2- Application of 45kg N/ fed which was split into two equal doses each 22.5kg N/fed, the first one was applied after six weeks from planting (after thinning) whereas the second one was applied four weeks later.

Mineral Nitrogen fertilizer was added as urea (46.5 % N).

The bio-fertilizer has been mixed with seed and applied as follows:

1- Rhizobactrine: seeds of sugar beet genotypes were inoculated with Rhizobactrine before sowing at the rate of 380g /fed, Rhizobactrine is a commercial name and consists of nitrogen fixed bacterial strains namely "Rhizobia *spp.*, *Azotobacter chrococcum* and *Azospirillum sp.*
2- Phosphorine: seeds of sugar beet genotypes were inoculated with Phosphorine before sowing at rate of 380g /fed. Phosphorine is a commercial name and consists of an active phosphate dissolving bacterial strains namely " *Bacillus megatherium var. phosphaticum*".

Rhizobactrine and Phosphorine were obtained from The Microbiology Department, Agricultural Research Center, Ministry of Agriculture and Land Reclamation, Egypt.

**Table (1): The mechanical and chemical analysis of the soil samples taken at 30cm depth in the experimental sites before sowing.**

| Analysis | Season | |
|---|---|---|
| | 2004 /2005 | 2005 / 2006 |
| | **Mechanical analysis** | |
| Coarse sand % | 1.65 | 1.45 |
| Fine sand % | 15.40 | 16.40 |
| Silt % | 19.20 | 20.05 |
| Clay % | 63.75 | 62.10 |
| Texture | Clay | Clay |
| $CaCO_3$ | 1.60 | 1.60 |
| | **Chemical analysis** | |
| Soil pH (1:2.2) | 8.4 | 8.10 |
| EC m mhos/cm | 3.55 | 3.42 |
| Organic matter % | 1.82 | 1.90 |
| Available N p pm | 16.30 | 16.30 |
| Available P p pm | 6.55 | 6.30 |
| Available K p pm | 285.40 | 265.64 |
| | **Cations and anions, meq / l** | |
| Ca | 2.40 | 2.10 |
| Mg | 2.80 | 2.60 |
| K | 0.40 | 0.29 |
| Na | 6.70 | 6.65 |
| | **Anions meq/L. :** | |
| $HCO_3^-$ | 6.40 | 6.10 |
| $Cl^-$ | 6.30 | 5.90 |
| $SO_4^{--}$ | 0.23 | 0.19 |

**The following characters were determined:**

**1. <u>Yield characters</u>:**

**1-** 1- Root yield (ton /fed.): roots of each plot were weighed after removing leaves.

1- 2- Leaf yield (ton / fed.): Weight of total leaves for each plot.

1- 3- Sugar yield (ton /fed.): it has been calculated by multiplying sucrose percentage with root yield / fed

**2. Quality characters:**

**2-1- Total Soluble Solids percentage (T.S.S. %):**

It was measured on five random roots per plot using a hand refract meter.

**2-2- Sucrose percentage:**

It was measured for each plot with saccharimeter. Samples of pulp of 15kg of cleaned roots in each plot were randomly taken, then 26 grams of the mixtured were treated with 176cm. of basic lead acetate and filtered. Sucrose percentage was measured in the solution. In addition to that, sucrose percentage was measured for individual five plants in each plot for correlation studies.

**2-3. Purity percentage:**

It was determined according to Supernova *et al.* (1979) as follows:

$$\text{Purity \%} = \frac{\text{Sucrose percentage}}{\text{T.S.S.\%}} \times 100$$

