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EFFECT OF PLANTING DATES , NITROGEN FERTILIZER SOURCES AND RATES ON YIELD AND QUALITY OF THE NEW SUGAR CANE VARIETY PH8013.

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ABSTRACT

Two field experiments were carried out at El-Mattana Research Station, Qena Governorate during the two successive seasons of 2005/2006 and 2006/2007 to study the effect of planting dates, nitrogen fertilizer sources and rates and their interactions on yield and yield components as well as quality of new sugar cane variety ph8013.

Results showed that planting date had significant effect on stalk height, stalk diameter, number of internodes/stalk, cane yield/fed, brix %, sucrose %, purity %, sugar recovery% and reducing sugar%. Early planting date (March 15th) gave the highest cane yield/fed , sugar yield and sucrose percentage in the two growing seasons. Cane yield, sugar yield, stalk height, sucrose% and purity % were significantly affected by nitrogen sources in the first season. Ammonium sulphate fertilizer gave the highest cane yield , sucrose% and purity %. While, the highest value of sugar yield/fed. and stalk height were obtained by using ammonium nitrate. Increasing N levels attained a positive and significant effect on stalk height, stalk diameter, cane and sugar yields. Fertilizing sugar cane with 260 kg N/fed. recorded the highest values of these traits.

From economically point of view, the best results with regard to cane and sugar yield were obtained from planting sugar cane on March 15th and using ammonium sulphate at rate of 180 kg N/fed. These results were true under Qena conditions.

INTRODUCTION

Sugar is considered one of the most important strategic commodities world-wide and comes second after wheat in Europe, North and South America and Australia, and after rice in Asian countries. Sugar industry largely depends on sugarcane crop. Egypt has the first position in sugar production and the fourth position in the world sugar consumption. However, there is a gap between the production and consumption that adds load on the budget. To decrease this gap, it is necessary to increase the production of sugar cane through studying the factors affecting the productivity such as planting dates, nitrogen sources and nitrogen fertilization levels, etc. The effects of planting dates on the performance of sugar cane with special emphasis on cane and sugar yield proved to be a vital importance. (Sudama and Dua , 1990; Ahmed and Rajasekaran ,1993; Duhra *et al.* ,1993; Dey and Singh,1995; Saini *et al.*, (1996); Rao *et al* ., 1997; Jadhav *et al.*, 2000; Viator *et al* ,2005 and Viator *et al* 2006).

The difference between sources of nitrogen, with or without the nitrification inhibitor, are expected to have consequences on growth, yield and quality parameter that could affect sugar processing Mokadem (1998) ; Alam, *et al.*, (2001) ; Isa *et al* , (2006) and Saravanan *et al.* , (2006) found that cane yield was increased with increasing N application rate. They added that increasing nitrogen application from 100 to 150 and 200 kg/ha increased juice content, but decreased the quality parameters. On the other hand, Asokan *et al.*, (2005), found that N-levels up to 100 kg / ha. had no effect on cane and sugar yields and juice quality parameters.

Cane and sugar yields as well as juice quality could be affected by nitrogen fertilizer levels. The issue of the nitrogen nutrition of sugar plants has been controversial because views vary as regards the form of nitrogen that is utilized best by plants. (El-Bashbishy, *et. al.*, 1993; Kapoor *et al.*, 1993; Ahmed 1995 ; Zahoor, *et al.*, 1997 ; Abd-El-Latif, *et al.*, 1999; Azzazy, *et al.*, 2000; Ramesh, and Sumamsusan-Varghese ,2003 ; El-Geddawy *et al.*, 2005; El-Geddawy *et al.*, 2003; Nassar *et al.*, 2005; Jagtap *et al.*, 2006 and Taha *et al.*, 2007).

Yield and quality of sugar cane variety ph8013

This study aimed to study the effect of planting dates , nitrogen sources and levels of fertilizer on yield and its components as well as quality of the new sugar cane variety ph 8013.

MATERIALS AND METHODS

Two field experiments were carried out at El-Mattana Research Station, Qena Governorate during the two successive seasons of 2005/2006 and 2006/2007 to study the effect of planting dates, nitrogen fertilizer sources and rates and their interactions on yield and yield components as well as quality of sugarcane crops. The experimental design was split - split- plot with four replications . The three planting dates were randomly distributed in the main plots, the three nitrogen sources were assigned to sub-plots and the three nitrogen fertilization levels were allocated to sub-sub-plots. Each plot contains five rows, the length of each row was seven meters , while row width was one meter.

The studied factors were as follows:

1- Planting dates: 15th March., 15th April. and 15th May.
2- Nitrogen sources: Urea 46 % nitrogen, Ammonium nitrate 33.5 % nitrogen and Ammonium sulphate 20.5 % nitrogen.
3- Nitrogen fertilizer levels: 180 kg N/fed., 220 kg N/fed. and 260 kg N/fed.

Fixed doses of phosphorus and potassium fertilizers were applied at rate of 30 kg P_2O_5 /fed. and 50 kg K_2O /fed. Phosphorus was applied during land preparation as calcium superphosphate (15.5%P_2O_5). Potassium fertilizer was applied once as potassium sulphate (48% K_2O) with the second addition of nitrogen fertilizer.

Sugar cane was planted on the above mentioned planting dates and harvested after 12 months in both seasons .

Nitrogen doses were splited into two equal doses, the first application was added after 60 days from planting , while the second one was applied after 30 days later.

