Original Research Article

YIELD AND QUALITY OF SOME SUGARCANE VARIETIES AS AFFECTED BY ROW AND HILL SPACING OF SEEDLINGS

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ABSTRACT

The present work was conducted at Shandaweel Agricultural Research Station (latitude of 26 33° N and longitude of 31 41°E), Sohag Governorate, Egypt on a plant-cane grown in 2022/2023 and its 1st ratoon in 2023/2024 seasons. The main objective was to assess the advantage of growing some sugarcane varieties, using seedlings instead of cane cuttings, on their yield and quality. A randomized complete block design in a split-plot arrangement was used with three replications to lay out eighteen treatments, represented the combinations of three sugarcane varieties[(Giza 2004-27, commercially called G-4); (Giza 2003-47, G-3 and the commercial cultivar G.T.54-9, C9 as a chek], which occupied the main plots, whereas nine combinations among tow row spacing (100 and 120 cm) and three hill spacing of cane transplants (30, 40 and 50 cm) were distributed randomly in the sub plots.

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Results showed that the tested sugarcane varieties varied significantly in stalk height, diameter and number of millable canes/fed,stalk weight kg/plant, cane and sugar yields (tons/fed),brix, sucrose, purity and sugar recovery percentages in both seasons. Sugarcane G.2004-27 variety exhibited the superiority in stalk weight (kg/plant) and cane yield while, sugarcane G.2003-47 showed a significant superiority in the brix, sucrose, and purity and sugar recovery percentages in both seasons

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Data show that increasing row spacing from 100 to 120 and hill space 30, 40 to 50 cmsignificantly onstalk height, diameter and number of millable canes/fed,stalk weight kg/plant, cane and sugar yields (tons/fed),brix, sucrose, purity and sugar recovery percentages in both seasons.

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Under conditions of the present work, growing promising sugarcane variety G. 2004-27 in rows of 100 cm apart with 30 cmseedlings can be recommended to get the maximum cane yield/fed underSohag Governorate.

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INTRODUCTION

Sugarcane is important cash and industrial crop in Egypt, occupying 333 thousand feddan, production is estimated at 15.959 million tons of cane with an average yield of 46.706 ton/fed[1] **(Sugar Crops Council, annual report, 2023).**

In Egypt, sugarcane is grown in the traditional way, which is the method of planting with cane cuttings, which contains 3-4 buds/cane cutting, through which an amount of millable cane estimated at about 5-7 tons/fed is consumed, with a total of 350-500 thousand tons of cane is enough to plant 70.000 feddan planted during spring season. Recently, the Sugar Crops Research Institute at the Agricultural Research Center in Egypt adopted the production of seedlings for growing sugarcane with the aim of reducing the consumption of seeds this saves a few thousand tons of raw materials that can be delivered to mills for sugar extracting and also reducing irrigation water, as it is important to mention that a considerable amount of irrigation water can be saved during the period of cane seedlings production using bud chips in the nursery, compared to the field irrigation in the usual planting, as well as the possibility of growing with some other crops before planting cane. The method of planting by seedling cane is planting excised auxiliary buds of cane stalk, popularly known as bud chips. These bud chips are less bulky, easily transportable and more economical seed material. In case of using bud chips in planting about 150-200kg/fed of material will be markedly sufficient, where it results in a saving of about 97% of cane by weight **El- Soghier (2021).**

Paying attention to different agricultural practices for sugarcane cultivation leads to achieving the highest productivity, one of these practices is row and seedling spacing. Row and seedling spacing has a direct effect on plant population. It plays a distinct role in the amount of solar radiation and hence, crop canopy development, which in turn affects photosynthesis and ultimately the dry matter produced by plant.**El-Geddawy,*et al.* (2002)**and**El-Shafai and Ismail (2006)** They found that the widest row spacing gave the highest juice quality and stalk diameter. Otherwise, They found that the distance row spacing gave the highest stalk height, number of millable canes, cane and sugar yields/fed.**Raskar and Bhoi (2003)** found that cane girth and number of millable canes were significantly higher with a 90-cm intra-row spacing compared with 30 or 60-cm intra-row spacing.

