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Sugarcane Clones Tolerant to Post Harvest Deterioration in Plant and Ratoon Crops Across Three Farming Situations

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ABSTRACT

Fifteen sugarcane clones including two checks 2003V 46 and Co 86032 were studied in two plant and one ratoon across three farming situations from 2022-23 to 2023-24 to identify clones tolerant to delayed harvest (10 to 13th months of crop age) and delayed crushing (0, 24,48 and 72 hrs) after harvest. Data was recorded on cane and estimated sugar yield at harvest. Juice quality parameters (sucrose and purity) and indicators of juice quality deterioration (dextrans and reducing sugars) were determined at 10, 11, 12 and 13th months of crop age at 24 hrs interval (from immediately after harvest to 72 hrs after crop harvest. Among the test clones, the high cane and sugar yielding clones *viz.;* 2016T 7, 2003V 46 TC, CoA 14328 in early and 2009V 89 and CoA 19322 in mid-late recorded low per cent reducing sugars and dextrans and higher per cent juice sucrose and purity compared to the check Co 86032 but on par with the best check 2003V 46 TC under delayed harvest and delayed crushing at each harvest in all the farming situations. Dextrans increased linearly among the clones upto 12th months of crop age and then decreased at 13th month of crop age while per cent reducing sugars increased progressively with the increase in the crop age (10th to 13th month). Both per cent reducing sugars and dextranslin early increased with increase in time lag intervals of crushing (0 to 72 hrs after harvest). Dextrans were found high in early clones while per cent reducing sugars were observed to be high in midlate clones. Dextrans were found to be high in ratoons whereas per cent reducing sugars were high in plant crops. Among the three-farming situation FSI: sandy soils with bore well irrigation followed by FSII: garden lands with limited irrigation and FSIII: wet-lands with well irrigation, were observed to be the favourable environments for higher cane and sugar yields and quality retention for longer period.

Keywords: Post-harvest deterioration, reducing sugars, dextrans

INTRODUCTION

Post harvest deterioration of sugarcane is a severe problem for the sugar industry causing 20-30 per cent sucrose losses in cane producing countries (Eggleston, 2001; Solomon, 2009, 2011). Microbial agents are the major contributors for the inversion of sucrose followed by enzymes and chemicals. The cut ends of canes facilitate invasion of microbes particularly *Leuconostoc* bacteria which converts sucrose intodextrans (Kim and Robyt, 1995). Invertase enzymes hydrolyze sucrose into glucose and fructose. Inversion of sucrose by plant and microbial invertases leads formation of organic acids and dextrans largely influence loss of recoverable sugar after harvest of cane. Formation of organic acids by micro-organisms results in loss of sucrose and lowering of juice PH. Dextrans, a polysaccharide is the major contributor to post harvest sucrose loss. Dextrans are formed due to utilization of glucose by *Leuconostoc* bacteria and left over by- product fructose is an indication of cane deterioration (Eggleston et al. 2002). Dextrans formation depends on time lag between harvest and milling , size of cane files, varietal characters, ambient

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temperature and humidity (Solomon et al. 2011). Other workers also observed increase in reducing sugars and PH in sugarcane under delayed harvest and staling (Solomon et al. 2008; Bhatia et al. 2009; Singh et al. 2015). Reducing sugars are highly prone to rapid bio-deterioration resulting in undesirable and harmful products (ethanol, acids, polysaccharides). Post harvest deterioration in sugarcane becomes more pronounced with the increase in the time lag between harvest and crushing. Two clones *viz.*; 2003V 46 and Co 86032 are under extensive cultivation in Andhra Pradesh. However, Co 86032 is highly susceptible to post harvest deterioration and yellow leaf disease while 2003V 46, a sucrose rich early clone is susceptible to delayed harvest and yellow leaf disease. Adoption of planting material derived through micro propagation in sugarcane aid restoration of yield potential and prolonging the shelf life of clones. Through the present investigation 13 clones including 2003V 46 TC derived from micro propagation were tested against Co 86032 and 2003 V 46 to identify high cane and sugar yielding clones possessing tolerance to delayed harvest and crushing.

MATERIALS AND METHOD

The experimental material comprising 15 sugarcane clones including two popular clones as checks (2003V 46 and Co 86032) were grown in a randomized block design with three replications in two plant and one ratoon from 2022-23 to 2023-24 under three farming situations *viz:* FSI: sandy soils with bore well irrigation; FSII: garden lands with limited irrigation and FSIII: wetlands with well irrigation. All the recommended package of practices were adapted for raising a healthy crop. Data were recorded on cane and estimated sugar yield at 10th month in early clones and at 11th month in mid late clones. Juice sucrose and purity per cent (Meade and Chen,1977) were estimated following standard procedures. Per cent reducing sugars were determined by adopting dinitrosalysic acid reagent method (DNS) (Miller, 1959) while dextrans were determined using dextran pocket refractometer from 10th to 13th months of crop age and at 24 hrs of time intervals (0,24,48 and 72 hrs) at each month of harvest. Mean data were analyzed following the methods suggested by Panse and Sukhatme, (1985).

