RESPONSE OF SWEET SORGHUM (*SORGHUM BICOLOR* L.) TO MINERAL NITROGEN AND BIOFERTILIZATION

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Abstract

Two field experiments were carried out on a clay loamy soil at the experimental field of the Agricultural Research Station Sabaheia, Alexandria during 2001 and 2002 seasons, to study the effect of three levels of a mineral nitrogen fertilizer (40, 60 and 80 kg N/fed in urea form) and three levels of biofertilizer (0, 800 and 1600 g cerealin/fed) on sweet sorghum var. Collier. The experiments design was a split plot with four replications.

The results showed that leaf area (cm^2), stalk yield (ton/fed), juice yield (ton/fed), total soluble solids % and sucrose % were significantly responded to the mineral nitrogen fertilizer in both seasons and plant length, stalk diameter, purity % and extraction percentage in the 1st season.

Cerealin application significantly increased stalk diameter, leaf area (cm^2), stalk yield (ton/fed), juice yield (ton/fed), sucrose %, purity % in both seasons while total soluble solids % was significantly affected by cerealin in the 1st season and plant length in the 2nd season.

Interaction effect between nitrogen and cerealin fertilizers significantly increased sucrose % and purity % in both seasons and juice yield and stalk yield in the 1st season. Otherwise, stalk length, diameter, leaf area and extraction % were insignificantly affected by interaction between nitrogen and cerealin fertilizers.

This study recommends the application of nitrogen fertilizer at 80 kg N/fed and/or 1600 g cerealin/fed to yield the highest value of stalk yield of sweet sorghum.

INTRODUCTION

Sorghum bicolor L. is a tropical and subtropical African annual summer growing grain crop. Sweet sorghum is considered one of sorghum types which was cultivated in Egypt as a summer forage crop on small scale. It is characterized by having high sucrose and low reducing sugars and starch content. These characters make it suitable for jaggory and syrup production. The syrup produced from sweet sorghum is a concentrated juice with an attractive color and good sweet taste that is liked by the

Egyptian people. Also, it is free from jelly like consistency and free from crystals and sediments.

Nitrogen fertilizer has a vital role in increasing sweet sorghum production. Biofertilization of nitrogen is an important cultural practice for viable economic production and protecting the environmental components from pollution.

Sarig *et al* (1985) showed that inoculation of sorghum with *Azospirillum* increased stem diameter and developed root systems. Balasubramanian *et al* (1986) found no difference in yield between 60 kg N/ha with *A. brasilense* and 80 kg N/ha without inoculation. It was concluded that inoculation with *A. brasilense* could reduce the fertilizer requirements by 20 kg N/ha. Panwar *et al* (1990) showed that sorghum seed inoculation with *A. brasilense* increased growth and leaf area. Hussein (1992) noticed that inoculation of two sweet sorghum varieties with *A. brasilense* increased plant height, fresh stalk yield, juice extraction, T.S.S %, sucrose percentage and juice yield. Hassouna *et al* (1993) showed that inoculation with *Azospirillum* on sweet sorghum increased fresh weight of stalk and sucrose in the juice. Almodares *et al* (1996) revealed that sucrose content and purity were the highest when 100 kg N/ha was applied. Higher nitrogen rates increased stalk yield but decreased purity. Taha *et al* (1999) stated that plant height, stalk diameter, stalk yield, brix percentage, juice yield and syrup yield increased with increasing nitrogen rates. Ihtisham and Jan (2001) stated that all nitrogen levels positively affected leaf area, stem thickness and plant height. Nanda *et al* (2001) cleared that N fertilizer with *Azotobacter* gave sorghum yield more than with *Azospirillum* and no fertilizer. Moreover, they found that 60 kg N/ha +Azospirillum inoculation increased forage yield by 11.10 % compared to 80 kg N/ha. Eskander (2003) showed that stalk height, stalk weight, leaf area and juice yield were significantly affected by nitrogen fertilizer while stalk diameter was not affected. El-Zeny (2004) found that inoculation with *Bacillus polymyxa* on sweet sorghum increased plant height, leaf area, stripped stalks yield, juice extraction percentage and juice yield. Increasing nitrogen levels from zero up to 90 kg N/ha also significantly increased plant height, stalk diameter, leaf area, stripped stalks yield, juice extraction, juice yield, sucrose percentage and purity percentage. Saleh (2004) found that yield and yield components as well as juice quality were significantly increased by application of 100 kg N/fed or 75 kg N/fed with *Azotobacter* or *Azospirillum* inoculation, respectively. El-Shafai, *et al.* (2005) recorded significant differences in stalk height, stalk diameter, stripped stalks as affected by the applied mineral and/or bio-N fertilizers. Applying 60 kg N/fed was enough to obtain the highest percentages of total soluble solids and sucrose. Inoculating seeds of Honey variety with Nitrobin + 60 kg N/fed gave the highest purity %. The highest stripped stalk yield/fed was produced by inoculating seeds with Nitrobin + 80 kg N/fed. Ismail *et al* (2005) reported that application of 90 kg N/fed increased leaf area index, stalk height and diameter, stalk yield, sucrose and purity percentages. The aim of this investigation is to assess the response of sweet sorghum to mineral nitrogen and biofertilizers.

