ISSN 1110-0419

Annals Of Agric. Sc., Moshtohor,
Vol. 44(1): 89-100, (2006).

RESPONSE OF SOME SUGAR BEET VARIETIES TO METHANOL AND METHOD OF NITROGEN FERTILIZER APPLICATIONS

BY

Shafika N.Moustafa
Physiological and Chemical Research, Sugar Crop Institute. Agricultural Research Center, Giza, Cairo

ABSTRACT

Two experiments were conducted at EL-Fayoum Governorate in 2003/2004 and 2004/2005 winter seasons to investigate the response of some sugarbeet varieties to nitrogen fertilizer applications alone or combined with methanol and their interactions. Three levels of methanol [zero (tap water), 15 and 30%] as foliar application. Nitrogen fertilizer was soil and foliar application as follows, control (70 kg/fed top dressing as solid urea) and 70, 90 and 110 kg N/fed (2/3 of each as soil application, and 1/3 as foliar application) with 6% urea. The tested sugarbeet varieties were Del 939, Kawamira and Oscar poly. A split plot design, with three replications, was used in both seasons, where sugarbeet varieties were arranged in the main plots, nitrogen fertilizer applications combined with methanol as foliar application occupied the sub-plots. The obtained results could be summarizing as follows:

- Increasing nitrogen fertilizer applications, combined with methanol as foliar application up to 110 kg N/fed +30% methanol increased photosynthetic pigments (chlorophyll a, b and carotenoids in mg/g.f.w), soluble carbohydrates (reducing and non-reducing sugars in g/100 g.d.w), purity%, extractable sugar%, yields of roots , tops and sugars as well as sucrose content. On the other hand, impurities percentage (Na, K and α-amino N) were decreased. It is worth to mention that nitrogen fertilizer applications, combined with methanol, had a positive effect on all studied traits except for, sodium concentration in beetroots.
- Kawamira variety surpassed the other varieties (Del 939 and Oscar poly) in the content of chlorophyll (a), non-reducing sugars%, purity%, extractable sugar%, yields of roots, tops and sugar (ton/fed) and sucrose content. In addition, Kawamira variety contained lower impurities (Na, K and α-amino N).
- For the interaction between nitrogen fertilizers applications combined with methanol as foliar application and sugarbeet varieties, it was insignificant for all studied traits, except for sugar lost to molasses, extractable sugar and top
- Treating Kawamira variety with nitrogen fertilizer by 90 kg N/fed and 30% methanol was preferable and recommended for increasing yield and content of sucrose and purity by 19.2, 32.6 and 1.89%, respectively, as well as decreasing impurities (Na, K and α-amino N by 21.7, 4.9 and 11.7%, respectively).

INTRODUCTION

Nitrogen is an essential constituent of amino acids, amides, nucleotides and nucleoproteins. In addition, it is essential for cell division and expansion, and hence, growth. Nitrogen deficiency interrupts growth processes and causes stunting, yellowing and reduces dry matter yields. Sugarbeet crop is generally thought to need up to 80-100 kg N/fed to give maximum sugar yields.

An important criterion of beet quality is the harmful nitrogen, which represents the soluble nitrogen of sugar beet that not eliminated during traditional juice purification. So, we adjustment of applied nitrogen should be undertaken in the field by decreasing its source in the final application.

Beek and Huijbregts (1986) showed that increasing nitrogen particularly increased α amino-N content and K+Na. They added that α amino-N was favorable as a quality indicator in relation to nitrogen supply.

Foliar application with urea solution gave higher yields and greater N use efficiency than solid urea (Czuba, 1994 and Witek, 2000). Root sugar content and juice purity in sugar beet were higher with foliar N application, but α amino N content was lower compared with control (top dressing of N) (Jaszczolt, 1998). Also, El-Maghraby *et al* (1998) reported that increasing concentration of N as foliar application on sugar beet plant caused a significant increase in root length, root diameter, root and top weights / plant, root and sugar yields (tons /fed), sucrose% and purity %.

Regarding, the response of sugar beet varieties to foliar N fertilizer application, Podlaska and Artyszak (1995) found that foliar application with N increased root and top yields of Pn Mono 1 variety, compared with the other one (Jamira variety). Jamira did not respond to the method of N application.

Methanol is a source of either fixed carbon or supplemental methyl group for pectin production. Panella *et al* (2000) found that experimentally foliar application of methanol had improved growth and productivity in a number of agricultural crops. In addition, Zbiec *et al* (1999 and 2003) and recently, Abd El-Magid *et al*, (2004) showed that sugar beet plant treated with methanol lead to increase photosynthesis and yields of roots and sugar.

