EFFECT OF LEVELS, DOSES OF NITROGEN FERTILIZER AND SEEDING RATES ON YIELD AND QUALITY OF SUGARCANE

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ABSTRACT

Two field experiments were conducted at Shandaweel Agricultural Research Station, Sohag Governorate, Egypt (latitude of 26 61° N, longitude of 31 52° E and altitude of 72 m above sea level) in 2016/2017 and 2017/2018 seasons to assess the effect of levels and number of doses of nitrogen fertilizer as well as seed rates on yield and quality of sugarcane. This work included 27 treatments, represent the combinations among three rates of seeds [1.0, 1.5 and 2.0 rows of 3-budded cane cuttings (25200, 37800 and 50400 buds/fed)], three levels of N (180, 210 and 240 kg N/fed), and three N doses (each N level was split and applied as 2, 3 and 4 equal doses). The sugarcane cultivar namely G. 2004-27 (Giza-4) was used as a planting material. A randomized complete block design (RCBD) was used a split-split plot arrangement and replicated three times. The main-plots were devoted for seed rates, N levels were randomly applied in the sub plots, while number of N doses were distributed in the sub-sub plots, in both seasons.

The results revealed that seed rates had a significant effect on all studied traits of sugarcane at harvest time. Planting sugarcane using 2.0 rows of cuttings (50400 buds/fed) improved millable cane height, number of millable canes/fed, cane and sugar yields/fed, while significant improvements in millable cane diameter, millable cane weight, brix%, sucrose% and sugar recovery% was recorded in case of growing sugarcane using 1.0 row (25200 buds/fed), in both seasons.

Increasing N fertilizer level to 240 kg N/fed resulted a significant increase in millable cane height, diameter, millable cane weight, number of millable canes/fed, cane and sugar yields/fed, while the application of 210 kg N/fed led to a significant increase in brix, sucrose and sugar recovery percentages, in both seasons.

The results indicated that increasing the number of N doses from 2 to 4 had significant positive effects on millable cane height, diameter, millable cane weight, number of millable canes/fed, cane and sugar yields/fed, along with brix, sucrose, and sugar recovery percentages, in both seasons.

Under conditions of this work, it was found that growing Giza-4 sugarcane variety using 2.0 rows of cane setts (50400 buds/fed) with add 240 kg N/fed into 4-doses can be recommended to get the maximum cane and sugar yields.

INTRODUCTION

Sugarcane G. 2004-27 (Giza-4) variety is a newly registered one. So, finding out the recommendation package required for growing it becomes of paramount importance to get the its highest cane and sugar yield. Among the agricultural treatments, this work will begin with studying the appropriate seed rate as well as levels and number of doses of nitrogen fertilizer.

Many researchers in Egypt and most countries of the world showed that cane yield increase with increasing seeding rate, probably due to the maximum utilization of growth factors as solar radiation, water and nutrients by an optimal number of cane plants, which will reflected in more photosynthesis and dry matter accumulation in cane stalks. In this respect, **Ismail, *et al.* (2008)** indicated that growing sugarcane using 50400 buds/fed gave the highest number of millable canes, stalk height, brix, sucrose, sugar recovery, cane and sugar yields/fed compared to 25200 and/or 37800 buds/fed. **Hasan, *et al.* (2009)** found that stalk height, diameter, brix, sucrose, sugar recovery, cane and sugar yields/fed differed significantly, as a result of planting sugarcane using 1.5, 2.0 and 2.5 rows of cane cuttings/fed. **Shalaby, *et al.* (2011)** showed that planting sugarcane with 50400 buds/fed recorded higher values of stalk height, sucrose, sugar recovery, millable canes/fed, cane and sugar yields/fed, while using 37800 buds/fed resulted in higher stalk diameter and brix. **El-Geddawy, *et al.* (2015)** reported that drilling two rows of sugarcane setts attained significantly the highest values of stalk length, diameter, number of millable canes/fed, brix, sucrose, cane and sugar yields/fed. **Bekheet and Abd El-Aziz (2016)** indicated that increasing seeds rate from 1.5 to 2.0 drills produced significant increases in stalk height, diameter, number of millable canes, brix, sucrose, cane and sugar yields/fed. **Makhlouf, *et al.* (2016)** found that planting sugarcane by 37800 buds/fed produced higher stalk diameter and stalk fresh weight, while planting it by 50400 buds/fed attained the highest brix, sugar recovery, number of millable canes/fed, cane and sugar yields/fed.

It is well known as a fact that nitrogen is an essential nutrient in building up plant organs. Concerning nitrogen fertilization levels, **Osman, *et al.* (2010)** found that increasing N levels to 240 kg N/fed recorded the highest stalk length, diameter, number of millable canes, brix%, cane and sugar yields/fed, while sucrose% and sugar recovery% decreased significantly. **El-Gedawwy, *et al.* (2012)** found that increasing N levels to 230 kg N/fed produced the highest stalk height, diameter, stalk fresh weight, number of millable canes, brix, sucrose, sugar recovery, cane and sugar yields/fed. **Bekheet and Abd El-Aziz (2016)** showed that raising N level to 220 kg N/fed resulted in increases in stalk height, diameter, number of millable canes/fed, cane and sugar yields/fed. **Makhlouf, *et al*. (2016)** cleared that increasing N levels up to 240 kg N/fed led to significant increases in stalk length, diameter, stalk fresh weight, number of millable canes/fed, cane and sugar yields/fed.

Increasing the number of N-doses given for sugarcane plants could positively affect cane and sugar yields, where splitting the amount of nitrogen fertilizer decreases its leaching beyond root zone, especially when flooding irrigation is used, hence increasing N utilization by cane plants. In this connection, **Pannerselvam and Durai (2004)** and **Nigade, *et al*. (2006)** ~~they~~ found that applying nitrogen in four splits improved growth and yield attributes resulting in higher cane yield compared to three doses. **Mokadem, *et al.* (2008)** indicated that increasing number of N-doses attained increases in stalk length, diameter, number of

millable canes/fed, sugar recovery%, cane and sugar yields/fed. **Wubale and Girma (2018)** studied dividing the applied N levels into three equal doses (15, 75 and 150 days after planting); two equal doses (75 and 150 days after planting) and a single dose to every N level at 150 days after planting. They found that the highest length, stalk diameter and cane yield were attained by adding 195 kg N/ha split into three equal doses.

The aim of the present work was to find out the appropriate seed rate as well as levels and number of doses of nitrogen fertilizer required for growing sugarcane G. 2004-27 (Giza-4) variety to get the highest cane and sugar yields/fed.

