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Evaluation of Sugarcane Clones for Moisture Stress Tolerance Traits for Rainfed Cane Cultivation

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ABSTRACT

Twelve pre release sugarcane clones were tested against clone Co 6907 for their suitability to late planted conditions (June planting) at Regional Agricultural Research Station, Anakapalle during 2014-15 & 2015-16. Among the pre release clones tested sugarcane clones 2006A 223 (71.2t/ha) and 2009A 107 (71 t/ha) recorded higher cane yield over standard Co 6907 (59.4t/ha) followed by 2000A 213 (64.7t/ha), 2000A 241 (64.9t/ha), 2005A 128 (63.9 t/ha) 2000A 56 (62.9 t/ha) and 2001A 70 (63.4 t/ha). All these clones are significantly on par with standard Co 6907 with tolerance to red rot and smut diseases, whereas Co 6907 is susceptible to smut disease. These clones also recorded significantly low SLA over standard Co 6907 which indicates more photosynthetic assimilates per unit area. SPAD / SCMR values at 120 under stress conditions sugarcane clones 2000A 56, 2000A 241, 2000A 213 and 2001A 70 are significantly on par with standard Co 6907. The ancillary data denoting stress tolerance like sheath moisture per cent, root spread area, total bio mass production per stool under stress and physiological parameters like leaf proline content & SOD activity under stress conditions is also high in sugarcane clones 2000A 56, 2000A 241, 2009A 107 and 2001A 70 over standard Co 6907. Based on two years of finding sugarcane clones 2000A 56, 2000A 241, 2009A 107, 2006A 223, 2005A 128 and 2001A 70 were found to suitable for rainfed cane cultivation based on cane yield, ancillary data and physiological triats in relation to moisture stress tolerance.

Key words: *Rainfed sugarcane, SPAD / SCMR, Leaf proline, SOD (super oxide dismutase) activity, Cane yield, Per cent juice sucrose, Root spread area and Number of millable canes.*

INTRODUCTION

Sugarcane is grown under completely rainfed condition in sizeable area during May – June in North Coastal districts. Nearly 40-50% of cane cultivation of North Coastal zone is under rainfed cane cultivation. The crop experiences moisture stress at all crop growth stages. Moisture stress affects germination, cane length, cane diameter, single cane weight, cane elongation, biomass production, NMC, cane yields under late planted rainfed conditions (Raja Rajeswari et al., 2003 & 2009).

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The cane yields obtained are ranged from 30 - 35 t/ha under rainfed conditions. SPAD /SCMR values, SOD values and carbon isotope discrimination values indices of moisture stress tolerance in field conditions. High values of SPAD and other ancillary parameters with cane yield of sugarcane was recorded high under moisture stress conditions (Sujatha & Jhansi, 2016). Present study was conducted involving 12 pre release clones including the standard Co 6907 to identify a high yielding clone coupled with toleratnce to suitable for late planted rainfed conditions (June planting).

MATERIALS AND METHODS

Twelve promising pre release clones were studied with Co 6907 under late planted rainfed conditions at Regional Agricultural Research Station, Anakapalle during 2014-15 & 2015-16. The design adopted was RBD with 3 replications. Each clone was planted in six rows of eight meters length with spacing of 60 cms between rows. Trash mulching @ 3t/ha was done at 3rd day after planting. Management of early shoot borer and white fly was carried out by spraying Monochrotophos @ 1.6ml/lt and biologically controlled with using *Trichocards*. A fertilizer dose of 75 kg N + 50 kg P2O5 + 50 Kg K2O / ha was adopted. Nitrogen was applied into two equal splits at 30 and 60 DAP. Detrashing and spreading on dried leaves was carried out in between two rows to conserve soil moisture after cessation of rains. Data was recorded on cane yield, per cent juice sucrose, ancillary data (Meade and Chen, 1971) and NMC at harvest, SCMR values at 120 DAP leaf proline at 120 DAP and SOD were recorded adopting standard procedures (Dhopte & Manuel Livera, 1989).

