SUGAR BEET YIELD AND QUALITY AS AFFECTED BY NITROGEN LEVELS AND FOLIAR APPLICATION WITH MICRONUTRIENTS.

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ABSTRACT

Four nitrogen rates (95, 80, 65 and 50 kgN/fad.) and three micronutrients application times (without, once, Twice) were tested on growth, yield and quality of sugar beet at Sakha Agricultural Research station farm during. 2006/2007 and 2008/2008 seasons. .

Application of nitrogen fertilizer at the rate of 95 kgN/fad or application of mixture of micronutrients with twice spraying as well as their recorded the highest values in characteristics of quantity i.e. root dimensions, dry matter of plant as well as yields of top, root and sugar, on the opposite direction, these high rates from macro or micronutrients significantly decreased characteristics of quality such as total soluble solids in term (T.SS%) , sucrose and purity percentages on both season.

Generally, it could be concluded that fertilized sugar beet plants with 95 kgN/fad. and twice sprayed with micronutrients mixture greatest sugar beet productivity under Sakha, Kafr EL-Sheikh condition.

INTRODUCTION

Nowadays, sugar beet (***Beta vulgaris*** L.) has been introduced as a new sugar crop in Egypt to take descending order after sugar cane. The aim of all investigators was to decrease the gap between production and consumption of sugar. Fertilization is limiting factor for sugar beet production. Thus, its favorable to choose the optimum rate and times of application from macro and micro nutrients to gave the maximum yield and quality for sugar beet crop. Therefore, fertilization rate for nitrogen and number of applications for micronutrients is very important and become target to many investigators. **Abd EL-Hadi *et al.* (2002); Abdel-Gawad *et al.* (2004); Ismail and Ghait (2005) and Nemeat Alla *et al.* (2007**) reported that root dimensions significantly affected by

nitrogen levels and gave maximum root dimensions with high dose of N. **Aboushady *et al.*, (2007)** concluded that maximum dry matter was obtained when sugar beet fertilized with micronutrients. The highest top yield recorded with application nitrogen at 90 kg/fad **Nemeat Alla (2004); Ouda (2006) and Mahmoud (2007)**. When sugar beet fertilized by high rate of nitrogen and gave micronutrients produced maximum root yield by **Abd EL-Hadi *et a.l* (2002); Ramadan and Nassar (2004) and Nemeat Alla *et al.*, (2005).** On the other side, the high levels of nitrogen or micronutrients gave the lowest values of quality characters such as sucrose, total soluble solids and purity percentages as reported by **Ramadan and Nassar (2004) and Nemeat Alla *et al.*, (2007).**

The objective of this study was increasing sugar beet productivity by determine the optimum nitrogen rates and micro elements of sugar beet at Sakha, Kafr El Shiekh Governorate.

Generally, it can be abstracted that all of macro or micro elements must be added at optimum levels and times to obtained maximum yield and quality of sugar beet.

MATERIALS AND METHODS

Two field experiments were carried out at Sakha Agricultural Research Station, Agricultural Research Center, Egypt, during 2006/2007 and 2007/2008 seasons to study the effect of four nitrogen rates and three spraying with micronutrients on growth yield and quality of sugar beet cv. Farida. The studied fertilizer treatment were as follow:

Nitrogen fertilizer rates :-

Four nitrogen rates i.e. 95, 80, 65 and 50 kg N/fad. In the form of Urea (46% N). Nitrogen fertilizer was applied in two equal half at 4 - 6 leaf stage (40 days from sowing) and 8- leaf stage (60 days from sowing).

Spraying treatments:-

1. Spraying with distilled water.
2. Spraying with micronutrients mixture once after 60 days from sowing.
3. Spraying with micronutrients mixture twice after 60 and 75 days from sowing.

Solution of micronutrients mixture included iron sulphate, ammonium molybdate, zinc sulphate, manganese sulphate and boric acid (each at rate of 1.0g/L) in addition to copper sulphate (at the rate of 0.5g/L).

A split plot design with three replications was used, the main plots were occupied by nitrogen rates whereas the number of spraying for micronutrients mixture were allocated in the sub-plots.

Each sub-plot has six ridges 0.55m apart and 7m long. The preceding crop was Rice in the two seasons. The chemical analysis of experimental soil is presented in Table (1).

Table (1): Chemical analysis of soil experimental site (0- 30 cm depth)at farm Sakha research station, Kafr EL-Sheikh in 2006/2007 and 2007/2008 seasons.

