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## **Co 10026 (UPAHAR) – AN EARLY HIGH YIELDING VARIETY FOR PENINSULAR ZONE**

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### **ABSTRACT**

Co 10026 (Upahar), an early variety developed through hybridization and selection involving two high yielding and high quality parents Co 86010 and Co 86011 at ICAR-Sugarcane Breeding Institute (SBI), Coimbatore, evaluated under All India Coordinated Research Project (Sugarcane) programme and released in 2019 for commercial cultivation in Peninsular zone. The clone was selected from the ground nursery and evaluated in different clonal stages in Pre Zonal Varietal Trial (PZVT) at Ugar Sugar Works, North Karnataka and AICRP trials from 2013-2017 at ICAR-SBI, Coimbatore and other AICRP centres of Peninsular Zone. Under AICRP(S) Co 10026 was evaluated in 16 centres of Peninsular Zone and out of 33 trials conducted across zone, it ranked in top three in 21 trials for cane yield (t/ha), 23 trials for Commercial Cane Sugar (t/ha) and exhibited its superiority for cane and sugar yield over the zonal check CoC 671. This variety recorded cane yield of 109.01 t/ha, sugar yield of 13.85 t/ha, Pol % cane of 13.58 % and juice sucrose of 17.98 % at 300 days across the zone. It showed 11.80 %, 16.78 % and 23.99 % improvement for sugar yield over the best standard CoC 671, Co 85004 and Co 94008 respectively. Co 10026 exhibited 20.15 % improvement over CoC 671 for cane yield and an improvement of 17.87 % and 19.18 % in comparison with the other zonal checks Co 85004 and Co 94008 respectively. This clone surpassed all the entries and three standards for sugar yield and cane yield and emerged as a qualifying entry for sugar yield and cane yield in eight and five locations respectively. Co 10026 was the only qualifying entry in the ratoon trials and is an excellent ratooner with an improvement of 17.97 % for sugar yield and 27.36 % for cane yield in ratoon crop over the standard CoC 671. It recorded 9.86 % and 16.40 % improvement for sugar yield and cane yield respectively over the best standard Co 85004.

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The clone had recorded a significant improvement of 9.18% and 5.37% over checks Co 94008 and Co 85004 for sucrose % at 240 days. The clone had improvement of 3.99 % over the check Co 94008 for sucrose % at 300 days. Co 10026 has the ideal plant characters of very tall, semi erect, medium thick canes and early fast growth with high tillering ability. It is moderately resistant to red rot and tolerant to drought and salinity.

**Key words:** Co 10026, sugarcane variety, cane yield, sugar yield, red rot

## INTRODUCTION

Sugarcane is an important commercial crop of the nation cultivated on about 5 million ha area including both sub-tropical and tropical regions. It is also an important candidate crop as it is a rich source of food components and also a source of bio-fuel and energy, a byproduct of sugarcane fibre. Genetic enhancement in sugarcane has contributed in yield increase in the last decades in many sugarcane-producing regions across the globe as indicated by studies in Australia (Cox and Stringer, 2007) and other countries. The top priority of breeders is to select clones for high sugar yield through cane yield and sugar content. The ultimate goal of sugarcane breeding programmes is to develop genetically improved varieties with high yield potential and adaptability to stress environments and the varieties play a major role to meet all the needs. Cane yield is an important character and improved varieties need to be developed combining different industrial attributes. Juice quality is also essentially a relative character and controlled by a strong and very evident variety-environment interaction. Varietal differences exist early in the harvesting period and varieties of commercial status exhibit reasonably good juice quality under favorable conditions. Sugarcane varietal development programmes are time consuming, hence it is important to periodically assess the clones to select competitive genotypes for yield components and provide genetic gains (Dumont *et al* 2019). Several attempts are continuously being made to identify new/alternate sugarcane varieties for tropics with diverse background and early maturity through multilocation testing to improve the productivity. Till date, Co 86032 is the predominant variety during early period of crushing season due to non-availability of suitable early maturing varieties combining high yield in Peninsular zone, The early maturing sugarcane variety Co 10026 is one such variety identified through multilocation testing in tropical zone of India that combines high yield and quality in comparison with Co 86032 at ten months of age indicating its potential as a high yielding early clone in the tropical zone. The paper deals with the performance and potential of the new variety Co 10026 in Peninsular Zone.

