Plant Archives Vol. 20, Supplement 2, 2020 pp. 2871-2879 **e-ISSN:2581-6063 (online), ISSN:0972-5210**

RESPONSE OF SUGARCANE *SACCHARUM OFFICINARUM* L. VARIETIES TO SEEDLING TECHNIQUE

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Abstract

A research study was carried out on the sugarcane in the fields of the College of Agriculture, University of Diyala during the two seasons 2018 and 2019, as the setts were planted inside a greenhouse to obtain three ages of seedlings (30, 45 and 60 days) for three varieties (CP72-2086, CP89- 2143 and CP81-325) were moved to the field on 1 March 2018 to evaluate the varieties in their ability to tolerate environmental variations and to know the extent to which seedlings can be cultivated in the sustainable field at the appropriate time and their success in increasing the number of milliable canes as well as knowing the extent effect of biological interaction between the seedlings ages and varieties in phenotypic traits. The results showed that CP89-2143 was able to achieve the highest increase in seedlings age 45 and 60 days, achieving 208 and 202 cm, respectively, compared to the traditional planting method that recorded 165 cm for the same variety. The age of the seedlings 60 days caused a significant increase in the period of the tillering stage and did not differ significantly from the age of seedlings 45 which recorded 45.10 and 44.33 days, respectively, compared to the traditional planting method that recorded 31.10 days. 270 days after planting. The 60-day seedling age with variety CP89-2143 achieved the highest significant increase in the number of milliable canes (61.7 cane.m^{-2}) and the least significant decrease in the average number of non-milliable canes (1.4 cane.m^{-2}).The control treatment achieved the highest increase in the average of cane diameter of all varieties and the variety CP89-2143 achieved high average reached 3.4 cm did not differ significantly from the age of seedlings 45 and 60 days with variety CP89-2143. The seedlings of all ages and for all varieties achieved the highest increase in the average of number of green leaves compared to the traditional planting method after 45 and 270 days of planting.

Keywords: Seedling ages, Varieties, Phenotypic traits, Sugarcane.

Introduction

The sugarcane crop *Saccharum officinarum* L. is an important industrial agricultural crops, as it is concerned with cultivation of all countries of the world located between latitudes 35˚ north and south of the equator. The countries interest in cultivating this crop comes from its production of sugar that is indispensable in all countries of the world as well as the secondary industries produced from its waste, whether before or after industrialization (Muhammad, 2016 and Yu *et al*., 2019). Varieties vary in their production of sugarcane stems by varying environmental conditions, as a loss in yield is observed in some cultivars under these conditions (Ghaffar *et al*., 2013). Varieties also differ in their ability to record the highest number of tillers, the number of milliable canes, cane height, and one cane weight (Pooja, 2016).

The transplant technique was not used on the sugarcane in Iraq but was used on other field crops and achieved positive results (Almubarak *et al*., 2018), while in Egypt the transplant technique was used on the sugarcane in order to reduce the cost of production of setts per hectare (Galal, 2016 and Al-Wakeel and Al-Muhanna, 2014 and Abd El Mawla *et al*., 2014). In Indonesia was interested in developing cane yield through the use of seedling cultivation technique (Suhesti *et al*., 2018). As for India, it achieved 100% germination guarantee and increased number of tillers per seedling (Nalawade *et al*., 2018). It is worth mentioning in Iraq, that sugarcane plants enter the tillering stage with a short period of time that may not exceed a month depending on the available temperature, which should not exceed 30°C. Otherwise, it will move towards the elongation stage, and because the sugarcane depends on the number of tillers that turn Later on to milliable canes. The idea of using seedling technique came in this crop, which may be early in the crop entering the tillering stage to take a longer period of time, which allows more tillers to be formed since the early stages of growth. The cultivation of seedlings of different ages and varieties of sugarcane in our current study is with the aim of evaluating the varieties in their ability to withstand environmental conditions and knowing the extent to which seedlings can be grown in the sustainable field at the right time and their success in increasing the number of milliable canes as well as knowing The extent of the effect of biological interaction between seedling ages and varieties on phenotypic traits.

