

Original Research Article

<https://doi.org/10.20546/ijcmas.2020.908.189>

Swarnamukhi (Co T 10367) - A New Sugarcane clone for Andhra Pradesh

M. Jayaprakash, M. Hemanth Kumar*, K.R. Tagore, N. Sabitha, K. Prasada Rao,
L. Madhavi Latha, M. Subba Rao, T.M. Hemalatha, N.V. Sarala,
K.V. Nagamadhuri, B. Vajantha and Y. Amaravathi

Agricultural Research Station, Perumallapalle, A.P – 517 505, India

*Corresponding author

ABSTRACT

Swarnamukhi (Co T 10367) an early maturing clone was developed from CoH 110 GC at Agricultural Research Station, Perumallapalle. The variety tested in sixteen locations of peninsular zone (AICRP, Sugarcane) centers was ranked 3rd, 5th and 2nd for CCS yield (13.44 t/ha), Cane yield (103.04 t/ha) and sucrose (18.49%), respectively. Juice sucrose % at 10th month after planting was 18.49% which was at par with national checks. It was found to be moderately resistant to red rot, resistant to smut, moderately resistant to wilt and moderately susceptible to pokkah boeing diseases. It is a good ratooner yielding good quality jaggery. It has recorded 57.5% increase in jaggery yield (10.1 t/ha) over 83 V 15 (6.4 t/ha) with good quality. The clone is suitable for wide row planting. The tolerance of this clone to salinity and its ability to respond to drought management practices makes it suitable for cultivation under saline and drought conditions with less loss in delayed harvesting. This variety can be identified by its yellow cane colour when unexposed and purple on exposure to sunlight. It has cylindrical internodes with straight alignment; spineless leaf sheath and weak clasping. Bud is medium in size, ovate in shape and bud cushion is absent. Crown is erect, leaves are long and broad. Swarnamukhi was released and recommended for commercial cultivation in Andhra Pradesh by State variety release sub-committee in 2018.

Keywords

Sugarcane, Early maturing clone, Swarnamukhi, Cane yield, Juice sucrose, CCS yield

Article Info

Accepted:

18 July 2020

Available Online:

10 August 2020

Introduction

Sugarcane (*Sachharum* spp complex) is an important commercial crop in the tropics and subtropics grown for sugar under different agro climatic conditions. Tropical region which includes major sugarcane growing states of Maharashtra, Karnataka, Tamil Nadu, Andhra Pradesh, Orissa, Telangana and Madhya Pradesh occupies around 40% of the total sugarcane cropped area in the country

(Govindaraj *et al.*, 2017). However sugarcane suffers from various pests and diseases, abiotic factors such as drought, water logging, salinity etc. which leads to severe yield losses and quality deterioration (Nair, 2011). Stabilizing sugarcane production by development of strategies to combat biotic and abiotic stresses and improving the productivity by developing early drought tolerant high yielding clones are the two facets of sugarcane crop improvement. In

general farmers will go for late harvesting due to delayed issue of cane cutting orders by sugarcane mills. Development of early varieties with less loss in cane and sucrose yield when harvested late is essential to avoid the losses in the situation of late harvesting. Sugarcane is a high water demanding crop with the highest productivity per drop of water consumed. One of the major constraints for achieving full production potential of sugarcane is the occurrence of frequent drought periods during crop growth. Water deficit stress during crop growth period accounts for 30-70 per cent of loss in sugarcane productivity (Appunu *et al.*, 2017). Apart from drought stress, sugarcane diseases also seriously affects cane and juice yield in major sugarcane varieties (Viswanathan *et al.*, 214). Development of suitable varieties superior to the existing varieties under biotic and abiotic stresses assumes importance for improving productivity levels in Andhra Pradesh. Hence research efforts were made to develop high yielding, early maturing varieties with tolerance to drought, salinity and diseases including less loss in delayed harvesting.