MATERIALS AND METHODS

Two field experiments were conducted at Shandaweel Agricultural Research Station, Sohag Governorate, Egypt (latitude of 26 61° N, longitude of 31 52° E and altitude of 72 m above sea level) in 2016/2017 and 2017/2018 seasons to assess the effect of levels and number of doses of nitrogen fertilizer as well as seed rates on yield and quality of sugarcane. This work included 27 treatments, represent the combinations among three rates of seeds [1.0, 1.5 and 2.0 rows of 3-budded cane cuttings (25200, 37800 and 50400 buds/fed)], three levels of N (180, 210 and 240 kg N/fed), and three N doses (each N level was split and applied as 2, 3 and 4 equal doses, which were given after 60, 90, 120 and 150 days from planting, respectively). The sugarcane cultivar namely G. 2004-27 (Giza-4) was used as a planting material. A randomized complete block design (RCBD) was used a split-split plot arrangement and replicated three times. The main-plots were devoted for seed rates, N levels were randomly applied in the sub plots, while number of N doses were distributed in the sub-sub plots, in both seasons.

Each plot area was 35 m^2 with 5 rows of 7 meters in length and 1.0 meter apart. Sugarcane was planted in the last week of February and harvested after 12 months, in both seasons. Phosphorus fertilizer as calcium super phosphate (15% P_2O_5) was added once during seed bed preparation at the rate 30 kg P_2O_5/fed. Potassium fertilizer was added once as potassium sulfate (48% K_2O) with the 2^{nd} dose of N fertilizer at the rate of 48 kg K_2O/fed.

Chemical and mechanical properties of the experimental soil are presented in Table (1).

The recorded data:

The following data were recorded at harvest:

1. Millable cane highest (cm). 2. Millable cane diameter (cm).
3. Millable cane weight (kg).

A sample of 20 millable canes from each treatment was taken at random, cleaned and crushed to extract the juice, which was analyzed to determine the following quality traits:

1. Brix% (total soluble solids of juice) was determined using "Brix Hydrometer" according to the method described by "The Chemical Control Lab" of Sugar and Integrated Industries Company **(Anonymous, 1981)**.
2. Sucrose% was determined using "Sacharemeter" according to **A.O.A.C. (2005)**.
3. Sugar recovery% was calculated as follows:

Sugar recovery % = [sucrose % - 0.4 (brix % - sucrose %) × 0.73]. Where B = Brix reading, S = Sucrose percentage, 0.4 and 0.73 constants. **Yadav and Sharma (1980).**

Table (1): Chemical and mechanical properties of the upper 40-cm of the experimental soil

Season		**2016/2017**	**2017/2018**
Mechanical analysis	**Sand%**	56.34	59.20
	Silt	28.44	24.30
	Clay	15.22	16.50
Soil texture		**Sandy loam**	**Sandy loam**
Chemical analysis	**N Available (ppm)**	0.20	0.24
	$CaCO_3$%	1.20	1.47
	CO_3 Meq/100g	0	0
	H CO_3 Meq/100g	0.30	0.33
	CL^- Meq/100g	0.89	0.89
	$SO_4^=$ Meq/100g	1.02	1.13
	Ca^{++} Meq/100g	0.53	0.54
	Mg^{++} Meq/100g	0.27	0.35
	Na^+ Meq/100g	1.25	1.31
	K^+ Meq/100g	0.16	0.15
	EC(ds/m) (1:5)	0.24	0.26
	pH	7.5	7.3

The harvested sugarcanes of the middle three rows of each experimental unit were cut, topped, cleaned up from trash and weighed and counted to estimate the following traits:

1. Number of millable canes/fed. 2. Cane yield/fed (tone).
3. Sugar yield/fed (ton), which was estimated according to the following equation: Sugar yield/fed (ton) = cane yield/fed (ton) x sugar recovery%/100.

Statistical analysis:

The collected data were statistically analyzed according to **Gomez and Gomez (1984)** using the computer "MSTAT-c" statistical analysis package described by **Freed, *et al.* (1989)**. The least significant differences (LSD) at 0.05

level of probability were calculated to compare the differences among means of treatments.

RESULTS AND DISCUSSION

1. Millable cane height:

Data in Table (2) showed that the used seed rates significantly affected millable cane height, in both seasons. Planting sugarcane using 2.0 rows of cane cuttings (50400 buds/fed) increased millable cane height by 14.03 and 3.60 cm, compared to that planted with 1.0 and 1.5 drills of 3-budded setts (25200 and 37800 buds/fed, respectively), in the 1st one, corresponding to 15.02 and 4.50 cm, in the 2nd one. These results may be due to that increasing seed rate resulted in an increase in plants population density, causing mutual shading among plants, and hence directed plants to search for solar radiation **(Chang, 1974)**. Similar results were given by **Shalaby*, et al.* (2011); El-Geddawy*, et al*. (2015)** and **Bekheet and Abd El-Aziz (2016).**

Increasing N level given to cane plants to 210 and 240 kg N/fed led to a significant increase in millable cane height reached (11.79 and 20.67 cm) and (9.80 and 19.73 cm), compared to those provided with 180 kg N/fed, in the 1st and 2nd season, respectively (Table 2). The increase in cane height may be attributed to the role of nitrogen as an essential element in building-up plant organs and enhancing their growth. These results are similar to those obtained by **El-Gedawwy, *et al.* (2012); Bekheet and Rania (2016)** and **Makhlouf *et al.* (2016).**

Data in the same table revealed that millable cane height was gradually and significantly increased with increasing number of N-doses from 2 to 4 in both seasons. These results may be referred to that increasing the splitting of N-level guaranteed the availability of nitrogen required by cane plants and decreased its loss by leaching by the surface irrigation beyond root system, which ensured better nutrition and positively reflected in better growth appearance. Similar trends were reported by **Pannerselvam and Durai (2004); Nigade*et, al*. (2006); Mokadem, *et al.* (2008)** and **Wubale and Girma (2018)**.

Millable cane height was significantly influenced by the interactions between the studied factors except for that between seed rate and number of N-doses in the 1st season and that of N levels x number of N-doses in the 2nd one (Table 2). Planting sugarcane by 2.0 rows with the application of 240 kg N/fed, divided into 4 doses, resulted in the longest millable cane, in the 1st and 2nd seasons.

2. Millable cane diameter:

Data in Table (3) indicated that reducing the used planting material to 1.0 row of cane cuttings (25200 buds/fed) significantly resulted in producing the thickest millable cane diameter, in both seasons, compared to those obtained in case of planting with 1.5 and 2.0 rows of cane setts (37800 and 50400 buds/fed, successively), in both seasons. These results may be attributed to the lower inter-plant competition among plants for light and nutrients, as well as little mutual shading in case of planting with the lowest seeding rate, which

resulted in the lowest plant population, in comparison to the other higher seed rates. These results are in harmony with those reported by **Shalaby, *et al.* (2011)** and **Makhlouf, *et al.* (2016)**.

Millable cane diameter increased significantly when N level was raised from 180 up to 240 kg N/fed given to cane plants in the 1st and 2nd seasons (Table 3). These results may be attributed to the role of N element in building-up plant organs and enhancing plant growth. These results are in agreement with those reported by **Osman, *et al.* (2010); El-Gedawwy, *et al.* (2012); Bekheet and Abd El-Aziz (2016)** and **Makhlouf, *et al.* (2016)**.