RESULTS AND DISCUSSION

The data on cane yield, yield components and other quality parameters with ancillary data are given in Table 1. The results obtained are presented on character wise.

Tiller production: The data on tiller production at formative under stress varied from 98.85 000/ha (2004A 55) to 131.5 000/ha (2007A 81). Among 12 sugarcane clones tested 2007A 81 recorded significantly higher tiller production over standard Co 6907 (110.8).

Number of Millable canes: Number of millable canes were high in sugarcane clone 2007A 81 (95.9 000/ha) followed by 2005A 128 (93.03 000/ha) which are on par with standard Co 6907 (82.86 000/ha).

Per cent juice sucrose: The cane quality in terms of per cent juice sucrose was ranged from 17.95 (2001A 70) to 19.6 (2000A 56). Sugarcane clone 2000A 56 (19.6) recorded per cent juice sucrose over other clones tested and on par with the check Co 6907 (19.2%).

Specific leaf area (Cm^2 /g): The parameter indicating assimilation of photosynthates in leaf is SLA (cm2/g). It is ranged from 110.76 cm^2/g (2000A 213) to 162.28 cm^2g (2000A 56). The SLA of sugarcane clones 2000A 213 (110.76 cm^2/g), 2000A 241 (109.6 cm^2/g), 2007A 81 (123.4 cm^2/g) recorded low SLA over other clones tested and standard Co 6907 (148.49 cm^2/g) which indicated more photosynthetic assimilates per unit area under stress conditions.

Root spread area: Among 12 sugarcane clones tested the root spread area at 120 DAP (stress conditions) ranged from 886 cm^2 (2007A 126) to 1707 cm^2 (2000A 56). Sugarcane clones 2000A 56 (1707 cm^2), 2009A 107 (1659 cm^2), 2001A 70 (1356 cm^2) and 2000A 241 (1351 cm^2) recorded higher root spread area over other clones tested. The standard Co 6907 recorded a root spread area of 1110 cm^2.

Total bio mass production per stool (g/stool): The dry meter production at 120 DAP (under stress) in sugarcane clones tested is ranged from 732 g/stool (2005A 128) to 1535 g/stool (2000A 56). The dry meter production at 120 DAP at formative stage (under stress) was high in 2000A 56 (1535 g/stool) followed by 2001A 70 (1518 g/stool), 2000A 241 (1407 g/stool), 2007A 81 (1332 g/stool) and 2006A 223 (1231 g/stool) which are significantly superior over standard Co 6907 (888 g/stool).

Sheath moisture per cent: Per cent moisture in sheath which is an important trait for moisture stress studies was ranged from 69 per cent (2006A 223) to 75.1 per cent (2000A 56). Higher sheath moisture per cent under stress was recorded in sugarcane clones 2000A 56 followed by 2005A 128 (73.2%) which are on par with standard Co 6907 (73.7 %).

Leaf proline (µ moles /g fresh weight): Leaf proline content which is an important drought tolerance denoting trait ranged from 59 µ moles /g fresh weight (2007A 126) to 161 µ moles /g fresh weight (2001A 70). High leaf proline content recorded in 2001A 70 followed by 2000 A241 (156 µ moles /g fresh weight), 2009A 107 (153 µ moles /g fresh weight) which area superior over standard Co 6907 (134.5 µ moles /g fresh weight).

Super oxide dismutase (SOD) activity (OD min/g): It is a prominent enzymatic physiological in relation to moisture stress tolerance. It is ranged from 0.159 OD min/g (2007A 126) to 0.515 OD min/g (2000A 241). SOD activity was high in 2000A 241 (0.515 OD min/g) and 2001A 70 (0.511 OD min/g) followed by 2000A 56 (0.499 OD min/g) and Co 6907 (0.462 OD min/g) which indicates drought tolerance nature of sugarcane clones under moisture stress conditions.