Materials and Methods

Swarnamukhi was developed from Co H 110 GC. This clone was tested as 2005 T 16 in station yield trials along with two standard checks from 2007-08 to 2009-10 at Agricultural Research Station, Perumallapalle. Station trials were planted in RBD with three replications with a plot size of 6 rows of 6 m length with a row spacing of 80 cm. Recommended package of practices were followed. Data were recorded for yield and juice quality parameters. Juice analysis was done as per standard procedures given by Meade and Chen, 1977. Juice quality traits and yield data were recorded at 10th month. This clone was evaluated across 16 locations of peninsular zone under AICRP (S)

programme along with three standards (Co C 671, Co 94008 and Co 85004) during 2015-16 and 2016-17. The clone was evaluated in farmer's fields and sugarcane factories farm locations (KCP, Vuyyuru, SNJ Sugars and Products Limited, Nelvoy and Sudalagunta Sugars Limited, BN Kandriga). The clone was screened at Agricultural Research Station, Perumallapalle for red rot by artificial inoculation of major pathotypes CF 261, CF 419 and CF 671 through plug and cotton swab methods and it was also screened for smut disease by soaking the setts in smut spore suspension (10⁶ spores/ml). The clone was also screened in AICRP(S) trials of peninsular region during 2013 to 2017 for red rot, smut, pokka boeing and YLD diseases. Statistical analysis of data was carried out as per Panse and Sukhatme (1978).

Results and Discussion

Swarnamukhi was evaluated in station yield trials as 2005 T16 (PYT, MYT I Plant Crop, MYT II Plant crop and MYT Ratoon crop) at Agricultural Research Station, Perumallapalle from 2007-2010 (Table 1). The clone has recorded cane yield of 82.9 t/ha when compared to the standard checks 83 V 15 (75.2 t/ha) and Co 86032 (59.3 t/ha). The clone has recorded 18.3% increase in CCS yield (10.7 t/ha) over 83 V 15 (9.04 t/ha) and 75.2% increase in CCS yield over check Co 86032 (6.1 t/ha). When compared with checks, it has recorded 18.5% sucrose at 10th month after planting which is higher than the standard checks 83 V 15 (17.5%) and Co 86032 (15.1%). It was also compared with 2003 V 46 (Bharani), the popular variety and has recorded 11.3 % increased CCS yield (13.17 t/ha).

It was tested in 16 centers of peninsular zone as Co T 10367 in initial varietal trial, advance varietal trial (early) plant crop I, II and ratoon during 2013-14 to 2015-16

(Table-2). The pooled analysis revealed that the clone was ranked 3rd, 5th and 2nd for CCS yield (13.44 t/ha), Cane yield (103.04 t/ha) and sucrose (18.49%) respectively. Pooled mean CCS yield of Co T 10367 (13.44 t/ha) was 8.47% higher than the national check, Co C 671 (12.39 t/ha), 20.32% higher than Co 94008 (11.17 t/ha) and 13.32% higher than Co 85004 (11.86 t/ha). It has recorded cane yield of 103.04 t/ha which was 13.56% higher than Co C 671 (90.73 t/ha), 12.64% higher than Co 94008 (91.47 t/ha) and 11.4% higher than Co 85004 (92.48 t/ha). Juice sucrose% at 10th month after planting was 18.49% which was at par with national checks Co C 671 (18.95%), Co 94008 (17.29%) and Co 85004 (18.25%).