Table (2): Effect of seed rates, nitrogen levels, number of N doses and their interactions on millable cane height (cm) in 2016/2017 and 2017/2018 seasons

Seed rate/fed (A)	N level, kg N/fed (B)	2016/2017				2017/2018			
		Number of N doses (C)			Mean	Number of N doses (C)			Mean
		2 doses	3 doses	4 doses		2 doses	3 doses	4 doses	
1.0 Row (25200 buds)	180	299.37	301.93	305.70	**302.33**	296.63	300.60	303.53	**300.26**
	210	307.70	314.13	316.87	**312.90**	305.67	308.07	311.30	**308.34**
	240	317.50	321.57	324.80	**321.29**	312.87	315.63	317.47	**315.99**
Mean		**308.19**	**312.54**	**315.79**	**312.17**	**305.06**	**308.10**	**311.43**	**308.20**
1.5 row (37800 buds)	180	307.37	311.87	315.83	**311.69**	305.03	308.53	311.73	**308.43**
	210	319.37	323.90	328.60	**323.96**	316.10	318.10	322.33	**318.84**
	240	329.43	331.17	335.87	**332.16**	325.17	324.43	333.07	**328.89**
Mean		**318.72**	**322.31**	**326.77**	**322.60**	**315.43**	**318.36**	**322.38**	**318.72**
2.0 rows (50400 buds)	180	309.57	313.93	318.40	**313.97**	308.80	311.33	315.60	**311.91**
	210	322.63	326.43	330.43	**326.50**	318.57	322.50	327.40	**322.82**
	240	334.83	337.97	341.57	**338.12**	331.07	334.39	338.73	**334.91**
Mean		**322.34**	**326.11**	**330.13**	**326.20**	**319.48**	**322.92**	**327.24**	**323.22**
Average of N-levels	180	305.43	309.24	313.31	**309.33**	303.49	306.82	310.29	**306.87**
	210	316.57	321.49	325.30	**321.12**	313.44	316.22	320.34	**316.67**
	240	327.26	330.23	334.08	**330.52**	323.03	326.33	330.42	**326.60**
Mean of N doses		**316.42**	**320.32**	**324.23**		**313.32**	**316.46**	**320.35**	
LSD at 0.5 level for:									
Seed rate A			**1.80**	**A x C**	**NS**	**A**	**0.49**	**A x C**	**0.60**
Nitrogen level B			**0.63**	**B x C**	**0.75**	**B**	**0.77**	**B x C**	**NS**
N-dose number C			**0.43**	**Ax BxC**	**1.36**	**C**	**0.35**	**AxBxC**	**1.04**
A x B			**1.09**			**A x B**	**1.34**		

Data in Table (3) revealed that millable cane diameter was gradually increased with increasing number of N-doses from 2 to 4 doses in both seasons. These results may be referred to that, more splitting of N-level led to increase the availability of nitrogen as structural element for cane plants for longer time and decrease its loss by leaching as a result of using flooding irrigation, which ensures better nutrition and reflected in better growth performance. Similar trends were reported by **Mokadem, *et al.* (2008)** and **Wubale and Girma (2018)**.

Millable cane diameter was significantly affected by the interactions between the studied factors in in both seasons (Table 3), except that of seed rate x N levels in the 1st and 2nd seasons. The highest millable cane thickness was obtained when sugarcane was planted using 1.0 row of 3-budded cuttings with the addition of 240 kg N/fed divided into 4 doses, in both seasons.

Table (3): Effect of seed rates, nitrogen levels, number of N doses and their interactions on millable cane diameter (cm) in 2016/2017 and 2017/2018 seasons

Seed rate/fed (A)	N level, kg N/fed (B)	2016/2017				2017/2018			
		Number of N doses (C)			Mean	Number of N doses (C)			Mean
		2 doses	3 doses	4 doses		2 doses	3 doses	4 doses	
1.0 row (25200 buds)	180	2.51	2.53	2.55	**2.53**	2.47	2.49	2.51	**2.49**
	210	2.56	2.57	2.60	**2.58**	2.53	2.55	2.57	**2.55**
	240	2.61	2.63	2.65	**2.63**	2.59	2.61	2.63	**2.61**
Mean		**2.56**	**2.58**	**2.60**	**2.58**	**2.53**	**2.55**	**2.57**	**2.55**
1.5 row (37800 buds)	180	2.49	2.51	2.53	**2.51**	2.45	2.47	2.49	**2.47**
	210	2.55	2.56	2.58	**2.56**	2.51	2.53	2.55	**2.53**
	240	2.59	2.61	2.62	**2.60**	2.57	2.59	2.61	**2.59**
Mean		**2.54**	**2.56**	**2.58**	**2.56**	**2.51**	**2.53**	**2.55**	**2.53**
2.0 rows (50400 buds)	180	2.46	2.49	2.51	**2.48**	2.45	2.46	2.48	**2.46**
	210	2.52	2.54	2.55	**2.54**	2.49	2.51	2.53	**2.51**
	240	2.57	2.58	2.59	**2.58**	2.54	2.55	2.59	**2.56**
Mean		**2.52**	**2.54**	**2.55**	**2.53**	**2.49**	**2.51**	**2.53**	**2.51**
Average of N-levels	180	2.48	2.51	2.53	**2.51**	2.46	2.48	2.50	**2.48**
	210	2.54	2.56	2.58	**2.56**	2.51	2.53	2.55	**2.53**
	240	2.59	2.61	2.62	**2.61**	2.56	2.58	2.61	**2.59**
Mean of N doses		**2.54**	**2.56**	**2.58**		**2.51**	**2.53**	**2.55**	
LSD at 0.5 level for:									
Seed rate	**A**		**0.004**	**A x C**	**0.009**	**A**	**0.008**	**A x C**	**0.012**
Nitrogen level	**B**		**0.005**	**B x C**	**0.009**	**B**	**0.009**	**B x C**	**0.012**
N-dose number	**C**		**0.005**	**AxBxC**	**0.015**	**C**	**0.005**	**AxBxC**	**0.015**
A x B			**NS**			**A x B**	**NS**		

3. Millable cane fresh weight:

Data in Table (4) illustrate that reducing the used planting material to 1.0 row of cane cuttings (25200 buds/fed) significantly increased millable cane fresh weight, compared to those obtained in case of planting with 1.5 and 2.0 rows of cane setts (37800 and 50400 buds/fed, successively), in both seasons. These results may be referred to the lower competition among plants for growth factors as sun light, water and nutrients, grown under conditions of the lowest seed rate, which resulted in the thickest cane stalks (Table 2), compared to higher plant populations, emerged

in case of using higher seed rates.The results are in conformity with those of **Makhlouf, *et al.* (2016)**.

Millable cane weight increased significantly when N level was raised from 180 up to 240 kg N/fed in the 1st and 2nd seasons (Table 4). These results may be attributed to the role of N element in building-up plant organs and enhancing plant growth. These results are in agreement with those reported by **El-Gedawwy, *et al.* (2012)** and **Makhlouf, *et al.* (2016)**.

