EFFECT OF PREVIOUS CROPS AND NITROGEN SOURCES ON SUGAR BEET PRODUCTION IN NORTH DELTA REGION

Hilal, S.M.M.*; A.Y. Ragab and A.I. Badr***

* Sugar Crop Res. Inst., Agric. Res. Center, Egypt

** Agronomy Dept., Faculty of Agric. Kafr El-Sheikh, Univ. Egypt

ABSTRACT

Two field experiments were carried out at North Delta region on Farmer's fields during 2006/07 and 2007/08 winter seasons to study the effect of five previous crops; i.e. seed watermelon, maize, cotton, Snake cucumber and rice, and two N-forms, i.e., Ammonium nitrate and urea on sugar beet production. The experimental design was a split-plot, with four replications, where the previous crop were allocated to the main plots and N-forms were arranged in the sub-plots.

The results show that preceding crops significantly affected root dimension, root yield, top yield sugar % and sugar yield t/fed. Beet sowing after cotton or snake cucumber produced the highest values for all studied traits.

Nitrogen forms caused a significant effect on root yield, top yield, sugar % and yield t/fed. Also, the results indicated that urea application gave the highest values of these traits, followed by ammonium nitrate in both seasons.

It could be seen from obtained data that beet growing after cotton or snake cucumber with urea fertilizer produced the maximum root, gross and white sugar yields t/fed. compared with sowing after seed watermelon or rice with ammonium nitrate fertilizer.

INTRODUCTION

Sugar-beet (*Beta vulgaris*, L.) is primarily a crop grown in areas where temperate climate prevails (Latitudes 30-60 north). However, during the last to subtropical areas. The crop was introduced to Egypt during the mid seventies of the last century, as a supplementary sugar crop. Its cultivation started in North Delta in all affected low fertile soils.

The cultivated area of sugar beet was about 232.000 fed produced 507.000 ton sugar in 2008 season (Sugar Crops Council Report, 2008).

Crop rotation plays an important role in raising soil fertility as well as, increasing crop production.

Soine and Severson (1975) and Nordgaard *et al.*(1982) found a positive effect of previous crops on sugar beet root yield and quality.

Plants utilize both the NO^-_3 and NH^+_4 forms of nitrogen. It is considered that the nitrate form is utilized more efficiently in the growth and development of plants, and that the comparative uptake of the two ions is dependent on both the plant species as well as on specific environmental factors. In Egypt many investigations cleared that applying N at level of 90 kg/fed. exhibited the highest root quality, technological parameters, root and sugar yields (ton/fed.) and minimize sugar lost to molasses (Krstick *et al.,* 1986). Whereas further increases in N rate decreased sucrose, purity and recoverable sugar percentage. El-Harriri and Gohaarha (2001); Moustafa and Darwish (2001); Abo El-Wafa (2002) and Hilal, 2005).

Thus the aim of the present investigation was to study the effect of five summer previous crops (seed watermelon, maize, cotton, snake cucumber and rice) and two forms of nitrogen (ammonium nitrate and urea) on yield and quality of sugar beet.

MATERIALS AND METHODS

The present investigation was conducted at Kafr El-Sheikh region during the two growing seasons of 2006/2007 and 2007/2008 to study the effect of preceding crops and nitrogen forms on yield and quality of sugar beet. Two series of field experiments were carried out at the old cultivated soil district on farmer's fields, where mainly different summer crops were planted. Each Experiment included five preceding crops (Seed Watermelon, Maize, Cotton, Snake Cucumber and Rice) and two forms of nitrogen (ammonium nitrate and urea).

Soil structure and chemical analysis were taken from 0-30 cm depth in the experimental sites before soil preparation (mean of two seasons). Mechanical analysis was (sand 24.45%, silt 23.86%

and clay 51.58%). The soil type was clay in texture, while chemical analysis was (pH 8.3, organic matter 1.99%, soil salts [EC (m-mmhos/cm)] 2.82, available N (ppm) 22.6, available P (ppm) 7.05 and Available K (ppm) 278.16, according to the methods of Jackson, 1967.

Sugar beet was sown on 20/10/2006 and 25/10/2007 the first and second seasons, respectively. Soils were basically fertilized with 30 kg P_2O_5/fed. in the form of calcium super phosphate (15.5% P_2O_5) and 24 kg K_2O in the form of potassium sulphate (48% K_2O) during soil preparation. Seeds of multigerm sugar beet cultivar "Karolla' were planted by hand in hills with approximately 3-4 seed balls per hill. Plants were thinned to one plant per hill after 35 days from sowing. Other cultural practices were done as recommended.