## **MATERIALS AND METHODS**

Co 10026 named as "Upahar" was evolved through hybridization of two high yielding and quality parents (Co 86010 x Co 86011). It is an early maturing clone, identified as Co cane during the year 2010 from ICAR-Sugarcane Breeding Institute, Coimbatore. The clone was evaluated and selected from the ground nursery stage in 2006 and thereafter in different clonal stages and PZVT till 2011 under North Karnataka condition for yield, quality parameters and screened for natural incidence of sugarcane woolly aphid. The clone was tested in IVT (2013-14) under All India Coordinated Research Project on Sugarcane [AICRP(S)] in 16 centres of Peninsular zone and due to its superior performance for cane yield and juice quality, it was promoted to AVT for multilocation testing (2015-2017) which was widely spread over major tropical belt of sugarcane (Coimbatore, Akola, Basmathnagar, Kolhapur, Mandya, Navsari, Padegaon, Perumalapalle, Powerkheda, Pravaranagar, Pugalur, Pune, Sameerwadi, Sankeshwar and Thiruvalla centres). The trials were laid out in randomized block design (RBD) replicated thrice with a plot size of eight rows of 6m length spaced 90 cm apart. Standard sugarcane cultivation practices were followed (Sundara, 1998). Plant protection measures were carried out to raise a healthy crop. Observations were recorded at harvest (300 days) on number of millable canes ('000/ha), cane thickness (cm), cane height (cm), single cane weight (kg), CCS (t/ha) and cane yield (t/ha). Quality parameters (Brix %, Sucrose% and CCS %) were recorded at 240 and 300 days. Red rot reaction of this clone was evaluated under natural and artificial conditions with predominant red rot causing pathotype in Peninsular region. Statistical analysis was carried out using standard procedure (Singh and Chaudhary, 1985)

## **RESULTS AND DISCUSSION**

### **Performance in Initial Varietal Trial (IVT)**

The overall mean performance of Co 10026 in sixteen locations revealed maximum cane yield of 102.83 t/ha, CCS % of 12.34 % and sugar yield of 12.72 t/ ha in comparison with CoC 671 (96.7 t/ha cane yield, 12.34 t/ha sugar yield and 12.68 % CCS). It exhibited its superior performance for cane and sugar yield in Coimbatore, Navsari, Padegaon, Pune, Sankeshwar and Sameerwadi centres. In Coimbatore, the clone recorded 123.60 t/ha cane yield and 15.96 t/ha sugar yield in comparison with CoC 671 (95.8 t/ha cane yield and 11.81 t/ha sugar yield). [PI, Varietal Improvement Programme AICRP (S) Report : 2013-2014].

### **Performance of Co 10026 in AICRP centres of Peninsular zone**

*Overall Mean Performance of Co 100026 in Advanced Varietal Trials across the Zone*