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[1]Sugar Crops Research Inst., ARC, Giza. Egypt

However, Millable cane height was insignificantly affected by row spacing.**Abd El-Lattief (2016)** found that narrow inter-row spacing 100 cm produced higher number of millable canes, cane and sugar yields compared to the other inter-row spacing 120 and 140 cm. **Galal,*et al*.(2018)** indicated that planting sugarcane in rows spaced at 100 cm attained significant increases in the number of millable canes, stalk length, stalk weight, sucrose %, sugar recovery %, cane and sugar yields in the plant and 1stratoon cane crops. **Gadallah and Abd El-Aziz-Rania (2019)** showed that planting sugarcane in rows spaced at 100 cm apart attained a significant increase in cane stalk height, number of millable canes and cane yield. While, stalk diameter, brix, sucrose and sugar recovery% as well as sugar yield were recorded surpassed the other varieties recorded at 120 cm row spacing.

In Egypt, the commercial cane variety G.T.54-9occupies most of the area planted with sugarcane. Recently, Sugar Crops Research Institute developed a lot of promising varieties of sugarcane, among them G.2004-27, G.84-47 and G.2003-47. The newly bred varieties showed variable response to different agronomic practices. In this respect, many studies and researches carried out to evaluate sugarcane varieties for productivity and juice quality traits as well as significant variables among varieties were reported by**Ahmed, (2003); Ahmed,*et al.* (2008); Ismail,*et al*. (2008);Makhlouf, *et al.* (2016); El-Bakry, (2018); Gadallah and Mehareb(2020); Ali,*et al.* (2022)** and **Hussein,*et al*. (2023).**

The main objective of this study was to evaluate the method of planting by seedlings for some varieties of sugarcane when planting with different row spaces and different spaces between seedlings to obtain the highest yield of cane and sugar.

MATERIALS AND METHODS

The present work was carried out at Shandaweel Agricultural Research Station (latitude of 26 33° N and longitude of 31 41°E), Sohag Governorate, Egypt on a plant-cane (P.C.) grown in2022/2023and its 1stratoon (F.R.) in2023/2024 seasons. The main objective was to assess the advantage of growing some sugarcane varieties, using seedlings instead of cane cuttings, on their yield and quality. A randomized complete block design in a split-plot arrangement was used with three replications to lay out eighteen treatments, represented the combinations of three sugarcane varieties [(Giza 2004-27, commercially called G-4); (Giza 2003-47, commercially called G-3 and the commercial cultivarG.T.54-9,C9 as a

chek], which occupied the main plots, whereas nine combinations among tow row spacing (100 and 120 cm) and three hill spacing of cane transplants (30, 40 and 50 cm) were distributed randomly in the sub plots. Healthy seedlings of 60days age, previously produced using bud chips, was transplanted to the main field on the 1st week of May, 2022.

Bud-chip seedlings production started on the 1st week of March. Fresh harvested canes free from disease and pests were topped and bud chips were separates using bud-chipping manual tool. Stalks remained after the separation of buds was delivered to the sugar mill. Bud chips were soaked in warm water mixed in the Maxim XL 3.5% fungicide for ten minutes. The buds were sown in an upright position at 3-5 cm depth in polythene bags of 13x6 cm dimensions, filled with soil taken from the permanent field mixed with a small percentage (20%/seedling bag) of organic fertilizer as farmyard manure containing (0.35% N, 0.48% P, 1.2% K, 8% organic matter and 15% moisture).The nursery was irrigated daily. Nitrogen fertilizer was added at the rate of 5kg ammonium nitrates (33.5% N)/1000seedlings, which was divided into two doses: at the 30th and 40th day after planting.

