

RESEARCH ARTICLE**Identification of early and mid-late maturing sugarcane varieties for western region of Tamil Nadu**A. Anna Durai^{a*}, C. Mahadevaiah^a and K. Gopinath^b^a *Division of Crop Improvement, ICAR-Sugarcane Breeding Institute, Coimbatore, Tamil Nadu -641007, India*^b *Ponni Sugars (Erode) Limited, Odapally, Tamil Nadu, India*

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Abstract

Field experiments were conducted during 2016-17 and 2017-18 crop seasons with twenty test clones viz., Co 0238, Co 0240, Co 06031, Co 09004, Co 11015, Co 13001, Co 13003, Co 13006, Co 13014, Co 13018, Co 13020, Co 13021, Co 14008, Co 14016, Co 14026, Co 15005, Co 15007, Co 15021, Co 16001 and Co 16002 along with three standards viz., Co 86032, Co 0212 and Co 06030 at Ponni Sugar Ltd, Odapally. On the basis of pooled mean of two plant crop trials and a ratoon trial, clones such as Co 09004, Co 11015, Co 16002 and Co 13001 were identified as early high sucrose clones suitable for early crushing. These clones may be used as potential donors in the hybridization programme for transferring extra earliness and high sucrose trait in high yielding commercial varieties. Based on juice quality characteristics at 300 days and 360 days Co 15007 was identified as mid-late maturing clones. The ratoon performance of Co 14016 was excellent. Co 14016 which recorded significantly higher cane yield (184.72 t/ha) and sugar yield (23.17 t/ha) than the standard Co 86032 (134.02 and 17.73 t/ha respectively) may be used as a parental source for crossing with extra early maturing varieties to improve cane yield and ratoon performance. On the basis of the cane yield and sugar yield at harvest, Co 13014 and Co 15007 were found better than Co 86032. Based on the juice quality traits, Co 15005 and Co 15007 were identified as typical mid-late clones. The variety Co 11015 registered 6.79, 7.56 and 7.02 per cent improvement in sucrose % at 240, 300 and 360 DAP, respectively over Co 86032 which is a remarkable improvement in sugarcane. The mean CCS yield (19.27 t/ha) of Co 11015 was at par with that of the standard Co 86032 (20.54). Therefore, large scale cultivation of this extra early high sugar variety Co 11015 in the north-western region of Tamil Nadu is suggested for improving sugar recovery and profit of the farmers.

Keywords: Sugarcane; High yielding varieties; Sucrose; Commercial cane sugar yield**Introduction**

Sugarcane, being an important commercial crop next to cotton, accounts for 75 % of the world sugar production (Wang et al. 2010) and is becoming an important source of biofuel production (Oliveira et al. 2005). In India, sugarcane is grown in several states having diverse agro-ecological conditions in tropical (Maharashtra, Karnataka, Tamil Nadu, Andhra Pradesh, Gujarat) and subtropical (Uttar Pradesh, Bihar, Haryana, Punjab, Uttarakhand) conditions. Regardless of pronounced development in sugarcane research, low productivity is being recorded in the Indian sub-continent (Kulkarni et al. 2010) due to distinct and diverse nature of

sugarcane cultivation. Though Tamil Nadu ranked first in terms of sugarcane productivity (98.24 t/ha) among major sugarcane growing states in India (Anonymous 2020), it is much lower than the production potential of 212 t/ha (Waclawosky et al. 2010). In the last 10 years from 2006-07 to 2015-16, sugarcane productivity in the state was above 100 t/ha but it has come down to <100 t/ha since 2016-17. The major reasons for this are frequent drought, occurrence of insect pests and diseases and usage of inferior quality cane varieties. Besides, 55 diseases (Rao et al. 2002) and around 50 species of borers attack sugarcane causing significant yield loss of 25-30 % have been

