J. Agric. Sci. Mansoura Univ., 27 (11): 7257 - 7266, 2002

EFFECT OF PLANTING DATES, NITROGEN LEVELS AND BIOFERTILIZATION TREATMENTS: 2: YIELD, YIELD COMPONENTS AND QUALITY OF SUGAR BEET (*Beta vulgaris*, L.)

Kandil, A. A.; M. A. Badawi; S. A. El-Moursy and U. M. A. Abdou
Agron. Dept., Fac. Agric., Mansoura University, Egypt

ABSTRACT

Two field experiments were carried out at El-Serw region in Northern Faraskour district Damitta Governorate to investigate effect of planting dates, nitrogen levels and biofertilization treatments as well as their interactions on yield and quality of sugar beet (*Beta vulgaris*, L.) variety Top.
The main results could be summarized as follows:

Some yield components character i.e. root length, root diameter, root fresh weight, foliage fresh weight, and root /top ratio (in the second season) were exerted a significant effect as a results from planting dates treatments. The treatment from planting dates which gave the high values was planting on 15th of October of all yield components except root diameter (in the second season only) and root/top ratio in both seasons.

In the first season root quality characters (TSS, Sucrose and juice purity %) were insignificantly affected due to the planting dates treatments. The highest values of yield quality characters were planting beet on 15th of October over both seasons).

Planting dates treatments had significant effect on root yield, top yield, sugar yield and harvest index. Planting dates on 15th of October gave the highest values of yield characters except harvest index.

- Raising nitrogen fertilizer levels from 0 to 20, 40, 60 and 80 kg N/fad showed a significant increase on all yield components and yield in both seasons except root/top ratio resulted from fertilizing beet with 40 kg N/fad. Vice versa the highest values of TSS, sucrose and purity % were obtained from control treatments (without N-fertilizing) in both seasons.
- Biofertilization treatments had significant effect on all yield components and yield and the best treatment with biofertilizer was rhizobactein treatment except root /top ratio were obtained from uninoculation seeds.
- TSS %, sucrose % and juice purity %, the highest values of these characters were obtained with uninoculation treatment (control). The interaction between planting dates and nitrogen levels had significant effect on all yield components and yield characters except root /top ratio.
- The interaction between planting dates and biofertilization treatments had significant effect on root diameter (in the first season), foliage fresh weight in the second season (at harvest), juice purity (in the first season only), root, top and sugar yields.
- The interaction between nitrogen levels and biofertilization treatments had significant effect on all yield components, yield quality and yield except root /top ratio, TSS (in the first season), purity 5 and sugar yield (in the first season.
- The interaction among planting dates, nitrogen fertilizer levels and biofertilization treatments had significant effect on root diameter, root and foliage fresh weights, root and top yields.

INTRODUCTION

Sugar beet (*Beta vulgaris,* L.) has several advantages as suitable complementary crop for increasing local sugar production in Egypt. Also, sugar beet is considered as an industrial crop to produce various products as Alcohol, forage and other many products. Planting dates, nitrogen fertilization and biofertilization are considered among the important agricultural practices to improve sugar beet productivity.

