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RESPONSE OF SUGAR BEET *(Beta Vulgaris* L.) YIELD AND QUALITY TO SOIL APPLICATION OF YEAST AT DIFFERENT NITROGEN FERTILIZER LEVELS

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ABSTRACT

Good nitrogen management is critical for production of a high yield, good quality sugar beet crop. Not enough N can limit yield, while too much N can reduce quality. Some sugar beet growers in parts of El.Minia Governorate continue to use for maximizing sugar beet yield by application of yeast to soil at late stage of crop age during March month. So, this trail was conducted at Mallawi Agric. Res. Station, El-Minia, Egypt, during ٢٠٠٩/٢٠١٠ and ٢٠١٠/٢٠١١ seasons to deduce the effect of soil application of yeast , i.e. zero , ٢.٠ and ٤.٠ kg / fed on yield and quality of sugar beet at different nitrogen fertilizer levels (٦٠ , ٨٠ and ١٠٠ kg/fed) . The experiment was performed in a split plot design with four replicates.

The obtained results revealed that nitrogen fertilizer level had a significant effect on root length and diameter (cm), pol%, alpha amino nitrogen (α-N), potassium content, sodium content, ,sugar recovery % and quality index of sugar beet , as well as root and sugar yields (ton/fed) recovery of sugar beet in both seasons.

A significant differences in root length and diameter (cm), pol%, α-N , K, Na contents and sugar recovery% of sugar beet , as well as root and recoverable sugar yields (ton/fed) of sugar beet were found between the studied soil application of yeast treatments in both seasons and combined .While , quality index of sugar beet

was insignificantly affected by addition of yeast in the two growing seasons

Significant interactions were recorded between nitrogen fertilizer level and soil application of yeast (AB) on root diameter, sodium content, root and recoverable sugar yields (ton/fed) of sugar beet in two growing seasons, in the ١st for potassium content of sugar beet and in the ٢nd for α-N content and sugar recovery of sugar beet.

In general, it can be concluded that application of nitrogen fertilizer level at ١٠٠ kg/fed with yeast at rate of ٢.٠ kg/fed could be recommended for maximizing sugar beet productivity under the environmental conditions of El.Minia Governorate for grower and sugar factory .

INTRODUCTION

Sugar beet historically has been an important crop in some areas because of its capacity to provide both cash income from the harvested root as well as livestock feed in the form of above-ground biomass (tops) and root processing by-products such as pulp and molasses. The Egyptian Government strategy to fulfill sugar needs depend on increasing sugar production from sugar beet. Recently, sugar beet crop has an important position in Egyptian crop rotation as winter crop. Sugar beet (*Beta vulgaris* L.) was introduced to Egypt to overlap the vast gap between sugar consumption and production, it is represented the second sugar crop after sugar cane. Egyptian Government is pushing hardly to grow and develop sugar beet crop by building new factories . The sugar produced from sugar beet increased from ٧.٣٦٪ in ١٩٩٠ to about ٤٩.٧٠٪of the total local sugar production (١.٩٩ million ton) in ٢٠١٠. Sugar beet is a high value crop requiring high annual expenditure for production (Eckhoff & Flynn ٢٠٠٨ and CCSC, ٢٠١١).

Modern agricultural practice has been relying heavily on the use of chemical fertilizers to meet this challenging demand. Unfortunately, extensive and often unbalanced (over and under) fertilization also leads to environmental degradation. Soil beneficial microorganisms were also enhanced. Soil fertilized with prolonged application of yeast in China has shown improvement in humus content and organic carbon content, and significantly lower specific gravity (bulk density) compared to the soil treated with chemical fertilizer .Chemical fertilizers also cause farmland degradation, and reduced soil fertility and biodiversity . Continued use of chemical fertilizers could not increase crop yields in number of countries. It costs billions of dollars a year in loss of productivity and bio-diversity, as well as environmental pollution .Yeast contains cytokinins , IAA, proteins , amino acids such as , glycine ,histidine , isolysine , lysine , cystine methionine , phenyl alanine , tyrosine , threonine and treptophan . Also, it contains fat, nucleic acid , adenylic acid enzymes , vitamin B١ and B٦. It is very beneficial and essential for the synthesis of aminoleulinic acid (AA)and is necessary for the formation of protaperphyrin the precursor of chlorophyll (Hess , ١٩٨١ ; Subba Rao , ١٩٨٤ and Abou–Zaid ,١٩٨٤ Stemwedel, ٢٠٠٩) .

Nitrogen is the single most important nutrient for optimum sugar beet production. Nitrogen status of the plant affects early growth or time to full canopy closure and the quality of the sugar beet at harvest. Optimum nitrogen management promotes vigorous early season plant growth reducing the number of days to canopy closure, which allows the sugar beet to utilize the sunlight's energy more efficiently to make sucrose. Excess N at or near the end of the growing season reduces sugar beet quality by reducing sucrose concentration and increasing impurities concentration . Increasing nitrogen rate up to ٧٠ Kg N fad$^{-١}$ (Badawi ١٩٩٦ and Salama and Badawi ١٩٩٦), ١٠٥ Kg N fad$^{-١}$ and ١٢٠ Kg N fad$^{-١}$ (El- Hennawy *et al* ١٩٩٨ and Sarhan ١٩٩٨) significantly increased root length,root diameter as well as root, and sugar yields/fed, but it resulted in marked reduction in TSS, juice purity and sucrose percentage. Adding nitrogen in the suitable time has an effective role in maximizing the N utilization through minimizing losses of the applied nitrogen . Nitrogen fertilizer improve growth and yield components of sugar beet . Whereas , increasing nitrogen fertilizer level up to ١٠٠ kg / fed enhanced growth attributes of sugar beet (El.Hawary, ١٩٩٩ ; El.Shafai ,٢٠٠٠; Fadel,٢٠٠٢; Kandil , *et al* . ٢٠٠٢ and Attia *et al*.٢٠٠٤).