Many investigators noticed that plants given many applications of aqueous methanol, showed symptoms of nutrient deficiency and supplementation with a source of N sustained growth and eliminated symptoms of deficiency. They added that, methanol was not toxic at certain concentrations. In this respect, Nonomura and Benson (1992) found that treated sugar beet with nutrient supplemented methanol showed up to 100 % increase in yields. Deka *et al* (1996) noticed that plants, receiving methanol alone, showed N deficiency symptoms, but these symptoms were reversed by urea spray and gave the highest plant dry weigh.

For the effect of foliar application with nitrogen and methanol on sugar beet varieties Panella *et al* (2000) showed that significant difference, for root and sugar yields or sucrose content, occurred among Monohikari, Beta 2398 and Fc709-2 varieties.

This work aims to clarify the response of some sugar beet varieties to methods of nitrogen fertilizer application in combination with aqueous methanol. Moreover, the effect of these treatments on the activity, as well as juice quality and root, top and sugar yields of sugar beet plant.

MATERIALS AND METHODS

Two field experiments were conducted at El - Fayoum Governorate in 2003/2004 and 2004/2005 winter seasons to study the response of some sugar beet varieties to methanol and method of nitrogen fertilizer applications as well as their interactions. Soil samples were taken before sowing and were prepared for the determination of mechanical and chemical soil properties according to Page (1982) and Jackson (1973). The obtained results showed that soil particle size distribution was sand (87.5 and 86.6%), silt (4.90 and 5.10%) and clay (7.6 and 8.3%), and available nitrogen (9.1 and 10.4 ppm), respectively, in the two seasons.

Multigerm sugar beet varieties [Del 939 (v1), Kawamira (v2) and Oscar Poly (v3)] were planted on October 18^{th} and 22^{nd} in 2003/2004 and 2004/2005 wi nter seasons, respectively. The experimental design was split plot with three replicates, was used in both seasons. The three sugar beet varieties were allocated in the main plots and the sub-plots were occupied with the control (top dressing of 70 kg N/fed as urea, 46%). Three rates of nitrogen application (70, 90 or 110 kg N/fed); named as N_{70}, N_{90} or N_{110} (2/3 the rate of N as soil application + 1/3 the rate of N as foliar application with 6% urea solution) and three levels of methanol as foliar application (0, 15% or 30%) named as Me_0, Me_{15} or Me_{30} Methanol plus urea were foliarly applied seven times at weekly intervals throughout the growing season, starting after 45 days from sowing. Phosphorus fertilizer was applied at 30 kg P_2O_5/fed as calcium super phosphate (15.5 % P_2O_5) and potassium fertilizer at 24 kg K_2O/fed as potassium sulfate (48 % K_2O) were added at recommended times during soil preparation and before sowing, respectively. The normal practices of sugar beet cultivation were maintained at level to assure optimum production. The plants were harvested after 210 days from sowing date. Three plants were randomly taken from each plot to determine the following traits;

1- Contents of photosynthetic pigments (chlorophyll a, b and carotenoids) in beet leaves (mg/g.f.w) were determined, according to the method of Wettstein (1957).
2- Soluble carbohydrates fraction: reducing and non-reducing sugars (gm/100g.d.w.). The technique used for determination of soluble carbohydrates fractions was estimated according to Shaffer and Hartmann (1921) and modified by Said (1941 and 1945).
3- Root quality; i.e., sucrose (% pol), impurities (Na, K and α amino N mg/100g. beet) and purity% (Devillers, 1988) also, some technological parameters i.e., sugar lost in molass (SLM) (Devillers, 1988), extractable sugar(%) (Ex) (Dexter *et al*, 1967) and alkalinity coefficient (AC) were determined using an Automatic French System (Hycel).
4- Root, top and sugar yields (tons/fed). Data were statistically analyzed, according to Snedecor and Cochran (1981), and treatment means were compared by using the LSD test at 0.05 level of probability.

RESULTS AND DISCUSSION

1-Leaves photosynthetic pigments content:

Data presented in Table (1) showed the effect of nitrogen fertilizer application, combined with methanol as foliar spray, on the content of photosynthetic pigments (chlorophyll a and b and carotenoids) in leaves of sugarbeet plants.

As for the effect of nitrogen fertilizer applications combined with methanol, data clarified that the concentrations of leaf pigments significantly increased with increasing nitrogen rate up to 110 kg N/fed and this effect was increased by foliar spraying with 30% methanol. This result may be due to the utilization of methanol as a source of carbon. The availability of carbon in vicinity of leaf enhanced the photosynthesis rate; Nonomura and Benson (1992). Abd El-Magid *et al* (2004) obtained similar results.

Table (1): Effect of foliar application with nitrogen and methanol on photosynthetic pigments (mg/g.f.w) in leaves of some sugar beet varieties (combined over 2003/2004 and 2004/2005 seasons).

