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Evaluation of mid-late clones of sugarcane for their cane yield and yield components

D ADILAKSHMI

Acharya NG Ranga Agricultural University
Regional Agricultural Research Station, Anakapalle 531001 AP, India
Email for correspondence: adilakshmi87@gmail.com

ABSTRACT

Three mid-late clones of sugarcane viz 2007A177, 2007A126 and 2007A161 along with four standards viz 83V15, Co 7805, Co 86249 and Co 7219 were evaluated in main yield trials during 2011-12 and 2012-13 at Regional Agricultural Research Station, Anakapalle, AP. The mean data obtained from two plant and one ratoon crops in the experiment on number of millable canes (NMC), cane yield, per cent juice sucrose, commercial cane sugar (CCS) yield, stalk length, stalk diameter, single cane weight and germination per cent were statistically analysed and compared. The results revealed that the clone 2007A177 recorded significantly higher cane yield (112.86 tons/ha), CCS yield (15.29 tons/ha), juice sucrose (18.57%), stalk diameter (3.06 cm) and single cane weight (1.17 kg) compared to the best standard 83V15 (102.44 tons/ha, 13.49 tons/ha, 18.22%, 2.43 cm and 1.13 kg respectively). The clone 2007A161 recorded highest NMC of 99.23 thousand/ha while the clone 2007A126 recorded the highest stalk length of 3.09 m and highest germination (63.83%). The clone 2007A177 was found to be resistant under nodal and plug methods of inoculation against the prevailing red rot races with intermediate reaction (MR) against Cf 997 and moderately susceptible to smut.

Keywords: Clone; inoculation; NMC; CCS; plug method

INTRODUCTION

Evolving improved sugarcane genotypes suitable for different agro-climatic zones of Andhra Pradesh with high yield and high sucrose coupled with resistance to major diseases is a continuous process with a view to increase the productivity and sugar recovery. Red rot is the most devastating and widespread disease of sugarcane and there is need for development of varieties/ clones resistant/immune to the disease. Production and productivity of sugarcane is governed by varieties, seasons, agronomic package of practices besides balanced nutrition. To meet the needs of growing population the sugarcane productivity and production needs to be increased. The increased requirement of sugar has to be met mostly through enhanced production per unit area/unit time. In view of the above present investigation

was carried out to evolve high yielding, sucrose rich clones of sugarcane with resistance to major diseases.

Chandrakant et al (2007) undertook eighty four clones including three checks in first and second consecutive clonal generations with the objective to identify reliable yield attributing traits for formulation of selection indices and selection of suitable clones in early clonal generation. Sukhchain et al (1997) evaluated seventeen diverse clones of sugarcane (*Saccharum* spp) (7 early, 6 mid-season and 4 late) in flooded environment (FE) and non-flooded environment (NFE) for cane yield, commercial cane sugar (CCS), internode length, internode number, stalk length, stalk thickness (circumference), stalk number, sugar recovery and stalk weight. Kumar and Singh (2005) did genetic evaluation of twenty seven mid-late sub-tropical sugarcane clones based on thirteen quality and quantity attributing traits viz germination per cent, number of tillers at 120 and 240 days, number of millable canes, number of internodes per stalk, cane height, cane girth, single cane weight, sucrose per cent, commercial cane sugar (CCS tons/ha) and cane yield (tons/ha).

MATERIAL and METHODS

Three clones viz 2007A177, 2007A161 and 2007A126 along with standards viz 83V15, Co 7805, Co 86249 and Co 7219 were evaluated under main yield trial at Regional Agricultural Research Station, Anakapalle during 2011-12 and 2012-13. The trial was laid out in RBD with three replications. Recommended doses of fertilizers (112 kg N + 100 kg P_2O_5 + 120 Kg K_2O/ha) were applied. Irrigations were accorded at weekly interval during formative phase of the crop. Weeding, earthing up and trash-twist (TT) propping were carried out as per the recommendation. Data on germination per cent at 35 DAP, number of millable canes (NMC), length of cane, cane diameter, single cane weight and cane yield per plot were recorded at harvest. Juice sucrose was determined at harvest (12^{th} month) following the standard procedure (Meade and Chen 1977). Estimated commercial cane sugar (CCS) yield was determined based on CCS per cent and cane yield. Statistical analysis was performed as per the procedure of Panse and Sukhatme (1978). Reaction to diseases viz red rot and smut both under natural and artificial conditions was recorded. Resistance to red rot against the mixed inoculum of three predominant pathotypes (Cf 419, Cf 671 and Cf 997) in Andhra Pradesh through both nodal and plug methods was also tested. Besides reaction to smut under artificially inoculated conditions was evaluated.

RESULTS and DISCUSSION

The mean data on all the parameters viz NMC, cane yield, CCS yield, per cent juice sucrose, stalk length, stalk diameter,

single cane weight along with germination per cent were analysed statistically. Number of millable canes (Table 1) ranged from 79.40 (Co 7219) to 99.23 thousand/ha (2007A161). The clone 2007A161 recorded maximum NMC of 99.23 thousand/ha when compared to best standard 83V15 (90.23 thousand/ha). However the clone 2007A177 also recorded superior NMC of 96.98 thousand/ha over the best standard followed by 2007A126 (96.73).

