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EFFECT OF NITROGEN FERTILIZATION ON YEILD AND QUALITY OF SOME SUGAR CANE VARIETIES UNDER DEVOLPED SURFACE IRRIGATION SYSTEM

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Abstract

Two field trials were carried out at El-Mattana Research Station, Qena Governorate,Upper Egypt in 1998/2000 and 1999/2002 seasons to study the effect of three sugar cane varieties (G.85/37, G.84/47 and G.T54/9). and 3 N-levels (120, 160 and 200 kg N/fed) on cane yield and quality under surface developed irrigation system.The obtained results showed that the tested varieties differed significantly in stalk length, in the 1st and 2nd seasons and, cane yield significantly by the used varietues in the 2nd season only. Sugar yield, sugar recovery% and purity% were not affected by the tested varities.There was a significant and gradual increase in stalk length and cane yield as N doses were increased up to 200 kg N/fed. For both seasons.Sugar recovery % and purity % were statistically and negatively affected by increasing N level in the1st and 2nd seasons.

INTRODUCTION

The new developed surface irrigation system widely introduced in Egypt on a large scale since 1984. Also water plays an important role in building up plant parts and photochemical processes of plants. Water is the carrier of soil solutes from soil to growing plant tissues through roots and translocates mineral nutrients and sugar within the plant. It is also essential for digestion of starch to sugar as mentioned by (Dillewijn 1952), 5 percent of water is reagent for hydrolytic process utilized for the physiochemical functions of which less than one percent of the absorbed water is utilized chemically in photosynthesis.

Nitrogen is considered one of the most important elements which has a direct effect on plant growth, yield and juice quality.Abd El-Gawad *et al.* (1992-a) mentioned that application of nitrogen fertilizer up to 240 kg N/fed resulted in a significant increase in stalk length. They added that application of 180 kg N/fed was enough to attain the highest values of stalk diameter. Abd El-Gawad *et al.* (1992-b) obtained a neg-

ative response of sugar cane recovery and juice purity percentages due to the increase in N doses up to 240 kg N/fed. Abd El-Hadi *et al.* (1994) found that application of nitrogen fertilizer at rate of (150, 175 and 200 Kg/fed) gave a significant increase in sugar yield. Azzazy (1995) revealed that application of nitrogen fertilizer up to 150, 180 and 210 kg N/fed increased stalk, length, cane and sugar yield in both seasons, but decreased sugar recovery and purity percentages. He stated that sugar cane variety G.T.54-9 surpassed the other two varieties (F.153 and G.74-96) in stalk height and diameter. Dey and Davis (1997) found that application of fertilizer N at maximum rates of 106 and 150kg N/ha increased cane yields 38% and 33% in the plant and ratoon crops respectively. Rahman *et al* (1997) cleared that sugar cane plant was given 0, 150, 300 or 450 kg N/ha. Sugar yield was highest with 450 kg. Juice quality (brix, pol, purity and sugar content) was not affected by nitrogen fertilizer. Azzazy and Dorgham (2000) mantioned that sugar cane variety G.85-37 attained a superiority in plant height, cane and sugar yields over G.84-47 variety. Azzazy *et al* (2000) found that sugarcane variety G.T.54-9 attained a significant superiority in stalk height , stalk diameter cane yield and sugar yields over F.153 and G.74-96 varieties. Sugar recovery and purity percentages were not affected by the tested varieties. also they stated that there was a significant and gradual increase in stalk height, stalk diameter cane and sugar yields as N levels were increased up to 241.5 kg N/fed. for both ratoons. Sugar recovery % and purity % were statistically and negatively affected by increasing N level in the 2nd ratoon only. Singh *et al* (2000) found that variety CoSe 93232 had the highest cane yield (73.37 t/ha) and commercial cane sugar (8.75 t/ha), followed by CoSe 92423 (71.29 and 8.48 t/ha) and CoS 91269 (70.75 and 8.26 t/ha), respectively.

The present work was conducted to find out the relation of nitrogen application on qulitative and quantitive parameters of some sugar cane varities (through the new devolped surface irrigation system).

MATERIALS AND METHODS

Two field trials were carried out at El-Mattana Research Station, Qena Governorate, Upper Egypt in 1998/2000 and 1999/2002 seasons to study the effect of three sugar cane varieties (G.85/37,G.84/47 and G.T54/9). and 3 N-levels (120, 160 and 200 kg N/fed) on cane yield and quality under surface developed irrigation system. A

split-plot design in four replications was used, sugar cane varieties were allocated in the main plot and nitrogen fertiliezrs levels were distrbuted in sub-plot. Plot area was 56 m^2, including 8 rows of 100 cm width and 7 m length. Sugar cane varieties were cultivated at the first week of October 1998 in autume planting. and harvested in Feb. 2000 in the first season and cultivated in the same date of 1999 and harvested in Feb. 2002. Phosphorus was applied as calcium super phosphate (15% P_2O_5) during land preparation at rate of 30 kg P_2O_5/fed. Nitrogen was applied as Urea (46% N) in two equle doses, the first dose was added after 45 days from planting and the 2^{nd} dose was applied one month later. Potassium fertilizer was added as potassium sulphate (48% K_2O) at rate of 24 kg K_2O/fed with the first dose of nitrogen fertilizer.