Season	PH (1:2.5)	EC m mhos /cm	Organic Matter %	Available			Anions Meq/L			
				N ppm	P ppm	K ppm	Hco^-_3	Cl^-	So^-_4	Co^-_3
2006/07	8.3	3.34	1.82	15.5	6.31	281.35	6.5	6.1	0.21	0.0
2007/08	8.4	3.40	1.91	16.3	6.25	290.1	6.1	5.9	0.16	0.0

Seed of multigerm cultivar " Farida " was sown on hills 20cm apart. On 21 October 2006 and 22 October 2007 in both seasons, respectively. Plants where thinned to one plant per hill at four true leaves. The other cultural practices for growing sugar beet were conducted as the recommended.

At maturity (196 days from sowing). The area of 23.10 m^2 of each plot were harvest to estimate root, top yields. Ten guarded plants were taken at random to estimate root dimensions (length and diameter) as well as yields components and its quality.

Total soluble solids (TSS%) percentage was determined using hand refract meter. Sucrose percentage was determined using the method described by Le Docte (1927) and Juice purity was estimated using method of Silin and Silina (1977).

The oretical sugar yield/fad. was calculated according to the following formula :

Sugar yield = root yield tons/fad. × sucrose %

Statistical analysis :

Data obtained were subjected to procedures of split plot design out lined by **Gomez and Gomez (1984)** by using analysis of variance Technique by means of " **MSTAT** " computer software package. To compare between means of significance **Duncan's** multiple sugar test was used **(Duncen,1955).**

RESULTUS AND DISUTION

A. Agronomical studies.

A.1. Root dimensions (length and diameter cm.)

Data presented in table (2) indicate that sugar beet plants received 95 kg N/fad. gave the highest values of root length 31.12 and 32.66cm. as well as root diameter 12.20 and 12.89 cm., on the other hand, plants fertilized with the lowest nitrogen rate 50 kg N/fad. gave the lowest values of root length 25.75 and 27.34cm. as well as root diameter 8.63 and 9.15cm. as compared with all other treatments in 2006/2007 and 2007/2008 seasons, respectively.

The increase in root length and diametcr owing to increasing nitrogen rate might be attributed to the nitrogen element have main role in increasing cell elongation and cell division, there fore root dimensions increases. These results are in agreement with those of **Abd El-Hadi *et al.* (2002), Abd El-Gawad *et al.* (2004) Ismail and Ghait (2005)** and **Nemeat-Alla *et a.l* (2007).**

The obtained results showed clearly that root dimension increase with increasing number of sprayings with micronutrients mixture in both seasons. The highest values of root length 29.45 and 30.90cm. as well as root diameter 10.98 and 11.69cm. recorded with plants spraying twice, on the other side, the lowest values of root length 27.89 and 29.20cm. as well as root diameter 9.97 and 10.11cm. recorded with plants sprayed with distilled water (control) in 2006/2007 and 2007/2008 seasons respectively. The increase in root dimensions due to spraying with micronutrients may be attributed to increasing cell number and size according to increasing concentration of micronutrients especially iron and boron, hence root diameter and length increased. These results are in harmony with those of **Ibrahim *et al.* (1988); Narayan *et al.* (1991); Nemeat-Alla, E.A.E (1997), Nemeat-Alla** and **El-Geddawy (2001), Nemeat-Alla *et al.* (2005)** and **Ouda (2007).**

Table (2) Root length and root diameter (cm) as affected by nitrogen

fertilizer levels and application times of micronutrients in 2006/2007 and2007/2008 seasons.

Treatments	Root length		Root diameter	
	seasons			
	2006/2007	2007/2008	2006/2007	2007/2008
N. rate (kg N/fad.)	*	*	*	*
95	31.12 a	32.66 a	12.20 a	12.89 a
80	29.80 b	30.80 b	10.81 c	10.72 b
65	27.78 c	28.67 c	9.92 c	10.40 c
50	25.75 d	27.34 d	8.63 d	9.15 d
No. of spraying micronutrients	*	*	*	*
Without spraying	27.89c	29.20 c	9.97 c	10.11 c
Once	28.50b	28.47 b	10.80 b	11.00 b
Twice	29.45a	30.90 a	10.98 a	11.69 a
Interaction	**	*	*	NS