Materials and Methods

A research study on sugarcane was carried out from two experiments, the first on sugarcane planting for the year 2018 and the second on sugarcane first ratoon for the year 2019 in the fields of the College of Agriculture - University of Diyala. The cultivated sets of three varieties are CP72-2086, CP89-2143 and CP81-325. A factorial experiment was applied according to the Complete Randomized Block Design with three replicates, each replicate was divided into 12 experimental units that included nine treatments for the seedling method consisting of three varieties with three seedling ages, as well as three treatments represented by setts cultivation of the same varieties directly in the field as a traditional planting method (control treatment).

After conducting soil service operations, the field was divided into several experimental units. The area of the experimental unit is 8 m² and the distance between an experimental unit to another is 1 m and between a replicate and another 2 m. The experimental unit included four lines of length 2m each and the distance between one line to another

1m. Experiment was fertilized with urea fertilizer (46% N), 200 kg N per hectare two additions, the first was added the beginning of the tillering stage, and the second the beginning of the elongation stage after the weeding process. As for triple super phosphate fertilizer (45% P2O5), it was added by 200 kg P2O5 before planting (Rizk and Abdel-Ali, 1981). The data were recorded for a number of important growth traits in the growing plants in the central lines of each experimental unit and their mean was calculated, as the following phenotypic traits were studied at the end of the tillering, elongation and final ripening stages (Almubarak, 2004).

- **Cane height (cm):** Measured using a tape measure from the soil surface up to the last node of ten plants taken from the midline of each experimental unit**.**
- **Period of the tillering stage:** It was calculated from calculating the number of days from the beginning of the tillering stage until the beginning of the elongation stage for each experimental unit, as the beginning of the elongation stage was determined when the temperature reached 30 ° C (Saad , 2016).
- **Milliable and non-milliable canes:** The number of milliable and non-milliable canes were calculated for one square meter of each experimental unit at the final ripening stage.
- **Cane diameter (cm):** measured using the Vernia from three locations, base, middle and top of the stem. It was divided by 3 to obtain an average of this characteristic of ten plants that were taken to measure the cane height**.**at the final ripening stage.
- **Number of green leaves:** The green leaves were counted for ten plants that were taken to measure the cane height from each experimental unit at the end of the tillering and final ripening stages.

The data were analyzed according to the method of analysis of variance for a factorial experiment by Randomized Completely Block Design (RCBD) using the SPSS. The Least Significant Difference test (L.S.D) was chosen to compare the means, at a probability level of 0.05.

Results and Discussion

Cane height (cm):

The data in Table (1) indicate that significant effects occurred between the seedling ages and varieties and their interaction in the average cane height, after 45 days of planting, the 45-day age recorded a significant increase, reaching 29.2 cm compared to the control treatment recorded 1.3 cm. After 180 days of planting , the seedling age 60 and 45 days recorded significant differences, average of 145.6 and 143.3 cm, respectively, compared to the traditional planting treatment, which recorded an average of 111.0 cm. As for 270 days after planting, the increase in the treatment of seedling ages continued to 45 and 60 days, reaching an average of 195.9 and 195.8 cm, respectively, compared to the traditional planting treatment, which recorded an average of 159.9 cm.

The increase in the average of cane height when the seedlings of various ages is a natural result of the plant stays and growth during the periods 60, 45 and 30 days inside the greenhouse. This increase continued until the stage of final ripening, as plants during this period began storing food in large quantities in the stem, roots and leaves, and prepared as a result of the abundance of nutrients achieved during those periods to move quickly to the major vegetative growth stage towards the early ripening stage compared to the control treatment that recorded a significant decrease, possibly due to the length of time from sett planting until the emergence that took up to 15 days, which had a clear effect on the late exposure of the plant to sunlight and the process of photosynthesis, which negatively affected its growth and stem elongation.