reported (Kalunke et al. 2009). The average annual rainfall of Tamil Nadu had decreased to 62 % and the highest deficit of normal rainfall in Indian states is recorded in the state with 82 % deficit in 2016. At present, Co 86032 a mid-late variety is cultivated in about 50.3 % of the cane area in Tamil Nadu (Ram and Karuppaiyan 2020). In the absence of early maturing variety, harvesting of this mid-late variety during the early part of the crushing season lead to low sugar recovery. Cultivation of early maturing high yielding varieties with high sucrose content, resistant to major biotic and abiotic stresses and adaptability to different agro-ecological situation of Tamil Nadu is viewed as viable option to enhance the sugarcane production in the state. Selection of suitable variety alone reported to have improved the cane yield in the range of 28-60 per cent (Kathiresan et al. 2001). Viewing in this direction, a collaborative project was initiated to identify high yielding and high sugar sugarcane variety for Tamil Nadu by the ICAR-Sugarcane Breeding Institute, Coimbatore in association with South Indian Sugar Mills Association, Chennai. The Ponni Sugar (Erode) Ltd, Odapally, Erode district located in western region of Tamil Nadu was identified as one of the test locations to identify the superior varieties alternative to those in cultivation.

Materials and Methods

Twenty test clones viz., Co 0238, Co 0240, Co 06031, Co 09004, Co 11015, Co 13001, Co 13003, Co 13006, Co 13014, Co 13018, Co 13020, Co 13021, Co 14008, Co 14016, Co 14026, Co 15005, Co 15007, Co 15021, Co 16001 and Co 16002 along with the three standards viz., Co 86032, Co 0212 and Co 06030 formed materials of the study. The experiment was laid out during 2017-18 (Plant crop trial I) and 2018-19 (Plant crop II + Ratoon trials) in randomised complete block design with three replications at the Research and Development Farm of Ponni Sugars (Erode) Ltd, Odapally,

Erode District, Tamil Nadu. All the recommended agronomical practices were followed to raise a healthy crop (Sundara 1998). The germination count was taken at 30 days after planting. The data on yield component traits viz., tillers at 120 days ('000/ha), number of millable canes (NMC) at 240 days and 300 days were taken and presented in '000/ha. The data on other yield components viz., single cane weight (Kg), cane diameter (cm) and cane height (cm) were taken from randomly selected five canes of each genotype from each replication. Plot yield at 300 days was calculated based on the single cane weight and NMC. At harvest, plot yield was obtained and extrapolated to cane yield t/ha. Cane juice at 240 days, 300 days and 360 days was extracted using power operated crusher and was clarified using lead acetate. The juice quality parameters viz., juice brix %, juice sucrose %, commercial cane sugar (CCS) % and purity % were worked out as per Chen and Chou (1993). The analysis variance (ANOVA) for the all the data collected for the two plant crop and a ratoon crop seasons were statistically analysed using OPSTAT programme (HAU OPSTAT, 14,139.232.166/opstat/default.asp.)

Results and Discussion

First plant crop trial

The germination of the setts is usually less than 40% in sub-tropical India where as it is 60-80 % in tropical condition (Jain et al. 2006). The germination entries in the present trial varied from 50 % (Co 0240) to 78.75 % (Co 0212) and crop establishment was excellent to take observations on yield and quality traits. Variation observed in juice quality attributes and cane yield characters are presented in Table 1. Similarly, Prabhakar et al. (2012) reported the significant different among the promising sugarcane varieties for yield and quality characters.. Among the 20 entries evaluated, four entries viz., Co 11015 (17.39 %),

Co 13001 (17.16 %), Co 09004 (16.89 %) and Co 16002 (16.68 %) were found numerically superior to the popular variety Co 86032 (16.55 %) for juice sucrose content at 240 days. At 300 days, besides Co 09004 (19.30 %), Co 11015 (18.69 %), Co 16002 (18.37 %) and Co 13001 (17.68 %), three other entries viz., Co 15007 (18.17 %), Co

16001 (18.01 %) and Co 15005 (17.47 %) showed numerical superiority to Co 86032 (17.34 %). Yanam et al. (1997) observed that juice quality mainly depends on the genetic nature of the variety. Limited number of entries showed their superiority for sucrose content over the standard at 240 days of maturity and that was increased to

Table 1. Performance of entries for juice quality attributes in first plant crop at 240 days and 300 days