The analysis of variance indicated that significant interaction effects were found between N rates × No. of spraying on root length and diameter in both seasons except on root diameter in the first season. Tables (3 and 4). Sugar beet plants fertilized with 95.kg N/fad. and sprayed twice by micronutrients mixture gave the highest root length 31.30 and 32.67cm., but the lowest values 23.50 and 25.60cm. receded with plants received 50 kg N/fad. and sprayed by distilled water as compared with other treatments in 2006/2007 and 2007/2008 seasons, respectively. These results were found by **Ibrahim *et al.* (1988); Narayan *et al.* (1991); Nemeat-Alla, E.A.E (1997), Nemeat-Alla** and **El-Geddawy (2001), Nemeat-Alla *et al.* (2005)** and **Ouda (2007).**

In addition, the wider roots 11.79cm. was found with plants received 95 kg N/fad. And sprayed twice by micronutrients , vice verso, the narrower roots 6.38cm. was recorded when plants

fertilizer by 50 g N/fad. and did not treated by micronutrients compared to they interaction treatments in 2006/2007 seasons.

Table (3) Root length as affected by the interaction between nitrogen fertilizer level and application time of micronutrients in 2006/2007 and2007/2008 seasons.

Treatments	No. of sprayings with micronutrients		
	Without spraying	Once	Twice
2006/2007 season			
N. rate (kg/fad.)			
95	29.50 b	29.53 b	31.30 a
80	28.55 c	28.63 c	29.28 bc
65	26.39 ef	26.92 de	27.30 d
50	23.50 h	24.87 g	25.73 f
2007/2008 season			
N. rate (kg/fad.)			
95	31.02 b	31.23 b	32.67 a
80	28.95 de	29.75 cd	30.68 c
65	27.31 f	27.75 ef	28.24 d
50	25.60 h	26.22 g	27.48 f

Table (4) Root diameter as affected by the interaction between nitrogen fertilizer level and application time of micronutrients in 2006/2007 season.

Treatments	No. of sprayings with micronutrients		
	Without spraying	Once	Twice
2006/2007 season			
N. rate (kg/fad.)			
95	10.64 b	10.90 b	11.79 a
80	9.15 cd	9.34 c	10.85 b
65	8.16 ef	8.28 ef	8.97 de
50	6.38 g	7.81 g	8.22 f

A.2. Dry weight per plant (g) and root/top ratio :

Data recorded in Table (5) indicate that the effect of nitrogen fertilizer rates was significant on dray weight per plant and insignificant on root/top ratio in both seasons. Sugar beet plants fertilized by 95 kg N/fad. gave the highest plant dray weight 204.79 and 208.10 g., on the contrary, applied nitrogen fertilizer at a rate of 50 kg N/fad. gave the slight plant dray weight 191.25 and 194.10

g. as compared with other treatments in 2006/2007 and 2007/2008 seasons, respectively. Regarding effect of nitrogen rates on root/top ratio, the obtained results indicated that root/top ratio increased with decreasing nitrogen rate but this increase did not reach to the level of significance in both season.

Table (5) Plant dry weight (g.) and root/top ratio as affected by nitrogen fertilizer level and application time of micronutrients in 2006/2007 and2007/2008 seasons.

Treatments	Dry matter		Root / top ratio	
	seasons			
	2006/2007	2007/2008	2006/2007	2007/2008
N. rate (kg/fad.)	**	**	NS	NS
95	204.76 a	208.10 a	2.80	2.84
80	197.43 b	199.51 b	3.16	3.35
65	194.95 c	196.49 c	3.41	3.37
50	191.26 d	194.10 d	3.59	3.44
No. of spraying micronutrients	**	**	NS	NS
Without spraying	192.60 c	196.67 c	3.36	3.31
Once	197.66 b	200.15 b	3.14	3.16
Twice	199.78 a	204.60 a	3.05	3.01
Interaction	**	**	NS	NS

The increase in plant dray weight due to increasing nitrogen rate may be attributed to the raising effect of nitrogen on vegetative growth i.e. number and area of leaves as well as photo synthesis rate which increased dray matter acumination and stored in root, thus increased plant dray weight. These results are in the same line with those obtained by **Olovius, K. (2001), Nemeat-Alla, H.E.A. (2004),El-Shafai and El-Tantawy (2006)** and **Aboushady *et al.* (2007).**

Plant dray weight significantly affected by number spraying with micronutrient, while root/top ratio insignificantly affected in both seasons. Plant dry weight increased with increasing number of sprayings with micrometer in both seasons. Plants twice sprayed with micronutrient gave the highest plant dry weight 199.78 and 204.60 g. but the lowest plant dry weight 192.60 and 196.67 g.

recorded with plants grown on the control treatment (sprayed with water) compared to other treatments in 2006/2007 and 2007/2008 seasons, respectively.

