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Research Note

Performance of promising early maturing sugarcane clones for yield and quality traits during varietal development process

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Abstract
Performance of twenty early maturing sugarcane clones and two checks were assessed for cane yield and quality traits. Data were recorded for germination per cent, numer of tillers, cane height, cane thickness, single cane weight, cane yield, Brix %, sucrose %, purity %, CCS % and sugar yield. The basis of overall performance, four test clones *viz*., C 32011, C 31098, C 31095 and C 32029 exhibited better performance in respect of cane yield with mean values of 142.25 t/ha, 138.35 t/ha, 137.82 t/ha and 137.57 t/ha respectively against best standard CoC (Sc) 24 (125.15 t/ha). Highest average sugar yield was observed in C 31098 (17.92 t/ha), C 32011 (17.74 t/ha), C 32031 (17.69 t/ha) and C 31095 (17.65 t/ha) against the best standard CoC (Sc) 24. From the results, it was concluded that test clones *viz*., C 31098, C 32011, C 32031 and C 31095 could be forwarded to next selection stage for further Breeding programme.

Key words
Sugarcane, early maturing, clone, cane yield and sugar yield

Sugarcane (*Saccharum spp*. hybrids) is one of the major cash crop grown extensively all over in the world from tropical to sub-tropical regions. India is the second largest producer of sugarcane next to the Brazil in terms of area and production. In India, Tamil Nadu ranks third in area and production next to Uttar Pradesh and Maharastra and ranks first in productivity (Sugar India, 2014).

The early maturing sugarcane varieties are chosen in the beginning of crushing season for higher sugar recoveries. Besides, the influence of season is less pronounced on early maturing varieties and in late planted conditions, growing of early maturing clones facilitate recovery of higher sugar yield. Production and productivity of sugarcane is governed by varieties, season and agronomic package of practices besides balanced nutrition. Among the components, varieties play paramount role in sugar mills. Hence it is imperative to identify new sugarcane varieties to replace the deteriorating commercial varieties through which the overall productivity could be stabilized. Therefore, to meet the immediate need of sugarcane farming community and sugar factory, there is a need of more number of early maturing, high sugar varieties having high tonnage, good ratooning ability to meet the challenges for improving sugar recovery, especially during the beginning of the crushing season (Shanmuganathan, 2015).

The present study was conducted at Sugarcane Research Station, Tamil Nadu Agricultural University, Cuddalore, India (latitude; 11º 46' North; longitude: 79º.46' East; altitude: 4.60 m MSL). Evolution of sugarcane clones starts from the Fluff seedlings. From the seedlings study plot, seedlings were selected based on the brix value, high tillering ability to Progeny Row Trial. The selected sugarcane clones from the single plant trial were promoted and year wise tested in subsequent selection stages. During January 2015-16, twenty early maturing Sugarcane clones obtained from Initial Yield Trail and two checks were planted as Advanced Varietal Trial in Randomized Complete Block Design with two replications for further testing and selection. Five rows of each sugarcane clones were planted by overlapping method using two budded setts and 1.2 m respectively. All the agronomic practices and need based plant protection measures were followed to maintain good crop.

The data for different traits such as germination (%), number of tillers ('000/ha), number of millable cane ('000/ha), cane height (cm), cane thickness (cm), single cane weight (kg), cane yield (t/ha), Brix %, Sucrose %, Purity %, commercial cane sugar (CCS) % and sugar yield (t/ha) were recorded. Five canes were randomly selected from each replication for juice analysis. The canes were crushed in the crusher and their juice was analyzed in the laboratory for the assessment of sucrose per cent and CCS per cent. The data recorded were statistically analyzed as per Panse and Sukhatme (1978).

The analysis of variance of the present study for plant crop during 2014-15 cropping season revealed that there was a significant difference in the mean values for cane yield, sugar yield and its attributes. The variation in cane yield and yield components among the varieties may be attributed due to their differences in genetic makeup (Mali and Singh, 1995). Memon *et al.* (2005) also reported great variability among the sugarcane genotypes for cane yield and yield components.