## RESULTS AND DISCUSSION

### 1. Yield characters:

**1-1 Root yield (ton /fed.):**

Table ( 2 ) showed that, in the first season (2004- 2005), the highest average root yield was 26.53 ton/fed for the multigerm cultivar Strube-Dieck, followed by the monogerm genotype, Teriy, which yielded 25.22 ton/fed. The lowest one was the Egyptian genotype EG.26which recorded 24.77 ton/fed. The treatment (45kg N/fed + Rhizobactrine + Phosphorine) yielded the highest average root yield (28.19 ton / fed) followed by the treatment (90 kgN /fed.),as recommended treatment, which yielded 27.75ton/fed.The lowst average (20.19 ton/fed) was obtained from treatment (45kg N/ fed + phosphorine).For the second season (2005–2006 ), there was no significant difference between the three genotypes, as well as mineral and bio-nitrogen fertilizer treatments. The interaction between genotypes and treatments was significant in the first season.The treatment (90kg N/fed.), as recommended treatment , showed the highest root yield (27.64 ton/fed), followed by the treatment (45kg N/fed + Rhizobactrine + Phosphorine + Manure), which gave 27.04 ton/fed. both treatments gave more than 27 ton/fed. with no significant difference in the second season, which means that the treatment (45kg N/fed + Rhizobactrine + Phosphorine + Manure) is preferable than the treatment (90kg N/fed.). For the first season, the highest average of root yield was 32.35 and 31.84 ton/fed for the multigerm genotype, Strube–Dieck, by the treatment (90kg N/fed.) and (45kg N/fed + Rhizobactrine + Phosphorine) respectively.Then the monogerm genotype, Teriy, recorded 29.14 ton/fed by the treatment (45kg N/fed + Phosphorine + Manure), followed by the multigerm Egyptian genotype which recorded 28.68 ton/fed with the treatment (45kg N/fed + Rhizobacrtine + Phosphorine).It has half quantity of nitrogen, which reduced the cost to the half amount, in addition to minimize the environmental pollution, putting in consideration the good root yield. Differences due to the interaction between genotypes and N-treatments, however, were insignificant in the second season. The above mentioned results are in general agreement with El-Manhaly *et al* (2000), Kajiyama *et al.* (2000), El Harriri and Gobarha ( 2001), Mostafa and Darwish (2001), Nemeat–Alla *et al.* (2002), Badr(2004), El-Manhaly *et al.* (2004), Ghura *et al.* (2004), Ghura (2005) and Ghura *et al.* (2006). Several authors recorded a significant increase in root yield by application of biofertilizer, such as El-Badry and El-Bassal (1993), Favilli *et al.* (1993), Afify *et al.* (1994), SuckhovitSkaya (1998), Cakmakci *et al.* (1999), Sultan *et al.* (1999), Abo El-Fotoh *et al.* (2000),Hassanein and El-Shebiny (2000), Hassouna and Hassanein (2000), Bassel *et al.* (2001), Maareg and Badr (2001), Khalil (2002), Nour-Eldin *et al.* (2002), Aly (2003) and Badr (2004). However, Zalat *et al.* (2002) indicated that root yield was significantly decreased with decreasing N application from 90 to 60 and 30Kg N / fed

**1-2 Leaf yield (ton / fed):**

The data presented in table (2) indicated that the differences due to genotypes were not significant over the two seasons. Highly significant differences were detected for N-treatments and for the interaction between genotypes and treatments over the two seasons. For the first season (2004-2005), the highest average of leaf yield was 9.02 ton/fed for the treatment (45kg N/fed + Manure), followed by the treatment (45kg N/fed + Rhizobactrine) and (45kg N/fed + Rhizobactrine + Phosphorine + Manure), where each of them recorded above 8.5 ton/fed. For the second season (2005 -2006) the highest average of leaf yield was 8.91 ton/fed for the treatment (45kg N/fed+ Manure), followed by the treatments (45kg N/fed + Rhizobactrine) and (45kg N/fed + Rhizobactrine + Phosphorine + Manure), where they recorded 8.64 and 8.34 ton/fed, respectively. Differences due to the interactions between genotypes and N-treatments were highly significant in the both seasons. For the first season, the highest average of leaf yield was 9.71 ton/fed for the multigerm genotype, Strube-Dieck, by the treatment (45kg N/fed + Rhizobactrine), than the Egyptian genotype EG.26 recorded 9.19 ton/fed by the treatment (45kg N/fed + Manure), followed by the monogerm genotype which recorded 9.09 ton / fed by the treatment (45kg N/fed + Rhizobactrine + Manure).For the second season, the highest average of leaf yield noticed for the Egyptian genotype EG.26 by the treatment (45kg N /fed + Manure) followed by the multigerm genotype with the same treatment, after that the monogerm one they recorded 9.23 ton / fed, 9.07 ton / fed and 9.03 ton / fed respectively.These results are in general agreement with the results of El-Zayat(2000), El-Harriri and Gobarah (2001), Nemeat-Alla (2001), Nemeat–Alla *et al.* (2002), Badr (2004), Ghura (2005) and Ghura *et al.* (2006). With regard to biofertilizer treatment, many authors recorded a significant increase in leaf yield by the application of biofertilizer, such as, Aly (1996), Suckhovitskaya (1998), Hassouna and Hassanein (2000), Bassel *et al.* (2001), Maareg and Bader (2001), Nour-Eldin *et al* (2002) and Badr (2004). On the other hand, Zalat (2002) indicated that the biofertilizers decreased the leaf yield.