Treatment	Chlorophyll a			Mean	Chlorophyll b			Mean	Carotenoids			Mean
	V_1	V_2	V_3		V_1	V_2	V_3		V_1	V_2	V_3	
Control	4.40	4.93	4.63	**4.65**	2.43	2.23	2.00	**2.22**	1.23	1.17	1.20	**1.20**
N_{70}+Me_0	4.87	5.33	5.13	**5.11**	2.60	2.37	2.13	**2.37**	1.33	1.28	1.14	**1.25**
N_{70}+Me_{15}	5.07	5.53	5.30	**5.30**	2.77	2.53	2.30	**2.53**	1.38	1.31	1.29	**1.33**
N_{70}+Me_{30}	5.23	5.67	5.47	**5.46**	2.87	2.63	2.40	**2.63**	1.41	1.39	1.33	**1.38**
N_{90}+Me_0	5.43	5.90	5.63	**5.65**	3.07	2.80	2.57	**2.81**	1.48	1.42	1.36	**1.42**
N_{90}+Me_{15}	5.63	6.10	5.87	**5.87**	3.20	3.00	2.73	**2.98**	1.54	1.49	1.42	**1.48**
N_{90}+Me_{30}	5.87	6.33	6.07	**6.09**	3.40	3.13	2.93	**3.15**	1.60	1.55	1.47	**1.54**
N_{110}+ Me_0	5.50	6.03	5.77	**5.77**	3.30	3.03	2.80	**3.04**	1.52	1.48	1.42	**1.47**
N_{110}+Me_{15}	5.60	6.13	5.87	**5.87**	3.40	3.13	2.87	**3.13**	1.55	1.51	1.49	**1.52**
N_{110}+Me_{30}	5.70	6.23	5.93	**5.95**	3.50	3.23	2.97	**3.23**	1.61	1.56	1.52	**1.56**
Mean	5.33	5.82	5.57	-	3.05	2.81	2.57	-	1.47	1.42	1.36	-
L.S.D at 0.05 V (A)				**0.21**				**0.23**				**0.01**
N+Me (B)				**0.11**				**0.25**				**0.13**
(AxB)				**N.S**				**N.S**				**N.S**

V_1 Del 939 V_2 Kawamera V_3 Oscar poly

Concerning the effect of sugarbeet varieties on chlorophyll a, b and carotenoids concentration, it could be notice from data in Table (1) that varieties of sugarbeet, under this investigation significant by differed in their concentrations of photosynthetic pigments. In addition, Kawamira variety responded better than the two other varieties (Del 939 and Oscar poly) for all studied treatments which gave higher contents of chlorophyll a.

The interaction effect was insignificant between nitrogen fertilizer applications combined with methanol as foliar application and studied sugarbeet varieties, for all photosynthetic pigments. It is worthy to mention that nitrogen fertilizer application at 90 kg N/fed, combined with 30% methanol gave higher content of chlorophyll (a) for Kawamira variety, while treating sugarbeet with nitrogen fertilizer application at 90 kg N/fed and 30% methanol, gave a higher content of chlorophyll (b) and carotenoids in Del 939 variety.

2-Root soluble carbohydrates fraction:

Reducing sugar level in roots is only a guide to juice colors and it is the primary cause of increased lime salts, causing evaporator scaling and necessitating a very high usage of sodium carbonate in the factories to maintain the juice at a ph value $\geq$ 7.0 (Oldfield *et al*, 1971).

Data of sugarbeet roots soluble carbohydrates fraction; i.e., reducing and non-reducing sugars revealed that increasing nitrogen fertilizer application in combination with methanol significantly increased the total soluble sugars, reducing and non- reducing sugars Table 2). The increase in biomass synthesis was due to enhanced carbon dioxide assimilation and transpiration (Zbiec *et al*, 2003). The higher concentration recorded 84.30, 6.60 and 78.84 for total soluble sugars, reducing and non-reducing sugars in beet roots when sugarbeet plants were treated with 90 kg N/fed+30% methanol, 110 kg N/fed+30% methanol and 90 kg N/fed+30% methanol, respectively. This result agrees with those reported by Witek (2000).

Data in Table (2) indicated that varieties significantly differed in their contents of soluble carbohydrates in beet roots. Kawamira variety (v_2) recorded the maximum value of total soluble sugars (83.95) and non-reducing sugars (78.32). Oscar poly variety (v_3) ranked the second, followed by Del 939 variety. Del 939 variety gave the highest value for reducing sugar (5.64) followed by Oscar poly and Kawamira varieties.

Regarding the interaction effect between nitrogen fertilizer applications, combined with methanol as foliar application and the studied sugarbeet varieties, data in Table (2) showed insignificant increase for total soluble sugars, reducing and non- reducing sugars. Where, nitrogen fertilizer applications at 90 kg N/fed, combined with 30% methanol, gave the highest content of total soluble sugars (87.05) and non-reducing sugars (80.83) for Kawamira variety, while Del 939 variety gave the highest reducing sugars (7.03) when using nitrogen fertilizer applications at 110 kg N/fed, combined with 30% methanol as foliar application.