Entries	Germination (%)	Tillers at 120 days ('000/ha)	240 days			300 days				
			Sucrose (Pol) %	Juice Brix %	CCS %	Sucrose (Pol) %	Juice Brix %	Purity %	Estd. cane yield (t/ha)	Estd. CCS yield (t/ha)
Co 0238	72.71	168.67	15.95	18.97	10.76	17.01	19.76	86.06	120.21	13.89
Co 0240	50.00	93.29	14.24	16.98	9.59	15.13	18.43	82.02	120.37	12.02
Co 06031	57.50	117.75	15.30	18.35	10.28	16.90	19.60	86.14	168.53	19.38
Co 09004	67.43	130.94	16.89	19.39	11.60	19.30	21.30	90.54	122.82	16.40
Co 11015	58.13	157.56	17.39	19.96	11.94	18.69	20.78	89.81	139.41	18.60
Co 13001	77.57	160.19	17.16	20.21	11.63	17.68	20.91	84.54	114.91	13.72
Co 13003	68.75	153.94	15.10	18.06	10.16	17.37	20.06	86.60	138.30	16.45
Co 13006	57.99	151.77	15.01	18.17	10.04	16.61	19.38	85.70	129.70	14.67
Co 13014	69.93	132.02	13.25	16.02	8.87	16.89	19.28	87.56	144.13	16.73
Co 13018	66.39	188.35	12.78	16.82	8.15	16.48	19.29	85.46	164.94	18.50
Co 13020	78.33	157.95	13.33	16.57	8.78	16.69	19.46	85.78	153.00	17.42
Co 13021	75.21	175.85	15.04	17.92	10.14	16.40	19.36	84.73	129.71	14.39
Co 14008	56.88	125.46	13.62	16.84	9.00	16.48	19.27	85.47	152.86	17.23
Co 14016	63.06	227.55	13.93	16.84	9.32	16.69	19.23	86.81	151.63	17.40
Co 14026	65.56	120.14	12.62	15.39	8.41	15.50	18.39	84.27	155.36	16.25
Co 15005	67.22	144.37	15.69	18.18	10.72	17.47	19.73	88.56	153.72	18.59
Co 15007	69.72	142.44	15.57	18.20	10.60	18.17	20.55	88.45	161.55	20.29
Co 15021	59.93	135.80	12.28	15.35	8.07	13.81	17.10	80.67	158.62	14.38
Co 16001	71.04	166.74	16.13	19.37	10.83	18.01	21.20	84.96	111.51	13.60
Co 16002	66.53	198.23	16.68	19.12	11.46	18.37	20.65	88.98	113.39	14.46
Co 86032	64.51	211.96	16.55	18.70	11.03	17.34	19.57	88.59	159.60	19.16
Co 0212	78.75	228.24	14.84	17.91	9.42	17.21	19.93	86.33	149.75	17.75
Co 06030	74.31	119.52	14.17	16.81	10.19	16.84	19.94	84.44	174.12	19.84
CD	8.34	28.73	1.34	1.39	0.99	1.41	1.33	2.27	37.85	4.78
CV	7.56	11.09	5.44	4.71	5.99	5.04	4.08	1.59	16.04	17.48

higher number during 10th month. These results infer that though there may not be much variation among the varieties for juice sucrose content during initial phase of sucrose accumulation, the early varieties are more efficient in partitioning the cane dry mater into sucrose during the initial part of the crop cycle (Nayamuth et al. 1999). Based on the consistency in the juice sucrose content at 240 and 300 days, four clones viz., Co 09004, Co

11015, Co 13001 and Co 16002 were identified as early high sugar types. The juice purity of these clones, an important quality parameter determining sugar yield were >85% at 240 and 360 days.