Cane yield (Table 1) ranged from 83.90 tons/ha (Co 86249) to 112.86 tons/ha (2007A177). The clone 2007A177 stood first in I plant (129.17 tons/ha) and ratoon (104.86 tons/ha) with a mean cane yield of 112.86 tons/ha followed by 2007A126 (112.16 tons/ha) and 2007A161 (104.45 tons/ha) and excelled the best standard 83V15 (102.44 tons/ha) whereas the standards viz Co 7805, Co 7219 and Co 86249 recorded the cane yield of 93.46, 93.18 and 83.90 tons/ha respectively.

CCS yield (Table 1) ranged from 10.32 (Co 86249) to 15.29 tons/ha (2007A177). The clone 2007A177 was found to be superior with a CCS yield of 15.29 tons/ha followed by 2007A126 (14.66 tons/ha) and 2007A161 (13.85 tons/ha) over the best standard 83V15 (13.49 tons/ha). However the other standards recorded 12.30 (Co 7805), 12.04 (Co 7219) and 10.32 tons/ha (Co 86249) CCS yield. Per cent juice sucrose (Table 1) ranged from 17.23 (Co 86249) to 18.57 (2007A177). The clone 2007A177 recorded highest per cent juice sucrose of 18.57 followed by 2007A161 (18.38) and 2007A126 (18.37) while the best standard (83V15) recorded 18.22 per cent juice sucrose followed by Co 7805 (18.19), Co 7219 (17.99) and Co 86249 (17.23).

Data on yield components viz stalk length, stalk diameter, single cane weight along with germination per cent are presented in Table 2. Stalk length varied from 2.63 (Co 86249) to 3.09 m (2007A126). The clone 2007A126 recorded highest cane length followed by 2007A177 (2.73 m) and 2007A161 (2.71 m) when compared the best standard Co 7805 (2.95 m). Cane diameter ranged from 2.19 (Co 86249) to 3.06 cm (2007A177). The clone 2007A177 recorded higher cane diameter of 3.06 cm followed by 2007A126 (2.57 cm) which was found to be superior over four standards 83V15 (2.43 cm), Co 7805 (2.32 cm), Co 86249 (2.19 cm) and Co 7219 (2.30 cm). Single cane weight ranged from 1.04 (Co 86249) to 1.17 kg (2007A177 and 2007A126). Both the clones 2007A177 and 2007A126 recorded significantly higher single cane weight of 1.77 kg that was superior to other test clone and four standards 83V15 (1.13 kg), Co 7805 (1.06 kg), Co 86249 (1.04 kg) and Co 7219 (1.05 kg). Germination per cent recorded in two plant crops ranged

Table 1. Pooled data in main yield trial (mid-late) for NMC, cane yield, CCS yield and per cent juice sucrose

Clone/ standard	I Plant (2011-12)	II Plant (2012-13)	Ratoon (2012-13)	Mean	I Plant (2011-12)	II Plant (2012-13)	Ratoon (2012-13)	Mean
	NMC (000/ha)				Cane yield (tons/ha)			
Clone								
2007A177	98.22	96.45	96.29	96.98	129.17	104.55	104.86	112.86
2007A126	96.68	100.15	93.36	96.73	126.23	109.80	100.46	112.16
2007A161	99.77	96.45	101.46	99.23	108.02	102.70	102.62	104.45
Standard								
83 V 15	93.75	87.19	89.74	90.23	121.84	93.29	92.20	102.44
Co 7805	84.65	88.19	90.12	87.65	95.99	92.28	92.12	93.46
Co 86249	84.95	69.29	87.42	80.55	89.81	73.53	88.35	83.90
Co 7219	86.26	90.51	61.43	79.40	89.66	95.91	93.98	93.18
CD (0.05)	8.24	8.18	4.41	-	11.11	7.78	4.65	-
CV (%)	5.06	14.28	18.65	-	5.78	14.43	8.65	-
	CCS yield (tons/ha)				Per cent juice sucrose			
Clone								
2007A177	17.34	14.43	14.11	15.29	18.61	18.81	18.30	18.57
2007A126	16.82	14.95	12.21	14.66	19.23	18.78	17.10	18.37
2007A161	14.17	14.67	12.71	13.85	18.15	19.65	17.34	18.38
Standard								
83V15	16.12	12.78	11.58	13.49	18.37	18.80	17.50	18.22
Co 7805	12.82	12.45	11.64	12.30	18.52	18.56	17.50	18.19
Co 86249	11.11	9.50	10.34	10.32	17.44	17.83	16.43	17.23
Co 7219	11.69	13.02	11.40	12.04	18.23	18.64	17.11	17.99
CD (0.05)	1.52	1.77	1.45	-	0.55	0.12	0.71	-
CV (%)	5.97	1.95	1.03	-	1.7	1.48	1.24	-

