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Impact of Using Seed Cuttings Taken From Different Crop Cycle of Some Sugarcane Cultivars on their Quality and Productivity

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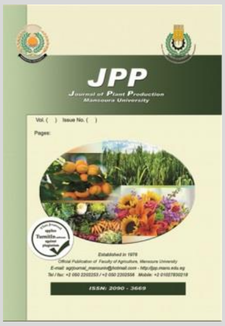

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ABSTRACT

A field experiment was conducted during two successive seasons (2022/2023 and 2023/2024) at Shandaweel Agricultural Research Station, Sohag Governorate, Egypt (latitude 26 33°N and longitude 31 41°E) to evaluate the performance of four sugarcane cultivars: the commercial G.T.54-9, Giza-4, G.84-47 and Giza-3. The cultivars were planted using seed setts obtained from plant cane, first ratoon and second ratoon cane crops. The experiments were laid out in a randomized complete block design (RCBD) with a split-plot arrangement and three replications. Sugarcane varieties were assigned to the main-plots, while, the ages of planting seed setts (cuttings taken from the pant, first and second cane ratoon cane crops) were allocated to the subplots. The results revealed significances among sugarcane varieties across all evaluated traits. Variety G.4 revealed significant differences among the greatest values for stalk height, stalk diameter, fresh stalk weight, number of millable canes per feddan, as well as cane and sugar yields per feddan in both seasons. In contrast, variety G.3 excelled in brix percentage, sucrose content, and sugar recovery percentage. The results cleared that the seed ages had a substantial influence on most of the sugarcane traits measured. Sugarcane cultivation using cutting of the plant cane improved stalk height, number of millable canes/fed, cane, and sugar productivity/fed, along with brix, sucrose and sugar recovery percentages. Within the settings of this study, it was shown that cultivation using cuttings taken from a plant cane field of the sugarcane Giza.4 variety is advisable for achieving the highest cane and sugar yield.

Keywords: Sugarcane, varieties, plant cane, ratoons, quality cane and sugar yields.

INTRODUCTIOIN

Sugarcane (*Saccharum* spp., L.) is among the leading cash crops cultivated worldwide, as a major source of sugar and bioenergy, playing a vital role in the economies of many countries, including Egypt. The productivity and quality of sugarcane are influenced by several factors, including variety stability during its successive growth cycle due to different biotic and abiotic pressures.

Selecting sugarcane varieties with high yield potential and good ratooning ability is crucial for sustainable production, especially in environments such as Upper Egypt. It is known that the variation between varieties and genotypes is due to the difference in foliage size (leaf area), stomatal density on both leaf surfaces, thickness of cuticle (wax layer). Many studies have confirmed that the potential of cane cultivar is the cornerstone of sugar production per unit area. Azzazy *et al.* (2005) cleared that sugarcane cultivars G.T.54-9, Phil.8013, Giza.95-21, Giza.99-165, Giza.98-28 and Giza 95-19 varied substantially in height and diameter stalk, cane and sugar yields along with sucrose % and sugar recovery%. El-Shafai and Ismail (2006) found that G.T.54-9 variety was excellent in stalk height, count of stalks, cane and sugar production relative to the other varieties (G.95-21, G.95-19, and Phil.8013). Ismail and El-Sogheir (2008) observed notable variations across cane varieties in stalk length, stalk diameter, count of stalks per square meter, cane production, sugar yield, sucrose content, and sugar recovery percentage. Ismail *et al.* (2008) noted that G.T.54-9 outperformed other varieties in stalk length, sugar recovery, juice purity, and sugar yield per feddan. In contrast, G.95-21 yielded more millable canes and enhanced cane output, while Phil.8013 exhibited thicker stalks. Ahmed *et al.* (2008) reported that the Giza 84-47 variety outperformed the other two varieties (Phil.8013 and Giza 98-28) in terms of stalk number, sugar recovery percentage, stalk height, and cane production, whereas the Phil.8013 variety exhibited greater stalk thickness, brix percentage, sucrose percentage, and sugar yield. El-Bakry (2018) revealed that Giza-3 variety cultivar in juice quality characters over than two varieties G.T.54-9 and G.2003-49. Galal *et al.* (2018) showed that Giza-3 variety was distinguished in quality characteristics, while, Giza-4 variety exhibited the greatest stalk, weight/stalk along with cane and sugar production. Abazied, Sakina (2018) found that G.84-47 and G.2003-47 varieties recorded the greatest brix and purity percentages compared to G.T.54-9 variety. Teama *et al.* (2020) noted the superiority sugarcane G.2003-47 in quality characteristics compared to the other varieties, G.T.54-9 and G.2004-27. Ahmed *et al.* (2020) resulted that the highest sucrose, brix, purity and sugar recovery percentages, given by G. 2003-47 cultivar. Gadallah *et al.* (2020) recorded that sugarcane cultivar G.2003-47 surpassed in brix%, sucrose% and sugar recovery%, at the same time, cultivar G.2004-27 recorded the greatest count of millable cane/fed. Ali *et al.* (2023) showed that G.T.54-9 superiority in diameter, cane and sugar production, while, Giza-4 variety recorded the longest stalk, number of stalks and cane output. Yousif *et al.* (2023) recorded that cultivar G.2004-27 give the longest stalk and cane yield, at the same time, G.2003-47 give the highest quality percentages. Ali *et al.* (2024) noted the uniqueness of the promising variety Giza-4 in its superiority in weight and yield of stalks, while, Giza-3 superiority in quality percentages.