Regarding the varieties, after 45 days of planting, the CP81-325 variety outperformed the other varieties and recorded an average of cane height of 21.1 cm compared to the CP72-2086 and CP89-2143 varieties which recorded 19.7 and 19.4 cm, respectively. After 180 days of planting, the variety CP72-2086 recorded the highest mean of 167.7 cm compared to the varieties CP89-2143 and CP81-325 which recorded 141.9 and 135.4 cm respectively, and after 270 days of planting, the variety CP89-2143 excelled in this trait, registering 192.7 cm as average of cane height compared to CP81-325 and CP72-2086, which recorded 185.7 and 173.3 cm respectively.

The superiority of the variety CP89-2143 in the average of this trait by giving it the highest average height of the stem in the stage of full maturity is evidence that it is the most efficient in exploiting its genetic and physiological capabilities, so the highest average of this trait was given at the end of the crop growth, as the plant height is affected by the genetic factor and the environmental factors surrounding it Al-Dulaimi and Al-Fahdawi (2018). Also, the significant differences between the varieties in the average of this trait and in the different growth periods were consistent with the results of Al-Janabi and others (2005) and Kuri and Chandrashekar (2015) which found a significant difference in average of plant height between the studied genotypes.

The interaction between the seedling age of 60 days and the CP81-325 variety achieved the highest mean for this trait after 45 days of planting as it reached a height of 30.8 cm and did not differ significantly from the seedling age of 45 days for the CP89-2143 and CP81-325 which record an mean of 30.4 and 29.6 cm respectively, but after 180 days of planting, the variety CP89-2143 was able to achieve the highest average of cane height at the age of seedlings 45 and 60 days, reached 152.0 and 151.3 cm, respectively. The previous two treatments continued until maturity stage (270 days after planting), with average of cane height of 208.3 and 202.8 cm, respectively, compared to the traditional (control) treatment that recorded 165.1 cm for the same variety.

The significance of the interaction indicates that the genotypes have varied their response under the influence of cultivation by seedling technique, and as a result, they differed in their heights. This may be due to the fact that the CP89-2143 variety under seedling technology has utilized its genetic and physiological capabilities with high efficiency to convert photosynthesis products that accumulated early in the seedling leaves for the growth and elongation of stem cells instead of accumulating in plant parts Thus, its plants achieved an increase in the mean of root length and dry weight of plants when transporting them from the greenhouse to the permanent field which may have a positive effect later on increasing the average of cane height.

Table 1 : Effect of seedlings ages and varieties in cane height (cm) during the growth stage of sugarcane (plant cane) for first year 2018.

45 days after planting				
Seedling ages(day)	Varieties			Mean
	CP72-2086	CP89-2143	CP81-325	
30	23.6	22.8	23.2	23.2
45	27.8	30.4	29.6	29.2
60	26.4	23.0	30.8	26.7
Control	**1.3**	1.7	1.0	**1.3**
Mean	19.7	19.4	**21.1**	
L.S.D 0.05 for ages 1.088 for varieties 0.942 for interaction 1.885				
180 days after planting				
Seedling ages(day)	Varieties			Mean
	CP72-2086	CP89-2143	CP81-325	
30	128.6	146.0	138.4	137.7
45	133.3	152.0	144.6	143.3
60	138.7	151.3	146.7	145.6
Control	102.6	118.3	112.0	111.0
Mean	167.7	141.9	135.4	
L.S.D 0.05 for ages 1.325 for varieties 1.148 for interaction 2.295				
270 days after planting				
Seedling ages(day)	Varieties			Mean
	CP72-2086	CP89-2143	CP81-325	
30	171.4	194.6	185.8	183.9
45	180.9	208.3	198.5	195.9
60	189.3	202.8	195.3	195.8
Control	151.5	165.1	163.0	159.9
Mean	173.3	192.7	185.7	
L.S.D 0.05 for ages 1.968 for varieties 1.704 for interaction 3.409				

Table 2 : Effect of seedling ages and varieties in cane height (cm) during the growth stage of sugarcane (ratoon) for second year 2019.

