# Evaluation of Sugarcane (*Saccharum spp*. hybrids) Clones for Yield and Quality and its Contributing traits


## ABSTRACT

Evaluation and identification of varieties for different agro-climatic condition is of paramount importance in sugarcane cultivation to realize higher recoveries for the sugar mills and cane yield for farmers. The present investigation was undertaken with the objective of evaluation of sugarcane clones for yield and quality and its contributing traits. The Experimental materials consist of five test clones *viz*., CoA 13322, CoA 13323, CoC 13336, CoC 13337 and CoV 13356 and two standard checks (CoC 01061 and CoA 92081). Observations were recorded for germination per cent (%), number of tillers (x1000/ha), number of millable cane (x1000/ha), cane length (cm), Cane diameter (cm), Single cane weight (kg), cane yield (t/ha), brix (%), Purity (%), sucrose (%), CCS (%) and CCS yield (t/ha). Based on the results of the different clones for different traits evaluated, the clone CoC 13336 was found to be the best performing clone in respect of cane yield, CCS yield and other important traits over the standards (checks). The clone CoC 13337 was the next best performing clone for cane yield, CCS yield and other traits over the standards and these two clones may be promoted for further evaluation trial for the release new sugarcane variety suitable for early season of Tamil Nadu.



***Key words:*** Sugarcane, Early Clones, Evaluation, Cane yield, Sucrose % and CCS yield.




## 1. INTRODUCTION

Sugarcane the most important industrial cash crop of India, involves low risk and farmers are assured of returns up to some extent even under certain adverse conditions. Sugarcane is cultivated in different agro climatic environments in all the sugarcane rising countries of the world. India is the second largest producer of sugarcane next to the Brazil in terms of area (48.67 lakh ha) and production (376.91 m.tonnes). In India, Tamil Nadu ranks fourth in area and production next to Uttar Pradesh, Maharastra and Bihar and ranks first in productivity. In Tamil Nadu, it was grown in an area of 1.31 lakh hecters and producing 14.12 m. tonnes of sugarcane with a productivity of 107.62 t/ha [1]. India is the world's most exclusive user and the second most noteworthy sugar producer. Lower efficiency, low sugar recovery and high cost of production are important difficulties for sugarcane crop. Variety plays an important role in expanding and declining per unit area sugarcane yield, while use of low quality sugarcane varieties adversely affects sugarcane production [2]. There are many reasons behind low cane yield however developing of low yielding varieties are one of them. Subsequently, there is a need to introduce better high yielding varieties [3]. Evaluation and identification of varieties for different agro-climatic condition is of paramount importance in sugarcane cultivation to realize higher recoveries for the sugar mills and cane yield. The proper choice of varieties, season and timely application of agronomic practices coupled with application of adequate major nutrients plays vital role in sugarcane productivity [4]. Non adoption of any one of the above components leads to reduction in sugarcane productivity [4].

Variety plays a pivotal role in increasing cane and sugar yields, proper choice of varieties, season and viable agronomic technologies will determine the success of any crop production and will hold good for successful cultivation of crop [5]. Hence, sugarcane breeders are releasing new sugarcane varieties in different maturity group at frequent interval to increase the cane and sugar yield. Genetically improved sugarcane varieties may stand ability to produce satisfactory results for cane yield and sugar percentage under given set of environmental condition [6]. Keeping in view the evaluation of early maturing sugarcane genotypes for cane yield and quality contributing traits were conducted with five sugarcane clones with two standard checks.

## 2. MATERIALS AND METHODS

### 2.1 Experimental Materials and Site

The present experiment was conducted in early season of Tamil Nadu during 2016-17 at Sugarcane Research Station, Tamil Nadu Agricultural University, Cuddalore, Tamil Nadu, India (latitude; 11º 46' North; longitude: 79º.46' East; altitude: 4.60 m MSL). The experimental consist of consist of five test clones *viz*., CoA 13322, CoA 13323, CoC 13336, CoC 13337 and CoV 13356 and two standard check varieties (CoC 01061 and CoA 92081).