Planting date is considered among the most important factor for all field crops generally, and sugar beet specially. It has an active role for growth, yield and root quality of sugar beet plants. The suitable date for sugar beet planting mainly depends on many factors such as the previous crop, weathering conditions, contorting conditions with sugar factories and cultivated cultivar. Badawi (1989) in Egypt, pointed out that early planting (1st September) favoured length and diameter of root (cm), root fresh weight (g), foliage fresh weight, total soluble solids (TSS), sucrose percentage and purity percentage as well as root, top and sugar yields (ton /fad). There was no significant differences in all characters between sowing of September 1st and that of October 1st. El-Kassaby and Leilah (1992) in Egypt, reported that sowing sugar beet during October markedly increased root diameter, root length, root weight and sugar content as well as root and sugar yields than sowing during November. Leilah and Nasr (1992) in Egypt, found that sowing dates had significant effects on sucrose percentage, juice purity, root and sugar yields/fad. Early sowing (15th Sept.) recorded the highest root yield/fad without significant difference from 15th Oct. While the highest values of sucrose %, juice purity % and sugar yield/fad were obtained with sowing on 15th Oct. Ghonema (1998) found that planting dates markedly affected all characters under study except foliage weight and root/top ratio in the second season. Planting sugar beet during October recorded the highest root length, root diameter, root and foliage fresh weights sucrose and purity percentages and root yield as well as sugar yield compared with other planting dates. Minx (1999) reported that each day of delay in sowing reduces final yield by 0.8 to 1.3 % while each day delay in harvest increase sugar content by 0.3 to 0.4 %. Ramadan and Hassanin (1999) in Egypt, revealed that sugar beet sown on 10th September gave significantly higher root length and diameter, as well as root and recoverable sugar yields. Delaying sowing date up to 10th November, intensified the reduced of sucrose, purity and recoverable sugar percentages but increased Na, K, amino-N and sucrose loss to molasses. Abdou (2000) in Egypt, reported that planting sugar beet plants on first October resulted in marked increase in number of leaves/plant, root diameter and length, root and foliage fresh weights, root/top ratio and harvest index as well as root, top and sugar yields/fad. While the highest values of TSS %, sucrose % and purity % were recorded from planting sugar beets on first September.

Fertilization is among the vital factors affecting growth, yield and quality of sugar beet especially nitrogen. Nitrogen is referred as balance wheel of plant nutrition. It has an active role to raise the efficiency of other nutrients as well as raising sugar beet productivity. El-Kased *et al.* (1993) revealed that nitrogen significantly increased root yield and the impurities of

sugar juice, but it reduced the sucrose percentage. The total sugar production and the extractable sugar were significantly increased as nitrogen increased up to 100 kg N/fad. El-Attar *et al.* (1995) in Egypt, showed that increasing nitrogen application recorded significant increases in root weight/plant and root, top and gross sugar yields. Maximum sugar yields were obtained from 80 kg N/fad. Badawi (1996) pointed out that increasing nitrogen rates from 0 to 60 kg N/fad induced the favorable effect on sugar beet yields and their attributes. However, raising nitrogen rates from 60 to 80 kg N/fad did not induce marked effects for most studied traits. On the other hand, raising nitrogen rates caused a decrease in TSS %, sucrose % and purity %. Therefore, the dose of 60 kg N/fad was recommended for increasing root and sugar yields as well as decreasing fertilizer costs. Salama and Badawi (1996) in Egypt, showed that increasing N-levels from 50 to 70 kg N/fad significantly increased root diameter, root and sugar yields/fad. However, raising N-rates from 70 to 90 kg N/fad did not induce marked effects for studied traits and markedly reduced TSS and sucrose %. The recommended N-dose should be 70 kg N/fad for the experimental site at Mansoura. Azzazy (1998) studied the effect of three nitrogen fertilizer levels (40, 60 and 80 kg N/fad) on yield and quality of sugar beet. He reported that increasing nitrogen levels significantly increased root diameter, root length and top yield, but decreased sucrose %, sugar yield and purity %. El-Moursy *et al.* (1998) in Egypt, indicate that increasing nitrogen fertilizer level up to 100 kg N/fad significantly increased root length and diameter, root fresh weight, top, root and sugar yields/fad as well as total soluble solids percentage in both seasons. On the other hand, increasing nitrogen fertilizer levels from 40 through 100 kg N/fad caused marked decrease in sucrose and purity percentages. Seleem (1998) cleared that increasing nitrogen fertilizer caused a significant increase in root length, root diameter as well as root fresh and dry weights. Meanwhile, root/top ratio was not significantly increase with the addition of nitrogen. He also found that all yield quality determinations of beet i.e TSS %, sucrose and juice purity % were significantly reduced as nitrogen level increased. Abdou (2000) in Egypt, found that adding 100 kg N/fad was associated with the highest values of number of leaves/plant, diameter, length and fresh weight of roots and foliage fresh weight as well as root, top and sugar yields/fad. While, the highest values of TSS, sucrose and purity % were recorded under the low levels of nitrogen. Abd El-Moneim (2000) reported that nitrogen significantly increased root length and diameter, top and root fresh weights, root, top and sugar yields/fad, but it reduced TSS, sucrose % and purity percentage. Hassanin and Sohair, Elaryan (2000) reported that increasing N rate up to 90 kg N/fad improved size and weight of the individual root and increased root yield by 3.4 tons, sugar yield by 460 kg and top yield by 1.41 ton/fad. On the other hand, higher N rate depressed beet quality. El-Shahawy *et al.* (2001) reported that 60 kg N/fad gave the highest values of root and grass sugar yields as well as top yield. While, the highest values of sucrose %, while possible extraction sugar % and sugar purity % were obtained under the lowest level of nitrogen (Zero N/fad).