The developed surface irrigation used in this investigation is a new technique to transmit irrigation water, by means of a pump, from the main source (open canal) to the field though Poly-Vinyl-Chloride (P.V.C) pipe line located at 1 m depth which rises again to soil surface at the upper part of the field carrying water to be applied in the furrows through perforated 4-inch Poly-Ethylene (P.E) line. Valves (to control irrigation) and water meters of 0.1 cubic meter accuracy (to measure the amount of water applied) were attached to the network. The capacity of the used pump was up to 120 m^3/feddan, head. The pump was connected to the main line by flexible quick hitch hose. The calculated amounts of water being 9200 and 9600 m^3/fed represented 22 and 23 irrigations in the first and second sesones, respectively. Water was conducted through a water meter of 0.1 cubic meter accuracy used to be tightly hooked where the wide inlet towards the main pump .The upper 15 cm of soil of the experimental site contained 55.29 % clay, 32.41 % silt, 12.30% sand. Soil moisture at the field capacity was 48.32%.

At harvest, plants of six guarded rows of each treatment were harvested to determine yield, yield components and juice quality.

Data recorded:

At harvest, a sample of 30 stalks represented each treatment was taken at random and the following data were recorded:

1. Stalk length (cm)
2. Stalk diameter (cm).
3. Cane yield (tons/fed.).
4. Purity percentage was calculated according to the following equation:

   Purity % = Sucrose % / Brix % x 100

5. Sugar recovery percentage was calculated as follows:

   Sugar recovery % = richness % x purity %

6. Sugar yield (tons/fed) was estimated according to following equation:

   Theoretical sugar production = cane yield (tons/fed) x sugar recovery %

The recorded data were statisticaly analyzed according to procedure outlined by Sndercor and Cochran (1981).

RESULTS AND DISCUSSION

1. Stalk length:

Data given in Table (1) reveal significant deffernces among the used varieties on stalk length, it could be noticed that G.T.54-9 variety attained a superiority in plant length amounted to 48.17 and 15.67 cm over G.85-37 and G.84-47 varieties, respectively, in the 1st season, corresponding to 23.34 and 14.00 cm in the 2nd season.

Data collected in Table (1) show that there was a significant and gradual increase in the values of stalk length accompanied to the increase in nitrogen doses up to 200 kg N/fed in the1st and 2nd seasons, the relative increase in stalk length may be due to important role of nitrogen in meristemic activity in addition to cell elongation.These results are in line with those found by Azzazy *et al* (2000).

The interaction between sugar cane varieties and nitrogen fertilizer had significant effect on stalk length in the 2nd season only. However, it could be noticed that the varities positively responded to the applied dose of nitrogen fertilizer in both seasons. Stalk length of G.84-47 variety increased by adding the middle dose of nitrogen (160 kg N/fed.) whereas that of the other two varities G.85-37 and G.T 54-9 increased by adding the maximum of dose of nitrogen (200 kg N/fed).

Table 1. Effect of nitrogen fertilizer on stalk length of some sugar cane varieties (1998/2000 and 1999/2002) seasons.

Sugarcane Variety	1998/2000			Average	1999/2002			Average
	N-level (kg N/fed)				N-level (kg N/fed)			
	120	160	200		120	160	200	
G. 85-37	210.00	250.00	255.00	238.00	271.50	278.50	287.50	279.50
G. 84-47	260.00	265.00	287.50	270.83	278.00	292.50	295.00	288.50
G.T. 54-9	280.50	268.00	311.00	286.50	288.00	302.00	317.50	302.50
Average	250.16	261.00	289.50	265.22	279.00	291.00	300.00	290.56
L.S.D. at 5% level for:								
Varities (V) =	39.16				17.49			
Nitrogen (N) =	27.01				4.35			
NxV =	N.S				7.56			

2. Stalk diameter:

Data presented in Table (2) indicate that stalk diameter did not significantly differ among the used varieties in both seasons.

Cncerining the effect of nitrogen fertiliezer on the stalk diameter the collcted data in Table (2) cleared a significant and positive response of stalk diameter to the increase in N-level. Increasing N-level up to 200 kg/fed increased stem diameter by 11.5 and 14.2 mm compared with the lowest nitrogen dose of 120 kg N/fed in the1st and 2nd seasons,respectively.These findings are in accordance with that found by Abd El-Gawad *et al.* (1992-a).