A split plot design with four replications was used in both seasons. The experiment included 10 treatments. The five preceding crops (seed watermelon, maize, cotton, snake cucumber and rice) were distributed at random to the main plots, whereas the two nitrogen forms (ammonium nitrate and urea) were allocated randomly in the sub plots. The sub plot area was 50.4 m^2 and included 12 ridges, 7 m long, 60 cm apart and 20 cm between hills. The outer two ridges were considered as belt or band. The central ridges were kept to determine yield and yield attributes. Nitrogen fertilizers in both forms were applied in two equal doses, after thinning and 25 days later.

The collected data in both seasons involved the following traits:

A. Yield and its attributes:

At maturity (210 days form sowing), central area of 33.65 m^2 from each plot were harvested (root and top yields of this area were transformed to metric tons per feddan) in both experiments, to estimate the following characters:

1. Root length (cm).
2. Root diameter (cm).
3. Root weight (kg).
4. Root yield (t/fed.).
5. Foliage fresh weight/plant (kg).
6. Top yield (t/fed.).

7. Gross sugar yield (t/fed.) = root yield (t/fed.) x gross sugar %.
8. White sugar yield (t/fed.) = root yield (t/fed.) x white sugar %.
9. Sugar losses yield = root yield (t/fed.) x sugar loss %.

B. Quality parameters:

All quality parameters were determined in Delta sugar company limited laboratories at El-Hamoul, Kafr El-Sheikh Governorate according to the method of Le-Docte (1927) as described by McGrinnus (1971).

The studied quality parameters included:

1. Gross sugar %:

Juice sugar content of each treatment was determined by means of an automatic sugar polarimetric according to McGinnus (1971).

2. Extractable white sugar %:

Corrected sugar content (white sugar) of beet was calculated by linking the beet non-sugars K, Na and α-amin-N (expressed as miliequivalents/100 g of beet) according to Reinefeld *et al.* (1974) as described by Harvey and Dutton (1993).

3. Loss sugar % = gross sugar % - white sugar %.
4. Juice purity % (QZ) = $\frac{\text{White sugar \%}}{\text{Gross sugar \%}}$ x 100

Statistical analysis:

The analysis of variance was carried out according to Gomez and Gomez (1984). All means were compared by Duncan's Multiple Range Test (Duncan, 1955). All statistical analyses were performed by using the analysis of variance technique by means of "IRRISTAT" Computer Package and L.S.D. test for interactions.

RESULTS AND DISCUSSION

The obtained results of yield and its components as well as sugar quality as influenced by preceding crops, nitrogen forms and their interaction in 2006/07 and 2007/08 seasons could be discussed as follow:

1. Yield and its components:

1. Root length (cm):

Means of root length at harvest as affected by preceding crops and nitrogen forms during the two growing seasons are presented in Table 1.

Results recorded in Table (1) indicate that the preceding crops had significant effect on root length of sugar beet during the two seasons of study.

Table (1): Effect of previous crops, nitrogen forms and their interactions on root dimensions (cm) at harvest in 2006/07 and 2007/08 seasons.

Previous crops	Root length (cm)			Root diameter (cm)		
	Nitrogen forms					
	Ammonium nitrate	Urea	Mean	Ammonium nitrate	Urea	Mean
	2006/2007 season					
Seed watermelon	35.95	32.50	34.22 c	12.80	12.47	12.63 a
Maize	34.10	40.80	37.45 ab	12.20	12.22	12.21 a
Cotton	33.40	40.00	36.70 ab	12.51	11.45	10.98 b
Snake cucumber	40.10	37.40	38.75 a	12.80	12.87	12.83 a
Rice	38.20	32.75	35.47 bc	11.35	10.92	11.13 b
Mean	36.35	36.69		11.93	11.98	
Interaction L.S.D. 5%	2.68			0.86		
	2007/2008 season					
Seed watermelon	35.85	32.70	34.27 b	12.60	12.80	12.70 ab
Maize	34.90	39.10	37.00 a	12.25	12.55	12.40 b
Cotton	30.95	40.70	35.83 ab	11.52	12.05	11.78 c
Snake cucumber	38.80	35.70	37.25 a	12.85	13.60	13.22 a
Rice	38.10	37.10	37.60 a	11.10	11.20	11.15 d
Mean	35.72	37.06		12.06	12.44	
Interaction L.S.D. 5%	4.45			1.25		

Means designed by the same letter within the same row or column for each season are not significantly different at 5% level, according to DMRT and L.S.D. test for interactions.

