

EVALUATION OF DIFFERENT MORPHO-PHYSIOLOGICAL TRAITS OF PRE-RELEASE
EARLY SUGARCANE CLONES

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ABSTRACT: Five promising early sugarcane clones (2006 T3, 2006 T8, 2006 T19, 2006 T23 and 2006 T36) from yield trials along with two checks (Co C 671 and Co 94008) were evaluated for identification of sugarcane clones suitable for delayed harvest and crushing at Agricultural Research Station, Perumallapalle, Chittoor, Acharya N.G. Ranga Agricultural University, Andhra Pradesh, during 2011-2012. The data on different growth parameters viz., Germination per cent, Plant height, SCMR values and Leaf area index were recorded at different crop growth periods. The highest germination count was recorded with 2006 T36 followed by Co C 671 and Co 94008, whereas the lowest count was recorded with 2006 T23. Among the clones 2006 T3 and 2006 T36 recorded the highest plant height at different crop growth periods (90, 120, 240 DAP and at harvest) along with two standards (Co C 671 and Co 94008), while the clone 2006 T23 recorded the lowest plant height. The highest SCMR values and LAI was recorded with Co C 671, Co 94008 followed by 2006 T36 and 2006 T3 at different crop growth periods (60, 90, 120 and 150 days), whereas, the clone 2006 T23 recorded the lowest SCMR and LAI values. The data recorded on different yield attributes viz., cane diameter (cm), cane length (cm), number of millable canes and cane yield at harvest showed that 2006 T36 and 2006 T3 recorded the higher cane yields along with checks, while the clone 2006 T23 recorded the lowest cane yield.

Key words: Variety, Morpho-physiological traits, Yield, Sugarcane.

INTRODUCTION

Sugarcane is the world's most important sugar crop, which is classified under the genus "*Saccharum*" and belongs to the family Graminae/ Poaceae. Sugarcane is one of the most important cash crop grown in India which occupies important position in Indian agriculture as it sustains the second largest organised industry in the country next to textiles with providing employment to a large number of people and contributing to growth of rural economy. Because most operations of cultivation and processing are carried out manually, Nearly 35-40 million farmers, 3.5 lakh skilled and unskilled workers are engaged in sugarcane production chain in India. In India sugarcane is cultivated in an area of 5.02 M ha, with 342.1 Mt production and productivity of 68.1 t per ha. In Andhra Pradesh area under cultivation is 1.80 M ha and the production is 140.4 Mt with productivity of 78.0 t per ha (Cooperative sugar; 2012). Even though it has gained popularity as kalpavriksha or wonderful crop, there are some major constraints which reflect the yield as it is a temperature dependent crop. One of such major factors is the selection of variety. The selection of variety alone improves the cane yield in range of 28 to 60 percent (Kathiresan *et al.*, 2001). As variety plays a pivotal role for 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. Continuous research on selection and identification of promising sugarcane clones for particular agro-climatic situation will be one of the appropriate approaches for realizing sustainable sugarcane productivity. Considering the above factors in view, the present study was programmed to find out suitable sugarcane clones with high quality and yield by the evaluation of different morpho-physiological traits which enhance the yield and quality of sugarcane.

MATERIALS AND METHODS

Five promising early sugarcane clones from yield trials along with two checks were evaluated in RBD with three replications at Agricultural Research Station, Perumallapalle during 2011-2012. The selected clones were planted in the month of January with a seed rate of 40,000 three budded setts ha⁻¹ along with irrigation.

A spacing of 80 cm between furrows was followed. Atrazine @ 2kg a.i. ha⁻¹ was sprayed as pre-emergence herbicide at 3rd day after planting. Fertilizer dose of 224:112:112 of N:P₂O₅:K₂O kg ha⁻¹ was followed. Other cultural operations like hand weeding, earthing up, trash twist propping etc., were practiced as per recommendation. The data on different morpho-physiological traits viz., field emergence index, plant height, SCMR values, leaf area index, cane diameter(cm), cane length(cm), number of millable canes and cane yield were recorded at different crop growth periods and at harvest respectively.

Germination per cent was determined by counting number of germinated buds in each varietal plot on 30th day after planting and expressed as percent of total. Plant height was recorded from randomly tagged five plants at different intervals viz; 90, 120, 240 days after planting and at harvest, by measuring from the base of the stem (ground level) to the top node by using transverse scale. The mean was calculated and expressed in cms. After the separation of leaves from the plant at different intervals viz; 60, 90, 120, 150 days, leaf area was estimated by using leaf area meter (LI-COR model LI 3000) and expressed as cm² plant⁻¹. Then leaf area index was calculated by dividing the total leaf area with the corresponding ground area as suggested by Watson (1952).

$$\text{LAI} = \text{Total leaf area} / \text{Unit ground area}$$

The SPAD chlorophyll meter readings were recorded at different intervals viz., 60, 90, 120 and 150 days after planting by using simple hand held and portable SPAD meter which provides information on the relative amount of leaf chlorophyll. The third leaf from the apex was selected to record SCMR by using SPAD chlorophyll meter (Minotla chlorophyll meter SPAD-502).

