EFFECT OF SEED CUTTING POSITION ON SOME GROWTH TRAITS AND YIELD OF SUGAR CANE

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Abstract

The present study was carried out at El-Mattana Agricultural Research Station, Qena Governorate, Upper Egypt during 2000/2001 and 2001/2002 growing seasons. The aim of this study is to investigate the effect of seed cutting position (cuttings taken from three positions on cane stalks i.e., top, middle, bottom and a mixture of the three ones) on the performance of three sugarcane varieties (G.T.54-9, F.160 and G.84-47). A split-plot experimental design with three replications was used in both seasons. Sugarcane varieties were allocated in the main plots while seed cutting treatments were randomly distributed in the sub-plots. The results indicated that G.T.54-9 significantly surpassed the other two varieties in millable cane length, quality characteristics as well as cane and sugar yields. The results showed that top setts gave higher number of millable cane, stalk length, cane and sugar yields compared with middle, bottom and mixed ones.

INTRODUCTION

The commercial variety G.T.54-9 occupies most of the area planted with sugarcane in Egypt. Recently, Sugar Crops Research Institute produced some promising varieties of sugarcane among them F.160 and G.84-47. It is well known that cuttings of cane stalk are different in their age, moisture, sucrose and reducing sugar contents. Therefore, buds located on top, middle and bottom parts of cane stalk may have variable sprouting potential affecting the subsequent growth and development of cane plants and their yields. Chaugule and Sachan (1974) reported that top setts gave higher yields than other parts of stalks. Gill, *et al.* (1975) pointed out that setts taken from upper third portion of cane stalks were superior to those from middle and bottom in germination and shoot number. They added that top seeds gave higher cane yield than that of middle, bottom and mixed seeds. Ayub *et al.* (1988) mentioned that the top position setts had higher germination, greater stand density and better cane development and produced 19.54, 11.53 and 10.08 tons more yield per hectare than those of middle, bottom and mixed setts, respectively. However, sucrose content was not significantly affected. Sharma, *et al.* (1991). found significant differences in sucrose and purity % among sugar cane varieties. Ahmed (1998) noticed significant differences in cane yield and its components, juice quality and sugar yield among G.T.54-9 variety and the promising ones. Yousef *et al.* (1998) found wide variations in brix, sucrose, purity percentages and sugar yield among varieties. Osman (2000) reported significant differences between the studied varieties in yield and its components. Yousef, *et al.* (2000) revealed that sugarcane varieties significantly differed in number of millable cane/m^2, millable cane length, millable cane diameter and cane yield. Mohamed and Ahmed (2002) obtained significant differences among the studied cane varieties in stalk height, and diameter, number of millable cane, net cane and sugar yields.

Material and Methods

Two field experiments were conducted at El-Mattana Agricultural Research Station, Qena Governorate, Upper Egypt in two successive growing seasons of 2000/2001 and 2001/2002 to evaluate three sugarcane varieties (G.T.54-9, F.160 and G.84-47) as affected by seed cutting positions (cuttings taken from three portions i.e., top, middle and bottom parts of cane stalks as well as a mixture of the three ones). Planting took place in the 2nd week of March, while harvest was done in the 3rd week of March in the 1st and 2nd seasons. A split-plot experimental design with three replications was used in both seasons. Sugarcane varieties were allocated in the main plots while seed cutting treatments were randomly distributed in the sub-plots. The sub-plot area was 35 m^2 (including 5 ridges of 1 m apart and 7 m in length). Each row was planted by 28 three-budded setts. All other agricultural operations were practiced as recommended in the region.

Data recorded:

The following data were recorded at harvest:

I. Yield and its components:

1. Number of millable stalks/m^2.

2. Millable stalk length (cm) was measured from land level up to the top visible dewlap.

3. Millable stalk diameter (cm) was measured at the middle part of stalks.

4. Cane yield (tons/fed). The millable cane of three guarded rows of or each sub

plots were harvested, topped, cleaned, weighed and cane yield (tons/fed) was determined.