The clone Co 10026 was evaluated under AICRP(S) during 2013-2014 (IVT) and 2015-2017 (in AVT trials) across Peninsular zone. This clone recorded cane yield of 109.01 t/ha, sugar yield of 13.85 t/ha, Pol % cane of 13.58 % and juice sucrose of 17.98 % at 300 days across the zone (Tables 1-4). This clone surpassed all the entries and three standards for sugar yield and cane yield and was qualifying entry for sugar yield and cane yield in 8 and 5 locations respectively. Co 10026 recorded an average CCS yield of 13.85 t/ha from three crops (2P+1R) against the standards CoC 671 (12.39 t/ha), Co 94008 (11.17 t/ha) and Co 85004 (11.86 t/ha) with 11.80 % improvement over CoC 671, 16.78 % over Co 85004 and 23.99 % over Co 94008 from 33 trials. Co 10026 with an overall mean cane yield of 109.01 t/ha was superior to CoC 671 (90.73 t/ha), Co 85004 (92.48 t/ha) and Co 94008 (91.47 t/ha) with an improvement of 20.15 %, 17.87 % and 19.18 % respectively. In both plant and ratoon crops the clone showed improvement over both the standards. Out of 33 trials conducted across 16 centres, it ranked in top three in 21 trials for cane yield (t/ha), 23 trials for Commercial Cane Sugar (t/ha) and 8 and 7 trials for juice sucrose % and Pol % cane respectively. The ultimate product in breeding is identification and release of variety that possess resistance to new pathological or entomological stresses, or possess improved adaptation to prevailing or emerging abiotic stresses, e.g., moisture stress, salinity, etc. to have improved productivity and profitability (Berding and McIntyre, 2010). This variety with resistance to red rot, smut and with no natural incidence of sugarcane white wooly aphid and adaptation to drought and salinity situations offers scope for Peninsular zone in early crushing period.

Co 10026 is an excellent ratooner with an improvement of 17.97 % for sugar yield and 27.36 % for cane yield in ratoon crop over the standard CoC 671. It recorded 9.86 % and 16.40 % improvement for sugar yield and cane yield respectively over the best standard Co 85004.

Co 10026 recorded juice sucrose of 15.41 % at 240 days in comparison with CoC 671 (15.51%) and with an improvement of 9.18 and 5.37 % over other checks Co 94008 and Co 85004 respectively. It recorded an overall improvement (2P+1R) of 6.51 %, 1.91 %, 3.67 %, 3.95 %, 1.78% and 3.27 % over CoC 671 in Mandya, Padegaon, Pravaranagar, Pugalur, Pune and Thiruvalla centres respectively. Considering the mean of two plant crops, the clone had recorded a significant improvement of 9.18% and 5.37% over the checks Co 94008 and Co 85004 for sucrose % at 240 days. The clone had an improvement of 3.99 % over the check Co 94008 for sucrose % at 300 days. Similar studies by Chapman (1996), Mishra and Chaudhary (2003) in evaluation of promising entries have resulted in identification of elite clones and varieties.

In Peninsular zone, Co 86032 is the predominant variety during early period of crushing season due to non-availability of suitable early maturing varieties combining high yield. Hence, the performance of Co 10026 was compared with Co 86032 for its juice sucrose % and cane yield at 300 days. The clone recorded a significant improvement of 11.14 % over Co 86032 for sucrose % at 10 months. The clone recorded a high cane yield of 109.01 t/ha at 10 months in comparison with the yield levels of Co 86032 (106.50 t/ha) at 12th month thereby indicating its suitability as a potential high yielding early clone for the zone.

Variety	Sucrose % (2P)	Variety	Cane yield (t/ha) (2P+1R)
Co 10026 (10 m)	17.96	Co 10026 (10 m)	109.01
Co 86032 (10 m)	16.16	Co 86032 (12 m)	106.50
% imp over Co 86032	11.14	% imp over Co 86032	2.36

Source: PI, Varietal Improvement Programme AICRP (S) Report : 2016-2017

The overall mean performance of the clone for juice quality at 240 days in twelve AICRP centres was 15.41 % in comparison with CoC 671 (15.87 %), Co 94008 (14.39%) and Co 85004 (14.88 %). It showed an improvement of 8.36 % and 4.84 % over Co 94008 and Co 85004 respectively. The clone recorded Pol % cane of 13.58 in comparison with CoC 671 (13.95 %), Co 94008 (12.74%) and Co 85004 (13.47%).(AICRP (S), PI Report 2016-2017.