Table (2): Effect of foliar application with nitrogen and methanol on soluble carbohydrates fraction (g/100g.d.w) in roots of some sugar beet varieties (combined over 2003/2004 and 2004/2005 seasons).

Treatment	Total soluble sugars			Mean	Reducing sugars			Mean	Non-reducing sugars			Mean
	V_1	V_2	V_3		V_1	V_2	V_3		V_1	V_2	V_3	
Control	75.72	78.91	76.83	77.15	3.81	3.11	3.31	3.41	72.64	75.12	73.52	73.76
N_{70}+Me_0	76.61	80.63	78.34	78.53	4.39	4.09	4.19	4.22	72.56	76.22	74.01	74.26
N_{70}+Me_{15}	77.83	82.10	79.04	79.67	4.82	4.22	4.52	4.52	73.61	77.28	74.54	75.14
N_{70}+Me_{30}	78.94	83.33	80.42	80.90	5.23	4.53	4.63	4.80	74.48	78.19	75.86	76.18
N_{90}+Me_0	80.46	85.57	81.17	82.40	5.69	5.09	5.29	5.36	75.36	79.83	75.82	77.00
N_{90}+Me_{15}	81.34	86.40	82.73	83.49	5.72	5.22	5.62	5.52	76.15	80.71	77.11	77.99
N_{90}+Me_{30}	82.51	87.05	83.34	84.30	6.23	5.43	5.93	5.86	77.13	80.83	77.48	78.48
N_{110}+Me_0	78.82	82.84	81.34	81.00	6.59	5.59	6.19	6.12	73.25	76.21	75.15	74.87
N_{110}+Me_{15}	80.53	85.81	82.04	82.79	6.92	5.82	6.42	6.39	74.76	78.95	75.62	76.44
N_{110}+Me_{30}	80.82	86.82	82.56	83.40	7.03	5.93	6.85	6.60	74.93	79.83	75.74	76.83
Mean	79.36	83.95	80.78	-	5.64	4.90	5.30	-	74.49	78.32	75.49	-
L.S.D at 0.05 V (A)				1.48				0.57				1.52
N+Me (B)				0.82				0.31				1.51
(AxB)				N.S				N.S				N.S

V_1 Del 939 V_2 Kawamera V_3 Oscar poly

3-Juice quality:

Beet quality is not a single character, which can be presented in a quantitive form by using a single numeric value. In fact, it is a combination of the entire chemical and all aspects of the beet root which influences processing or affects the yield of sugar or its byproducts (Oldfield, 1974).

Data reported in Table (3) revealed that nitrogen fertilizer application, combined with methanol as foliar application, had a significant effect on purity percentage and the two impurities potassium and α amino N percentage but an insignificant effect on sodium percentage. These effects were increased by increasing the rate of treatments up to 110 kg N/fed, combined with 30% methanol. The treatment of nitrogen fertilizer application at 90 kg N/fed combined with 30 %methanol surpassed all treatments in juice purity percentage. The obtained results indicated that the increase in the percentage of purity for plants fertilized by nitrogen fertilizer application at 90 kg N/fed, combined with 30% methanol over those fertilized with 70 kg N/fed, as a top dressing with solid urea (control) reached 1.89%. This reflects an increasing concentration of amino compounds, caused by excessive uptake of nitrogen as solid urea. It could be concluded that the best treatment, giving higher purity and lower impurities, especially α-amino N was using nitrogen fertilizer applications at 90 kg N/fed, combined with 30% methanol.

The change in impurities (potassium and α amino N percentage) due to varieties were not reached the 5% level of significance, while purity percentage was significant, except for Kawamira variety which gave higher value in juice purity but lower value in all impurities percentage, except for Na over the other both varieties. Kerr and McCullagh (1989) found marked reductions in the level of the major non-sugars and particularly amino nitrogen, in British varieties.

The response of juice quality traits to the interactions between varieties and fertilizer treatments were insignificant for purity and impurities percentages (Table, 3). From previous data, it could be concluded that the promising treatment for increasing purity and reducing impurities (potassium, sodium and α amino N %) was using Kawamira variety, treated with nitrogen fertilizer application at 90 kg N/fed, combined with 30% methanol.

4-Some technological parameters:

Data in Table (4) showed that treatment sugarbeet plants with nitrogen fertilizer applications, combined with methanol as foliar application significantly affected all technological parameters; i.e., sugar lost to molass (SLM), extractable sugar (ExS) and alkalinity coefficient (AC). Sugar lost to molass significantly decreased with increasing the rate of nitrogen fertilizer application and the level of methanol this may be due to the decrease in the level of juice impurities. Also, it was noticed that theextractable sugar (mg/ 100 g. beet) was increased by all treatments under study comparing with control (top dressing with solid urea). This was attributed to the increase of sucrose content in juice beet by the same treatments.

Table (3): Effect of foliar application with nitrogen and methanol on purity (%) and impurities (mg/100g. beet) of some sugar beet varieties (combined over 2003/2004 and 2004/2005 seasons).