**1.3 - Sugar yield (ton /fed.):**

From the analysis of variance table (2), it could be seen that the genotypes, N-treatments and the interaction between them gave highly significant differences for the two seasons. For the first season (2004-2005) the highest genotype average was from multigerm genotype, Strube-Dieck (5.37 ton/fed) followed by the Egyptian genotype EG.26 (5.02 ton /fed) and the monogerm genotype Teriy (4.81 ton/fed).The highest sugar yield was obtained from the treatment (90kg N/fed.), followed by the treatment (45kg N/fed + Rhizobactrine + Phosphorine + Manure) then the treatment (45kg N/fed +Rhizobactrine + Phosphorine) where they recorded 5.66, 5.47 and 5.39 ton/fed respectively. The remaining other treatments gave moderate sugar yield while the least sugar yields were obtained from the treatments (45kg N/fed + Rhizobactrine), (45kg N/ fed + Phosphorine). For the second season (2005-2006),the highest genotype average was from multigerm genotype Strube-Dieck which recorded 5.21 ton/fed followed by the Egyptian genotype EG.26 which yielded 4.98 ton/fed followed by the monogerm genotype Teriy which it yielded 4.78 ton /fed. The highest sugar yield was obtained from the treatments (90kg N/fed.), (45kg N/fed + Rhizobactrine + Phosphorine) and (45kg N/fed + Phosphorine + Manure)where they recorded 5.56, 5.49 and 5.27 ton /fed respectively, while the least average was from the treatment (45kg N/fed + Phosphorine ) which recorded 3.99 ton /fed. Differences due to the interaction between genotypes and treatments, were highly significant in both seasons. For the first season, the highest average of sugar yield was 6.84 ton/fed for the multigerm genotype, Strube-Dieck, by the treatment (45kg N/fed + Rhizobactrine + Phosphorine + Manure), then the monogerm genotype, Teriy, recorded 6.10 ton/fed by the treatment (45kg N/fed + Phosphorine +

Manure), followed by the multigerm genotype, Strube-Dieck, which recorded 6.16 ton/fed with the treatment (45kg N/fed + Rhizobactrine + Phosphorine). For the second season, the highest average of sugar yield was 6.88 ton/fed. for the multigerm genotype, Strube-Dieck, with the treatment (45kg N/fed + Rhizobactrine + Phosphorine), then the monogerm genotype, Teriy, which recorded 5.79 ton/fed by the treatment (45kg N/fed + Phosphorine + Manure), followed by the multigerm genotype, Strube-Dieck, it recorded 5.88 ton/fed with the treatment (45kg N/fed+ Rhizobactrine + Phosphorine + Manure). The above mentioned results are in general agreement with Hassanein and Elayan (2000), Badr (2004), El-Manhaly *et al.* (2004), and El-Aref *et al.* (2005).who pointed out that increasing nitrogen fertilizers levels increased sugar yield .On the other hand, Azzazy (1998) showed that increasing nitrogen levels increased sugar yield but this increase was not significant. However several authors recorded significant increase in sugar yield by increasing the amount of biofertilizers, such as, El-Badry and El-Bassal (1993), Afify *et al.* (1994), Suckhovitskaya (1998), Sultan *et al.* (1999), AboEl-Fotoh *et al.* (2000), Hassanein and El-Shebiny (2000), Bassel *et al.* (2001), Maareg and Badr (2001), Nour El-din *et al.* (2002), Aly (2003), Badr (2004) and Assey (2005).

## 2. Quality characters:

### 2.1. Total Soluble Solids percentage (T. S .S. %):

From the analysis of variance table (3), it could be seen that the genotypes and the interaction between genotypes and fertilization treatments gave highly significant differences for the two seasons. For the first season (2004-2005), the highest average of T.S.S. % was 26.93% for the multigerm genotype Strube-Dieck followed by the Egyptian genotype, EG.26 ( 25.95%) and the monogerm genotype ( 25.16% ).For the second season (2005-2006) the highest average of T.S.S.% was 26.69%.for the multigerm genotype Strube-Dieck followed by the Egyptian genotype EG.26 ( 26.11% ) and the monogerm genotype Teriy (25.22%).On the other side, no significant differences were detected for the mineral and bio-nitrogen fertilizer treatments in both seasons. Differences due to the interaction between genotypes and treatments, however, were highly significant in both seasons. For the first season, the highest average of T.S.S. % was 28.4% for the multigerm genotype, Strube-Dieck, by the treatment (45kg N/fed + Rhizobactrine + Phosphorine + Manure), then the Egyptian genotype, EG.26, recorded 27.47% by the treatment (45kg N/ fed+ Phosphorine + Manure), followed by the average for multigerm genotype, Strube-Dieck, it recorded 27.40% with the treatment (45kg N/ fed +Manure). For the second season, the highest averages of T.S.S.% were 28.13% and 27.50 %.for the multigerm genotype, Strube-Dieck, by the treatment (45kgN/fed + Rhizobactrine + Phosphorine + Manure) and the treatment (45kg N/ fed + Phosphorine + Manure).The Egyptian genotype, EG.26, it recorded 27.27% by the treatment (45kg N/ fed + Phosphorine + Manure). The above mentioned results are in general agreement with the findings of Ghura *et al.*(2000), Ghura (2001), Badr (2004) and Ghura *et al.* (2006). All those authors pointed out that increasing N level decreased gradually total soluble solids percentage. In some cases, the application of N increased T.S.S.% in sugar beet. On the other hand Nemeat –Alla (2001) recorded that the T.S.S.% was not affected by increasing N levels. However by biofertilizers treatments, Sultan *et al.* (1999), Bassel *et al.* (2001), Maareg and Badr (2001) and Aly (2003), all those outhors recorded increase in T.S.S.% by application of bio-fertilizer. Or the other hand, Hassouna and Hassanein (2000) show that T.S.S.% was decreaed with application of biofertilizer.