The highest mean values attained for previous crops were 38.75, 37.25 and 37.00 cm in both seasons, respectively which, resulted from planting sugar-beet after either snake cucumber or maize. However, the lowest values in this respect were obtained from planting after seed watermelon.

These results are possibly ascribed to that some crops could have an adverse effect on the physical and chemical properties of soil cultivated later with sugar-beet. Similar observations were reported by Serag El-Din (2000), Magda (2001) and Mostafa and Drwish (2001).

Concerning the effect of nitrogen forms on root length data revealed non-significant effect in both seasons. Similar results were found by Ismail and Abo El-Ghait (2005).

Data in Table (1) show that the longest roots were obtained from preceding crops (Maize or Cotton) fertilized with Urea and Snake Cucumber with ammonium nitrate.

2. Root diameter (cm):

The analysis of variance reveal that root diameter was significantly effected by preceding crops in both seasons. In general, the trend of these results are similar to that of root length (Table 1).

The results in Table (1) reveal that root diameter was not significantly affected by N sources in both seasons.

Data presented in Table (1) also, show that the highest root diameter values were obtained from planting sugar-beet after snake cucumber or maize with urea as a source for N fertilization.

3. Root yield:

Root weight/kg at harvest as well as root yield t/fed. as affected by preceding crops, nitrogen forms and their interaction are shown in Table (2).

Preceding crops had highly significant effect on sugar-beet root yield in both seasons.

Data presented in (Table 2) show that the highest root yield were 42.60, 41.81, 41.40 and 40.62 t/fed. produced from preceding crops (cotton or snake cucumber in both seasons respectively, while, the lowest ones were obtained from planting sugar beet after seed watermelon.

It could be concluded that planting sugar-beet after cotton or snake cucumber increased root weight and root yield more than when it was grown after seed watermelon. The explanation of these findings is similar to that previously mentioned regarding, the superiority of root dimensions of sugar-beet plants when it was grown after cotton or snake cucumber rather than when grown after seed watermelon.

Table (2): Effect of previous crops, nitrogen forms and their interactions on root weight and root yield at harvest in 2006/07 and 2007/08 seasons.

Previous crops	Root weight (kg)			Root yield (t/fed.)		
	Nitrogen forms					
	Ammonium nitrate	Urea	Mean	Ammonium nitrate	Urea	Mean
	2006/2007 season					
Seed watermelon	1.05	1.37	1.21 c	31.50	41.25	36.37 c
Maize	1.27	1.30	1.28 bc	38.10	39.00	38.55 bc
Cotton	1.39	1.44	1.42 a	41.85	43.35	42.60 a
Snake cucumber	1.35	1.41	1.38 ab	40.50	42.30	41.40 ab
Rice	1.32	1.38	1.35 ab	39.75	42.26	40.50 ab
Mean	1.27 b	1.38 a		38.34 b	41.43 a	
Interaction L.S.D. 5%	0.17			4.99		
	2007/2008 season					
Seed watermelon	1.09	1.36	1.22 c	33.15	40.8	36.97 b
Maize	1.25	1.20	1.27 bc	39.60	38.85	39.22 a
Cotton	1.44	1.35	1.39 a	43.12	40.50	41.81 a
Snake cucumber	1.32	1.39	1.36 ab	39.75	41.50	40.62 a
Rice	1.25	1.38	1.31 abc	37.50	41.25	39.37 a
Mean	1.27 b	1.35 a		38.62 b	40.58 a	
Interaction L.S.D. 5%	0.18			6.27		

Means designed by the same letter within the same row or column for each season are not significantly different at 5% level, according to DMRT and L.S.D. test for interactions.

These finding agree with those obtained by Winter (1984), Serag El-Din (2000), John *et al.* (2003) and Sims (2007). They reported that sugar beet production differs depending on the previous crop that was grown.