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Mean performance of different early sugarcane clones for yield and its contributing traits are presented in Table 1. Germination per cent is the most critical factor which determines the varietal potential to exploit the available resources and ultimately effects cane stand. In the present study the germination percentage was ranged from 48.15 to 65.85. Among the test clones, the C 32020 recorded high germination percentage (65.85) followed by the clone C 32031(64.15) and clone C 32029 (63.62). Among the test clones, seven clones recorded superior performance over the best standard CoC (Sc) 24, which recorded 55.17 %. The significant difference among the study material was also reported by Imdad Ali Sohu *et al.* (2008).

Tillering potential of a clone ultimately effects cane yield positively. In the present study, number of tillers varied from 117.45 to 145.84 (x1000/ha). The clone C 32031 recorded higher tiller counts (1,45,840 /ha) followed by clone C 32029 (1,42,470 /ha) and clone C 32011 (1,42,350 /ha). Among the clones evaluated, the eight clones were recorded superior performance over the best standard CoC(Sc) 24 (1,27,150/ha, which recorded 1,27,150 /ha. Similar results were reported by Shanmuganathan *et al*. (2015).

The number of millable cane directly influences cane yield as it is the combined interaction of germination and tillering. In the present study, number of millable cane per hectare ranged from 98.57 to 127.95 (x1000/ha). The test clone C 32031 recorded higher tiller counts (1,27,950/ha) followed by clone C 32011 (1,27,230/ha) and clone C 32029 (1,25,470/ha). Among the twenty clones, five clones recorded superior performance over the best standard CoC (Sc) 24 (1,13,850 /ha). This is in agreement with the results reported by Panhwar *et al.* (2008) and Shanmuganathan *et al*. (2015).

Single cane weight ranged from 0.97 kg (C 32002) to 1.45 kg (C 32029). Among the 20 clones evaluated, seven clones were recorded numerically higher performance than the best standard CoC(Sc) 24 which recorded 1.25 kg. Single cane weight is the product of its length, girth and contributes substantially towards final cane yield. The similar work was already reported by Sabitha and Prasada Rao, (2008).

For cane yield, the clones and standards ranged from 98.75 t/ha to 142.25 t/ha. The clone C 32011 yielded the highest tonnage (142.25 t/ha) and it was followed by C 31098 (138.35 t/ha) and the clone C 31095 (137.82 t/ha). Among the twenty clones evaluated, six clones were recorded higher performance over the best check variety CoC (Sc) 24, which recorded by 125.15 t/ha. Similar reports were reported by Shanmuganathan *et al*. (2015). Panhwar *et al.* (2008) reported great variability among the sugarcane genotypes for cane yield and yield components when tested in 4th cycle under agro-climatic conditions of Thatta.

The search of varieties that, besides having desirable characteristics, exhibit high sugar content is an important aspect in sugarcane breeding. Sugar recovery stands the factor of prime importance both from millers and breeding point of view (Shanmuganathan *et al*., 2015). The data regarding mean performance of sugar yield and its attributing characters of different early sugarcane clones are depicted in table 1.

Sucrose per cent in cane juice is important quality character of sugarcane. Its determination is useful in deciding the quality of sugarcane and it influences the sugar recovery and sugar production in factory (Thangavelu, 2007). The Sucrose per cent was varied from 16.71 – 17.95. Seven test clones *viz.*, C 31098 (17.95 %), C 32031 (17.95 %), C 32029 (17.91 %), C 32026 (17.85 %), C 31087 (17.85 %), C 32013 (17.76 %) and C 31075 (17.75 %) recorded higher sucrose per cent than the best check variety Co 86032, which recorded 17.75 %. Similar reports were reported by Shanmuganathan *et al.* (2016).

The CCS was ranged from 12.15 % – 12.95 %. Among the 20 clones, seven test clones *viz.*, C 31098 (12.95 %), C 32031 (12.90 %), C 32029 (12.82 %), C 32075 (12.81 %), C 32095 (12.81 %), C 32026 (12.77 %) and C 31087 (17.75 %) recorded higher CCS per cent than the best check variety Co 86032, which recorded 12.72 %. Similar reports were reported by Shanmuganathan *et al.* (2016).

Sugar yield is the combination of cane yield and corresponding commercial cane sugar. The sugar yield of the present study materials varied from 12.21 to 17.92 t/ha. Among the twenty test clones, six clones *viz.*, C 31098 (17.92 t/ha), C 32011 (17.74 t/ha), C 32031 (17.69 t/ha), C 31095 (17.65 t/ha), C 32029 (17.64 t/ha) and C 31075 (17.51 t/ha) recorded significantly higher sugar yield than the best check variety CoC (Sc) 24 (15.78 t/ha). The highest sugar yield in clones may be attributed to relatively more average cane yield and recoverable sugar percentage. The results are almost same as demonstrated by Shanmuganathan *et al.* (2015).