45 days after planting				
Seedling ages(day)	**Varieties**			**Mean**
	CP72-2086	**CP89-2143**	**CP81-325**	
30	25.3	33.0	28.4	28.9
45	26.2	32.5	27.9	28.9
60	25.1	34.7	28.2	29.3
Control	26.8	32.0	30.8	29.9
Mean	25.9	33.1	28.8	
L.S.D 0.05 for ages N.S for varieties 0.961 for interaction 1.922				
180 days after planting				
Seedling ages(day)	Varieties			Mean
	CP72-2086	CP89-2143	CP81-325	
30	130.6	151.3	141.0	141.0
45	133.2	149.2	143.1	141.8
60	131.7	152.4	140.8	141.6
Control	134.3	151.4	140.0	141.9
Mean	132.5	151.1	141.2	
L.S.D 0.05 for ages N.S for varieties 0.965 for interaction 1.929				
270 days after planting				
Seedling ages(day)	Varieties			Mean
	CP72-2086	CP89-2143	CP81-325	
30	185.8	209.1	194.8	196.6
45	183.6	212.9	197.8	198.1
60	186.9	206.6	200.7	198.0
Control	184.2	206.5	199.8	196.8
Mean	185.1	208.8	198.3	
L.S.D 0.05 for ages 0.872 for varieties 0.755 for interaction 1.510				

Various results appeared during the year 2019 (Table 2), as the differences were not significant between the seedlings ages and the control treatment (traditional planting method) in the mean of cane height after 45 and 180 days of planting, this may be due to the exposure of all crop plants, whether transferred as seedlings or It was planted in a traditional method during the year 2018 to increase the temperature during the beginning of March, which caused the buds to be stimulated at the same time or to re-grow them all without there being a specific factor. While similar results appeared between the plant cane (the year 2018) and the first ratoon (the year 2019) with respect to the varieties, as the variety CP89-2143 showed a significant increase during the period of crop growth, and this result confirms its high genetic potential compared to other varieties. The seedlings of 45 days of variety CP89-2143 also showed the highest increase in the average of this trait for the first ratoon.

Period of tillering stage

It is noted from the data of Table (3) that there were significant effects between the seedling ages and varieties their interaction in the period of the tillering stage. The seedlings age 60 days caused a significant increase in the average of this trait and did not differ significantly with the seedlings age 45 days which recorded 45.1 and 44.3 days compared to the control treatment which recorded 31.1 days, and for the variety CP72-2086 there was a significant increase in the average of this trait reached 39.8 days and did not differ significantly with variety CP89-2143 that recorded 39.1 days compared to the variety CP81-325 that recorded 38.7 days. As for the bilateral interaction between the seedling ages and varieties, the seedlings with a 60-day age with the variety CP72-2086 achieved the highest mean reached 46.6 days and did not differ significantly with the age of seedlings 60 and 45 days with the variety CP81-325 which recorded 45.3 and 45.0 days, respectively. In general, the two ages 45 and 60 days for all varieties have achieved an increase in the period of the tillering stage compared to the 30-day seedlings and the control treatment.

The superiority of the seedling technique in achieving the longest period of the tillering stage is perhaps due to the long period of exposure of plants or seedlings to climate factors, especially temperature and lighting, which contributed to the detection of buds before being transferred to the field and are still in the greenhouse, which took advantage of the longest period of development and formation tillers compared to the traditional planting method (control treatment) that caused the prolongation of the period of planting until the emergence of buds that took up to 15 days, which led to reducing the period of the tillers stage, Parajuli (2016) stated that the tillers grow better at a daily temperature of between 18 - 35 ºC and an average temperature of 26 ºC, while tillers growth is less when the temperature rises below 35 ºC and falls below 18 ºC. These results are consistent with Vasantha *et al*. (2005), Munir *et al*. (2009) and Charumathi *et al*. (2012).