Nitrogen sources exerted significant effect on root weight as well as t/fed. in both seasons. Root yield was increased by urea application in the two seasons. Thus, urea fertilizer increased root yield through increasing dry matter weight accumulation and root size as well as root weight. The higher root yields were obtained from urea application (41.43 and 40.58 t/fed.) in both seasons. Similar results were recorded by Krstic *et al.* (1986), Michael *et al.* (1991), Steven (1991) and El-Sheref (1992). On the contrary Ismail and Abo El-Ghait (2005) found that root yield was not significantly affected by N sources.

The obtained results indicate that the interactions between preceding crops and nitrogen forms significantly affected root yield (Table 2).

4. Top yield:

Means for foliage fresh weight kg/plant as well as top yield t/fed. as affected by preceding crops, nitrogen forms and their interaction are shown in Table (3).

The obtained results show that preceding crops had significant effect on top yields. The highest values of top yield (165.87, 15.90, 16.95 and 16.57 t/fed.) were obtained from sowing sugar beet after cotton or snake cucumber in the first and second season, respectively. It could be mentioned that sowing sugar beet after cotton increase yield rather than those grown after other crops. This result is in agreement with that reported by Serag El-Din (2000).

Table (3): Effect of previous crops, N-forms and their interactions on foliage fresh weight/plant and top yield at harvest in 2006/07 and 2007/08 seasons.

Previous crops	Foliage fresh weight /plant (kg)			Top yield (t/fed.)		
	Nitrogen forms					
	Ammonium nitrate	Urea	Mean	Ammonium nitrate	Urea	Mean
	2006/2007 season					
Seed watermelon	0.42	0.51	0.47 b	12.60	15.30	13.95 b
Maize	0.49	0.60	0.54 a	14.55	18.00	16.27 ab
Cotton	0.55	0.58	0.56 a	16.50	17.25	16.87 a
Snake cucumber	0.52	0.54	0.53 a	15.60	16.20	15.90 ab
Rice	0.56	0.48	0.47 b	13.80	16.25	14.02 b
Mean	0.49 b	0.54 a		14.61 b	16.20 a	
Interaction L.S.D. 5%	0.06					
	2007/2008 season					
Seed watermelon	0.45	0.53	0.49 bc	13.50	16.05	14.77 bc
Maize	0.45	0.54	0.49 bc	13.50	16.20	14.85abc
Cotton	0.53	0.60	0.56 a	15.90	18.00	16.95 a
Snake cucumber	0.53	0.57	0.55 ab	16.05	17.10	16.57 ab
Rice	0.44	0.49	0.47 c	13.35	14.85	14.10 c
Mean	0.48 b	0.54 a		14.46 b	16.44 a	
Interaction L.S.D. 5%	0.06			2.30		

Means designated by the same letter within the same row or column for each season are not significantly different at 5% level, according to DMRT and L.S.D. test for interactions.

The results indicate significant effects on means of top yields at harvest in both seasons due to N-forms (Table 3). Data reveal that the highest top yield (16.20 and 16.44 t/fed.) was recorded with urea fertilizer in the first and second seasons, respectively. This increase may be due to stimulated vegetative growth of sugar beet to ammonium as the sole nitrogen source than nitrate. The same result was obtained by Mike and Nick (1993), Magda (2001) and Mostafa and Darwish (2001).

There was a significant interaction between proceeding crops and N-forms for top yields in both seasons. It is clear from data in Table (3) that sugar beet grown after cotton under urea application gave the highest top yield, while, the lowest ones were obtained when it was grown after seed watermelon under nitrate fertilizer.

Finally, the results indicate that the yield of sugar beet (roots and top) was highly related to preceding crops and N-forms. Since the preceding crop would increase organic matter along with enhancing micro-organisms activity in soil. These factors are with the potential for causing an increment in sugar beet productivity when grown after cotton rather than when grown after other crops. Thus, the highest root and top yield were recorded with NH^{+}_{4} and the lowest with NO^{-}_{3}. Sugar beet root and top yields response to N-forms varied among the previous crops (Tables 2 and 3).

II. Quality parameters:

The most important single parameters which characterize quality of sugar beet are: sugar contents, white sugar percentage, loss sugar concentration and juice purity in beet rots (Winner, 1981).

Data in Table (4) show the mean percentages of gross sugar, white sugar and loss sugar for the investigated sugar beet as affected by preceding crops, nitrogen forms and their interactions.

1. Gross sugar percentage:

Data presented in Table (4) reveal that preceding crop significantly affected gross sugar % during the second season only. The highest mean values were 18.65 and 18.45% obtained from planting sugar beet after cotton or snake cucumber, while, the lowest values of those characters were 18.05 and 17.82% from sugar beet grow after rice in both seasons respectively.