Phosphorus fertilizer was added to the permanent field, at 30 kg P_2O_5/fed as calcium super phosphate (15% P_2O_5) during land preparation. Nitrogen fertilizer as urea (46% N) was applied to the plant-cane at 210 kg N/fed, which was divided into three doses: after the1st, 2nd hoeing and 30 days later *i.e.*, 45, 75 and 105 days after transplanting. In the 1stratoon cane crop, 230 kg N/fed was applied, which was divided in two equal doses: at 15 days after ratoon initiation, *i.e.* after the 1st hand hoeing and 30 days later, *i.e.* after the 2nd hand hoeing. Potassium fertilizer was added once with the 2nd N-dose, at 24 kg K_2O/fed as potassium sulfate (48% K_2O) in both seasons. The other agronomic practices were done as recommended by the Sugar Crops Research Institute.

Mechanical and chemical properties of the upper 30 cm of the experimental soil showed that soil texture was clay loam, which contained 21.5 % sand, 29.3 % silt, 49.2 % clay; 94 mg/kg soil N, 18 mg/kg soil P_2O_5 and 117 ppm $K_2O$with pH of 7.55.*A:*

The recorded data:

At harvest (1st week of March in the plant-cane and its 1stratoon crop),a sample of 20 canes were randomly collected from the three middle rows of each experimental unit were cut, topped, cleaned up from trash, weighed and counted to estimate the following traits:

1. Stalk length (cm), which was measured from soil surface to the top visible dewlap.
2. Stalk diameter (cm), which was measured at the middle part of stalks.

At harvest the following traits were determined on plot basis and converted to feddan (4200 m^2):

1. Number of millable canes (thousands/fed) was counted.
2. Net stalk fresh weight (kg).

3. Cane yield/fed (ton).
4. Sugar yield/fed (ton), which was estimated according to the following equation:

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

Juice quality traits

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

1. Brix% (TSS: total soluble solids of juice), which was determined using "Brix Hydrometer" according to **A.O.A.C. (2005)**.
2. Sucrose% was determined using "Sacharemeter" according to **A.O.A.C.(2005).**
3. Juice purity% was calculated using the following equation:

Purity%= (Sucrose%/brix%)x**100.**

4. Sugar recovery% was calculated according to **Yadav and Sharma (1980)** as follows: **Sugar recovery%= [sucrose%-0.4 (brix%- sucrose%) × 0.73]**

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 according to **Snedecor and Cochran (1981).**

RESULTS AND DISCUSSIONS

Growth characteristics andtheir effect of sugarcane varieties:

Results in Table (1) the tested sugarcane varieties varied significantly in stalk height, diameter and number of millable canes/fed in both seasons. The commercial G.T.54-9 variety had the highest diameter among the three varieties, followed by G.2004-27 and G.2003-47 which recorded the lowest

values in these traits. While, G.2004-27 variety gave the highest stalk height and number of millable canes/fed in both seasons, however, the difference between G.T.54-9 and G.2004-27 varieties in stalk height was insignificant in both seasons. The variance among cane varieties in these traits may be due to their gene make-up. **Ismail,*et al.* (2008)** and **Ahmed,*et al.* (2008)** recorded differences among the tested cane varieties in stalk height and diameter.These results are in agreement with those reported by**Ahmed, (2003);Makhlouf, *et al.* (2016); El-Bakry, (2018); Gadallah and Mehareb(2020); Ali,*et al.* (2022)** and **Hussein,*et al.* (2023).**

Table (1): Effect of seedlings technology on growth characteristics of some sugarcane varieties in the 2022/2023 and 2023/2024 growing seasons

Varieties	Stalk height (cm)		Stalk diameter (cm)		No. of millable canes/fed	
	2022/23 P.C.	2023/24 F.R.	2022/23 P.C.	2023/24 F.R.	2022/23 P.C.	2023/24 F.R.
G.T.54-9	270.8	315.0	2.47	2.55	55.992	64.026
G.2004-27	275.2	315.4	2.39	2.47	56.668	64.576
G.2003-47	265.6	272.2	2.30	2.49	48.375	55.833
LSD at 0.05	**4.99**	**5.33**	**0.04**	**0.04**	**0.381**	**0.183**

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Growth characteristicsandtheir effect on row spacing and hill space:

