EFFECT OF MICRO NUTRIENT COMPOUND, PHOSPHORUS RATES AND NITROGEN RATES AND ITS APPLICATION METHODS ON YIELD AND QUALITY OF SUGAR BEET (*Beta vulgaris* L.) UNDER TWO SOWING DATES

Osman[*], M.S.; Abd Elhay, G. H.[*]; El-Geddawy[**], I.H. and Abd-Elsalam. K.A.G.[**]

*** Agronomy, Faculty of Agriculture, Al-Azhar University.**

**** Researcher, Sugar Crops Res. Inst., Agric. Res. Center**

ABSTRACT

Two field experiments were carried out in Tamiya Agricultural Research Station at Fayoum Governorate for the two successive growing seasons of 2008/ 2009 and 2009/2010 to study yield and quality of sugar beet as affected by sowing dates included two sowing dates i.e. 15th July and 15th November and some macro and micro nutrients treatments

Each sowing date included 24 - treatment which were the combination between three concentrations of foliar application micro nutrition (Fe, Mn, Zn and B) (0.5, 1.0 and 1.5 cm^3 /L), two phosphorus rates (22.5 and 30 kg P_2O_5 /fed), two nitrogen rates (80 and 100 kg. N /fed) and two N- application method.

Treatments were arranged in a split plot design with four replications. Foliar nutrient treatments were allocated in the main plots, whereas, the combination between phosphorus rates, nitrogen application method and rates were distributed in the sub plot area. The results showed that:

Sucrose in both seasons and purity percentages in the 2nd season were significantly increased when sugar beet was sown on 15th July, meanwhile, non of the examined concentration of foliage compound as well as phosphorus level and nitrogen application method attained any significant effect on these characters. However, increasing the applied nitrogen let to significant decrease in sucrose % in both seasons of the 2nd sowing date (15th November). Moreover, purity % was not affected by nitrogen level in the 1st season and in the 1st sowing date in the 2nd season. Meanwhile in the 2nd sowing date of the 2nd season, purity %was reduced significantly by increasing in nitrogen level up100 Kg. N /fed.

Tops yield was not affected by sowing dates, however root and sugar yields were significantly affected by sowing dates. Root and sugar yield significantly increased in the 1st sowing date. Also foliage compound treatments affected root and top yields in both seasons. On the other hand, sugar yield insignificantly affected by foliage compound treatments.

Increasing phosphorus application significantly increased tops and root yield in both seasons, whereas sugar yield significantly increased with the increase in phosphorus level in the 1st sowing date of the 2nd season. Drilling method of nitrogen application significantly increased tops yield in both seasons, however increased root yield significantly in the 2nd sowing date of the two seasons. Also sugar yield was significantly increased by drilling nitrogen in the 1st season only.

Increasing nitrogen rates let to significant increase in tops and roots yield in both seasons, meanwhile, this increase was statistically for sugar

yield in the 1st sowing date of the 1st season and in the 2nd sowing date of the 2nd season.

Based upon the obtained results and under this conditions, it could be recommended by the 1st sowing date and using nutrients compound (Fe, Mn, Zn and B) by 1.5 cm^3 /L, 30 KgP_2O_5 and 100 Kg.N/fed. by drilling method.

Key words: Micro nutrient; Phosphorus rates; Nitrogen rates and Sugar beet.

INTRODUCTION

Improving sugar beet production and its quality became the main target for the interested people in sugar beet production domain in the University, Ministry of Agriculture and or in Sugar factories. There are many factors affecting directly juice quality and yield components. Micro nutrients has a direct influence on the quality of juice through their direct or indirect effect on plant metabolisms consequently sugar accumulation, also macro element such as phosphorus or nitrogen or their application methods play a direct effect on plant synthesis in turn its yield component

Wrobel (1996), in Poland**,** grew sugar beet on four soil types with NPK alone or with 2.0 kg B, 8.0 kg Cu, 0.4 kg Mo, 8.0 kg Zn, 2.0 kg Mn, all 5 of these trace elements at the rates listed or the trace elements which were deficient in each soil (Mo in 2 soils, Cu in one and Zn in one). Applying B, Mn and the appropriate deficient trace elements gave the highest root and sugar yields. Mn and the deficient trace elements increased leaf yield. **Osman (1997),** in his study at Sakha Research Station, Egypt, on the effect of B, Zn, Mn and their mixture on sugar beet reported that all micronutrients under study had no significant effect on sucrose percentage. Mn application at 40 g/fed. significantly raised purity percent.

Saad (2005), reported that increasing boron levels from zero to 1 and 2 kg /fed. increase top yield/fed **Khalil (2010);-** showed that nitrogen fertilization level given to sugar beets from 80 to 100 and 120 kg N/fed significantly increased root, sugar and top yields/fed.