The objective of this work was to evaluate the effect of soil addition of yeast on yield and quality of sugar beet at different nitrogen fertilizer levels needed to obtain the highest yield and quality of sugar beet at harvest .

MATERIALS AND METHODS

The presented work was conducted at Mallawi Agric. Res. Station El .Minia Governorate, Egypt, during the two successive seasons of ٢٠٠٩/٢٠١٠ and ٢٠١٠/٢٠١١ to deduce the effect of soil application of yeast on yield and quality of sugar beet at different nitrogen fertilizer levels . Sugar beet cultivar namely Kawamera was sown on ١٦th and ١٨th October in both seasons, respectively. Split plot design with four replicates was used .The main plots were assigned to three nitrogen fertilizer levels (٦٠ , ٨٠ and ١٠٠ kg / fed). The sub-plots were allocated for Three soil applications of Active wet yeast (*Saccharomyces cerevisiae* strain), i.e. zero , ٢.٠ and ٤.٠ kg / fed . Active wet yeast obtained from the Egyptian Sugar and its Integrated Industries Company, Hawamdia , Egypt, was carefully prepared before using by the accessory addition of the Egyptian treacle at ٠.٢٠ % to prepared solutions of yeast for activation the reproduction of yeast . Yeast solution were left stand at ٣٨ ^{O}C for one hour before applying at ٤٠ days from sowing of sugar beet after the irrigation . Nitrogen fertilizer in the form of urea (٤٦ %N) was applied as a side-dressing in two equal doses, one half after thinning and the other before the third watering (٧٠ days from sowing). Potassium fertilizer in the form of potassium sulphate (٤٨ % K٢O) was added at the recommended rate(٢٤ kg K٢O/fed) after thinning, however phosphorus fertilizer was added at recommended rate of ٣٠ kgs /fed at planting . Beet plants were thinned to one plant/hill at the age of ٣٥ days from sowing . All required agricultural practices were done as followed by sugar beet growers in the region.

Sub-plot area is ١٠.٥ m٢ (five rows of ٦٠-cm width and ٣.٥ m in length). Some chemical and physical properties of the soil of the experimental site were determined before seed bed preparation according to the procedures outlined by Jackson (١٩٦٧) and Olsen & Sommers (١٩٨٢) as shown in Table ١.

Table ١: Some physical and chemical characteristics of the experimental soils*.

Properties	Season ٢٠٠٩/٢٠١٠	Season ٢٠١٠/٢٠١١
Texture analysis:		
Clay %	٤٣.٢٠	٤٧.٤٠
Silt %	٣٣.٢٠	٢٨.٦٠
Sand %	٢٣.٦٠	٢٤.٠٠
Texture grade:	**Clay**	**Clay**
pH (١:١ suspention)	٧.٥٠	٧.٥٠
Ec m.mohs (١:١)	١.٣٢	١.١٥
Organic matter %	١.١٨	١.٢٤
Soluble cations:		
Ca^{++} + Mg^{++} meq/١٠٠g soil	٠.٩٦	٠.٨٤
Na^{+} meq/١٠٠g soil	٠.٣٧	٠.٤٤
K^{+} meq/١٠٠g soil	٠.٠٩	٠.١١
Soluble anions:		
$CO_٣$+ $HCO_٣$ meq/١٠٠g soil	٠.٣٣	٠.٣٦
Cl^{-} meq/١٠٠g soil	٠.٨٤	٠.٩١
Available N mg / kg soil	٢١.١	١٩.٣٥
Available P (ppm)	٨.٥٠	٧.٨٥
Available K (ppm)	١٧٥	١٨٠

* Each value represents the mean of ٥ samples

Data recorded:

Vegetative traits : At harvest (at age ١٩٥ days from sowing),a samples of ten roots were taken at random from the three middle rows of each plot to record :

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

Quality parameters:

A samples of twenty roots were taken at random of each plot were harvested and send to the laboratory , cleaned with running tap water, dried , each sample was grated separately with grater into cassettes and mixed thoroughly to determine the quality characteristics as described in Cooke & Scott, (١٩٩٣).

١. Pol % was estimated in fresh samples of sugar beet roots, using saccharometer according to the method described in AOAC, (٢٠٠٥).

٢. Alpha amino nitrogen, sodium and potassium contents: were estimated according to the procedure described by the sugar company using auto Analyzer (Cooke and Scott, ١٩٩٣). The results were calculated as milliequivalent per ١٠٠ gm beet.

٣. Sugar recovery % was calculated using the following equation:

Sugar recovery % = Pol,%- [٠.٢٩ + ٠.٣٤٣ (K + Na) + α - N (٠.٠٩٤)],

Where, K, Na and α - N were determined as milliequivalent/١٠٠ g beet.

٤. Quality index was calculated using the following equation: Quality index ,%= Sugar recovery % X ١٠٠ ÷ pol %

Yield traits (ton/fed):

١. Roots yield (ton /fed): At ١٩٥ days from sowing, plants of sugar beet from the three middle rows of each plot were harvested to determine roots yield as ton /fed on fresh weight basis.