Red rot of sugarcane is a dreadful and life threatening disease of sugarcane (Kumar *et al.*, 2018) and a major constraint of sugarcane production (Viswanathan *et al.*, 2008). Newly developed sugarcane clones should have red rot resistance for commercial cultivation. Swarnamukhi was screened at Agricultural Research Station, Perumallapalle for red rot and smut disease resistance during 2008-09 and 2010-11. It was inoculated with three major red rot pathotypes *viz.*, CF 261, CF 419 and CF 671 by two standard inoculation methods i.e. plug and cotton swab. It showed resistant reaction to all the three pathotypes by both the methods. It also showed resistant reaction to smut disease (Table-3). It was screened for major diseases in AICRP (Sugarcane) centers during 2013-14 to 2016-17 (Table 4). It showed resistance to moderately resistance reaction to red rot, smut and yellow leaf disease (YLD), moderately resistant to wilt and moderately susceptible to pokkah boeing disease. It was also screened for major insect pests in AICRP (Sugarcane) centers during 2013-14 to 2016-17 (Table 5) and found to be less susceptible to early shoot borer, internode borer, root borer, top shoot

borer and pyrilla and less susceptible for scale insects and mealy bugs. Swarnamukhi was tested in onfarm trials from 2012 to 2015. It has recorded 8.18% increased cane yield (115.78 t/ha) against 87 A 298 (107.1 t/ha). Identification of varieties through characterization is important to reap the best out of the variation created (Praveen *et al.*, 2017). The variety can be identified by its distinguished morphological characters (Fig. 2 and 3). The cane is tall, yellow when unexposed and purple on exposure to sunlight. It has cylindrical internodes with straight alignment; leaf sheath is weak in clasping without spines. Bud is medium in size, ovate in shape and bud cushion is absent. Leaf lamina is erect, long and broad. Pithiness is absent. Flowering is slightly present. The most commonly used molecular markers for assessment polymorphism are RAPDs and SSRs. As RAPDs are quick and easy to assay, requiring low quantities of template DNA (Mallikarjuna *et al.*, 2018). DNA fingerprinting of sugarcane variety Swarnamukhi and four check varieties *viz.*, 2006T3, 2003T121, Bharani (2003V46) and Swetha (2003V59) were profiled with 17 RAPD markers. All the 17 RAPD markers resulted in reproducible banding pattern and fifteen markers (OPA-02, OPA-04, OPA8, OPB-05, OPC-2, OPC-3, OPC-15, OPG-11, OPG-08, OPA-12, OPC-14, OPF-13, OPS-09, OPV-19 and OPV-20) out of 17 RAPD markers are polymorphic in the five varieties of sugarcane included in this study. Based on the allelic separation of 15 polymorphic RAPD markers, the sugarcane variety Swarnamukhi 2005T16 has distinctly different allelic pattern (Figure 4). The overall size of the amplicons varied from 100 to 3000bp. The DNA fingerprinting can identify sugarcane genotypes unambiguously (Figure 1) and facilitate cultivar identification and notification (Bhat, 2006; Amaravathi *et al.*, 2014).

Table.1 Performance of 2005 T 16 (Co T 10367) in station yield trials from 2007-08 to 2009-10 at Agricultural Research Station, Perumallapalle

Clone (S)	PYT 2007-08	MYT I Plant Crop 2008-09	MYT II Plant Crop 2009-10	MYT Ratoon Crop 2009-10	Mean	% Increase over checks
Cane Yield (t/ha)						
2005 T 16	109.5	64.8	89.6	67.6	82.9	-
83 V 15 (C)	-	73.3	96.9	55.4	75.2	10.2
Co 86032 (C)	-	-	59.3	-	59.3	39.8
CD (5%)	NS	7.80	17.1	11.1	-	-
CV (%)	-	6.30	11.2	11.8	-	-
Sucrose at 10th month						
2005 T 16	18.3	18.0	17.3	20.4	18.5	-
83 V 15 (C)	-	17.9	15.8	18.9	17.5	5.4
Co 86032 (C)	-	-	15.1	-	15.1	22.4
CD (5%)	1.6	0.9	1.7	1.1	-	-
CV (%)	5.2	3.2	7.0	3.3	-	-
CCS Yield (t/ha)						
2005 T 16	14.4	8.1	10.7	9.6	10.7	-
83 V 15 (C)	-	9.3	10.4	7.4	9.04	18.3
Co 86032 (C)	-	-	6.1	-	6.1	75.2
CD (5%)	NS	1.2	1.8	1.6	-	-
CV (%)	-	8.0	12.4	13.4	-	-