RESULTS AND DISCUSSION

Mean data pertaining to cane and sugar yields, per cent juice sucrose, purity, reducing sugars, dextrans for the top high cane and sugar yielding clones over six plant crops and three ratoons (two plant crops and on ratoon from 2022-23 to 2023-24 across thee farming situations) were furnished in (Tables 1 to 5). Results were presented here under on character-wise.

Cane yield (t/ha)

Cane yield varied among the clones from 96.0 (Co 0238) to 138.8 (2003V 46 TC) over six plant crops with mean cane yield of 122.6 t/ha and from 64.3 (Co 0238) to 112.4 (2003V 46TC) in three ratoon crops with a mean cane yield of 89.4 t/ha across three farming situations. Among the test clones 2003V 46 TC (138.8 and 112.4 t/ha) followed by CoA 14328 (135.3 and 107.2 t/ha) and 2016T 7 (133.5 and 105.70 t/ha) in early group and CoA 19322 (134.6 and 106.8 t/ha) and 2009V 89 (132.2 and 98.0 t/ha) in mid late group registered higher cane yield compared to the check Co 86032 (105.9 and 79.5 t/ha) but were on par with the best check 2003V 46 (133.6 and 98.9 t/ha over plant and ratoon crops, respectively across three farming situations (Table 1).

Sugar yield (t/ha)

The character ranged from 10.2 (Co 0238) to 20.4 (2003 V 46 TC) over six plant crops with a mean sugar yield of 14.9 t/ha and from 6.96 (Co 0238) to 16.7 (2003V 46 TC) with a mean sugar yield of 11.3 t/ha over three ratoon crops across three farming situations. The test clones viz; 2003V 46 TC (20. 4 and 16.7 t/ha) followed by 2016 T 7 (18.7 and 15.5t ha), Co A 14328 (17.5 and 13.9 t/ha) in early and CoOA 19322 (17.4 and 14.4 t/ha) and 2009V 89 (17.7 and 13.4 t/ha) in mid late registered higher sugar yield over the check Co 86032 (11.8 and 9.1 t/ha) but on par with the best check 2003 V 46 (18.6 and 14.1 t/ha) (Table 1). The micro propagated 2003V46 (TC) recorded higher values for yield components viz; girth of cane, length of millable canes, single cane weight and number of millable canes also at harvest when compared to the standard 2003V46 (Naidu et al. 2024)

Table 1 : Performance of top five high cane and sugar yielding clones possessing tolerance to post harvest deterioration

S. No	Clone No	Cane Yield (t/ha)		Sugar Yield (t/ha)	
		Plant	Ratoon	Plant	Ratoon
1	2009V89	132.20	98.00	17.70	13.40
2	2016T7	133.50	105.70	18.70	15.10
3	CO A 14328	135.30	107.20	17.50	13.90
4	COA 19322	134.60	106.80	17.40	14.40
5	200346 TC	138..8	112.40	20.40	16.70
6	2003V 46	133.60	98.90	18.60	14.00
7	CO 86032	105.90	79.50	11.80	9.10
	Mean	122.60	89.40	14.90	11.30
	Sem	2.29	1.93	0.33	0.27
	C. D at 5%	6.66	5.59	0.96	0.08
	C.V (%)	6.52	3.73	3.84	4.07

Juice sucrose (%)