Abd Elsalam (2007); applying indicted that 100kgN gave of sugar beet yields (top-root-sugar). **Aboushady *et al* (2008)** pointed out that increasing nitrogen fertilizer rate from 70 to 90 kg N/fed. sucrose %, purity % and extractability decreased in two studied seasons. **El-Shouny *et al*. (2003),** showed significant effects for sowing dates on top, root and sugar yields per fed in both seasons. Early planting (25th Sept.) was associated with the greatest values of the mentioned yields in both seasons. **Ferweez *et al*. (2004),** in Egypt, studied the effect of three sowing dates i.e. 15th September, 15th October and 15th November on the productivity of sugar beet cultivar Gloria. They concluded that sowing dates had a highly significant effect on root, top and recoverable sugar yields. Their results indicated that sowing sugar beet on 15th October produced the highest values of root and recoverable sugar yields. Sowing on 15th November gave the highest values of top yield and lowest values of root and recoverable sugar yields. **Bachoosh (2010);** indicated that compared to the other two sowing dates (15th Oct. and 15 th Nov.). 15th Sep. significantly increased root, sugar and top yields/fed.

MATERIALS AND METHODS

A field experiment included two sowing dates i.e. 15th July and 15th November was carried out in Tamiya Agricultural Research Station at Fayoum for the two successive growing seasons of 2008/ 2009 and 2009/2010 to study yield and quality of sugar beet as affected by sowing dates and application methods of some micro and macro nutrients under Fayoum Governorate.

Each sowing date of the present study consists of 24 treatments which were the combination between three foliar application micro nutrition (Fe, Mn, Zn and B) (0.5, 1.0 and 1.5 cm^3 / L), two phosphorus rates (22.5 and 30 kg P_2O_5 / fad.), two nitrogen application methods (Broadcast and drilling application) and two nitrogen rates (80 and 100 Kg N/ fad.)

Treatments were arranged in a split plot design with four replications. Foliar micro nutrients was allocated in the main plots, whereas, the combination between phosphorus rates, nitrogen application method and rates were distributed in the sub plot area . Plot area was 21 m^2 which included six ridges of 50 cm apart and 7 meter in length. Sugar beet seeds viz Oscar Poly was sown. Plants were thinned to one plant per hill after four weeks from sowing.

Superphosphate fertilizer (15.5% P_2O_5) was added at rate of 22.5 and30 kg p_2O_5/ fad with preparation of soil

Nitrogen fertilizer was applied in two equal does; the first dose was applied after thinning and the second one was added one month later. Potassium fertilizer was applied with the first dose of nitrogen fertilizer at a rate of 24 kg K_2O/fed in the form of Potassium Sulfate (48% K_2O).

All the common agricultural practices for sugar beet crop were done as usual in sugar beet fields.

Table (1) Chemical and physical properties of the experimental sites of the two growing seasons:

Table (1-a): Chemical analysis of used soil during 2003/2004 and 2004/2005 seasons.

Properties		**2008/2009**	**2009/2010**
Total N %		0.45	0.32
P (ppm.)		0.136	0.070
E.C.(dS/ m^{-1})		4.6	2.4
pH		7.8	7.5
$CaCO_3$ %		24.5	24.55
Cations	Mg^{++}	6.3	4.2
	Na^{+}	0.337	0.131
	K^{+},	0.06	0.02
Anions			
	$SO4^{-}$	10.1	7.2
	CL^{-}	3.2	1.4

Table (1- b) Physical properties of experimental soil during 2008/2009 and 2009/2010 seasons

Properties				
Seasons	**Sand**	**Silt**	**Clay**	**Texture grade**
2008/2009	21.3	39.3	37.4	Loamy
2009/2010	23.60	29.90	46.50	Loamy

Data recorded

I -Juice quality:

At harvest (210 days from sowing) ten plants were taken at random from each sub plot area to determine the following parameters:

1. Sucrose percentage of sugar beet roots, was determined according to the method described by **Le-Docte (1927)**.
2. Purity percentage of sugar beet roots was calculated according to the following equation:

Purity percentage = (sucrose % x 100) / TSS%

II Yields:

At harvest i.e. 210 days from sowing plants of the four guarded rows for each sub plot were uprooted and separated into roots and leaves and weighed to determine:

1- Top yield (ton/fed).
2- Root yield (ton/fed).
3-Sugar yield (ton/fed) was estimated according to the following equation:

Sugar yield (ton/fed) = root yield(ton/fed) x sucrose % X purity %

Statistical analysis:

Data obtained of the two growing seasons were collected, computed and subjected to the proper statistical analysis of split plot design according to **Snedecor and Cochran (1980)**. To compare between means the least significant difference test was used according to **Waller and Duncan 1969).**

RESULTS AND DISCUSSION

Effect of treatments on juice quality:

1-Sucrose percentage

The available data in Table (2) revealed that on the examined concentrations of the foliage compound insignificantly influence on sucrose percentage. This finding was completely true not only in the two sowing dates but also in the two growing seasons. This result is in agreement with **Osman (1997),** who reported that all micronutrients under study had no significant effect on sucrose percentage.