Table 2. Pooled data in main yield trail (mid-late) for yield components

Clone/ standard	I Plant (2011-12)	II Plant (2012-13)	Ratoon (2012-13)	Mean	I Plant (2011-12)	II Plant (2012-13)	Ratoon (2012-13)	Mean
	NMC (000/ha)				Cane yield (tons/ha)			
Clone								
2007A177	2.81	2.88	2.50	2.73	3.14	3.06	2.98	3.06
2007A126	3.16	3.16	2.94	3.09	2.56	2.62	2.54	2.57
2007A161	2.70	2.73	2.69	2.71	2.44	2.3	2.28	2.34
Standard								
83V15	2.88	2.85	2.80	2.84	2.52	2.44	2.32	2.43
Co 7805	2.90	3.35	2.61	2.95	2.18	2.26	2.52	2.32
Co 86249	2.68	2.69	2.52	2.63	2.28	2.1	2.2	2.19
Co 7219	2.66	2.65	2.66	2.66	2.22	2.38	2.3	2.30
CD (0.05)	0.22	0.32	0.83	-	0.25	0.51	0.65	-
CV (%)	4.90	5.1	5.30	-	5.54	4.44	5.21	-
	Single cane weight (kg)				Germination (%)			
Clone								
2007A177	1.31	1.09	1.10	1.17	47.80	64.69	-	56.25
2007A126	1.32	1.10	1.08	1.17	49.65	78.01	-	63.83
2007A161	1.11	1.02	1.01	1.05	49.30	68.69	-	59.00
Standard								
83V15	1.28	1.07	1.03	1.13	48.90	67.65	-	58.28
Co 7805	1.10	1.05	1.02	1.06	46.35	70.37	-	58.36
Co 86249	1.04	1.06	1.01	1.04	46.24	42.59	-	44.42
Co 7219	1.04	1.09	1.03	1.05	47.74	66.26	-	57.00
CD (0.05)	0.05	0.07	0.10	-	5.80	8.25	-	-
CV (%)	3.18	0.9	3.45	-	4.50	5.82	-	-

from 44.42 (Co 86249) to 63.83 (2007A126). Among the test clones the clone 2007A126 recorded the highest germination per cent followed by 2007A161 (59.00) when compared to the best standard Co 7805 (58.36).

Data on reaction to red rot and smut are presented in Table 3. The clone 2007A177 was found to be resistant under nodal method and plug method of inoculation against all the prevailing races of red rot and intermediate reaction (MR) against Cf 997 that was moderately susceptible to smut. The other two test clones viz 2007A126 and 2007A161 exhibited resistance against all the prevailing races under nodal method with susceptible reaction under plug method of inoculation.

In earlier works Chandrakant et al (2007) reported that preliminary selection in early clonal generation should be based on quantitative traits viz single cane weight, number of shoots at 120 days and number of millable canes and quality traits should be delayed to later generation till the character stabilizes. Tyagi et al (2013) worked on a high yielding mid-late maturing sugarcane variety CoPant 97222 for north west zone areas. The per cent increase for cane yield of CoPant 97222 over checks CoS 767, Co 1148 and CoS 8436. There was also increased sugar yield over checks. Juice sucrose per cent at harvest in CoPant 97222 was on par with CoS 767 and CoS 8436 but superior to Co 1148. The number of millable canes in CoPant 97222 were on par with CoS 8436 but cane length, cane diameter and cane weight were high in variety CoPant 97222 over the checks. The variety was resistant to red rot under natural and artificial inoculated conditions. The variety CoPant had tall medium thick canes with erect growing habit and non lodging. Sukhchain et al (1997) reported that cane yield and sugar recovery had high direct effects on CCS. Selection for improvement of cane yield can be based on stalk number and stalk weight in flooded environment (FE) and non-flooded environment (NFE). Kumar and Singh (2005) showed that maximum direct effect on cane yield was exhibited by number of millable cane followed by single cane weight. Number of millable canes and single cane weight could be equally utilized for assessing the genotypic performance.

CONCLUSION

From the above results it is apparent that the clone 2007A177 is promising for cane yield, per cent juice sucrose, CCS yield and yield components viz stalk diameter and single cane weight when tested in two plant and one ratoon crop and was found to be resistant under nodal method and plug method of inoculation against all the prevailing races of red rot and immune reaction against Cf 997 and moderately susceptible to smut. It needs further observation and evaluation through adaptive trials in sugar factories to

Table 3. Reaction of sugarcane standards and clones to diseases

Clone/ standard	Red Rot						Smut
	Nodal Method			Plug Method			
	Cf 419	Cf 671	Cf 997	Cf 419	Cf 671	Cf 997	
Clone							
2007A177	R	R	R	R	R	I	MS
2007A126	R	R	R	S	S	S	HS
2007A161	R	R	R	S	S	S	MR
Standard							
83V15	R	R	R	R	R	R	R
Co 7805	R	R	R	S	I	I	MR
Co 86249	R	R	R	R	R	R	R
Co 7219	R	R	R	I	I	S	HS

assess their performance and adaptability. The improved cane was thick with erect growth habit and of non-lodging nature. The clone can be distinguished by pale green with yellowish canes, dark green lamina and green purple miming sheath, without spines and with ligule dentoid on one side.

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