Data in Table (2) show that increasing row spacing from 100 to 120 and hill space 30, 40 to 50 cm led to a significant decrease in cane stalk height, number of millable canes/fed in the plant and 1st ratoon crops, while stalk diameter increasing in the plant and 1st ratoon crops,. This result could be due to the competition among cane plants for light in the dense planting, *i.e.* narrower row spacing. **Chang, (1974)** reported that the proportion of invisible solar radiation is so much increased than the visible solar radiation due to dense sowing. The former has an elongation effect and hence accounts for the increase observed in stalk height when sugarcane was planted in close spaced rows. The same finding was reported by **El-Geddawy,*et al.* (2002);El-Shafai and Ismail (2006); Abd El-Lattief (2016)** and **Gadallah and Abd El-Aziz-Rania (2019)** who found that cane stalk height increased with decreasing row spacing .

Table (2): Effect of seedlings technology on growth characteristics at different row and hill spacing in the 2022/2023 and 2023/2024 growing seasons

Treatments		Stalk length (cm)		Stalk diameter (cm)		No. of millable canes/fed	
Row space (cm)	Hill space (cm)	2022/23 P.C.	2023/24 F.R.	2022/23 P.C.	2023/24 F.R.	2022/23 P.C.	2023/24 F.R.
100	**30**	288.8	310.4	2.26	2.46	56.413	63.729
	40	276.7	304.3	2.33	2.49	54.206	62.371

	50	271.6	299.7	2.40	2.48	52.973	60.731
120	**30**	266.4	302.0	2.39	2.49	54.511	62.250
	40	263.1	299.0	2.44	2.53	52.676	61.000
	50	256.8	288.8	2.49	2.57	51.289	58.788
LSD at 0.05		**3.91**	**2.80**	**0.03**	**0.03**	**0.407**	**0.213**

Effect of interaction between row spacing and hill space & sugarcane varieties on growth characteristics:

As for the significant interaction effects, stalk height and diameter was significantly affected by the interactions between row spacing and cane varieties in plant cane Table (3). The same interaction also showed a significant effect on the number of millable canes/fed in the plant cane and 1st ratoon.The Giza 2004-27 variety achieved the highest number of millable canes/fed with planning distance 100 cm /30cm in the plant cane and 1st ratoon which gave 59.627 and 66.587/fed in both seasons. While the highest cane stalkwith planning distance 100 cm /30cm in the plant cane, on the contrary, the cane stalkthicknesswas obtaineddistance 120 cm /50cm in the plant cane.

Table (3): Effect of seedlings technology on the interaction between different row and hill spacing and sugarcane varieties on growth characteristics in 2022/2023 and 2023/2024 growing seasons

Treatments			**Stalk length (cm)**		**Stalk diameter (cm)**		**No. of millable canes/fed**	
Varieties	**Row space (cm)**	**Hill space (cm)**	**2022/23 P.C.**	**2023/24 F.R.**	**2022/23 P.C.**	**2023/24 F.R.**	**2022/23 P.C.**	**2023/24 F.R.**
G.T.54-9	**100**	**30**	294.3	324.0	2.35	2.48	58.435	65.667
		40	277.7	316.3	2.43	2.54	56.299	65.033
		50	271.0	315.0	2.48	2.53	55.063	63.967
	120	**30**	265.0	316.7	2.48	2.54	56.603	64.507
		40	261.0	312.3	2.53	2.57	55.467	63.850
		50	256.0	305.5	2.57	2.63	54.083	61.130
G.2004-27	**100**	**30**	295.3	325.0	2.32	2.46	59.627	66.587
		40	284.3	320.0	2.34	2.47	56.843	65.233
		50	275.3	312.7	2.43	2.44	55.993	63.260
	120	**30**	268.3	318.7	2.35	2.45	57.043	65.457
		40	267.0	314.3	2.41	2.49	55.580	64.583
		50	261.0	301.7	2.47	2.53	54.920	62.333
G.2003-47	**100**	**30**	276.7	282.3	2.13	2.45	51.178	58.933
		40	268.3	276.7	2.22	2.45	49.477	56.846
		50	268.0	271.3	2.29	2.48	47.863	54.967
	120	**30**	265.3	273.0	2.33	2.49	49.887	56.787
		40	262.0	270.3	2.39	2.52	46.980	54.567
		50	253.3	259.3	242	2.54	44.863	52.900
LSD at 0.05			**6.77**	**NS**	**0.05**	**NS**	**0.704**	**0.401**