The diameter of cane was recorded at top, middle and bottom nodes of the cane with Vernier callipers. Means were worked out and expressed in cms. Mean length of cane from the base to last transverse mark in the mature cane was recorded and expressed in cms. The number of millable canes were counted from the net plot area of each genotype from three replications and recorded separately.

Mean weight of canes was calculated from net plot area of each genotype from three replications and recorded separately. The data was subjected to statistical scrutiny by split-plot method outlined by Panse and Sukhatme (1985).

RESULTS AND DISCUSSION

The results pertaining to morpho-physiological traits are presented in tables/ depicted in fig., and discussed as below.

Germination per cent (%)

The data on germination per cent of promising sugarcane clones was depicted in Figure 1. The data revealed that the highest germination count was recorded in Co 94008 (70.63) and was at par with Co C 671 (70.53) and 2006 T36 (71.00), while the lowest count was recorded in 2006 T23 (63.30). Hence, Co 94008, Co C 671 and 2006 T36 clones showed to put up early establishment, early vigour and growth compared to other clones. Hapase *et al.* (2008) reported that there was positive association of germination per cent with tillering, number of millable canes and cane yield.

Plant height (cm)

Plant height of sugarcane increased progressively with advance in age of the crop up to maturity. However, promising sugarcane clones recorded significant differences for plant height among the clones as presented in Figure 2. Sabitha and Prasad Rao (2008) reported in their study on sugarcane that clones with higher plant height recorded higher yield.

The data revealed that highest plant height at different crop growth periods (90, 120, 240 DAP and at harvest) was recorded with 2006 T3 and 2006 T36 along with two standards (Co C 671 and Co 94008), while the clone 2006 T23 recorded the lowest indicating the poor crop growth and initial vigour of clones Raja Rajeswari *et al.* (2004).

Leaf area index

Leaf area index of sugarcane clones tended to increase with advance in age of the crop up to 150 days of crop age. However, varied with some clones as shown in figure 3. The data of present study shown that at all stages of crop growth period viz., 60, 90, 120 and 150 DAP the highest LAI was recorded with Co C 671, Co 94008 followed by 2006 T36 and 2006 T3 indicating the luxurious growth of crop.

However, the clone 2006 T23 recorded the lowest leaf area index was indicating its crop growth and biomass yield (Raja Rajeswari *et al.* 2004).

SCMR values

Increasing trend of SCMR values up to 120 days in all promising sugarcane clones was observed and decreasing trend was noticed in some clones as discussed below as depicted in the figure 4. Higher SCMR values indicates their tolerance to moisture stress and higher water use efficiency (Mukunda Rao *et al.* 2011).

At all stages of crop growth period viz., 60, 90, 120 and 150 DAP the highest SCMR values were recorded with Co C 671, Co 94008 followed by 2006 T36 and 2006 T3. The higher SCMR values shows positive reflectance on relative water content, root length and also shows tolerant to moisture stress (Naidu *et al.* 2007). Whereas, the clone 2006 T23 recorded the lowest, indicating poor tolerance to moisture stress.

Cane diameter (cm)

Among the promising early sugar cane clones Co C 671 (3.43 cm) recorded the highest cane diameter and was at par with Co 94008 (3.26 cm) and 2006 T36 (3.27 cm) while the lowest was recorded in 2006 T19 (2.46 cm), indicating the thin nature cane as shown in table . Similar reports were noted by Sabitha and Prasad Rao (2008) in sugarcane. However, Kadam *et al.* (2007) reported that higher cane diameter showed positive reflectance on cane yield.

Cane length (cm)

The data on cane length during harvesting stage of crop was recorded and presented in table. The data revealed that the highest cane length was recorded with 2006 T36 (311.54 cm) followed by Co C 671 (305.62 cm) indicating the superiority of clones over the standard, while the lowest cane length was noticed in 2006 T23 (243.21 cm). Similar results were reported by Sabitha and Prasad Rao (2008) and Indrajith and Natarajan (2011). However, Kadam *et al.* (2005) reported that higher cane yield was observed in the clone with higher cane length.