Among the top high cane and sugar yielding clones, 2016T 7 (20.4 and 20.9) 2003V 46 TC (20.8 and 21.1), CoA 14328 (17.4 and 18.6) and CoA 19322 (18.3 and 17.8) recorded higher per cent juice sucrose at 11th months of crop age in plant and ratoons, respectively compared to the check CoO 86032 (17.4 and 17.7) but on par with the best check 2003V 46 (20.3 and 20.8) across the three farming situations. Ratoon crops recorded higher per cent juice sucrose than plant crop across farming situations. A progressive reduction in juice sucrose was noted from 0hrs of crushing after harvest to 72 hrs of crushing after harvest at each month of harvest. Per cent juice sucrose declined after 11th months of crop age in all the clones except 2009V 89. Per cent sucrose immediately after harvest (0 hrs) varied 13.8 (2008V 257 and 2009V 89) to 20.4 (2003V 46 TC) with a mean of 16.2 over six crops and from 14.2 (2008V 257) to 20.7 (2003V 46T C) with a mean of 16.6 over three ratoon crops whereas it ranged from 12.7 (CoA 20327) to 19.5 (2003V 46 TC) with a mean of 15.2 over six plant crops and from13.0 (CoA 20327) to19.8 (2003V 46 TC) with a mean of 15.6 over three ratoon crop at 72 hrs after crop harvest across the farming situations at 10th months of crop harvest. Across farming situations at 13th months of crop harvest, per cent sucrose varied from 15.3 (Co 0238) to 19.5 (2003V 46 TC) with a mean of 17.4 over six crops and from 15.5 (Co 0238) to 19.8 (2003V 46 TC and 2016T 7) with a mean of 17.7 over three ratoon crops at 0 hrs after harvest while it ranged from 14.3 (Co 0238) to 18.5 (2003V 46 TC) with a mean of 16.2 over six plant crops and from 1 4.6 (Co 0238) to 18.7 (2003V 46 TC) with a mean of 16.5 over three ratoon crop at 72 hrs after crop harvest (Table 2).

Juice purity (%)

The clones viz.; 2016T 7 (89.2 and 89.6) and 2003V 46 TC (91.0 and 90.5) recorded higher per cent juice among the top high cane and sugar yielding clones in plant and ratoon crops, respectively upto 11th months of crop age while CoA 19322 (88.6 and 87.2) and CoA 14328 (87.0 and 89.0) maintained higher per cent purity upto 12th months of crop age in plant and ratoon crops , respectively. However, per cent purity declined in all the clones from 0 hrs of crushing to 72 hrs after crushing. Reduction in per cent purity was found to be low in 2003V 46 TC and 2016T 7 compared to all other clones and checks Co 86032 and 2003V 46 across farming situations. Ratoon crop recorded higher per cent juice purity over plant crop across farming situations. A progressive reduction in juice sucrose was noted from 0 hrs of crushing after harvest to 72 hrs after harvest at each month of harvest. Per cent juice purity declined after 11th months of

Table 2A : Percent juice sucrose from 10th to 11th months of harvest and at different time intervals of crushing

S. No.	Clone	10th month								11th month							
		0 hrs		24hrs		48hrs		72hrs		0 hrs		24hrs		48hrs		72hrs	
		Plant	Ratoon	Plant	Ratoon	Plant	Ratoon	Plant	Ratoon	Plant	Ratoon	Plant	Ratoon	Plant	Ratoon	Plant	Ratoon
1	2009V89	13.8	14.6	13.5	14.3	13.2	14.0	13.1	13.8	15.5	15.6	15.3	15.4	15.0	15.1	14.7	14.8
2	2016T7	19.6	20.1	19.4	19.8	19.2	19.6	19.0	19.5	20.4	20.9	20.3	20.8	20.1	20.6	19.9	20.3
3	CO A 14328	16.1	17.1	15.5	16.7	15.0	16.2	14.6	15.9	17.4	18.6	17.2	18.5	16.7	17.9	16.4	17.6
4	COA 19322	16.8	16.4	16.3	15.8	15.9	15.2	15.6	14.9	18.3	17.8	18.1	17.6	17.5	17.0	17.3	16.8
5	2003V 46 TC	20.4	20.7	20.3	20.5	19.7	20.0	19.5	19.8	20.8	21.1	20.6	20.9	20.2	20.4	19.5	19.7
6	2003V 46(C)	19.6	20.1	19.5	19.9	19.2	19.6	19.0	19.4	20.3	20.8	19.9	20.4	19.6	20.0	19.4	19.9
7	CO 86032(C)	16.1	16.5	15.8	16.1	15.5	15.8	14.9	15.2	17.6	18.0	17.3	17.7	17.0	17.4	16.7	17.1
	Mean	16.2	16.6	15.9	16.3	15.5	15.9	15.2	15.6	17.4	17.7	17.1	17.4	16.7	17.0	16.3	16.7
	Sem	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	C. D at 5%	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.4	0.4	0.3	0.3
	C.V (%)	1.0	1.0	1.2	1.1	1.2	1.2	1.1	1.0	1.1	1.0	1.2	1.2	1.4	1.4	1.0	1.0

Table 2B : Percent juice sucrose from 12th to 13th months of harvest and at different time intervals of crushing