Once more , the results obtained in Table (2) cleared that the differences between phosphorus rates was not enough to reach the level of significance with respect to their influence on sucrose percentage of sugar beet roots in the two sowing dates as well as in the two seasons. On the other hand it could be remarked a slightly increment in the values of sucrose percentage with the low phosphorus rate (22.5 Kg P_2O_5 /fad.).

As for the influenced of N-application method on sucrose percentage, illustrated data in Table (2) distinctly cleared that sucrose percentage of sugar beet roots was insignificantly affected by the studied N- application method whether in two sowing dates and or the two growing seasons.

Increasing the applied rate of nitrogen from 80 to 100 Kg.N/fad. decreased the values of sucrose percentage . However This decrease was significantly in the two sowing dates of the 1st season as well as in the 2nd sowing date of the 2nd season. This reduction mainly due to the inverse relationship between nitrogen fertilization and juice quality in terms of sucrose. **Aboushady *et al* (2008).**pointed out that increasing nitrogen fertilizer rate from 70 to 90 kg N/fed decreased,

sucrose % in two studied seasons. this result is in agreement with **Abd Elsalam (2007)** who indicated that 60 kg N/fed attained high values of sucrose compared with 80 and 100 kg N/fed**.**

Concerning sowing dates effect on sucrose percentage in the two seasons. Results given in Table (2) obviously show a pronounced and significant effect on sucrose percentage due to sowing date. the earlier, the sowing date, the high the sucrose percentage. The distinct effect of the early sowing date (15th July) on sucrose percent may be due to the suitable conditions (cooler season) for sucrose acumulation during maturity stage compared with the later one (15th November). **Bachoosh (2010);** found that sucrose % was, significantly increased by sowing dates15sept compared with 15th Oct. and 15th Nov. Also **El-Shouny *et al*. (2003),** showed significant effects for planting dates on sucrose percentage of sugar beet cv. Ras poly. Early planting date (25 Sept.) was associated with the high trait values.

Interaction significant:

Data in Table (2-a) clear the influence of the interaction between foliar application treatments and N-application method on sucrose percentage. The collected data pointed out that increasing the concentration of foliar compound let to increase in the values of sucrose percentage .This finding almost was fairly true under the two N-application method.

Table (2): Effect of micro nutrition, phosphorus levels and nitrogen levels and its application method on sucrose% under two sowing dates (Combined in 2008/2009 and 2009/2010 seasons)

	Season (2008/2009)		Season (2009/2010.)	
	15 July	15 Nov.	15 July	15 Nov.
Sowing dates				
Combined	19.758	18.409	19.455	18.211
L.S.D	0.306		0.355	
Foliar micro-nutrition conc. cm^3 / L				
0.5	21.454	17.198	21.013	16.995
1.0	21.193	16.638	20.745	16.856
1.5	21.183	16.833	20.656	16.735
LSD	N.S	N.S	N.S	N.S
Phosphorus rates Kg/ Fed. :				
22.5	21.334	16.939	20.812	16.803
30.0	21.220	16.841	20.797	16.921
LSD	N.S	N.S	N.S	N.S
Nitrogen application methods				
Broadcast	21.389	16.981	20.869	16.964
Drilling	21.165	16.798	20.739	16.760
LSD	N.S	N.S	N.S	N.S
Nitrogen rates Kg. / fed. :				
80	21.594	17.474	21.247	17.363
100	20.960	16.306	20.362	16.360
LSD	S	S	N.S	S

Table (2-a) : Effect of the interaction between Foliar micro-nutrition and Nitrogen application methods on sucrose at 15th Nov. of the 2nd season**.**

Treatments	Broadcast application	Drilling application
0.5 cm^3/L(Foliar)	17.359	16.630
1.0 cm^3/L(Foliar)	17.093	16.618
1.5 cm^3/L(Foliar)	17.359	17.032
L.S.D at 0.05 level of significance		0.700

2-Purity percentage

Table (3): Effect of micro nutrition, phosphorus levels and nitrogen levels and it's application method on purity under two sowing dates (Combined in 2008/2009 and 2009/2010 seasons)

	Season (2008/2009)		Season (2009/2010.)	
	15 July	15 Nov.	15 July	15 Nov.
Sowing dates				
Combined	80.871	79.457	79.814	77.456
L.S.D	N.S		1.069	
Foliar micro-nutrition conc. C3 / L				
0.5	86.667	75.947	81.867	76.883
1.0	86.125	76.304	81.112	75.829
1.5	85.642	70.299	80.725	75.392
LSD	N.S	N.S	N.S	N.S
Phosphorus rates Kg/ Fed. :				
22.5	86.275	72.972	81.258	76.800
30.0	86.014	75.395	81.211	75.269
LSD	N.S	N.S	N.S	N.S
Nitrogen application methods				
Broadcast	86.200	74.366	81.531	75.792
Drilling	86.089	74.001	80.939	76.278
LSD	N.S	N.S	N.S	N.S
Nitrogen rates Kg. / fed. :				
80	86.397	74.118	81.469	77.564
100	85.892	74.249	81.000	74.506
LSD	N.S	N.S	N.S	S