Data in Table (4) pointed out that millable cane weight was gradually and markedly increased with increasing number of N-doses from 2 to 3 and 4 doses, in both seasons. These results may be referred to that, more splitting of N-level led to increase the availability of nitrogen as structural element for cane plants for longer time and decrease its loss by leaching, which contributed to better growth performance. Similar trends were reported by **Mokadem, *et al.* (2008)** and **Wubale and Girma (2018)**.

Millable cane weight was significantly affected by the interactions between the studied factors in both seasons. Planting sugarcane using 1.0 row of 3-budded cane cuttings with the addition of 240 kg N/fed, divided into 4-doses gave the highest millable cane weight, in the 1st and 2nd season.

3. Brix percentage:

Data in Table (5) revealed that decreasing seed rate to 1.0 row of cane cuttings (25200 buds/fed) used in sugarcane planting significantly increased brix% compared to that planted with 1.5 or 2.0 drills of setts (37800 and 50400 buds/fed, respectively), in the 1st and 2nd seasons. These results may be due to the great competition among plants for light and nutrients as well as mutual shading compared in case of using high rate of seeds for planting. Solar radiation has an effect on brix% and sucrose% **(Chang, 1974)**. These results are in agreement with those mentioned by **Hasan, *et al.* (2009)** and **Shalaby, *et al.* (2011)**.

Data in Table (5) showed that increasing N fertilizer from 180 up to 210 kg N/fed significantly improved in brix%, thereafter, it decreased with raising nitrogen fertilization level to 240 kg N/fed, in both seasons. These results may indicate that 210 kg N/fed was the best dose recording the highest total soluble solids in cane juice, while the highest N-level may directed cane plants for more vegetative growth rather than dry matter accumulation. These results are in line with those mentioned by **Osman, *et al.* (2010)** and **El-Gedawwy, *et al.* (2012)**.

Table (4): Effect of seed rates, nitrogen levels, number of N doses and their interactions on millable cane weight (kg) in 2016/2017 and 2017/2018 seasons

Seed rate/fed (A)	N level, kg N/fed (B)	2016/2017				2017/2018			
		Number of N doses (C)			Mean	Number of N doses (C)			Mean
		2 doses	3 doses	4 doses		2 doses	3 doses	4 doses	
1.0 row (25200 buds)	**180**	1.337	1.347	1.363	**1.349**	1.348	1.361	1.368	**1.359**
	210	1.367	1.392	1.403	**1.387**	1.385	1.399	1.413	**1.399**
	240	1.418	1.425	1.436	**1.426**	1.431	1.440	1.453	**1.441**
Mean		**1.374**	**1.388**	**1.401**	**1.388**	**1.388**	**1.400**	**1.411**	**1.400**
1.5 row (37800 buds)	**180**	1.326	1.340	1.345	**1.337**	1.334	1.342	1.353	**1.343**
	210	1.358	1.369	1.389	**1.372**	1.358	1.370	1.382	**1.370**
	240	1.403	1.413	1.416	**1.411**	1.403	1.410	1.419	**1.411**
Mean		**1.363**	**1.374**	**1.383**	**1.373**	**1.365**	**1.374**	**1.385**	**1.375**
2.0 rows (50400 buds)	**180**	1.308	1.316	1.329	**1.318**	1.316	1.325	1.341	**1.327**
	210	1.342	1.351	1.364	**1.352**	1.345	1.361	1.365	**1.357**
	240	1.377	1.387	1.398	**1.388**	1.386	1.396	1.406	**1.396**
Mean		**1.342**	**1.352**	**1.364**	**1.353**	**1.349**	**1.361**	**1.371**	**1.360**
Average of N-levels	**180**	1.324	1.335	1.346	**1.350**	1.332	1.343	1.354	**1.343**
	210	1.356	1.370	1.385	**1.371**	1.363	1.376	1.387	**1.375**
	240	1.399	1.409	1.417	**1.408**	1.407	1.415	1.426	**1.416**
Mean of N doses		**1.360**	**1.371**	**1.383**		**1.367**	**1.378**	**1.389**	
LSD at 0.5 level for:									
Seed rate	**A**	**0.002**	**A x C**	**0.001**		**A**	**0.002**	**A x C**	**0.001**
Nitrogen level	**B**	**0.001**	**B x C**	**0.001**		**B**	**0.001**	**B x C**	**0.001**
N-dose number	**C**	**0.001**	**AxBxC**	**0.003**		**C**	**0.001**	**AxBxC**	**0.002**
A x B		**0.002**				**A x B**	**0.001**		

Table (5): Effect of seed rates, nitrogen levels, number of N doses and their interactions on brix% in 2016/2017 and 2017/2018 seasons

Seed rate/fed (A)	N level, kg N/fed (B)	2016/2017				2017/2018			
		Number of N doses (C)			Mean	Number of N doses (C)			Mean
		2 doses	3 doses	4 doses		2 doses	3 doses	4 doses	
1.0 row (25200 buds)	180	20.48	20.74	21.04	**20.76**	19.93	20.23	20.54	**20.23**
	210	21.39	21.51	21.62	**21.51**	21.03	21.29	21.47	**21.27**
	240	20.93	21.26	21.44	**21.21**	20.82	21.06	21.28	**21.05**
Mean		**20.93**	**21.17**	**21.37**	**21.16**	**20.53**	**20.86**	**21.10**	**20.85**
1.5 row (37800 buds)	180	20.40	20.64	20.98	**20.67**	19.79	20.17	20.45	**20.14**
	210	21.22	21.35	21.48	**21.35**	20.85	21.13	21.36	**21.11**
	240	20.82	21.13	21.31	**21.09**	20.62	20.88	21.08	**20.86**
Mean		**20.82**	**21.04**	**21.26**	**21.04**	**20.42**	**20.73**	**20.96**	**20.70**
2.0 rows (50400 buds)	180	20.18	20.41	20.65	**20.41**	19.56	19.91	20.18	**19.88**
	210	21.21	21.28	21.39	**21.30**	20.64	20.88	21.14	**20.89**
	240	20.79	21.08	21.22	**21.03**	20.53	20.69	20.94	**20.72**
Mean		**20.73**	**20.92**	**21.09**	**20.91**	**20.24**	**20.49**	**20.75**	**20.50**
Average of N-levels	180	20.35	20.60	20.89	**20.61**	19.76	20.10	20.39	**20.08**
	210	21.27	21.38	21.50	**21.39**	20.84	21.10	21.33	**21.09**
	240	20.85	21.16	21.33	**21.11**	20.65	20.88	21.10	**20.88**
Mean of N doses		**20.83**	**21.05**	**21.24**		**20.42**	**20.69**	**20.94**	
LSD at 0.5 level for:									
Seeds rate A			**0.07**	**A x C**	**NS**	**A**	**0.07**	**A x C**	**NS**
Nitrogen levels B			**0.05**	**B x C**	**0.05**	**B**	**0.04**	**B x C**	**0.03**
Number of N doses C			**0.03**	**AxBxC**	**0.09**	**C**	**0.02**	**AxBxC**	**NS**
A x B			**0.09**			**A x B**	**NS**		

Data in Tables (5) cleared that increasing the number of N-doses to 4-doses resulted in a significant increase in brix%, in both seasons. This result may be due to that increasing the splitting of N-level led to availability of nitrogen as an essential element used by cane plants and contributed to better growth and efficient dry matter accumulation. Similar results were reported by **Mokadem*, et al.* (2008)**.