Table.2 Performance of Co T 10367 (2005 T 16) in Advanced Varietal Trials – Early (Pooled Mean) during 2015-16 and 2016-17 in 16 AICRP (S) centres

S. No.	Entries	CCS (t/ha) at harvest			Cane yield (t/ha) at harvest			Sucrose % at harvest (10 th month)		
		Weighted average	Rank	% increase over checks	Weighted average	Rank	% increase over checks	Weighted average	Rank	% increase over checks
1	Co 10004	12.06		-	93.61	6	-	18.08	-	-
2	Co 10005	13.37	4	-	105.29	2	-	18.15	5	-
3	Co 10006	10.14		-	79.72		-	17.77	-	-
4	Co 10024	13.27	5	-	105.2	3	-	17.86	-	-
5	Co 10026	13.85	1	-	109.01	1	-	17.98	-	-
6	Co 10027	13.6	2	-	104.69	4	-	18.34	3	-
7	CoT 10366	11.61		-	97.2	7	-	17.1		-
8	CoT 10367 (2005 T 16)	13.44	3	-	103.04	5	-	18.49	2	-
9	CoC 761 ©	12.39	6	8.47	90.73	-	13.56	18.95	1	-2.4
10	Co 94008 ©	11.17	-	20.32	91.47	-	12.64	17.29	-	-2.4
11	Co 85004 ©	11.86	-	13.32	92.48	8	11.40	18.25	4	6.9

Table.3 Reaction of 2005 T 16 (Co T 10367) for Red rot and Smut diseases at Agricultural Research Station, Perumallapalle from 2008-2011

S.No.	Clone	2008-09			2010-11			Smut	
		Cf 261	Cf 419	Cf 671	Cf 261	Cf 419	Cf 671	2008-09	2010-11
1	2005 T 16	R	R	R	R	R	MR	R	R
2	93 V 297	S	S	S	S	S	S	-	-
3	87 A 298	R	R	R	R	R	R	S	S

R: Resistant, MR: Moderately Resistant, S: Susceptible

Table.4 Reaction of Co T 10367 for Red rot, Smut, Pokkah Boeing, YLD and Wilt in zonal varietal trials during 2013-2014 to 2016-2017

Variety	Year	Coimbatore			Thiruvalla			Navsari					Kolhapur		Pade-gaon	Pune	Sankeshwar		Powerkheda	
		Red rot		Smut	Red rot		Smut	Red rot		Smut	Wilt	YLD	Smut	Pokkah boeing	Smut	Smut	Smut	YLD	Smut	YLD
		P	N		P	CS		P	CS											
Co T 10367	2013-14	R	R	HS	MR	R	-	MR	R	MR	-	-	MR	MS	MR	-	MR	-	-	-
	2014-15	-	-	-	MR	R	-	MR	R	MR	MR	-	R	-	R	R	HS	-	R	-
	2015-16	-	-	-	Cf 06-R 12-MR	Cf Cf 06-R 12-R	-	MR	R	MR	MR	R	R	-	R	-	MS	R	R	R

P: Plug method, N: Nodal method, CS: Cotton Swab method,
R: Resistant, MR: Moderately Resistant, MS: Moderately Susceptible, HS: Highly Susceptible

Table.5 Reaction of Co T 10367 for major insect pests in Zonal varietal trials during 2013-14 to 2016-17