Data obtained in Table (3) cleared that foliar application treatments insignificantly effected on the values of purity of sugar beet roots. This finding is in accordance with **Saad (2005)**, who reported that increasing boron levels from zero to 1 and 2 kg /fed. tended to increase purity percentage. **Osman (1997),** in his study at Sakha Research Station, Egypt, on the effect of B, Zn, Mn and their mixture on sugar beet reported that. Mn application at 40 g/fed. significantly raised purity percent The results showed that boron application increased juice purity and sugar content in the root **(Al-Mohmmad and Al-Geddawi, 2001).**

Data in Table (3) demonstrated that the differences between the examined rates of phosphorus fertilizer insignificantly influnced on purity percentage. However, **Hassanein (1992)** reported that the application of 45.0 kg P_2O_5/fed.

improved quality in terms of purity percentage.

Concerning the effect of nitrogen rates and its N-application method on purity percentage of sugar beet roots. The available data pointed out that the two factors insignificantly effected on purity percentage, except nitrogen rates at the 15th of November of the 2nd season where it is noticed that increasing the applied dose of nitrogen reduced juice purity of sugar beet. **Aboushady *et al* (2008).** Pointed out that increasing nitrogen fertilizer rate from 70 to 90 kg N/fed decreased purity

Once more , the influence of sowing dates on purity percentage , the results given in Table (3) indicated to somewhat an increase in purity percentage in the early sowing date (15^{th} July) compared to the later one (15^{th} November) which recorded lower purity percentage. This find was true in the two season but, statistically in the 2^{nd} season only.

II Effect of treatments on yields

1- Tops yield tons/fad.

Data showed in Table (4) appeared an ascending increase in the values of sugar beet tops yield accompanied to the increase in the concentration of foliage treatments in the two sowing dates of the two growing seasons. These increments were statistically, also it could be noted that the highest top yield was recorded with the highest concentration of the foliage compound (1.5 cm^3/L). The effective role of micro and macro element had been reported by **Saad (2005)**, who reported that increasing boron levels from zero to 1 and 2 kg /fed. tended to increase top yield/fed**.** Also **Wrobel (1996),** in Poland**,** Found that

Data illustrated in Table (4) pointed out that phosphorus fertilizer rates except the 1^{st} sowing dates in 2^{nd} season. significantly increased the values of sugar beet top yield. This increment may be due to the important role of phosphorus element in plant metabolism consequently plant growth and in turn foliage weight. This result is in agreement with **Hassanein (1992)** who reported that the application of 45.0 kg P_2O_5/fed. improved root characters in terms of increased yield of roots, tops and sugar per fad.

Result available in Table (4) cleared that This trait statistically and positively responded to N-application methods. Drilling nitrogen fertilizer surpassed broadcast method with respect to its influence on top yield /fad. for sugar beet crop. This finding is in accordance with **Khalil(2010)** who indicted that increasing nitrogen fertilization level given to sugar beets from 80 to 100 and 120 kg N/fed significantly increased root, sugar and top yields/fed. Also, **Abd Elsalam (2007);-** Applying 100kgN/fed attained high values of Top yield.

The results obtained In Table(4) cleared that increasing nitrogen rate from 80 to 100 Kg.N/fad. positively improved the values of top fresh yield. This finding is in line with that obtained by **El-Shouny *et al*. (2003**)

Belonging sowing dates effect on sugar beet top fresh weight/fad. , the presented figures in Table (4) pointed out that no statistical differences between sowing dates with respect to their effect on top fresh weight of sugar beet crops.

Ferweez *et al*. (2004), who Found that1ate sowing date up to 15Nov. gave high values of top yield compared with early sowing date.

Table (4): Effect of micro nutrition, phosphorus levels and nitrogen levels and its application method on tops yield under two sowing dates (Combined in 2008/2009 and 2009/2010 seasons)

	Season (2008/2009)		Season (2009/2010.)	
	15 July	15 Nov.	15 July	15 Nov.
Sowing dates				
Combined	13.865	13.936	14.041	14.144
L.S.D	N.S		NS	
Foliar micro-nutrition conc. C^3 / L				
0.5	13.477	13.706	13.727	13.891
1.0	13.810	14.160	14.152	14.170
1.5	13.942	14.307	14.312	14.304
LSD	0.077	0.192	0.080	0.108
Phosphorus rates Kg/ Fed. :				
22.5	13.701	13.989	14.015	14.077
30.0	13.785	14.131	14.112	14.166
LSD	S	S	N.S	S
Nitrogen application methods				
Broadcast	13.438	13.845	13.779	13.813
Drilling	14.49	14.271	14.348	14.430
LSD	S	S	S	S
Nitrogen rates Kg. / fed. :				
80	13.519	13.883	13.634	13.963
100	13.967	14.232	14.349	14.280
LSD	S	S	S	S