S. No.	Clone	12th month								13th month							
		0 hrs		24hrs		48hrs		72hrs		0 hrs		24hrs		48hrs		72hrs	
		Plant	Ratoon	Plant	Ratoon	Plant	Ratoon	Plant	Ratoon	Plant	Ratoon	Plant	Ratoon	Plant	Ratoon	Plant	Ratoon
1	2009V89	18.2	18.6	17.7	18.1	17.2	17.6	16.9	17.2	16.5	16.9	16.4	16.7	16.3	16.6	15.8	16.1
2	2016T7	19.4	19.8	19.1	19.5	18.7	19.2	18.4	18.9	18.3	18.8	17.9	18.3	17.6	18.0	17.3	17.7
3	CO A 14328	18.4	18.3	17.9	17.8	17.6	17.5	17.2	17.1	17.7	17.6	17.4	17.4	17.1	17.0	16.5	16.0
4	COA 19322	17.9	18.7	17.4	18.3	17.1	17.9	16.7	17.5	17.2	18.0	17.0	17.7	16.6	17.4	16.3	16.8
5	2003V 46 TC	19.5	19.8	19.3	19.5	18.9	19.1	18.5	18.7	18.3	18.5	17.7	17.9	17.2	17.4	16.9	17.1
6	2003V 46(C)	19.0	19.5	18.8	19.2	18.4	18.8	18.1	18.5	17.7	18.1	17.1	17.5	17.0	17.4	16.8	17.1
7	CO 86032(C)	16.7	17.1	16.1	16.5	15.6	16.0	15.4	15.8	16.3	16.6	15.3	15.7	14.8	15.2	14.6	14.9
	Mean	17.4	17.7	16.9	17.3	16.6	16.9	16.2	16.5	16.2	16.5	15.8	16.1	15.5	15.8	15.1	15.4
	Sem	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	C. D at 5%	0.4	0.4	0.3	0.3	0.4	0.3	0.3	0.3	0.4	0.4	0.1	0.1	0.3	0.3	0.3	0.3
	C.V (%)	1.5	1.5	1.2	1.2	1.3	1.2	1.0	1.0	1.5	1.3	1.5	1.4	1.1	1.1	1.1	1.1

crop age in all the clones except 2009V 89. Per cent purity immediately after harvest (0 hrs) varied from 71.0 (2009V 127) to 90.1 (2009V 89) with a mean of 86.0 over six crops and from 78.7 (2009V 127) to 91.2 (2009V 89) with a mean of 86.9 over three ratoon crops whereas it ranged from 61.0 (2009V 127) to 83.4 (2003V 46 TC) with a mean of 76.2 over six plant crops and from 67.5 (2009V 127) to 82.9 (2003V 46TC) with a mean of 77.0 over three ratoon crop at 72 hrs after crop harvest across farming situations at 10th months of crop harvest. Across farming situations at 13th months of crop harvest, per cent purity varied from 74.8 (2008V 257) to 91.0 (CoA 20324) with a mean of 84.5 over six crops and from 75.1 (2008V 257) to 91.3 (CoA 20324) with a mean of 84.8 over three ratoon crops at o hrs after harvest while it ranged from 60.2 (CoA 19321) to 80.6 (CoA 14328) with a mean of 74.0 over six plant crops and from 60.4 (CoA 19321) to 80.3 (CoA 14328) with a mean of 74.3 over three ratoon crop at 72 hrs after crop harvest (Table 3).

Reducing Sugars (%)

The top high cane and sugar yielding clones, 2016T 7 and 2003V 46 TC recorded lower per cent reducing sugars at all months of crop harvest compared to the checks Co 8632 and 2003V 46 across all farming situations. Mean per cent reducing sugars were observed to be high in plant crops compared to the ratoon crops in all the clones studied and at all time intervals of crushing and all months of crop harvest across all farming situations. A progressive increase in reducing sugars was recorded in all the clones tested with concomitant increase in time lag between harvest and crushing and reached higher value at 72 hrs after crushing at each month of harvest. Per cent reducing sugars increased 10th months of crop age in all the clones. Per cent reducing sugars varied from 0.27 (2003V46 TC) to 0.73 (Co 0238) with a mean of 0.47 over six crops and from 0.17 (CoA 19322) to 0.36 (Co 0238) with a mean of 0.26 over three ratoon crops at zero hrs of crushing (immediately after harvest) whereas it ranged from 0.29 (2003V46 TC) to 0.63 (2008V257) with a mean of 0.44 over six plant crops and from 0.25 (CoA 19322) to 0.64 (CoA 20321) with a mean of 0.44 over three ratoon crop at 72 hrs of crushing after harvest across farming situations at 10th months of crop harvest. Across farming situations at 13th months of crop harvest per cent reducing sugars varied from 0.26 (2016T7) to 0.76 (2008V257) with a mean of 0.45 over six crops and from 0.21 (CoA 19322) to 0.41 (2009V127) with a mean of 0.33 over three ratoon crops at 0 hrs after harvest while it ranged from 0.48 (2003V46 TC) to 1.21 (2008V257) with a mean of 0.85 over six plant crops and from 0.45 (2003V46 TC) to 0.74 (Co 0238) with a mean of 0.54 over three ratoon crops at 72hrs after harvest (Table 4). Reducing sugars in juice are an important indicator of cane deterioration. It is considered as the governing factor in sugarcane growth process and quality maintenance. A sharp increase in acid invertase activity leads to increase in reducing sugars. Similar results on progressive increase in reducing sugars with the increase in staling period as observed in the present study were also reported by Magdum et al. (1987), Verma et al. (2012) and Singh et al. (2020) in sugarcane.