It could be noticed that planting sugar beet after cotton gave the highest percentage. This finding coincide with that reported by Smith and Dexter (1988); Serag El-Din (2000); Sims (2004) and Ismail and Abo El-Ghait (2005).

Data recorded in Table (4) reveal that nitrogen forms had a significant impact on sugar % in the first season only. The highest percentages were obtained from urea application. Similar results were found by Ismail and John *et al.* (2003), Mike and Nick (1993), Magde (2001) and Steven (1991). On the other hand, urea gave the lowest values of sugar percentage (El-Esawy 1994).

The effect of interaction was significant between preceding crop and N-forms on sugar % in both seasons (Table 4). The highest values of sugar % resulted from sowing after cotton with both N-forms. This result coincides with that reported by Lamp *et al.* (2001); Sims *et al.* (2002) and John *et al.* (2003),.

2. White sugar percentage:

Quality, expressed as purity %, which is the percentage of sucrose in juice from roots as a percent of the total soluble solids in the juice. Purity is important to the processor as soluble solids other than sucrose in the expressed sugar juice. Particularly, soluble N compounds make it more difficult to recover sucrose in the refining process.

In general, the trend of the effect of preceding crop, N-forms and their interaction on white sugar percentage was similar to that of gross sugar percentage and similar discussions could be cited (Table 4).

3. Loss sugar percentage:

The most sugar losses in sugar factories result from the sugar in molasses, which is not crystallized. It is estimated by the major non-sugar components in the beet. Although the efficiency of sugar recovery depend, to a large extent, on the factory equipments, the beet quality is by far, the most important parameter affecting the process.

With respect to the effect of preceding crop, the results indicated that loss sugar % was significantly affected only in the first season, but N-forms had insignificant and interactions had a slight effect on these trait (Table 4). The obtained results show that the lowest values of loss sugar % were recorded by growing sugar beet after rice. Whereas, sowing after seed water melon gave the highest one. These results are in agreement with those found by Draycott (1972), Lamb *et al.* (2001) and Sims (2007).

Table (4): Effect of previous crops, N-forms and their interactions on gross sugar %, white sugar % and loss sugar% in 2006/07 and 2007/08 seasons.

Previous crops	Gross sugar %			White sugar %			Loss sugar %		
	Nitrogen forms								
	Amm. nitrate	Urea	Mean	Amm. nitrate	Urea	Mean	Amm. nitrate	Urea	Mean
	2006/2007 season								
Seed watermelon	18.10	18.36	18.23	14.32	14.67	14.50	3.89	3.77	3.83 a
Maize	17.85	18.65	18.25	14.37	14.96	14.66	3.52	3.69	3.60 b
Cotton	19.20	18.10	18.65	15.72	14.65	15.18	3.49	3.45	3.47 c
Snake cucumber	17.70	18.90	18.30	13.93	15.29	14.16	3.46	3.60	3.53 bc
Rice	17.70	18.40	18.05	13.93	15.00	14.47	3.46	3.43	3.44 c
Mean	18.11 b	18.48 a		14.45 b	14.91 a		3.56	3.59	
Interaction L.S.D. 5%	0.96			0.94			0.36		
	2007/2008 season								
Seed watermelon	17.75	18.67	18.21ab	14.43	14.93	14.68 a	3.38	3.80	3.59
Maize	18.35	17.95	18.15 b	14.70	14.30	14.50ab	3.68	3.36	3.52
Cotton	18.50	18.70	18.65 a	14.95	14.94	14.94 a	3.61	3.79	3.72
Snake cucumber	18.50	18.40	18.45ab	14.74	15.00	14.87 a	3.42	3.43	3.42
Rice	17.60	18.05	17.82 b	13.99	14.24	14.12 b	3.73	3.50	3.61
Mean	18.06	18.35		14.56	14.68		3.56	3.57	
Interaction L.S.D. 5%	0.67			0.73			0.49		

Means designated by the same letter within the same row or column for each season are not significantly different at 5% level, according to DMRT and L.S.D. test for interactions.