Chemical and physical properties for the experimental soil are presented in Table 1.Meteorological data which involved means of

maximum and minimum temperatures °C recorded at Mattana Agric. Res. Stations in both growing seasons are presented in Table 2.

All other agricultural practices were carried out as recommended under Quena conditions.

Table 1: Physical and chemical properties of the upper 40 cm of the experimental soil site.

Season		2005/2006	2006/2007
Physical analysis	Fine sand	34.40 %	33.90 %
	Silt	32.50 %	31.50 %
	Clay	33.10%	34.60 %
Soil texture		Clay loom	Clay loom
Chemical analysis	pH	7.60	8.20
	N Available (ppm)	25.0	26.31
	$Co_{3\ Meq/100g}$	Absent	Absent
	$H\ Co_{3\ Meq/100g}$	0.28	0.23
	$Cl^{-}_{Meq/100g}$	0.237	0.232
	$So_4^{=}{}_{Meq/100g}$	0.67	0.71
	$Ca^{++}_{Meq/100g}$	0.62	0.50
	$Mg^{++}_{Meq/100g}$	0.42	0.33
	$Na^{+}_{Meq/100g}$	0.30	0.19
	$K^{+}_{Meq/100g}$	0.135	0.140

Table 2: Meteorological data recorded at Mattana Agric. Res. Stations in both 2005/2006 and 2006/2007 growing seasons.**

Months	2005	2006	2007
March	20.4	24.5	20.8
April	25.8	28.6	25.0
May	30.9	32.7	30.1
June	34.5	32.0	34.2
July	33.2	32.5	32.7
August	33.1	31.2	32.2
September	31.6	30.1	30.8
October.	26.8	28.3	25.9
November.	24.7	28.4	24.7
December.	16.8	18.9	18.5
January.	17.2	16.8	17.2
February	18.4	18.4	18.4

** Weather bureau station,

Data recorded:

Yield and its components:

At harvest, three guarded rows of each treatment were harvested, topped and cleaned to estimate the following characteristics: stalk height (cm). , stalk diameter (cm). ,number of internodes per stalk , Cane yield (tons/fed) was determined from the weight of the three middle guarded rows of each plot and transformed to ton/ fed; Sugar yield (tons/fed.) was estimated according to the following equation: Sugar yield (tons/fed.) = Cane yield (tons/fed) x Sugar recovery %.

Juice quality characters:

At harvest, a sample of 20 stalks from each plot was taken at random, stripped, cleaned and squeezed to determine the following measurements:

Brix percentage was determined in the laboratory by using brix hydrometer; sucrose percentage by using Sacharemeter according to A.O.A.C. (1995).

Sugar recovery percentage was calculated as follows:

Sugar recovery % = Richness % x Purity %

Where: Richness = (Sucrose in 100 grams juice x factor) / 100

Factor = 100 - [Fiber % + physical impurities % + percent water free from sugar]

Purity percentage was calculated according to the following formula :

$$\textit{Purity}\ \text{percentage} = \frac{\text{Sucrose percentage}}{\text{Brix percentage}} \times 100$$

Reducing sugars percentage was determined by Fehling solution.

Statistical analysis:

The collected data were subjected to proper statistical analysis of split - split- plot design according to the procedures outlined by Snedecor and Cochran (1981). The comparison among means was done using LSD at 0.05 level of probability.

RESULTS AND DISCUSSIONS

Effect of planting dates , nitrogen sources and levels as well as their interactions on yield and its components.

Effect of planting dates, nitrogen sources and levels as well as their interactions on yield and its components of sugar cane at harvest in 2005/2006 and 2006/2007 seasons are shown in Tables 3, 4 and 5. Stalk length and stalk diameter increased gradually with delaying planting date of sugar cane in the first and second seasons, respectively. Planting on May 15th gave the tallest and thinnest stalk in the first season. The results showed that planting date had significant effect on the number of internodes/stalk, cane yield (ton/fed.) and sugar yield (ton/fed.) in both seasons. It is clear that planting on March 15th produced the highest number of internodes/stalk, cane and sugar yields (ton/fed.). These results are in agreement with those obtained by Hassanin and El-Naggar (1971); Ahmed and Rajasekaran (1993); Duhra *et al* (1993); Borthakur (1995); Vitor *et al* (2005) and Viator *et al* (2006)

The obtained results revealed that cane stalk height and stalk diameter were significantly influenced by nitrogen sources in both seasons. The height and stalk diameter were increased by using ammonium nitrate. Cane yield and sugar yield (ton/fed.) were significantly affected by nitrogen sources in 2005/2006 season. Applications of ammonium sulphate fertilizer gave the highest cane and sugar yields, while the lowest ones were obtained by using urea. Using ammonium sulphate increased cane yield/fed. by 6.52% and 5.35% in the first season compared to urea and ammonium nitrate, respectively. As well as, using ammonium sulphate increased sugar yield/fed. by 12.35% and 8.66% compared to urea and ammonium nitrate, respectively, in the second season. While, number of internodes/stalk was insignificantly affected by nitrogen sources in both seasons. Generally, using ammonium sulphate gave the highest values of these traits in both seasons. These results are in agreement with those obtained by Kapoor *et al.*, (1993) ; Kumar *et al.*, (1996); Mokadem (1998); Viator *et al* (2005) and Saravanan *et al* (2006).