Brix% was insignificantly affected by the interactions between the studied factors except that of seed rate x N level in the 1st season; seed rate x number of N dose, in both seasons as well as the 2nd order interaction between the three factors, in the 2nd season. The highest brix% was recorded by planting sugarcane using 1.0 row of 3-budded cane setts and adding 210 kg N/fed into 4-doses.

4. Sucrose%:

Data in Table (6) showed that decreasing seed rate to 1.0 row of cane cuttings (25200 buds/fed) used in sugarcane planting significantly increased sucrose % compared to that planted with 1.5 or 2.0 drills of setts (37800 and 50400 buds/fed,

respectively), in the 1st and 2nd seasons. These results are line with that shown by **Hasan, *et al.* (2009)**.

Data in Table (6) showed that increasing N fertilizer from 180 up to 210 kg N/fed significantly improved in sucrose%, thereafter, it decreased with raising nitrogen fertilization level to 240 kg N/fed, in both seasons. These results may indicate that 210 kg N/fed was the best dose recording the highest sucrose in cane juice, while the highest N-level may directed cane plants for more vegetative growth rather than dry matter accumulation. These results are in line with those mentioned by **Mokadem, *et al*. (2008)** and **El-Gedawwy, *et al.* (2012).**

Data in Tables (6) clear that increasing the number of N-doses from 2 to 4 resulted a significant increase in sucrose% in both seasons. This result is similar to that of brix% (Tables 5). This result may be due to that increasing the splitting of N-level led to availability of nitrogen as an essential element to better growth and increase sucrose accumulation. Similar results were reported by **Mokadem, *et al.* (2008).**

Sucrose% was significantly affected by the interactions between the studied factors except that of seed rate x number of N dose in the 1st season; seed rate x N level in the 2nd season. The highest sucrose% was recorded by planting sugarcane using 1.0 row of 3-budded cane setts and adding 210 kg N/fed into 4-doses in both seasons.

5. Sugar recovery%:

Data in Tables (7) revealed that decreasing seed rate to 1.0 row of cane cuttings (25200 buds/fed) used in sugarcane planting significantly increased sugar recovery% compared to that planted with 1.5 or 2.0 drills of setts (37800 and 50400 buds/fed, respectively), in the 1st and 2nd seasons. Increasing in brix% and sucrose% (Tables 5 and 6) resulted in increased sugar recovery%. These results are in agreement with those mentioned by **Hasan, *et al.* (2009).**

Table (6): Effect of seed rates, nitrogen levels, number of N doses and their interactions on sucrose% in 2016/2017 and 2017/2018 seasons

Seed rate/fed (A)	N level, kg N/fed (B)	2016/2017				2017/2018			
		Number of N doses (C)			Mean	Number of N doses (C)			Mean
		2 doses	3 doses	4 doses		2 doses	3 doses	4 doses	
1.0 Row (25200 buds)	180	17.49	17.75	17.97	**17.74**	17.07	17.40	17.66	**17.38**
	210	18.49	18.71	18.83	**18.67**	18.06	18.30	18.56	**18.31**
	240	17.94	18.35	18.69	**18.33**	17.99	18.10	18.32	**18.14**
Mean		**17.97**	**18.27**	**18.50**	**18.25**	**17.71**	**17.93**	**18.18**	**17.94**
1.5 row (37800 buds)	180	17.37	17.63	17.85	**17.62**	16.84	17.33	17.73	**17.31**
	210	18.36	18.56	18.65	**18.52**	17.94	18.19	18.41	**18.18**
	240	17.86	18.14	18.53	**18.18**	17.80	18.00	18.18	**18.00**
Mean		**17.86**	**18.11**	**18.34**	**18.11**	**17.53**	**17.84**	**18.11**	**17.83**
2.0 rows (50400 buds)	180	17.21	17.46	17.67	**17.45**	16.65	17.14	17.55	**17.11**
	210	18.29	18.48	18.47	**18.41**	17.83	18.02	18.28	**18.04**
	240	17.75	18.07	18.39	**18.07**	17.69	17.81	18.09	**17.87**
Mean		**17.75**	**18.00**	**18.18**	**17.98**	**17.39**	**17.66**	**17.97**	**17.67**
Average of N-levels	180	17.36	17.61	17.83	**17.60**	16.86	17.29	17.65	**17.27**
	210	18.38	18.58	18.65	**18.54**	17.94	18.17	18.42	**18.18**
	240	17.85	18.19	18.53	**18.19**	18.83	17.97	18.20	**18.00**
Mean of N doses		**17.86**	**18.13**	**18.40**		**17.54**	**17.81**	**18.09**	
LSD at 0.5 level for:									
Seeds rate A			**0.07**	**A x C**	**NS**	**A**	**0.07**	**A x C**	**0.03**
Nitrogen levels B			**0.07**	**B x C**	**0.06**	**B**	**0.03**	**B x C**	**0.03**
Number of N doses C			**0.03**	**AxBxC**	**0.10**	**C**	**0.02**	**AxBxC**	**0.05**
A x B			**0.11**			**A x B**	**NS**		

Data in Table (7) showed that increasing N fertilizer from 180 up to 210 kg N/fed significantly improved in sugar recovery%, thereafter, it decreased with raising nitrogen fertilization level to 240 kg N/fed, in both seasons. This result is similar to that of brix and sucrose% (Tables 5 and 6), where it is known that sugar recovery% depends mainly on sucrose content. Similar results were given by **El-Gedawwy, *et al.* (2012).**

Data in Tables (7) cleared that increasing the number of N- doses to 4-doses for cane plants resulted significant increase in sugar recovery% in both seasons. The increase sugar recovery% due to increase in brix% and sucrose% (Tables 5 and 6). Similar results were reported by **Mokadem, *et al.* (2008).**

Sugar recovery% was significantly affected by the interactions between the studied factors except that the 2nd order interaction between the three factors, in the 1st season; seed rate x N levels in the 2nd season (Table 7). The highest sugar recovery% was recorded by planting sugarcane using 1.0 row of 3-budded cane setts and adding 210 kg N/fed into 4-doses.