٢. Recoverable sugar yield (ton/fed.) was calculated from the following equation: Recoverable sugar yield (ton/fed.) =Roots yield (ton/fed.)X Sugar recovery %.

Collected data were subjected to the proper analysis of variance (ANOVA). The proper statistical of all data was carried out according to lined by Gomez & Gomez (١٩٨٤). Homogeneity of variance and differences among treatments were evaluated by the least significant difference test (LSD) at ٥ % .

RESULTS AND DISCUSSION

Vegetative traits :

Data in Tables, ٢ and ٣ reveal that nitrogen fertilizer level had a significant effect on root length and diameter (cm) of sugar beet in both seasons and combined . It could be noted from the combined analysis that root length of sugar beet increased by ١.٤٧and ٤.٤٧٪, and root diameter increased by ١٣.٣١ and ٢١.٧٠ % when nitrogen fertilizer level was increased from ٦٠ to ٨٠ and ١٠٠ kg/fed, respectively. These results could be attributed to the role of nitrogen in enhancing growth, chlorophyll formation, photosynthesis process by increasing division or elongation of cell . The rate of increasing in root length accompanying the increase in nitrogen fertilizer level was lower than that of root diameter . These findings are in the same trend with those obtained by Sarhan, (١٩٩٨) ; El. Hawary, (١٩٩٩) and Attia *et al.*(٢٠٠٤) . Gomaa, *et al.*(٢٠٠٥). They revealed that the increment of growth attributes obtained by increasing nitrogen fertilizer level could be due to the role of nitrogen in increment photosynthesis process associated with accumulation of carbohydrates translated from leaves to developing roots ,consequently increasing root size .

Table ٢ : Effect of yeast on root length (cm) of sugar beet at different nitrogen fertilizer levels .

Nitrogen fertilizer (A)	٢٠٠٩/٢٠١٠ season				٢٠١٠/٢٠١١ season				Combined			
	Soil application of yeast (kg / fed) (B)											
	٠.٠	٢.٠	٤.٠	Mean	٠.٠	٢.٠	٤.٠	Mean	٠.٠	٢.٠	٤.٠	Mean
٦٠ kg/fed	٣٧.٧٠	٣٩.٤٣	٣٩.٢٧	٣٨.٨٠	٣٦.٦٧	٣٩.٥٧	٣٨.١٣	٣٨.٦٨	٣٧.١٩	٣٩.٥٠	٣٨.٧٠	٣٨.٧٤
٨٠ kg/fed	٣٨.١٠	٣٩.٥٧	٣٩.٧٧	٣٩.١٥	٣٩.٦٧	٤١.٢٣	٣٩.٥٣	٤٠.١٤	٣٨.٨٩	٤٠.٤٠	٣٨.٦٥	٣٩.٣١
١٠٠ kg/fed	٣٩.٤٣	٤١.٠٣	٤٠.٤٠	٤٠.٢٩	٣٩.٥٧	٤١.١٣	٤١.٢٣	٤٠.٦٤	٣٩.٥٠	٤١.٠٨	٤٠.٨٢	٤٠.٤٧
Mean	٣٨.٤١	٤٠.٠١	٣٩.٨١	٣٩.٤١	٣٨.١٢	٤٠.٣٢	٤٠.١٤	٣٩.٥٣	٣٨.٢٧	٤٠.١٧	٣٩.٩٨	٣٩.٤٧
F value	**	**	Ns		**	**	Ns		**	**	Ns	
LSD ٠.٠٥	A=٠.٦٢	B=٠.٥١	AB=--		A=٠.٣٤	B=٠.٤٣	AB=--		A=٠.٢٩	B=٠.٣٣	AB=--	

Ns = Non significant

Table ٣ : Effect of yeast on root diameter (cm) of sugar beet at different nitrogen fertilizer levels .

Nitrogen fertilizer (A)	٢٠٠٩/٢٠١٠ season				٢٠١٠/٢٠١١ season				Combined			
	Soil application of yeast (kg / fed) (B)											
	٠.٠	٢.٠	٤.٠	Mean	٠.٠	٢.٠	٤.٠	Mean	٠.٠	٢.٠	٤.٠	Mean
٦٠ kg/fed	٧.٣٣	١٠.٦٧	١٠.٤٠	٩.٤٧	٧.٦٠	١٠.٧٠	١٠.٥٠	٩.٦٠	٧.٤٧	١٠.٦٩	١٠.٤٥	٩.٥٤
٨٠ kg/fed	٩.١٠	١١.٦٧	١١.٥٧	١٠.٧٨	٩.١٣	١١.٧٠	١١.٦٧	١٠.٨٣	٩.١٢	١١.٦٩	١١.٦٢	١٠.٨١
١٠٠ kg/fed	١١.٢٠	١١.٧٧	١١.٥٧	١١.٥١	١١.٣٧	١١.٧٧	١١.٩٧	١١.٧٠	١١.٢٩	١١.٧٧	١١.٧٧	١١.٦١
Mean	٩.٢١	١١.٣٧	١١.١٨	١٠.٥٩	٩.٣٧	١١.٣٩	١١.٣٨	١٠.٧١	٩.٢٩	١١.٣٨	١١.٢٨	١٠.٦٥
F value	**	**	**		**	**	**		**	**	Ns	
LSD ٠.٠٥	A=٠.١٧	B=٠.١١	AB=٠.١٨		A=٠.٣٤	B=٠.١٢	AB=٠.٢١		A=٠.١٥	B=٠.١٠	AB=--	