#### Mean Performance in locations

In Coimbatore, Co 10026 recorded a cane yield of 160.63 t/ha with an improvement of 42.20 % against CoC 671 (112.96 t/ha). It recorded sugar yield of 20.47 t/ha in comparison with standards CoC 671 (16.36 t/ha), Co 94008 (11.54 t/ha) and Co 85004 (16.15 t/ha) and showed an increase of 16.36 %, 11.54% and 16.15% for and sugar yield respectively. The clone performed well in Karnataka ( Mandya, Sankeshwar and Sameerwadi ) with an overall mean cane yield of 96.01 t/ha, sugar yield of 16.94 t/ha with an improvement of 32.04 % and 28.48 % over CoC 671 for sugar yield and cane yield respectively. (Table 5).

In the sugarcane tracts of Maharashtra the clone showed superior performance for yield and quality traits and recorded 100.59 t/ha cane yield and 13.31 t/ha sugar yield with an improvement of 17.79 %, and 19.22% respectively over CoC 671. In Gujarat, the clone recorded cane yield of 116.77 t/ha and 14.02 t/ha sugar yield with an improvement of 13.67 % and 29.06 % over CoC 671 respectively.

### *Salient characters*

It is a high yielding, sparse flowering early variety. It is tall with medium thick, pink orange wax coated canes. It has long internodes with prominent bud groove, no spines, and splits, greenish orange growth ring, brown dewlap, easy to detrash, long lanceolate ligular process and semi compact canopy with pointed leaves. The clone is well suited for wide row spacing. The variety exhibits early vigour with excellent field stand, high tillering with good cane population and ratoonability. The variety gives A1 quality jaggery. It possesses tolerance to drought and salinity conditions, the major yield limiting abiotic stresses in Peninsular zone. Co 10026 is resistant to red rot and YLD in all centres and smut in three centres and did not show natural incidence of sugarcane white wooly aphid under endemic locations.

### **CONCLUSION**

Sugarcane cultivation begins with appropriate selection of variety suited for the region, season etc. Hence a suitable balanced proportion of area should be cultivated under early, mid-late and late maturing varieties to ensure continuous and quality cane supply throughout the crushing period. To cater the need of variety for early crushing, Co 10026 is an ideal clone which possess high yield and resistance to red rot and would certainly improve sugarcane yield and sugar productivity and suitable for early crushing in Peninsular zone.

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### **REFERENCES**

- Berding N, McIntyre R.K. (2010). Evaluation of commercial performance and attributes of Q200 in North Queensland. *Proc Aust Soc Sugar Cane Technol* Vol (32):266-272.
- Chapman, L.S.(1996). Increase in sugar yield from plant breeding from 1946 to 1996 sugarcane : Research towards efficient and sustainable production. *Symposium Brisbane*.37-38.
- Cox, M.C., and J.K. Stringer. (2007). Benchmarking genetic gains from new cultivars in Queensland using productivity data. *Proceedings of the International Society of Sugar Cane Technologists* 26: 624-631.

- Dumont, T, Chane, A.T, Barau, L, Siegmund, B and Hoarau, J.Y (2019). Genetic Variabilities and Genetic Gains for Yield Components in Regional Sugarcane Breeding Programmes on Reunion Island. Sugar Tech <https://doi.org/10.1007/s12355-019-00718-9>
- Misra, S.R and Chaudhary K.S. (2003). Promising varieties of sugarcane released through AICRP(S) system. Indian Sugar. 53 :19-25.
- Singh, R.K and Chaudhary, B.D. (1985) Biometrical Method in quantitative Genetics Analysis. Kalyani Publishers, New Delhi.
- Sundara B (1998) Sugarcane cultivation. Vikash Publishing House Pvt Ltd., New Delhi, p.1-292