**2.2. Sucrose percentage:**

Regarding sucrose percentage, table (3) showed significant differences due to genotypes in both seasons. Highly significant differences were noticed for fertilization treatment and for the interaction between genotypes x fertilization treatments for the two seasons. For the first season (2004-2005), the highest average of sucrose percentage was (20.25%) for the multigerm genotype Strube-Dieck followed by the monogerm genotype Teriy (19.90%) and the Egyptian genotype EG26 (19.48 %).The highest average of sucrose percentage was obtained from the treatment (45kg N/fed + Rhizobactrine + Phosphorine +Manure), followed by the treatments (90Kg N/fed.) and the treatment (45Kg N/fed + Phosphorine+ Manure), where they recorded (20.64 %, 20.35% and 20.15%), respectively. The least percentage was 18.62% which was obtained from the treatment (45kg N/fed + Rhizobactrine). For the second season (2005-2006),the highest average of sucrose percentage was 20.12% for the multigerm genotype Strube-Dieck followed by the monogerm genotype Teriy (19.96%), and the Egyptian genotype EG. 26 (19.83%). The highest averages of sucrose percentage were obtained from the treatment (45kg N/fed + Rhizobactrine + Phosphorine + Manure), followed by the treatments (90kg N/fed.) and (45 kg N/fed + Phosphorine + Manure) were they recorded 20.81%, 20.62% and 20.01%, respectively. The least percentage was 18.61% which was obtained from treatment (45kg N/fed + Rhizobactrine). Differences due to the interaction between genotypes and N-treatment, however, were highly significant in both seasons. For the first season, the highest average of sucrose percentage were 22.24 %, 21.61 % and 21.02 % for the multigerm genotype, Strube-Dieck by the treatments (45kg N/fed + Rhizobactrine + Phosphorine + Manure), (45kg N/fed + Rhizobactrine + Manure) and (90kg N/fed.). For the interaction between the monogerm genotype, Teriy, and the treatments were the highest average of sucrose percentage, 21.15%, 20.95% and 20.93% for the treatments (45kg N/fed + Rhizobactrine + Phosphorine), (45kg N/fed + Rhizobactrine) and (45kg N/fed + Phosphorine + Manure) respectively. For the multigerm Egyptian genotype, EG.26, it recorded 21.05 %, 20.59% and 20.52% for the treatments (90kg N/fed.), (45kg N/fed + Manure) and (45kg N/fad + Phosphorine). For the second season, the highest average of sucrose percentage were 22.30 %, 20.80 % and 20.63 % for the multigerm genotype, Strube-Dieck, by the treatments (45kg N/fed + Rhizobactrine + Phosphorine + Manure), (90kg N/fed.) and (45kgN/fed + Rhizobactrine + Manure). For the interaction between the monogerm genotype, Teriy, and the treatments were the highest average of sucrose percentage, 20.73%, 20.56% and 20.52% for the treatments (45kg N/fed + Phosphorine + Manure), (45kg N/fed + Rhizobactrine + Phosphorine) and (45kg N/fed + Rhizobactrine), respectively. For the multigerm Egyptian genotype EG.26 it recorded 20.67 % and 20.42% for the treatments (90kg N/fed.) and (45kg N/fed+ Manure) respectively.The above mentioned results are in general agreement with_El-Zayat (2000) and Abo-Elwafa (2002). On the other hand, Nemeat-Alla (2001) showed that increasing nitrogen level did not affect sucrose percentage. Regarding biofertilizer treatment, many authors recorded a significant increase in sucrose percentage by application of bio-fertilizers, such as, Favilli *et al.*(1993), Afify *et al.* (1994), Aly (1996), Sultan *et al.*(1999), AboEl-Fotoh *et al.*(2000), Bassel *et al.*(2001), Maareg and Badr (2001), Khalil (2002), Nour-Eldin *et al.*(2002) and Aly (2003). On the other hand, Hassouna and Hassanein (2000) reported slightly positive effect on sucrose percentage but Badr (2004) recorded no evidence for significant effect on sucrose percentage due to biofertilizer application.

**2.3. <u>Juice purity percentage:</u>**

Data Presented in table (3), revealed that genotypes, N-treatments and the interaction between them, gave highly significant variations during the two seasons. For the first season (2004-2005), the highest average of juice purity percentage was 78.98 % for the monogerm genotype Teriy, followed by the Egyptian genotype EG.26 (77.82%) and the multigerm genotype Strube-Dieck ( 75.69% ). The highest juice purity percentage was obtained from the treatment (45kg N/fed + Manure), followed by the recommended treatment (90kg N/fed.) where they recorded 79.32% and