El-Bassel (1992) found that inoculation with *Azospirillum* on sugar cane in Egypt achieved a great saving in mineral nitrogen fertilizers (about

120 kg/fad), there was also an increase in average yield from 7.2 to 12.6 tons/fad with a marked increase in sugar yield (1.3 ton/fad). El-Badry and El-Bassel (1993) in Egypt, found that a significant saving in nitrogen fertilizers (about 40 %) with *Azospirillum* inoculation. There was also an increase in the average of yield from 2.8 to 6.0 tons/fad, with a marked increase in sugar yield of sugar beet. Favilli *et al.* (1993) noticed that inoculation sugar beet seeds with *Azospirillum lipoferum* plus 60 kg N/ha improved the root weight compared with 100 kg N/ha alone. Shabev *et al.* (1995) found that inoculation of sugar beet seeds by nitrogen fixation bacteria led to increases in plant yield and nitrogen uptake and positive nitrogen balance, as a result of increasing nitrogen fixation in the rhizosphere. Selim (1998) found that biofertilizer treatments significantly increased root and foliage fresh weights, root length and diameter as well as root and sugar yields of sugar beet. Sadek (1999) and Dawa *et al.* (2000) pointed out that inoculation of sweet potato plants with N-fixing bacteria (*Azospirillum or Azotobacter*) advanced shoot growth and tuber root yield. Sultan *et al.* (1999) reported that inoculation of sugar beet fruit with *Azobacterin* significantly increased leaf area, root length and diameter, root yield/fad as well as total soluble solids.

MATERIALS AND METHODS

The present investigation was conducted at El-Serw region in Northern Faraskour district, Damitta Governorate during the two growing seasons of 1998/1999 and 1999/2000 to study the effect of planting dates, nitrogen fertilization levels and biofertilization treatments as well as their interaction on the yield, yield components and quality of sugar beet cultivar (cv. Top).

This study included four planting dates. Each planting date was conducted in a separate experiment. The planting dates were the 15th of September, 1st of October, 15th of October and 1st of November in the first and second seasons, respectively.

A split-plot design with four replicates was used for each planting dates. The main plots were occupied by the five nitrogen levels:

N1- Zero kg N/fad (control) N2- 20 kg N/fad
N3- 40 kg N/fad N4- 60 kg N/fad
N5- 80 kg N/fad

Nitrogen fertilizer was added in the form of ammonium sulphate (20.5 % N) was applied as a side dressing at the previously mentioned rates in two equal parts, one half after thinning (before the first irrigation) and the other half before the second irrigation.

While, the sub-plots were devoted to the following three biofertilization treatments:

b1- Untreated seeds (control)
b2- Treated seeds with Cerialine (600 g/fad)
b3- Treated seed with Rhizobactrein (600 g/fad)

The experimental basic unit area included five ridges, each of 60 cm width and 3.5 m length occupying an area of 10.5 m^2 (1/400 fad). The preceding summer crop was rice in both seasons.