4. Gross sugar yield (t/fed.):

The data indicate that sugar yield differs depending on the preceding crop. Sugar yield were greater following cotton or snake cucumber than following other crops (Table 5). These observation suggest that nitrogen availability varies between the previous crops. That is, nitrogen availability is greater following cotton and snake cucumber than following corn, rice and seed watermelon. The gross sugar yield is an important yield parameter. Sugar beet (sowing after cotton gave the highest sugar yield (7.94 and 7.88 t/fed.). While, the lowest sugar yield (6.53 and 6.75 t/fed.) were recorded after seed watermelon in both seasons, respectively (Table 5). Similar results were recorded by Serag El-Din (2000).

Regarding the effect of N-forms, data in Table (5) show that significant differences were recorded between ammonium nitrate and urea on sugar yield. Results in Table (5) further indicate that the highest values of sugar yield (7.66 and 7.44 t/fed.) were obtained from urea application. On the contrary, the lowest sugar yields (6.90 and 6.98 t/fed.) were recorded from ammonium nitrate fertilizer. As to gross sugar yield t/fed. expressed as the multiplication of root yield t/fed. by gross sugar (%), the differences in root yield and gross sugar (%) between traits reflected the differences in sugar yield t/fed.

The effect of interaction was significant between preceding crop and N-forms on sugar yield in both seasons Table (5). The highest sugar yield (ton/fed.) resulted from sowing after cotton with ammonium nitrate, while the lowest one resulted from growing after seed watermelon and ammonium nitrate.

5. White sugar yield (t/fed.):

Sugar beet root quality is defined here as the net recoverable sucrose per ton of beet harvested. Root quality takes into account sugar concentration minus loss to molasses impurities. Previous crop, N-forms and their interactions had significant affects on white sugar yield Table (5).

Net white sugar yield followed response trends similar to those described for gross sugar yield.

Table (5): Effect of previous crops, N-forms and their interactions on gross and white sugar yield in 2006/07 and 2007/08 seasons.

Previous crops	Gross sugar yield (t/fed.)			White sugar yield (t/fed.)		
	Nitrogen forms					
	Ammonium nitrate	Urea	Mean	Ammonium nitrate	Urea	Mean
	2006/2007 season					
Seed watermelon	5.47	7.59	6.53 b	4.52	6.05	5.28 c
Maize	6.82	7.27	7.04 ab	5.49	5.83	5.66 bc
Cotton	8.03	7.84	7.94 a	6.58	6.35	6.46 a
Snake cucumber	7.17	8.00	7.58 a	5.93	6.47	6.20 ab
Rice	7.03	7.61	7.32 ab	5.50	6.21	5.85 abc
Mean	6.90 b	7.66 a		5.60 b	6.18 a	
Interaction L.S.D. 5%	1.17			0.88		
	2007/2008 season					
Seed watermelon	5.89	7.651	6.75 c	4.69	6.40	5.54 b
Maize	7.26	6.97	7.11 bc	5.82	5.55	5.48 ab
Cotton	8.20	7.57	7.88 a	6.64	6.03	6.33 a
Snake cucumber	7.39	7.63	7.51 ab	6.03	6.31	6.12 a
Rice	6.60	7.41	7.00 bc	5.24	5.87	5.56 b
Mean	6.98 b	7.44 a		5.61 b	6.02 a	
Interaction L.S.D. 5%	1.10			0.99		

Means designated by the same letter within the same row or column for each season are not significantly different at 5% level, according to DMRT and L.S.D. test for interactions.

6. Loss sugar yield (t/fed.):

Data presented in Table (6) show that previous crop, N sources and their interaction did not significantly affect the loss sugar yield in both seasons.

7. Juice purity percentage:

Concerning the effect of preceding crops, N-forms and their interaction on purity percentage, results in Table (6) indicate that such effect was not significant on these traits in the two seasons.

Table (6): Effect of previous crops, N-forms and their interactions on loss sugar yield, juice purity (QZ) and their interactions in 2006/07 and 2007/08 seasons.

