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EFFECT OF NITROGEN FERTILIZATION ON YIELD AND YIELD COMPONENTS OF SUGAR CANE

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Abstract

The present work was conducted for two successive seasons, i.e. 1996 /1997 and 1997 /1998 in Shandaweel Research Station, Agricultural Research Center, Souhag Governorate. The aime of this study is to invistigate the effect of fertlization on yield and yield components of some sugar cane varieties.This experiment included 18 treatments which were the combination between two sugar cane varieties (G.T.54-9 and G.85-37) and the following nine fertilization treatments:

(180 kg N /fed.,120 kg N / fed., 60 kg N / fed., inoculation with *Azotobacter* +60 kg N /fed., inoculation with *Azotobacter* + 120 kg / fed., inoculation with *Azospirillum* + 60 kg/fed., inoculation with *Azospirillumm* +120 kg / fed., inoculation with azotobacter only and inoculation with *Azospirillum* only).

*- Sugar cane variety G.85-37 surpassed G.T.54-9 variety in respect to net cane yield . G.85-37 attained a distinct increment amounted to 19.18% and 6.5% over those of the commercial variety in the 1st and 2nd season, respectively.

*-There was a pronounced superiority in the values of net cane yield for the combination between any of the examined biofertilizer (*Azotobacter* and/or *Azospirillum*) with the middle dose of the mineral nitrogen 120 kg N over those resulted from biofertilizer or mineral nitrogen fertilizer alone, in the 1st season.

*- Sugar cane variety G.T.54-9 recorded the highest value of sugar recovery(S.R. %) in the 1st season (12.87 %). However,the difference between the two varieties in that respect was insignificant in the 2nd season.

*- The highest sugar recovery value (12.933%) was recorded by applying 180 kg N/fed. Similar result was obtained when sugar cane seed setts were inoculated by Azospirillum alone.

*- The promissing sugar cane variety G.85-37 significantly surpassed the commercial one in respect to sugar yield, in both seasons. The relative advantage in sugar yield for G.85-37 variety over that of G.T.54-9 variety amounted to be 13.843% and 5.658% in 1st and 2nd season, respectively.

*- Sugar yield was statistically affected by fertilization treatments. The highest values of sugar yield were gained when sugar cane seed setts were inoculated by *Azotobacter* and/or *Azospirillum* in addition to 120 kg N/fed.

INTRODUCTION

Sugar is considered to be a strategic and vital commedity. Sugar cane is the main crop for sugar production in Egypt. Its production increased from 672 thousand tons in 1979 to almost 1.325 million /tons in 1999. In spite of the vertical increase in sugar cane yield from 37 tons/fed. (1980) to 49.00 tons/fed. (1999). Efforts should be directed to improve yield and quality of sugar cane varieties and the environmental maintanance through decreasing the amount of mineral fertilizers application.

The long duration crops like sugar cane require high dose of nitrogen which represents 30 to 40percent of the total cost of cultural practices. Recently, nitrogen fixation by microbes in sugar cane fields has been established, which can meet effectively supplement the need of nitrogen and reduce the cost of production via, reducing doses of inorganic nitrogen fertilizers.

Macalintal and Urgel (1992), showed that Azospirillum inoculation seed pieces fertilized with 58.33 kg N/ha. gave the highest yields of cane and sugar. They added that nitrogen application and Azospirillum inoculation did not significantly affect rendement. Morever, they cleared that Azospirillum inoculated seed pieces could replace about 60 percent of required nitrogen fertilizer of Phil 7544 variety. Muthukumarasamy *et al.* (1994), cleared that cane growing rhizophere soils for first time in India. They found that when these bacteria were used as a biofertilizers for sugar cane with a 50 % reduction in N fertilizers, crop productivity increased by 5.7 t/acre. Azospirillum can tolerate pH 3.6 and is suited to a sugar rich environmental and it can also transfer more than 40 % of fixed nitrogen immediately to the surrounding plant tissue.. Durai and Ravichandran (1996), reported that sugar cane cvs. Co.6304 was inoculated with 7 kg of Azospirillum sp. along with 225 kg N/ha. They found that Azospirillum inoculation plots had the same cane yield as plots fertilized with 300 kg/ha. reuslting in a saving of 75 kg N/ha. Mehta *et al.* (1996), showed that sugar cane cvs. Co.6304 was given 0 to 250 kg N + 125 kg P + 125 kg K/ha. with or without setts inoculation with *Azotobacter or Azospirillum* or soils inoculation with *Pseudomonas*. They found that the