The increase in plant dry weight cussed by increasing number of sprayings by micronutrients may be due to this mixture having boron which translocated photosynthesis substances especially carbohydrate from leaves to rots as well as Iron and Zinc has the important role in photosynthesis operation, there for raising pant dry weight.

The present data in Table (6) show clearly that the interaction effect among nitrogen rates and number of sprayings with micronutrient was significant on plant dry weight and insignificant on root/top ratio in both seasons. However, ants received 95 kg N/fad and twice sprayed with micronutrients gave the highest plant dry weight 209.95 and 212.17 g. on the other hand, the lowest plant dry weight 191.31 and 191.55 g. was found when fertilized plants with 50 kg N/fad. and sprayed with water (without micronutrient) compared to other treatments in 2006/2007 and 2007/2008 seasons, respectively.

B. Top; root and sugar yields:

Top, root and sugar yields per Fadden (ton).

Data recorded in Table (7) indicate that the effect of nitrogen rats was significant on top and root yield per fad. as well as was insignificant on sugar yield per fad. in both seasons.

Increasing nitrogen fertilizer application from 50 to 95 kg N/fad. Increased top yield per fad. by 43.53% and 41.56 % as well as root yield per fad. by 11.80 % and 16.90% in 2006/2007 and 2007/2008 seasons, respectively. In addition, sugar yield per fad. increased with increasing nitrogen rate but increase did not reach to the level of significance in both seasons.

The increase of top and root yield due to increasing nitrogen rate may be attributed to increasing vegetative growth as well as rot length and diameter which led to raising top and root yield per fad. These results are in harmony with those of Nemeat-Alla (2004), Gamal (2005), Ouda (2006) and Mahmoud (2007).

The obtained results indicated that number of sprayings with micronutrients significantly affected top and root yield per

Table (6) Plant dry weight (g.) affected by the interaction between

nitrogen fertilizer levels and application times of micronutrients in 2006/2007 and2007/2008 seasons

Treatment	No. of spraying		
	Without spraying	Once	Twice
2006/2007 season			
N. rate (kg/fad.)			
95	196.87 c	205.10 b	209.95 a
80	193.65 ef	195.61 cd	196.75 c
65	192.27 fg	193.69 ef	194.91 de
50	191.31 g	192.74 fg	193.82 ef
2007/2008 season			
N. rate (kg/fad.)			
95	198.50 cd	210.59 b	212.17 a
80	197.40 de	198.24 cd	198.80 c
65	195.54 fg	196.51 ef	197.40 de
50	191.55 i	193.40 h	194.47 gh

Table (7) Top, Root and sugar yields (ton/fad.) as affected by nitrogen fertilizer levels and application times of micronutrients in 2006/2007 and2007/2008 seasons.

Treatments	Top yield (ton/fad.)		Root yield (ton/fad.)		sugar yield (ton/fad.)	
	seasons					
	2007/08	2007/08	2007/08	2007/08	2006/07	2007/08
N. rate (kg/fad.)	*	*	*	*	NS	NS
95	10.32 a	10.90 a	28.89 a	30.92 a	4.131	4.326
80	8.99 b	8.95 b	28.30 b	30.00 b	4.075	4.275
65	8.00 c	8.60 c	27.25 c	28.98 c	4.060	4.211
50	7.19 d	7.70 d	25.84 d	26.45 d	4.016	3.997
No. of spraying micronutrients	*	*	*	*	NS	NS
Without spraying	7.50 c	7.98 c	25.23 c	26.41 c	3.772	3.962
Once	8.39 b	8.62 b	26.31 b	27.20 b	3.868	3.979
Twice	8.98 a	9.20 a	27.38 a	27.68 a	3.967	4.014
Interaction	*	*	*	*	NS	NS

fad., but it had insignificant effect on sugar yield in both seasons. Plants twice sprayed with micronutrients gave 19.73% and 15.29% increase in top yield per fad. as well as 8.52% and 4.08% increase in root yield per fad. compared to those of plants grown on the control treatments (sprayed with water) in 2006/2007 and 2007/2008seasn, respectively. In this connection, sugar yield per fad. increased with increasing number of sprayings with micronutrients but this increase did not reach to the level of the significance in both seasons.