Previous crops	Loss sugar yield (t/fed.)			Juice purity (QZ) %		
	Nitrogen forms					
	Ammonium nitrate	Urea	Mean	Ammonium nitrate	Urea	Mean
	2006/2007 season					
Seed watermelon	1.32	1.56	1.44	79.16	79.59	79.37
Maize	1.34	1.44	1.39	80.40	80.13	80.26
Cotton	1.46	1.49	1.48	81.76	80.94	81.35
Snake cucumber	1.40	1.52	1.46	80.26	78.20	78.46
Rice	1.37	1.42	1.39	80.72	81.39	81.05
Mean	1.38	1.48		80.55	77.25	
Interaction L.S.D. 5%	0.35			23.09		
	2007/2008 season					
Seed watermelon	1.31	1.57	1.44	77.01	79.77	78.39
Maize	1.45	1.30	1.38	80.02	81.53	80.78
Cotton	1.50	1.50	1.50	79.26	79.76	79.51
Snake cucumber	1.30	1.42	1.39	81.00	81.39	81.30
Rice	1.40	1.44	1.42	79.55	80.86	80.20
Mean	1.38	1.45		79.45	80.66	
Interaction L.S.D. 5%	0.270			36.01		

Means designated by the same letter within the same row or column for each season are not significantly different at 5% level, according to DMRT and L.S.D. test for interactions.

REFERENCES

Abo El-Wafa, A.M. (2002). Effect of plant spacing, nitrogen rates and frequency on yield and quality of Kawemira sugar beet variety under Upper Egypt conditions. J. Agric. Sci. Mansoura Univ., 27(2): 707-716.

Draycott, A.P. (1972). Sugar-beet nutrition. John Wiley & Sons., New York. James, D.W., C.E. Nelson, and A.R. Halvorson. 1967. Soil testing for residual nitrite as a guide for nitrogen fertilization of sugar beets. Circ. 480. Washington Agric. Exp. Stn., Pulman.

Duncan, B.D. (1955). Multiple range and multiple F-test. Biometrics, 11: 1-42.

El-Essawy, I.I. (1994). Effect of nitrogen source and time of application on yield and quality of sugar beet. Egypt. J. Appl. Sci., 9(12): 938-951.

El-Harriri, M.A. and M.E. Gobaaraha (2001). Response of growth, yield and quality of sugar beet to nitrogen and potassium fertilizers under newly reclaimed sandy soil. J. Agric. Sci. Mansoura Univ., 26(10): 5895-5907.

El-Sheeref, E.El.M. (1992). Effect of different sources and rates of N-fertilizer on yield and quality of sugar beet. Ph.D. Thesis, Vienna Univ., Austria.

Gomez, K.A. and A.A. Gomez (1984). Statistical procedures for Agricultural Research. An International Rice. Research Institute Book. John Willey and Sons. Inc., New York, USA.

Hervey, C.W.; J.V. Dutton (1993). Root quality and processing: pp. 571- 617. In the sugar beet crop. Science into Practice. Edited by D.A. Coke and R.K. Scatt. Published 1993 byCHarman & Hall. London.

Hilal, S.M.M. (2005). Response of sugar beet crop to application of biological and chemical fertilizers under North Delta conditions. Ph.D. Thesis Faculty of Agriculture, Kafr El-Sheikh, Tanta Unniv.

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

Jackson, M.L. (1967). Soil Chemical Analysis Prentice Hall Private Ltd., New York, USA.

John *et al.* (2003). Sugar beet growth as affected by wheat residues and nitrogen fertilization in Agron. J. 95: 1560-1565. American Society of Agronomy 6775. Segoe Rd., Madison, WI53711 USA.

Krstic, B.; G. Gebauer and M. Saric (1986). Specific response of sugar beet cultivars to different nitrogen forms. Z. Pflanzenernaehr. Bodenk. 149: 561-571.

Lamb, J.A.; A.L. Sims; L.J. Smith and G.W. Rehm (2001). Fertilizing sugar beet in Minnesota and North Dakota. Ext. Bull. Fo-07715 c. Univ. of Minnesota, St. Paul.

LeDocte, A. (1927). Commercial determination of sugar in the beet root using the sachs. LeDocte Process Int. Sug. J. 29, 488-492.

Magda, A. Hussein (2001). Response of sugar beet to various nitrogen sources in relation to sulphur application. J. Agric. Res. Tanta Univ., 27(2): 348-357.

McGinnus, R.A. (1971). Sugar beet technology, 2nd ed. Sugar Beet Development Foundation, Fot. Collins, Colo, USA.

Michael (1991). The nitrogen nutrition of sugar beet. An approach to better forecasting of nitrogen fertilizer requirement. Vol. 59 No. 63 p. 84-86.

Mike, A. and S. Nick (1993). Nitrogen fertilizer recommendations. British Sugar Vol. 61 No. 4.

Moustafa, S.N. and S.D. Darwish (2001). Biochemical studies on the efficiency use of some nitrogen fertilizers for sugar beet production. J. Agric. Sci. Mansoura Univ., 26(4): 2421-2439.