MATERIALS AND METHODS

Two field experiments were conducted during 2001 and 2002 seasons at Agricultural Research Station Sabaheia, Alexandria Governorate to study the effect of mineral and biofertilizers of nitrogen and their interaction on growth, juice quality and yield of sweet sorghum (*Sorghum bicolor* L. Moench). The physical and chemical analyses of the soil of the experimental site are given in Table 1.

Table 1. Physical and chemical soil characteristics of the experimental field.

Season	Physical properties				Chemical properties				
	Clay	Silt	Sand	Texture	E.C. m.mhos (cm)	Organic matter%	CaCO3 %	Total N %	pH
2001	45.63	40.80	13.57	Clay loam	2.40	1.08	17.85	0.06	8.20
2002	47.12	42.24	10.62	Clay loam	2.61	2.44	14.64	1.24	7.84

Chemical properties										
Season	Cations (meq/L)				Anions (meq/L)					
	Ca++	Mg++	Na+	K+	CO3--	HCO3-	Cl-	SO4--	P (ppm)	
2001	13.80	5.63	19.4	1.45	0.0	2.13	22.3	13.35	1.70	
2002	12.21	8.90	14.3	1.20	0.0	4.24	17.0	11.50	3.55	

Sweet sorghum variety Collier was sown on 9 May and 10 June in 2001 and 2002 seasons, respectively. Split plot design with four replications was used. Each trial included 9 treatments represented the combination between three levels of mineral fertilizer (40, 60 and 80 kg N/fed in the form of Urea (46 % N) which arranged at random in the main plots while three levels of biofertilizers (Cerealin) of 0, 800 and 1600 g cerealin/fed were allocated in the sub plots. Sweet sorghum seeds were inoculated by biofertilizer in a shadow place pre-planting and immediately sown and irrigated. The biofertilizer used was a mixture of growth promoting N fixing bacteria of *Azotobacter*, *Azospirillum* and *Klubsiella*, registered under the name of cerealin and was provided by the Biofertilization Unit, Soil, Water and Environment Research Institute, Agricultural Research Center. Plot area was 10.50 square meters (3.5 in length, 3 m in width with 5 ridges, 60 cm apart and 25 cm between plants. The first and the fifth ridges were left as borders. Phosphorus fertilizer at 15.5 kg P_2O_5 /fed was added during land preparation in the form of calcuim super phosphate. Potassium fertilizer in the form of potassium sulphate (48 % K_2O) was applied at 48 kg K_2O /fed. Potassium and nitrogen fertilizers were applied in two equal doses, one before the first irrigation at about 21 days from planting and the other before the second irrigation at about 35 days from planting. Sweet sorghum harvesting was performed at 112 days from planting (dough ripening stage). The following data were recorded:

Growth, yield and juice technological characters were determined from the three middle ridges. Sample size was 10 plants/plot.

Plant height (cm), stalk diameter (cm), leaf area (cm^2) according to Montogomery (1911), stalk yield (tons/fed), juice yield (tons/fed), juice extraction % which estimated from the formula: Juice extraction % = [(juice yield/stalk yield) x 100], total soluble solids (TSS%), sucrose %, purity % which estimated from the formula: purity% = [(sucrose % / TSS %) x100].

Data were subjected to statistical analysis according to the method as described by Snedecor and Cochran (1981). Using LSD test at level 5 % of significance to compared the treatment means.