Dextrans

Mean dextrans content was found to be higher in ratoon compared to the plant crops in all the farming situations. Dextrans were noted to be low in all the high cane and sugar yielding clones compared to the check Co 86032 but on par with the best check 2003 V 46. Dextrans progressively increased from 0h of crushing to 72 hrs of crushing at all months of crop harvest. A progressive increase in dextrans was noted from zero hrs of crushing after harvest to 72 h after harvest at each month of harvest. (Table 5). Per cent dextrans increased from 10th to 13th months of crop harvest in all the clones across all farming situations. Dextrans varied at 0 hrs of crushing from 12.2 (CoA19322) to 14.4 (2012V123) with a mean of 13.3 over six crops and from 16.1 (CoA19322) to 20.0 (2009V127) with a mean of 18.5 over three ratoon crops whereas it ranged from 13.7 (CoA19322) to 16.1 (CoA19321) with a mean of 15.1 over six plant crops and from 16.9 (CoA19322) to 20.9 (2009V127 and 2012V123 with a mean of 19.6 over three ratoon crop at 72 hrs after crushing at 10th months of crop harvest across farming situations. Across farming situations at 13th months of crop harvest dextrans varied from

Table 3A : Percent purity from 10th to 11th months of harvest and at different time intervals of crushing

S. No.	Clone	10th month								11th month							
		0 hrs		24hrs		48hrs		72hrs		0 hrs		24hrs		48hrs		72hrs	
		Plant	Ratoon	Plant	Ratoon	Plant	Ratoon	Plant	Ratoon	Plant	Ratoon	Plant	Ratoon	Plant	Ratoon	Plant	Ratoon
1	2009V89	90.1	91.2	82.5	83.7	77.0	78.3	74.3	75.6	87.0	87.6	83.9	84.5	81.3	81.8	79.0	79.5
2	2016T7	87.7	88.0	85.9	86.3	84.8	85.2	83.9	84.2	89.2	89.0	88.5	88.9	87.0	87.4	85.1	85.4
3	CO A 14328	84.9	85.9	79.8	82.2	76.1	79.1	73.3	76.4	86.1	87.7	83.8	84.6	80.1	80.2	78.4	78.5
4	COA 19322	85.5	85.1	81.9	80.0	78.8	76.3	76.1	73.5	87.3	86.3	84.2	83.9	79.9	80.3	78.2	78.6
5	2003V 46 TC	89.7	89.1	88.0	87.5	84.7	84.2	83.4	82.9	91.0	90.5	86.2	85.7	82.9	82.4	79.3	78.9
6	2003V 46(C)	86.6	87.6	84.8	85.9	82.3	83.3	80.5	81.5	86.4	87.5	83.4	84.5	81.5	82.5	80.0	81.0
7	CO 86032(C)	80.5	80.8	76.8	77.1	74.5	74.8	71.0	71.2	82.8	83.1	71.1	87.4	79.3	79.6	77.9	78.2
	Mean	86.0	86.9	82.3	83.1	78.7	79.5	76.2	77.0	85.9	86.7	82.9	83.7	80.1	80.8	77.5	78.2
	Sem	0.7	0.7	0.7	0.7	0. 70	0.7	0.5	0.5	0.6	0.6	0.8	0.7	0.8	0.7	0.6	0.7
	C. D at 5%	2.1	2.1	2.0	2.1	2.0	2.1	1.3	1.3	1.6	1.6	2.2	2.1	2.2	2.1	1.9	1.9
	C.V (%)	1.5	1.4	1.5	1.5	1.5	1.6	1.1	1.0	1.1	1.1	1.6	1.5	1.6	1.6	1.4	1.4

Table 3B : Percent purity from 12th to 13th months of harvest and at different time intervals of crushing