II. Juice quality:

A sample of 20 millable cane stalks from each treatment were chosen immediately after harvest, cleaned and crushed through mill and juice was analyzed to determine the following parameters:

1. Brix percentage (total soluble solids, TSS %) in juice was determined using Brix Hydrometer.

2. Sucrose percentage was determined using Saccharemeter according to A.O.A.C. (1995).

3. Sugar recovery percentage was calculated according to the following formula described by Yadav and Sharma (1980).

Sugar recovery percentage = [sucrose% - 0.4(brix% - sucrose%)] x 0.73

III. Sugar yield:

Sugar yield (tons/fed) was estimated as follows:

Theoretical sugar yield = cane yield (tons/fed) x sugar recovery percentage.

All recorded data were statistically analyzed according to the method of Snedecor and Cochran (1981).

1. Number of millable stalks/m^2:

Data shown in Table 1 revealed that the studied sugarcane varieties significantly differed in number of millable cane/m2 in both seasons. The highest number of millable cane/m^2 (12.70 and 12.99) was produced by G.84-47 variety in the 1st and 2nd season, respectively. The variation among sugarcane varieties in number of millable cane/m^2 may be controlled by their genetic structures which reflected on the capacity of this variety to produce more survival and millable cane tillers at harvest. The effective role of varieties on number of millable cane/m^2 has been reported by Mohamed and Ahmed (2002).

Number of millable cane/m^2 was significantly influenced by seed cutting positions in the two plant crops. Planting sugarcane using top cuttings gave the highest number of millable cane/m^2 compared with setts taken from the middle, bottom portions or mixed ones. This result could be due to the fact that top setts (having buds of relatively younger age) give higher seedling number and have a considerable tillering ability more than the other cuttings taken from other parts of cane stalks. Ayub *et.al* (1988) showed that the higher number of millable cane may be attributed to higher initial germination and shoot counts.

Number of millable cane/m^2 was significantly affected by the interaction between the two factors studied in both seasons. The maximum stand density (14.74 and 15.26 millable stalks/m^2, in the 1st and 2nd plant cane crop, respectively) was obtained from G.84-47 and F.160 varieties when they planted by top seeds setts..

Table (1): Number of millable cane/m2 of three sugarcane varieties as affected by seed cutting position in 2000/2001 and 2001/2002 seasons.

Season	st plant cane grown in 2000/20011					nd plant cane grown in 2001/20022				
Sugarcane variety	Seed cutting position				Mean	Seed cutting position				Mean
	Top	Middle	Bottom	Mixed		Top	Middle	Bottom	Mixed	
G.T. 54-9	11.07	10.85	9.91	10.88	11.03	13.35	10.90	9.55	11.19	11.07
F. 160	11.60	10.31	9.60	10.54	10.51	15.26	10.67	10.05	11.32	11.04
G. 84-47	14.74	12.70	11.05	12.31	12.70	12.13	12.70	10.71	13.30	12.99
Mean	12.94	11.29	10.18	11.24		12.65	11.42	10.10	11.94	

L.S.D. at 5% level:

Sugarcane varieties (A)	1.84	1.15
Seed cutting positions (B)	0.88	0.55
(A) x (B)	2.16	1.35

2. Millable stalk length(cm):

Data presented in Table 2 indicated that millable stalk length was significantly affected by the examined cane varieties, seed position and their interaction in the 1st and 2nd plant cane crops.

The commercial sugarcane variety G.T.54-9 had the tallest millable cane stalks compared with G.84-47 and F.160 varieties in both seasons. This result may be due to the genetic differences among varieties in their ability of the formation of internodes and determination of their length. These results are in line with those obtained by Yousef et al. (2000).

The results in Table 2 showed that using cuttings taken from the top position of cane stalks gave the tallest millable canes (278 and 277 cm, in the 1st and 2nd plant crop, successively). The increase in cane length in high stand density could be due to the competition among plants for light and available nutrients. Similar results were reported by Ayub *et al.* (1988).