Stalk weight kg/plant, cane yield and sugar yield (tons/fed) as affected by sugarcane varieties:

Sugarcane G.2004-27 variety exhibited the superiority in stalk weight (kg/plant) and cane yield recording significant increases amounted to 8.601 and 10.751 tons/fed higher than those produced by G.2003-47 variety, in the plant and 1st ratoon canes, respectively Table (4). Sugarcane G.T.54-9 variety exhibited the superiority in sugar yield recording significant increases amounted to 0.171 and 0.636 tons/fed higher than those produced by G.2003-47 variety, in the plant and 1st ratoon canes, respectively. These results could be attributed to higher values of stalk height and number of millable canes/fed (Table 1). These results are in agreement with those reported by **Ahmed (2003)** and **Ismail,*et al.* (2008)**.

Table (4): Effect of seedlings technology on stalk weight kg/plant, cane yield and sugar yield (tons/fed)of some sugarcane varieties in 2022/2023 and 2023/2024 growing seasons

Varieties	Stalk weight (kg/plant)		Cane yield (ton/fed)		Sugar yield (ton/fed)	
	2022/23 P.C.	2023/24 F.R.	2022/23 P.C.	2023/24 F.R.	2022/23 P.C.	2023/24 F.R.
G.T.54-9	0.991	1.033	55.486	66.147	6.250	7.934
G.2004-27	0.986	1.041	55.879	67.253	6.117	7.515
G.2003-47	0.978	1.012	47.277	56.502	6.079	7.298
LSD at 0.05	**0.008**	**0.002**	**0.387**	**0.288**	**0.077**	**0.177**

Stalk weight kg/plant, cane yield and sugar yield (tons/fed) as affected by row spacing and hill space:

Data in Table (5) clear that stalk weight kg/plant, cane yield and sugar yield (tons/fed) were significantly and negatively influenced by increasing row spacing, where the wider the row spacing, the higher the stalk weight kg/plant and sugar yield (ton/fed) and lower cane yield(ton/fed). This result was true in both of the plant cane and 1st ratoon crops. This result can be attributed to lower values of stalk height and number of millable canes/fed (Table 2) and sugar recovery(Table 8) at the widest row spacing (120 cm).Planting sugarcane in rows spaced at 100-cm with 30cm apart produced 1.319 and 1.387 tons/fed of cane higher than that grown at 120-cm rows, in plant cane and 1st ratoon crops respectively. These results are in agreement with those reported by**El-Geddawy,*et al.* (2002);El-Shafai and Ismail (2006)**and**Gadallah**and **Abd El-Aziz-Rania (2019).**

Table (5):Effect of row spacing and hill space on stalk weight kg/plant, cane yield and sugar yield (tons/fed)in 2022/2023 and 2023/2024 growing seasons

Treatments		Stalk weight (kg/stalk)		Cane yield (ton/fed)		Sugar yield (ton/fed)	
Row space (cm)	Hill space (cm)	2022/23 P.C.	2023/24 F.R.	2022/23 P.C.	2023/24 F.R.	2022/23 P.C.	2023/24 F.R.
100	**30**	0.981	1.030	55.346	65.716	6.316	7.525
	40	0.981	1.028	53.242	64.154	6.173	7.620

	50	0.989	1.017	52.437	61.808	6.085	7.308
120	**30**	0.991	1.032	54.027	64.329	6.331	7.943
	40	0.981	1.031	51.733	62.920	6.042	7.579
	50	0.985	1.035	50.499	60.878	5.944	7.518
LSD at 0.05		**0.007**	**0.002**	**0.439**	**0.288**	**0.081**	**0.099**

Effect of interaction between row spacing & hill space and sugarcane varieties on stalk weight kg/plant, cane yield and sugar yields (tons/fed):

Stalk weight kg/plant and cane yield was significantly affected by the interaction between row spacing & hill spacing xsugarcane varieties in the plant cane and 1st ratoon crops Table (6). Insignificant variance in sugar yield was found in cane plants. However, the difference in sugar yield was found between these interactions in the1st ratoon crops.