**TABLE 1 - MEAN PERFORMANCE OF CO 10026 FOR CCS (t/ha) IN AICRP: ADVANCED VARIETAL TRIALS (AVT) (2015-2017)**

	Year of testing	No. of trials/locations	Co 10026	CoC 671 (Standard)	Co 94008 (Standard)	Co 85004 (Standard)	Co 10005 (Next best entry)
CCS (t/ha) Zonal mean	Plant-I (2015-16)	15	13.88	13.59	11.87	12.04	14.18
	Plant -II (2016-17)	11	14.41	11.78	10.87	11.69	13.28
	Ratoon (2016-17)	7	12.93	10.96	10.28	11.77	11.92
	<b>Weighted Mean</b>		13.85	12.39	11.17	11.86	13.37
Percentage increase or decrease over the checks & qualifying varieties	Plant-I (2015-16)			2.13	16.93	15.28	-2.12
	Plant -II (2016-17)			22.33	32.57	23.27	8.51
	Ratoon (2016-17)			17.97	25.78	9.86	8.47
	<b>Weighted mean</b>			11.80	23.99	16.78	3.59

Source: Principal Investigators' Report, AICRP on Sugarcane, Varietal Improvement 2015-2016 and 2016- 2017

**TABLE 2 - MEAN PERFORMANCE OF CO 10026 FOR CANE YIELD (t/ha) IN AICRP: ADVANCED VARIETAL TRIALS (AVT) (2015-2017)**

Character	Year of testing	No. of trials/locations	Co 10026	CoC 671 (Standard)	Co 94008 (Standard)	Co 85004 (Standard)	Co 10005 (Next best entry)
Mean yield (t/ha) Zonal	Plant-I (2015-16)	15	110.50	96.12	95.22	96.54	112.11
	Plant -II (2016-17)	11	111.61	90.66	90.95	90.40	104.66
	Ratoon (2016-17)	7	101.98	80.07	84.77	87.61	92.64
	<b>Weighted Mean</b>		109.01	90.73	91.47	92.48	105.29
Percentage increase or decrease over the checks & qualifying varieties	Plant-I (2015-16)			14.96	16.05	14.46	-1.44
	Plant -II (2016-17)			23.11	22.72	23.46	6.64
	Ratoon (2016-17)			27.36	20.30	16.40	10.08
	<b>Weighted mean</b>			20.15	19.18	17.87	3.53

Source: Principal Investigators' Report, AICRP on Sugarcane, Varietal Improvement 2015-2016 and 2016- 2017

**TABLE 3 - MEAN PERFORMANCE OF CO 10026 FOR SUCROSE % (300 D) IN AICRP: ADVANCED VARIETAL TRIALS (AVT) (2015-2017)**

Character	Year of testing	No. of trials/locations	Co 10026	CoC 671 (Standard)	Co 94008 (Standard)	Co 85004 (Standard)	Co 10005 (Next best entry)
Sucrose (%) Zonal mean	Plant-I (2014-15)	15	17.71	18.87	17.38	17.97	18.07
	Plant-II (2015-16)	11	18.22	18.75	17.10	18.28	18.06
	Ratoon (2015-16)	7	18.16	19.41	17.42	18.79	18.45
	<b>Weighted Mean</b>		17.98	18.95	17.29	18.25	18.15
Percentage increase or decrease over the checks & qualifying varieties	Plant-I (2014-15)			6.15	1.90	-1.45	-1.99
	Plant-II (2015-16)			2.83	6.55	-0.33	0.89
	Ratoon (2015-16)			-6.44	4.25	-3.35	-1.57
	<b>Weighted mean</b>			-5.12	3.99	-1.48	-0.94

Source: Principal Investigators' Report, AICRP on Sugarcane, Varietal Improvement 2015-2016 and 2016-2017

**TABLE 4 - MEAN PERFORMANCE OF CO 10026 FOR POL % CANE (300 D) IN AICRP: ADVANCED VARIETAL TRIALS (AVT) (2015-2017)**

Character	Year of testing	No. of trials/locations	Co 10026	CoC 671 (Standard)	Co 94008 (Standard)	Co 85004 (Standard)	Co 10005 (Next best entry)
Pol (%) in cane Zonal mean	Plant-I (2015-16)	6	13.36	14.06	12.53	13.08	13.19
	Plant-II (2016-17)	8	14.08	14.22	13.46	14.10	14.02
	Ratoon (2016-17)	5	14.00	14.13	13.11	13.92	13.17
	<b>Weighted Mean</b>		13.58	13.95	12.74	13.47	13.50
Percentage increase or decrease over the checks & qualifying varieties	Plant-I (2015-16)			-4.98	6.62	2.14	1.29
	Plant-II (2016-17)			-0.98	4.61	-0.14	0.43
	Ratoon (2016-17)			-0.92	6.79	0.57	6.30
	<b>Weighted mean</b>			-2.65	6.59	0.82	0.59