Significant differences in stalk length were detected due to the interaction among cane cutting positions and sugar cane varieties in both seasons. In the 1st one, the highest millable cane (289 cm) was markedly obtained by G.T.54-9 when it was planted by top seeds without any significant difference with that recorded by the same variety planted with mixed seeds or that of G.84-47 (279.0 cm) planted using top setts. In the 2nd season, the highest stalk (292.0 cm) was obtained by planting G.T.54-9 variety using top cuttings with marked variations with those recorded by the same variety (262.0 cm) and G.84-47 one (266.0 cm) in case of planting them with bottom cuttings.

Table (2): Millable cane height (cm) of three sugarcane varieties as affected by seed cutting position in 2000/2001 and 2001/2002 seasons.

Season	1st plant cane grown in 2000/2001					2nd plant cane grown in 2001/2002				
Sugarcane variety	Seed cutting position				Mean	Seed cutting position				Mean
	Top	Middle	Bottom	Mixed		Top	Middle	Bottom	Mixed	
G.T. 54-9	289	270	258	278	274	292	280	262	281	279
F. 160	267	240	235	249	248	251	243	237	242	243
G. 84-47	279	265	254	262	265	289	273	266	281	277
Mean	278	259	249	263		277	265	255	268	

L.S.D. at 5% level:		
Sugarcane varieties (A)	21	27
Seed cutting positions (B)	6	12
(A) x (B)	11	20

3. Millable stalk diameter (cm):

Data illustrated in Table 3 cleared that millable stalk diameter varied significantly from variety to another in the 1st and 2nd seasons. The thickest stalks were produced by F.160 variety followed by G.T.54-9 while G.84-47 variety gave the lowest value of stalk diameter. The superiority of F.160 variety in stalk diameter may be controlled by genetic make up as well as low stand density (Table 1). Similar results were obtained by Ahmed (1998).

Millable stalk diameter significantly responded to seed cutting position. It was found that setts taken at the bottom position resulted in thicker millable canes (2.69 and 3.00 cm, in the 1st and 2nd season, respectively) compared with those of top, middle positions as well as mixed seed. This result may be attributed to the least number of millable cane/m^2 (10.18 and 10.10 stalks/m^2 in the 1st and 2nd season, respectively) resulted from planting sugarcane using basal cuttings (Table 1) which insure better conditions for growth in terms of sufficient nutrients and solar radiation interception, compared with higher number of millable cane/m^2 in case of using top, middle or mixed seeds. The present result is in agreement with that obtained by Gill *et al.* (1975).

Data in Table 3 demonstrated a significant response of stalk diameter to the interaction among cane varieties and seed cutting positions in both seasons. Using the middle and /or the basal cuttings attained the thickest millable cane amounted by 2.86 in 1st season and 3.08 in the 2nd season respectively for F.160 variety. However planting seed setts by using the basal position gave the thickest stalk in both seasons for G.T.54-9 and G.84-47 varieties.

Table (3): Millable cane diameter (cm) of the three sugarcane varieties as affected by seed cutting positions in 2000/2001 and 2001/2002 seasons.

Season	st plant cane grown in 2000/2001					nd plant cane grown in 2001/2002				
Sugarcane variety	Seed cutting position				Mean	Seed cutting position				Mean
	Top	Middle	Bottom	Mixed		Top	Middle	Bottom	Mixed	
G.T. 54-9	2.54	2.62	2.68	2.64	2.62	2.75	2.88	3.02	2.92	2.89
F. 160	2.62	2.86	2.76	2.70	2.74	2.83	2.99	3.08	2.90	2.95
G. 84-47	2.50	2.51	2.62	2.58	2.55	2.62	2.70	2.90	2.76	2.75
Mean	2.55	2.66	2.69	2.64	2.75	2.73	2.86	3.00	2.86	