RESULTS AND DISCUSSION

1. Plant height (cm):

Data presented in Table (2) showed that plant height was significantly increased by increasing N from 40 to 60 and 80 kg /fed in 2002 season. The increase was 5.64 and 13.93 % compared with the application of 40 kg N/fed. The increase in plant height might be due to the role of nitrogen in stimulating the meristematic activity and cell elongation of plants. These results coincide with the findings of **Taha *et al* (1999), Ihtisham and Jan (2001), Eskander (2003), El-Zeny (2004) and El-Shafai, *et al.* (2005).**

Table 2. Effect of nitrogen and cerealin levels on plant height (cm) during 2001and 2002 seasons.

Nitrogen level (kg N/fed)	Cerealin level (g/fed)							
	2001 season				2002 season			
	0	800	1600	Mean	0	800	1600	Mean
40	187.31	195.61	199.43	194.12	190.04	179.87	190.20	186.70
60	194.91	201,73	209.74	202.33	192.44	195.21	204.04	197.23
80	199.68	208.12	211.46	206.42	200.55	208.23	207.16	205.31
Mean	193.97	201.87	206.88	200.95	194.34	194.44	200.47	196.42

LSD	2001	2002
N level (N)	N.S	8.71
Cerealin (C)	N.S	6.28
Nx C	N.S	N.S

Cerealin fertilization levels increased plant height in 2002 season. Plant height was 194.30, 194.10 and 200.47 cm due to the application of 0, 800 and 1600 g cerealin/fed, respectively. This result was insignificant when cerealin was applied at 800 g/fed while adding cerialin at the rate of 1600 g/fed gave a significant increase by 3.15 % compared with control (untreated). Increasing plant height may be attributed to the role of biofertilizer in N- fixation in soil, which increases vegetative growth. This result is in agreement with those reported by Hussein (1992) and El-Zeny (2004).

The interaction effect between nitrogen and cerealin fertilizer was not significant with regard to the plant height in both seasons.

2. Stalk diameter (cm):

Data presented in Table 3 showed that nitrogen fertilizer significantly increased stalk diameter in the second season only. The stalk diameter was increased by 2.97 and 5.47 % when N fertilizer was increased from 40 to 60 and 80 kg N/fed, respectively. This result is mainly due to the role of nitrogen fertilizer in stimulating the meristematic growth activity of cells. Similar findings were obtained by Taha *et al* (1999), Eskander (2003), Ismail *et al* (2005) and El-Shafai, *et al.* (2005).

Regarding to cerealin fertilizer effect, it is noticed that stalk diameter was significantly affected by cerealin in both seasons. Stalk diameter was 2.21, 2.34 and 2.45 cm for 0, 800 and 1600 g cerealin/fed, respectively, in the 1st season, corresponding to, 2.10, 2.20 and 2.27 cm/plant in the 2nd season, respectively. These results produced increases 5.73 and 10.71% in the 1st season, corresponding, 4.75 and 8.08% in the 2nd season, respectively. The gradually increasing of this trait due to increase meristematic activity of inoculated plants and consequently increased stalk diameter. This result is in harmony with those obtained by Sarig *et al* (1985) and Hussein (1992).

The results revealed that there was no effect for the interaction between nitrogen fertilizer and cerealin in both seasons.

Table 3. Effect of nitrogen and cerealin levels on stalk diameter (cm)(g/m^2) during 2001and 2002 seasons.

Nitrogen level (kg N/fed)	Cerealin level (g/fed)							
	2001 season				2002 season			
	0	800	1600	Mean	0	800	1600	Mean
40	2.11	2.23	2.32	2.22	2.04	2.14	2.22	2.13
60	2.23	2.35	2.48	2.35	2.10	2.21	2.28	2.20
80	2.29	2.43	2.54	2.42	2.17	2.26	2.32	2.25
Mean	2.21	2.34	2.45	2.33	2.10	2.20	2.27	2.19
LSD								
N level (N)				N.S				0.01
Cerealin (C)				0.18				0.02
Nx C				N.S				N.S

3. Leaf area per plant (cm^2):

Table 4 indicated that there were significant differences among nitrogen levels in the leaf area/plant in both season. In 2001 season, the leaf area/plant was 654.11, 685.00 and 715.11 cm^2 for the application of 40, 60 and 80 kg N/fed, respectively. In the second season, the increase in leaf area was 29.28 and 45.30 cm^2/plant, respectively, when N levels were increased up to 60 and 80 kg N/fed. This result reflects the important role of nitrogen in building photosynthetic area of sweet sorghum plants. Similar results were obtained by Eskander (2003), El-Zeny (2004) and Ismail *et al* (2005).