Treatment	Purity %			Mean	Impurities (mg/100g. beet)											
					K			Mean	Na			Mean	α-amino nitrogen			Mean
	V_1	V_2	V_3		V_1	V_2	V_3		V_1	V_2	V_3		V_1	V_2	V_3	
Control	91.16	91.80	91.79	**91.58**	4.81	4.41	4.83	**4.68**	2.03	2.15	2.04	**2.07**	1.62	1.51	1.73	**1.62**
$N_{70}+Me_0$	91.66	92.43	92.24	**92.11**	4.67	4.34	4.71	**4.57**	1.90	2.03	1.96	**1.96**	1.60	1.47	1.68	**1.58**
$N_{70}+Me_{15}$	91.66	93.01	92.78	**92.73**	4.51	4.22	4.56	**4.43**	1.77	1.85	1.85	**1.82**	1.55	1.41	1.71	**1.56**
$N_{70}+Me_{30}$	92.39	93.06	93.06	**92.84**	4.57	4.24	4.59	**4.47**	1.80	1.88	1.87	**1.85**	1.59	1.40	1.69	**1.56**
$N_{90}+Me_0$	92.17	92.71	92.78	**92.55**	4.63	4.31	4.67	**4.53**	1.78	1.82	1.80	**1.80**	1.58	1.39	1.71	**1.56**
$N_{90}+Me_{15}$	92.76	93.34	93.42	**93.17**	4.66	4.39	4.73	**4.59**	1.80	1.85	1.81	**1.82**	1.59	1.41	1.58	**1.53**
$N_{90}+Me_{30}$	92.90	93.45	93.57	**93.31**	4.54	4.23	4.57	**4.45**	1.60	1.61	1.65	**1.62**	1.43	1.33	1.52	**1.43**
$N_{110}+Me_0$	91.95	92.64	92.59	**92.39**	4.77	4.55	4.84	**4.72**	1.94	2.02	1.96	**1.97**	1.70	1.47	1.68	**1.62**
$N_{110}+Me_{15}$	92.53	93.19	92.94	**92.99**	4.68	4.41	4.70	**4.59**	1.76	1.79	1.84	**1.79**	1.51	1.38	1.56	**1.48**
$N_{110}+Me_{30}$	93.03	93.32	93.17	**93.18**	4.65	4.34	4.68	**4.56**	1.77	1.78	1.81	**1.78**	1.49	1.38	1.56	**1.48**
Mean	**92.30**	**92.90**	**92.83**	-	**4.65**	**4.34**	**4.69**	-	**1.81**	**1.88**	**1.86**	-	**1.56**	**1.41**	**1.63**	
L.S.D at 0.05 V (A)				0.24				N.S				N.S				N.S
N+Me (B)				0.32				0.16				N.S				0.19
(AxB)				N.S				N.S				N.S				N.S

V_1 Del 93 **V_2 Kawamera** **V_3 Oscar poly**

Table (4): Effect of foliar application with nitrogen and methanol on some technological parameters (mg/100g.beet) in root of some sugar beet varieties (combined over 2003/2004 and 2004/2005 seasons).

Treatment	Sugar lost to molass (SLM)			Mean	Extractable Sugar (ExS)			Mean	Alkalinity coefficient (AC)			Mean
	V_1	V_2	V_3		V_1	V_2	V_3		V_1	V_2	V3	
Control	1.86	1.78	1.91	**1.85**	13.46	15.14	13.82	**14.14**	4.22	4.03	4.27	**4.18**
N_{70}+Me_0	1.82	1.75	1.86	**1.81**	13.93	16.07	14.42	**14.81**	4.11	4.01	4.27	**4.13**
N_{70}+Me_{15}	1.77	1.70	1.82	**1.76**	14.86	17.04	15.12	**15.67**	4.05	3.75	4.29	**4.04**
N_{70}+Me_{30}	1.79	1.71	1.83	**1.77**	15.16	17.24	15.89	**16.10**	4.01	3.83	4.30	**4.07**
N_{90}+Me_0	1.79	1.70	1.84	**1.78**	14.67	16.36	15.17	**15.40**	4.06	3.80	4.40	**4.08**
N_{90}+Me_{15}	1.72	1.66	1.75	**1.71**	15.59	17.45	16.72	**16.59**	4.29	4.07	4.42	**4.26**
N_{90}+Me_{30}	1.80	1.72	1.82	**1.78**	16.20	18.11	17.17	**17.16**	4.06	4.16	4.40	**4.21**
N_{110}+Me_0	1.86	1.79	1.88	**1.84**	14.94	16.85	15.64	**15.81**	3.95	4.08	4.43	**4.15**
N_{110}+Me_{15}	1.78	1.72	1.80	**1.77**	15.44	17.42	15.84	**16.23**	4.26	4.16	4.53	**4.32**
N_{110}+Me_{30}	1.77	1.71	1.79	**1.76**	16.67	17.77	16.26	**19.9**	4.31	4.14	4.46	**4.30**
Mean	**1.80**	**1.72**	**1.83**	-	**15.09**	**16.95**	**15.61**	-	**4.13**	**4.00**	**4.39**	-
L.S.D at 0.05 V (A)				**0.01**				**0.02**				**0.21**
N+Me (B)				**0.01**				**0.01**				**0.13**
(AxB)				**0.02**				**0.02**				**N.S**