Different results appeared on sugarcane (ratoon) in the second year 2019 (Table 4) in the average of period of the tillering stage, as no significant differences appeared between the seedling ages and the control treatment (traditional planting method) and this may be due to the fact that stimulation of the buds of the setts was at a time one to expose the buds to suitable temperatures for stimulation and thus entered the tillering stage at the same time opposite to what happened in the sugarcane planting for the first year 2018, and there was a clear variation in the period of the tillering stage because of exposure setts to stimulate its buds which are inside the greenhouse and thus the period of the tillering stage began In it, when transferred to the permanent field at a time when the sugarcane planted in the traditional method required a number of days and exposure to the necessary growth requirements of water, food and therefore to light, which caused the clear difference in the period of tillering stage between them.

Number of Milliable and non-milliable canes

The results of Table (5) show that there were significant effects between the seedling ages and varieties their interaction in the average number of milliable and non-milliable canes. Significant effects were observed between the seedling ages, the seedlings age 45 and 60 days recorded an increase in the average number of milliable canes of 54.7 and 54.3 cane.m^{-2}, with an increase of 128 and 126%, respectively, compared to the control treatment that recorded the number of milliable canes 24.0 cane.m^{-2} and a significant decrease in the average number of non-milliable canes, as it recorded 2.8 cane, m^{-2} with a decrease of 28 % For each seedling age of 30 and 45 days compared to the control treatment that recorded the number of non-milliable canes 3.9 cane.m^{-2}.

Regarding the varieties, the CP89-2143 variety significantly outperformed the average number of milliable canes from the other two varieties, as the average number was 49.3 cane.m^{-2}, while the variety CP72-2086 share the lowest average number of canes of 40.5 cane.m^{-2}, as for the non-milliable canes, the result was reversed, with the highest mean number of milliable canes (CP89-2143) having the lowest mean of this trait of 2.3 cane.m^{-2}

As for the interaction, the seedling age was 45 days for the CP89-2143 variety, the highest significant increase in the number of milliable canes was 61.7 cane.m^{-2}, with an increase of 111% and the lowest significant decrease in the average number of non-milliable canes 1.4 cane.m^{-2} and with a decrease It reached 44%.

The increase in the number of milliable canes and the decrease in the number of non-milliable canes using the transplanting technique may be due to the increase in the average number of tillers that occurred after 45 days of planting and continued until harvest, due to the role of this technique in the early impact of vegetative growth, including number of tillers since the beginning of the tillering stage, the newly formed tillers have allowed to grow and develop later and create milliable canes in order to improve the absorption of both water and food and to provide a suitable place for the growth of tillers on one side, and provide sufficient light for photosynthesis on the other side, This in turn, caused the storage of sufficient quantities of sugars that accumulate in the canes of the crop plants.

Similar results appeared in the average of this trait in the first ratoon sugarcane for the year 2019 (Table 6) in both seedling ages and varieties and the interaction between them, as seedlings at the age of 45 days recorded an increase in the average number of milliable canes with an increase of 58% and a decrease in the number of non-milliable canes ratio decreased by 38%, while control treatment (traditional

planting method) recorded a decrease in the number of milliable canes and an increase in the number of non-milliable canes. Variety CP89-2143 also recorded an increase in the average number of milliable canes and a decrease in the number of non-milliable canes. As for the interaction, the seedlings at the age of 45 days with the CP89-2143 variety achieved the highest increase in the average number of milliable canes, with an increase of 35% and the lowest decrease in the average number of non-milliable canes, with a decrease of 35%.

Cane diameter (cm)

Table (7) data shows the presence of significant effects between seedling ages and interaction between seedling ages and varieties, while the varieties had no significant effect on average of cane diameter. The control treatment (traditional planting method) recorded a significant increase in the average of this trait of 3.2 cm

Achieving the control treatment of the highest average of cane diameter may be due to achieving these treatments with the lowest cane height (Table 1).Perhaps the food represented by photosynthesis has been used to increase the diameter instead of investing it in increasing the cane height, Rizk and Abd ali (1981) indicated to a highly significant negative correlation between cane height and cane diameter.

As for the decrease in the average of cane diameter in the seedling ages treatments, it may be due to an increase in the mean of cane height (Table 1) and an increase in the average number of milliable canes (Table 5), which increased competition for food between the canes and in turn contributed to the depletion of large quantities of food for growth, which was negatively reflected on average of cane diameter.