Table (7): Effect of seed rates, nitrogen levels, number of N doses and their interactions on sugar recovery% in 2016/2017 and 2017/2018 seasons

Seed rate/fed (A)	N level, kg N/fed (B)	2016/2017				2017/2018			
		Number of N doses (C)			Mean	Number of N doses (C)			Mean
		2 doses	3 doses	4 doses		2 doses	3 doses	4 doses	
1.0 row (25200 buds)	**180**	11.22	11.40	11.50	**11.37**	11.01	11.24	11.40	**11.21**
	210	11.96	12.17	12.24	**12.12**	11.61	11.77	12.00	**11.80**
	240	11.53	11.86	12.18	**11.86**	11.66	11.66	11.81	**11.71**
Mean		**11.57**	**11.81**	**11.97**	**11.78**	**11.42**	**11.56**	**11.74**	**11.57**
1.5 row (37800 buds)	**180**	11.33	11.30	11.38	**11.34**	10.79	11.20	11.55	**11.18**
	210	11.89	12.08	12.12	**12.03**	11.57	11.73	11.88	**11.73**
	240	11.84	11.67	12.06	**11.74**	11.54	11.64	11.75	**11.64**
Mean		**11.57**	**11.68**	**11.85**	**11.70**	**11.30**	**11.52**	**11.73**	**11.52**
2.0 rows (50400 buds)	**180**	11.04	11.22	11.34	**11.21**	10.69	11.10	11.47	**11.09**
	210	11.80	12.01	11.93	**11.91**	11.56	11.66	11.84	**11.69**
	240	11.37	11.60	11.93	**11.64**	11.45	11.51	11.72	**11.56**
Mean		**11.41**	**11.61**	**11.74**	**11.74**	**11.23**	**11.42**	**11.68**	**11.44**
Average of N-levels	**180**	11.20	11.31	11.41	**11.30**	10.83	11.18	11.47	**11.16**
	210	11.88	12.01	12.10	**12.02**	11.58	11.72	11.91	**11.74**
	240	11.46	11.71	12.06	**11.74**	11.55	11.60	11.76	**11.64**
Mean of N doses		**11.51**	**11.70**	**11.85**		**11.32**	**11.50**	**11.71**	
LSD at 0.5 level for:									
Seeds rate A			**0.06**	**A x C**	**0.08**	**A**	**0.05**	**A x C**	**0.03**
Nitrogen levels B			**0.09**	**B x C**	**0.08**	**B**	**0.02**	**B x C**	**0.03**
Number of N doses C			**0.05**	**AxBxC**	**NS**	**C**	**0.02**	**AxBxC**	**0.05**
A x B			**0.14**			**A x B**	**NS**		

6. Number of millable canes/fed:

Data in Table (8) cleared that the used seed rates significantly affected number of millable canes/fed, in both seasons. Planting sugarcane using 2.0 rows of cane cuttings (50400 buds/fed) increased number of millable canes/fed by 4.429 and 2.244 thousand/fed, compared to that planted with 1.0 and 1.5 drills of setts (25200 and 37800 buds/fed, respectively), in the 1st season, being 4.877 and 2.086 thousand/fed in the 2nd one. The increase of number of millable cane/fed may be due to the increase in population of cane plants emerged and utilized the available growth factors as space, sun light, water and nutrients. These results are in harmony with those reported by **Ismail, *et al.* (2008); Shalaby, *et al.* (2011); El-Geddawy, *et al* (2015); Bekheet and Abd El-Aziz (2016)** and **Makhlouf, *et al.* (2016)**.

Significant increases of 0.825 and 1.585 millable canes/fed were gained by increasing the applied N levels to 210 and 240 kg N/fed the 1st season, respectively, compared with that recorded by applying 180 kg N/fed. Similarly, increases of 0.853

and 1.683 millable canes/fed were obtained, in the 2nd season (Table 8). These results are similar with those obtained by **Osman, *et al.* (2010)**; **El-Gedawwy, *et al.* (2012); Bekheet and Abd El-Aziz (2016)** and **Makhlouf, *et al.* (2016)**.

In the same table, it can be noticed that the number of millable canes/fed increased significantly with the increase in the number of N-doses from 2 to 4 doses, in both seasons. These results may be due to the fact that increasing fractionation of N level contributes to the continuous availability of N as an essential element for cane plants, ensuring better nourishment, especially at tillering stage, which positively reflected on the harvested millable canes. Similar trend was reported by **Mokadem, *et al*. (2008)**.

Number of millable canes/fed was significantly affected by the interactions between the studied factors in both seasons. Planting sugarcane by 2.0 rows with the addition of 240 kg N/fed, divided into 4-doses gave the highest number of millable canes/fed in the 1st and 2nd season.

Table (8): Effect of seed rates, nitrogen levels, number of N doses and their interactions on number of millable canes (thousand/fed) in 2016/2017 and 2017/2018 seasons

Seed rate/fed (A)	N level, kg N/fed (B)	2016/2017				2017/2018			
		Number of N doses (C)			Mean	Number of N doses (C)			Mean
		2 doses	3 doses	4 doses		2 doses	3 doses	4 doses	
1.0 row (25200 buds)	**180**	39.457	39.887	40.155	**39.833**	39.357	39.718	39.983	**39.686**
	210	40.543	40.880	41.183	**40.869**	40.248	40.587	40.940	**40.592**
	240	41.453	41.793	42.015	**41.754**	41.170	41.493	41.807	**41.490**
Mean		**40.484**	**40.853**	**41.118**	**40.819**	**40.258**	**40.599**	**40.910**	**40.589**
1.5 row (37800 buds)	**180**	42.397	42.620	42.860	**42.626**	42.310	42.573	42.877	**42.587**
	210	43.058	43.333	43.580	**43.324**	43.055	43.390	43.753	**43.399**
	240	43.772	43.943	44.190	**43.968**	43.970	44.140	44.350	**44.153**
Mean		**43.076**	**43.299**	**43.543**	**43.306**	**43.112**	**43.368**	**43.660**	**43.380**
2.0 rows (50400 buds)	**180**	44.243	44.577	44.800	**44.540**	44.320	44.652	44.910	**44.627**
	210	44.993	45.313	45.533	**45.280**	45.178	45.417	45.807	**45.467**
	240	45.780	46.000	46.317	**46.032**	46.083	46.297	46.533	**46.304**
Mean		**45.006**	**45.279**	**45.550**	**45.284**	**45.194**	**45.455**	**45.750**	**45.466**
Average of N-levels	**180**	42.032	42.361	42.605	**42.333**	41.996	42.314	42.590	**42.300**
	210	42.865	43.176	43.432	**43.158**	42.827	43.131	43.500	**43.153**
	240	43.668	43.912	44.174	**43.918**	43.741	43.977	44.230	**43.983**
Mean of N doses		**42.855**	**43.150**	**43.404**		**42.855**	**43.141**	**43.440**	
LSD at 0.5 level for:									
Seeds rate A			**0.031**	**A x C**	**0.028**	**A**	**0.019**	**A x C**	**0.024**
Nitrogen levels B			**0.023**	**B x C**	**0.028**	**B**	**0.015**	**B x C**	**0.024**
Number of N doses C			**0.016**	**AxBxC**	**0.049**	**C**	**0.014**	**AxBxC**	**0.042**
A x B			**0.039**			**A x B**	**0.026**		

7. Cane yield/fed:

Data in Table (9) showed that the used seed rates significantly affected cane yield /fed, in both seasons. Planting sugarcane using 2.0 rows of cane cuttings (50400 buds/fed) increased cane yield by 4.267 and 1.629 tons/fed, compared to that planted with 1.0 or 1.5 drills of setts (25200 and 37800 buds/fed, successively), in the 1st season, corresponding to 4.648 and 2.085 tons of canes/fed, in the 2nd one. These results could be due to the increase in number of millable canes/fed (Table 8). These results are in accordance with those reported by **Shalaby, *et al.* (2011); El-Geddawy, *et al.* (2015); Bekheet and Abd El-Aziz (2016)** and **Makhlouf, *et al.* (2016)**.