Table 3 : Effect of Planting dates , nitrogen sources and levels as well as their interaction on stalk length and stalk diameter at harvest in 2005/2006 and 2006/2007 seasons.

Planting dates	Nitrogen sources(S)	Stalk length								Stalk diameter							
		2005/06				2006/07				2005/06				2006/07			
		Nitrogen levels (kg N/fed)(L)								Nitrogen levels (kg N/fed)(L)							
		180	220	260	mean	180	220	260	mean	180	220	260	mean	180	220	260	mean
15th March	Urea	257.33	249.33	260.66	255.77	248.33	250.00	266.66	255.00	2.90	2.94	3.16	3.00	3.15	3.22	2.85	3.07
	Amm. Nitrate	254.66	255.00	263.66	257.77	251.66	250.00	266.66	256.11	2.94	2.87	3.02	2.94	3.21	3.27	3.20	3.23
	Amm.Sulphate	244.33	255.00	271.66	257.00	236.66	251.66	258.33	248.88	2.98	2.84	2.94	2.92	3.23	3.23	3.16	3.21
Mean		252.11	253.11	265.33	256.85	245.55	250.55	263.88	253.33	2.94	2.88	3.04	2.95	3.20	3.24	3.07	3.17
15th April	Urea	250.00	261.66	245.00	252.22	280.33	323.33	318.33	307.33	3.26	3.40	3.23	3.30	2.87	2.66	2.71	2.74
	Amm. Nitrate	260.00	252.33	248.33	253.55	323.33	292.33	315.00	310.22	3.40	3.30	3.28	3.33	2.79	2.82	2.92	2.84
	Amm.Sulphate	239.33	251.00	230.00	240.11	305.00	322.33	296.66	308.00	3.43	3.40	3.34	3.39	2.64	2.75	2.70	2.69
Mean		249.77	255.00	241.11	248.63	302.88	312.66	310.00	308.51	3.36	3.36	3.28	3.34	2.76	2.74	2.77	2.76
15th May	Urea	252.33	242.66	253.33	249.44	248.00	245.00	256.00	249.66	3.26	3.40	3.40	3.35	3.36	3.26	3.40	3.34
	Amm. Nitrate	254.66	265.00	256.00	258.55	253.33	273.33	265.00	263.88	3.36	3.43	3.40	3.40	3.13	3.40	3.38	3.30
	Amm.Sulphate	266.66	268.33	273.33	269.44	260.00	265.33	280.00	268.44	3.40	3.30	3.38	3.36	3.25	3.48	3.36	3.36
Mean		257.88	258.66	260.88	259.14	253.77	261.22	267.00	260.66	3.34	3.37	3.39	3.37	3.25	3.38	3.38	3.33
S x L	Urea	253.22	251.22	253.00	252.48	258.88	272.77	280.33	270.00	3.14	3.24	3.26	3.22	3.13	3.05	2.98	3.05
	Amm. Nitrate	256.44	257.44	256.00	256.63	276.11	271.88	282.22	276.74	3.23	3.20	3.23	3.21	3.04	3.16	3.16	3.12
	Amm.Sulphate	250.11	258.11	258.33	255.51	267.22	279.77	278.33	275.11	3.27	3.18	3.22	3.22	3.04	3.15	3.07	3.09
Mean		253.25	255.59	255.77	254.87	267.40	274.81	280.29	274.16	3.21	3.21	3.24	3.22	3.07	3.12	3.07	3.08
LSD at 0.5 level of significance																	
Planting dates (P)		7.39				NS				0.02				0.04			
Nitrogen source (S)		2.25				4.01				NS				0.06			
Nitrogen levels (L)		2.10				9.49				NS				0.05			
P x S		11.70				NS				0.45				NS			
P x L		12.79				NS				0.50				NS			
S x L		NS				NS				NS				NS			
L x P x S		NS				28.47				NS				NS			

Table 4 : Effect of Planting dates , nitrogen sources and levels as well as their interaction on number of internodes / stalk at harvest and cane yield (ton/ fed.) in 2005/2006 and 2006/2007 seasons.