The experimental field well prepared through two ploughing and leveling. Calcium super phosphate (15.5 % P_2O_5) was applied during tillage operations at the rate of 100 kg/fad. Potassium sulfate (48 % K_2O) at a rate of 50 kg/fad was applied before the first and second watering.

Sugar beet cultivar (TOP) was obtained from the Dakahlia Sugar Company at Belkass to which the author is indebted. Seed balls were hand sown as the usual dry sowing (after inoculation seed with bacterial suspension) on one side of the ridge in hill 20 cm apart at the rate of 3-5 seed balls per hill during the aforementioned dates in both seasons. Each planting date were irrigated immediately after sowing directly. Beet plants were thinned in two time, the last one was done to let one plant/hill.

1- Yield components:

At harvest (190 days), five plants were taken at random from each plot to estimate the following characters:

1. Root length (cm)
2. Root diameter (cm).
3. Root fresh weight (g/plant)
4. Foliage fresh weight (g/plant)
5. Root / top ratio.

2- Yield quality:

1. Total soluble solids % (TSS) of roots: it was measured in juice of fresh root using hand refractometer.
2. Sucrose percentage: it was determined polarimetrically on lead acetate extract of fresh macerated roots according to Le. Docte method (1927).
3. Juice purity percentage: it was calculated according to the following equation:

$$\text{Juice purity \%} = \frac{\text{Sucrose \%}}{\text{TSS \%}} \times 100$$

3- Yield:

At harvesting time, sugar beet plants in two ridges of each experimental unit (sub-plot) were collected and cleaned, then after roots and tops were separated and each was weighted in kg, then after it was converted to estimate:

1- Root yield (ton/fad).
2- Top yield (ton/fad).
3- Sugar yield (ton/fad). It was calculated by multiplying root yield by root sucrose percentage.

Statistical analysis:

All data of each sowing date in each season were statistically analyzed according to the technique of Analysis of Variance (ANOVA) of the split plot design. Then the combined analysis for the four studied planting dates was done in each season according to the method stated by Gomez and Gomez (1984). Treatment means were compared using the least significant difference (LSD) method.

RESULTS AND DISCUSSION

Yield components and yield as well as yield quality of sugar beet as affected by planting dates, nitrogen levels and biofertilization treatments are presented in Table (1, 2 and 3) for the first and second season, respectively.

1- Effect of planting dates:

Data presented in Tables (1,2 and3) show that planting beet on 15th of October was accompanied by a substantial increase in all yield components and yield as well as yield quality except root /top ratio in the first and second season respectively. Root length (cm), root diameter (cm), root fresh weight (g/plant), foliage fresh weight (g/plant), TSS %, sucrose %, purity %, root, top and sugar yields. The highest root yields were (20.7 and 21.8 ton/fad), top yields (10.8 and 12.28 ton /fad) and sugar yields (3.27 and 3.79 ton /fad) in the first and second seasons, respectively were obtained when sugar beet was planted on 15th of October. The superiority of October planting may be attributed to the suitable climatic conditions particularly temperature, day length, light density and longer growth period and hence increase root weight and root yield /fad and consequently increase sugar yield /fad. The scope of this findings is generally according to those obtained by El-Kassaby and Leilah (1992), Leilah and Nasr (1992), Ramadan and Hassanin (1999) and Abdou (2000).

Table 1: Averages of root length and diameter, root fresh weight and foliage fresh weight as affected by planting dates, nitrogen levels and biofertilization treatments during 1998/99 and 1999/2000 seasons.