79.10%, respectively, whereas the least average was from the treatment (45kg N/fed + Rhizobactrine). For the second season (2005-2006), the highest average of juice purity percentage was obtained from the monogerm genotype Teriy ( 78.96% ), followed by the Egyptian genotype EG.26 ( 77.63% ) after that the multigerm genotype Strube-Dieck (76.14% ).The highest juice purity percentage was obtained from the treatment (45kg N/fed + Rhizobactrine + Phosphorine), followed by the recommended treatment (90kg N/fed.) and (45kg N/fed + Rhizobactrine + Manure) where they recorded 81.49%, 79.52% and 79.10%, respectively. The least average was obtained from the treatment (45kg N/fed + Rhizobactrine) which recorded 69.23 %.Differences due to the interaction between genotypes and N-treatments, were highly significant in both seasons. For the first season, the highest average of juice purity percentage was 88.62 %for the Egyptian genotype, EG.26. By the treatment (45kg N/fed +Manure), Then the multigerm genotype, Strube-Dieck, it recorded 84.28% by the treatment (45kg N/fed + Rhizobactrine + Manure), followed by the monogerm genotype, Teriy, it recorded 83.78%, with the treatment (45kgN/fed + Phosphorine +Manure). For the second season, the highest average of juice purity percentage was 84.51% for the multigerm genotype, Strube-Dieck by the treatment (45kg N/fed + Rhizobactrine + Manure), then the monogerm genotype, Teriy, recorded 84.33 % by the treatment (45kg N / fed + Phosphorine + Manure), followed by the Egyptian genotype, EG.26 it recorded 82.93% .with the recommend treatment (90kg N/fed.). The above mentioned results are in general agreement with Anderson and Peterson (1988), Halvorson and Hartman (1988), Obead (1988), Mahmoud *et al.* (1990) Kumar and Zutshi (1991), Sourour *et al.* (1992), Sharif and Eghbal (1994), Nemeat -Alla (1997), Basha (1999), Hassanein and Elayan (2000),El-Harriri and Gobarha (2001), Mostafa and Darwish (2001), Nemat-Alla (2001) and Badr (2004).All those researchers showed that increasing nitrogen level decreased Purity percentage. On the other hand, Tabl *et al.*(1986), Abdel-Aal and Ibrahim (1990), El-Essawy (1996), Azzazy (1998)and Basha (1999), showed that increasing level of nitrogen increased purity percentage. Concerning biofertilizer treatments, several authors recorded an increase in purity percentage with increasing the amount of biofertilizer, such as , Sultan *el al.* (1999), Abo El-Fotoh *et al* (2000), Maareg and Badr (2001), Nour-Eldin *et al.* (2002) and Badr (2004).

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Table (2): Effect of the genotypes and mineral – bio nitrogen fertilizer levels and the interaction between them of sugar beet on ( root , leaf , sugar yields ( ton / fed) for two seasons.

| | Root yield | | Leaf yield | | Sugar yield | |
|---|---|---|---|---|---|---|
| | 2004-2005 | 2005-2006 | 2004-2005 | 2005-2006 | 2004-2005 | 2005-2006 |
| **A : Genotype** | | | | | | |
| Strube -Dieck | 26.53 | 25.85 | 8.05 | 8.02 | 5.37 | 5.21 |
| Teriy | 25.22 | 25.15 | 8.56 | 8.40 | 4.81 | 4.78 |
| EG.26 | 24.77 | 25.31 | 8.39 | 8.32 | 5.02 | 4.98 |
| L.S.D. 0.05 | 0.69 | N.S. | N.S. | N.S. | 0.24 | 0.14 |
| **B: mineral and bio nitrogen fertilizer:** | | | | | | |
| 1- 90 kg N/fed | 27.75 | 27.64 | 8.01 | 8.03 | 5.66 | 5.56 |
| 2- 45 kg N/fed + Rhizobactrine | 23.58 | 25.38 | 8.87 | 8.64 | 4.33 | 4.38 |
| 3- 45 kg N/fed + Phosphorine | 20.19 | 23.03 | 8.13 | 8.21 | 4.09 | 3.99 |
| 4- 45 kg N/fed + Manure | 25.50 | 23.66 | 9.02 | 8.91 | 4.96 | 5.03 |
| 5- 45 kg N/fed + Rhizobactrine + Phosphorine | 28.19 | 26.20 | 8.21 | 8.11 | 5.60 | 5.49 |
| 6- 45 kg N/fed + Rhizobactrine + Manure | 25.72 | 24.34 | 8.36 | 7.88 | 5.07 | 4.95 |
| 7- 45 kg N/fed + Phosphorine + Manure | 26.69 | 26.31 | 7.75 | 7.82 | 5.39 | 5.27 |
| 8- 45 kg N/fed + Rhizobactrine + Phosphorine + Manure | 26.44 | 27.04 | 8.75 | 8.34 | 5.47 | 5.22 |
| L.S.D. 0.05 | 0.69 | N.S. | 0.51 | 0.58 | 0.27 | 0.57 |
| **Interaction :** | | | | | | |
| A * B | ** | N.S. | ** | ** | ** | ** |