It can be observed from data recorded in Tables ٢ and ٣ that a significant differences in root length and diameter (cm) of sugar beet were apparent between the studied yeast treatments in both seasons and combined. Combined analysis show that the highest values of root length (٤٠.١٧cm)and root diameter (١١.٣٨cm) of sugar beet were recorded with soil application of yeast by rate of ٢.٠ kg/fed compared with the others . These results might be attributed to soil beneficial microorganisms were also enhanced. Soil fertilized with prolonged application of yeast has shown improvement in humus content and organic carbon content, and significantly lower specific gravity (bulk density) when compared to the soil treated with chemical fertilizer. These findings are in the same trend with those obtained by Abou–Zaid , (١٩٨٤) and Stemwedel, (٢٠٠٩) .

Significant interaction was recorded between nitrogen fertilizer level and soil application of yeast on root diameter in the two growing seasons as shown in Table ٣. The combined analysis show that the highest value of root diameter (١١.٧٧cm) of sugar beet were recorded with nitrogen fertilizer level at ١٠٠ kg/fed with soil application of yeast at the rate of ٢.٠ kg/fed., while nitrogen fertilizer level at ٦٠ kg/fed with soil addition of yeast by rate of ٠.٠ kg/fed gave the lowest value (٧.٤٨ cm) . .

Quality parameters :

Data in Tables ٤-٩ show that nitrogen fertilizer level had a significant effect on pol%, alpha amino nitrogen (α-N) potassium content, sodium content ,sugar recovery % and quality index of sugar beet in the two growing seasons and the combined . It could be noted from combined analysis that the increase in the level of nitrogen fertilizer from ٦٠ to ٨٠ and ١٠٠ kg /fed resulted in a gradual decrease in pol%, ,sugar recovery % and quality index of sugar beet, and increased α- N , potassium , sodium contents. The need for nitrogen in sugar beet production is well documented , but the excess of nitrogen fertilizer may decrease the pol% or sucrose . An accurate prediction of nitrogen needs is therefore essential in the overall nitrogen management system.

Table ٤ : Effect of yeast on pol% of sugar beet at different nitrogen fertilizer levels .

Nitrogen fertilizer (A)	٢٠٠٩/٢٠١٠ season				٢٠١٠/٢٠١١ season				Combined			
	Soil application of yeast (kg / fed) (B)											
	٠.٠	٢.٠	٤.٠	Mean	٠.٠	٢.٠	٤.٠	Mean	٠.٠	٢.٠	٤.٠	Mean
٦٠ kg/fed	١٧.٩٤	١٨.٢٥	١٨.٢٢	١٨.١٤	١٧.٩٥	١٨.١٥	١٨.٢٧	١٨.١٢	١٧.٩٥	١٨.٢٠	١٨.٢٤	١٨.١٣
٨٠ kg/fed	١٦.٠٤	١٦.٣٣	١٦.٣٤	١٦.٢٣	١٥.٩٤	١٦.٤٢	١٦.٣٠	١٦.٢٢	١٥.٩٩	١٦.٣٧	١٦.٣٢	١٦.٢٣
١٠٠ kg/fed	١٤.٨٧	١٥.١٨	١٥.٢٢	١٥.٠٩	١٤.٨٣	١٥.٢٥	١٥.٢٤	١٥.١١	١٤.٨٥	١٥.٢١	١٥.٢٣	١٥.١٠
Mean	١٦.٢٨	١٦.٥٩	١٦.٥٩	١٦.٤٩	١٦.٢٤	١٦.٦١	١٦.٦٠	١٦.٤٨	١٦.٢٦	١٦.٦٠	١٦.٦٠	١٦.٤٨
F value	**	**	Ns		**	**	Ns		**	**	Ns	
LSD .٠٥	A=٠.١٤	B=٠.١٠	AB=--		A=٠.٠٧	B=٠.٠٨	AB=--		A=٠.٠٦	B=٠.٠٦	AB=٠.١٠	

The unfavorable effect of high nitrogen fertilizer level might be principally attributed to the effect of excessive nitrogen addition in terms of increasing root yield (ton/fed) and tissue water content as well as increasing the impurities or non-sucrose substances such as proteins , ά-N content and hence decreasing pol% of sugar beet . Also , there were an increase in the absorption of Na and K elements from the soil by roots with increasing nitrogen fertilizer level , consequently increasing Na and K contents of sugar beet as well as decreasing quality index and sugar recovery %of sugar beet . Such results are in the same line with those found by El.Shafai,(٢٠٠٠); Fadel,(٢٠٠٢); Kandil,*et al.* (٢٠٠٢) and Attia *et al.*(٢٠٠٤). Badawi *et al.* (٢٠٠٤); and

Gomaa, *et al.* (٢٠٠٥). They indicated that the increased use of nitrogen fertilizer reduced sucrose concentrations of sugar beet. In this subject, Stevens, *et al.* (٢٠٠٨ , ٢٠١٠ and ٢٠١١) revealed that excess N applications both reduced root sucrose concentration and increased impurities that cause more sucrose to be lost to molasses during the extraction process .

Table ٥: Effect of yeast on α-N content*of sugar beet at different nitrogen fertilizer levels .