Interaction significant:

Data illustrated in Table (4-a) showed that the interaction between foliar application treatments and nitrogen rates on Top yield was significance in the 1st season. Figures obtained revealed that increasing micro nutrients and nitrogen fertilizer rates let to increasing top yield.. The highest top yield was recorded with the combination between 100 kgN/fad. and 1.5 cm^3 /L. of micro nutrient

Table (4-a) Effect of interaction between Foliar micro-nutrition and nitrogen rates on top yield at the 15th Nov. of the 1st season

Treatments	80 Kg.N./fad.	100 Kg.N./fad.
0.5 cm^3/L(Foliar)	13.612	13.800
1.0 cm^3/L(Foliar)	13.958	14.362
1.5 cm^3/L(Foliar)	14.079	14.534
L.S.D at 0.05 level of significance		0.157

Results obtained in Table (4-b) clear the interaction between foliar application treatments and nitrogen rates on top fresh weight yield in the 2nd season.

Table (4-b): Effect of interaction between Foliar micro-nutrition and Nitrogen application methods on top yield at 15th Nov. of the 1st season.

Treatments	Broadcast application	Drilling application
0.5 cm^3/L(Foliar)	13.579	13.833
1.0 cm^3/L(Foliar)	13.900	14.421
1.5 cm^3/L(Foliar)	14.055	14.558
L.S.D at 0.05 level of significance		0.157

Results in Table (4-c) cleared that raising the concentration of foliar compound attained a statistical effect on tops yield. This fact was completely true in both N- application rate, however, this increment was higher under drilling method of nitrogen application.

Table (4-c): Effect of interaction between foliar micro-nutrition and Nitrogen application rates on tops yield at 15th Nov of the 2nd season

Treatments	80 Kg.N./fad.	100 Kg.N./fad.
0.5 cm^3/L(Foliar)	13.700	14.083
1.0 cm^3/L(Foliar)	14.025	14.316
1.5 cm^3/L(Foliar)	14.166	14.441
L.S.D at 0.05 level of significance		0.60

2- Root yield (tons/fad.)

Data obtained in Table (5) reveal the values of root yield in both sowing dates of the two growing seasons. The results obtained appeared that the various concentration of the foliage
Compound except the 1st sowing date of the 1st season significantly effected on root yield.

It is obviously showed that root yield positively and ascendingly responded to the increase in the concentration of the foliar compound. This result is in harmony with **Saad (2005)**,who reported that increasing boron levels from zero to 1 and 2 kg /fed. tended to increase root yield/fed **Wrobel (1996),** in Poland**,** found that Applying B, Mn and the appropriate deficient trace elements gave the highest root yield.

Increasing the applied dose of phosphorus as it shown in Table (5) let to additional increment in the root yield. This observation was fairly true in both sowing dates of the two seasons. **Hassanein (1992)** reported that the application of 45.0 kg P_2O_5/fed. improved root yield per fad

Data illustrated in Table (5) proved that drilling method of nitrogen application is still the most effective N- application method not only on root yield but also, on the majority of the characters studied.

Data in Table (5) revealed that increasing nitrogen fertilizer from 80 Kg.N/fad. to 100 Kg.N/fad. increased root yield. This result was completely true in both sowing dates of the two growing seasons. **Khalil (2010);** indicated that increasing nitrogen fertilization level given to sugar beets from 80 to 100 and 120 kg N/fed significantly increased root, yield/fed.

Abd Elsalam (2007);- indicted that nitrogen rates (100kg) gave the best values of root yield compared to the ather two rates of nitrogen

It distinctly showed that the 1st sowing dates was the most effective sowing date with respect to root yield in both seasons. However, it could be noted that the 1st sowing date (15th July) in both seasons attained the highest root yield This advantage mainly due to the fact that the plant grown in the 1st sowing date (15th July) exposed to exhibted temperature paushed the plant growth as well as spent a cooling period during maturity stage which let to more and more sugar accumulation consequently more yield. **Bachoosh (2010)**. Indicated that sowing sugar beet seeds at 15th Sep significantly increased root yield/fed compared to the ether sowing date.

El-Shouny *et al*. (2003), showed significant effects for planting dates on root yield per fed in both seasons. Early planting (25 Sept.) was associated with the greatest values of the root yield in both seasons.

Ferweez *et al*. (2004), indicated that sowing sugar beet on 15th October produced the highest values of root yield.

Table (5): Effect of micro nutrition, phosphorus levels and nitrogen levels and it's application method on root yield under two sowing dates (Combined in 2008/2009 and 2009/2010 seasons).