L.S.D. at 5% level:		
Sugarcane varieties (A)	0.17	0.18
Seed cutting positions (B)	0.10	0.06
(A) x (B)	0.18	0.11

4. Cane yield:

Data illustrated in Table 4 pointed out that the tested sugarcane varieties varied significantly in cane yield in the two seasons. The highest cane yield was recorded by G.T.54-9 variety outyielding F.160 and G.84-47 varieties in cane yield by 4.584 and 2.076 tons/fed, in the 1st season, corresponding to 4.842 and 3.154 tons/fed, in the 2nd one. The effective role of varieties on cane yield has been reported by Yousef, et al. (2000) and Mohamed and Ahmed (2002).

The results showed that cane yield was significantly influenced by seed position in both seasons. Planting sugarcane using top setts resulted in the highest cane yield amounted to 47.244 and 47.400 tons/fed, in the 1st and 2nd plant crop, respectively. The superiority of top setts in the obtained cane yield/fed over the other seed cutting positions is probably due to higher number of millable cane/m^2 (Table 1). These results are in agreement with those reported by Gill, *et al.* (1975).

Cane was significantly affected by the interaction among cane varieties and setts positions in both seasons. Planting G.T.54-9 and F. 160 varieties by using top setts recorded the highest cane yield, mean while using middle setts attained the maximum yield for G.84-47 variety in the 1st season. However, the highest cane yield in 2nd season was obtained by using top setts. This finding was true for the studied varieties.

Table (4): Cane yield (tons/fed) of the three sugarcane varieties as affected by seed cutting positions in 2000/2001 and 2001/2002 seasons.

Season	1st plant cane grown in 2000/2001					2nd plant cane grown in 2001/2002				
Sugarcane variety	Seed cutting position				Mean	Seed cutting position				Mean
	Top	Middle	Bottom	Mixed		Top	Middle	Bottom	Mixed	
G.T. 54-9	51.600	46.067	41.067	45.383	46.029	51.800	46.067	40.467	45.950	46.071
F. 160	45.267	41.400	37.933	41.180	41.445	44.600	41.267	37.733	41.267	41.229
G. 84-47	44.867	46.000	41.133	43.810	43.953	45.800	43.067	38.667	44.133	42.917
Mean	47.244	44.489	40.044	43.458		47.400	43.469	38.956	43.800	

L.S.D. at 5% level:

Sugarcane varieties (A)	4.462	3.721
Seed cutting positions (B)	4.292	3.924
(A) x (B)	7.435	6.797

5. Brix percentage:

Data presented in Table 5 cleared that the studied sugarcane varieties were markedly differed in brix percentage. The commercial variety G.T.54-9 significantly surpassed the other two varieties in this trait in the 1st and 2nd seasons. The differences among varieties in brix percentage were reported by Yousef, *et al* (1998).

Using cane setts obtained from the different positions studied produced cane stalks significantly differed in brix percentage in both seasons. Setts obtained from bottom position of canes gave the highest value of this trait in both seasons.

Brix percentage significantly responded to the interaction among the evaluated varieties and seed positions in both seasons. Planting sugar cane variety F.160 by middle seed cutting and the other two varieties (G.T.54-9 and G.84-47) by top cutting recorded the highest values of brix % in the 1st season, while in the 2nd one, the highest brix values were obtained by using top, bottom and mixed seed cutting for G.84-47, F.160 and G.T.54-9 varieties, respectively.

Table (5): Brix percentage of three sugarcane varieties as affected by seed cutting position in 2000/2001 and 2001/2002 seasons.