Sugarcane is a vegetative propagated crop, through stem cuttings (setts). It is grown using cuttings taken from fields during its crop cycle: plant cane and/or the first ratoon at most.

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This practice is considered correct, because sets are obtained from a healthy cane crop having a good germination rate of more than 85%. However, it has been noted that some sugarcane farmers may resort to plant it by aged seed cutting taken from a second ratoon field and perhaps older canes. This practice may reduce production due to weak germination and heterogeneous growth of infected, lodged and/or damaged-budded stalks used for planting. In this connection, Murianigrum *et al*. (2022) documented that seed variety affects the length and thickness of the cane stalk, the earliest-maturing ratoon cane serves as a source for producing healthy, high-quality seeds if supported by effective management. A good seed in sugarcane is defined as the sett should be selected for seed purpose obtained from a healthy crop free from pests and disease like red rot, wild, smut, ratoon stunting etc., with a germination rate of no less than 85%. Due to the risk of carrying over diseases from the parent crop, ratoon cane is not recommended for use as seed. Kamat et al. (2023) recommend cultivating separate nursery fields with rigorous crop management practices specifically for seed production.

The chief purpose of this work is to assess four sugarcane varieties planted with cuttings taken from three ages of sugarcane cycle, i.e. plant, first, and second ratoon cane crops, aiming at providing practical planting recommendations for sugarcane growers to achieve the maximum cane and sugar outputs/fed.

MATERIALS AND METHODS

A field experiment was executed during two seasons 2022/2023 and 2023/2024 at Shandaweel Agricultural Research Station in, Sohag Governorate, Egypt (latitude 26 33°N and longitude 31 41°E) to evaluate performance four cane cultivars planted with cuttings taken from the crop cycle of sugarcane.

This study contained twelve treatments that represented combinations of four sugarcane varieties, namely; [the commercial variety G.T.54-9, G.2004-27 (Giza-4), G.2003-47 (Giza-3), and G.84-47], and three ages of cuttings taken from the plant, first and second ratoon cane crops, used as planting materials.

The experiments were conducted employing a randomized complete block design (RCBD) utilizing a split-plot arrangement, with three times, in the primary-plots, sugarcane varieties were placed, meanwhile, different planting ages of cane seed cuttings were designated to the sub-plots. Each sub-plot measured 21 m² (equivalent to 1/200 feddan) and consisted of six rows, each measuring 3.5 m in length and set 1.0 m apart. Planting was done during the last week of February placing double rows of three-budded cane cuttings, and it's harvested in both seasons 12 months after planting. Phosphorus, in the form of calcium superphosphate (15.5% P_2O_5), was incorporated throughout seedbed preparation at a rate of 30 kg P_2O_5 per feddan. Nitrogen, added in the form of urea (46.5% N) at rate of 210 kg N/feddan, divided into two doses at 60 and 90 days subsequent to planting (following the first and second hoeing). Potassium, supplied in the form of potassium sulfate (48% K_2O) at 24 kg/feddan, was applied once with the second nitrogen dose. All other agronomic practices followed the recommendations of the Sugar Crops Research Institute. Mechanical analysis of the experimental soil classified it as sandy clay loam, with sand contents of 21.5% and 21.7%, silt contents of 29.3% and 28.8%, and clay contents of 49.2% and 49.5% during the first and second seasons, correspondingly. Chemical analysis displayed nitrogen contents of 94 and 110 mg/kg, phosphorus (P_2O_5) contents of 18 and 19 mg/kg, and potassium (K_2O) contents of 117 and 150 mg/kg, with soil pH values of 7.55 and 7.60 for the two seasons, respectively.