Table: Performance of promising early sugarcane clones for yield and yield attributes at harvest

Clones	Cane diameter (cm)	Cane length (cm)	Number of internodes	Internodal length (cm)	Number of millable canes	Cane yield (t ha ⁻¹)
2006 T3	3.17	296.73	26.00	13.10	90,833	136.50
2006 T8	2.87	280.46	25.00	12.30	74,500	98.60
2006 T19	2.47	265.35	23.33	11.30	70,800	89.60
2006 T23	2.53	243.21	22.33	11.10	71,200	92.80
2006 T36	3.27	311.50	26.00	13.50	95,433	138.50
Co C 671	3.43	305.62	26.67	13.90	92,767	143.50
Co 94008	3.27	299.32	28.00	13.60	94,300	123.40
Grandmean	3.00	286.03	25.33	12.69	84,262	117.56
SEd	0.167	3.49	0.93	0.19	475	5.43
LSD (0.05)	0.364	7.60	2.03	0.43	1036	11.84

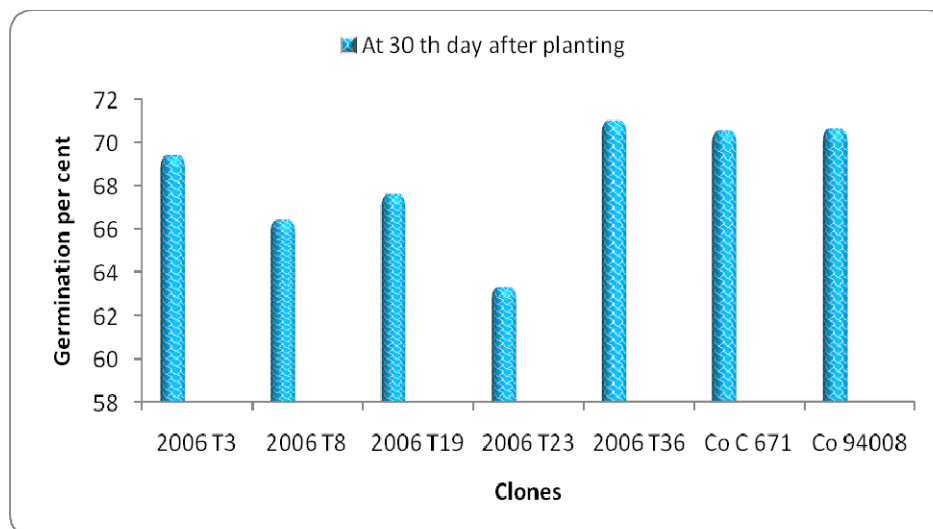


Fig. 1. Germination per cent of promising sugarcane clones

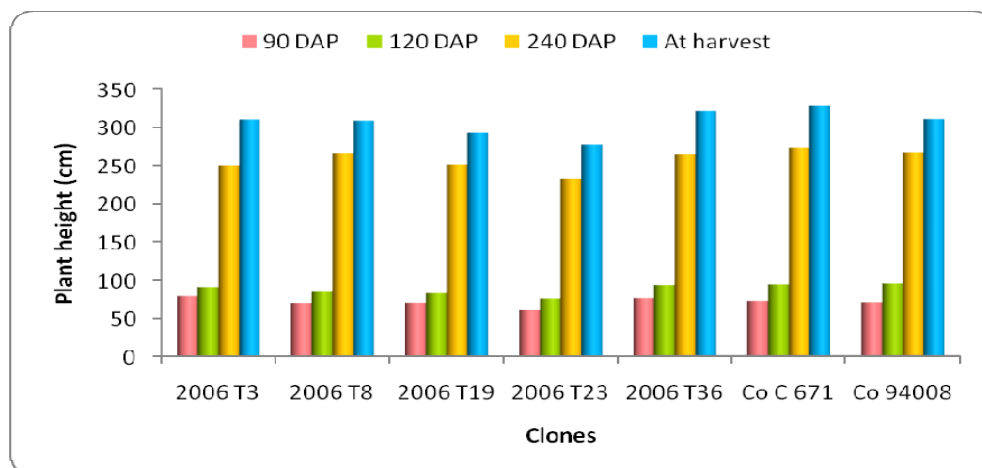


Fig. 2. Plant height (cm) of promising sugarcane clones at various growth stages

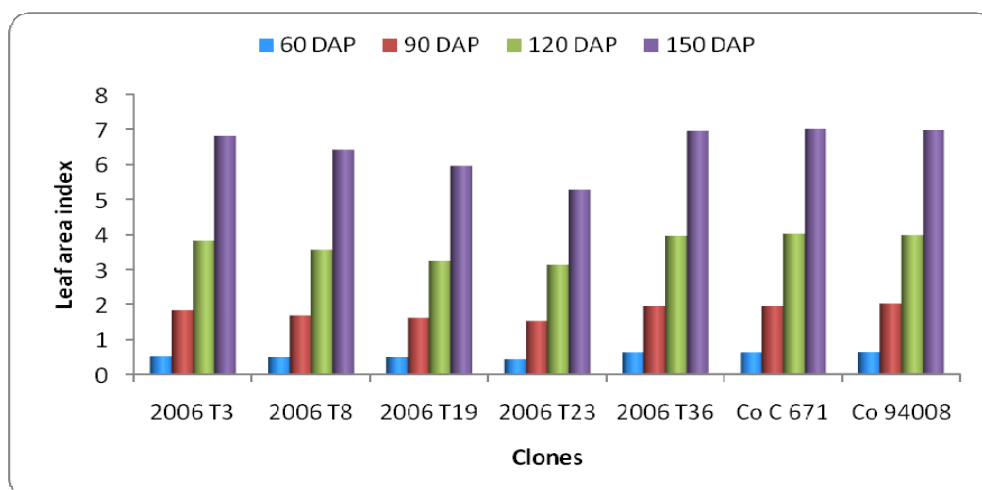


Fig. 3. Leaf area index of promising sugarcane clones at various growth stages

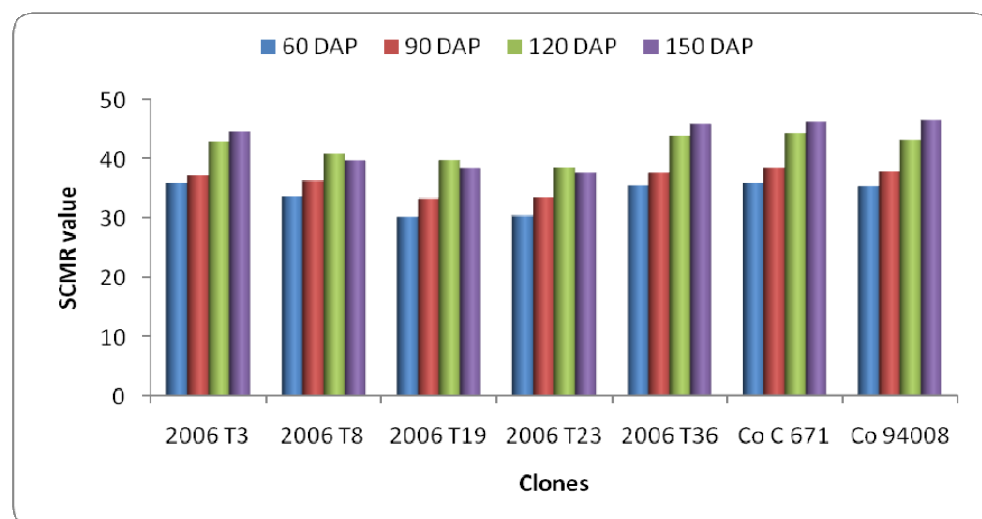


Fig. 4. SCMR values of promising sugarcane clones at various growth stages

Number of internodes

The highest number of internodes were recorded in Co 94008 (28.0) and was at par with Co C 671 (26.6), 2006 T36 (26.0) and 2006 T3 (26.0) as shown in Table, while the lowest number of internodes were recorded with 2006 T23 (23.33). Mukunda Rao *et al.* (2001) reported that the clones with higher number of internodes and high length of node shows significant higher cane yield.

Internodal length (cm)