highest NPK rate+setts inoculation with Azotobacter gave the highest average cane yield of 89.3 t./ha. This was not significantly different from treatments receiving 187.5 kg N + 125 kg P + 125 kg K/ha. with setts inoculation with *Azotobacter* 83.3t. or *Azospirillum* 81.2t. Mitkees *et al.* (1996), noticed that biofertilization with a mixure of N2 fixing bacteria, *Azospirillum*, *Bacillus*, *Klebsiella* and *Azotobacter* under the name 'Azottin'.was added to the soil with different levels of mineral N2 fertilizer. They indicated that such biofertilizer could componsate considerable parts of mineral fertilizer it saves about 50 kg N/fed. in old land and about 40 kg N/fed. in new land, as about 2/3 and 1/3 of the recommended nitrogen in both types of soil respectively. Abo El-Ghait. (2000), found that applying 180 kg N/fed. significantly produced the highest sugar cane yield t./fed. at Shandaweel in the first season. Also, he noticed that application of either 180 kg N/fed 280 kg N/fed. at Shandaweel in Souhag governorate in both season or. at El-Mattana Station in Qena governorate in the first season, significantly produced the highest sugar yield/fed.

El-Geddawy *et al.* (1997), found that sugar cane varieties showed a significant effect on the number of millable cane and stalk yield at harvest. Sugar cane variety viz F.153 exhibited a significant superiority over the other two varieties as G.T.54-9 and G.74-96. Sugar cane variety G.T.54-9 recorded the highest cane yield followed by F.153 and G.74-96 varieties. However, sugar cane variety G.T.54-9 attained a superiority in sugar yield over the other two varieties. Ahmed (1998), showed that G.87-55 variety surpassed the other varieties. Also, G.85-37 variety was statistically superior than other varieties in the two plant crops, while, in the first ratoon crop, G.T.54-9 gave the highest net cane yield. On the other hand, G.85-37 variety recorded a significant increase in sugar yield of the two plant crops, as well as, in the first ratoon crop, G.85-37 gave the highest sugar yield. Moreover, he showed that number of millable cane/m^2 was significantly affected by sugar cane varieties in the two plant and first ratoon crops. The highest number of millable cane/m^2 at harvest was obtained from G.85-37 variety.

Abo El-Ghait (2000) found that sugar cane variety G.85-37 significantly produced the highest value of cane yield (t./fed.) in two locations for both seasons. The same variety showed a superiority in sugar yield over (G.T.54-9, G.84-47 and F. 153 varieties) were grown at Shandaweel in the frist season and at El-Mattana in both seasons.

The objective of this study was to find out the optimum nitrogen level which could be used with bacterial inoculation that would result in the highest and most economic yield of plant cane and sugar without any deleterious changes in juice quality.

MATERIALS AND METHODS

The present work was conducted for two successive seasons, i.e. 1996/1997 and 1997/1998 at Shandaweel Research Station, Agricultural Research Center, Souhag Governorate to invistigate the effect of biofertlizers on yield and yield components of two sugar cane varieties.Each experiment included 18 treatments which were the combination between Two sugar cane varieties (G.T.54-9 "the commercial variety" and G.85-37 "the new promising variety") and the following nine fertilization treatments:

(180 kg N /fed.,120 kg N / fed., 60 kg N / fed., inoculation with *Azotobacter* +60 kg N /fed., inoculation with *Azotobacter* +120 kg / fed., inoculation with *Azospirillum* +60 kg/fed., inoculation with *Azospirillumm* +120 kg / fed., inoculation with azotobacter only and inoculation with *Azospirillum* only).

-*Azotobacter chrooccocum* and *Azospirillum brasilense* were obtained from Soil, Water and Environmental Research Institute, Agricultural Research Center Giza.