SPAD / SCMR values: The values of SPAD / SCMR of sugarcane clones tested are ranged from 32.8 (2003A 255) to 44.35 (2000A 241). The SPAD / SCMR values of sugarcane clones 2000A 241 (44.35), 2007A 126 (44.65), 2001A 70 (42.65) and 2000A 56 (41.25) are on par with the standard Co 6907 (46.3).

Cane yield: Among 12 sugarcane clones tested cane yield was high in 2006A 223 (71.2 t/ha) and 2009A 107 (71.0t/ha) which are significantly superior to check Co 6907 (59.43 t/ha). Sugarcane clones 2000A 241 (64.9 t/ha), 2000A 213 (64.7 t/ha), 2000A 56 (63.9 t/ha), 2005A 128 (63.9 t/ha) 2001A 70 (63.4 t/ha), and 2003A 255 (63.1 t/ha) recorded higher cane yield over other clones tested and on par with the check Co 6907 (59.4 t/ha).

Similar type of findings on performance of sugarcane clones under rainfed situation and moisture stress conditions was also studied by Raja Rajeswari et al., 2009 and Sujatha and Jhansi, 2016.

Table 1: Cane yield, quality parameters and ancillary data of sugarcane clones under rainfed conditions (Pooled data of 2014-15 & 20 15-16)

Sugarcane variety	SPAD / SCMR values (at 120 DAP)	Tiller production (000/ha) at 150 DAP	NMC (000/ha)	Cane yield (t./ha)	Percent sucrose	Root spread area /stool (Cm^2) at 150 DAP	Percent leaf sheath moisture	SLA at 180 DAP (cm^2)	Total biomass(g) / stool at 180 DAP (g)	Leaf proline (µ moles) at 180 DAP	SOD (OD min./g.) (at 120 DAP)
2000 A 56	41.3	102.3	76.4	63.9	19.6	1707	75.1	162.28	1535	120	0.498
2000 A 241	44.3	107.2	80.6	64.9	19.1	1350	72.1	109.60	1407	156	0.515
2009 A 107	34.6	103.7	86.6	71.0	18.46	1659	72.5	133.61	925	153	0.521
2004 A 55	33.3	96.9	79.5	60.3	19.3	943	73.0	123.73	878	90	0.345
2000 A 213	40.2	102.2	81.2	64.7	18.35	772	74.9	110.76	822	121	0.404
2003 A 255	32.8	106.2	82.1	63.0	18.59	928	71.6	167.71	817	115	0.383
2006 A 223	38.2	111.4	83.2	71.2	19.2	1186	69.0	130.65	1231	122.5	0.407
2007 A 126	44.6	113.5	85.5	56.9	19.0	886	72.1	144.46	1093	59	0.159
Co 6907 (c)	46.3	110.8	82.8	59.4	19.2	1110	73.7	148.49	888	134.5	0.462
2005 A 128	34.3	113.9	93.0	63.99	18.8	804	73.2	129.71	732	76	0.372
2007 A 81	43.2	131.5	95.9	59.5	19.0	1319	71.0	123.39	1332	95	0.339
2001 A 70	42.6	106.3	76.0	63.4	17.9	1355	72.9	133.17	1518	160.5	0.511
SEm±	2.5	3.9	5.0	3.6	0.4	80	0.7	5.6	78.7	5.7	-
CD (0.05)	7.5	12.2	15.5	11.1	1.1	276	2.1	15.3	241	17.6	-

CONCLUSIONS

Among the 12 tested sugarcane clones studied in comparison with Co 6907 under late planted rainfed conditions, sugarcane clones 2009A 107, 2006A 223, 2000A 546, 2000A 241, 2001A 70 and 2005A 128 are found suitable for cane cultivation under rainfed situation based on cane yield and quality parameters in relation to ancillary yield parameters and physiological stress tolerance traits.

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