The important breeding objective of increasing sugar yield in sugarcane has been generally achieved by increasing total biomass rather than directly increasing the sugar concentration in stalks

Table 2. Performance of entries in first plant crop at 360 days

Entry	CCS (t/ha)	Cane yield (t/ha)	Su-cro-se (Pol) %	Juice brix %	CCS %	NMC (*000/ha)	Stalk length (cm)	Stalk diameter (cm)	SCW (kg)
Co 0238	14.56	111.23	18.98	21.33	13.17	121.06	231.17	0.99	2.45
Co 0240	12.95	103.39	18.12	20.42	12.55	78.40	266.56	1.97	3.24
Co 06031	18.43	136.05	19.29	21.32	13.47	98.07	248.00	1.92	3.14
Co 09004	15.28	103.99	20.70	22.39	14.62	109.49	251.00	1.24	2.61
Co 11015	17.82	128.72	19.75	21.77	13.83	116.51	276.67	1.27	2.38
Co 13001	12.58	96.24	18.98	21.69	10.07	120.06	227.80	1.00	2.26
Co 13003	16.65	127.48	18.85	21.25	13.06	106.87	292.47	1.73	2.84
Co 13006	14.63	108.80	19.43	21.95	13.44	98.23	265.33	1.66	2.86
Co 13014	19.35	143.72	19.24	21.10	13.50	97.84	263.33	1.90	3.02
Co 13018	18.11	133.99	19.47	21.89	13.51	119.68	255.33	1.61	2.80
Co 13020	13.69	107.74	18.50	21.23	12.71	90.28	237.33	1.80	3.08
Co 13021	13.89	111.53	18.05	20.46	12.47	110.26	259.00	1.56	2.87
Co 14008	14.67	115.81	18.42	20.68	12.48	94.37	261.00	1.68	2.72
Co 14016	18.53	139.13	19.06	21.00	13.34	140.12	255.17	1.36	2.60
Co 14026	15.11	118.27	18.39	20.66	12.77	91.74	251.58	1.89	3.00
Co 15005	16.94	116.83	20.63	22.43	14.53	124.69	229.33	1.28	2.61
Co 15007	18.99	127.05	21.14	22.89	14.92	105.71	245.67	1.67	3.07
Co 15021	17.30	132.81	18.70	20.92	13.01	106.48	278.75	1.63	2.71
Co 16001	13.20	93.48	20.22	22.73	14.03	112.04	227.75	1.11	2.54
Co 16002	15.42	107.08	20.58	22.58	14.44	112.73	231.00	0.97	2.25
Co 86032	18.76	137.06	19.52	21.50	13.67	124.38	261.33	1.46	2.78
Co 0212	18.16	134.06	19.29	21.51	13.44	125.23	264.33	1.43	2.56
Co 06030	17.31	132.01	18.89	21.19	13.11	97.22	282.33	2.06	3.16
C.D.5%	3.98	28.94	1.09	0.87	0.89	16.05	N/A	0.3	0.28
C.V.	14.89	14.57	3.42	2.45	4.02	8.94	10.00	6.57	11.09

Table 3. Performance of test entries in second plant crop trial at 240 and 300 days

Entry	At 240 days				At 300 days				Estd. cane yield (t/ha)
	Su-crose %	Brix %	Purity %	CCS%	Sucrose %	Brix %	Purity %	CCS%	
Co 0238	14.26	16.78	84.98	9.67	15.90	18.77	84.67	10.77	154.66
Co 0240	13.98	16.70	83.67	9.42	15.66	18.28	85.63	10.66	134.98
Co 06031	13.65	16.72	81.60	9.07	16.02	18.61	86.00	10.94	227.77
Co 09004	17.56	19.54	89.92	12.25	15.99	18.58	85.87	10.92	145.80
Co 11015	17.37	19.55	88.88	12.05	18.58	20.68	89.86	12.96	187.29
Co 13001	15.71	18.61	84.40	10.62	17.53	20.27	86.46	11.99	128.58
Co 13003	16.30	19.11	85.28	11.08	15.98	18.73	85.29	10.86	141.52
Co 13006	15.36	18.13	84.66	10.40	16.48	19.05	86.42	11.28	142.19
Co 13014	14.00	16.68	83.87	9.44	15.15	17.61	86.00	10.35	175.05
Co 13018	14.50	17.40	83.10	9.74	16.43	19.04	86.24	11.23	149.82
Co 13020	13.75	16.92	81.04	9.11	16.25	19.14	84.80	11.02	126.82
Co 13021	12.83	15.82	80.92	8.50	14.87	17.91	83.00	9.92	134.41
Co 14008	13.88	17.14	80.98	9.19	15.04	17.83	84.29	10.16	169.38
Co 14016	13.93	16.72	83.23	9.36	15.43	18.23	84.59	10.44	201.41
Co 14026	13.87	16.67	83.15	9.31	16.22	18.63	87.00	11.13	168.38
Co 15005	15.30	17.69	86.39	10.48	16.59	18.93	87.57	11.43	167.92
Co 15007	15.98	18.46	87.14	10.94	17.58	19.69	89.22	12.21	150.81
Co 15021	12.81	15.97	80.20	8.43	13.47	16.51	81.59	8.95	177.59
Co 16001	15.46	18.48	83.64	10.41	16.98	19.95	85.09	11.53	135.30
Co 16002	16.29	18.56	87.80	11.24	17.85	20.14	88.64	12.36	139.30
Co 86032	16.00	18.31	87.69	11.08	16.69	18.92	88.10	11.53	201.62
Co 0212	15.21	17.92	84.79	10.31	16.10	18.51	86.90	11.05	169.04
Co 06030	13.77	16.55	83.22	9.24	15.50	18.21	85.12	10.52	196.20
CD at 5%	1.82	1.50	3.88	1.44	1.74	1.58	2.66	1.33	26.44
CV	7.42	5.15	2.78	8.66	6.50	5.09	1.87	7.28	9.89