Planting dates	Nitrogen sources(S)	Number of internodes / stalk								Cane yield (ton/ fed.)							
		2005/06				2006/07				2005/06				2006/07			
		Nitrogen levels (kg N/fed)(L)								Nitrogen levels (kg N/fed)(L)							
		180	220	260	mean	180	220	260	mean	180	220	260	mean	180	220	260	mean
15th March	Urea	17.20	16.80	17.11	17.03	18.20	18.50	17.50	18.06	69.86	62.60	54.33	62.26	70.60	57.66	76.33	68.20
	Amm. Nitrate	18.50	16.53	18.46	17.83	16.66	17.13	18.40	17.40	58.33	66.60	63.26	62.73	57.86	69.93	65.86	64.55
	Amm.Sulphate	17.71	16.60	17.93	17.41	18.03	17.20	18.13	17.78	72.60	56.00	64.13	64.24	61.26	60.20	64.20	61.88
Mean		17.80	16.64	17.83	17.43	17.63	17.61	18.01	17.75	66.93	61.73	60.57	63.08	63.24	62.60	68.80	64.88
15th April	Urea	15.73	15.80	17.66	16.40	15.73	16.30	16.73	16.25	55.80	46.26	53.86	51.97	49.33	49.73	54.33	51.13
	Amm. Nitrate	15.46	16.66	16.20	16.11	16.73	17.10	15.80	16.54	56.33	60.86	57.33	58.17	49.93	61.06	46.33	52.44
	Amm.Sulphate	16.13	16.06	16.50	16.23	16.13	17.00	18.06	17.06	65.66	63.33	62.06	63.68	42.26	51.46	51.80	48.51
Mean		15.77	16.17	16.78	16.24	16.20	16.80	16.86	16.62	59.26	56.82	57.75	57.94	47.17	54.08	50.82	50.69
15th May	Urea	14.60	14.03	16.20	14.94	15.60	16.23	18.40	16.74	60.26	65.93	58.06	61.42	61.26	66.26	63.20	63.57
	Amm. Nitrate	14.93	16.33	15.40	15.55	16.80	16.06	16.80	16.55	56.26	63.20	50.66	56.71	64.06	50.20	64.46	59.57
	Amm.Sulphate	15.60	16.20	16.46	16.08	16.06	17.20	16.80	16.68	60.46	60.00	57.06	59.17	55.60	45.13	65.20	55.31
Mean		15.04	15.52	16.02	15.53	16.15	16.50	17.33	16.66	59.00	63.04	55.26	59.10	60.31	53.86	64.28	59.48
S x L	Urea	15.84	15.54	16.99	16.12	16.51	17.01	17.54	17.02	61.97	58.26	55.42	58.55	60.40	57.88	64.62	60.97
	Amm. Nitrate	16.30	16.51	16.68	16.50	16.73	16.76	17.00	16.83	56.97	63.55	57.08	59.20	57.28	60.40	58.88	58.85
	Amm.Sulphate	16.48	16.28	16.96	16.58	16.74	17.13	17.66	17.18	66.24	59.77	61.08	62.37	53.04	52.26	60.40	55.23
Mean		16.20	16.11	16.88	16.39	16.66	16.97	17.40	17.01	61.73	60.53	57.86	60.04	56.91	56.85	61.30	58.38

LSD at 0.5 level of significance				
Planting dates (P)	1.13	0.74	4.63	6.06
Nitrogen source (S)	NS	NS	3.01	NS
Nitrogen levels (L)	0.70	0.65	NS	2.65
P x S	NS	NS	4.35	NS
P x L	1.79	1.63	3.11	NS
S x L	NS	NS	NS	NS
L x P x S	NS	NS	5.15	NS

Table 5 : Effect of Planting dates , nitrogen sources and levels as well as their interaction on sugar yield (ton/ fed.) and brix percentage at harvest in 2005/2006 and 2006/2007 seasons.

Planting dates	Nitrogen sources(S)	Sugar yield (ton/ fed.)								Brix percentage							
		2005/06				2006/07				2005/06				2006/07			
		Nitrogen levels (kg N/fed)(L)								Nitrogen levels (kg N/fed)(L)							
		180	220	260	mean	180	220	260	mean	180	220	260	mean	180	220	260	mean
15th March	Urea	8.27	7.17	6.04	7.16	8.19	6.60	8.59	7.79	23.44	23.84	23.64	23.64	23.34	23.68	23.94	23.65
	Amm. Nitrate	6.31	7.79	8.17	7.42	6.63	8.26	8.20	7.69	23.66	23.67	24.22	23.85	23.65	23.86	24.24	23.92
	Amm.Sulphate	9.27	6.84	7.39	7.83	7.74	7.21	7.64	7.47	24.06	23.99	23.62	23.89	24.36	24.03	23.86	24.08
Mean		7.95	7.27	7.20	7.47	7.52	7.36	8.08	7.65	23.72	23.83	23.82	23.79	23.78	23.86	24.01	23.88
15th April	Urea	5.89	5.05	5.80	5.58	5.38	5.49	6.76	5.87	23.67	23.82	24.35	23.95	24.49	24.38	23.61	24.16
	Amm. Nitrate	5.95	6.63	6.36	6.31	5.33	7.01	5.18	5.84	23.93	23.62	23.67	23.74	24.62	24.74	23.57	24.31
	Amm.Sulphate	7.67	6.49	7.07	7.08	4.70	5.47	6.02	5.40	24.04	23.74	23.50	23.76	23.95	23.89	24.17	24.00
Mean		6.51	6.06	6.41	6.32	5.14	5.99	5.99	5.70	23.88	23.70	23.80	23.80	24.35	24.34	23.78	22.82
15th May	Urea	6.83	6.70	6.53	6.68	5.59	6.46	6.33	6.13	23.67	23.68	23.60	23.65	22.81	22.45	23.32	22.86
	Amm. Nitrate	5.80	7.61	5.72	6.38	6.13	5.20	6.28	5.87	23.52	23.99	23.83	23.78	22.15	22.69	22.12	22.32
	Amm.Sulphate	7.03	6.99	6.72	6.91	5.39	4.51	6.43	5.44	24.23	24.11	23.76	24.04	23.08	22.81	22.65	22.85
Mean		6.55	7.10	6.32	6.66	5.70	5.39	6.35	5.81	23.81	23.93	23.73	23.82	22.68	22.65	22.70	22.67
S x L	Urea	7.00	6.31	6.12	6.48	6.39	6.18	7.23	6.60	23.59	23.78	23.86	23.75	23.54	23.50	23.62	23.55
	Amm. Nitrate	6.02	7.35	6.75	6.70	6.03	6.82	6.55	6.47	23.70	23.76	23.90	23.79	23.47	23.76	23.31	23.51
	Amm.Sulphate	7.99	6.77	7.06	7.28	5.94	5.73	6.64	6.10	24.11	23.94	23.63	23.89	23.79	23.58	23.56	23.64
Mean		7.00	6.81	6.64	6.81	6.12	6.25	6.81	6.39	23.80	23.83	23.80	23.81	23.60	23.61	23.49	22.45
SD at 0.5 level of significance																	
Planting dates (P)		0.67				0.74				0.24				NS			
Nitrogen source (S)		0.70				NS				NS				NS			
Nitrogen levels (L)		NS				0.45				NS				NS			
P x S		NS				1.28				0.45				NS			
P x L		NS				1.35				NS				NS			
S x L		1.21				NS				0.38				NS			
L x P x S		NS				NS				NS				NS			