Nitrogen fertilizer (A)	٢٠٠٩/٢٠١٠ season				٢٠١٠/٢٠١١ season				Combined			
	Soil application of yeast (kg / fed) (B)											
	٠.٠	٢.٠	٤.٠	Mean	٠.٠	٢.٠	٤.٠	Mean	٠.٠	٢.٠	٤.٠	Mean
٦٠ kg/fed	١.٢٣	١.١٦	١.١٦	١.١٨	١.١٩	١.١٦	١.١٦	١.١٧	١.٢١	١.١٦	١.١٦	١.١٨
٨٠ kg/fed	١.٨٤	١.٦٥	١.٦٢	١.٧٠	١.٩٠	١.٥٨	١.٥٢	١.٦٧	١.٨٧	١.٦٢	١.٥٧	١.٦٨
١٠٠ kg/fed	٢.١٤	١.٩٧	١.٦٥	١.٩٢	٢.١٠	١.٩٥	١.٨٨	١.٩٧	٢.١٢	١.٩٦	١.٧٦	١.٩٥
Mean	١.٧٤	١.٥٩	١.٤٨	١.٦٠	١.٧٣	١.٥٧	١.٥٢	١.٦٠	١.٧٣	١.٥٨	١.٥٠	١.٦٠
F value	**	**	Ns		**	**	**		**	**	*	
LSD ٠.٠٥	A=٠.٢٠	B=٠.١٨	AB=--		A=٠.٠٤	B=٠.٠٣	AB=٠.٠٤		A=٠.٠٨	B=٠.٠٨	AB=٠.١٥	

*= Alpha amino nitrogen content as milliequavalents / ١٠٠ gm beet

Table ٦: Effect of yeast on potassium content *of sugar beet at different nitrogen fertilizer levels .

Nitrogen fertilizer (A)	٢٠٠٩/٢٠١٠ season				٢٠١٠/٢٠١١ season				Combined			
	Soil application of yeast (kg / fed) (B)											
	٠.٠	٢.٠	٤.٠	Mean	٠.٠	٢.٠	٤.٠	Mean	٠.٠	٢.٠	٤.٠	Mean
٦٠ kg/fed	٤.٥٦	٥.١٦	٥.٢٣	٤.٩٩	٤.٤٧	٤.٧٥	٥.١٥	٤.٧٩	٤.٥٢	٤.٩٦	٥.١٩	٤.٨٩
٨٠ kg/fed	٥.٥٠	٥.٦٣	٥.٦٧	٥.٦٠	٥.٢٨	٥.٠٩	٥.٤٥	٥.٢٨	٥.٣٩	٥.٣٦	٥.٥٦	٥.٤٤
١٠٠ kg/fed	٥.٨٥	٥.٩٥	٥.٩٢	٥.٩١	٥.٧٠	٥.٨٣	٥.٧٥	٥.٧٦	٥.٧٨	٥.٨٩	٥.٨٣	٥.٨٣
Mean	٥.٣٠	٥.٥٨	٥.٦١	٥.٥٠	٥.١٥	٥.٢٣	٥.٤٥	٥.٢٨	٥.٢٣	٥.٤٠	٥.٥٣	٥.٣٩
F value	**	**	**		**	*	Ns		**	**	**	
LSD ٠.٠٥	A=٠.٠٦	B=٠.٠٥	AB=٠.٠٩		A=٠.٣٤	B=٠.٢٦	AB=		A=٠.١٤	B=٠.١٢	AB=٠.٢١	

*= Potassium content as milliequavalents / ١٠٠ gm beet

Table ٧ : Effect of yeast on sodium content *of sugar beet at different nitrogen fertilizer levels .

Nitrogen fertilizer (A)	٢٠٠٩/٢٠١٠ season				٢٠١٠/٢٠١١ season				Combined			
	Soil application of yeast (kg / fed) (B)											
	٠.٠	٢.٠	٤.٠	Mean	٠.٠	٢.٠	٤.٠	Mean	٠.٠	٢.٠	٤.٠	Mean
٦٠ kg/fed	١.٤٥	١.٣٧	١.٣٥	١.٣٩	١.٤٨	١.٣٢	١.٣١	١.٣٧	١.٤٧	١.٣٥	١.٣٣	١.٣٨
٨٠ kg/fed	١.٦٧	١.٤٧	١.٥٢	١.٥٥	١.٥٣	١.٤٢	١.٤١	١.٤٥	١.٦٠	١.٤٥	١.٤٦	١.٥٠
١٠٠ kg/fed	١.٨٨	١.٦٩	١.٦٧	١.٧٥	١.٨٢	١.٥٨	١.٥١	١.٦٤	١.٨٥	١.٦٣	١.٥٩	١.٦٩
Mean	١.٦٧	١.٥١	١.٥١	١.٥٦	١.٦١	١.٤٣	١.٤١	١.٤٩	١.٦٤	١.٤٨	١.٤٦	١.٥٣
F value	**	**	**		**	**	**		**	**	**	
LSD ٠.٠٥	A=٠.٠٤	B=٠.٠٣	AB=٠.٠٥		A=٠.٠٢	B=٠.٠٢	AB=٠.٠٤		A=٠.٠٢	B=٠.٠٢	AB=٠.٠٣	

*= Sodium content as milliequavalents / ١٠٠ gm beet .

Table ٨: Effect of yeast on sugar recovery %of sugar beet at different nitrogen fertilizer levels .