(Jackson 2005). For cane yield Co 13014 (143.72 t/ha) and Co 14016 (139.13 t/ha) were numerically superior to the best standard Co 86032 (137.06 t/ha) (Table 2). Stalk length and stalk diameter are known to be the major contributing factors for high cane yield (Naidu et al. 2007). Sugarcane growers are mainly interested in cane yield of a variety while millers are interested in sugar recovery (Malik 1994). Commercial cane sugar per cent (CCS %), a factor of prime importance for millers

showed significant differences among the entries. Maximum CCS % at harvest was observed in Co 15007 (14.92 %) which was significantly superior to the ruling variety Co 86032 (13.67 %). Other test clones which were numerically superior to Co 86032 for CCS % at harvest were Co 09004 (14.62 %), Co 15005 (14.53 %) and Co 11015 (13.83 %). Sugar yield, the function of cane yield and corresponding recoverable sugar % was the highest for Co 13014 (19.35 %). The early high

Table 4. Performance of entries at 360 days in plant crop II trial

Entry	CCS yield (t/ha)	Cane yield (t/ha)	Sucrose %	Brix %	Purity %	Stalk length (cm)	Stalk dia (cm)	SCW (kg)
Co 0238	17.80	144.29	17.84	20.02	89.03	256.67	2.82	1.16
Co 0240	14.29	128.33	16.26	18.71	86.84	268.33	3.24	1.71
Co 06031	22.99	187.56	17.82	20.37	87.46	296.67	3.00	1.99
Co 09004	17.17	129.02	19.09	21.41	89.25	306.67	2.81	1.39
Co 11015	23.68	160.66	20.87*	22.57	93.02	273.33	2.81	1.43
Co 13001	15.54	113.72	19.55	21.82	89.57	241.67	2.81	1.43
Co 13003	18.25	139.00	18.84	21.01	89.62	266.67	2.67	1.59
Co 13006	16.16	139.17	17.08	19.55	87.20	250.00	3.14	1.35
Co 13014	21.94	170.20	18.30	19.87	92.05	293.33	3.16	1.98
Co 13018	16.33	135.82	17.53	19.87	88.18	245.00	2.96	1.45
Co 13020	18.79	154.09	17.67	20.05	88.10	276.67	3.29	1.79
Co 13021	17.22	149.11	16.91	19.83	85.22	273.33	2.80	1.46
Co 14008	18.25	147.09	17.72	19.71	89.89	260.00	3.19	1.85
Co 14016	26.87	202.74	18.84	20.51	91.86	238.33	2.67	1.32
Co 14026	19.87	168.44	17.04	19.31	88.18	293.33	2.76	1.78
Co 15005	20.52	154.35	18.74	20.08	93.36	286.67	2.66	1.54
Co 15007	21.94	148.16	20.80	22.38	92.89	245.00	3.39	1.88
Co 15021	20.21	173.26	16.95	19.37	87.65	278.33	2.80	1.83
Co 16001	15.24	124.99	17.87	20.78	85.96	243.33	2.46	1.04
Co 16002	19.26	137.64	20.02*	22.12	90.47	266.67	2.50	1.24
Co 86032	25.15	198.01	18.09	19.82	91.24	273.33	2.92	1.69
Co 0212	22.39	172.97	18.45	20.29	89.39	248.33	2.99	1.34
Co 06030	21.44	174.03	17.76	20.01	88.72	271.67	2.79	1.64
CD st 5%	3.65	22.27	1.71	4.30	4.25	-	0.46	0.35
CV	11.25	7.79	5.91	2.92	2.88	11.01	9.64	13.71