Source: Principal Investigators' Report, AICRP on Sugarcane, Varietal Improvement 2015-2016 and 2016-2017

**TABLE 5 - PERFORMANCE OF CO 10026 IN STATES OF  
 MAHARASHTRA AND KARNATAKA**

2019

Crop	Entry	Maharashtra (Padegaon, Pune, Pravaranagar, Akola, Kolhapur			Karnataka (Mandya, Sankeshwar and Sameerwadi		
		CCS t/ha	Cane yield t/ha	Suc % 300d	CCS t/ha	Cane yield t/ha	Suc % 300d
I Plant	Co 10026	13.95	104.80	18.30	12.55	105.28	17.67
	<b>Stds CoC 671</b>	13.74	98.25	19.55	9.29	75.47	18.41
	<b>Co 94008</b>	11.26	82.16	17.86	10.62	88.54	17.75
	<b>Co 85004</b>	10.39	82.78	18.82	9.77	80.33	17.84
	% imp. over CoC 671	4.15	8.39	-6.31	37.67	42.89	-4.01
	% imp. over Co 94008	29.03	27.96	2.68	18.13	18.96	-0.45
	% imp. over Co 85004	38.38	29.39	-2.72	30.45	34.63	-0.87
II Plant	Co 10026	13.81	104.04	18.46	10.56	91.77	15.07
	<b>Stds CoC 671</b>	11.85	86.83	19.00	7.75	74.08	15.69
	<b>Co 94008</b>	10.41	84.65	17.17	8.45	81.00	14.26
	<b>Co 85004</b>	10.48	79.23	18.50	8.78	77.63	14.31
	% imp. over CoC 671	19.15	20.92	-2.67	35.09	25.40	-4.08
	% imp. over Co 94008	33.22	23.12	7.62	33.78	26.39	5.81
	% imp. over Co 85004	32.30	31.52	-0.02	21.09	20.13	5.33
Ratoon	Co 10026	12.18	92.93	18.24	10.21	80.67	18.67
	<b>Stds CoC 671</b>	9.03	71.68	18.01	8.61	62.33	19.86
	<b>Co 94008</b>	8.13	68.94	16.70	11.05	89.00	18.24
	<b>Co 85004</b>	8.39	65.25	18.17	10.04	75.33	19.51
	% imp. over CoC 671	39.97	34.94	1.74	18.58	29.42	-5.99
	% imp. over Co 94008	56.55	42.16	9.07	-7.60	-9.36	2.36
	% imp. over Co 85004	45.95	44.51	0.53	1.69	7.09	-4.31
Mean 2P+1R	Co 10026 <b>*Weighted Mean</b>	13.31	100.59	18.29	11.35	96.01	16.94
	<b>Stds CoC 671</b>	11.54	85.59	18.63	8.61	75.05	17.75
	<b>Co 94008</b>	9.94	78.58	17.14	9.57	84.21	16.85
	<b>Co 85004</b>	9.75	76.28	18.33	9.39	78.96	16.95
	% imp. over CoC 671	17.79	19.22	-1.63	32.04	28.48	-4.55
	% imp. over Co 94008	36.07	28.67	6.70	20.30	15.71	0.62
	% imp. over Co 85004	35.78	31.94	-0.11	21.02	21.80	-0.06

Source: Principal Investigators' Report, AICRP on Sugarcane, Varietal Improvement 2015-2016 and 2016- 2017