Characters	Root length (cm)		Root diameter (cm)		Root fresh weight (g/plant)		Foliage fresh weight (g/plant)	
Seasons / Treatments	1998/99	1999/2000	1998/99	1999/2000	1998/99	1999/2000	1998/99	1999/2000
A- Planting dates								
15 Sept	28.3	29.8	9.2	10.9	657.0	736.2	292.3	276.4
1 Oct	31.6	31.8	9.1	11.1	685.8	797.1	282.9	299.9
15 Oct	36.2	31.8	10.7	10.3	819.3	941.9	355.8	396.8
1 Nov	34.1	30.6	10.7	10.1	710.5	733.1	325.8	303.7
F test	**	**	**	**	**	**	**	**
LSD 5%	1.4	1.0	0.2	0.3	10.5	18.0	23.1	8.7
B- Nitrogen levels								
0 kg N/fad	28.4	25.7	7.5	7.7	384.4	370.1	158.8	148.9
20 kg N/fad	32.6	30.4	9.3	10.0	578.2	614.2	227.5	254.8
40 kg N/fad	32.0	30.9	10.2	10.9	724.8	833.5	284.0	332.3
60 kg N/fad	34.4	33.3	10.7	11.8	829.1	1010.4	373.2	390.4
80 kg N/fad	35.5	35.7	11.8	12.6	1074.2	1182.1	527.5	469.6
F test	**	**	**	**	**	**	**	**
LSD 5%	1.5	1.2	0.3	0.3	11.7	20.1	25.9	9.8
C- Biofertilization treatments								
Control	30.7	29.6	9.5	10.1	63.9	728.5	268.3	286.5
Cerialine	32.2	31.3	9.8	10.5	619.7	79.0	306.3	314.6
Rhizobacterin	34.7	32.1	10.5	11.3	815.8	879.7	367.9	356.5
F test	**	**	**	**	**	**	**	**
LSD 5%	0.9	0.9	0.1	0.2	8.9	10.6	12.4	6.4

2- Effect of nitrogen levels:

Data tabulated in Tables (1,2 and 3) show that fertilizer levels had significant effect on all yield components(root length, root diameter, root and foliage fresh weights and root/top ratio)), all yield quality characters (TSS, sucrose and purity percentage) and yield characters (root, top and sugar yields ton/fad).

Raising nitrogen fertilizer levels increased yield competes and yield characters but decreased yield quality such as (TSS, sucrose and purity %) which obtained from control treatments (without N-fertilizer))in both seasons. From data in Table (3) revealed that the 80 kg N/fad treatment was the most favourable treatment for raising root, top and sugar yields /fad. Similar findings were recorded by other workers including El-Kassed *et al.* (1993), El-Attar *et al.* (1995), Badawi (1996), Azzazy (1998), El- moursy *et al.* (1998), Seleem (1998), Abdou (2000) and Abd El-Moneim (2000).

Table 2: Averages of root /top ratio, TSS%, sucrose % and purity % as affected by planting dates, nitrogen levels and biofertilization treatments during 1998/99 and 1999/2000 seasons.

Characters	Root /top ratio		TSS %		Sucrose %		Purity %	
Seasons / Treatments	1998/99	1999/2000	1998/99	1999/2000	1998/99	1999/2000	1998/99	1999/2000
A- Planting dates								
15 Sept	2.32	2.65	18.4	20.3	15.8	16.7	86.4	82.6
1 Oct	2.53	2.65	18.4	20.0	15.9	16.3	86.5	81.7
15 Oct	2.49	2.43	18.4	20.8	16.1	17.8	87.2	85.7
1 Nov	2.42	2.41	18.3	18.9	15.7	15.5	85.9	82.1
F test	NS	**	NS	**	NS	**	NS	**
LSD 5%	--	0.08	--	0.4	--	0.4	--	1.7
B- Nitrogen levels								
0 kg N/fad	2.52	2.51	19.3	21.2	17.5	18.5	91.0	87.2
20 kg N/fad	2.63	2.47	18.3	20.2	15.8	17.0	86.8	84.1
40 kg N/fad	2.63	2.55	18.1	20.1	15.6	16.5	86.3	82.3
60 kg N/fad	2.31	2.61	18.2	19.5	15.7	16.0	86.4	82.2
80 kg N/fad	2.12	2.53	17.9	19.0	14.7	15.1	81.9	79.4
F test	**	NS	**	**	**	**	**	**
LSD 5%	0.44	--	0.4	0.5	0.4	0.5	2.2	1.9
C- Biofertilization treatments								
Control	2.52	2.57	18.4	20.2	16.2	17.0	87.9	83.9
Cerialine	2.42	2.54	18.5	20.1	15.8	16.7	85.4	82.9
Rhizobacterin	2.38	2.49	18.1	19.6	15.6	16.1	86.2	82.2
F test	NS	**	**	**	**	**	**	**
LSD 5%	--	0.01	0.3	0.3	0.3	0.2	1.6	1.1