Results showed that applied nitrogen levels attained a positive and significant effect on stalk height and number of internodes/stalk. These results were true in the both seasons. The highest values of stalk height and number of internodes/stalk were produced with fertilizing sugar cane with 260 kg N/fed. in both seasons.

Regarding the effect of nitrogen fertilizer levels on cane yield (ton/fed.) and sugar yield, it was significant in the second season only. Data in Tables (4 and 5) show that the highest values were obtained from the application of 260 kg N/fed. which gave a cane yield of 61.30 ton/fed., sugar yield of 6.81 ton/fed. However, the lowest yield was obtained from the application of 220 kg N/fed. and the application of 180 kg N/fed. for cane and sugar yields, respectively. Application of 260 kg N/fed. increased cane yield/fed. by 7.71% and 7.83% in the second season compared to 180 and 220 kg N/fed., respectively. The increases in cane yield/fed. due to the application of nitrogen fertilization can be explained by the fact that nitrogen has a vital role in building up metabolites, activating enzymes and carbohydrates accumulation which transferred from leaves to devolving stalk which in turn enhanced stalk length, diameter as well as number of internodes/plant and finally cane yield per unit area. These results agree with those obtained by Ahmed (1995); Mokadem (1998); Asokan *et al.*, (2005); El-Geddawy *et al.*, (2005); and Taha *et al.*, (2007).

However, excess nitrogen application was not desirable; because it reduced most quality parameters and sugar yield per unit area along with its critical effect on increasing environmental pollution. The increase in gross sugar yield per unit area due to application of nitrogen can be explained by the fact that nitrogen has active role in improving all growth attributes and stalk yield per fed. as well as sucrose percentage, consequently increasing gross sugar yield/fed.

Results revealed that N fertilization levels had significant effect on stalk diameter in the second season. Increasing the applied doses of nitrogen fertilization slightly increased stalk diameter. The positive effect of nitrogen fertilization on stalk diameter may be due to the

important role of N in building plant organs. These results are in line with those reported by Nassar *et al.*(2005).

Stalk height, stalk diameter and cane yield/fed. were significantly affected by the interaction between planting dates and nitrogen sources at harvest in the first season only. Planting sugar cane on May 15th and using ammonium sulphate produced the highest stalk height and cane yield/fed. While, the highest value from stalk diameter was obtained with planting on May 15th and using ammonium nitrate in the first season (Tables 3 and 4).

The interaction effect between planting dates and nitrogen sources on sugar yield was significant in the second season (Table 5).The highest values 7.79 ton /fed. in the second season, was produced from planting sugar cane on March 15th and using urea. The lowest one (5.4 ton/fed.) was resulted from planting sugar cane on April 15th and applying ammonium sulphate.

Regarding to the interaction effect between planting dates and nitrogen levels on stalk height, stalk diameter and cane yield/fed; it was significant in the first season only. The highest stalk height and stalk diameter were obtained from planting sugar cane on March 15th and application of 260 kg N/fed., which were 260.88 cm. and 3.39 cm. respectively. While, the highest value of cane yield 66.93 ton/fed. was recorded from planting sugar cane on March 15th and application of 180 kg N/fed. in the first season. Sugar yield/fed. in the second season was significantly affected by the interaction between planting dates and nitrogen fertilization levels, the greatest sugar yield/fed. was found with planting sugar cane on March 15th with application of 260 kg N/fed. The interaction effect between planting dates and nitrogen fertilization levels on number of internodes/stalk was significant in both seasons. Maximum number of internodes/stalk was obtained with planting sugar cane on April 15th and applying 260 kg N/fed., which gave 17.83 and 18.01 in the first and second seasons, respectively. While, the lowest values for this trait were resulted when planting was practiced on May 15th with 180 kg N/fed. which gave 15.04 and 16.15 in the first and second season, respectively.

Differences in sugar yield/fed. due to nitrogen sources X nitrogen levels interaction were significant in the first season

(Table 5). Maximum sugar yield/fed. was recorded for plots that received ammonium sulphate with application of 180 kg N/fed. which gave 7.99 ton/fed..

Moreover, the interaction effect of planting dates X nitrogen sources X nitrogen fertilization levels on stalk height and cane yield was significant in the second and first season, respectively. The highest cane yield/fed. was obtained from planting sugar cane on March 15th and using ammonium sulphate at rate of 180 kg N/fed. which gave 72.60 ton/fed. in the first season. While, the highest stalk height was resulted from planting sugar cane plants on April 15th and using ammonium nitrate at rate of 180 kg N/fed. which gave 323.33 in the second season.