Table (6): Effect of seedlings technology on the interaction between different row and hill spacing and sugarcane varieties on stalk weight kg/plant, cane yield and sugar yield (tons/fed) in 2022/2023 and 2023/2024 growing seasons

Treatments			**Stalk weight (kg/stalk)**		**cane yield (ton/fed)**		**Sugar yield (ton/fed)**	
Varieties	**Row space (cm)**	**Hill space (cm)**	**2022/23 P.C.**	**2023/24 F.R.**	**2022/23 P.C.**	**2023/24 F.R.**	**2022/23 P.C.**	**2023/24 F.R.**
G.T.54-9	**100**	**30**	0.986	1.042	57.600	68.393	6.420	7.774
		40	0.988	1.039	55.647	67.600	6.219	7.918
		50	0.999	1.022	55.028	65.350	6.149	7.790
	120	**30**	1.008	1.039	57.033	67.030	6.464	8.398
		40	0.977	1.025	54.178	65.470	6.155	7.907
		50	0.988	1.031	53.427	63.040	6.092	7.817
G.2004-27	**100**	**30**	0.979	1.041	58.373	69.300	6.302	7.337
		40	0.996	1.036	56.620	67.583	6.211	7.509
		50	0.993	1.025	55.578	64.837	6.064	7.106
	120	**30**	0.985	1.025	56.200	68.713	6.184	7.900
		40	0.989	1.048	54.987	67.690	6.034	7.613
		50	0.974	1.049	53.517	65.397	5.906	7.625
G.2003-47	**100**	**30**	0.978	1.009	50.063	59.453	6.226	7.465
		40	0.959	1.008	47.459	57.280	6.088	7.432
		50	0.976	1.005	46.705	55.237	6.042	7.028
	120	**30**	0.979	1.008	48.847	57.243	6.345	7.529
		40	0.980	1.019	46.033	55.600	5.938	7.218
		50	0.993	1.025	44.553	54.197	5.834	7.112
LSD at 0.05			**0.012**	**0.003**	**0.760**	**0.498**	**NS**	**0.114**

Quality characteristics and their impact on sugarcane varieties

Sugarcane G.2003-47 showed a significant superiority in the brix, sucrose, purity and sugar recovery (%) over that recorded by G.2004-47 and G.T.54-9, in the plant cane and the 1st ratoon Table (7). Differences among cane varieties in this trait were also found by **Ahmed, (2003); Ahmed,*et al.* (2008); Ismail,*et al.* (2008);Makhlouf, *et al.* (2016); El-Bakry, (2018); Gadallah and Mehareb(2020); Ali,*et al.* (2022)** and **Hussein,*et al.* (2023).**

Table (7): Effect of seedlings technology on juice quality of some sugarcane varieties in the 2022/2023 and 2023/2024 growing seasons

Varieties	Brix %		Sucrose %		Purity%		Sugar recovery%	
	2022/23 P.C.	2023/24 F.R.	2022/23 P.C.	2023/24 F.R.	2022/23 P.C.	2023/24 F.R.	2022/23 P.C.	2023/24 F.R.
G.T.54-9	21.02	22.394	17.78	18.99	84.58	84.77	11.27	12.00
G.2004-27	20.98	21.417	17.53	17.89	83.56	83.51	10.95	11.18
G.2003-47	23.71	23.828	20.26	20.37	85.49	85.48	12.68	12.92
LSD at 0.05	**0.26**	**0.36**	**0.25**	**0.35**	**1.36**	**0.25**	**0.12**	**0.23**

Quality characteristics and their impact on row spacing and hill space:

Data in Table (8) show that increasing row spacing from 100 to 120 and hill spacing 30, 40 and 50 cm led to a significant increase in brix, sucrose, purity and sugar recovery (%) in the plant and 1st ratoon crops.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)**. The same finding was reported by**El-Geddawy,*et al.* (2002);Galal,*et al.*, (2018)** and **Gadallah and Abd El-Aziz-Rania (2019)**.