V_1 Del 939 V_2 Kawamera V_3 Oscar poly

Three sugarbeet varieties under this investigation significantly varied for sugar lost to molasses, extractable sugar and alkalinity coefficient, in response to nitrogen fertilizer applications combined with methanol as foliar application. Also, it was observed from data in Table (4) that Kawamira variety gave a lower value for sugar lost to molasses(1.72) and alkalinity coefficient (4.00), but a higher value for extractable sugar content (16.95) compared with the two other varieties (Del 939 and Oscar poly).

The interaction effect between nitrogen fertilizer applications, combined with methanol as foliar application and sugarbeet varieties, significantly affected the sugar lost to molasses and extractable sugar, but it was insignificant for alkalinity coefficient. So, it was suggested to use Kawamira variety and nitrogen fertilizer application at 90 kg N/fed. combined with 30% methanol, to increase the extractable sugar and reduce sugar lost to molasses and alkalinity coefficient.

5-Yield components and sucrose content in sugarbeet plant:

Data in Table (5) showed that root, top and sugar yields (ton/fed), as well as sucrose content, in beet roots were significantly affected by nitrogen fertilizer application, combined with methanol as foliar application. The treatments of 110 kg N/fed + 30% methanol and 90 kg N/fed + 30% methanol significantly surpassed all the treatments for roots, tops and sugar yields and sucrose content, respectively. Lower values were obtained by top dressing with solid urea for such criteria. Czuba (1994) and Witek (2000) obtained similar results.

Sugarbeet varieties significantly varied concerning root and top yields (tons/fed), as well as sucrose percentage (Table, 5). Maximum values were produced for the previous characters were obtained by Kawamira variety, and minimum values were produced by Del 939 variety.

Table (5): Effect of foliar application with nitrogen and methanol on yields (ton/fed) and sucrose (%) of some sugar beet varieties (combined over 2003/2004 and 2004/2005 seasons).

Treatment	Root yield			Mean	Top yield			Mean	Sugar yield			Mean	Sucrose%			Mean
	V_1	V_2	V_3		V_1	V_2	V_3		V_1	V_2	V_3		V_1	V_2	V_3	
Control	24.38	26.30	25.55	**25.41**	6.93	7.96	7.45	**7.45**	3.53	4.33	3.83	**3.90**	14.72	16.45	15.00	**15.39**
N_{70}+Me_0	25.06	27.28	26.08	**26.14**	7.77	8.35	7.89	**8.00**	3.80	4.73	4.06	**4.20**	15.15	17.33	15.57	**16.02**
N_{70}+Me_{15}	25.23	28.20	27.08	**26.84**	8.14	8.70	8.17	**8.34**	4.04	5.15	4.39	**4.53**	16.03	18.26	16.22	**16.84**
N_{70}+Me_{30}	26.07	28.48	27.45	**27.33**	8.63	9.10	8.94	**8.89**	4.26	5.25	4.67	**4.73**	16.35	18.47	17.00	**17.27**
N_{90}+Me_0	25.50	27.84	27.25	**26.86**	7.93	8.77	8.32	**8.34**	4.04	4.90	4.43	**4.46**	15.86	17.60	16.27	**16.58**
N_{90}+Me_{15}	26.70	28.20	27.60	**27.50**	8.59	9.47	8.92	**8.99**	4.46	5.25	4.91	**4.87**	16.71	18.60	17.78	**17.70**
N_{90}+Me_{30}	27.33	28.90	28.27	**28.17**	9.18	10.12	9.67	**9.66**	4.76	5.59	5.17	**5.17**	17.40	19.33	18.29	**18.34**
N_{110}+Me_0	26.25	28.06	27.90	**27.40**	8.40	9.38	9.09	**8.95**	4.25	5.09	4.70	**4.68**	16.20	18.13	16.83	**17.05**
N_{110}+Me_{15}	26.60	28.58	28.33	**27.84**	9.07	10.12	9.87	**9.69**	4.42	5.32	4.80	**4.85**	16.62	18.62	16.96	**17.40**
N_{110}+Me_{30}	27.05	29.18	28.90	**28.38**	9.74	10.81	10.51	**10.35**	4.83	5.43	5.02	**5.09**	17.84	18.96	17.37	**18.06**
Mean	**26.02**	**28.10**	**27.44**	-	**8.44**	**9.28**	**8.88**	-	**4.24**	**5.10**	**4.60**	-	**16.29**	**18.18**	**16.73**	-
L.S.D at 0.05 (A)				**0.54**				**0.61**				**0.18**				**0.82**
N+Me (B)				**0.29**				**0.01**				**0.10**				**0.14**
(AxB)				**N.S**				**0.024**				**N.S**				**N.S**