Recorded data:

During harvest, 20 millable canes from every sub-plot were randomly selected to assess the subsequent attributes:

Growth measurements:

1- Stalk height (cm): determined by measuring from the ground level to the highest dewlap point.

2- Stalk diameter (cm): Recorded at the midsection of the stalk.

3- Net-stalk fresh weight (kg): Determined for individual stalks.

Quality attributes:

4. Brix percentage (total soluble solids, TSS %): was detected utilizing Brix Hydrometer standardized at 20 °C.

5. Sucrose content (100 cm³ juice): Measured employing a saccharometer as outlined by A.O.A.C. (2005).

6. Sugar recovery percentage: was detected based on Yadav and Sharama (1980):

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

Number, cane and sugar productivity/fed:

Millable cane was harvested from the four protected rows, topped, cleaned and weighed for the following calculations:

7. Number of millable canes from each sub-plot was counted and transformed into 1000/fed.

8. Canes yield/fed (ton) was determined from every sub-plot (kg) of millable canes, then transformed into tons/fed.

9. Sugar yield/fed (ton) was determined by the subsequent expression:

Sugar yield = cane yield/fed (ton) x sugar recovery % /100.

Statistical analysis

The gathered data were statistically analyzed employing analysis of variance (ANOVA) following the method of Gomez and Gomez (1984). Homogeneity of variances and treatment differences were analyzed utilizing the least significant difference (LSD) test at the 5% probability level.

RESULTS AND DISCUSSION

1. Stalk height (cm):

The findings in Table 1 pointed of sugarcane G.2004-27 (G.4) to a significantly superior to the other varieties, producing the tallest harvestable canes across both seasons, and showing no substantial variance with G.T.54-9 in this attribute, in the 1st one. At the same time, it was observed that G.84-47 and G.2003-47 (G.3) cultivars had the shortest millable canes, without a marked difference between them, in the 1st and 2nd seasons. The variation in stalk height of cane varieties is due to the difference in their genetic structure. Corresponding trends were documented by Galal *et al.* (2018); Gadallah *et al.* (2020); Yousif *et al.* (2023) and Ali *et al.* (2024).

The findings in Table 1 showed that planting sugarcane using cuttings taken from its crop cycle *i.e.* the plant cane, first and second ratoons appreciably impacted stalk height, in the two seasons. Growing cane with seed cuttings taken from the plant cane field increased stalk height in both seasons; without a significant difference between those of the plant cane and/or the first ratoon fields in the 1st one, and those of the first and second ratoons, in the 2nd season. These outcomes may be because of sugarcane is a perennial crop, vegetative planted with stalk pieces and occupies the field for several years. So, sugar canes from which the planting seeds are taken must be healthy, free of diseases and insects to ensure better potential for good germination, emergence, and homogeneous growth and hence, higher productivity and quality. This can be achieved in case of using young-aged cuttings from the plant cane or the first ratoon at most Kamat *et al*. (2023).

The interaction effect among cane cultivars and cutting age taken from the crop cycle significantly influenced stalk height in the 1st and 2nd seasons. The longest stalks were attained by the promising cultivar G.4 planted with cutting seeds from a plant cane field, in the two seasons.

Table 1. Crop cycle of different age's effect on mean stalk height (cm) sugarcane varieties and their interaction in 2022/2023 and 2023/2024 seasons.

Sugarcane varieties (A)	2022/2023 season				2023/2024 season			
	Cutting age* (B)			Mean	Cutting age* (B)			Mean
	Plant cane	First ratoon	Second ratoon		Plant cane	First ratoon	Second ratoon	
G.T.54-9	305.33	303.33	300.00	302.89	309.00	305.33	304.00	306.11
G.2004-27 (G.4)	308.67	305.00	302.67	305.44	314.00	309.00	306.67	309.89
G. 84-47	291.00	287.33	۲86.33	288.22	301.00	292.00	290.33	294.44
G.2003-47 (G.3)	291.33	288.67	285.67	288.56	296.00	297.67	290.00	292.56
Mean	299.08	296.08	293.67		305.00	299.50	297.75	
LSD at 0.05								
Sugarcane cultivars (A)				3.83				3.04
Cutting age (B)				3.50				2.86
(A) x (B)				6.63				5.27

*** Cutting age refers to: setts taken from the plant, 1st and 2ndratoon crops, used for sugarcane planting.**

2. Stalk diameter (cm):

The findings presented in Table 2 indicated that the examined sugarcane cultivars varied markedly in stalk diameter. G.2004-27 (Gia-4) variety was the best thickness of cane stalk, in the two seasons. In contrast, G.84-47 variety produced smaller diameter stalks in the two seasons. The variance in stalk diameter of cane varieties is due to the difference in their genetic structure. These findings are conforming to those documented by Galal *et al*. (2018); Gadallah *et al.* (2020); Yousif *et al.* (2023) and Ali *et al.* (2024).