* significant at 5% probability level

sugar variety Co 09004 maintained its superiority for sucrose content even upto 360 days as evident from its significantly higher sucrose content (20.70 %) than the best standard Co 86032 (19.52 %). Besides, the sucrose content of 2 test clones namely, Co 15007 and Co 15005 were significantly higher than that of the standard Co 86032 (19.52 %) at 360 days after planting (DAP). Therefore,

these may be identified as suitable clones for midlate harvest.

Second plant crop trial

In the second plant crop trial, Co 09004 (17.56 %) was found numerically superior to the ruling variety in the region Co 86032 (16.00 %) for juice sucrose content at 240 days. Other clones recorded numerically higher sucrose content than

Table 5. Performance of entries in first ratoon at 300 days

Entry	Sucrose %	Brix %	Purity %	CCS %	NMC ('000ha)	Single cane weight (Kg)	Estd. cane yield (t/ha)	Estd. CCS yield (t/ha)
Co 0238	15.58	17.65	88.11	10.77	142.61	1.00	142.99	15.24
Co 0240	15.88	18.09	87.76	10.95	96.45	1.43	135.85	14.79
Co 06031	15.41	17.78	86.61	10.55	112.19	1.30	146.18	15.30
Co 09004	17.41	19.34	89.92	12.15	109.43	1.09	119.07	14.49
Co 11015	17.08	19.01	89.82	11.90	118.83	1.28	152.21	18.15
Co 13001	17.66	20.79	84.91	11.98	123.23	0.91	112.20	13.37
Co 13003	15.75	18.25	86.25	10.77	99.96	1.20	120.50	12.90
Co 13006	16.07	18.74	85.75	10.95	114.12	1.13	129.81	14.22
Co 13014	16.33	18.41	88.66	11.32	121.91	1.39	169.96	19.32
Co 13018	15.04	17.58	85.60	10.24	131.94	1.14	149.94	15.42
Co 13020	15.59	18.37	84.88	10.57	64.82	1.20	76.75	8.12
Co 13021	15.84	18.45	85.82	10.80	107.87	1.25	133.31	14.41
Co 14008	14.63	17.31	84.50	9.90	103.07	1.32	135.48	13.41
Co 14016	16.20	18.41	87.98	11.18	153.63	1.23	190.40	21.28
Co 14026	15.04	17.50	85.89	10.26	101.70	1.24	125.97	12.95
Co 15005	15.44	17.94	86.05	10.54	136.96	0.78	108.75	11.42
Co 15007	17.44	19.73	88.43	12.07	104.63	1.11	116.03	13.95
Co 15021	13.51	16.11	83.86	9.10	134.18	1.15	154.75	14.10
Co 16001	17.86	20.68	86.49	12.22	131.64	0.86	111.05	13.56
Co 16002	15.89	18.20	87.31	10.92	134.41	0.93	124.89	13.66
Co 86032	16.50	18.51	89.09	11.45	142.67	1.14	161.83	18.48
Co 0212	16.11	18.35	87.76	11.10	140.28	1.00	140.09	16.45
Co 06030	15.46	18.01	85.82	10.54	114.43	1.37	156.69	16.56
CD	1.41	1.34	2.30	1.07	26.01	0.13	31.39	3.69
CV	5.33	4.42	1.60	5.89	13.22	7.03	14.04	15.04

Co 86032 were Co 11015 (17.37 %), Co 13003 (16.30 %) and Co 16002 (16.29 %). At 300 days, Co 11015 (18.58 %) recorded significantly higher sucrose content than the best standard Co 86032 (16.69 %). Other than Co 11015, four test entries viz., Co 16002 (17.85 %), Co 15007 (17.57 %), Co 13001 (17.52 %) and Co 16001 (16.97 %) were numerically superior to Co 86032 for juice sucrose content at 300 days. Co 09004 which was found as early high sucrose type during the first year was on par (15.99%) with Co 86032.