### 2.2 Experimental Layout and Crop Management

All the test clones (Experimental materials) planted in Randomized Block Design with three replications during early season of Tamil Nadu in the clay loam soil type. The plot size for each entry was six rows of five meter length spaced at 90 cm with a seed rate of twelve buds per meter. Recommended agronomic practices (weeding, fertilizer application, earthing-up, de-trashing and propping) were followed properly and need based plant protection measures were followed uniformly throughout the cropping period for maintaining good crop.

### 2.3 Traits Studied and Analysis

All the data were collected from the primary stalk. Five canes were randomly selected from each replication for juice analysis. Among these parameters, germination per cent were recorded on 30$^{th}$ days after planting, number of tillers (x1000/ha) were recorded at 120$^{th}$ days after planting, while all other parameters were recorded at harvest. For quality analysis, the cane samples were taken from each clone and juice was extracted by power crusher and analysed for Brix per cent and sucrose per cent (%) as per the method suggested by [7]. Then, the CCS yield was determined based on CCS per cent and cane yield. All the collected data were statistically analysed by standard statistical method described by [8].

## 3. RESULTS AND DISCUSSION

The analysis of variance (ANOVA) of the present study revealed that all characters under study recorded significant difference among the treatment mean squares (Table1). The results revealed that there was an amble scope for selecting a better genotype. The variation in cane yield and yield components among the genotypes may be attributed due to their differences in genetic makeup. Mean data of different yield, quality and its contributing traits were furnished in Table 2 and they are categorically described as follows,

**3.1. Growth Parameters:**

Germination per cent (at 30 DAP)

The most critical factor which determines the varietal potential to exploit the available resources and ultimately effects the cane stand. In this Trial, the germination per cent was recorded on 30 DAP and it was ranged from 52.74% (CoA 92081) to 63.91 (CoC 13337). Among the clones eavaluated, only one clone, CoC 13337 recorded higher germination per cent (63.91%) over the best standard CoC 01061 (63.32%). The germination per cent for different sugarcane clones already reported by [9].

Number of tillers (x 1000/ha) at 120 DAP

In the present study, number of tillers at 120 days after planting varied from 128.71 (CoC 13336) to 115.78 (CoA 92081). The two test clones CoC 13336 recorded higher tiller counts (128.71x1000/ha) followed by the clone CoC 13337 (127.98x1000/ha). The tillering potential of a clone ultimately effects cane yield positively and deciding the number of millable cane [9].

Number of millable cane (x 1000/ha) at harvest:

Number of millable cane at harvest, was ranged from 100.25 (CoV 13356) to 117.22 (CoC 13336). Only two clones CoC 13336 and CoC 13337 recorded numerically higher number of millable cane over the best standard CoC 01061 (111.29 /ha). Number of millable cane directly influences cane yield as it is the combined interaction of germination per cent and number of tillers of the particular clone [10].

**3.2. Cane Yield and yield contributing traits**

Cane length (cm):

Height of a cane contributes materially towards final cane yield. Under good growing conditions, individual seedling clones may produce up to about 2.0 m of cane can be forwarded /advanced to the next selection stage. In this study, the maximum cane length recorded by CoC 13336 (295.67 cm) and minimum by CoV 13356(265.33 cm). Three clones *viz*., CoC 13336 (295.67cm), CoC 13337 (290.33cm) and CoA 13322 (277.33cm) recorded numerically superior performance over the standard CoC 01061 (275.33cm). The research work carried out by [11] is in accordance with the present findings.

Cane diameter (cm):

In the trial, the cane diameter ranged from 2.50 cm (CoC 01061) to 3.06 cm (CoC 13337). Among the clones evaluated, four clones were recorded superior performance over the standard CoA 92081(2.72 cm). Canes that grow tall and thin may be more prone to lodging; the tall clones with thick stalked canes that resist lodging may have great potential to be the high yielding varieties in future. Cane diameter is an important yield contributing character and higher cane diameter would enhance the acceptability of varieties from commercial point of view. This finding is analogous with [12].