It is also noted from the results of the table that there were no significant effects between the varieties on the average of cane diameter, however the CP89-2143 variety recorded a significant increase in the average of this trait compared to the other two varieties. Perhaps this is due to his high genetic potential. Paktash and Waheeb (2004) indicated that genotypes may vary in their ability to increase the number and size of vascular bundles and thus their variation in the average of stem diameter.

With regard to interaction, the control treatment achieved the highest increase in the average of cane diameter of all varieties, the variety CP89-2143 achieved high mean reached 3.4 cm and did not significantly differ from the seedling ages 45 and 60 days for same variety.

Achieving seedlings ages 45 and 60 days, an increase in the average of this trait for variety CP89-2143 may be due to the distinguished of those ages by their high capabilities for optimal use of environmental factors for their highest root length and more leaves and dry weight in seedlings aged 45 and 60 days before transferring the seedlings to the permanent field which positively reflected in the storage of large quantities of food since the early stages of crop growth and were subsequently used to increase the average of cane diameter. Gardner *et al*. (1988) showed a positive correlation between the reserve stock in the cane and its durability, as the increase in the materials stored in the cane means an increase in the cane diameter.

Various results appeared in the average of cane diameter in sugarcane plants (first ratoon) for the second year 2019 (Table 8). No significant differences appeared between the seedling ages in the mean of this trait and this may be due to the synchronization of buds germination and the appearance of seedlings for all seedling ages and control at the same time Almost, the opposite of what happened in the sugar cane planting for the year 2018 (Table 7). Also, significant effects were found among the varieties in the average of cane diameter, as the variety CP89-2143 achieved a significant increase of 4.3 cm, and this may be due to the high genetic ability of the variety CP89-2143, which appeared in sugarcane plants for the year 2018 since the early stages of growth in more Studied traits. As for the interaction, the seedling ages 45 and 60 days with variety CP89-2143 achieved the highest increase in the average of cane diameter.

Number of Green leaves.plant^{-1}

Table (9) data indicates that there were significant differences between seedling ages, varieties and the interaction between them in the average number of green leaves. Regarding seedlings ages, after 45 days of planting, a significant increase was observed in the average of this trait among all seedling ages, as it recorded 9.6, 8.7 and 7.8 leaves.plant^{-1} for seedlings aged 60, 45 and 30 days, with an increase of 182, 156 and 129%, respectively, compared to the traditional planting (control) treatment that recorded 3.4 leaves.plant^{-1}.After 270 days of planting , the superiority of seedling ages continued in the average of this trait, reaching 15.6, 15.5 and 14.6 leaves.plant^{-1} for seedlings at the age of 60, 45 and 30 days with an increase of 21, 20 and 13%, respectively, compared to the traditional (control) treatment that recorded 12.9 leaves.plant^{-1} .

The increase in the number of green leaves using the seedling technique for different seedling ages may be due to the appearance of 5-7 leaves during the transfer of seedlings to the permanent field on 1 March, as well as an increase in the average root length and average stem length before transplanting the seedlings to the permanent field. The transplanted seedlings had a large root size and average high cane height, which allowed them to rapidly grow and exploit sunlight with high efficiency early in the crop growth in the field, which made them have a greater opportunity for stem growth and increase the number of nodes from which the leaves came out and thus increase the number of leaves, While the setts is still in the germination stage of traditional planting. Afzal *et al*. (2011) have indicated that the number of leaves is a genetic trait but is affected by the environmental conditions surrounding the plant.

Regarding the varieties, after 270 days of planting, the variety CP89-2143 recorded a significant increase in the average number of green leaves by 15.6 compared to the varieties CP81-325 and CP72-2086, which recorded 14.8 and 13.6 leaves.plant^{-1} respectively, this may be due to the significant increase in the total number of leaves for this variety since the transfer of seedlings from the greenhouse to the field, which had a positive impact on having high energy in taking advantage of the surrounding environmental conditions such as temperature and light during its growth period.