** and N.S. highly Significant at 0.05 level and not significant respectively

Table (3): Effect of the genotypes and mineral – bio nitrogen fertilizer levels and the interaction between them of sugar beet on (T S S , Sucrose, juice purity percentage ) for two seasons.

| | | T.S.S.% | | Sucrose % | | Juice purity % | |
|---|---|---|---|---|---|---|---|
| | | 2004-2005 | 2005-2006 | 2004-2005 | 2005-2006 | 2004-2005 | 2005-2006 |
| **A : Genotype** | | | | | | | |
| Strube -Dieck | | 26.93 | 26.69 | 20.25 | 20.12 | 75.69 | 76.14 |
| Teriy | | 25.16 | 25.22 | 19.90 | 19.96 | 78.98 | 78.96 |
| EG.26 | | 25.95 | 26.11 | 19.48 | 19.83 | 77.82 | 77.63 |
| L.S.D. | | | | | | | |
| | 0.05 | 0.32 | 0.39 | 0.41 | 0.51 | 0.63 | 3.38 |
| **B: mineral and bio nitrogen fertilizer:** | | | | | | | |
| 1- 90 kg N/fed | | 26.17 | 25.90 | 20.35 | 20.62 | 79.10 | 79.52 |
| 2- 45 kg N/fed + Rhizobactrine | | 25.89 | 25.46 | 18.62 | 18.61 | 68.77 | 69.23 |
| 3- 45 kg N/fed + Phosphorine | | 25.81 | 26.01 | 19.98 | 19.72 | 77.55 | 77.88 |
| 4- 45 kg N/fed + Manure | | 25.82 | 26.17 | 19.46 | 19.62 | 79.32 | 77.82 |
| 5- 45 kg N/fed + Rhizobactrine + Phosphorine | | 26.16 | 26.17 | 19.93 | 19.83 | 79.04 | 81.49 |
| 6- 45 kg N/fed + Rhizobactrine + Manure | | 25.42 | 25.56 | 19.85 | 19.93 | 78.87 | 79.10 |
| 7- 45 kg N/fed + Phosphorine + Manure | | 26.57 | 26.74 | 20.15 | 20.01 | 79.26 | 72.27 |
| 8- 45 kg N/fed + Rhizobactrine + Phosphorine + Manure | | 26.27 | 26.03 | 20.64 | 20.81 | 77.86 | 77.29 |
| L.S.D. | | | | | | | |
| | 0.05 | N.S. | N.S. | 0.88 | 0.98 | 1.19 | 2.85 |
| **Interaction :** | | | | | | | |
| A * B | | ** | ** | ** | ** | ** | ** |

** and N.S. highly Significant at 0.05 level and not significant respectively

Table (4): Effect of the interaction between genotypes and mineral-bio nitrogen fertilizer of sugar beet on root yield (ton/fed) for the first season (2004 -2005).

| Treatments | Genotypes | | |
|---|---|---|---|
| | q2004-2005 | | |
| | **Strube Dieck** | **Teriy** | **EG.26** |
| 1-90 kg N/fed | 32.35 | 24.70 | 26.21 |
| 2- 45 kg N/fed + Rhizobactrine | 21.43 | 24.15 | 25.15 |
| 3- 45 kg N/fed + Phosphorine | 20.17 | 20.95 | 19.47 |
| 4- 45 kg N/fed + Manure | 26.94 | 24.50 | 25.07 |
| 5- 45 kg N/fed + Rhizobactrine + Phosphorine | 31.84 | 25.04 | 28.68 |
| 6- 45 kg N/fed + Rhizobactrine + Manure | 22.38 | 28.09 | 26.68 |
| 7- 45 kg N/fed + Phosphorine + Manure | 29.04 | 29.14 | 21.88 |
| 8- 45 kg N/fed + Rhizobactrine + Phosphorine + Manure | 28.07 | 25.20 | 26.06 |
| **L.S.D. 0.05** | | **1.78** | |

Table (5): Effect of the interaction between genotypes and mineral-bio nitrogen fertilizer levels of sugar beet on Leaf yield (ton / fed) during the two seasons.

| Treatments | Genotypes | | | | | |
|---|---|---|---|---|---|---|
| | 2004-2005 | | | 2005-2006 | | |
| | Strube Dieck | Teriy | EG.26 | StrubeDieck | Teriy | EG.26 |
| 1-90 kg N/fed | 8.27 | 7.70 | 8.05 | 8.27 | 7.47 | 8.37 |
| 2- 45 kg N/fed + Rhizobactrine | 9.71 | 8.52 | 8.39 | 9.01 | 8.37 | 8.53 |
| 3- 45 kg N/fed + Phosphorine | 8.05 | 7.88 | 8.47 | 8.20 | 8.10 | 8.33 |
| 4- 45 kg N/fed + Manure | 8.98 | 8.88 | 9.19 | 9.07 | 8.42 | 9.23 |
| 5- 45 kg N/fed + Rhizobctrine + Phosphorine | 6.77 | 8.92 | 8.95 | 6.73 | 9.03 | 8.60 |
| 6- 45 kg N/fed + Rhizobactrine + Manure | 7.48 | 9.09 | 8.51 | 7.50 | 8.80 | 7.33 |
| 7- 45 kg N/fed + Phosphorine + Manure | 6.79 | 7.62 | 8.83 | 7.00 | 7.93 | 8.53 |
| 8- 45 kg N/fed + Rhizobactrine + Phosphorine + Manure | 8.39 | 8.50 | 8.80 | 8.33 | 8.47 | 8.23 |
| L.S.D. 0.05 | | 1.01 | | | 0.89 | |