Season	1st plant cane grown in 2000/2001					2nd plant cane grown in 2001/2002				
Sugarcane variety	Seed cutting position				Mean	Seed cutting position				Mean
	Top	Middle	Bottom	Mixed		Top	Middle	Bottom	Mixed	
G.T. 54-9	22.15	22.52	22.74	22.13	22.39	22.04	22.06	22.13	22.20	22.11
F. 160	20.91	21.25	21.14	21.00	21.07	21.04	21.06	21.59	21.29	21.25
G. 84-47	20.56	20.35	21.28	20.56	20.69	21.73	21.48	21.32	20.92	21.11
Mean	21.21	21.37	21.72	21.23		21.27	21.53	21.68	21.47	

L.S.D. at 5% level:

Sugarcane varieties (A)	0.53	0.36
Seed cutting positions (B)	0.38	0.47
(A) x (B)	0.66	0.82

6. Sucrose percentage:

The results illustrated in Table 6 indicated that the tested varieties showed a significant variation in sucrose percentage in the two plant crops. The highest value of sucrose percentage was obtained from G.T.54-9 variety in both seasons. The differences among cane varieties could be due to their gene make-up. This result is in accordance with that reported by Ahmed (1998).

Sucrose percentage was not appreciably affected by the studied sett positions in both seasons. This result is in harmony with that obtained by Ayub *et al* (1988) .

The interaction among the studied two factors had a significant effect on sucrose percentage in both seasons. Planting G.T.54-9 variety with mixed seed cuttings gave the highest value of sucrose % while the other varieties (F.160 and G.84-47) planted with top setts recorded the highest sucrose % in 1st season. In the 2nd one, G.T.54-9, F.160 and G.84-47 varieties attained the highest sucrose percentage when they were planted with middle, top and bottom seed cuttings, respectively.

Table (6): Sucrose percentage of the three sugarcane varieties as affected by seed cutting positions in 2000/2001 and 2001/2002 seasons.

Season	1st plant cane grown in 2000/2001					2nd plant cane grown in 2001/2002				
Sugarcane variety	Seed cutting position				Mean	Seed cutting position				Mean
	Top	Middle	Bottom	Mixed		Top	Middle	Bottom	Mixed	
G.T. 54-9	18.21	18.00	17.69	18.25	18.04	18.06	18.20	18.10	17.81	18.04
F. 160	17.22	16.24	17.22	16.70	17.00	17.52	16.49	16.41	16.93	16.72
G. 84-47	17.59	17.00	17.46	17.19	17.31	17.14	17.14	17.40	17.07	17.28
Mean	17.67	17.28	17.46	17.38		17.54	17.28	17.31	17.28	

L.S.D. at 5% level:

Sugarcane varieties (A)	0.88	1.22
Seed cutting positions (B)	N.S	N.S
(A) x (B)	0.80	1.77

7. Sugar recovery percentage:

Data in Table 7 revealed that the tested sugarcane varieties were markedly different in sugar recovery percentage in both seasons. The commercial variety G.T.54-9 surpassed the other two varieties recording the highest values of this trait (11.99 and 12.04 % in the 1st and 2nd season, respectively). The same finding was reported by Ahmed (1998).

The studied seed cutting positions had no significant influence on sugar recovery percentage in the two plant crops.

Sugar recovery percentage was significantly affected by the interaction among the studied two factors. Using the mixed cuttings and /or the bassal cuttings amounted by 12.19% in the 1st season and 12.27% in the 2nd season successively for G.T.54-9 variety. However planting seed settes by using the topsettes catting gave the greatest sugar recovery in both seasons for G.84-47 variety. successively

Table (7): Sugar recovery of the three sugarcane varieties as affected by seed cutting positions in 2000/2001 and 2001/2002 seasons.

Season	1st plant cane grown in 2000/2001					2nd plant cane grown in 2001/2002				
Sugarcane variety	Seed cutting position				Mean	Seed cutting position				Mean
	Top	Middle	Bottom	Mixed		Top	Middle	Bottom	Mixed	
G.T. 54-9	12.15	11.32	11.78	12.19	11.99	12.02	12.16	12.27	11.71	12.04
F. 160	11.49	10.80	11.43	10.54	11.10	11.27	10.71	10.47	11.10	10.89
G. 84-47	11.97	11.55	11.63	11.56	11.68	11.85	11.24	11.58	11.34	11.50
Mean	11.87	11.39	11.61	11.56		11.71	11.37	11.44	11.37	