3- Effect of biofertilization treatments:

Data in Tables (1, 2 and 3) show that treated sugar beet seeds with biofertilization i.e. Cerialline and Rhizobacterin caused significant increase of all yield components (root length, root diameter, root and foliage fresh weights and root/top ratio (in the second season only), yield quality characters (TSS %, sucrose %, and juice purity %) and yield characters (root, top and sugar yields/fad).

Table 3: Averages of root yield, top yield and sugar yield as affected by planting dates, nitrogen levels and biofertilization treatments during 1998/99 and 1999/2000 seasons.

Characters	Root yield (ton/fed)		Top yield (ton/fed)		Sugar yield (ton/fed)	
Seasons / Treatments	1998/99	1999/2000	1998/99	1999/2000	1998/99	1999/2000
A- Planting dates						
15 Sept	18.0	18.5	8.76	8.64	2.81	3.02
1 Oct	19.2	20.3	8.73	9.41	3.01	3.23
15 Oct	20.7	21.8	10.80	12.28	3.27	3.79
1 Nov	18.1	18.5	10.10	9.39	2.79	2.82
F test	**	**	**	**	**	**
LSD 5%	0.2	0.2	0.16	0.14	0.07	0.95
B- Nitrogen levels						
0 kg N/fad	11.4	10.8	5.25	4.87	1.99	2.00
20 kg N/fad	15.4	15.7	7.83	7.88	2.44	2.67
40 kg N/fad	19.5	20.3	9.18	10.13	3.05	3.37
60 kg N/fad	22.1	24.0	11.20	12.13	3.46	3.85
80 kg N/fad	26.6	27.8	14.59	14.65	3.89	4.19
F test	**	**	**	**	**	**
LSD 5%	0.2	0.2	0.17	0.15	0.07	0.11
C- Biofertilization treatments						
Control	17.3	18.2	8.61	9.06	2.76	3.04
Cerialine	18.7	19.7	9.51	9.79	2.92	3.22
Rhizobacterin	20.9	21.4	10.72	10.94	3.23	3.39
F test	**	**	**	**	**	**
LSD 5%	0.1	0.2	0.14	0.10	0.06	0.05

Generally, treated seeds with Rhizobacterin gave the highest values of the characters under study except the root quality characters (TSS %, sucrose %, and juice purity %) which obtained with uninoculation treatment (control). These resultes are in harmony with El-Bassel (1992), El-Badry and El-Bassel (1993), Favilli *et al.* (1993), Shabev *et al.* (1995), Selim (1998), Sultan *et al.* (1999) and Sadek (1999).

REFERENCES

Abd El-Moneim, S.A. (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.

Abdou, M.A. (2000): Effect of planting dates, plant population and nitrogen fertilization on sugar beet productivity under the newly reclaimed sandy soils. Ph. D. Thesis, Fac. Agric. Mansoura Univ.

Azzazy, N.B. (1998). Effect of sowing date, irrigation interval and nitrogen fertilization on yield and quality of sugar beet under upper Egypt conditions. Egypt. J. Agric. Res., 76 (3): 105-111.

Badawi, M.A. (1989). A preliminary study on the effect of some cultural practices on the growth and yield of sugar beet. J. Agric. Sci. Mansoura Univ., 14 (2): 984 - 993.

Badawi, M.A. (1996). Effect of soil and foliar fertilization with urea on yield, yield components and quality of sugar beet. (*Beta vulgaris*, L.). J. Agric. Sci. Mansoura Univ., 21 (9): 3083 - 3096.