S. No.	Clone	12th month								13th month							
		0 hrs		24hrs		48hrs		72hrs		0 hrs		24hrs		48hrs		72hrs	
		Plant	Ratoon	Plant	Ratoon	Plant	Ratoon	Plant	Ratoon	Plant	Ratoon	Plant	Ratoon	Plant	Ratoon	Plant	Ratoon
1	2009V89	94.4	94.9	91.0	91.4	85.4	85.8	81.5	81.9	86.8	87.7	84.5	84.9	83.3	83.7	79.9	60.3
2	2016T7	86.5	86.9	85.0	85.3	82.7	83.0	79.3	79.6	87.3	87.7	84.6	84.9	81.8	82.1	78.1	78.4
3	CO A 14328	87.0	89.0	83.6	84.7	81.2	82.5	77.4	79.2	89.2	88.3	86.7	85.8	83.8	82.9	80.6	80.6
4	COA 19322	88.6	87.2	84.4	83.8	82.2	81.4	78.9	77.6	87.9	89.3	85.4	86.8	82.5	84	80.3	80.8
5	2003V 46 TC	89.7	89.2	88.0	87.5	84.5	84.1	81.7	81.3	87.5	86.9	82.7	82.2	79.1	78.7	75.5	75.1
6	2003V 46(C)	87.3	88.4	85.2	86.3	83.1	84.2	81.5	82.6	82.4	83.4	79.6	80.6	78.3	79.3	76.8	77.7
7	CO 86032(C)	77.4	77.7	71.8	72.1	68. 7	69.0	67.0	67.3	78.3	78.6	70.4	70.6	67.9	68.1	66.2	66.4
	Mean	86.2	86.5	82.5	82.8	79.8	80.1	76.7	76.9	84.5	84.8	79.9	80.2	77.2	77.5	74	74.3
	Sem	1.0	1.0	0.8	0.8	0.9	0.9	0.6	0.6	0.85	0.87	0.77	0.75	1.07	1.08	0.61	0.62
	C. D at 5%	3.0	3.0	2.4	2.4	2.5	2.5	1.8	1.7	2.46	2.53	2.22	2.19	3.09	3.12	1.78	1.77
	C.V (%)	2.1	2.1	1.7	1.7	1.9	1.8	1.4	1.4	1.74	1.78	1.66	1.63	2.39	2.41	1.44	1.42

Table 4A : Percent reducing sugars from 10th to 11th months of harvest and at different time intervals of crushing

S. No.	Clone	10th month								11th month							
		0 hrs		24hrs		48hrs		72hrs		0 hrs		24hrs		48hrs		72hrs	
		Plant	Ratoon	Plant	Ratoon	Plant	Ratoon	Plant	Ratoon	Plant	Ratoon	Plant	Ratoon	Plant	Ratoon	Plant	Ratoon
1	2009V89	0.47	0.26	0.32	0.28	0.39	0.38	0.57	0.41	0.3	0.29	0.43	0.3	0.47	0.42	0.57	0. 44
2	2016T7	0.33	0.26	0.16	0.27	0.29	0.36	0.32	0.41	0.2	0.3	0.24	0.32	0.33	0.39	0.35	0.49
3	CO A 14328	0.39	0.21	0.25	0.26	0.28	0.31	0.32	0.34	0.28	0.34	0.36	0.4	0.39	0.47	0.42	0.51
4	COA 19322	0.39	0.17	0.16	0.19	0.23	0.24	0.3	0.25	0.21	0.2	0.27	0.23	0.39	0.27	0.42	0.32
5	2003V 46 TC	0.27	0.22	0.18	0.27	0.23	0.36	0.29	0.4	0.19	0.29	0.23	0.33	0.27	0.38	0.35	0.43
6	2003V 46(C)	0.3	0.27	0.22	0.3	0.25	0.42	0.31	0.44	0.23	0.3	0.28	0.37	0.3	0.42	0.4	0.47
7	CO 86032(C)	0.37	0.3	0.24	0.32	0.29	0.42	0.36	0.57	0.27	0.33	0.32	0.38	0.37	0.47	0.44	0.6
	Mean	0.47	0.26	0.27	0.3	0.37	0.4	0.44	0.44	0.32	0.31	0.4	0.35	0.47	0.45	0.54	0.57
	Sem	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.01	0.03	0.01	0.03	0.01	0.02
	C. D at 5%	0.02	0.02	0.02	0.02	0.02	0.03	0.02	0.03	0.04	0.05	0.04	0.08	0.03	0.08	0.03	0.04
	C.V (%)	3.03	4.13	4.13	3.81	3.11	4.99	3.21	3.73	6.65	10.15	5.72	1.37	3.03	10.6	3.3	5

Table 4B : Percent reducing sugars from 12th to 13th months of harvest and at different time intervals of crushing