V_1 Dei 939 **V_2 Kawamera** **V_3 Oscar poly**

Concerning the interaction effect between nitrogen fertilizer applications, combined with methanol and sugarbeet varieties, there was a significant effect only for top yield. However, it was insignificant for root and sugar yields and sucrose%. Maximum root and top yields were obtained when using nitrogen fertilizer applications at 110 kg N/fed, combined with 30 % methanol as foliar application. Maximum sugar yield and sucrose content were obtained when using and nitrogen fertilizer applications at 90 kg N/fed, combined with 30 % methanol as foliar application (Table 5). Similar results were obtained by Panella *et al* (2000).

It could be concluded that the promising treatment for increasing sugar was treating Kawamira sugarbeet variety with nitrogen fertilizer application at 90 kg N/fed, combined with 30 % methanol as foliar application.

REFERENCES

Abd El-Magid, A.A.; Abou El-Magd, B.M., and Abou El-Fotoh, H.G., (2004): Using some organic compounds for improving sugar beet productivity. J. Agric. Sci. 29 (3) : 1551-1561 Mansoura Univ.

Beek, M.A.-Van-Der and Huijbregts, A.W.M. (1986): Internal quality aspects of sugar beet. Proceedings, -Fertilizer-Society, No. 252, 22pp..

Czuba, R. (1994):The results of foliar nutrition of field crops. 1-Response of plants to foliar nitrogen application Roczniki-Gleboznawcze.45: 3-4, 69-78.

Deka, A.; Deka, P. and Bhuyan, R.P. (1996): Foliar application of methanol on young tea plants as fertilizing material .J.of the Agricultural Science Society of North East India 9:1, 82-83.

Devillers, P. (1988): Previous du sucre melasse sucrerie franases 190-200.(C.F. The Sugar Beet Crop. Book).

Dexter, S.T.; Frankes, M.G. and Snyder, F.W. (1967): A rapid and practical method of determining extractable white sugar as may be applied to the evaluation of agronomic practices and grower deliveries in the sugar beet industry. J. Am. Soc., Sugar Beet Technol. 14: 433-454.

El-Maghraby. S.S.; Sam, M.M.S. and Tawfik, Y.H. (1998): Effect of soil and foliar application of nitrogen and potassium on sugar beet.Egyp.J.of Agric.Res. 76: 2, 665-678 .

Jackson, M.L. (1973): Soil Chemical Analysis. Prectice-Hall, Inc. Engl.Wood Diffuse, N.S .

Jaszczolt, E. (1998):Comparison of two methods of applying nitrogen fertilizer to sugarbeet. Gazeta-Cukrownicza 106:33-34.

Kerr, S. and McCullagh, S. (1989): Report on the 1988 N. T. B. variety trials. British Sugar Beet Review 57 (2): 11-15.

Nonomura, A.M. and Benson, A.A. (1992): The path of carbon in photosynthesis improved crop yields with methanol. Proceedings of the National Academy of Science-of the United States of America 89: 20, 9794-9798.

Oldfield, J.F.T.; Dutton, J.V. and Teague, H.J. (1971): The significance of invert and gum formation in deteriorated beet. International Sugar Journal 73: 3-8, 35-40 and 66-8.

Oldfield, J.F.T. (1974): Quality requirements for economic processing in the factory. In Proceeding of the 37th Winter Congress of the International Institute for Sugarbeet Research, Session II, Report Mo. 2:2 pp.

Page, A.L. (1982): Methods of soil analysis. Part 2. Soil Sci.. Amer. Inc. Publi. Madison, Wisconsin, U.S.A.

Panella, L.; Nishio, J.N., and Martin.. S.S. (2000): Influence of methanol on sugarbeet yield and photosynthesis. J of Sugarbeet Research 37: 2, 55-72.

Podlaska, J. and Artyszak, A. (1995): Response of sugarbeet varieties to the soil and foliar nitrogen fertilization. Annals of Warsaw Agricultural University Vol. No. 29: 59-65.

Said, H. (1941): Research on plant metabolism.1.Respiration and sugar absorption by storage organs in relation to time and thickness of tissue slices. Cairo Univ. Fac. of Sci. Bull: 24:31

Said, H. (1945): The effect of various sugars on the metabolism of carrot discs with a carbon balance sheet. Cairo Univ. Fac. of Sci. Bull: 25:117.

Shaffer, P.A. and Hartmann, A.F. (1921): The iodometric determination of copper and its use in sugar analysis. J.Bio. Chem.: 45:365

Snedecor, G.W. and Cochran, W.G. (1981): Statistical Methods 6th ed-Iowa State Univ. Press. Amers. Iowa. U. S. A.