Single cane weight (kg):

Single cane weight is the product of its length, girth and contributes substantially towards final cane yield. This trait in this study, ranged from 0.99 kg (CoC 01061) to 1.34 kg (CoC 13336). Among the test clones, only three clones *viz*., CoC 13336 (1.34 kg), CoC 13337 (1.26 kg) and CoA 13322 (1.26 kg) were recorded numerically superior performance over the best standard CoA 92081 (1.23 kg). The similar work was already reported by [13].

Cane Yield (t/ha):

Cane yield is a major parameter to find out the economic potential of a genotype. It is the combination of functions like environmental responses and genetic potential of a genotype. High cane yielding varieties show best environmental response and hence revealed good performance of cane yield as compared to the other varieties. [14]. Therefore, the evolution of high yielding clones is urgently needed it may increase the cane and CCS yield per unit area. In the present study, the maximum cane yield was recorded in CoC 13336 (14.71 t/ha) and minimum in CoC 01061(113.22 t/ha). All the clones were recorded numerically superior performance over the better standard CoA 92081(116.78 t/ha.). The similar work was already reported by [9].

### 3.3. Quality contributing traits:

<u>Brix % at Harvest:</u>

Brix per cent (Total Soluble Solids) play an important role in determining the sugar recovery of sugarcane. In the present study, the Brix per cent varied from 20.92 (CoC 13336) to 20.30% (CoA 92081). Among the test clones, only one clone CoC 13336 (20.92 recorded numerically superior performance over the better standard CoC 01061, which recorded 20.77%. These results are in agreement with the findings of [14], who studied a number of sugarcane clones and found different levels of brix per cent in zonal varietal trials.

<u>Purity per cent at harvest:</u>

The purity per cent in the present study varied from 88.14 (CoA 92081) to 90.17 (CoC 13336). Among the clones evaluated, three clones *viz*., CoC 13336, CoV 13356 (90.42%) and CoC 13337 (90.07%) recorded numerically superior performance over the better standard CoC 01061 (89.95%). Similar reports already reported by [14].

<u>Sucrose per cent at harvest</u>:

The sucrose per cent is useful in deciding the quality of sugarcane and it influences the sugar recovery and sugar production in sugar mills. In this experiment, sucrose per cent at harvest ranged from 17.35 (CoA 92081) to 17.97 (CoC 13336). The test clones *viz*., CoC 13336 (17.97%), CoC 13337 (17.75) and CoV 13356 (17.72%) were recorded numerically superior performance over the best standard CoC 01061 (17.71%). The results are almost same as demonstrated by [15].

CCS per cent at harvest:

Commercial Cane Sugar (CCS) per cent is the best tool for breeders and millers for identification of high quality genotypes. The CCS per cent of the present investigation varied from 12.47 (CoA 92081) to 12.96 (CoC 13336). The test clones CoC 13336 (12.96%) and CoC 13337 (12.82%) recorded numerically superior performance in producing more CCS per cent over the better standard CoC 01061 (12.80%) [16]. This discussion shows a close conciseness with Ganapathy *et al.* [16].

CCS Yield (t/ha):

In this Varietal Trial, Commercial Cane Sugar yield ranged from 14.50 t/ha (CoC 01061) to 18.23 t/ha (CoC 13336). All the test clones were recorded numerically superior performance than the best standard CoA 92081 (14.56 t/ha). This discussion shows a close conciseness with those of [17]. The higher CCS yield of clones may be attributed to relatively more average cane yield and subsequent commercial cane sugar percentage [14]. There are varieties capable of giving higher cane yields and fairly good recovery leading to higher per acre sugar production.