Variety	Year	Coimbatore				Navsari						Padegaon				Pune					
		ESB	IB	RB	TB	ESB	TB	IB	RB	SI	MB	ESB	IB	TB	MB	SI	ESB	IB	SI	MB	
CoT 10367	2013-14	-	-	-	-	LS	MS	LS	MS	MS	MS	MS	MS	MS	LS	HS	MS	MS	LS	-	MS
	2014-15	LS	MS	-	LS	LS	MS	LS	MS	HS	HS	MS	MS	-	HS						
	2015-16	HS	-	-	LS	LS	LS	-	LS	LS	LS	-	HS	MS	-	HS	LS	MS	LS	-	LS

Variety	Year	Powerkheda		Mandya			Akola			
		ESB	PY	ESB	TB	IB	ESB	MB	SI	PY
CoT 10367	2013-14	MS	MS	LS	LS	LS	LS	LS	LS	-
	2014-15	LS	MS	LS	LS	LS	LS	HS	MS	LS
	2015-16	LS	LS	LS	LS	LS	LS	-	MS	LS

ESB: Early Shoot Borer, IB: Internode Borer, RB: Root Borer, TB: Top Shoot Borer, SI: Scale Insect, PY: Pyrilla, MB: Mealy Bug
LS: Less Susceptible, MS: Moderately susceptible, HS: Highly Susceptible

Table.6 Jaggery Yield (t/ha) in MYT Plant I crop during 2008-09 at ARS, Perumallapalle

Clone(s)	Jaggery yield	Colour intensity	pH	EC
	t/ha	%		(dS/m)
2005 T 16	10.1	51.9	5.8	0.1
83 V 15 (C)	6.4	76.7	5.72	0.1

Table.7 Performance of 2005 T 16 under wide row planting (5 ft)

Variety	Millable cane length (m)	Millable cane girth (cm)	NMC/ha	Cane yield (t/ha)	Sucrose (%)
2005 T 16	2.44	2.59	54294	62.7	17.89
2003 V 46 (Check)	2.36	2.48	48793	54.4	17.92
CD	0.3	0.45	8822	12.6	9.32
CV (%)	6.32	8.52	11.8	15.2	10.2

Table.8 Performance of 2005 T 16 under salinity during 2011-12

Salinity 2011-12		2005 T 16	Co 99004	83 V 15	93 A 145
Germination %	Control	91.74	79.23	87.57	66.35
	Salt treated	79	76.72	80.06	53.55
P content in plant (%)	Control	0.099	0.071	0.085	0.081
	Salt treated	0.083	0.07	0.064	0.07
K content in plant (%)	Control	0.85	0.62	0.79	0.71
	Salt treated	0.71	0.62	0.71	0.54
Fe conc. (ppm)	Control	23.08	24.32	26.13	25.11
	Salt treated	19.08	21.66	21.66	17.08
Zn conc. (ppm)	Control	23.25	19.46	24.63	23.16
	Salt treated	13.92	17.66	14.43	17.09

Fig.1 Field view of Swarnamukhi



Fig.2 Sett and leaf sheath of Swarnamukhi



Fig.3 Jaggery of Swarnamukhi



Swarnamukhi is highly suitable for jaggery making with golden yellow colour (Fig. 4). It has recorded high jaggery yield (10.1 t/ha) when compared to the popularly grown variety 83 V 15 (6.4 t/ha) (Table 6). The variety performed well in wide row (5 feet) planting (Table 7). Tolerance of this clone to salinity in saline soils was also established (Table 8). As nitrogen management is closely associated with sugarcane yield (Nagamadhuri *et al.*, 2011). Swarnamukhi was evaluated for response to higher doses of nitrogen. It gave 11.7 % higher cane yields at 125 % RDN (102.4 t/ha). The clone was released by state variety release sub-committee in 2018 and recommended for commercial cultivation in Andhra Pradesh. It was also notified by central variety release committee with notification number S.O.No.6318 (E) dated 26th December 2019.