Wettestein, D.(1957): Chlorophyll, L, Lted und der submikro Svoplsche Formmech Sallder-Plastiden Expti Cell.Rec.12, 427-433.

Witek, A. (2000): Foliar application of nitrogen to sugarbeet.Gazeta- Cukrownicza, 108: 6, 114-116.

Zbiec, I. ; Karczmarcyk, S., and Koszanski, Z. (1999): Influence of methanol on some cultivated plants.Folia Univeasitants Agriculturae Stetinensis No.7: 217-220.

Zbiec, I. ; Karczmarcyk, S., and Podsiadlo, C. (2003): Response of some cultivated plants to methanol as compared to supplemental irrigation. Agricultural University Szczecin Sloackiego 17, 71-434 Szczecin, Poland.

استجابة بعض أصناف بنجر السكر للميثانول وطرق استعمال التسميد النيتروجينى

شفيقه نصر مصطفى

قسم الفسيولوجى والكيمياء – معهد بحوث المحاصيل السكريه – مركز البحوث الزراعيه – الجيزه

أقيمت تجربتان حقليتان بمحافظة الفيوم فى موسمى شتاء ٢٠٠٣/٢٠٠٤ و٢٠٠٤/٢٠٠٥ لدراسة إستجابة بعض أصناف بنجر السكر للميثانول وطرق إستعمال التسميد النيتروجينى والتفاعلات بينهما .حيث تم رش الميثانول بثلاثة تركيزات [صفر (ماء) ، ١٥%، ٣٠ %) وثلاثة مستويات من السماد النيتروجيني وهى ٧٠ ، ٩٠ ، ١١٠ كج ن/فدان بالاضافه الى المقارنه (٧٠ كج ن/فدان اضافه أرضيه). تمت اضافة السماد النيتروجينى بنسبة ٢/٣ الكميه اضافة ارضية + ١/٣ الكميه رشا ورقيا بتركيز ٦% يوريا للمستويات السابقة. أستخدمت ثلاثة أصناف من بنجرالسكر وهى: ديل ٩٣٩ ، كاواميرا ، اوسكار بولى. كان التصميم المستخدم قطعا منشقة مرة واحدة فى ثلاث مكررات حيث وضعت لأاصناف فى القطع الرئيسيه ووزعت معاملات التسميد عشوائيا فى القطع الشقيه. وكانت أهم النتائج المتحصل عليها كما يلى:

- أدت زيادة معدلات التسميد النيتروجينى+ الرش بالميثانول حتى ١١٠كج ن/فدان + ٣٠ % ميثانول إلى زيادة الصبغات الضوئية (كلوروفيل أ وب والكاروتينويدات) مللجم/جم·وزن طازج والكربوهيدرات الذائبة (%) (السكريات المختزلة وغير مختزلة) والنقاوه والسكر المستخلص (%) وأيضا ناتج الجذور والعرش والسكر بالاضافه إلى محتوى السكر.كما إنخفضت النسبه المؤيه للشوائب (الصوديوم والبوتاسيوم والأحماض الأمينيه النتروحينيه) ومعامل القلويه· ويجدر الإشارة إلى أن إستعمال التسميد النيتروجينى مع الميثانول كان له تأثير إيجابى على كل الصفات السابقه فيما عدا تركيز الصوديوم فى عصير البنجر·
- تفوق الصنف "كاواميرا" على الصنفين الاخرين (ديل ٩٣٩ وأوسكار بولى) بالنسبة لمحتوى الاوراق من كلوروفيل (أ) والسكريات غير المختزلة والنقاوة والسكر المستخلص والسكروز وناتج الجذور، العرش ، السكر (طن/فدان). أحتوى أيضا نفس الصنف على أقل تركيز من الشوائب (الصوديوم والبوتاسيوم والأحماض الأمينيه النتروحينيه).
- وبالنسبة للتفاعلات بين التسميد النيتروجيني مع الرش الورقى بالميثانول وأصناف بنجر السكر، وجد أن تأثيرها سلبي على كل الصفات المدروسة ، فيما عدا السكر المفقود فى المولاس والسكر المستخلص وناتج العرش.

ومن الدراسة يمكن التوصية بإستخدام الصنف "كاواميرا" والتسميد بمعدل ٩٠ كج ن/فدان (٣/٢ تسميد أرضى و٣/١ رش ورقى) مع الرش الورقى بتركيز ٣٠% ميثانول للحصول على أعلى إنتاجية من السكر ومحتوى السكروز والنقاوة بنسب ١٩,٢ و٣٢,٦ و١,٨٩%على التوالى. بالاضافه إلى تقليل الشوائب (الصوديوم والبوتاسيوم والأحماض الأمينيه النتروحينيه) بنسب ٢١,٧ و٤,٩ و١١,٧% على التوالى.