In the corresponding Table 2, the difference in crop cycle *i.e.* plant, first and second cane ratoons did not show a notable impact on cane stalk diameter

Stalk diameter was markedly impacted by the interaction among varieties and cutting age taken from the crop cycle in the two seasons. The thickest stalks were attained by G.3 variety in the 1st one and/or the promising cultivar G.4, in the 2ndseason, when planted with cutting seeds from a plant cane field.

Table 2. Crop cycle of different age's effect on mean stalk diameter (cm) sugarcane varieties and their interaction in 2022/2023 and 2023/2024 seasons.

Sugarcane varieties (A)	2022/2023 season				2023/2024 season			
	Cutting age* (B)			Mean	Cutting age* (B)			Mean
	Plant cane	First ratoon	Second ratoon		Plant cane	First ratoon	Second ratoon	
G.T.54-9	2.43	2.43	2.43	2.43	2.50	2.50	2.42	2.47
G.2004-27 (G.4)	2.53	2.47	2.47	2.49	2.60	2.52	2.49	2.54
G. 84-47	2.06	2.23	2.23	2.18	2.18	2.16	2.14	2.16
G.2003-47 (G.3)	2.63	2.40	2.40	2.48	2.35	2.41	2.43	2.39
Mean	2.42	2.38	2.38		2.41	2.40	2.37	
L.S.D at 0.05								
Sugarcane cultivars (A)				0.09				0.02
Crop cycle age (B)				NS				NS
(A) x (B)				0.16				0.03

*** Cutting age refers to: setts taken from the plant, 1st and 2ndratoon crops, used for sugarcane planting.**

3. Net fresh weight (kg/stalk):

The findings in Table (3) highlighted that the confirming cane cultivar G.2004-27 resulted in the heaviest weight stalk, followed by G.T.54-9, while, G.84-47 showed the minimum stalk weight in the two seasons. The difference between cane cultivars in this attribute may be owing to their superiority in both length and diameter (Tables 1 and 2), as well as their genetic makeup. The same finding was documented by Galal *et al*. (2018); Gadallah *et al.* (2020); Yousif *et al.* (2023) and Ali *et al.* (2024).

Data in Table (3) indicated a substantial impact of planting using cuttings taken from its crop cycle i.e. the plant, 1st and 2nd cane ratoons on stalk weight. It was found that planting sugarcane using seed cuttings taken from plant cane field increased stalk weight by (0.129 and 0.151 kg) and (0.129 and 0.130 kg), in the 1st and 2nd seasons, compared by used seed cuttings from first and second cane ratoons successively. The outcomes might be attributed to the fact that sugarcane is planted using seed cuttings. The field from which these cuttings are taken must have vigorous growth and be free from diseases and insects to ensure higher productivity. This is achieved by using seed cuttings from plant cane of the appropriate age (Kamat *et al*., 2023).

The interaction effect among cane varieties and cutting age taken from the crop cycle significantly influenced stalk weight in the 1st and 2nd seasons. Heaviest stalk weight obtained when G.4 planted with cutting seeds from a plant cane field.

Table 3. Crop cycle of different age's effect on mean Net fresh weight (kg) sugarcane varieties and their interaction in 2022/2023 and 2023/2024 seasons.

Sugarcane varieties (A)	2022/2023 season				2023/2024 season			
	Cutting age* (B)			Mean	Cutting age* (B)			Mean
	Plant cane	First ratoon	Second ratoon		Plant cane	First ratoon	Second ratoon	
G.T.54-9	1.190	1.040	1.063	1.098	1.203	1.080	1.093	1.126
G.2004-27 (G.4)	1.283	1.220	1.156	1.220	1.313	1.197	1.175	1.228
G. 84-47	1.129	0.990	0.948	1.022	1.143	0.997	0.990	1.043
G.2003-47 (G.3)	1.173	1.010	1.004	1.063	1.182	1.049	1.063	1.098
Mean	1.194	1.065	1.043		1.210	1.081	1.80	
L.S.D at $_{0.05}$								
Sugarcane cultivars (A)				0.01				0.01
Crop cycle age (B)				0.01				0.01
(A) x (B)				0.02				0.03

*** Cutting age refers to: setts taken from the plant, 1st and 2ndratoon crops, used for sugarcane planting.**

4. Brix percentage:

Findings in Table 4 manifested that a significant superiority of sugarcane G.2003-47 (G.3) in Brix% over the other cane varieties, in both seasons. There was no appreciable difference among G.T.54-9 and/or G.2004-27 varieties in this attribute in both seasons. The genetic composition of the studied cultivars is likely responsible for the observed variance in this trait. This outcome aligns with those observed by El-Bakry (2018); Abazied, Sakina (2018); Teama *et al*. (2020); Yousif *et al.* (2023) and Ali *et al.* (2024).