Nordgaard, J.T.; R. Hemb. and M. Hughes (1982). Sugar beet yield and sugar content as influenced by previous crop and soil organic matter. Fertilizing sugar beet in Minnesota and North Dakota. Univ. of Minn. Extension Service. Fo-07715-C.

Reinfeld, E.; A. Emmerich; G. Baumaglen; C. Winner and U. Beiss (1974). Zurvoraussage des Melassezuckers aus Rubenanalysen. Zucker. 27-2-12.

Serag El-Din, A.A. El. (2000). Effect of preceding crop and nitrogen fertilizer level on yield and quality of some sugar beet varieties grown in Fayoum region. Ph.D. Thesis, Fac. Agric., El-Fayoum, Cairo Univ., Egypt.

Sims, A.L. (2004). Nitrogen management in sugar beet grown in spring wheat and corn residue. 2003 sugar beet Res. Ext. Rept., Coop. Ext. Serv., North Dakota State Univ. 35: 80-91.

Sims, A.L. (2007). Sugar beet Res. Ext. Rept., Coop. Ext. Serv. North Datota State Univ. 37: 110-115.

Smis, A.L.; J.T. Moraghan and L.J. Smith (2002). Spring wheat response to fertilizer nitrogen following a sugar beet crop varying in canopy color. Precis. Agric. 3: 283-295.

Smith, L.J. and A.G. Dexter (1988). Sugar beets following soybeans in a crop rotation. 1987 sugar beet. Res. Ext. Rept., Copp. Ext. Serv., North Dakota State Univ. 18: 54-57.

Soine, O.C. and R.K. Severson (1975). Sugar beet research. 1974 Sugar beet Res. Ext. Rept. Coop, Ext. Serve. North Dakota State Univ. 5: 80-90.

Winter, S.R. (1984). Cropping systems to remove excess soil filtrate in advance of sugar beet production. Journal of the A.S.S.B.T. Vol. 22, No. 3 and 4, April. Oct.

تأثير المحاصيل السابقة ومصادر النيتروجين على إنتاجية محصول بنجر السكر فى منطقة شمال الدلتا

سامية محمد محمود هلال ــ عادل يوسف رجب ــ علاء ابراهيم بدر

الملخص العربى

أجريت تجربتان حقليتان فى حقول المزارعين فى منطقة شمال الدلتا خلال موسمى الشتاء ٢٠٠٦/٢٠٠٧م ، ٢٠٠٧/٢٠٠٨م وذلك لدراسة تأثير خمسة محاصيل سابقة (الكانتالوب ــ الذرة ــ القطن ــ القثاء ــ الأرز) ومصدرين من السماد الأزوتى (نترات الأمونيوم واليوريا) على إنتاجية محصول بنجر السكر.

استخدم تصميم القطع المنشقة مرة واحدة فى أربع مكررات حيث تم توزيع المحاصيل السابقة فى القطع الرئيسية ومصدرى النيتروجين فى القطع المنشقة.

ويمكن تلخيص أهم النتائج المتحصل عليها كما يلى:

١- أوضحت النتائج أن المحاصيل السابقة كان لها تأثيرا معنويا على طول وقطر الجذر ومحصول الجذور ومحصول العرش ونسبة السكر ومحصول السكر طن/فدان.

٢- زراعة البنجر بعد القطن أو القثاء أنتجت أعلى القيم من الصفات السابقة تحت الدراسة.

٣- مصدر السماد النيتروجينى كان له تأثيرا معنويا على كل من محصول الجذور ومحصول العرش والنسبة المئوية للسكر ومحصول السكر طن/فدان.

٤- أوضحت النتائج أن إضافة السماد النيتروجينى فى صورة يوريا أعطت أعلى القيم لهذه الصفات ويتبعها إضافة السماد النيتروجينى فى صورة نترات الأمونيوم فى كلا الموسمين.

٥- تشير البيانات إلى أن نمو بنجر السكر بعد القطن أو القثاء مع مصدر السماد النيتروجينى فى صورة يوريا أعطى أعلى إنتاجية من محصول الجذور الطازجة طن/فدان ومحصول السكر الكلى ومحصول السكر الأبيض طن/فدان وذلك بالمقارنة بزراعته بعد الكانتالوب أو الأرز باستخدام السماد النيتروجينى فى صورة نترات الأمونيوم.