Exprimental treatments were arranged in a complete randomized block design with four replications. Plot area was 42 m^2 containing six rows, 7m in length and 1m in width. planting dates were on the 3rd week of March in both seasons. At planting the seed setts were inoculated by the studied biofertilizer i.e *Azospirillum* Sp. and *Azotobacter*, using the recommended dose i.e 24 unit*/fed. (unit weight 400g). Concerning nitrogen fertilizer the studied doses were applied in two equal doses in form of Urea (46.5 % N). The 1st one after 60 days from planting and the 2nd one 30 days later. The recommended dose of potassium and phosphorus (30 kg P_2O_2 and 48 kg k_2O/ fed.) were added as the traditional practice used by sugar cane farmers.

Inoculation technique: According to plot area (42 m^2) relative to unit area (1 feddan = 4200 m^2), the biofertilizers (*Azotobacter and Azosprillum*) were weighted, mixed with soil of the experimental field and dressed on cane cuttings allocated in the furrows, thereafter, were covered by soil from next ridges. Irrigation took place immedi-

ately. The normal agricultural pratices needed for growing sugar cane plants were followed.

The following characters were estmated at harvest:

*- Number of millable cane /Fed.

*- Net cane yield (tons/fed).

At harvest the four gaurded rows were harvested topped, cleaned and weighed to estimate the yield (ton/fed).

*-Sugar recovery percentage (S. R.%)

*.-Sugar yield (tons / fed)

Sugar yield was calculated according to the following equation:

Sugar yield + Net cane yield (ton/fed.) x Sugar recovery %

Statistical analysis:

The collected data were subject to the proper statistical analysis of complete rondomized block design according to Snedecor and chocran (1981).

RESULTS AND DISCUSSION

1. Number of millable cane (1000/fed):

The collected results in Table (1) showed that the number of millable cane /fed. Was significantly affected by the two varieties. This result was true in the second season. Sugar cane variety G.85-37 recorded a superiority (58.268 plant/fed.) over G.T.54-9 variety in respect to number of millable cane/fed in the 2nd season only. Varietal effect on millable cane number has been reported by Ahmed (1998), who showed that the highest number of millable cane/m^2 at harvest was obtained from G.85-37 variety.

Data given in Table (1) cleared that fertilization treatments had a significant effect on the number of millable cane/fed. at harvest in both growing seasons. The highest value of this trait (50733 and 63053 plant /fed.) were obtained when sugar cane seed setts were inoculated by *Azospirillum* in addition to 120 kg N/fed. in the 1st and the 2nd seasons respectively. This treament gave a distinct increment in the values of

millable cane number at harvest amounted to be 23.0%, 13.0% and 4.4% in the 1st season and 25.7%, 11.8% and 4.8% in the second season when the fertilizer dose of nitrogen was 60, 120 and 180 kg N/fed. respectively. This result is in agreement with that of Arvind and Mohan (1990) who found that the application of 150 kg N through urea as a complete inorganic source (control) was at par with 75% N of recommended dose (112.5 kg N/ha) + soaking setts in *Azospirillum* or 75 % N coupled with soil of *Azospirillum*, as well as *Azotobacter* in respect of millable cane number.

Concerning the interaction effect on the number of millable cane/fed had no significant effect on this character in the two seasons. Regardless the significant effect of fertilization treatments, it is obviously shown that the most effective interaction on millable cane number was that inoculated seed setts of sugar cane G.85-37 variety by *Azospirillum* in addition to 120 kg N/fed.

2. Net cane yield (tons/fed):

The results obtained in Table (2) showed that the twosugar cane varieties exhibted a significant effect on net cane yield (ton /fed). This finding was true in both growing seasons. Sugar cane variety G.85-37 surpassed G.T.54-9 variety in respect to net cane yield. This result indicated that the new promissing variety G.85-37 attained a distinct increment amounted to be 19.18% (9.40 ton/fed) and 6.5% (4.01 tons/fed) over those of the commercial variety in the 1st and 2nd season, respectively.

Data presented in Table (2) showed obviously that there are a significant differences between the studied fertilization treatments in both seasons. It is also clear that there was a pronounced superiority in the values of net cane yield for the combination between any of the examined biofertilizer (*Azotobacter* and/or *Asospirillum*) with the middle dose (120 kg N) of the mineral source as nitrogen over those resulted from biofertilizer or mineral nitrogen fertilizer alone, in the 1st season.