On the basis of overall performance, it was concluded that the test clones *viz*., C 31098, C 32031, C 32029, C 31075 and C 31095 exhibited better performance in terms of cane yield, sugar yield and its attributing traits. Hence it was suggested that the selected early sugarcane clones should be further tested in Multi-location yield trials and Adoptive Research Trials and the

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promising best one could be released as new early sugarcane variety for commercial cultivation after confirmation of yield in large scale demonstrations.

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Table 1. Mean performance of early sugarcane clones for cane yield and its contributing traits

Genotypes	Germination (%)	No. of tillers ('000/ha)	No. of Millable Canes ('000/ha)	Cane length (cm)	Cane thickness (cm)	Single cane Wt. (kg)	Cane Yield (tha)	Brix (%)	Sucrose (%)	Purity (%)	CCS (%)	Sugar Yield (t/ha)
C 31060	51.57	128.07	112.16	265.75	2.77	1.15	121.25	20.32	16.95	89.35	12.27	14.88
C 31074	52.00	123.55	103.61	273.33	2.75	1.31	127.45	20.71	17.30	90.42	12.56	16.01
C 31075	56.45	127.51	113.48	280.35	2.85	1.37	136.71	21.75	17.75	90.62	12.81	17.51
C 31087	63.16	118.64	105.42	272.15	2.77	1.21	123.52	21.14	17.85	90.16	12.75	15.75
C 31089	54.13	116.25	100.95	267.95	2.85	1.25	124.62	20.95	17.58	90.21	12.65	15.76
C 31095	55.64	129.18	111.72	287.51	2.91	1.35	137.82	21.72	17.73	90.81	12.81	17.65
C 31098	57.71	134.84	115.36	297.44	2.94	1.42	138.35	21.80	17.95	90.85	12.95	17.92
C 31177	51.67	127.35	107.64	267.38	2.71	1.01	110.75	20.15	17.27	88.92	12.54	13.89
C 32001	52.13	123.72	109.17	271.52	2.74	1.05	113.20	20.35	16.85	88.25	12.15	13.75
C 32002	48.15	121.52	112.51	270.25	2.62	0.97	105.92	21.45	17.72	89.75	12.62	13.37
C 32003	51.25	129.84	112.25	262.36	2.51	1.01	98.75	20.62	17.22	89.65	12.36	12.21
C 32007	51.37	131.25	123.41	271.85	2.72	1.11	115.67	19.75	16.71	88.74	12.21	14.12
C 32008	52.64	117.45	98.57	268.45	2.62	1.02	100.50	21.16	17.63	90.27	12.58	12.64
C 32011	61.25	142.35	127.23	292.84	2.95	1.41	142.25	21.10	17.55	89.92	12.47	17.74
C 32013	57.39	121.16	100.31	268.28	2.55	1.02	104.50	21.27	17.76	90.47	12.64	13.21
C 32020	65.85	122.38	101.24	271.33	2.72	1.05	125.11	20.71	17.31	89.62	12.41	15.53
C 32021	51.28	125.24	104.58	268.87	2.62	1.00	106.55	21.24	17.67	90.58	12.72	13.55
C 32026	49.75	121.18	99.25	266.64	2.57	1.10	104.72	21.53	17.85	90.64	12.77	13.37
C 32029	63.62	142.47	125.47	287.95	3.02	1.45	137.57	21.47	17.91	90.76	12.82	17.64
C 32031	64.15	145.84	127.95	293.72	2.95	1.38	137.15	21.75	17.95	90.82	12.90	17.69
Checks												
Co 86032	51.45	121.42	110.34	175.51	2.71	1.21	120.60	21.52	17.75	90.60	12.72	15.34
CoC (Sc) 24	55.17	127.15	113.85	177.45	2.82	1.25	125.15	20.95	17.51	90.15	12.61	15.78
CD (0.05 %)	5.72	12.65	10.57	16.16	0.15	0.13	10.15	0.45	0.37	1.92	0.32	1.18
CV (%)	5.14	6.17	5.62	4.37	2.71	4.32	5.87	1.52	1.28	1.75	1.31	4.14