Among the promising early sugar cane clones Co C 671 (13.9 cm) recorded the highest internodal length and was at par with Co 94008 (13.6 cm) and 2006 T36 (13.5 cm), while the lowest internodal length was recorded with 2006 T23 (11.10 cm) as shown in table. The result was concurred with findings of Mukunda Rao *et al.* (2011) and Raja Rajeswari *et al.* (2004).

Number of millable canes

The data on number of millable canes during harvesting stage of crop was reported in table. The data revealed that the clone 2006T36 (95,433 ha⁻¹) recorded highest number of millable cane over all the clones and was at par with standards Co 94008 (94,300 ha⁻¹) and Co C 671 (92,767 ha⁻¹). The results were in accordance with finding of Raja Rajeswari *et al.* (2009), Kulkarni *et al.* (2010) and Indrajith and Natarajan (2011), whereas the lowest number of millable canes were recorded in 2006 T19 (70.800 ha⁻¹) and 2006 T23 (71.200 ha⁻¹) indicating their poor cane yield.

Cane yield (t ha⁻¹)

The data on performance of promising sugarcane clones on cane yield was shown in Table. The data revealed that Co C 671 (143.5 ha⁻¹) recorded indicating the highest cane yield over all the clones was at par with 2006 T36 (138.5 ha⁻¹). Similar results were reported by Hapase *et al.* (2008), Kulkarni *et al.* (2010) and kadam *et al.* (2007), whereas the clone 2006 T23 (92.8 ha⁻¹) recorded the lowest yield among all the clones.

Based on the results from the present study it was concluded that clones 2006 T36, 2006 T3 proved that they posses good morpho-physiological properties along with two checks viz., Co C 671 and Co 94008. Hence, these two clones 2006 T36 and 2006 T3 can be considered as good for commercial cultivation and can be recommended for farmers.

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