	Season (2008/2009)		Season (2009/2010.)	
	15 July	15 Nov.	15 July	15 Nov.
Sowing dates				
Combined	45.806	43.069	50.357	51.681
L.S.D	1.044		0.591	
Foliar micro-nutrition conc. C3 / L				
0.5	46.958	39.042	50.833	48.083
1.0	48.625	41.458	52.125	50.250
1.5	48.000	42.542	53.375	51.500
LSD	N.S	1.005	10292	0.267
Phosphorus rates Kg/ Fed. :				
22.5	47.333	40.694	51.139	49.472
30.0	48.389	41.333	53.083	50.417
LSD	S	S	S	S
Nitrogen application methods				
Broadcast	46.472	39.250	51.889	49.167
Drilling	49.250	42.778	52.333	50.722
LSD	S	S	S	S
Nitrogen rates Kg. / fed. :				
80	46.389	39.806	50.694	48.556
100	49.333	42.222	53.528	51.333
LSD	S	S	S	S

Interaction significant:

Data given in Table (5-a) cleared a statistical effect on root yield of sugar beet crop due to the combination between N-application method with foliar application treatments. The highest root yield value was recorded with the combination between 1.5 cm^3 /L of foliar compound under drilling method of nitrogen application (52.5 tons/fed) compared to the ether interactions.

Table (5-a) Effect of interaction between Foliar micro-nutrition and N application methods on root yield at 15th Nov. of the 2nd season.

Treatments	Broadcast application	Drilling application
0.5 cm^3/L(Foliar)	47.583	48.583
1.0 cm^3/L(Foliar)	49.417	51.083
1.5 cm^3/L(Foliar)	50.500	52.500
L.S.D at 0.05 level of significance		0.558

3-Sugar yield (tons/fad.)

Results given in Table (6) showed that the examined foliar application treatments insignificantly effected sugar yield. This finding was true in the two sowing dates of both seasons. Regardless the insignificant effect of these treatments , it could be observed that increasing the used concentration from foliar compound up to 1.0 cm^3 in the 1st season and up to 1.5 cm^3 in the 2nd season attained somewhat increase in the values of sugar yield. This result is in accordance with that obtained by **Saad (2005)**, who reported that increasing boron levels from zero to 1 and 2 kg /fed. tended to increase sugar yield (tons/fed). This result is in agreement with that obtained by **Wrobel (1996),** Concerning the influence of phosphorus fertilizer rates on the values of sugar yield. The collected data in Table (6) clearly showed that phosphorus fertilizer application attained a relative increase in the values of sugar yield in the two seasons , however this influence was only statistically in the 2nd sowing date i.e.15th November of the 2nd season. This finding may be some attributed to the relative importance of phosphorus element as one of the important products in photosynthesis process which play a distinct role in plant metabolism. The important of phosphorus fertilizer had been reported by **Hassanein (1992)** who reported that the application of 45.0 kg P_2O_5./fed. improved sugar yield. concerning N-application methods. the results pointed out that the difference between the two application methods of nitrogen. was statistically in the 1st season only , Moreover , it could be deduced that drilling method for nitrogen fertilizer may be was still the suitable one for sugar yield too.

Results illustrated in table (6) cleared that the values of sugar yield tended to increase as the applied dose of nitrogen increased from 80 to 100 Kg.N/fad. in the 1st season, however, in the 2nd season this inverse relation between nitrogen rates and sugar yield was recorded , decreasing nitrogen rates from 100 to 80 Kg.N/fad. gave higher sugar yield. The above mentioned effects were statistically only in the 1st sowing date in the 1st season and in the 2nd sowing date in the 2nd season. Similar results were reported by **Abd Elsalam (2007) and Khalil (2010),** who attained high values of sugar yield from high level of nitrogen fertilizer application.

Regarding sowing dates, it is cleared that sowing dates significantly affected sugar yield in both seasons where the 1st sowing dates(15 July) attained the highest value compared to the late sowing date (15th Nov). this result may be attributed to the increase in sugar percentage and root yield and sequent sugar yield at the end. This result is in agreement with those obtained by **Bachoosh (2010) and El-Shouny *et al*. (2003),**

Table (6): Effect of micro nutrition, phosphorus levels and nitrogen levels and it's application method on sugar yield under two sowing dates (Combined in 2008/2009 and 2009/2010 seasons)

Treatment	Season (2008/2009)		Season (2009/2010.)	
	15 July	15 Nov.	15 July	15 Nov.
Sowing dates				
Combined	7.472	6.422	7.856	7.350
L.S.D	0.354		0.231	
Foliar micro-nutrition conc. C3 / L				
0.5	8.727	5.098	8.752	6.274
1.0	8.870	5.251	8.776	6.415
1.5	8.705	5.032	8.908	6.493
LSD	N.S	N.S	N.S	N.S
Phosphorus rates Kg/ Fed. :				
22.5	8.707	5.017	8.659	6.372
30.0	8.827	5.237	8.965	6.416
LSD	N.S	N.S	S	N.S
Nitrogen application methods				
Broadcast	8.561	4.942	8.830	6.314
Drilling	8.974	5.311	8.784	6.474
LSD	S	S	N.S	N.S
Nitrogen rates Kg. / fed. :				
80	8.653	5.147	8.789	6.536
100	8.883	5.106	8.835	6.252
LSD	S	N.S	N.S	S

Interaction significant:

Data in Table (6-a) clear the influence of the interaction between foliar application treatments and nitrogen rates on sugar yield.