The increase top and root yield owing to increasing number of sprayings with micronutrients may be due to increasing Boron, Zinc, Manages and Copper concentration raising net assimilation rate used in growth of leaves and root as well as dry matter translocated and accumulated in roots there fore increased top and root yields per fad. These results are in agreement with those of **Saif-Laila (1991), Abd El-hadi *et al* (2002),** and **Nemeat-Alla (2005).**

Data recorded in Table (8) exhibited that the interaction effect between nitrogen rates and number of sprayings by micronutrients was significant on top yield per fad. in both seasons. Sugar beet plants received 95 kg N/fad. and twice sprayed with micronutrients surpassed by water (control) by 171.28 % and 106.56 % in 2006/2007 and 2007/2008 season, respectively.

The interaction effect among nitrogen rates and number of sprayings with micronutrients was significant on root yield per fad. in both seasons (Table 9). Fertilized plants with nitrogen at the rate of 95 kg N/fad. and twice sprayed with micronutrients exceeded plants which fertilized by nitrogen ate a rate of 50 g N/fad. And did not received micronutrients (control) by 26.26% and 43.10% in 2006/2007 and 2007/2008 seasons, respectively. At the rate of 95 kg N/Fad. With twice sprayed by micronutrient to sugar beet plants greatest yields of top and root at Sakha condition.

Data in Table (10) indicate the there was a significant effect of interaction among nitrogen raters and number of sprayings with micronutrients on sugar yield per fad. in 2007/2008 seasons. Fertilized plants by 59 kg N/fad. and twice sprayed with micronutrients gave 32.63 % increase in sugar yield per fad.

Table (8) Top yield (ton/fad.) as affected by the interaction between nitrogen fertilizer levels and application times of micronutrients in 2006/2007 and2007/2008 seasons.

Factors	No. of spraying		
	Without spraying	Once	Twice
2006/2007 season			
N. rate (kg/fad.)			
95	9.52 c	10.58 b	11.19 a
80	7.92 ed	8.47 d	9.00 cd
65	6.92 d	7.83 ed	8.35 d
50	5.15 h	6.35 g	7.01 f
2007/2008 season			
N. rate (kg/fad.)			
95	9.98 c	10.91 b	11.65 a
80	8.43 d	8.89 d	9.43 c
65	7.49 de	8.45 d	9.14 cd
50	5.64 h	6.67 g	7.48 f

Table (9) Root yield as affected by the interaction between nitrogen fertilizer level and application time of micronutrients in 2006/2007 and2007/2008 seasons.

Factors	No. of spraying		
	Without spraying	Once	Twice
2006/2007 season			
N. rate (kg/fad.)			
95	27.02 bc	27.80 b	28.75 a
80	26.17 c	27.13 bc	27.80 b
65	25.32 cd	26.09 c	26.97 c
50	22.77 f	23.52 e	24.15 d
2007/2008 season			
N. rate (kg/fad.)			
95	30.14 b	31.10 ab	32.17 a
80	28.36 cd	28.78 cd	29.52 c
65	24.18 e	25.22 de	25.92 e
50	22.48 h	23.17 g	23.17 f

compared to fertilized plants with 50 kg N/fad and water sprayed (control) in 2007/2008 seasons. These results suggested that

applied nitrogen fertilized. Similar results were found by **Moustafa, Zeinab (1989), Narayan et al. (1991), Osman (1997), Nemeat – Alla and EL- Geddawy (2001) and Nemeat – Alla and Samia (2005).**

Table (10) sugar yield (ton/fad.) as affected by the interaction between nitrogen fertilizer level and application time of micronutrients in 2007/2008 season.

Factors	No. of spraying		
	Without spraying	Once	Twice
2007/2008 season			
N. rate (kg/fad.)			
95	4.19 b	4.29 ab	4.43 a
80	4.04 b	4.08 b	3.20 e
65	3.54 c	3.65 c	3.71 c
50	3.34 e	3.42 c	3.50 c

C. Quality parameters:

C.1. Total soluble solids %.

Results tabulated in Table (11) illustrate that the effect of nitrogen fertilizer rates was significant on total soluble percentage (TSS %) and sucrose percentage as well as insignificant on juice purity percentage in both seasons. TSS% and sucrose percentage significantly increased with decreasing nitrogen fertilizer rate in both seasons.The highest TSS% 20.35 and 20.50 % as well as sucrose percentage 15.54 % and 15.11 % were found when fertilized plants with 50 kg N/Fad. On the other hand, the lowest TSS% 18.78% and 19.00 % as well as sucrose percentage 14.30 % and 13.99% were recorded with fertilized plants by 95 kg N/fad. compared to other treatments in 2006/2007 and 2007/2008 seasons, respectively.