Regarding cerealin application, the leaf area/plant was significantly increased by increasing cerealin from 800 up to 1600 g/fed in both seasons. The increases were 135.19 and 53.72 cm^2 in the 1st and 2nd seasons, respectively. This result may be attributed to biological action of bacteria in producing metabolites that could be useful to soil and plants for better performance. This result is in agreement with those obtained by Panwar *et al* (1990), Hussein (1992) and El-Zeny (2004).

Interaction nitrogen x cerealin fertilizers was significant in the 1st season where the treatment 80 kg N/fed with 1600 g cerealin recorded the highest leaf area (815.61 cm^2) compared with the other interactions.

Table 4. Effect of nitrogen and cereal in levels on leaf area (cm^2) during 2001and 2002 seasons.

Nitrogen level (kg N/fed)	Cerealin level (g/fed)							
	2001 season				2002 season			
	0	800	1600	Mean	0	800	1600	Mean
40	521.66	720.33	720.33	654.11	528.46	734.81	798.66	687.31
60	681.53	594.76	778.72	685.00	571.50	767.97	810.30	716.59
80	735.73	594.00	815.61	715.11	586.00	778.43	833.40	732.61
Mean	646.31	636.36	771.55	684.74	561.99	760.40	814.12	712.17
LSD								
N level (N)				31.78				23.03
Cerealin (C)				22.34				43.62
Nx C				38.71				N.S

4. Stalk yield (tons/fed):

Results in Table 5 revealed that the application of nitrogen fertilizer at the rates of 40, 60 and 80 kg N/fed increased significantly stalk yield of sweet sorghum during 2001 and 2002 seasons. The increase in stalk yield was 5.46 and 8.47 % in the 1st season, corresponding to 7.67 and 8.30 % in the 2nd season, respectively, as N rates increased from 40 kg N/fed up to 60 and 80 kg N/fed. This result confirms the favorable impact of nitrogen on green meristematic regions and their active growth. Also, nitrogen plays an important role in synthesis, distributing and accumulating the important substances responsible for growth and reflected greatly on stalk components, i.e. stalk height, stalk diameter and leaf area as mentioned before. This result is in harmony with those obtained by Taha *et al* (1999), Eskander (2003), El-Zeny (2004), Ismail *et al* (2005) and El-Shafai, *et al* (2005).

Concerning cerealin fertilizer, results revealed that cerealin application at the rates of 800 and 1600 g /fed significantly increased stalk yield of sweet sorghum by 1.55 and 2.6 tons/fed (12.84 and 21.59 %) in 2001 season as well as 1.37 and 2.75 tons/fed (11.98 and 23.97 %) in 2002 season as compared with the control. These results demonstrated clearly that the stalk yield of sweet sorghum plants responded to cerealin fertilizer. This result may be due to that biofertilizer enrich the nutrient status of roots zone and consequently favors root absorption of elements plant growth and accumulation in stripped stalks of inoculated sweet sorghum plants and hence increased height, diameter of stalks and therefore improved their stalks yield /fed. Similar results were obtained by Hussein (1992) and El-Zeny (2004).

Interaction of nitrogen fertilizer x cerealin affected significantly stalk yield in the first season only. The highest stalk yield (15.29 tons/fed) was obtained by adding 80 kg N/fed +1600 g cerealin/fed while application 40 kg N/fed with non biofertilizer recorded the lowest stalk yield (11.64 tons/fed).

Table 5. Effect of nitrogen and cerealin levels on stalk yield (tons/fed) during 2001and 2002 seasons.

Nitrogen level (kg N/fed)	Cerealin level (g/fed)							
	2001 season				2002 season			
	0	800	1600	Mean	0	800	1600	Mean
40	11.64	13.00	13.85	12.83	10.85	12.37	13.42	12.21
60	12.12	13.68	14.79	13.53	11.67	13.20	14.58	13.15
80	12.37	14.09	15.29	13.92	11.94	13.02	14.72	13.23
Mean	12.04	13.59	14.64	13.43	11.49	12.86	14.24	12.86
LSD								
N level (N)				0.25				0.04
Cerealin (C)				0.12				0.09
Nx C				0.23				N.S

5. Juice yield (tons/fed):

Data presented in Table 6 showed significant differences among nitrogen levels in juice yield in both seasons. Juice yield were (3.74, 4.03 and 4.12 tons/fed) and (3.36, 3.70 and 3.81 tons/fed) by the application of 40, 60 and 80 kg N/fed, in 2001 and 2002 seasons, respectively. This increase may be due to the direct effect of nitrogen on the vegetative growth of plants and photosynthesis activity as well as consequently increasing juice yields as the final product. This result is in harmony with those obtained by Taha *et al* (1999), Eskander (2003), El-Zeny (2004) and Ismail *et al* (2005).