Table (6): Effect of the interaction between genotypes and mineral-bio nitrogen fertilizer of sugar beet on sugar yield (ton/fed) during the two seasons.

| Treatments | Genotypes | | | | | |
|---|---|---|---|---|---|---|
| | 2004-2005 | | | 2005-2006 | | |
| | **Strube Dieck** | **Teriy** | **EG.26** | **StrubeDieck** | **Teriy** | **EG.26** |
| 1-90 kg N/fed | 6.08 | 4.68 | 5.51 | 6.36 | 4.96 | 5.37 |
| 2- 45 kg N/fed + Rhizobactrine | 4.24 | 5.06 | 3.72 | 4.29 | 5.03 | 3.83 |
| 3- 45 kg N/fed + Phosphorine | 3.94 | 4.16 | 3.99 | 3.67 | 4.46 | 3.86 |
| 4- 45 kg N/fed + Manure | 5.03 | 4.69 | 5.16 | 5.00 | 4.81 | 5.28 |
| 5- 45 kg N/fed + Rhizobctrine + Phosphorine | 6.16 | 5.29 | 5.35 | 6.88 | 5.02 | 5.61 |
| 6- 45 kg N/fed + Rhizobactrine + Manure | 4.83 | 5.18 | 5.20 | 4.68 | 5.11 | 5.08 |
| 7- 45 kg N/fed + Phosphorine + Manure | 5.74 | 6.10 | 4.32 | 5.72 | 5.79 | 4.30 |
| 8- 45 kg N/fed + Rhizobactrine + Phosphorine + Manure | 6.84 | 4.97 | 5.20 | 5.88 | 4.67 | 5.10 |
| L.S.D. 0.05 | | **0.33** | | | **1.00** | |

**Table (7):Effect of the interaction between genotypes and mineral-bio nitrogen fertilizer of sugar beet on total soluble solids percentage (T.S.S. %) during the two seasons.**

| Treatments | Genotypes | | | | | |
|---|---|---|---|---|---|---|
| | 2004-2005 | | | 2005-2006 | | |
| | **Strube Dieck** | **Teriy** | **E.G.26** | **StrubeDieck** | **Teriy** | **E.G.26** |
| 1-90 kg N/fed | 26.70 | 25.90 | 25.90 | 26.57 | 25.13 | 26.00 |
| 2- 45 kg N/fed + Rhizobactrine | 25.23 | 25.87 | 26.57 | 24.67 | 25.65 | 26.05 |
| 3- 45 kg N/fed + Phosphorine | 26.90 | 24.33 | 26.20 | 26.70 | 24.73 | 26.60 |
| 4- 45 kg N/fed + Manure | 27.40 | 25.00 | 25.03 | 26.80 | 26.33 | 25.37 |
| 5- 45 kg N/fed + Rhizobctrine + Phosphorine | 27.03 | 25.37 | 26.07 | 26.60 | 25.00 | 26.90 |
| 6- 45 kg N/fed + Rhizobactrine + Manure | 26.53 | 25.13 | 24.60 | 26.53 | 25.03 | 25.10 |
| 7- 45 kg N/fed + Phosphorine + Manure | 27.23 | 25.00 | 27.47 | 27.50 | 25.47 | 27.27 |
| 8- 45 kg N/fed + Rhizobactrine + Phosphorine + Manure | 28.40 | 24.67 | 25.73 | 28.13 | 24.40 | 25.57 |
| L.S.D. 0.05 | | **1.42** | | | **1.66** | |

**Table (8): Effect of the interaction between genotypes and mineral-bio nitrogen fertilizer of sugar beet on sucrose percentage during the two seasons.**