Dawa, K.K.; A.I. Abdel-Fttah; E.E. El-Gamiely and U.M. Seif El-Din (2001). Effect of some chemical nitrogen sources, rates and biofertilizer (nitrobien) on plant growth, yield and tuber root quality of sweet potato. J. Agric. Sci. Mansouera Univ., 25 (8): 5397-5411.

El-Attar, H.A.; Y.A. Darweesh; M.K. El-Haris and F.A. Askar (1995). The effect of N P K fertilization on the yield components of sugar beet at Northen Nile Delta. J. Agric. Sci. Mansoura Univ., 20 (7): 3635 - 3643.

El-Badry, M. and A. El-Bassel (1993). Improving sugar beet crop by inoculation with free-living nitrogen fixing bacteria. 6th Inter. Symp. on nitrogen fixation with non legumes, Ismalia, Egypt.

El-Bassel, A. (1992). Improving sugar cane crop by inoculation with free living nitrogen fixing bacteria. 9th Internat. Cong. on Nitrogen Fixation, Cancum Mexico.

El-Kased, F.A.; A.A. El-Gharabawy and S.Y. Besheit (1993). Yield of sugar beet and quality as affected by nitrogen and phosphorus rates in calcareous soils. J. Agric. Sci. Mansoura Univ., 18 (2): 581 - 587.

El-Kassaby, A.T. and A.A. Leilah (1992). Effect of sowing and harvesting time on yield and quality of sugar beet. Proc. 5th Conf. Agron. Zagazig, Univ., 13 - 15 Sept., (2): 963 - 969.

El-Moursy, S.A.; A.T. El-Kassaby; A.M. Salama and H.M. Sarhan (1998). Marco-elements requirements of sugar beet. J. Agric. Sci. Mansoura Univ., 23 (2): 701-710.

El-Shahawy, M.L.; M.S.El-Yamani; Maani, Z.M. AbouAmou and Asmaa, A. El-Basuony (2001). Influence of tillage methods and nitrogen fertilization levels on yield quality and chemical composition of sugar beet crop. J. Agric. Sci. Mansoura Univ., 26 (2): 1177-1190.

Favilli, F.; R. Pastorei and A. Gori (1993). Response of sugar beet to *Azospirillum bacterization* in field experiments. Agric. Med., 123: 281-285.

Ghonema, M.H. and A.A. Sarhan (1994). Response of direct seeding and transplanted sugar beet to N P and K fertilization rates. J. Agric. Sci. Mansoura Univ., 19 (9): 2785 - 2797.

Gomez, K.A. and A.A. Gomez (1984). Statistical Procedures for Agricultural Research. John Wiley and Sons, Inc., New York. pp: 680.

Hassanin, M.A. and Sohair E.D. Elaryan (2000). Effect of phosphorus and nitrogen rates and time of nitrogen application on yield and juice quality of sugar beet. J. Agric. Sci. Mansoura Univ., 25 (12): 7389-7398.

Le-Docte, A. (1927). Commercial determination of sugar in the beet root using the Sachr Le Docte process. Inter. Sugar J., 29: 488-492. (C.F. Sugar beet nutrition April 1972, Applied Science Publishers LTD, London, A.P. Draycott).

Leilah, A.A. and S.M. Nasr (1992). The contribution of sowing and harvesting dates on yield and quality of some sugar beet cultivars. Proc. 5th Conf. Agron. Zagazig Univ., 13 - 15 Sept., 2: 970 - 979.

Minx, L. (1999). The length of growing season. A serious problem of Czech sugar beet industry. Listry Cukrovarnicke a Reparske 115, 50-51. (C.F. Field Crop Abst., 52, 5857, 1999)

Ramadan, B.S.H. and M.A. Hassanin (1999). Effect of sowing dates on yield and quality of some sugar beet (*Beta vulgaris*, L.) varieties. J. Agric. Sci., Mansoura Univ., 24 (7): 3227 - 3237.

Sadek, U.M.S. (1999). Studies on bio and chemical fertilization on sweet potato (*Ipomoea batatas*, L.). M.Sc. Thesis Fac. Agric. Mansoura Univ.