Table 2. Effect of nitrogen fertilizer on stalk diameter of some sugar cane varieties (1998/2000 and 1999/2002) seasons

Sugarcane Variety	1998/2000			Average	1999/2002			Average
	N-level (kg N/fed)				N-level (kg N/fed)			
	120	160	200		120	160	200	
G. 85-37	2.760	2.865	2.895	2.847	2.863	2.940	2.980	2.928
G. 84-47	2.850	2.910	2.930	2.847	2.950	2.990	3.005	2.985
G.T. 54-9	2.900	2.975	3.030	2.975	2.930	3.110	3.175	3.072
Average	2.843	2.917	2.958	2.406	2.915	3.013	3.057	2.995
L.S.D. at 5% level for:								
Varities (V) =	N.S				N.S			
Nitrogen (N) =	0.058				0.034			
NxV =	N.S				0.073			

The interaction effect between the studied factors on stalk diameter was significant in 2nd sasons only.The hieghest value of stalk diameter were recoded when the commercial variety G.T.54-9 was fertilized by 200 kg N/fed.

3. Sugar recovery percentage:

The results in Table (3) show that there was insignificant response in sugar recovery percentage due to the studied sugar cane varieties in the 1st and 2nd seasons.This result is in accordance with that of Azzazy *et al* (2000).

Reagarding the effect of nitrogen fertiliezr on Sugar recovery percentage there was a negative and significant influnce on this trait. Increasing N-levels up to (200 kg N/fed. decreased sugar recovery percentage in the 1st and 2 st seasons.This result is in line with that of Rahman *et al* (1997).

The interaction between the studied factors had no significant effect on sugar recovery % in both seasons.

Table 3. Effect of nitrogen fertilizer on sugar recovery percentage of some sugar cane varieties (1998/2000 and 1999/2002) seasons.

Sugarcane Variety	1998/2000			Average	1999/2002			Average
	N-level (kg N/fed)				N-level (kg N/fed)			
	120	160	200		120	160	200	
G. 85-37	13.965	13.625	12.825	13.472	14.710	14.080	13.430	14.073
G. 84-47	14.500	14.250	13.550	14.100	14.570	14.610	14.000	14.393
G.T. 54-9	14.170	13.450	13.360	13.660	13.520	13.520	13.040	13.360
Average	14.212	13.775	13.245	13.744	14.267	14.070	13.490	13.942
L.S.D. at 5% level for:								
Varities (V) =	N.S				N.S			
Nitrogen (N) =	0.787				0.519			
NxV =	N.S				N.S			

4. Purity percentage:

Data illustrated in Table (4) reveal that purity percentage insignificantly affected by the tested varieties. The results showed a reversible response of purity percentage to the increase in the applied N doses to the 1st and 2nd seasns. The highest N level (200 kg N/ha) attained the lowest Purity percentage. This result is in agrement with

results of Rahman *et al* (1997).

The interaction effect between the studied factors on purity percentage was not significant in both grwoing seasons.

Table 4. Effect of nitrogen fertilizer on purity percentage of some sugar cane varieties (1998/2000 and 1999/2002 seasons).

Sugarcane Variety	1998/2000			Average	1999/2002			Average
	N-level (kg N/fed)				N-level (kg N/fed)			
	120	160	200		120	160	200	
G. 85-37	89.73	88.11	86.28	88.04	91.83	90.61	89.43	90.62
G. 84-47	90.22	90.37	88.00	89.53	92.38	90.33	89.98	90.88
G.T. 54-9	90.15	88.39	87.89	88.81	90.50	87.51	87.00	88.33
Average	90.03	88.92	87.39	88.79	91.27	89.47	88.80	89.94
L.S.D. at 5% level for:								
Varities (V) =	N.S				N.S			
Nitrogen (N) =	1.998				1.552			
NxV =	N.S				N.S			

5. Cane yield:

There was a significant difference between the used varieties in their stalk yield.in the second season only. Variety G.T.54-9 oultyeilded the other two varieties i,e. G.85-37 and G.84-47 varieties by 3.22% and 13.77% in the 1st season corresponding to 9.35% and 7.17% in the 2nd season, respectively. This finding throw some light on the importance of gene make up i.e., varietal selection.This result is in agrement with thoses found by Azzazy and Dorgham (2000).

Results given in Table (5) indicate that nitrogen fertilizer level had a positive and significant effect on cane yield in both seasons. Applying the highest dose of nitrogen fertilizer (200 kg N/fed) resulted an increases in cane yield amounted by 6.53% and 4.97% compared with the middle dose (160 kg N/fed) and the lowest dose(120 kg N/fed), respectively, in 1st season being 18.61% and 11.86% in the 2nd one. The increase in cane yield due to the increase in stalk length and stalk diameter by applied the dose of nitrogen fertilizer as shwon in Table (1 & 2) .This result is in accordance with Dey and Davis (1997).