Effect of planting dates , nitrogen sources and levels as well as their interactions on juice quality.

Data related to the effect of planting dates, nitrogen sources and levels as well as their interactions on brix, sucrose, purity, sugar recovery (SR%) and reducing sugars percentages in 2005/2006 and 2006/2007 seasons are shown in Tables 5, 6 and 7 . The obtained results revealed that planting date exhibited significant effect on brix percentage in the first season. These results indicated that planting on May 15th gave the highest brix percentage.

Sucrose and purity percentages were significantly affected by changing date of planting in both seasons. It could be seen that early planting on March 15th gave the highest sucrose and purity percentages in the first season, while planting on April 15th gave the highest ones in the second season.

The increase in sucrose and purity percentages of juice in early planting could be due to the minimum accumulated night temperature in the period during production of sucrose. Also, the favorable effect of planting on the first of March might be due to the more suitable of all environmental condition during this period of formation more sucrose.

Effect of planting dates on sugar recovery percentage (SR %) and reducing sugar was significant in both seasons and first season, respectively. The highest percentage of sugar recovery 11.78% and 11.82 % recorded from planting sugar cane on March 15th in the first

and second seasons, respectively. While, The highest values of reducing sugar 2.88% obtained from April 15th in the first season. These results are in agreement with those obtained by Hassanin and El-Naggar (1971); Borthakur (1995); Dey and Singh (1995); Singh *et al* (1997) ; Jadhav *et al.*, (2000) ; McDonald and Lisson (2001) and Viator *et al* (2005) .

Data presented in Table 6 show that sucrose and purity percentage were significantly affected by nitrogen sources in the first season. Ammonium sulphate gave the highest sucrose and purity percentages than the other sources. The increase in purity percentage by using ammonium sulphate as nitrogen sources due to the effect of ammonium sulphate which resulted in increasing sucrose percentage. These results are in agreement with those obtained by Tripathi and Pandey (1993) ; Viator *et al* (2005) and Sarvanan *et al* (2006).

From the data in Table 6, it could be observed that nitrogen sources had significant effect on reducing sugar percentage in both seasons. The highest reducing sugars percentage was obtained with the application of ammonium nitrate and urea in the first and second seasons, respectively. These results are in agreement with those obtained by Kapoor *et al.*, (1993) ; Kumar *et al.*, (1996); Mokadem (1998); Viator *et al* (2005) and Sarvanan *et al* (2006).

Concerning the effect of nitrogen fertilization levels on sucrose; sugar recovery and reducing sugar percentages, the obtained results indicated that these traits positively and gradually responded to the increase in the applied doses of nitrogen fertilization. Fertilizing sugar cane with 260 kg N/fed. recorded the highest values of sucrose and sugar recovery percentages in both seasons. Moreover, the highest reducing sugar percentage was recorded with the application of 260 kg N/fed. in the second season. The increase in sugar recovery as a results of raising N rates may be due to their effect on enhancing leaf area and the increase in photosynthesis which lead to carbohydrate accumulation. In addition to the conversion of carbohydrates to simple sugars, data given in Table 6 obviously showed that increasing nitrogen fertilization levels caused a relative decreased in purity%, this effect was significant in first season. The inverse response in the

values of juice purity to the increase in nitrogen levels increased reducing sugars which consequently lowered purity percentage. These results are in agreement with that obtained by Abd El-latif *et al.*, (1993); Azzazy, *et al.* (2000); Alam *et al.*, (2001) Ahmed and Ferwez (2004); Jagtap *et al* ., (2006); Isa *et al.*, (2006) *and* Taha *et al.* (2007) .

Moreover, the interaction effect between planting dates and nitrogen sources on brix and sucrose percentage was significant in the first season. Tables 5 and 6 show that the highest percentages of brix (24.04%) was obtained from planting sugar cane on May 15th with applying ammonium sulphate. While, the lowest percentage was recorded from planting sugar cane on April 15th with applying urea, which gave 17.87% in the first season.

With regard to the interaction effect between planting dates and nitrogen sources on purity, sugar recovery (SR%) and reducing sugars percentages was significant in the first season , in both seasons and in the first season, respectively. Data presented in Tables 6 and 7 show that the highest purity, sugar recovery and reducing sugars percentages were recorded from planting on March 15th with applying ammonium sulphate, which gave 80.76% in the first season, planting on March 15th with applying ammonium sulphate, which gave 12.18 % and 12.06 % in both seasons and from the middle planting dates (April 15th) with applying ammonium nitrate, which gave 2.94% in the first season, respectively.

Moreover, the interaction effect betwwen planting dates and nitrogen fertilization levels on sucrose, purity, reducing sugars and sugar recovery percentages were significant in the first season and in both seasons, respectively. Maximum sucrose 19.02% in the first season and sugar recovery percentage (11.82% and 11.87%) in both seasons, respectively, were obtained from planting date on March 15th with application of 260 kg/ fed. The highest percentage of purity was obtained from planting on March 15th with the application of 180 kg N/fed. which was (79.69%).While, the highest reducing sugar was obtained an planting date April 15th and application of 180 kg N/fed., which was 3.03%.

Table 6 : Effect of Planting dates , nitrogen sources and levels as well as their interaction on sucrose and purity percentage at harvest in 2005/2006 and 2006/2007 seasons.