S. No.	Clone	12th month								13th month							
		0 hrs		24hrs		48hrs		72hrs		0 hrs		24hrs		48hrs		72hrs	
		Plant	Ratoon	Plant	Ratoon	Plant	Ratoon	Plant	Ratoon	Plant	Ratoon	Plant	Ratoon	Plant	Ratoon	Plant	Ratoon
1	2009V89	0.35	0.3	0.47	0.31	0.53	0.43	0.63	0.45	0.41	0.31	0.6	0.32	0.64	0.45	0.77	0.47
2	2016T7	0.22	0.31	0. 26	0.33	0.37	0.4	0.4	0.5	0.26	0.32	0.31	0.34	0.46	0.41	0.61	0.52
3	CO A 14328	0.33	0.36	0.42	0.42	0.45	0.49	0.49	0.53	0.45	0.37	0.54	0.43	0.58	0.51	0.63	0.54
4	COA 19322	0.25	0.2	0.29	0.24	0.45	0.28	0.46	0.33	0.3	0.21	0.31	0.24	0.51	0.29	0.57	0.34
5	2003V 46 TC	0.21	0.3	0.26	0.34	0.31	0.39	0.39	0.44	0.28	0.31	0.34	0.35	0.38	0.41	0.48	0.45
6	2003V 46(C)	0.23	0.31	0.29	0.38	0.32	0.43	0.42	0.48	0.3	0.32	0.36	0.39	0.39	0.44	0.54	0.5
7	CO 86032(C)	0.3	0.34	0.35	0.39	0.41	0.49	0.48	0.62	0.34	0.35	0.38	0.41	0.52	0.5	0.62	0.64
	Mean	0.36	0.32	0.45	0.36	0.53	0.47	0.62	0.53	0.45	0.33	0.56	0.37	0.66	0.48	0.85	0.54
	Sem	0.01	0.02	0.02	0.03	0.01	0.03	0.01	0.02	0.01	0.02	0.02	0.03	0.01	0.03	0.02	0.02
	C. D at 5%	0.03	0.05	0.04	0.08	0.03	0.08	0.03	0.05	0.03	0.06	0.05	0.09	0.03	0.09	0.05	0.05
	C.V (%)	5.9	10.2	5.9	13.6	3.13	10.71	3.01	5.3	5.4	10.2	5.3	13.6	3.03	10.9	3.4	5.33

Table 5a : Dextrans from 10th to 11th months of harvest and at different time intervals of crushing

S. No.	Clone	10th month								11th month							
		0 hrs		24hrs		48hrs		72hrs		0 hrs		24hrs		48hrs		72hrs	
		Plant	Ratoon	Plant	Ratoon	Plant	Ratoon	Plant	Ratoon	Plant	Ratoon	Plant	Ratoon	Plant	Ratoon	Plant	Ratoon
1	2009V89	13.0	18.8	15.2	19.1	15.4	19.9	15.9	19.5	15.9	18.9	16.6	19.6	17.3	19.3	19.2	19.5
2	2016T7	12.4	18.1	13.2	18.4	12.9	18.9	13.3	19.2	15.0	19.2	15.4	19.7	16.7	19.8	17.3	20.0
3	CO A 14328	12.3	18.1	13.1	18.3	13.8	19.2	14.2	19.1	14.6	18.6	15.4	19.2	17.0	19.4	18.4	19.8
4	COA 19322	12.2	16.1	12.8	16.4	13.3	17.3	13.7	16.9	13.8	15.9	15.0	17.0	16.0	17.8	17.6	18.4
5	2003V 46 TC	12.9	18.0	12.9	18.1	13.9	18.3	14.2	18.9	14.4	18.5	15.6	18.5	17.0	19.6	18.0	19.8
6	2003V 46(C)	13.0	18.0	13.0	18.4	14.1	18.4	14.4	19.0	14.6	18.4	15.8	18.7	17.3	19.7	18.3	19.9
7	CO 86032(C)	14.2	19.0	14.9	19.5	15.3	20.2	15.5	19.8	16.0	18.9	16.7	20.0	17.8	19.6	20.9	20.2
	Mean	13.3	18.5	14.3	18.9	14.7	19.3	15.1	19.6	15.4	18.9	16.7	19.4	18.1	19.7	19.2	20.0
	Sem	0.2	0.1	0.1	0.1	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.2	0.1	0.2	0.2	0..30
	C. D at 5%	0.5	0.4	0.3	0.4	0.5	0.5	0.5	0.3	0.4	0.4	0.3	0.4	0.3	0.5	0.4	0.9
	C.V (%)	1.8	1.2	1.1	1.2	1.8	1.4	1.8	1.0	1.6	1.1	1.1	1.3	0.9	2.0	1.3	2..71