The increase in TSS% and sucrose % caused by the lowest nitrogen rate may be attributed that it gave the lowest root size and lowest root moisture, thus increased concentration of TSS% and sucrose % in roots. These results are in agreement with those of **Orlovius (2001), Ramadan and Nassar (2004) and Nemeat – Alla *et al.* (2007).**

Results presented in Table (11) ratified that the effect of number of sprayings by micronutrients vas significant on TSS% in both seasons, and significant on sucrose % in the first seasons as

Table (11) Total soluble solids (TSS), sugar percentage and Juice purity as affected by nitrogen fertilizer level and application time of micronutrients in 2006/2007 and2007/2008 seasons.

Treatments	TSS %		sugar percentage		Juice purity	
	seasons					
	2007/08	2007/08	2007/08	2007/08	2006/07	2007/08
N. rate (kg/fad.)	*	*	*	*	NS	NS
95	18.78 d	19.00 d	14.30 c	13.99 d	76.14	73.63
80	19.94 c	19.40 c	14.40 c	14.25 c	72.22	73.45
65	19.64 b	20.00 b	14.90 b	14.43 b	76.57	72.65
50	20.35 a	20.50 a	15.54 a	15.11 a	75.69	73.71
No. of spraying micronutrients	*	*	*	*	NS	NS
Without spraying	20.10 a	20.60 a	14.95a	15.00 a	74.38	72.82
Once	19.70 b	20.00 b	14.70 b	14.63 b	74.62	73.15
Twice	19.40 c	19.65 c	14.49 c	14.50 c	74.69	73.79
Interaction	NS	NS	*	*	NS	NS

well as insignificant on juice purity % in both seasons. Plants did not feeding with micronutrients (control) gave the highest values of TSS% and sucrose % as compared with the there treatments in both seasons. These results are corresponding with nitrogen effect on TSS% and sucrose %. Data in Table (11) indicate that the interaction effect among nitrogen rate X number of sprayings with micronutrients was significant on sucrose % in the seconded seasons only and insignificant on TSS% and juice purity % in both seasons as well as sucrose % in the first seasons.

However, data in Table (12) show that the highest values of sucrose % 14.87% was found when plants received the lowest nitrogen rate 50 kg N/fad. And sprayed with water without micronutrients, but the lowest values was recorded when fertilized plants by the highest rate 95kg N/fad. And twice sprayed with micronutrients compared to all other this interaction treatments in 2007/2008 seasons.

Table (12) Sucrose percentage as affected by the interaction between nitrogen fertilizer level and application time of micronutrients in 2007/2008 season.

Treatments	No. of spraying		
	Without spraying	Once	Twice
2007/2008 season			
N. rate (kg/fad.)			
95	13.91 l	13.80 j	13.76 j
80	14.26 f	14.18 g	14.08 h
65	14.65 c	14.48 d	14.32 e
50	14.87 a	14.75 b	14.67 c

No significant differences were found among mean values of purity percentage due to effect of nitrogen levels or No. of spraying of mixture of micro nutrients in both season.

The analysis of variance indicted that N levels X no. of spraying of micro nutrients interaction not affected on purity percentage in both season.

Generally, it could be recommended that fertilized sugar beet plants with nitrogen at the rate of 95 kg N/fad. and twice sprayed with micronutrients mixture raising sugar beet productivity under Sakha, Kafer EL-Sheikh conditions.

REFERENCES

Abd EL-Gawad, A.M.; S.A.H. Allam; L.M.A. Saif and A.M.H. Osaman (2004). Effect of some micronutrients on yield and quality of sugar beet (***Beta vulgaris*** **L.).** Juice quality and chemical composition. Egypt. J. Agric. Res. 82 (4): 1681-1701.

Abd El-Hadi, A. H. ;A.M.A. Aly; A.A. Attiat; M.A. Zidan and F. zahran(2002). Response of sugar beet to various forms and rates of nitrogen fertilizer. Egyptian J. Soil Sci., (4): 643-658.