Concerning the biofertilizer effect, it is noticed that increasing the rate of cerealin up to 1600 g/fed significantly increased juice yield in both seasons. The increase was 13.45 and 24.54 % in 1st season, corresponding to 13.13 and 23.99 % in 2nd season, respectively. This increase in juice yield may be due to the role of bioertilizer in N- fixation in soil, which increases vegetative growth, chemical contents as T.S.S % and sucrose % and consequently, the final product (juice yield). This result is in accordance with those reported by **Hussein (1992)** and **El-Zeny (2004).**

Statistical analyses showed that juice yield was significantly affected by the interaction between nitrogen and cerealin in the 1st season only. The highest juice yield (4.57 tons/fed) was obtained from the application of 1600 g cerealin/fed with 80 kg N/fed compared with the other interactions.

Table 6. Effect of nitrogen and cerealin levels on juice yield (tons/fed) during 2001and 2002 seasons.

Nitrogen level (kg N/fed)	Cerealin level (g/fed)							
	2001 season				2002 season			
	0	800	1600	Mean	0	800	1600	Mean
40	3.36	3.75	4.11	3.74	2.97	3.40	3.70	3.36
60	3.56	4.07	4.47	4.03	3.31	3.71	4.07	3.70
80	3.64	4.16	4.57	4.12	3.39	3.83	4.22	3.81
Mean	3.52	3.99	4.38	3.97	3.22	3.65	4.00	3.62

LSD	2001 season	2002 season
N level (N)	0.21	0.14
Cerealin (C)	0.07	0.15
Nx C	0.13	N.S

6. Juice extraction percentage:

Data presented in Table 7 indicated that juice extraction percent was significantly affected by increasing the rates of nitrogen fertilizer in the 2nd season only. Application of 80 kg N/fed surpassed by 1.34 and 0.43 % in juice extraction % more than application of 40 and 60 kg N/fed, respectively. This increase may be attributed to the important role of N in building up, photosynthesis process and water content in cell, which result in increasing juice extraction % in the plants. Similar results were recorded by Eskander (2003) and El-Zeny (2004).

Concerning cerealin levels, it is obvious from data presented that juice extraction percentage was not significantly differed in both seasons.

Interaction between nitrogen and cerealin fertilizers did not significantly affect juice extraction percentage in both seasons.

Table 7. Effect of nitrogen and cerealin levels on juice extraction% during 2001and 2002 seasons.

Nitrogen level (kg N/fed)	Cerealin level (g/fed)							
	2001 season				2002 season			
	0	800	1600	Mean	0	800	1600	Mean
40	27.91	27.19	25.98	27.03	26.87	27.13	26.99	27.00
60	28.62	29.02	29.80	29.15	27.66	28.04	28.02	27.91
80	28.80	28.81	29.29	28.97	29.72	26.99	28.30	28.34
Mean	28.44	28.34	28.36	28.38	28.08	27.39	27.77	27.75

LSD	2001	2002
N level (N)	N.S	0.81
Cerealin (C)	N.S	N.S
Nx C	N.S	N.S

7. Total soluble solids percentage (TSS %) :

Data presented in Table 8 indicated that nitrogen levels exhibited a significant effect on total soluble solids percentage in both seasons. Increasing nitrogen fertilizer level from 40 up to 60 kg N/fed increased significantly TSS % in sweet sorghum juice by 0.85 and 1.93 in the 1st and 2nd seasons, respectively. Further increase in nitrogen fertilizer level from 60 up to 80 kg N/fed increased TSS % by 0.62 and 0.36 in 1st and 2nd seasons, respectively, but these increases were insignificant. This result might be explained by the direct effect of nitrogen in increasing photosynthesis activity and subsequently carbohydrate synthesis and its accumulation which is reflected on the total soluble solids. This result is similar to those obtained by Almodares (1996), Taha *et al* (1999), Eskander (2003), El-Zeny (2004) and El-Shafai, *et al* (2005). .