L.S.D. at 5% level:

Sugarcane varieties (A)	0.74	1.05
Seed cutting positions (B)	N.S	N.S
(A) x (B)	0.89	1.02

8. Theoretical sugar yield:

Data illustrated in Table 8 showed that the tested sugarcane varieties differed significantly in sugar yield in both seasons. Sugarcane variety G.T.54-9 surpassed F.160 and G.84-47 varieties by 0.892 and 0.575 ton/fed, in the 1st season, corresponding to 1.057 and 0.575 ton/fed in the 2nd one. These results are in accordance with that obtained by Yousef, *et al.* (1998).

Seed position significantly affected sugar yield in both plant cane crops. Using setts taken from the top position of cane stalks resulted in the highest sugar yield (5.616 and 5.501 tons/fed, in the 1st and 2nd season, respectively). This result could be attributed to the increase in cane yield recorded by top position setts (Table 4).

Sugar yield was significantly influenced by the different combinations among the studied factors in both seasons. Using the top cuttings attained the maximum sugar yields in 1st and 2nd seasons for G.T.54-9 and F.160 varieties. Whereas planting eed setts by the middle part of stem in 1st season and top part in the 2nd season produced the maximum sugar yield for G.84-47 variety.

Table (8): Sugar yield (tons/fed) of the three sugarcane varieties as affected by seed cutting positions in 2000/2001 and 2001/2002 seasons.

Season	1st plant cane grown in 2000/2001					2nd plant cane grown in 2001/2002				
Sugarcane variety	Seed cutting position				Mean	Seed cutting position				Mean
	Top	Middle	Bottom	Mixed		Top	Middle	Bottom	Mixed	
G.T. 54-9	6.291	5.445	4.835	5.534	5.526	6.212	5.479	4.965	5.965	5.511
F. 160	5.193	4.740	4.097	4.505	4.634	4.861	4.423	3.947	4.587	4.454
G. 84-47	5.364	5.390	4.752	5.057	5.140	5.429	4.839	4.472	5.005	4.936
Mean	5.616	5.191	4.561	5.032		5.501	4.913	4.461	4.997	

L.S.D. at 5% level:

Sugarcane varieties (A)	0.774	0.741
Seed cutting positions (B)	0.533	0.404
(A) x (B)	0.924	0.699

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تأثير موضع عقل التقاوى على الساق على بعض صفات النمو ومحصول قصب السكر

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معهد بحوث المحاصيل السكرية – مركز البحوث الزراعية – الجيزة – مصر

أقيم هذا البحث بمحطة المطاعنة للبحوث الزراعية بمحافظة قنا بمصر العليا خلال موسمى الزراعة 2000 / 2001 , 2001 / 2002 لدراسة تأثير موضع عقل التقاوى على الساق (عقل مأخوذة من الجزء القمى ، الوسطى ، القاعدى لعيدان القصب ومخلوط من الأجزاء الثلاثة) على أداء ثلاثة أصناف من قصب السكر (جيزة – تايوان ، 54 - 9 ، اف 160جيزة 47 - 84) استخدم تصميم القطع المنشقة مرة واحدة فى ثلاثة مكررات فى الموسمين حيث وزعت الأصناف فى القطع الرئيسية ووزعت معاملات التقاوى فى القطع الشقية

أوضحت النتائج أن الصنف جيزة – تايون 54 - 9 تفوق معنوياً على الصفين الأخرين فى عدد العيدان القابلة للعصير ، طول العود، صفات الجودة ، محصولى العيدان والسكر .

أوضحت النتائج أيضاً أن زراعة قصب السكر باستخدام عقل قمية أعطت عدداً أكبر من العيدان القابلة للعصير ذات أطوال وصفات جودة أفضل والذى إنعكس إيجابياً على محصولى العيدان والسكر مقارنة بالعقل الوسطية والقاعدية ومخلوط الأجزاء الثلاثة .