For juice quality parameters at 360 days, ten entries recorded higher sucrose content than Co 86032 (18.08 %). They were Co 11015 (20.87 %), Co 15007 (20.80 %), Co 16002 (20.02 %), Co 13001 (19.55 %), Co 09004 (19.09 %), Co 13003 (18.84 %), Co 14016 (18.84%), Co 15005 (18.74%), Co 0212 (18.45 %) and Co 13014 (18.30 %). The sucrose content of the former two entries (Co 11015 and Co 15007) was significantly higher than that of the standard Co 86032. In the second season also Co 86032 was the best standard for

Table 6. Performance of entries at 360 days in ratoon trial

Entry	CCS yield (t/ha)	Cane yield (t/ha)	Su-crose %	Brix %	Purity %	CCS%	Single cane weight (Kg)	Cane dia (cm)	Cane length (cm)
Co 0238	13.05	110.87	17.15	19.77	86.79	11.76	1.32	2.69	228.33
Co 0240	11.87	95.17	18.00	20.19	79.13	12.50	1.89	3.24	246.67
Co 06031	16.73	127.53	18.60	20.49	90.77	13.03	1.52	3.26	241.67
Co 09004	10.23	80.73	18.17	20.07	90.46	12.71	1.26	2.77	235.00
Co 11015	16.32	117.03	19.83	21.71	91.34	13.93	1.48	2.74	222.50
Co 13001	11.64	93.33	18.35	21.54	85.23	12.47	0.94	2.43	215.00
Co 13003	10.27	92.40	16.37	19.18	85.34	11.13	1.20	2.70	236.67
Co 13006	12.53	95.64	18.79	20.84	90.12	13.11	1.55	3.04	246.67
Co 13014	19.75	159.03	17.77	19.73	90.06	12.40	1.52	3.04	245.00
Co 13018	14.96	123.87	17.34	19.71	87.92	11.96	1.39	2.95	243.33
Co 13020	7.30	58.21	18.11	20.59	87.95	12.50	1.43	3.57	132.67
Co 13021	11.30	96.15	17.14	19.73	86.78	11.75	1.25	2.82	167.42
Co 14008	12.75	105.51	17.66	20.16	87.52	12.16	1.55	3.27	230.00
Co 14016	23.17	184.72	17.95	19.87	90.34	12.55	1.07	2.64	240.00
Co 14026	14.01	108.59	18.31	20.04	89.88	12.86	1.85	2.97	271.67
Co 15005	12.23	89.30	19.34	20.83	92.85	13.68	1.09	2.74	221.67
Co 15007	12.96	90.99	19.93	21.37	92.55	14.13	1.34	3.23	216.67
Co 15021	14.72	125.74	17.07	19.63	87.00	11.71	1.55	2.85	273.33
Co 16001	13.09	97.01	19.42	21.73	89.57	13.51	0.96	2.44	231.67
Co 16002	11.52	89.14	18.50	20.25	90.28	12.99	1.10	2.58	243.33
Co 86032	17.73	134.02	18.88	20.73	91.10	13.24	1.38	2.94	245.00
Co 0212	16.08	127.80	18.07	19.93	90.69	12.65	1.00	2.89	211.67
Co 06030	15.69	129.48	17.57	19.81	88.62	12.18	1.60	3.00	250.00
CD	3.6	27.358	1.39	1.238	N/A	1.12	0.36	0.34	N/A
CV	15.68	15.05	4.63	3.688	4.89	5.36	15.89	7.03	17.82

cane yield (198.01 t/ha) and sugar yield (25.15 t/ha) at 360 days. Among the test entries, Co 14016 with 202.74 t/ha of cane yield and 26.87 t/ha of sugar yield was the best.