Nitrogen fertilizer (A)	٢٠٠٩/٢٠١٠ season				٢٠١٠/٢٠١١ season				Combined			
	Soil application of yeast (kg / fed) (B)											
	٠.٠	٢.٠	٤.٠	Mean	٠.٠	٢.٠	٤.٠	Mean	٠.٠	٢.٠	٤.٠	Mean
٦٠ kg/fed	١٥.٦٦	١٥.٩٠	١٥.٨٥	١٥.٨٠	١٥.٨٠	١٥.٩٦	١٥.٩٤	١٥.٩٠	١٥.٧٣	١٥.٩٣	١٥.٩٠	١٥.٨٥
٨٠ kg/fed	١٣.٤٠	١٣.٧٣	١٣.٧٢	١٣.٦٢	١٣.٤٢	١٤.٠٣	١٣.٨١	١٣.٧٥	١٣.٤١	١٣.٨٨	١٣.٧٦	١٣.٦٩
١٠٠ kg/fed	١٢.٠١	١٢.٣٧	١٢.٤٦	١٢.٢٨	١٢.٠٦	١٢.٥٢	١٢.٥٧	١٢.٣٨	١٢.٠٣	١٢.٤٥	١٢.٥٢	١٢.٣٣
Mean	١٣.٦٩	١٤.٠٠	١٤.٠١	١٣.٩٠	١٣.٧٦	١٤.١٧	١٤.١١	١٤.٠١	١٣.٧٣	١٤.٠٩	١٤.٠٦	١٣.٩٦
F value	**	**	Ns		**	**	*		**	**	Ns	
LSD ٠.٠٥	A=٠.١٠	B=٠.١٠	AB=--		A=٠.١٢	B=٠.١٢	AB=٠.٢٢		A=٠.٠٦	B=٠.٠٨	AB=٠.١٣	

Table ٩: Effect of yeast on quality index% of sugar beet at different nitrogen fertilizer levels .

Nitrogen fertilizer (A)	٢٠٠٩/٢٠١٠ season				٢٠١٠/٢٠١١ season				Combined			
	Soil application of yeast (kg / fed) (B)											
	٠.٠	٢.٠	٤.٠	Mean	٠.٠	٢.٠	٤.٠	Mean	٠.٠	٢.٠	٤.٠	Mean
٦٠ kg/fed	٨٧.٣٢	٨٧.١٢	٨٧.٠٠	٨٧.١٥	٨٨.٠٠	٨٧.٩٣	٨٧.٢٨	٨٧.٧٤	٨٧.٦٦	٨٧.٥٣	٨٧.١٤	٨٧.٤٤
٨٠ kg/fed	٨٣.٥٩	٨٤.١٢	٨٣.٩٩	٨٣.٩٠	٨٤.٢١	٨٥.٤٨	٨٤.٧٠	٨٤.٨٠	٨٣.٩٠	٨٤.٨٠	٨٤.٣٤	٨٤.٣٥
١٠٠ kg/fed	٨٠.٨٠	٨١.٥٢	٨١.٨٩	٨١.٤٠	٨١.٢٩	٨٢.١٣	٨٢.٥٠	٨١.٩٧	٨١.٠٥	٨١.٨٣	٨٢.١٩	٨١.٦٩
Mean	٨٣.٩١	٨٤.٢٦	٨٤.٢٩	٨٤.١٥	٨٤.٥٠	٨٥.١٨	٨٤.٨٢	٨٤.٨٣	٨٤.٢٠	٨٤.٧٢	٨٤.٥٦	٨٤.٤٩
F value	**	Ns	*		**	Ns	*		**	**	**	
LSD ٠.٠٥	A=٠.٤٢	B=--	AB=٠.٦٠		A=٠.٦٩	B=--	AB=٠.٩٤		A=٠.٣٤	B=٠.٣٠	AB=٠.٥٣	

The data given in Tables ٤-٩ revealed that soil application of yeast had a significant effect on pol%, alpha amino nitrogen (α-N) , potassium content, sodium content and sugar recovery% of sugar beet in the two growing seasons and the combined .While, quality index of sugar beet was insignificantly affected by application of yeast in the two growing seasons. This means that the soil application of yeast on sugar beet at the suitable time and content not effect on quality of sugar beet. It could be noted from combined analysis that the increase of yeast content led to an increase in potassium content and sugar recovery % of sugar beet, while α-N and sodium contents of sugar beet were decreased. The favorable effect of yeast might be due to that yeast work on development of soil properties an encourage increase in the absorption of K and P elements from the soil by roots of beet with soil application of yeast, where potassium is used as Co-Enzyme with phosphorase to form sucrose that cause the increase in pol% and sugar recovery% of sugar beet . Moreover, potassium is well known for its vital role in sucrose transportation and accumulation in storage tissues of plants . Sugar beets absorb nutrients from the soil faster than almost any other crop and, as a result, this yeast is exceptionally rich in Selenium, Chromium, Potassium, Magnesium, Sodium, Copper, Manganese, Iron, Zinc and other factors natural to yeast (Abou –Zaid , (١٩٨٤). Such data confirmed the previous repots of Stemwedel, (٢٠٠٩) .

Significant interactions was recorded between nitrogen fertilizer level and soil addition of yeast on sodium content of sugar beet in two growing seasons and combined , in the ١st and combined for potassium content of sugar beet and in the ٢nd and combined for α-N content and sugar recovery% of sugar beet as shown in Tables ٥-٩ .