As for the interaction, the seedlings of all ages and for all varieties achieved the highest increase in the average number of green leaves compared to the traditional planting method after 45 and 270 days of planting. The increase

achieved by the use of seedling technique for all varieties is due to the ability of the technique to form strong seedlings capable of competing for the necessary growth requirements from the early stages of plant growth in comparison to the control treatment (traditional planting method) dependent on setts planting directly in the sustainable field, This reflected the ability of the seedlings to store large quantities of food early, possibly leading to benefit from them in the formation of a greater number of leaves, and this also reflected the extent of the relationship between genetics and the environment in changing the morphological form of the plant. This is in line with what Putri *et al*. (2013) stated that the number of leaves is affected by genotype and environmental factors.

Various results appeared in sugarcane plants (first ratoon) in the second year 2019 (Table 10). No significant effects were observed in the seedling ages, varieties and their interaction in the average number of green leaves after 45 days of planting, and this may be due to the exposure of all treatments the same environmental effects, such as temperature, lighting, etc., that caused the recording of non-significant effects in the average of cane height (Table 2), which reflected this result on the average number of green leaves. As for 270 days after planting, the variety CP89-2143 recorded a significant increase of 17.6 leaves.plant^{-1} compared to the varieties CP81-325 and CP72-2086, which recorded 16.5 and 15.6 leaves.plant^{-1} respectively, as the results showed that the registration of the variety CP89-2143 for all seedling ages had the highest increase in average of this trait compared to other treatments, may be attributed to the genetic potential of this variety with the highest increase in the average of cane height with all seedling ages (Table 2)

Table 3 : Effect of seedling ages and varieties in period of tillering stage of sugarcane (plant cane) for first year 2018.

Seedling ages(day)	**Varieties**			**Mean**
	CP72-2086	**CP89-2143**	**CP81-325**	
30	37.3	36.6	35.3	36.4
45	44.0	44.0	45.0	44.3
60	46.6	43.3	45.3	45.1
Control	31.3	32.6	29.3	31.1
Mean	39.8	39.1	38.7	
L.S.D 0.05 for ages 0.996 for varieties 0.862 for interaction 1.725				

Table 4: Effect of seedling ages and varieties in period of tillering stage of sugarcane (ratoon) for second year 2019.

Seedling ages (day)	**Varieties**			**Mean**
	CP72-2086	**CP89-2143**	**CP81-325**	
30	44.6	44.3	42.6	43.8
45	44.0	45.0	43.3	44.1
60	43.0	45.6	44.0	44.2
Control	43.9	44.8	42.9	43.9
Mean	43.9	44.9	43.2	
L.S.D 0.05 for ages N.S for varieties 0.815 for interaction 1.491				

Table 5: Effect of seedlings ages and varieties in milliable and non-milliable canes of sugarcane (plant cane) for first year 2018. (270 days after planting)

Number of milliable canes				
Seedling ages(day)	**Varieties**			**Mean**
	CP72-2086	**CP89-2143**	**CP81-325**	
30	40.7	47.4	43.7	43.9
45	49.3	61.7	53.0	54.7
60	51.6	58.7	52.7	54.3
Control	20.3	29.3	22.3	24.0
Mean	40.5	49.3	42.9	
L.S.D 0.05 for ages 1.556 for varieties 1.348 for interaction 2.696				
Number of non-milliable canes				
Seedling ages(day)	Varieties			Mean
	CP72-2086	CP89-2143	CP81-325	
30	3.0	2.0	3.3	2.8
45	3.0	1.4	4.0	2.8
60	4.3	2.3	4.0	3.5
Control	4.4	2.5	4.7	3.9
Mean	3.7	2.3	4.0	
L.S.D 0.05 for ages 1.066 for varieties 0.923 for interaction 1.846				

Table 6 : Effect of seedling ages and varieties in milliable and non-milliable canes of sugarcane (ratoon) for second year 2019. (270 days after planting)