Table 5b : Dextrans from 12th to 13th months of harvest and at different time intervals of crushing

S. No.	Clone	12th month								13th month							
		0 hrs		24hrs		48hrs		72hrs		0 hrs		24hrs		48hrs		72hrs	
		Plant	Ratoon	Plant	Ratoon	Plant	Ratoon	Plant	Ratoon	Plant	Ratoon	Plant	Ratoon	Plant	Ratoon	Plant	Ratoon
1	2009V89	17.3	20.0	18.1	19.4	18.8	19.7	18.6	20.6	13.9	18.9	14.6	19.3	15.8	19.7	16.7	19.9
2	2016T7	16.4	19.7	16.7	19.8	17.5	20.0	18.2	20.6	13.7	19.0	13.8	19.6	14.6	20.0	15.5	20.3
3	CO A 14328	17.1	19.4	17.4	19.7	18.1	20.1	18.4	20.7	13.7	18.3	14.4	19.1	15.6	19.8	16.9	20.4
4	COA 19322	16.4	17.4	16.8	18.0	17.6	18.9	17.6	19.1	13.0	16.0	13.7	16.2	14.2	18.2	15.6	19.4
5	2003V 46 TC	16.6	18.4	17.2	19.5	17.2	19.9	18.0	19.6	13.4	18.1	14.2	18.9	15.2	19.9	16.1	20.1
6	2003V 46(C)	17.0	19.1	17.4	19.5	17.7	20.1	18.2	20.1	13.5	18.3	14.4	18.7	15.4	20.0	16.3	20.3
7	CO 86032(C)	19.5	20.5	20.0	20.2	20.5	20.6	20.4	21.5	14.6	19.1	15.5	19.3	16.5	20.1	17.6	21.2
	Mean	18.0	19.6	18.5	19.9	18.9	20.2	19.6	20.7	14.2	18.6	14.9	19.2	16.0	20.0	17.0	20.5
	Sem	0.2	0.1	0.1	0.1	0.1	0.3	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.1	0.2
	C. D at 5%	0.5	0.3	0.4	0.4	0.3	0.9	0.4	0.3	0.4	0.4	0.3	0.4	0.3	0.6	0.4	0.5
	C.V (%)	1.5	0.8	1.2	1.2	0.8	2.2	1.1	0.8	1.4	1.3	1.2	1.3	1.3	6.8	1.2	1.4

13.0 (CoA19322) to 15.1 (2012V123 and CoA20327) with a mean of 14.2 over six crops and from 16.0 (CoA19322) to 19.7 (2009V127) with a mean of 18.6 over three ratoon crops at 0hrs of crushing after harvest while it ranged from 15.5 (2016T7) to 18.3 (CoA19321) with a mean of 17.0 over six plant crops and from 19.4 (CoA19322) to 21.4 (2012V123) with a mean of 20.5 over three ratoon crop at 72 hrs of crushing after crop harvest. The clones *viz.;* 2016T 7, 2003V 46 TC, CoA 19322 and CoA 14328 recorded lower dextrans at all months of months of crop age. Higher contents of dextrans in cane juice observed in the present study in ratoon crops as compared to plant crops is contradicting the findings of Kouzi and Kontro (2024). However, the findings are in tune with the results reported by Bhatia et al. (2009) and Saxena et al. (2012).

CONCLUSION

Per cent juice sucrose, purity, reducing sugars and dextrans determined at different months of crop age (10,11,12 and 13th months) and at 24 hrs intervals of crushing (0,24,48 and 72 hrs) indicated that per cent sucrose and purity progressively decreased with the increase in the time lag interval of crushing (0 to 72 hrs). Dextrans increased linearly among the clones upto 12th months of crop age and then decreased at 13th month of crop age whereas per cent reducing sugars increased progressively with the increase in the crop age (10th to 13th month) . Both per cent reducing sugars and dextrans linearly increased with increase in time lag intervals of crushing(0 to 72 hrs after harvest). Dextrans were found high in early clones while per cent reducing sugars were observed to be high in midlate clones. Dextrans were found to be high in ratoons whereas per cent reducing sugars were high in plant crops. Among the three farming situation sandy soils with bore well irrigation followed by garden lands with limited irrigation and wetlands with well irrigation were observed to be the favourable environments for higher cane and sugar yields and quality retention for longer period. The high cane and sugar yielding clones 2003V 46 TC, 2016T 7, CoA 14328, CoA 19322 and 2009V 89 were found to possess higher shelf life and tolerant to post harvest deterioration.

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