In same Table 4 sugarcane cultivation using cuttings taken from its crop cycle, *i.e.* the plant, first and second cane ratoons substantially affected Brix% in the 1st one. Planting cane using seed cuttings taken from the plant cane field increased Brix% compared to seeds cuttings taken from the first and second cane ratoons. These findings could be attributed to the use of high-quality seeds for planting, which affects juice quality characteristics, including Brix and sucrose percentages.

The interaction effect among cane varieties and cutting age taken from the crop cycle significantly influenced Brix% in the 1st season. The maximum brix% was achieved by cultivar G.3 planted with cutting seeds from a plant cane field.

Table 4. Crop cycle of different age's effect on mean Brix percentage sugarcane varieties and their interaction in 2022/2023 and 2023/2024 seasons.

Sugarcane varieties (A)	2022/2023 season				2023/2024 season			
	Cutting age* (B)			Mean	Cutting age* (B)			Mean
	Plant cane	First ratoon	Second ratoon		Plant cane	First ratoon	Second ratoon	
G.T.54-9	21.11	19.55	20.10	20.25	20.93	19.89	19.22	20.01
G.2004-27 (G.4)	21.47	20.53	18.59	20.20	20.68	18.75	19.68	19.70
G. 84-47	20.68	20.79	20.74	20.74	20.62	20.45	20.98	20.68
G.2003-47 (G.3)	22.11	22.01	21.47	21.86	21.75	20.90	20.94	21.20
Mean	21.34	20.72	20.23		21.00	20.00	20.21	
L.S.D at $_{0.05}$								
Sugarcane cultivars (A)				0.60				0.76
Crop cycle age (B)				0.47				NS
(A) x (B)				1.03				NS

*** Cutting age refers to: setts taken from the plant, 1st and 2ndratoon crops, used for sugarcane planting.**

5. Sucrose percentage:

The statistical analysis in Table 5 indicated to substantial superiority of G.2003-47 (G-3) variety compared with other varieties, where it had the greatest sucrose% in the 1st and 2ndseason. However, Giza-4 variety showed low sucrose content during both seasons. The observed variation in sucrose content among the varieties studied is largely ascribed to differences in their genetic structure. These outcomes are consistent with those stated by El-Bakry (2018); Abazied, Sakina (2018); Teama *et al.* (2020); Ahmed *et al.* (2020); and Ali *et al.* (2024).

The findings in Table 6 indicated that the variations in seed ages (cuttings taken from the pant, first and second ratoon cane crops) markedly affected in sucrose content, in the 1st season only. Planting cane using seed cuttings taken from the plant cane field increased sucrose content compared to seeds cuttings taken from the first and second cane ratoons.

Sucrose content varied appreciably with the interaction of varieties with cutting age taken from the crop cycle in the 1st season. The greatest sucrose% was achieved by variety G.3 sown using cutting seeds from a plant cane field, in the 1st season.

Table 5. Crop cycle of different age's effect on mean sucrose percentage sugarcane varieties and their interaction in 2022/2023 and 2023/2024 seasons.

Sugarcane varieties (A)	2022/2023 season				2023/2024 season			
	Cutting age* (B)			Mean	Cutting age* (B)			Mean
	Plant cane	First ratoon	Second ratoon		Plant cane	First ratoon	Second ratoon	
G.T.54-9	19.24	18.24	18.14	18.54	19.11	18.36	17.78	18.42
G.2004-27 (G.4)	19.36	18.28	16.89	18.18	18.46	17.33	17.49	17.76
G. 84-47	19.43	19.29	19.23	19.32	19.20	19.00	19.30	19.16
G.2003-47 (G.3)	20.75	20.63	19.92	20.43	20.73	19.72	19.54	20.00
Mean	19.70	19.11	18.55		19.37	18.60	18.53	
L.S.D at $_{0.05}$								
Sugarcane cultivars (A)				0.42				0.50
Crop cycle age (B)				0.36				NS
(A) x (B)				0.73				NS

*** Cutting age refers to: setts taken from the plant, 1st and 2nd ratoon crops, used for sugarcane planting.**

6. Sugar recovery percentage:

The results of Table 6 indicated marked variations between sugarcane varieties in sugar recovery % in the two seasons. G.2003-47 (Gia-3) variety produced high value of sugar recovery% relative to the other cane cultivars. The rise in sugar recovery% could be ascribed to the same trend of both Brix% and sucrose content (Tables 4 and 5 respectively) recorded by the previously mentioned variety. These outcomes are consistent with those documented by El-Bakry (2018); Abazied, Sakina (2018); Teama *et al*. (20٢٠); Yousif *et al.* (2023) and Ali *et al.* (2024).