Inoculating sugar cane seed setts by *Azospirillum* + 120 kg N/fed produced an increase in net cane yield amounted to 12.23% (6.88 ton/fed.) and 1.01% (0.7 ton/fed) compared with 180 kg N/fed. in the 1st and 2nd season., respectively. The above mentioned result indicated that the mean value of increment amounted to 3.8 ton/fed represent an additional net income for the grower amounted to 380 LE. This result is in

agreement with Macalintal and Urgel (1992) who finding that *Azospirillum* inoculation seed pieces fertilized with 58.33 kg N/ha gave the highest yield of cane. They mentioned that those yields were significantly higher than those obtained from seed pieces inoculated or not and unfertilized and uninoculated seed pieces fertilized with 175 kg N/ha. Morever, they cleared that *Azspirillum* inoculated seed pieces could replace about 60 percent of required nitogen fertilizer of Phil 7544 variety.

Once more, it could be noted that in spite of the insignificant influence of the interaction between fertilization treatments and the examined varieties that the pronounud effect of the combination between the used biofertilizer source (*Azotobacter* and /or *Azospirillum*) and the applied dose of 120 kg N/fed.and the promissing variety G.85-37 surpassed the different combinations.

3. Sugar recovery percentage (S. R.%):

Data given in Table (3) cleared that sugar recovery percentage (S. R. %) responded statisticaly by the examined varieties, this result was true in the 1st season only. Sugar cane variety G.T.54-9 recorded the highest value of S. R. % in the 1st season (12.87 %). However,the difference between the two varieties in respect to S. R. % was insignificant and negligible in 2nd season. On the contrary, Nassar (1996) found that G.85-37 variety had the highest sugar recovery percentage over G.T.54-9 and F.153 varieties.

The available data in Table (3) cleared that fertilizer treatments had a significant effect on sugar recovery percentage at harvest in the 1st season. The highest value (12.933%) was recorded by applying 180 kg N/fed. Similar result was obtained when sugar cane seed setts was inoculated by *Azospirillum* alone. This result is in agreement with that of Muthukumarasamy *et al.* (1994) who cleared that using bacteria as a biofertilizers for sugar cane with a 50% reduction in N fertilizer, showed that a marginal increase in sugar recovery.

The interaction effect between varieties and fertilization treatments on sugar recovery percentage was significant in the first season. The highest value of sugar recovery % (13.537 %) was recorded with applying 180 kg N/fed. alone with G.. 54 -9 variety.

4. Sugar yield (ton / fed):

The results obtained in Table (4) cleared that the promissing sugar cane G.85-37 variety significantly surpassed the commercial one in respect to sugar yield, in both growing seasons. The relative advantage in sugar yield for G.85-37 variety over that of G.T.54-9 variety is 13.843% and 5.658% in 1st and 2nd season respectively.This result is in agreement with that of Abd El-latif *et al.* (1993), who noticed that G.85-37 variety recorded the highest yield of cane and sugar in comparison with G.T.54-9 and /or G.68-88 varieties.

Concerning fertilization treatments the results obtained obviously showed that sugar yield wasstatistically affected by fertilization treatments. The highest values of sugar yield were abtained when sugar cane seed setts were inoculated by *Azotobacter* and/or *Azospirillum* in addition to 120 kg N/fed. This increment in sugar values in both seasons amounted to be 2.836%, 14.53% and 36.83% in the 1st season and 1.12%, 15.74% and 28.15% in the 2nd season, wheras the corresponding values were 10.47%, 23.04% and 46.99% in the 1st season and 1.5%, 15.74% and 20.06% in the 2nd season compared with fertilization by the mineral nitrogen by 180, 120 and 60 kg N/fed. The pronounced effect of both treatments (*Azotobacter* and/or *Azospirillum* in addition to 120 kg N/fed.) on sugar yield is due mainly to the distinct effect on stalk yield /fed. for both treatments (Table 2). This results is in agreement with that of Thakur and Singh (1996) who studied the effect of biofertilizers (*Azotobacter chroococcum and Azospirillum brasilense*) alone or with meniral fertilizer on sugar cane productivity. The results showed a significant increase in cane and sugar yields compared with nitrogen fertilizer alone at 35 and 70 kg N/ha. Morever, they noticed that the biofertilizers also had an important role in the utilization of N by sugar cane through higher biological N fixation and increasing the availability and uptake of N.

Regarding the interaction effects, the availabale data revealed that sugar yield of sugar cane plants were insignificantly affected by the different combination of the studied factors.