The results showed that N levels significantly affected cane yield (tons/fed), in both seasons. Increasing N levels to 240 kg N/fed increased cane yield by 5.223 and 2.635 tons/fed, compared with that obtained by adding 180 and 210 kg N/fed, in the 1st season, respectively, corresponding to 5.320 and 2.862 tons/fed, in the 2nd one (Table 9). These results are probably due to the increase in all of cane height, diameter and millable cane weight as well as number of millable canes/fed (Tables 2, 3, 4 and 8, respectively). These results are in a line with those reported **Osman, *et al.* (2010); El-Gedawwy, *et al.* (2012); Bekheet and Abd El-Aziz (2016)** and **Makhlouf, *et al*. (2016)**.

Increasing dividing the amount of N fertilizer up to 4-doses significantly increased cane yield /fed by (1.700 and 0.825 ton/fed) and (1.700 and 0.857 ton/fed), compared to applying it at 2 and/or 3 doses, in the 1st and 2nd season, successively. These results were probably attributed to the increase in all of cane height, diameter and millable cane weight as well as number of millable canes/fed (Tables 2, 3, 4 and 8, respectively). Similar trends were reported by **Pannerselvam and Durai (2004); Nigade, *et al*. (2006); Mokadem, *et al*. (2008)** and **Wubale and Girma (2018)**.

Cane yield was significantly affected by the interactions between the studied factors in both seasons (Table 9). The greatest cane yield/fed was obtained by planting sugarcane using 2.0 rows of 3-budded cane cuttings, and fertilizing sugarcane plants with 240 kg N/fed, divided into 4-equal doses, in both seasons.

4. Sugar yield/fed:

Data in Table (10) manifested that planting sugarcane using 2.0 rows of cane cuttings (50400 buds/fed) significantly increased sugar yield/fed by 0.386 and 0.124 ton/fed compared to that planted with 1.0 and 1.5 drills of setts (25200 and 37800 buds/fed, respectively), in the 1st season, corresponding to 0.461 and 0.194 ton/fed, in the 2nd one. The increase in sugar yield/fed was associated with the increase in cane yield/fed (Table 9), which is considered the main component of sugar yield. These results are in accordance with those reported by **Ismail, *et al.* (2008); Hasan, *et al.* (2009); Shalaby, *et al.* (2011); El-Geddawy, *et al.* (2015); Bekheet and Abd El-Aziz (2016)** and **Makhlouf, *et al.* (2016)**.

Sugar yield was significantly increased by 0.848 and 0.155 ton/fed in the 1st season, and 0.872 and 0.276 ton/fed, in the 2nd one, when sugarcane was fertilized with 240 kg N/fed, compared to that supplied with 180 and/or 210 kg N/fed, respectively (Table 10). These results were fairly attributed to the increase in cane yield/fed, which showed the same trend in response to the application of the highest N-level. Similar results were given by **Osman, *et al.* (2010); El-Gedawwy, *et al.* (2012); Bekheet and Abd El-Aziz (2016)** and **Makhlouf, *et al* (2016)**.

Sugar yield significantly and positively increased as the number of N-doses increased from 2 up to 4-doses, in both seasons (Table 10). These results can be attributed to the same tendency of cane yield/fed and sugar recovery% in response to increasing the fractioning of N level (Tables 7 and 9), where cane yield and sugar content is the corner stone in the produced sugar yields. Similar trends were reported by **Mokadem, *et al*. (2008)** and **Wubale and Girma (2018)**.

Sugar yield was significantly affected by the interactions between the studied factors in both seasons, except that between seeds rate and N levels and the 2nd order interaction in the 1st season (Table 10). The highest sugar production/fed was obtained by planting sugarcane variety *vz.* G.2003-47 (Giza 4) using 2.0 rows of 3-budded cane seeds and fertilizing it with 240 kg N/fed, divided into 4-equal doses, in both seasons.

CONCLUSION

Under conditions of this work, it was found that growing Giza-4 sugarcane variety using 2.0 rows of cane setts (50400 buds/fed), fertilized with 240 kg N/fed divided into 4-equal doses can be recommended to get the maximum cane and sugar yields/fed in Sohag.

Table (9): Effect of seed rates, nitrogen levels, number of N doses and their interactions on cane yield (ton/fed) in 2016/2017 and 2017/2018 seasons

Seed rate/fed (A)	N level, kg N/fed (B)	2016/2017				2017/2018			
		Number of N doses (C)			Mean	Number of N doses (C)			Mean
		2 doses	3 doses	4 doses		2 doses	3 doses	4 doses	
1.0 row (25200 buds)	180	49.781	50.749	51.720	**50.750**	50.088	51.091	51.712	**50.964**
	210	52.382	53.825	54.705	**53.638**	52.739	53.723	54.764	**53.742**
	240	55.672	56.435	57.168	**56.425**	55.840	56.625	57.610	**56.691**
Mean		**52.612**	**53.670**	**54.531**	**53.604**	**52.889**	**53.813**	**54.695**	**53.799**
1.5 row (37800 buds)	180	53.052	53.914	54.446	**53.804**	53.253	53.940	54.811	**54.001**
	210	55.258	56.059	57.264	**56.194**	55.225	56.190	57.186	**56.200**
	240	58.129	58.796	59.259	**58.728**	58.378	58.942	59.606	**58.975**
Mean		**55.480**	**56.256**	**56.990**	**56.242**	**55.619**	**56.357**	**57.201**	**56.392**
2.0 rows (50400 buds)	180	54.537	55.334	56.179	**55.350**	54.986	55.829	56.871	**55.896**
	210	57.007	57.820	58.692	**57.840**	57.376	58.391	59.106	**58.291**
	240	59.606	60.367	61.292	**60.422**	60.400	61.142	61.920	**61.154**
Mean		**57.050**	**57.841**	**58.721**	**57.871**	**57.588**	**58.454**	**59.299**	**58.447**
Average of N-levels	180	52.457	53.333	54.115	**53.302**	52.776	53.620	54.464	**53.620**
	210	54.882	55.901	56.887	**55.890**	55.113	56.101	57.019	**56.078**
	240	57.802	58.533	59.240	**58.525**	58.206	58.903	59.712	**58.940**
Mean of N doses		**55.047**	**55.922**	**56.747**		**55.365**	**56.208**	**57.065**	
LSD at 0.5 level for:									
Seed rate	A		**0.064**	A x C	**0.059**	A	**0.059**	A x C	**0.058**
Nitrogen level	B		**0.047**	B x C	**0.059**	B	**0.040**	B x C	**0.058**
N-dose number	C		**0.034**	AxBxC	**0.103**	C	**0.036**	AxBxC	**0.100**
	A x B		**0.082**			A x B	**0.069**		