References

- Amaravathi, Y., Vasanthi, R.P., Siva Kumar, E., Purushotham, M. and Giridhara Krishna T. 2014 DNA fingerprinting of groundnut (*Arachis hypogaea* L.) varieties of Tirupati using SSR markers. *Electronic Journal of Plant Breeding*, 5(4): 677- 687.
- Appunu, C., Mohanraj, K., Hemaprabha, G., Anna Durai, A., Mahadevaiah, C., Vijayan Nair and Bakshi Ram 2017. Co - 06022 – A sugarcane early maturing and drought tolerant variety suitable for Tamil Nadu and Pondicherry. *Journal of Sugarcane Research* 7 (2): 83-92.
- Bhat, K. V. 2006. DNA finger printing and cultivar identification. National Centre on DNA Fingerprinting. New Delhi. NBPGR.
- Govindaraj, G., Bhagyalakshmi, K.V., Alarmelu. S., Hemaprabha, G., Nagarajan R., Somarajan, K.G., Shanti, R.M., Mohanraj, K., Anna Durai, A., Revindra Kumar and Bakshi Ram 2017. Co-09004 (Amritha): New high sugar and early maturing variety released for cultivation in Peninsular zone. *Journal of Sugarcane Research* 7(2) : 174-176.
- Kumar, M., Misra, V., Singh, B.D., Mall, A.K. and Pathak, A.D. 2018. Incidence of red rot disease in sugarcane variety CoS 8436 in Bihar, India, 18 (SI): 182-186.
- Mallikarjuna, S.J., Hemanth Kumar, M., Mohan Reddy, D., Sudhakar, P. and Hemalatha, T. M. 2018. Assessment of genetic polymorphism in sugarcane somoclonal by using random amplified polymorphic DNA. *International Journal of current microbiology and*

- applied sciences. 7(6): 1412-1419.
- Meade GP, Chen JcP 1977. Cane hand book 10th edition John Wiley and Sons. New York.
- Nagamadhuri, K.V., Hemanth Kumar, M., Subba Rao, M., Sarala, N.V. and Giridhar, V. 2011. Response of promising midlate maturing sugarcane varieties to different doses of nitrogen fertilizers. *Journal of Sugarcane Research* 1(1): 49-54.
- Nair, N. V. 2011. Sugarcane varietal development programmes in India. An overview. *Sugar Tech.* 13: 275-280.
- Panase and Sukhatme P.V. 1978. Statistical methods for agricultural workers. ICAR, New Delhi. Pp 539-547.
- Praveen, K., Reddy, K H P., Hemanth Kumar, M., Reddy, D M., Eswar Reddy, N P., Latha, P. and Balaji, M. 2017. Morphological characterization of sugarcane somaclones using DUS descriptors. *The Bioscan.* 10 (33-34): 34-44.
- Vishwanathan, R. and Samiyappan, R. 2008. Bio-formulation of fluorescent *Pseudomonas* spp. Induces systemic resistance against red rot disease and enhances commercial sugar yield in sugarcane. *Archives of Phytopathology and Plant Protection*, 41(5): 377-388.
- Vishwanathan, R., chinnaraja, C., Malthi, P., Gomathi, R., Rakkiyappan, P., Neelamathi, D., Ravichnadrana, V. 2014. Impact of Sugarcane yellow leaf virus (Sc YLV) infection on physiological efficiency and growth parameters of sugarcane under tropical climatic conditions in India. *Acta Physiologia Plantarum* 36: 1805 – 1822.

How to cite this article:

Jayaprakash, M., M. Hemanth Kumar, K.R. Tagore, N. Sabitha, K. Prasada Rao, L. Madhavi Latha, M. Subba Rao, T.M. Hemalatha, N.V. Sarala, K.V. Nagamadhuri, B. Vajantha and Amaravathi, Y. 2020. Swarnamukhi (Co T 10367) - A New Sugarcane clone for Andhra Pradesh. *Int.J.Curr.Microbiol.App.Sci.* 9(08): 1653-1660.
doi: <https://doi.org/10.20546/ijcmas.2020.908.189>