Planting dates	Nitrogen sources(S)	Sucrose percentage								Purity percentage							
		2005/06				2006/07				2005/06				2006/07			
		Nitrogen levels (kg N/fed)(L)								Nitrogen levels (kg N/fed)(L)							
		180	220	260	mean	180	220	260	mean	180	220	260	mean	180	220	260	mean
15th March	Urea	17.93	18.92	18.02	18.29	18.15	18.79	19.67	18.87	80.43	78.29	76.62	78.45	78.30	79.07	76.56	77.97
	Amm. Nitrate	18.64	18.67	19.73	19.01	18.72	19.18	18.17	18.69	76.10	78.87	82.58	79.18	76.14	79.12	82.46	79.24
	Amm.Sulphate	19.33	19.39	19.31	19.34	18.95	19.79	18.51	19.08	82.54	80.82	78.94	80.76	82.46	81.23	80.50	81.40
Mean		18.63	18.99	19.02	18.88	18.61	19.25	18.78	18.88	79.69	79.33	79.38	79.46	78.96	79.80	79.84	79.54
15th April	Urea	17.71	17.44	18.47	17.87	20.22	20.10	20.98	20.43	74.31	74.92	78.08	75.77	81.55	82.46	87.66	83.89
	Amm. Nitrate	18.49	18.12	18.49	18.37	19.88	20.55	19.80	20.07	78.20	77.07	77.27	77.51	80.85	83.08	84.08	82.65
	Amm.Sulphate	18.29	17.60	19.29	18.39	19.75	19.41	20.43	19.86	77.55	76.65	75.09	76.43	82.28	81.23	84.94	82.81
Mean		18.16	17.72	18.75	18.21	19.95	20.02	20.40	20.12	76.68	76.21	76.18	76.57	81.56	82.26	85.54	83.12
15th May	Urea	18.45	18.11	17.81	18.12	17.65	18.11	18.54	18.10	78.85	73.43	75.55	75.94	76.39	79.47	80.94	78.93
	Amm. Nitrate	18.12	18.83	19.22	18.72	18.54	18.28	18.62	18.48	74.96	77.27	80.12	77.45	81.91	84.11	80.50	82.17
	Amm.Sulphate	18.92	18.29	18.25	18.42	18.09	17.90	18.30	18.10	79.16	78.69	76.44	78.10	78.88	80.62	79.76	79.75
Mean		18.49	18.41	18.42	18.44	18.09	18.09	18.49	18.23	77.65	76.46	77.37	77.16	79.06	81.40	80.40	80.28
S x L	Urea	18.03	18.15	18.10	18.09	18.67	19.0	19.73	19.13	77.86	75.55	76.75	76.72	78.74	80.33	81.72	80.27
	Amm. Nitrate	18.42	18.54	19.15	18.70	19.05	19.33	18.86	19.08	76.42	77.74	79.99	78.05	79.63	82.10	82.33	81.35
	Amm.Sulphate	18.85	18.43	18.95	18.74	18.93	19.03	19.08	19.01	79.75	78.72	76.82	78.43	81.20	81.03	81.73	81.32
Mean		18.43	18.37	18.73	18.51	18.88	19.12	19.22	19.07	78.01	77.33	77.85	77.73	79.86	81.15	81.93	80.98
SD at 0.5 level of significance																	
Planting dates (P)		0.63				0.55				2.01				1.85			
Nitrogen source (S)		0.62				NS				1.40				NS			
Nitrogen levels (L)		0.33				0.63				0.58				NS			
P x S		1.05				NS				2.25				NS			
P x L		0.20				NS				3.48				NS			
S x L		0.33				NS				3.43				NS			
L x P x S		NS				NS				NS				NS			

Table 7 : Effect of Planting dates , nitrogen sources and levels as well as their interaction on sugar recovery and reducing sugar percentage at harvest in 2005/2006 and 2006/2007 seasons.