Table (6 –a) Effect of the interaction between Foliar micro-nutrition and Nitrogen rates on 15th November. of the 1st season

Treatments	80 Kg.N /fad.	100 Kg.N /fad.
0.5 cm^3/L(Foliar)	5.381	4.814
1.0 cm^3/L(Foliar)	5.253	5.549
1.5 cm^3/L(Foliar)	4.808	5.256
L.S.D at 0.05 level of significance		0.566

The obtained data appeared a significant influence on sugar yield due to the interaction between foliar application treatments and nitrogen rates. It is obviously cleared that increasing the applied dose of nitrogen under the middle (1.0 cm^3) foliar application treatments attained the highest values of sugar yield. On the contrary increasing the concentration of foliar application compound to the highest concentration i.e.1.5 cm^3 caused a reduction in sugar yield at 80kgN/Fed

Results given in Table (6-b) reveal the interaction effect between foliar application treatments and phosphorus rates on sugar yield. Data illustrated in Table (6-b) pointed out that increasing phosphorus fertilizer rates increased the

values of sugar yield. This finding was fairly true under the various concentration of foliar concentration treatments. Adding 30.0 Kg.P_2O_5 with 1.5 cm^3 produced the high significant value of sugar yield.

Table (6-b) Effect of interaction between Foliar micro-nutrition and phosphorus rates on 15th July. of the 2nd season

Treatments	22.5 Kg.P_2O_5/Fed	30.0 Kg.P_2O_5/ Fed
0.5 cm^3/L(Foliar)	8.611	8.894
1.0 cm^3/L(Foliar)	8.601	8.952
1.5 cm^3/L(Foliar)	8.766	9.050
L.S.D at 0.05 level of significance		0.481

Figures in Table (6-c) showed a significant response in sugar yield due to the increase in phosphorus rates under the different N-application methods. However the difference between N-application method was insignificantly under the same rate of phosphorus.

Table (6-c) Effect of interaction between phosphorus rates and Nitrogen Application methods on sugar yield at 15th July. of the 2nd season.

Treatments	Broadcast application	Drilling application
22.5 Kg.P_2O_5	8.680	8.638
30.0 Kg.P_2O_5	8.981	8.949
L.S.D at 0.05 level of significance		0.393

Table (6-d) Effect of interaction between Foliar micro-nutrition and N- application method on sugar yield at 15th Nov. of the 2nd season.

Treatments	Broadcast application	Drilling application
0.5 cm^3/L(Foliar)	6.380	6.169
1.0 cm^3/L(Foliar)	6.283	6.547
1.5 cm^3/L(Foliar)	6.280	6.706
L.S.D at 0.05 level of significance		0.363

Results given in Table (6-d) the highest value of sugar yield was recorded from adding 1.5 cm^3 /L of micro nutrients and drilling method of nitrogen fertilizer.

The results obtained in Table (6–e) revealed that the highest significant effect on sugar yield was produced with the combination between 80 Kg.N /fad. and 30.0 Kg.P_2O_5. This finding may be atlributed to the relative importance of phosphorus element with respect to sugar yield especially under the low nitrogen level.

Table (6-e) Effect of interaction between phosphorus rates and Nitrogen rates on sugar yield at 15th Nov. of the 2nd season

Treatments	80 Kg.N /fad.	100 Kg.N /fad.
22.5 Kg.P_2O_5/fad	6.504	6.241
30.0 Kg.P_2O_5/ fad	6.569	6.262
L.S.D at 0.05 level of significance		0.297

Data in Table (6-f) revealed that increasing the applied nitrogen rates from 80 to 100 Kg.N/fad. under the different N-application method decreased the values of sugar yield . It is also, cleared that the low nitrogen level with drilling method of nitrogen attained the highest sugar yield.