In same Table 6 demonstrated that planting sugarcane using cuttings taken from its crop cycle; *i.e.* the plant, first and second cane ratoons, it had a substantial impact on sugar recovery%, in both seasons. Planting cane using seed cuttings taken from the plant cane field increased sugar recovery%. Rising in both, brix and sucrose percentages (Tables 4 and 5) led to an improvement in sugar recovery%.

Sugar recovery % differed substantially when the interaction cane varieties with cutting age taken from the crop cycle, in the two seasons. The best sugar recovery% was given by cultivated Giza-3 cultivar with cutting seeds from a plant cane field.

Table 6. Crop cycle of different age's effect on mean sugar recovery percentage sugarcane varieties and their interaction in 2022/2023 and 2023/2024 seasons.

Sugarcane varieties (A)	2022/2023 season				2023/2024 season			
	Cutting age* (B)			Mean	Cutting age* (B)			Mean
	Plant cane	First ratoon	Second ratoon		Plant cane	First ratoon	Second ratoon	
G.T.54-9	12.01	11.79	11.26	11.68	11.94	11.70	11.36	11.67
G.2004-27 (G.4)	11.85	11.14	10.73	11.24	11.35	11.09	10.75	11.06
G. 84-47	12.53	12.26	12.22	12.34	12.26	12.13	12.15	12.18
G.2003-47 (G.3)	13.77	13.12	12.60	13.17	13.45	12.91	12.47	12.94
Mean	12.54	12.08	11.70		12.25	11.96	11.68	
L.S.D at 0.05								
Sugarcane cultivars (A)				0.21				0.18
Crop cycle age (B)				0.20				0.24
(A) x (B)				0.36				0.31

*** Cutting age refers to: setts taken from the plant, 1st and 2ndratoon crops, used for sugarcane planting.**

7. Number of millable canes/fed:

Data in Table 7 observed that the hopeful G.2004-27 (G.4) cultivar noticeably exceeded in the count of millable canes/fed by 3.47, 7.47 and 7.47 thousand, respectively, compared to the other cane cultivars G.T.54-9, G.84-47, and G.2003-47 in the 1st season, corresponding to 6.58, 9.33, and 10.73 thousand, during 2nd one. Differences in this trait among cane varieties may be attributed to the ability of each variety for germination and tillering, as genetic makeup plays a fundamental role in this regard. These findings are consistent with those documented by Galal *et al*. (2018); Gadallah *et al.* (2020); Yousif *et al.* (2023) and Ali *et al.* (2024).

The results presented that sugarcane cultivation using cuttings taken from its crop cycle, i.e. the plant cane, first and second ratoon appreciably impacted the count of the millable canes/fed, in the two seasons. Transplanting sugarcane by applying seed cuttings taken from the plant cane field amplified the count of the millable canes by 5.950 and 8.750 thousand each feddan, relative to planted seed cuttings taken from the first and second cane ratoons, consecutively, in the 1st season and amounting to 7.000 and 10.850 thousand/fed in the 2nd one (Table 7). The augment of count of millable cane/fed may be caused by the quality of the cuttings and the vitality of the buds from the seeds age of plant cane fields, which is reflected in the growth and branching and thus the rise in the count of the millable canes (Kamat *et al*. 2023). Alternatively, the lowest count of millable cane/fed was achieved when cultivated with seed cuttings taken from 2nd ratoon cane field. This may be due to the low quality of the seeds and the lack of vitality of some buds, which reduced plant density.

The total count of millable canes/fed varied substantially with the interaction of cane varieties and cutting age taken from the crop cycle, in both seasons. Promising cultivar Giza-4 planted with cutting seeds from a plant cane field had maximum number of millable canes 51.80 and 57.40 (1000/fed) in the1st and 2nd seasons, respectively.

Table 7. Crop cycle of different age's effect on the mean count of millable cane (1000/fed) sugarcane varieties and their interaction in 2022/2023 and 2023/2024 seasons.