The interaction effect between the studied factors on cane yield were insignificant in both growing seasons. However, it could be noticed that the applied dose fo nitrogen under the examined varieties improved cane yeild. Also the highest cane value was attained under the commerial variety under 200 kg N/fed.

Table 5. Effect of nitrogen fertilizer on cane yield of some sugar cane varieties (1998/2000 and 1999/2002 seasons).

Sugarcane Variety	1998/2000			Average	1999/2002			Average
	N-level (kg N/fed)				N-level (kg N/fed)			
	120	160	200		120	160	200	
G. 85-37	41.700	46.800	50.100	46.530	44.000	47.300	51.150	47.550
G. 84-47	38.700	42.630	46.100	42.470	46.500	48.650	50.000	48.517
G.T. 54-9	43.200	49.300	51.600	48.033	49.000	52.300	54.500	52.000
Average	41.330	46.240	49.260	45.680	46.500	49.550	52.017	49.336
L.S.D. at 5% level for:								
Varities (V) =	N.S				1.954			
Nitrogen (N) =	2.710				1.239			
NxV =	N.S				N.S			

6. Sugar yield:

Data presented in Table (6) show that sugar yield did not significantly differ amang the studied sugarcane varieties in both growing seasons.

Data in Table (6) show that nitrogen fertiliezrs insignificantly affected theoretical sugar yield in the first season only. Applying the highest dose of nitrogen fertilizer (200 Kg N/ha) increased sugar yield by 2.471% and 10.58% ton/ha compared with (160 Kg and 120 kg N/ha), respectively, in 1st seasons. Once more, the collcted data of sugar yield cleared that sugar was more attributed with cane yield than sugar recovery which negatively responded to the applied dose of nitogen Table (3). These results are in line with thoses found by Azzazy *et al* (2000).

The interaction between sugar cane varieties and the nitrogen level were insignificantly in their effect on sugar yield in boss growing seasons.

Table 6. Effect of nitrogen fertilizer on sugar yield of some sugar cane varieties (1998/2000 and 1999/2002 seasons).

Sugarcane Variety	1998/2000			Average	1999/2002			Average
	N-level (kg N/fed)				N-level (kg N/fed)			
	120	160	200		120	160	200	
G. 85-37	5.609	6.074	6.246	5.976	6.473	6.687	6.873	6.678
G. 84-47	5.968	6.372	6.425	6.255	6.663	7.102	7.110	6.949
G.T. 54-9	6.109	6.618	6.887	6.538	6.778	7.109	7.056	6.981
Average	5.895	6.355	6.519	6.256	6.628	6.966	7.013	6.869
L.S.D. at 5% level for:								
Varities (V) =	N.S				N.S			
Nitrogen (N) =	0.426				N.S			
NxV =	N.S				N.S			

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تاثير التسميد الازوتى على محصول وجودة بعض أصناف قصب السكر تحت نظام الرى السطحى المطور

ناصر بخيت عزازى ، ابراهيم حنفى الجداوى

معهد بحوث المحاصيل السكرية - جيزة - مصر.

اقيمت تجربتان حقليتان بمحطة بحوث المطاعنة بمحافظة قنا بمصر العليا بغرض دراسة إستجابة صنفين من قصب السكر(جيزة ٣٧/٨٥ وجيزة ٤٧/٨٤) مقارنة بالصنف التجارى جيزة تايوان ٩/٥٤ لثلاثة معدلات من التسميد الازوتى (١٢٠و١٦٠و٢٠٠ كجم ازوت) على المحصول والجودة تحت نظام الرى السطحى المطور خلال موسمى الزراعة الخريفى ١٩٩٨/٢٠٠٠ و١٩٩٩/٢٠٠١ وقد اوضحت النتائج مايلى:

يوجد فرق معنوى فى طول ساق القصب بين الاصناف المختبرة فى كل من الموسم الاول والثانى بينما يوجد فرق معنوى فى محصول القصب للاصناف المنزرعة فى الموسم الثانى فقط.

لا توجد فروق معنوية فى محصول السكر والنسبة المئوية لناتج السكر والنسبة المئوية للنقاوة بين الاصناف المستخدمة.

بزيادة معدلات التسميد الازوتى حتى٢٠٠ كجم ن/ فدان ادى الى زيادة معنوية فى محصول القصب وطول العود فى كل من الموسم الاول والثانى.

تاثرت كل من النسبة المئوية لناتج السكر والنقاوة عكسيا بزيادة مستويات السماد الازوتى فى كلا الموسمين .