Table 1. Effect of fertilization treatments of mineral nitrogen and biofertilizer on number of millable cane (thousand/fad.) of two varieties of sugarcane at harvest.

Varieties / Fertilization	1996/1997 season			1997/1998 season		
	G.T. 54/9	G. 85/37	Average	G.T. 54/9	G. 85/37	Average
180 kg N/fed	47.400	49.800	48.600	60.413	59.907	60.160
120 kg N/fed	44.500	45.300	44.900	54.920	57.880	56.400
60 kg N/fed	41.500	41.000	41.250	48.520	51.800	50.160
Azotobacter + 60 kg N/fed	45.633	41.267	43.450	55.840	58.147	56.993
Azotobacter + 120 kg N/fed	49.993	49.567	49.780	58.393	64.227	61.560
Azospirillum + 60 kg N/fed	44.100	43.100	43.600	55.360	58.640	57.000
Azospirillum + 120 kg N/fed	50.000	51.467	50.733	59.653	66.453	63.053
Azotobacter alone	40.100	36.700	38.400	52.107	51.373	51.740
Azospirillum alone	36.300	40.600	38.450	50.780	55.987	53.383
Average	44.392	44.311	44.351	55.165	58.268	56.717
L.S.D at 5% level						
Varieties (V)		N.S			2.5465	
Fertilization		5.397			5.402	
V x F		N.S			N.S	

Table 2. Effect of fertilization treatments of mineral nitrogen and biofertilizer on net cane yield t/fed of two varieties of sugarcane at harvest.

Varieties / Fertilization	1996/1997 season			1997/1998 season		
	G.T. 54/9	G. 85/37	Average	G.T. 54/9	G. 85/37	Average
180 kg N/fed	51.300	61.200	56.250	66.933	70.827	68.880
120 kg N/fed	47.000	56.700	51.850	60.480	64.667	62.573
60 kg N/fed	38.700	52.800	45.750	53.920	62.773	58.347
Azotobacter + 60 kg N/fed	50.000	59.600	54.800	64.160	65.160	64.660
Azotobacter + 120 kg N/fed	55.200	65.800	60.500	65.853	71.520	68.687
Azospirillum + 60 kg N/fed	47.633	56.100	51.867	64.093	64.427	64.260
Azospirillum + 120 kg N/fed	57.967	68.300	63.133	67.147	71.840	69.493
Azotobacter alone	46.367	53.800	50.083	59.880	60.813	60.347
Azospirillum alone	47.000	51.500	49.250	55.467	61.973	58.720
Average	49.019	58.422	53.720	61.993	66.000	63.996
L.S.D at 5% level						
Varieties (V)		2.432			2.284	
Fertilization		5.16			4.846	
V x F		N.S			N.S	

Table 3. Effect of fertilization treatments of mineral nitrogen and biofertilizer on sugar recovery (%) of two varieties of sugarcane at harvest.

Varieties / Fertilization	1996/1997 season			1997/1998 season		
	G.T. 54/9	G. 85/37	Average	G.T. 54/9	G. 85/37	Average
180 kg N/fed	13.537	12.330	12.933	11.537	11.933	11.735
120 kg N/fed	13.330	11.907	12.618	11.373	11.243	11.308
60 kg N/fed	12.703	11.023	11.863	11.130	10.887	11.008
Azotobacter + 60 kg N/fed	12.647	12.870	12.758	11.903	11.513	11.708
Azotobacter + 120 kg N/fed	12.347	12.280	12.313	12.043	11.600	11.822
Azospirillum + 60 kg N/fed	12.907	12.540	12.733	11.493	11.507	11.500
Azospirillum + 120 kg N/fed	12.750	12.560	12.655	11.850	11.493	11.672
Azotobacter alone	12.650	12.000	12.325	10.947	11.503	11.225
Azospirillum alone	13.040	12.813	12.927	11.653	10.780	11.217
Average	12.879	12.258	12.569	11.548	11.384	11.466
L.S.D at 5% level						
Varieties (V)		0.323			N.S	
Fertilization		0.685			N.S	
V x F		0.969			N.S	

T able 4. Effect of fertilization treatments of mineral nitrogen and biofertilizer on sugar yields t/fed of two varieties of sugarcane at harvest.