Number of milliable canes				
Seedling ages(day)	**Varieties**			**Mean**
	CP72-2086	**CP89-2143**	**CP81-325**	
30	46.0	62.0	49.0	52.3
45	57.6	69.0	59.6	62.1
60	54.6	63.6	57.0	58.4
Control	36.0	51.0	31.0	39.3
Mean	48.6	61.4	49.2	
L.S.D 0.05 for ages 2.384 for varieties 2.065 for interaction 4.129				
Number of non-milliable canes				
Seedling ages(day)	Varieties			Mean
	CP72-2086	CP89-2143	CP81-325	
30	6.0	2.0	5.3	4.4
45	5.0	1.3	4.0	3.4
60	6.0	2.0	5.0	4.3
Control	7.3	2.0	7.3	5.5
Mean	6.1	1.8	5.3	
L.S.D 0.05 for ages 1.571 for varieties 1.361 for interaction 2.722				

Table 7 : Effect of seedling ages and varieties in cane diameter (cm) of sugarcane (plant cane) for first year 2018. (270 days after planting)

Seedling ages(day)	**Varieties**			**Mean**
	CP72-2086	**CP89-2143**	**CP81-325**	
30	2.2	2.3	2.3	2.2
45	2.5	3.0	2.7	2.7
60	2.5	2.9	2.6	2.6
Control	3.2	3.4	3.1	3.2
Mean	2.6	2.9	2.6	
L.S.D 0.05 for ages 0.441 for varieties N.S for interaction 0.765				

Table 8 : Effect of seedlings ages and varieties in cane diameter (cm) of sugarcane (first ratoon) for second year 2019. (270 days after planting)

Seedling ages(day)	**Varieties**			**Mean**
	CP72-2086	**CP89-2143**	**CP81-325**	
30	3.9	3.9	3.3	3.7
45	4.1	4.4	3.4	3.9
60	3.7	4.6	3.2	3.8
Control	4.0	4.1	3.5	3.9
Mean	3.9	4.3	3.4	
L.S.D 0.05 for ages N.S for varieties 0.245 for interaction 0.491				

Table 9: Effect of seedlings ages and varieties in number of leaves.plant^{-1} during the growth stage of sugarcane (plant cane) for first year 2018.

45 days after planting				
Seedling ages(day)	**Varieties**			**Mean**
	CP72-2086	**CP89-2143**	**CP81-325**	
30	7.7	7.8	7.8	7.8
45	8.7	8.7	8.8	8.7
60	9.7	9.6	9.5	9.6
Control	3.2	3.5	3.5	3.4
Mean	7.3	7.4	7.4	
L.S.D 0.05 for ages 0.268 for varieties N.S for interaction 0.464				
270 days after planting				
Seedling ages(day)	Varieties			Mean
	CP72-2086	CP89-2143	CP81-325	
30	13.5	15.6	14.6	14.6
45	14.3	16.6	15.5	15.5
60	15.2	16.4	15.3	15.6
Control	11.5	13.6	13.7	12.9
Mean	13.6	15.6	14.8	
L.S.D 0.05 for ages 0.395 for varieties 0.342 for interaction 0.684				

Table 10 : Effect of seedling ages and varieties in number of leaves.plant^{-1} during the growth stage of sugarcane (ratoon) for second year 2019.

45 days after planting				
Seedling ages(day)	**Varieties**			**Mean**
	CP72-2086	**CP89-2143**	**CP81-325**	
30	6.3	6.6	6.6	6.5
45	6.6	6.2	6.4	6.4
60	6.4	6.7	6.5	6.5
Control	6.5	6.8	6.4	6.6
Mean	6.5	6.6	6.5	
L.S.D 0.05 for ages N.S for varieties N.S for interaction N.S				
270 days after planting				
Seedling ages(day)	Varieties			Mean
	CP72-2086	CP89-2143	CP81-325	
30	15.5	17.5	16.2	16.4
45	15.8	17.7	16.9	16.8
60	15.5	17.4	16.5	16.5
Control	15.6	17.8	16.3	16.6
Mean	15.6	17.6	16.5	
L.S.D 0.05 for ages N.S for varieties 0.293 for interaction 0.586				

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