| Treatments | Genotypes | | | | | |
|---|---|---|---|---|---|---|
| | 2004-2005 | | | 2005-2006 | | |
| | **Strube Dieck** | **Teriy** | **EG.26** | **StrubeDieck** | **Teriy** | **EG.26** |
| 1-90 kg N/fed | 21.02 | 18.97 | 21.05 | 20.80 | 19.16 | 20.67 |
| 2- 45 kg N/fed + Rhizobactrine | 19.78 | 20.95 | 15.12 | 19.56 | 20.52 | 15.75 |
| 3- 45 kg N/fed + Phosphorine | 19.55 | 19.88 | 20.52 | 19.61 | 20.09 | 19.47 |
| 4- 45 kg N/fed + Manure | 18.67 | 19.13 | 20.59 | 18.97 | 19.48 | 20.42 |
| 5- 45 kg N/fed + Rhizobctrine + Phosphorine | 19.34 | 21.15 | 19.32 | 19.43 | 20.56 | 19.51 |
| 6- 45 kg N/fed + Rhizobactrine + Manure | 21.61 | 18.46 | 19.48 | 20.63 | 19.20 | 19.97 |
| 7- 45 kg N/fed + Phosphorine + Manure | 19.76 | 20.93 | 19.77 | 19.66 | 20.73 | 19.64 |
| 8- 45 kg N/fed + Rhizobactrine + Phosphorine + Manure | 22.24 | 19.71 | 19.97 | 22.30 | 19.91 | 19.64 |
| L.S.D.0.05 | | 1.53 | | | 1.69 | |

**Table (9): Effect of the interaction between genotypes and mineral-bio nitrogen fertilizer of sugar beet on juice purity percentage during the two seasons.**

| Treatments | Genotypes | | | | | |
|---|---|---|---|---|---|---|
| | 2004-2005 | | | 2005-2006 | | |
| | **Strube Dieck** | **Teriy** | **EG.26** | **StrubeDieck** | **Teriy** | **EG.26** |
| 1-90 kg N/fed | 79.55 | 74.48 | 83.26 | 79.40 | 76.23 | 82.93 |
| 2- 45 kg N/fed + Rhizobactrine | 75.47 | 76.82 | 54.03 | 75.54 | 76.34 | 55.83 |
| 3- 45 kg N/fed + Phosphorine | 72.68 | 80.38 | 80.19 | 73.44 | 80.61 | 79.57 |
| 4- 45 kg N/fed + Manure | 68.79 | 80.53 | 88.62 | 72.28 | 80.68 | 80.49 |
| 5- 45 kg N/fed + Rhizobctrine + Phosphorine | 74.35 | 83.41 | 79.18 | 73.62 | 82.23 | 78.52 |
| 6- 45 kg N/fed + Rhizobactrine + Manure | 84.28 | 72.79 | 79.53 | 84.51 | 73.27 | 79.51 |
| 7- 45 kg N/fed + Phosphorine + Manure | 71.58 | 83.78 | 82.41 | 71.56 | 84.33 | 78.93 |
| 8- 45 kg N/fed + Rhizobactrine + Phosphorine + Manure | 78.65 | 79.62 | 75.30 | 78.74 | 77.59 | 75.30 |
| L.S.D. 0.05 | | **2.10** | | | **1.64** | |

# الملخص العربي

## استجابة بعض أصناف بنجر السكر للتسميد الحيوى والأزوتى

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** مركز البحوث الزراعية – معهد بحوث المحاصيل السكرية – الجيزة .

اجريت هذه الدراسة في المزرعة البحثية بمحطة بحوث سخا الزراعية بمحافظة كفر الشيخ خلال الموسمين الزراعين 2005/2004 و 2006/2005 وذلك بهدف معرفة تأثيرات التسميد النيتروجينى المعدني وبعض الأسـمدة الحيوية والعضوية حيث كان السماد النيتروجينى المعدني بمستوين هما 90 كجم / فدان وهي الجـرعه الموصي بها و 45 كجم / فدان مع إضافات للتسميد الحيوي لكلا من الريزوباكترين والفوسفورين مـضاف الـيهم او بـدون اضافة للسماد العضوي وكذلك جميع التداخلات الممكنه بينهم .

ويمكن تلخيص أهم النتائج المتحصل عليها للصفات التي درست خـلال الموسـمين الـزراعيين كالتالي:

1- يمكن التوصية بالسماد الحيوي والعضوي مع الكمية الأقل من السماد المعدني للحصول علي أعلـي محصول من الجذور والسكر والورق وأيضا لتقليل خطر تلوث البيئة والتكاليف.

2- وبصفة عامة للمحافظة علي صفات الجودة العالية من المواد الصلبة الذائبة و النسبة المئوية لتركيز السكروز ، والنسبة المئوية لنقاوة العصير يجب استعمال السماد الحيوى مع المعدني المنخفض حيث اثبتت الدراسة أنها اعطت أفضل نتائج وكذلك لتقليل خطر تلوث البيئة ولتقليل التكاليف .

بوجه عام تشير نتائج هذه الدراسة إلي:

إن استخدام المستويات المنخفضة من السماد النيتروجينى المعدني 45 كجم نيتروجين /فدان مـع استخدام الأسمدة الحيوية ومعها السماد العضوي أو بدون السماد العضوي أدي إلي زيادة محصول وجودة جذور وسكر بنجر السكر لنباتات بنجر السكر. وهذا يعطى الأمل الكبير فـي تقليـل اسـتخدام الأسـمدة المعدنية الآزوتية مما يشجع المزارع علي ذلك نظرا لتقليل التكاليف كما أنه مفيد في تقليل خطـر تلـوث البيئة .