Aboushady, Kh.; E.A.E. Nemeat-Alla and Nariman O.A. Yousef (2007). Effect of level and time of nitrogen application and harvesting date on yield and quality of sugar beet (***Beta vulgaris*** **L.).** Minufiya. J. Agric. Res., 32 (5): 1403-1417.

Duncan,B.P.(1955).Multiple Range and Multiple F-test:Biometrics 11: 1-42.

EL-Shafai, A.M.A. and M.T. EL-Tantawy (2006). Effect of land leveling and nitrogen fertilization on yield and quality of sugar beet. Egypt. J. of Appl. Sci., 21 (11):19-31.

Gamal, S. EL-Sayed (2005). Effect of nitrogen and magnesium fertilization on yield and quality of two sugar beet varieties. Egypt. Agric. Res., 83 (2): 709-722.

GOMEZ, K.A. and A.A.GOMEZ(1984). Statistical procedures for agricultural research. 2nd.pp680, John Willy and Sons. New Yourk.

Hassanin, M.A. and A.A. Abu EL-Dahab (1991). Effect of foliar fertilization with some micronutrients on yield and quality of sugar beet (***Beta vulgaris*** L). Bulletin of faculty of agriculture, University of Cairo,42:3,663-672.

Ibrahim, M.H., Gh. R. Sorour and A.M. Omar (1988). Varietals response of sugar beet to foliar application of some micronutrients. Proc 3rd Egyptian conf. Agron. Kafr EL-shiekh, 5-7 Sept. 1988 vol. 11:324-334.

Ismail, A.M.A. and R.A.A. EL- Ghait (2005). Effect of nitrogen sources and levels on yield and quality of sugar beet. Egypt. J. Agric. Res. 83 (1): 229-239.

Le-Docte, A. (1927). Commercial determination of sugar in the beet root using the sachr-le Docte process, Int. Sug. J. 29:488-492.

Mahmoud, I.I. (2007). Effect of nitrogen, Potassium and manganese fertilization on growth and yield of sugar beet. J. Adv. Agric. Res. (Fac. Ag. Saba Basha). Vol. 12 (4): 693-704.

Moustafa, Zeinab, (1989). Effect of some micronutrients on some biochemical constituents in sugar beet plant. M. Sc. Thesis soil Sci. Dept- Fac. Agric. Ain Shams Univ. 1989.

Moustafa, Zeinab. R.; Omar, S.E.H. (2006). Effect of foliar spray with boron or magnesium in combination with nitrogen fertilization on sugar beet plants. Egyptian-Journal- of Soil-Science. 64 (2): 115-129.

Narayan, D., A.S. Chandel and G.R. Singh (1991). Effect of boron fertilization on yield and quality of sugar beet. (***Beta vulgaris*** L.). Indian Journal of plant Physiology 32 (2): 164-

168.

Nemeat-Alla, E.A.E. (1997). Agronomic studies on sugar beet (Beta vulgris L.). Ph. D. Thesis, Fac. Agric., Tanta University.

Nemeat-Alla, E.A.E. (2005). Yield and quality of sugar beet as affected by different nitrogen and sulphur rates under clayey soils. J. Agric. Sci. Mansoura Univ., 30 (12): 7255-7264.

Nemeat-Alla, E.A.E. and I.H.M. EL-Geddawy (2001). Response of sugar beet to foliar spraying time with micronutrients under different level of nitrogen and phosphorus fertilization. J. Agric. Res. Tanta Univ., 27 (4): 670-681.

Nemeat-Alla, E.A.E. and Samia, G.A. Mohamed (2005). Agronomical and statistical studies on the response of sugar beet to foliar application with micronutrients under different macronutrients formula. J. Agric. Sci. Mansoura Univ., 30 (12): 7284-7284.

Nemeat-Alla, E.A.E; A.I. Badr and M.F.M. Ibrahim (2007). Macro-element requirements of sugar beet. J. Agric. Sci. Mansoura Univ., 32 (1): 8849-8857.

Nemeat-Alla, H.E.A. (2004). Effect of some Agronomic practices on yield and quality of sugar beet. M. Sc. Thesis, Fac. Agric., Kafr EL-sheikh, Tanta University.

Orlovius, K. (2001). Effect of foliar fertilization with magnesium, sulfur, manganese and boron to sugar beet, oilseed rape and cereals plant-nutrition food security and sustainability of agro ecosystems through basic and applied research fourteenth International Plant Nutrition Colloquium, Hanover, Germany 2001; 788-789. (C.F. CD- Rom Computer system).