Sugar cane varieties (A)	2022/2023 season				2023/2024 season			
	Cutting age* (B)			Mean	Cutting age* (B)			Mean
	Plant cane	First ratoon	Second ratoon		Plant cane	First ratoon	Second ratoon	
G.T.54-9	47.60	40.60	36.40	41.53	51.80	44.80	39.20	45.27
G.2004-27 (G.4)	51.80	43.40	40.60	45.27	57.40	51.80	46.20	51.80
G. 84-47	42.00	36.40	35.00	37.80	47.60	40.60	39.20	42.47
G.2003-47 (G.3)	40.60	37.80	35.00	37.80	47.60	39.20	36.40	41.07
Mean	45.50	39.55	36.75		51.10	44.10	40.25	
L.S.D at 0.05								
Sugarcane cultivars (A)				2.47				2.68
Crop cycle age (B)				3.07				2.68
(A) x (B)				NS				4.65

*** Cutting age refers to: setts taken from the plant, 1st and 2ndratoon crops, used for sugarcane planting.**

8. Cane yield/fed:

Findings in Table 8 revealed that the planted cane cultivars differed markedly in cane production in the two seasons. Sugarcane G. 2004-27 (Giza-4) given matchless cane yield/fed compared to the other cane cultivars, produced 8.450, 16.57 and 15.03 tons/fed more than those attained from G.T.54-9, G.84-47 and G.2003-47 cultivars, in the 1st one, successively, corresponding to 8.74, 15.44 and 14.170 tons/fed, in the 2nd one,. These findings can be ascribed to the rise in cane length, diameter, weight and the count of cane stalks/fed (Tables 1, 2, 3 and 7, correspondingly), which is the main component of cane production, in addition to the adaptation of the variety to local environmental conditions. Comparable findings were reviewed by Galal *et al.* (2018); Gadallah *et al.* (2020); Yousif *et al.* (2023) and Ali *et al.* (2024).

The results in Table 8 indicated planting sugarcane using cuttings taken from its crop cycle, *i.e.* the plant cane, first and second ratoons substantially varied cane production in the two seasons. Transplanting sugarcane applying seed cuttings taken from the plant cane field amplified cane yield by 7.750 and 8.780 tons/fed, compared to planted seed cuttings taken from the first and second cane ratoons, severally, in the 1st one, equivalent to 5.500 and 7.930 tons/fed, in the 2nd one. These findings can be ascribed to the rise in cane length, diameter, weight and count of cane stalks/fed (Tables 1, 2, 3 and 7, correspondingly), which is the main component of cane production, accompanying the planted sugarcane using seeds cutting of plant cane field.

The interaction effect among cane varieties and cutting age taken from the crop cycle significantly influenced cane production/fed, in the 2nd season only. The maximum cane yield (63.750 tones/fed) was obtained by the promising cultivar G.4 planted with cutting seeds from a plant cane field,) in the 2nd season.

Table 8. Crop cycle of different age's effect on mean cane yield (ton/fed) sugarcane varieties and their interaction in 2022/2023 and 2023/2024 seasons.

Sugar cane varieties (A)	2022/2023 season				2023/2024 season			
	Cutting age* (B)			Mean	Cutting age* (B)			Mean
	Plant cane	First ratoon	Second ratoon		Plant cane	First ratoon	Second ratoon	
G.T.54-9	54.65	43.62	42.83	47.03	55.78	49.70	43.74	49.74
G.2004-27 (G.4)	60.22	54.19	52.05	55.48	63.75	57.90	53.77	58.48
G. 84-47	43.06	37.61	36.08	38.91	45.72	42.71	40.70	43.04
G.2003-47 (G.3)	45.99	37.50	37.86	40.45	48.22	41.15	43.56	44.31
Mean	50.98	43.23	42.20		53.37	47.87	45.44	
L.S.D at 0.05								
Sugarcane cultivars (A)				1.58				1.70
Crop cycle age (B)				1.95				0.61
(A) x (B)				NS				3.10

*** Cutting age refers to: setts taken from the plant, 1st and 2ndratoon crops, used for sugarcane planting.**

9. Sugar yield/fed:

Findings in Table 9 illustrated a clear superiority of sugarcane G.2004-27 over the other cultivars in sugar yield/fed showing a rise in sugar production of 0.75, 1.45, and 0.92 tons/fed greater than those recorded by G.T.54-9, G.84-47and G.2003-47 varieties, severally, in the 1st one, compared to 0.67, 1.24 and 0.74 tons/fed in 2nd season. The rise in sugar yield/fed was linked to the rise in cane yield/fed (Table 8), which caused an increase in sugar production. Such varietal discrepancies were documented by Gadallah *et al.* (2020); Yousif *et al.* (2023) and Ali *et al.* (2024).