Yield traits (ton/fed):

The results in Tables ١٠ and ١١ indicate that nitrogen fertilizer level had a significant effect on root and recoverable sugar yields (ton/fed) of sugar beet in both seasons and combined . It could be noted from the combined analysis that the increase in level of nitrogen fertilizer from ٦٠ to ٨٠ and ١٠٠ kg/fed led to an increase of root yield (ton/fed) of sugar beet by ٢٠.٤٦ and ٣٧.١٢٪, as well as, recoverable sugar yield (ton/fed) of sugar beet increased by ٤.١١ and ٦.٦٨ %, respectively. The increase in root yield might be due to the role of nitrogen in building up metabolites activating enzymes and carbohydrates accumulation which transferred from leaves to developing roots yield per unit area .While, the increase in recoverable sugar yield (ton/fed) of sugar beet might be due to an increase in root yield (ton/fed) of sugar beet although the decrease in pol% of sugar beet with increasing level of nitrogen fertilizer (Tables ٤ and ١٠). It could be noted from the results that the rate of increasing in root yield (ton/fed) ,which accompanying the increase in nitrogen fertilizer level was higher than that of recoverable sugar yield (ton/fed) of sugar beet. This result might be due to the decrease in pol% of sugar beet with increasing level of nitrogen fertilizer. These findings are in the same trend with those obtained by Gomaa, *et al.* (٢٠٠٥) and Stevens, *et al.* (٢٠٠٨ , ٢٠١٠ and ٢٠١١).

It can be observed from the data recorded in Tables ١٠ and ١١ that soil application of yeast had a significant effect on root and recoverable sugar yields (ton/fed) of sugar beet in the two growing seasons and combined . It could be noted from the combined analysis that the highest values of root and recoverable sugar yields (٣٠.٥٤ and ٤.٢٥ tons/fed) of sugar beet were recorded with soil application of yeast by rate of ٢.٠ kg/fed compared with the others . These results could be attributed to soil fertilized with the application of yeast caused improvement in specific gravity (lower bulk density),which led to an increase in root diameter (Table, ٣), consequently an increase in root yield (ton/fed) of sugar beet when compared to the other. Therefore , the increase in root yield (ton/fed) of sugar beet with application of yeast might be principally led to an increase in recoverable sugar yield of sugar beet and not the increase in pol% of sugar beet (Table ٤ -١٠). These findings are in the same trend with those obtained by Gomaa, *et al.* (٢٠٠٥).

Table ١٠: Effect of yeast on root yield(ton/fed) of sugar beet at different nitrogen fertilizer levels .

Nitrogen fertilizer (A)	٢٠٠٩/٢٠١٠ season				٢٠١٠/٢٠١١ season				Combined			
	Soil application of yeast (kg / fed) (B)											
	٠.٠	٢.٠	٤.٠	Mean	٠.٠	٢.٠	٤.٠	Mean	٠.٠	٢.٠	٤.٠	Mean
٦٠ kg/fed	٢٢.٤٠	٢٦.٠٣	٢٥.٣٧	٢٤.٦٠	٢١.٧٧	٢٥.٨٧	٢٥.٨٠	٢٤.٤٨	٢٢.٠٨	٢٥.٩٥	٢٥.٥٨	٢٤.٥٤
٨٠ kg/fed	٢٦.٢٣	٣١.٥٠	٣٠.٣٣	٢٩.٣٦	٢٧.٠٧	٣٠.٨٧	٣١.٣٧	٢٩.٧٧	٢٦.٦٥	٣١.١٨	٣٠.٨٥	٢٩.٥٦
١٠٠ kg/fed	٣٢.١٣	٣٤.٦٠	٣٤.٢٠	٣٣.٦٤	٣٢.٨٠	٣٤.٣٧	٣٣.٨٠	٣٣.٦٦	٣٢.٤٧	٣٤.٤٨	٣٤.٠٠	٣٣.٦٥
Mean	٢٦.٩٢	٣٠.٧١	٢٩.٩٧	٢٩.٢٠	٢٧.٢١	٣٠.٣٧	٣٠.٣٢	٢٩.٣٠	٢٧.٠٧	٣٠.٥٤	٣٠.١٤	٢٩.٢٥

F value	**	**	**	**	**	**	**	**	*
LSD ٠.٠٥	A=٠.٦١	B=٠.٥٢	AB=٠.٨٩	A=٠.٦١	B=٠.١٨	AB=٠.٣٢	A=٠.٣٦	B=٠.٢٦	AB=٠.٤٥

Significant interactions were recorded between nitrogen fertilizer level and soil application of yeast (AB) on root and recoverable sugar yields (ton/fed) of sugar beet in the two growing seasons and combined as shown in Tables ١٠ and ١١ . It could be noted from the combined analysis that the highest values of root and recoverable sugar yields (٣٤.٤٨ and ٤.٣٢ tons/fed) of sugar beet were recorded with nitrogen fertilizer level at ١٠٠ kg/fed with soil application of yeast by rate of ٢.٠ kg/fed while nitrogen fertilizer level at ٦٠ kg/fed with soil application of yeast by rate of ٠.٠ kg/fed gave the lowest values (٢٢.٠٨ and ٣.٤٨ tons/fed) . .

Table ١١: Effect of yeast on recoverable sugar yield(ton/fed) of sugar beet at different nitrogen fertilizer levels .