Table 8. Effect of nitrogen and cerealin levels on total soluble solids percentage during 2001and 2002 seasons.

Nitrogen level (kg N/fed)	Cerealin level (g/fed)							
	2001 season				2002 season			
	0	800	1600	Mean	0	800	1600	Mean
40	14.95	15.17	15.40	15.17	13.25	12.55	13.50	13.10
60	15.75	16.09	16.22	16.02	14.63	14.88	15.57	15.03
80	16.28	16.64	17.00	16.64	15.06	15.41	15.71	15.39
Mean	15.66	15.97	16.21	15.94	14.31	14.28	14.93	14.51

LSD	2001	2002
N level (N)	0.69	0.63
Cerealin (C)	0.48	N.S
Nx C	N.S	0.99

In regard to cerealin levels, Data showed that cerealin significantly affected T.S.S % in the 1st season only. Application 1600 g /fed recorded high value of T.S.S (16.21 %) compared to the other two levels of cerealin. This increase may be due to the role of bioertilizer in increasing available nutrients for growth of plants and subsequently increasing juice quality. These results are in a accordance with those reported by Hussein (1992) and El-Zeny (2004).

Interaction nitrogen x cerealin fertilizers significantly affected total soluble solids in the second season only. The highest T.S.S %. (15.71) was obtained by the application of 80 kg N/fed + 1600 g cerealin/fed.

8. Sucrose percentage:

Results in Table 9 revealed that nitrogen fertilizer levels had significant effects on sweet sorghum plants with respect to sucrose percentage in both seasons. Increasing nitrogen levels from 40 up to 60 kg N/fed increased significantly sucrose percentage by 1.0 and 0.65 in the 1st and 2nd seasons, respectively. Otherwise, when N levels increased up to 80 kg N/fed, the increases were insignificant where recorded 0.22 and 0.33. In the beginning, the increase may be attributed to the role of nitrogen in vegetative growth of sorghum plants where it improves the photosynthesis efficiency and increased the amount of synthesized metabolites by plant and consequently improve the quantity and quality traits such as TSS and purity, then decreased by increasing N level where the increase in N fertilizer help to accumulate alpha amino nitrogen and impurities in plant which decrease juice quality. Similar results were obtained by Almodares *et al* (1996), Taha *et al* (1999), Eskander (2003), El-Zeny (2004), Ismail *et al* (2005) and El-Shafai, *et al* (2005).

Concerning cerealin effect, results revealed that increasing cerealin levels up to 1600 g/fed increased significantly sucrose percentage in sorghum juice in both seasons. Application of 1600 g cerealin/fed gave the highest value of sucrose (8.06 and 7.47 %). The increases were 0.63 and 0.31 in the 1st season and 1.19 and 0.41 in the 2nd seasons, respectively compared with untreated and 800 g cerealin/fed. This result is similar to those obtained by Hussein (1992) and Hassouna *et al* (1993).

Interaction of nitrogen x cerealin affected significantly sucrose percentage in both seasons. Application of 80 kg N/fed with 1600 g cerealin/fed gave 8.79 and 7.91 % of sucrose in 1st and 2nd seasons, respectively while application of nitrogen at the rate of 40 kg N/fed with non biofertilizer recorded the lowest sucrose % (6.80 and 5.73 %) in the 1st and 2nd seasons, respectively. These results revealed the importance of mineral and biofertilizers of nitrogen for juice quality of plants.

Table 9. Effect of nitrogen and cerealin levels on sucrose percentage during 2001and 2002 seasons.

Nitrogen level (kg N/fed)	Cerealin level (g/fed)							
	2001 season				2002 season			
	0	800	1600	Mean	0	800	1600	Mean
40	6.80	7.01	7.21	7.01	5.73	6.48	6.97	6.39
60	7.59	8.26	8.19	8.01	6.60	6.98	7.53	7.04
80	7.90	7.99	8.79	8.23	6.50	7.71	7.91	7.37
Mean	7.43	7.75	8.06	7.75	6.28	7.06	7.47	6.93

LSD		
N level (N)	0.24	0.40
Cerealin (C)	0.08	0.37
Nx C	0.16	0.64

9. Purity percentage:

The results in Table 10 revealed that nitrogen levels exhibited a significant effect on purity percentage in the 2nd season only. Increasing N levels up to 80 kg/fed decreased purity %. Otherwise, The highest purity 46.44 percentage was obtained by the application of 40 kg N/fed. This result may be attributed to the decrease of total soluble solids in juice. Generally, the purity behaves the inverse effect with TSS % in juice. This result agreed with those reported by Almodares *et al* (1996), Eskander (2003) and Ismail *et al* (2005).