Varieties / Fertilization	1996/1997 season			1997/1998 season		
	G.T. 54/9	G. 85/37	Average	G.T. 54/9	G. 85/37	Average
180 kg N/fed	6.923	7.533	7.228	7.673	8.440	8.057
120 kg N/fed	6.263	6.717	6.490	6.870	7.273	7.072
60 kg N/fed	4.887	5.977	5.432	5.947	6.827	6.387
Azotobacter + 60 kg N/fed	6.320	7.653	6.987	7.600	7.500	7.550
Azotobacter + 120 kg N/fed	6.793	8.073	7.433	8.007	8.287	8.147
Azospirillum + 60 kg N/fed	6.153	7.047	6.600	7.357	7.410	7.383
Azospirillum + 120 kg N/fed	7.397	8.573	7.985	7.947	8.423	8.185
Azotobacter alone	5.887	6.430	6.158	6.550	6.967	6.758
Azospirillum alone	6.133	6.603	6.368	6.470	6.943	6.707
Average	6.306	7.179	6.742	7.158	7.563	7.361
L.S.D at 5% level						
Varieties (V)		0.33			0.336	
Fertilization		0.701			0.713	
V x F		N.S			N.S	

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تأثير التسميد النيتروجينى على محصول ومكونات قصب السكر الغرس

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اقيمت هذه الدراسة موسمين متتاليين ١٩٩٦/١٩٩٧ و ١٩٩٧/١٩٩٨ بمحطة بحوث شندويل (محافظة سوهاج) - مركز البحوث الزراعية بهدف دراسة تأثير التسميد على المحصول ومكوناته لبعض اصناف قصب السكر.

اشتملت التجربة على ١٨ معاملة هى التوافق بين صنفين من القصب (G.T.54-9 and G.85-37) وثمانى معاملات تسميد (١٨٠كجم ن/فدان ، ١٢٠ كجم ن/فدان و ٦٠ كجم ن/فدان) ، التلقيح بمركب الازوتوبكتر + ٦٠ كجم ن/فدان ، التلقيح بمركب الازوتوبكتر + ١٢٠ كجم ن/فدان ، التلقيح بمركب الأزوسبرلم + ٦٠ كجم ن/فدان ، التلقيح بمركب الأزوسبرلم + ١٢٠ كجم ن/فدان ، التلقيح بمركب الازوتوبكترفقط "عدد ٢٤ كيس/فدان "والتلقيح بمركب الأيزوسبرلم فقط "عدد ٢٤ كيس /فدان").

- تفوق الصنف G.85-37 على الصنف جيزه تيوان ٥٤-٩ فيما يتعلق بمحصول قصب السكر، وتشير النتائج الى ان الصنف G.85-37 قد حقق زيادة واضحة قدرها ١٩,١٨ ٪ و ٥,٦ ٪ على الصنف التجارى جيزة تيوان ٥٤-٩ فى الموسم الأول والثانى على التوالى.
- حقق التوافق بين اى من مركب الأزوسبرلم او الأزوتوبكتر مع معدل ١٢٠ كجم ن/فدان تفوقا واضحا فى محصول عيدان قصب السكر بالمقارنة بأى من التسميد الحيوى او الكيماوى للنيتوجين فى الموسم الأول فقط .
- حقق الصنف G.T.54-9 اعلى قيمة لناتج السكر (١٢,٨٧ ٪) فى الموسم الأول ، بينما الاختلاف بين الصنفين فيما يتعلق بهذه الصفة كان غير معنويا فى الموسم الثانى.
- ادت اضافة ١٨٠ كجم ن /فدان الى الحصول على اعلى قيمة من ناتج السكر (١٢,٩٣٣ ٪) وقد تحققت نفس النتيجة عندما لقحت تقاوى القصب بمركب الأزوسبرلم فقط.
- تفوق الصنف G.85-37 معنويا على الصنف التجارى G.T.54-9 فيما يتعلق بمحصول السكر فى كلا الموسمين وقدرت الزيادة بنحو ١٣,٨٤٣ ٪ و ٥,٦٥٨ ٪ فى الموسم الأول والثانى على التوالى.
- تأثر محصول السكر معنويا بمعاملات التسميد ، وقد ادى تلقيح تقاوى القصب بمركب الأزوتوبكتر او الأزوسبرلم بالأضافة الى ١٢٠ كجم ن/فدان الى الحصول على اعلى قيمة لمحصول السكر.