In same Table 9 sugarcane planting using cuttings taken from its crop cycle *i.e.* the plant, first and second cane ratoons led to a marked difference in sugar yield in the two seasons. Planting sugarcane applying seed cuttings taken from the plant cane field raised sugar yield by 1.18 and 1.46 tons/fed, relative to those cultivated seed cuttings taken from the first and second cane ratoons, correspondingly, in the 1st season, compared to 0.81 and 1.21 tons/fed, in the 2nd one. The rise in sugar yield/fed is attributed to the rise in cane yield/fed (Table 8).

Sugar yield/fed substantial influenced by the interaction among cane varieties and cutting age taken from the crop cycle, in the 2nd season. Planting the promising cultivar G.4using cutting seeds from a plant cane field, had the largest sugar yield (7.240 tons/fed).

Table 9. Crop cycle of different age's effect on mean sugar yield (ton/fed) sugarcane varieties and their interaction in 2022/2023 and 2023/2024 seasons.

Sugar cane varieties (B)	2022/2023 season				2023/2024 season			
	Cutting age* (B)			Mean	Cutting age* (B)			Mean
	Plant cane	First ratoon	Second ratoon		Plant cane	First ratoon	Second ratoon	
G.T.54-9	6.56	5.14	4.82	5.51	6.66	5.82	4.97	5.81
G.2004-27 (G.4)	7.14	6.04	5.59	6.26	7.24	6.41	5.77	6.48
G. 84-47	5.40	4.92	4.41	4.81	5.61	5.18	4.94	5.24
G.2003-47 (G.3)	6.33	4.62	4.77	5.34	6.48	5.31	5.43	5.74
Mean	6.36	5.18	4.90		6.49	5.68	5.28	
L.S.D at 0.05								
Sugarcane varieties (A)				0.21				0.22
Crop cycle age (B)				0.27				0.15
(A) x (B)				NS				0.38

*** Cutting age refers to: setts taken from the plant, 1st and 2nd ratoon crops, used for sugarcane planting.**

CONCLUSION

Under conditions of this work, cane growers are advised to plant sugarcane variety G.2004-27(Giza-4) use cuttings taken from a plant cane field as planting material for the maximum cane and sugar production.

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تأثير استخدام عقل تقاوي مأخوذة من دورة محصول بعض أصناف القصب على الجودة و الانتاجية

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الملخص

أُجريت تجربة حقلية في موسمي ٢٠٢٣/٢٠٢٢ و٢٠٢٤/٢٠٢٣ بمحطة البحوث الزراعية بشندويل محافظة سوهاج – مصر (خط عرض ٢٦ ٣٣ درجة شمالاً وخط طول ٣١ ٤١ درجة شرقًا)، لدراسة تأثير استخدام تقاوي مأخوذة من دورة بعض أصناف من قصب السكر (الغرس الربيعي والخلفة الأولي والخلفة الثانية) على المحصول والجودة. استخدم أربعة أصناف من قصب السكر هي الصنف التجاري، جيزة تايوان ٥٤-٩ والصنف الواعد جيزة ٤ والصنف جيزة ٨٤-٤٧ والصنف جيزة ٣ وثلاثة أعمار محصولية هي القصب الغرس الربيعي والخلفة الأولى والخلفة الثانية. أستخدم تصميم القطاعات الكاملة العشوائية باستخدام القطع المنشقة مره واحدة في ثلاث مكررات، وزعت أصناف قصب السكر عشوائيًا في القطع الرئيسية بينما وزعت أعمار دورة محصول القصب في القطع الفرعية. أظهرت النتائج أن أصناف قصب السكر تباينت بشكل ملحوظ في جميع الصفات المدروسة وسجل صنف قصب السكر جيزة ٤ أعلى ارتفاع للساق، وقطر، ووزن الساق، وعدد القصب القابل للعصر/فدان، بالإضافة إلى إنتاجية القصب والسكر/فدان، في كلا الموسمين، بينما تفوق الصنف جيزة ٣ في نسب البركس، والسكروز، وناتج السكر .أظهرت النتائج أن عمر المحصول المأخوذ تقاوي كان له تأثير كبير على معظم صفات قصب السكر المدروسة. أدى زراعة قصب السكر باستخدام عقل من حقل قصب الغرس إلى تحسين ارتفاع الساق، وعدد القصب القابل للعصر/فدان، ونسبة البركس ، والسكروز، وناتج السكر بالإضافة إلى إنتاجية القصب والسكر/فدان.في ظل ظروف هذا العمل، وُجد أن زراعة صنف قصب السكر جيزة ٤ باستخدام عقل تقاوي مأخوذة من دورة المحصول (الغرس) يمكن التوصية بها لتحقيق أقصى إنتاجية من القصب والسكر.