Table (8): Effect of seedlings technology on juice quality at different row and hill spacing in the 2022/2023 and 2023/2024 growing seasons

Treatments		Brix %		Sucrose %		Purity%		Sugar recovery%	
Row space (cm)	Hill space (cm)	2022/23 P.C.	2023/24 F.R.	2022/23 P.C.	2023/24 F.R.	2022/23 P.C.	2023/24 F.R.	2022/23 P.C.	2023/24 F.R.
100	**30**	21.50	21.507	18.15	18.19	84.39	84.52	11.46	11.50
	40	21.87	22.308	18.48	18.89	84.43	84.65	11.66	11.93
	50	21.98	22.209	18.58	18.80	84.49	84.60	11.67	11.87
120	**30**	21.99	23.222	18.62	19.67	84.64	84.69	11.68	12.39
	40	21.95	22.786	18.58	19.24	84.62	84.24	11.64	12.10
	50	22.09	23.248	18.72	19.69	84.69	84.66	11.84	12.39
LSD at 0.05		**0.23**	**0.28**	**0.22**	**0.23**	**NS**	**0.14**	**0.12**	**0.13**

Effect of interaction between row spacing and hill space & sugarcane varieties on juice quality:

In respect to the significant interaction effects, sucrose, purity and sugar recovery (%) was significantly affected by the interaction between row spacing and hill space & sugarcane varieties n the 1st ratoon only. Insignificant variance in brix% was found in cane plant and 1st ratoon, as well as sucrose, purity and sugar recovery (%) in thecane plant (Table 9).

Table (9): Effect of seedlings technology on the interaction between different row and hill spacing and sugarcane varieties on juice quality in 2022/2023 and 2023/2024 growing seasons

Treatments			Brix %		Sucrose %		Purity%		Sugar recovery%	
Varieties	Row space (cm)	Hill space (cm)	2022/23 P.C.	2023/24 F.R.	2022/23 P.C.	2023/24 F.R.	2022/23 P.C.	2023/24 F.R.	2022/23 P.C.	2023/24 F.R.
G.T.54-9	**100**	**30**	20.79	21.24	17.58	17.96	84.54	84.54	11.15	11.37
		40	20.97	21.86	17.69	18.51	84.33	84.69	11.18	11.71
		50	20.96	22.20	17.68	18.83	84.35	84.84	11.17	11.92

	120	**30**	21.06	23.35	17.85	19.84	84.75	84.97	11.33	12.53
		40	21.08	22.63	17.88	19.15	84.80	84.64	11.36	12.08
		50	21.23	23.08	17.98	19.61	84.69	84.97	11.40	12.40
G.2004-27	**100**	**30**	20.60	20.27	17.22	16.90	83.58	83.37	10.80	10.59
		40	20.94	21.25	17.50	17.76	83.60	83.56	10.97	11.11
		50	21.23	20.99	17.72	17.53	83.47	83.51	10.91	10.96
	120	**30**	21.02	22.02	17.57	18.41	83.59	83.61	11.00	11.50
		40	20.99	21.66	17.54	18.05	83.55	83.33	10.97	11.25
		50	21.08	22.31	17.62	18.67	83.59	83.71	11.04	11.66
G.2003-47	**100**	**30**	23.11	23.01	19.65	19.70	85.04	85.64	12.44	12.56
		40	23.71	23.81	20.24	20.41	85.36	85.71	12.83	12.97
		50	23.76	23.44	20.35	20.03	85.65	85.47	12.94	12.73
	120	**30**	23.90	24.29	20.45	20.77	85.58	85.48	12.99	13.15
		40	23.76	24.06	20.32	20.53	85.52	85.30	12.90	12.98
		50	23.97	24.35	20.57	20.77	85.81	85.30	13.03	13.12
LSD at 0.05			**NS**	**NS**	**NS**	**0.40**	**NS**	**0.24**	**NS**	**0.23**

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addd conclusion :[13WU]Comment and

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