## 4. CONCLUSION

From the results of the present study, it could be concluded that the early maturing clone, CoA 13323 was found to be better for cane yield and CCS yield. Another clone, CoA 13322 was found to be next better performing clone for CCS yield. For quality traits *viz*., brix %, sucrose %, CCS % and purity per cent, the clone CoC 13336 was the best performing clone over the check variety CoA 92081. Hence, these three early maturing clones *viz*., CoA 13323, CoA 13322 and CoC 13336 could be forwarded next evaluation trials for the confirmation of the results for better cane yield and CCS yield under varied agro climatic conditions for release as new sugarcane variety.

## REFERENCES


1. Sugarcane Statistics- India; 2020. Available: *https://www.statista.com*
2. Mian, A.M. Sugarcane variety composition in Pakistan In: Proceedings of Seminars on Agriculture, Pakistan Society of Sugar Technologists, Faisalabad. 2006; 107-121.
3. Chattha MU, Ehsanullah. Agro-quantitative and qualitative performance of different cultivars and strains of sugarcane Saccharum officeinarum, L.). *Pakistan Sugar J*. 2003; 18(6): 2-5.
4. Ganapathy. S and R.S. Purushothaman. Performance of Promising Early Maturing Sugarcane Clones for Yield and Quality Traits during Varietal Development Process**.** Electronic J. Plant Breeding. 2017, 8(1): 279 - 282.
5. Sharath Kumar Reddy, Y., Naga Madhuri, K.V., Raja Rajeswari, V. and Sudhakar, P. Evaluation of different Morpho-Physiological traits of pre-release early sugarcane clones. Int. J. Applied Biol. and Pharmaceutical Technology. 2014. 5(3): 233-238.
6. Getaneh, A., Tadesse, F. and Ayele, N. Agronomic performance evaluation of ten sugarcane varieties under wonji-Shoa Agro climatic condition. J. Agrl. Natural Resources Sci, 2015. 2(1), 260-266.
7. Meade, C.P. and Chen, J.C.P. Cane sugar hand book. 1977. 10th Edn. John Wiley & Sons Inc, New York.
8. Panse, V.G. and Sukhatme, P.V. Statistical methods for Agricultural Workers. 1978. ICAR, New Delhi.
9. Ganapathy, S. and Purushothaman, R.S. Evaluation of Early Maturing Sugarcane Clones for Yield, Quality and Its Contributing Traits in East Coast Zone of Tamil Nadu. Int. J. of Plant Soil. Sci*. 2022. 34 (20), 575-581.*
10. Ganapathy, S and Purushothaman, R.S. Evaluation and identification of high yielding and high quality early maturing sugarcane clones suitable for East Coast Zone. Advances in Life sciences, 2016. 5 (11); 4555-4559.
11. Panhwar RN, Chohan M, Panhwar DB, Memon MA, Memon YM, Panhwar MA. Relative cane yield and quality appraisal of divergent sugarcane clones in 4th cycle under Thatta climatic conditions. Pak. Sugar Journal. 2008; 23(1): 15-20.

12. Ganapathy, S and V. Ravichandran, V. Evaluation and identification of promising sugarcane clones for yield, quality and resistance to red rot suitable for India's East Coast Zone. Int. J. of Agric. Sci. 2022. 14 (12); 11991-11994.

13. Sabitha, N, Prasada Rao K. Promising high yielding and sucrose rich early maturing sugarcane clones for Andhra Pradesh. Sugar Journal 2008 – 39th Annual convention of SISSTA. 2008; 11 - 14.

14. Ganapathy, S., Ravichandran, V and Jayakumar, J. Performance of Mid-late Sugarcane Clones in AICRP(S) Trials for Quality Traits and Red Rot Resistance. Int. J. of Plant Soil. Sci. 2022*. 34 (24); 1068-1073.*

15. Hapase R S, *et al*. Sugar productivity assessment of early maturing sugarcane genotypes in Peninsular India. Sugar Journal 2013 - 43rd Annual Convention of SISSTA. 2013: 29-33.

16. Ganapathy S, Ravichandran V. Evaluation of mid-late sugarcane clones for yield, quality and red rot resistance in zonal varietal trials. Annals of Plant Protection Sciences. 2018; 26(1): 142-146.