Planting dates	Nitrogen sources(S)	Sugar recovery percentage								Reducing sugar percentage							
		2005/06				2006/07				2005/06				2006/07			
		Nitrogen levels (kg N/fed)(L)								Nitrogen levels (kg N/fed)(L)							
		180	220	260	mean	180	220	260	mean	180	220	260	mean	180	220	260	mean
15th March	Urea	11.87	11.41	11.07	11.45	11.55	11.45	11.48	11.49	2.43	2.33	2.26	2.34	2.23	2.30	2.23	2.25
	Amm. Nitrate	10.71	11.55	12.88	11.71	11.45	11.77	12.52	11.91	2.23	2.30	2.60	2.37	2.30	2.33	2.53	2.38
	Amm.Sulphate	12.78	12.23	11.53	12.18	12.58	11.99	11.61	12.06	2.53	2.20	2.40	2.37	2.53	2.20	2.40	2.37
Mean		11.78	11.73	11.82	11.78	11.86	11.73	11.87	11.82	2.40	2.27	2.42	2.36	2.35	2.27	2.38	2.34
15th April	Urea	10.32	10.89	10.79	10.76	10.91	11.08	12.35	11.45	2.93	3.13	2.70	2.92	2.26	2.33	2.66	2.42
	Amm. Nitrate	10.50	10.88	10.93	10.77	10.79	11.42	11.17	11.13	3.06	2.76	3.00	2.94	2.46	2.66	2.20	2.44
	Amm.Sulphate	11.72	10.31	11.43	11.15	10.91	10.58	11.64	11.04	3.10	2.50	2.73	2.77	2.43	2.26	2.40	2.36
Mean		10.84	10.69	11.05	10.86	10.87	11.03	11.72	11.20	3.03	2.80	2.81	2.88	2.38	2.42	2.42	2.41
15th May	Urea	11.32	10.18	11.08	10.86	9.05	9.72	10.11	9.63	2.76	2.76	2.66	2.73	2.43	2.56	2.76	2.58
	Amm. Nitrate	10.31	11.97	11.23	11.17	9.60	10.40	9.73	9.91	2.66	2.76	2.73	2.72	2.83	2.13	2.20	2.28
	Amm.Sulphate	11.58	11.66	11.74	11.66	9.62	10.00	9.79	9.80	2.80	2.83	2.76	2.80	2.46	2.36	2.50	2.44
Mean		11.07	11.27	11.35	11.23	9.42	10.04	9.88	9.78	2.74	2.78	2.72	2.75	2.47	2.35	2.48	2.44
S x L	Urea	11.17	10.83	10.98	10.99	10.50	10.75	11.31	10.86	2.71	2.74	2.54	2.66	2.31	2.40	2.55	2.42
	Amm. Nitrate	10.50	11.46	11.68	11.21	10.61	11.19	11.14	10.98	2.65	2.61	2.77	2.68	2.43	2.37	2.31	2.37
	Amm.Sulphate	12.03	11.40	11.56	11.66	11.04	10.85	11.01	10.97	2.81	2.51	2.63	2.65	2.47	2.27	2.43	2.39
Mean		11.23	11.23	11.41	11.29	10.72	10.93	11.15	10.93	2.72	2.62	2.65	2.66	2.40	2.35	2.43	2.39

LSD at 0.5 level of significance				
Planting dates (P)	0.45	0.65	0.22	NS
Nitrogen source (S)	0.58	NS	0.03	0.02
Nitrogen levels (L)	NS	0.40	NS	0.06
P x S	0.97	0.60	0.15	NS
P x L	1.04	1.25	0.65	NS
S x L	NS	NS	NS	NS
L x P x S	NS	NS	NS	NS

As shown in Table 6 , the interaction between nitrogen sources and levels on sucrose and purity percentages was significant in first season. It is important to note that the greatest sucrose and purity percentage was found from using ammonium nitrate with 260 kg N/fed . which was 19.15 and 79.99%, respectively.

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تأثير مواعيد الزراعة ومصادر ومعدلات السماد الأزوتى على المحصول والجودة لصنف قصب السكر الجديد Ph8013

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قسم المحاصيل – كلية الزراعة – جامعة المنيا

مركز البحوث الزراعية – معهد بحوث المحاصيل السكرية – الجيزة

أقيمت تجربة حقلية بمحطة البحوث الزراعية بالمطاعنة بمحافظة قنا فى الموسمين تاليين ٢٠٠٥/٢٠٠٦ ، ٢٠٠٦/٢٠٠٧ لدراسة تأثير مواعيد الزراعة ومصادر دلات السماد الأزوتى على المحصول والجودة لصنف قصب السكر الجديد **Ph8013**. خدم تصميم القطع المنشقة مرتين فى أربعة مكررات فى كلا الموسمين حيث تم وضع مواعيد راعة(١٥ مارس ، ١٥ أبريل ، ١٥ مايو) فى القطع الرئيسية، ومصادر السماد الأزوتى فى ع تحت الرئيسية (يوريا ٤٦ % نتروجين ، نترات الأمونيوم ٣٣,٥% نتروجين ، كبريتات ونيوم ٢٠,٥% نتروجين). ومستويات السماد الأزوتى فى القطع تحت – تحت الرئيسية (١٨٠ ، ٢ ، ٢٦٠ كجم نتروجين/ فدان). وكانت القطعة التجريبية الواحدة تحتوى على خمسة خطوط ل الخط ٧ م ، عرض ١م.

أوضحت النتائج المتحصل عليها أن طول وسمك الساق ،عدد السلاميات/ ساق، محصول يقان، والنسب المئوية لكل من البركس ، السكروز والنقاوة ، وناتج السكر ، والسكريات المختزلة تأثرت معنويا بمواعيد الزراعة وأعطت الزراعة فى ١٥ مارس أفضل النتائج بالنسبة لنسبة كروز ، محصولى السيقان والسكر فى كلا موسمى الزراعة.

وقد وجد أن محصول السكر/ فدان ، طول الساق، النسبة المئوية للسكروز ، والنقاوة قد تأثرت ويا بمصادر السماد الأزوتى ، حيث أعطى إضافة الأزوت فى صورة سلفات أمونيوم أعلى القيم سبة المئوية للسكروز، ومحصول السيقان ، والنقاوة. بينما أعطى إضافة نترات الأمونيوم أفضل م لطول الساق ، محصول السكر/فدان.

وقد لوحظ أن زيادة مستويات السماد النتروجينى قد أدى إلى زيادة ايجابية ومعنوية فى طول ساق ، السمك ، محصولي السيقان والسكر حيث أعطى إضافة ٢٦٠ كجم/ فدان الى أفضل النتائج ذه الصفات.

والخلاصة فأن أفضل النتائج بخصوص محصولى السيقان والسكر يمكن الحصول عليها زراعة فى ١٥ مارس مع إضافة ١٨٠ كجم نتروجين/ فدان فى صورة سلفات أمونيوم تحت ظروف حافظة قنا.