Nitrogen fertilizer (A)	٢٠٠٩/٢٠١٠ season				٢٠١٠/٢٠١١ season				Combined			
	Soil application of yeast (kg / fed) (B)											
	٠.٠	٢.٠	٤.٠	Mean	٠.٠	٢.٠	٤.٠	Mean	٠.٠	٢.٠	٤.٠	Mean
٦٠ kg/fed	٣.٥١	٤.١٣	٤.٠٣	٣.٨٩	٣.٤٤	٤.١٢	٤.١٢	٣.٨٩	٣.٤٨	٤.١٣	٤.٠٨	٣.٨٩
٨٠ kg/fed	٣.٥٢	٤.٣٢	٤.١٧	٤.٠٠	٣.٦٤	٤.٢٦	٤.٤٠	٤.١٠	٣.٥٨	٤.٢٩	٤.٢٨	٤.٠٥
١٠٠ kg/fed	٣.٨٦	٤.٣١	٤.٢٣	٤.١٣	٣.٩٥	٤.٣٢	٤.٢٤	٤.١٧	٣.٩١	٤.٣٢	٤.٢٤	٤.١٥
Mean	٣.٦٣	٤.٢٥	٤.١٤	٤.٠١	٣.٦٨	٤.٢٤	٤.٢٥	٤.٠٦	٣.٦٥	٤.٢٥	٤.٢٠	٤.٠٣
F value	**	**	*	**	**	**	**	**	**			
LSD ٠.٠٥	A=٠.٠٦	B=٠.٠٨	AB=٠.١٣	A=٠.١٠	B=٠.٠٥	AB=٠.٠٩	A=٠.٠٥	B=٠.٤٢	AB=٠.٠٧			

In general, it can be concluded from the results that application of nitrogen fertilizer level at ١٠٠ kg/fed with soil addition of yeast at rate of ٢.٠ kg/fed could be recommended for maximizing sugar beet productivity under the environmental conditions of El.Minia Governorate for grower and sugar factory .

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استجابة ناتج وجودة بنجر السكر لإضافة الخميرة عند معدلات مختلفة من السماد النيتروجينى

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تحسم الإدارة الجيدة للتسميد النيتروجينى إنتاج ناتج عالي من محصول بنجر السكر ذو جودة عالية ، لكن لا توجد كمية محددة من السماد النيتروجينى كافية ان تعطى الناتج المطلوب حيث ان زيادة كمية السماد النيتروجينى تخفض جودة المحصول . ويلاحظ قيام بعض زراع بنجر السكر فى أجزاء مختلفة من محافظة المنيا استخدام الخميرة فى المرحلة الأخيرة من عمر المحصول خلال شهر مارس لزيادة ناتج محصول بنجر السكر بصرف النظر عن الجودة . لهذا السبب أقيمت تجربتين حقليتين بمحطة البحوث الزراعية بملوي ،محافظة المنيا ، مصر خلال موسمى٢٠٠٩ /٢٠١٠،٢٠١٠/٢٠١١ لدراسة تأثير الاستخدام الارضى لثلاث مستويات من الخميرة فى عمر٤٠ يوم من الزراعة هي صفر ، ٢.٠ و ٤.٠ كجم خميرة / فدان على ناتج وجودة محصول بنجر السكر عند ثلاثة مستويات مختلفة من السماد النتيروجينى هى ٦٠ ، ٨٠ و ١٠٠ كجم / فدان في تصميم قطع منشقة مرة واحدة .

Effect of adde yeast on sugarbeet yield and quality

أوضحت النتائج المتحصل عليها الأتى :

١ – وجد إن لمستويات السماد النتيروجينى تأثيرا معنويا على جميع الصفات الخضرية (طول و قطر الجذر) ، صفات الجودة التكنولوجية مثل نسبة السكر في جذور البنجر ، كميات ألفا أمنيو نتروجين ،البوتاسيوم والصوديوم، و نسبة استخراج السكرو معامل الجودة ، وكذلك الصفات الإنتاجية { ناتج الجذور النظيفة و ناتج السكر القابل للاستخراج (طن /فدان)} في كلا الموسمين الزراعيين.

٢– أحدثت مستويات الاستخدام الارضى للخميرة تأثيرا معنويا على جميع الصفات الخضرية (طول و قطر الجذر) ، صفات الجودة التكنولوجية مثل نسبة السكر في جذور البنجر ، كميات ألفا أمنيو نتروجين ،البوتاسيوم والصوديوم، و نسبة استخراج السكر عدا معامل الجودة ، كذلك الصفات الإنتاجية { ناتج الجذور النظيفة و ناتج السكر القابل للاستخراج (طن /فدان)} في كلا الموسمين الزراعيين.

٣ – سجل تفاعل معنوي بين مستويات السماد النتيروجينى و مستويات الاستخدام الارضى للخميرة بالنسبة لقطر الجذر وكمية الصوديوم ونواتج الجذور النظيفة و السكر القابل للاستخراج (طن /فدان) فى كلا الموسمين ،كمية البوتاسيوم فى الموسم الأول فقط وكمية ألفا أمنيو نتروجين ونسبة ناتج السكر فى الموسم الثاني فقط .

٤– تحت ظروف التجربة وجد إن استخدام المعدل ١٠٠ كجم نيتروجين / فدان مع الاستخدام الارضى للخميرة بمعدل ٢.٠ كجم / فدان موصى بها للحصول على أقصى ما يمكن من إنتاجية البنجر للمزارع ومصنع السكر .