Also, it is clear from Table 10 that the purity percentage was significantly increased by increasing cerealin rates from 0 to 1600 g/fed. Application of 1600 g cerealin/fed increased purity percentage of stalk juice by about 1.74 and 2.37 in the 1st season, corresponding 6.44 and 1.93 in the 2nd season higher than 0 and 800 g cerealin/fed, respectively. These results coincide with those obtained by Hussein (1992) and El-Zeny (2004).

Regarding the interaction effect, results indicated that the interaction between nitrogen fertilizer x cerealin for purity percentage was significant in both seasons. Application of 1600 g cerealin/fed with 80 and 40 kg N/fed in the 1st and 2nd seasons gave the highest purity percentage compared with the other interactions.

Table 10. Effect of nitrogen and cerealin levels on purity percentage during 2001and 2002 seasons.

Nitrogen level (kg N/fed)	Cerealin level (g/fed)							
	2001 season				2002 season			
	0	800	1600	Mean	0	800	1600	Mean
40	45.14	45.44	46.21	45.60	41.02	48.41	49.89	46.44
60	47.66	48.81	48.50	48.32	41.11	45.72	44.77	43.87
80	48.04	44.71	51.35	48.03	41.59	43.12	48.38	44.36
Mean	46.95	46.32	48.69	47.32	41.24	45.75	47.68	44.89

LSD	2001	2002
N level (N)	N.S	1.12
Cerealin (C)	1.15	1.66
Nx C	0.25	2.88

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استجابة الذرة السكرية للتسميد النتروجينى المعدنى والحيوى

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أقيمت تجربتان حقليتان بمحطة البحوث الزراعية بالصباحية بالأسكندرية موسمى ٢٠٠١ و ٢٠٠٢ لدراسة تأثير التسميد بالنتروجينى المعدنى (يوريا ٤٦% نتروجين) والسريالين على محصول الذره السكرية وقد استخدم تصميم القطع المنشقة فى أربعة مكررات. إشتملت التجربة على ثلاث مستويات من التسميد النتروجينى المعدنى فى القطع الرئيسية (٤٠، ٦٠ و ٨٠ كجم ن/فدان) وثلاث مستويات من السريالين (بدون تلقيح، ٨٠٠ و ١٦٠٠ جم/فدان) وضعت فى القطع الشقية.

أوضحت النتائج استجابة صفات طول و مساحة الأوراق للنبات و محصول السيقان ومحصول العصير والنسبة المئوية لكلا من المواد الصلبة الكلية الذائبة والسكروز بالعصير معنوياً بمعاملات التسميد النتروجينى المعدنى فى الموسمين بينما تأثرت صفات طول و قطر النبات والنسبة المئوية لكلا من استخلاص العصير و النقاوة فى الموسم الثانى وقد سجلت أعلى القيم لهذه الصفات من المعاملة ٨٠ كجم نتروجين/فدان.

تأثرت صفات قطر ومساحة الأوراق ومحصول السيقان و محصول العصير والنسبة المئوية للسكروز والنسبة المئوية للنقاوة معنوياً بمستويات السريالين فى الموسمين بينما تأثرت صفة النسبة المئوية للمواد الصلبة الكلية الذائبة بالعصير فى الموسم الأول وطول النبات فى الموسم الثانى فقط وكانت أعلى قيمة فى تلك الصفات من استخدام مستوى ١٦٠٠ جم سريالين للفدان.

كان التفاعل بين التسميد النتروجينى و السريالين معنوياً على صفات النسبة المئوية للسكروز والنقاوة فى الموسمين بينما تأثرت صفات مساحة الأوراق ومحصول السيقان ومحصول العصير فى الموسم الأول وقد سجلت أعلى القيم لهذه الصفات من المعاملة ٨٠ كجم نتروجين + ١٦٠٠ جم سريالين للفدان.

يوصى هذا البحث باستخدام التسميد النتروجينى بمعدل ٨٠ كجم ن/فدان و/أو ١٦٠٠ جم سيريالين/فدان للحصول على أعلى محصول سيقان.