Table (10): Effect of seed rates, nitrogen levels, number of N doses and their interactions on sugar yield/fed (ton) in 2016/2017 and 2017/2018 seasons

Seed rate/fed (A)	N level, kg N/fed (B)	2016/2017				2017/2018			
		Number of N doses (C)			Mean	Number of N doses (C)			Mean
		2 doses	3 doses	4 doses		2 doses	3 doses	4 doses	
1.0 row (25200 buds)	**180**	5.584	5.783	5.947	**5.771**	5.512	5.744	5.893	**5.716**
	210	6.262	6.551	6.696	**6.503**	6.124	6.325	6.573	**6.341**
	240	6.418	6.695	6.965	**6.693**	6.509	6.602	6.804	**6.638**
Mean		**6.088**	**6.343**	**6.536**	**6.322**	**6.048**	**6.224**	**6.423**	**6.232**
1.5 row (37800 buds)	**180**	6.013	6.090	6.198	**6.100**	5.747	6.040	6.330	**6.039**
	210	6.570	6.770	6.938	**6.759**	6.389	6.590	6.793	**6.591**
	240	6.676	6.861	7.145	**6.894**	6.735	6.860	7.003	**6.866**
Mean		**6.420**	**6.574**	**6.760**	**6.584**	**6.291**	**6.497**	**6.708**	**6.499**
2.0 rows (50400 buds)	**180**	6.023	6.210	6.375	**6.203**	5.880	6.195	6.524	**6.271**
	210	6.728	6.942	7.002	**6.890**	6.631	6.808	6.997	**6.467**
	240	6.778	7.004	7.313	**7.032**	6.914	7.036	7.254	**6.686**
Mean		**6.510**	**6.719**	**6.897**	**6.708**	**6.475**	**6.680**	**6.925**	**6.693**
Average of N-levels	**180**	5.873	6.028	6.173	**6.025**	5.713	5.993	6.249	**5.985**
	210	6.520	6.754	6.878	**6.718**	6.382	6.575	6.688	**6.581**
	240	6.624	6.853	7.141	**6.873**	6.719	6.833	7.020	**6.857**
Mean of N doses		**6.339**	**6.545**	**6.731**		**6.271**	**6.467**	**6.686**	
LSD at 0.5 level for:									
Seed rate	**A**		**0.031**	**A x C**	**0.046**	**A**	**0.023**	**A x C**	**0.019**
Nitrogen level	**B**		**0.041**	**B x C**	**0.046**	**B**	**0.014**	**B x C**	**0.019**
N-dose number	**C**		**0.027**	**AxBxC**	**NS**	**C**	**0.011**	**AxBxC**	**0.032**
	A x B		**NS**			**A x B**	**0.025**		

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تأثير مستويات وعدد جرعات السماد النيتروجينى ومعدلات التقاوى على حاصل وجودة قصب السكر

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أُجريت تجربتان حقليتان بمحطة البحوث الزراعية بشندويل بمحافظة سوهاج (دائرة عرض ٢٦.٣٣ درجة شمالاً وخط الطول ٣١.٤١ درجة شرقاً وإرتفاع ٧٢ متراً عن سطح البحر) فى موسمى ٢٠١٧/٢٠١٦ و ٢٠١٨/٢٠١٧ لدراسة تأثير مستويات وعدد جرعات السماد النيتروجيني ومُعدلات مختلفة من التقاوى على جودة وحاصل قصب السكر. إشتملت الدراسة على ٢٧ معاملة مثلت التوافقات بين ثلاثة معدلات من التقاوى هى ١ و١.٥ و ٢ صف من عُقل تحتوى الواحدة على ٣ براعم (٢٥٢٠٠ و ٣٧٨٠٠ و ٥٠٤٠٠ برعم/فدان) ، وثلاثة مستويات من السماد النيتروجيني (١٨٠ ، ٢١٠ و٢٤٠ كجم نيتروجين/فدان) وعدد جرعات التسميد (حيث قُسِمَ كل مستوى من النيتروجين إلى ٢ و٣ و٤ جرعات مُتساوية). استخدِم الصنف جيزة ٢٠٠٣-٢٧ (المُسمّى تجارياً جيزة-٤). نُفِّذت التجربة فى تصميم القطاعات كاملة العشوائية (بتوزيع القطع المنشقة مرتين) فى ثلاث مكررات ، حيث وضعت مُعدلات التقاوى فى القطع الرئيسية ، ومستويات النيتروجين فى القطع الشقية الأولى، بينما وزعت الجرعات عشوائياً فى القطع الشقية الثانية، فى كلا الموسمين .

أوضحت النتائج أن معدلات التقاوى أثرت معنوياً على كل الصفات المدروسة ، وأدت الزراعة بصفين من عقل التقاوى (٥٠٤٠٠ برعم/فدان) إلى زيادة معنوية فى إرتفاع العود وعدد العيدان القابلة للعصر/فدان وحاصلى العيدان والسكر/فدان ، في حين إنخفض قطر العود و النسبة المئوية لكلٍ من البركس والسكروز وناتج السكر بزيادة معدل التقاوى ، فى كلا الموسمين.

أدت زيادة مستوى السماد النيتروجينى إلى ٢٤٠ كجم نيتروجين/فدان إلى زيادة معنوية في كلٍ من إرتفاع وقطر العود وعدد العيدان القابلة للعصر/فدان وحاصلى العيدان والسكر/فدان ، بينما أعطى التسميد بإضافة ٢١٠ كجم نيتروجين/فدان زيادة معنوية فى النسبة المئوية لكلٍ من البركس والسكروز وناتج السكر ، في الموسمين.

أشارت النتائج أن زيادة عدد دفعات السماد الأزوتي من ٢ إلى ٤ جرعات أعطى زيادة ايجابية ومعنوية فى إرتفاع وقطر العود وعدد العيدان القابلة للعصير/فدان وحاصلى العيدان والسكر/فدان وكذلك النسبة المئوية لكلٍ من البركس والسكروز وناتج السكر فى الموسمين.

تحت ظروف هذا العمل يمكن التوصية بزراعة صنف القصب "جيزة ٤" بصفين من عقل التقاوى (٥٠٤٠٠ برعم/فدان) مُسمّداً بإضافة ٢٤٠ كجم نيتروجين/فدان مُقسَّمة على أربع جرعات مُتساوية للحصول على أعلى حاصل من القصب والسكر للفدان فى محافظة سوهاج.