Table (6-f) Effect of the interaction between N-application method and nitrogen rates on sugar yield at 15th Nov. of the 2nd season

Treatments	80 Kg.N /fad.	100 Kg.N /fad.
Broadcast application	6.467	6.161
Drilling application	6.605	6.342
L.S.D at 0.05 level of significance		0.514

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تاثير العناصرالصغرى ومعدلات الفوسفور ومعدلات وطرق اضافة النيتروجين على محصول وجودة بنجر السكر تحت ميعادى زراعة

محمود سيف السيد عثمان* جمال الدين حسن عبد الحى*
ابراهيم حنفى محمود الجداوى كرم عبدالصادق جودة عبدالسلام****
*** قسم المحاصيل -كلية الزراعة - جامعة الازهر**
**** معهد بحوث المحاصيل السكرية - مركز البحوث الزراعية**

أجريت هذه الدراسة بمحطة البحوث الزراعية بطامية بمحافظة الفيوم فى موسمى الزراعة ٢٠٠٨/٢٠٠٩، ٢٠٠٩/٢٠١٠ لدراسة تأثير التسميد بالعناصر الغذائية الكبرى والصغرى ومواعيد الزراعة على محصول وجودة بنجر السكر. تضمنت الدراسة ٢٤ معاملة فى كل موعد زراعة (٧/١٥ و ١١/١٥) تضمنت المعاملات فى كل موعد زراعة ثلاثة تركيزات لمحلول العناصر الغذائية (٠.٥-١.٠-١.٥ سم^3/لتر)، اثنين معدلات فوسفور (٢٢.٥-٣٠ وحدة فوسفور/فدان) عدد اثنين طرق اضافة للنيتروجين (تكبيش-نثر) وعدد اتنين معدل اضافة للنيتروجين (٨٠-١٠٠ وحدة ازوت/فدان) وزعت المعاملات فى نظام القطع المنشقة مرة واحدة فى اربع مكررات حيث وضعت معاملات الرش فى القطع الرئيسية بينما كانت التوافيق بين الثلاث عوامل الآخرى فى القطع الشقية.
اوضحت النتائج:- ان نسبة السكروز ازدادت معنويا فى موعد الزراعة ٧/١٥ فى موسمى الزراعة وان نسبة النقاوة قد ازدادت معنويا فى موعد الزراعة ٧/١٥ فى موسم الزراعة الثانى- لم تتأثر نسبة السكروز والنقاوة بمعدلات اضافة محلول العناصر الغذائية ومعدلات الفوسفور وطرق اضافة النيتروجين - أدت زيادة معدلات النيتروجين الى نقص معنوى فى نسبة السكروز فى الموسم الاول وفىالموسم الثانى فى موعد الزراعة ١١/١٥ ولم تؤثر زيادة معدلات اضافة النيتروجين معنويا على نسبة النقاوة فى الموسم الاول وفى موعد الزراعة ٧/١٥ فى الموسم الثانى ولكن كان هذا التأثير معنوى فى موعد الزراعة ١١/١٥ فى الموسم الثانى حيث نقصت نسبة النقاوة معنويا بزيادة معدلات النيتروجين.
- لم يتأثر محصول العرش معنويا بمواعيد الزراعة ولكن كان لموعد الزراعة تأثير معنوى على محصول الجذور والسكر حيث ازداد محصول الجذور والسكر معنويا فى موعد الزراعة ٧/١٥ – زاد محصول العروش والجذور معنويا فى موسمى الزراعة بزيادة معدلات رش محلول العناصر الغذائية وكانت هذة الزيادة غير معنوية (فى محصول الجذر فى الموسم الاول فى موعد الزراعة ٧/١٥) لم تؤثر زيادة معدلات رش محلول العناصر معنويا على محصول السكر- أدت زيادة معدلات الفوسفور الى زيادة معنوية فى محصول العروش والجذور فى موسمى الزراعة كما زاد محصول السكر بزيادة معدلات الفوسفور وكانت هذ الزيادة معنوية فى الموسم الثانى فى موعد الزراعة ٧/١٥ فقط - زاد محصول العروش معنويا باضافة النيتروجين تكبيشا فى موسمى الزراعة كما أدى إضافة النيتروجين تكبيشا الى زيادة معنوية فى محصول الجذور فى الموسم الاول وفى الموسم الثانى فى موعد الزراعة ١١/١٥ زاد محصول السكر باضافة النيتروجين تكبيشا وكانت هذه الزيادة معنوية فى موسم الزراعة الاول - كما ازداد محصول العروش والجذور معنويا بزيادة معدلات النيتروجين فى موسمى الزراعة وازداد محصول السكر بزيادة معدلات النيتروجين وكانت هذة الزيادة معنوية فى الموسم الاول فى موعد الزراعة٧/١٥ وفى الموسم الثانى فى موعد الزراعة ١١/١٥ .
تحت ظروف هذه الدراسة يمكن التوصية بزراعة بنجر السكر فى ٧/١٥ ورشة بمحلول العناصر الغذائية (حديد- زنك- منجنيز- بورون) بمعدل ١.٥سم^3/لتر واضافة ٣٠ وحدة فوسفور عند تجهيز التربة للزراعة و١٠٠وحدة ازوت تكبيش بجوار النباتات المنزرعة تحت ظروف محفظة الفيوم.