17. Nirmodh Prabha. Evaluation of Early Group of Sugarcane Genotypes for Yield and Quality Traits. Int. J. Curr. Microbiol. App. Sci. 2021; 10(02): 648-652.

**Table 1. Mean square values and their significance from ANOVA for cane yield, quality and its contributing traits**

| Source of Variation | df | Mean Square values | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Germin-ation. | No. Of tillers | NMC | Stalk length | Stalk diameter | Single cane wt. | Cane Yield | Brix % | Sucrose % | Purity % | CCS % | Sugar Yield. |
| Variety | 06 | 361.43 | 9.80 | 187.85 | 407.08 | 0.103 | 0.051 | 340.60 | 0.186 | 0.104 | 1.866 | 0.072 | 6.62 |
| Error | 12 | 28.65 | 39.88 | 33.10 | 71.55 | 0.005 | 0.007 | 33.66 | 0.021 | 0.010 | 0.280 | 0.007 | 0.52 |
| Total | 20 | 400.87 | 53.77 | 223.05 | 499.63 | 0.115 | 0.060 | 390.35 | 0.227 | 0.124 | 2.480 | 0.087 | 7.51 |

**Table 2. Performance of early maturing sugarcane clones for yield and quality traits in Zonal Varietal Trial**

| S. No. | Clone | Germi-nation (%) | No. of tillers (x1000/ha) | NMC (x1000/ ha) | Cane Length (cm) | Cane Diameter (cm) | Single Cane Wt. (kg) | Cane Yield (t/ha) | Brix (%) (10 m) | Purity (%) (10 m) | Sucrose (%) (10 m) | CCS (%) (10 m) | CCS Yield. (t/ha). |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | CoA 13322 | 59.50 | 127.09 | 110.87 | 277.33 | 2.87 | 1.26 | 127.15 | 20.27 | 88.88 | 17.60 | 12.63 | 16.06 |
| 2 | CoA 13323 | 56.34 | 116.90 | 100.61 | 272.33 | 2.86 | 1.23 | 122.63 | 20.52 | 89.91 | 17.66 | 12.77 | 15.66 |
| 3 | CoC 13336 | 62.42 | 128.71 | 117.22 | 295.67 | 2.97 | 1.34 | 140.71 | 20.92 | 90.17 | 17.97 | 12.96 | 18.23 |
| 4 | CoC 13337 | 63.91 | 127.98 | 116.94 | 290.33 | 3.06 | 1.26 | 139.92 | 20.75 | 90.07 | 17.75 | 12.82 | 17.93 |
| 5 | CoV 13356 | 60.94 | 120.18 | 100.25 | 265.33 | 2.70 | 1.03 | 122.83 | 20.74 | 90.16 | 17.72 | 12.75 | 15.66 |
| | Standard | | | | | | | | | | | | |
| 1 | CoC 01061 | 63.32 | 127.58 | 111.29 | 275.33 | 2.50 | 0.99 | 113.22 | 20.77 | 89.95 | 17.71 | 12.80 | 14.50 |
| 2 | CoA 92081 | 52.74 | 115.79 | 100.70 | 265.67 | 2.72 | 1.23 | 116.78 | 20.31 | 88.14 | 17.35 | 12.47 | 14.56 |
| | S.Ed. | 6.29 | 5.16 | 4.70 | 6.90 | 0.06 | 0.07 | 4.74 | 0.11 | 0.62 | 0.08 | 0.07 | 0.59 |
| | CD (0.05%) | 13.70 | 11.23 | 10.25 | 15.05 | 0.13 | 0.16 | 10.32 | 0.26 | 1.35 | 0.18 | 0.15 | 1.29 |
| | CV (%) | 13.88 | 5.12 | 5.37 | 3.05 | 2.63 | 7.43 | 4.60 | 0.71 | 0.85 | 0.57 | 0.68 | 4.49 |