Ratoon trial

Ratooning is equally important to that of plant crop for overall profitability sugarcane cultivation as it saves about 30 % of the operational cost, mainly that of seed and reduced expenses for initial land preparation. Acceptance of a new variety

by farmers depends on its ratooning potential. Hence it is always better to have ample number of clones with yield, quality, different maturity and good ratooning potential so that effective varietal scheduling can be formulated to provide high yield to farmers and quality canes to the millers the two stakeholders of the sugarcane varieties. Considerable variation for ratoon performance has been observed among the entries tested. At 300 days after ratooning, Co 16001 recorded the

highest juice sucrose content of 17.86 % which is 1.36 units higher than the standard variety Co 86032 (16.50 %). Other entries numerically superior to Co 86032 at 300 days were Co 13001 (17.66 %), Co 15007 (17.44 %), Co 09004 (17.41 %) and Co 11015 (17.08 %).

For juice quality parameters at 360 days, Co 15007 was found to have the highest juice sucrose content (19.93 %) which was 1.05 unit higher than the ruling variety Co 86032 (18.88 %). Other test entries superior to Co 86032 for juice sucrose were Co 11015 (19.83 %), Co 16001 (19.42 %) and Co 15005 (19.34 %). Varieties which maintains high sucrose content for longer duration are preferred than those with a short duration (Rao 1977). In this study, the entries Co 15007, Co 11015 and Co 16001 maintained their superiority for sucrose content from 10th month to 12th month. The ratoon yield of Co 14016 was excellent (Table 6). The clone recorded 23.17 t/ha CCS yield and 184.72 t/ha cane yield which was significantly higher than the best standard Co 86032 whose CCS and cane yields respectively were 17.73 t/ha 134.02 t/ha. The next best entry in the ratoon for CCS and cane yield was Co 13014. It recorded 159.03 t/ha cane yield and 19.75 t/ha of CCS yield which were numerically higher than that of Co 86032.

Conclusion

The pooled mean of two plant crops and one ratoon trials at Ponni Sugar Ltd, Odapalley indicated that Co 11015, Co 09004, Co 16002 and Co 13001 were the extra early maturing genotypes since their sucrose % were >16 % and juice purity were > 85 % at 8th month which is a criteria for extra early maturity or short duration varieties reported by Sahi and Sundara (1986) and Yadava (1993). Moreover, the sucrose % in these clones was numerically higher than the ruling variety Co 86032 at 240, 300 and 360 days. The cane yield of these clones may be increased significantly through agronomic

manipulations. Another notable observation in the study is that the clone Co 11015 registered 6.79, 7.56 and 7.02 per cent improvement for sucrose % at 240, 300 and 360 DAP, respectively over Co 86032 which is a remarkable improvement in sugarcane. In sugarcane not only high sucrose content but also retention of sucrose quality as the age of the crop advances is important (Alexander 1973). In Co 11015, the high sucrose % was not only retained but also increased as the age of the crop increased from 240 days to 360 days. This is an added advantage of Co 11015. If harvest at 8 or 10th month is delayed by some reasons, millers need not bother about its quality. The CCS yield of Co 11015 (19.27 t/ha) was on par with that of Co 86032 (20.54 t/ha). Therefore, Co 11015 is recommended for commercial cultivation as an extra early variety in the North West region of Tamil Nadu for increasing sugar recovery and profit to farmers. Based on juice quality characters at 300 days and 360 days, Co 15007 was identified as mid-late maturing clones. Co 14016 was the best entry for yield traits with an average cane yield of 175.53 t/ha and sugar yield of 22.85 t/ha in comparison to the cane yield (156.36 t/ha) and sugar yield (20.34 t/ha) of the standard Co 86032. Higher cane yield of Co 14016 could be attributed to its harmonised tillering habit with high more number of tall millable canes and good sprouting or ratooning ability. Therefore, it is suggested to use Co 14016 as a parental source for crossing with extra early maturing varieties like Co 11015 to improve yield and ratoon performance.

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