Salama, A.M. and M.A. Badawi (1996). Evaluation of six sugar beet cultivars under N-levels and harvesting dates. J. Agric. Sci. Mansoura Univ., 21 (1): 139 - 153.

Seleem, E.M.E. (1998). The combined effect of salinity and NPK fertilization on sugar beet (*Beta vulgaris*, L.) M. Sc. Thesis, in Soil Sci., Fac. Agric. Mansoura Univ.

Selim, S.H.H. (1998). Effect of some agricultural treatments on sugar beet (*Beta vulgaris*, L.). Ph.D. Thesis Fac. Agric. Mansoura Univ.

Shabev, V.P.; V. Yusnolin and O.S. Safrina (1995). Nitrogen fixation in rhizophere, yield of beet root and nitrogen balance flood plain and soil using nitrogen fixing bacteria of the genus *Pseudomonas*. *Agrokhimiya*, 11: 3-14. (C.F. CD ROM Computer System)

Sultan, M.S.; A.N. Attia; A.M. Salama; A.E. Sharief and E.H. Selim (1999). Biological and mineral fertilization of sugar beet under weed control. I. Sugar beet productivity. 1st International Conference on Sugar and Integrated Industries, Luxor Egypt, Feb. 15th - 18th 1: 171-181.

تأثير مواعيد الزراعة ومستويات النيتروجين والتسميد الحيوي على: ٢. المحصول ومكوناته وصفات الجودة في بنجر السكر

أحمد أبو النجا قنديل، محسن عبد العزيز بدوي ، سعد أحمد المرسي ، أسامة عوض عبده

قسم المحاصيل – كلية الزراعة – جامعة المنصورة – المنصورة –جمهورية مصر العربية

أقيمت تجربتان حقليتان بمنطقة السرو، محافظة دمياط لدراسة تأثير مواعيد الزراعة ومستويات النيتروجين والتسميد الحيوي والتفاعل بينهم على المحصول ومكوناته وصفات الجودة لنبات بنجر السكر الصنفTop. وتلخص أهم نتائج الدراسة في الآتي:

١. تأثرت معنويا بعض صفات مكونات المحصول وقد أدت الزراعة في ١٥ أكتوبر إلى الحصول على أعلى متوسطات لمكونات المحصول ، باستثناء قطر الجذر (في الموسم الثاني) ونسبة الجزر/العرش (في كلا الموسمين). وقد تأثرت معنويا صفات الجودة بمواعيد الزراعة، حيث سجلت الزراعة في ١٥ أكتوبر أعلى المتوسطات لصفات الجودة في كلا الموسمين. كما أثرت مواعيد الزراعة معنويا على محصول الجذور والعرش والسكر/فدان وأيضا دليل الحصاد.

٢. أدت الزيادة في مستويات النيتروجين من صفر إلى ٢٠، ٤٠، ٦٠ و ٨٠ كجم/فدان إلى زيادة معنوية في كل مكونات المحصول والمحصول في الموسمين، باستثناء نسبة الجذر/العرش حيث بلغت أقصاها مع إضافة ٤٠ كجم نيتروجين/فدان.

٣. أثر التسميد الحيوي معنويا على صفات المحصول ومعظم مكوناته ، وقد سجلت معاملة البذور بلقاح الريزوباكترين أعلى المتوسطات في هذا الشأن.

٤. كان للتفاعل بين مواعيد الزراعة والتسميد النيتروجيني تأثيرا معنويا على المحصول وجميع مكوناته، ما عدا نسبة الجذر/الساق. كما أثر التفاعل بين مواعيد الزراعة والتسميد الحيوي معنويا على قطر الجذر ووزن العرش عند الحصاد ونسبة نقاوة العصير ومحصول الجذور والعرش والسكر / فدان. كما أثر التفاعل بين مستويات النيتروجين ومعاملات التسميد الحيوي معنويا على جميع صفات المحصول وصفات الجودة.