Osman, A.M.H. (1997). Effect of some micronutrients on yield and quality of sugar beet. M. Sc. Thesis Fac. Of Agric. Moshtorhor Zagazig Univ.

Ouda, Sohier, M.M. (2006). Effect of chemical and bio fertilizer of phosphorus and boron on yield quality of sugar beet. Zagazig J. Agric. Res 34 (1): 20-28.

Ouda, Sohier, M.M.(2007). Effect chemical and bio fertilizer of nitrogen and boron on yield and quality of sugar beet

Zagazig J. Agric. Res. 34 (1): 1-11.

Ramadan,B.S.H. and A.M.Nassar (2004). Effect of nitrogen fertilization on yield and quality of some beet varieties, Egyptian j. Agric. Res., 82(3):1253-1268.

Safrronovskaya, G.M. (1998). Effect of Zinc fertilizer on productivity and changes in sod-podzlic Loamy soil pochvovedenie-i-Hgrokhimiya 30:166-171.

Saif-Laila,M.A.(1991). Yield and quality of sugar beet as affected by nitrogen sources and rate of some microelements in Kafer EL-Sheikh. Ph. D. thesis, Fac. of Agric. Ain Shams Univ.

Saif-Laila, M.A.(2000). Stepwise regression and path coefficient analysis for some sugar beet characters under levels of boron and nitrogen fertilization. Proc. 9th conf. Agron., Minufiya Univ., 1-2 Sept. 569-581.

Silin, P.M. and N.P. Silina (1977). Chemistry control in sugar technology. Food Tech. Pub. USSRP. 167.

Stratieve, S;B. Sedlarska and D. Stoynov (1990). Effect of zinc and boron on sugar beet grown on a leached smonitza Chernozem soil pochvoznanie-i- agrokhimiya 25:9-14.

الملخص العربي

تأثر محصول بنجر السكر كماً ونوعاً بمستويات التسميد الأزوتي والرش بالعناصر الصغرى

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أقيمت تجربتان حقليتان في المزرعة البحثية لمحطة البحوث الزراعية بخسا -محافظـــــة كفر الشيخ في الموسمين الزراعيين ٢٠٠٦/٢٠٠٧ ، ٢٠٠٧/٢٠٠٨ لدراسة تأثير إضافة السماد الآزوتى بمعدلات مختلفة (٩٥ ، ٨٥ ، ٦٥ ، ٥٠ كجم ن/ف) وكذلك عـــدد مرات الرش بمخلوط العناصر الصغرى)بدون رش -رشه -رشتين (في تجربه كان تصميمها الإحصائي قطع منشقة مره واحـــده حيـــث وضعت معدلات السماد ألازوتى في القطع الرئيسية وأما عدد مرات

الإضافة للعناصر الصغرى فقد تم وضعها في القطع الشقية الأولى . وقد تم تنفيذ جميع العمليات الزراعيـــة الباقيـــة حـــسب التوصـــيات الموصى بها من الزراعة حتى الحصاد.

وقد أ وضحت النتائج المتحصل عليها أن التسميد ألازوتى أثر على جميع الصفات تحت الدراسة بأعلى معدل 95 كجم ن/ف حيـــث سجل اكبر قيم لطول الجذر وقطره وكذلك محصول العرش الفـــدان، محصول الجذور للفدان ، محصول السكر للفدان بينمـــا كـــان لهـــذا المعدل تأثير سلبي بالنقص للنسبة المئوية للمواد الصلبة الذائبة الكلية والنسبة المئوية للسكروز وكذلك النسبة المئوية لنقاوة العـــصير . وكذلك نسبه الجذور/للعرش.

كان تأثير الرش بالعناصر الصغرى معنويـــاً علـــي معظـــم الصفات المدروسة في كلا الموسمين حيث أعطت النباتات التي رشت مرتان بالعناصر الصغرى أعلي قيم لكلا من طـــول وقطـــر الجـــذر والوزن الجاف للنبات ومحصول الفدان من العرش والجذور والسكر بينما نقصت النسبة المئوية لكلا من المواد الـــصلبة الذائبـــة الكليـــة والسكروز ونقاوة العصير.

عموماً توصي الدراسة أن تسميد بنجر السكر بمعدل ٩٥ كجم ن / فدان مع رشتان من مخلوط العناصر الصغرى أدي إلي زيـــادة إنتاجية بنجر السكر تحت ظروف سخا بمحافظة كفر الشيخ.