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## Research Article

### Co 12009: Midlate sugarcane variety for tropical India

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#### Abstract

Co 12009 was identified by ICAR-Sugarcane Breeding Institute, Coimbatore as a high yielding and midlate maturing variety which was selected from the cross of [(Co 7201 x (Co 62174 x SES 91)) x Co 88037] x Co 62198. The variety was approved in the 83<sup>rd</sup> meeting of the Central Sub Committee on Crop standards, Notification and released for cultivation as a midlate variety in the States of Andhra Pradesh, Chhattisgarh, Gujarat, Karnataka, Kerala, Maharashtra, Madhya Pradesh, Tamil Nadu and Telangana of Peninsular Zone. It has SES 91 (*S. spontaneum*) as a genetic base and is a product of three nobilized generations. It performed well in All India Coordinated Research Project AICRP(S) trials conducted across the centres of Peninsular zone for cane yield, sugar yield and sucrose % with an overall mean of 119.65 t/ha of cane yield, 17.31 t/ha of commercial cane sugar, 19.91 per cent of juice sucrose at 360 days of harvest in comparison with midlate standard Co 86032. It is an excellent ratooner with an improvement of 13.70 and 10.43 per cent for sugar and cane yield, respectively over Co 86032 and also performed well under 125 % RDF (recommended dose of fertilizer) condition and wide row spacing for cane yield and it was superior to all the three standards viz., CoC 671, Co 86032 and CoSnk 05103. It is resistant to red rot and proved its wide adaptability in varied environments and also a promising donor for drought. Co 12009 is viewed as a potential midlate variety and is expected to produce higher cane and sugar yield in the states of Peninsular zone.

**Keywords:** Co 12009, Midlate variety, Cane yield, sugar yield, Sugar cane

#### INTRODUCTION

In sugarcane cane, yield is an important character and varieties play an important role in sugarcane production and its sustainability. New varieties with high yield coupled with good quality and well suited for varied environments and different maturity phases are identified and are a continuous process. Intermittent and prolonged drought is observed in farmer's fields due to irregular rainfall patterns and hence clones that exhibit tolerance to low moisture levels are more desirable. Varietal development based on the evaluation of different genotypes under varying environmental conditions is essential to select high-yielding and stable varieties. There is a need to identify high yielding new crop varieties adapted to the varying ecological and climatic conditions. The varietal improvement programme at the ICAR -Sugarcane Breeding Institute, Coimbatore, is focused in developing superior varieties with the potential to increase sugar

yield and combining high cane yield, sucrose content and resistance to pests and diseases. Efforts are continuously being made to identify alternate sugarcane varieties that combine diverse background, high yield and varied adaptability with wide performance to the changing climatic/ecological conditions through multilocation testing to improve the productivity in tropical India. The midlate maturing sugarcane variety Co 12009, is a variety with a new genetic base of SES 91 (*S.spontaneum*) identified through multilocation testing in the tropical zone of India that combines high yield and quality in comparison with Co 86032 at twelve months of age indicating its potential as a high yielding variety with wide adaptability under varied environments and red rot resistance.

#### MATERIALS AND METHODS

Co 12009 was identified through hybridization and

selection of the cross [(Co 7201 x (Co 62174 x SES 91)) x Co 88037]] x Co 62198 of which SES 91 clone is a new genetic base involving *S. spontaneum*. It is the nobilized third back cross product of F<sub>1</sub> hybrid involving Co 62174 and SES 91 and crossed with viz., BGC 25021, Co 7201, Co 88037 and Co 62198 at three stages of nobilisation. The clone was evaluated in the ground nursery at ICAR-Sugarcane Breeding Institute, Research Centre, Agali and in subsequent clonal stages at ICAR- SBI, Coimbatore for yield and quality parameters during the period of 2006-2012. The clone was tested in Initial Varietal Trial (IVT) (2015-16) under the All India Coordinated Research Project on Sugarcane [AICRP(S)] in 14 centres of Peninsular India and promoted to advanced Varietal Trial (AVT) testing (2017-2019) in major tropical regions of sugarcane (Coimbatore, Akola, Basmathnagar, Kolhapur, Mandya, Navsari, Padegaon, Perumalpalpe, 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 6 m length spaced 90 cm apart. Normal cultural practices were followed and plant protection measures were carried out to raise a healthy crop (Sundara, 1998). Observations were recorded at 300 and 360 days on the number of millable canes ('000/ha), cane thickness (cm), cane height (cm), single cane weight (kg), CCS (t/ha) and cane yield (t/ha) at 360 days. Quality parameters (Brix %, Sucrose% and CCS %) were recorded at 300 and 360 days. The red rot reaction of this clone was evaluated under natural and artificial conditions with predominant red rot causing pathotype in the Peninsular region. Statistical analysis was carried out using a standard procedure (Singh and Chaudhary, 1985). The genealogy of Co12009 is given below.

## RESULTS AND DISCUSSION

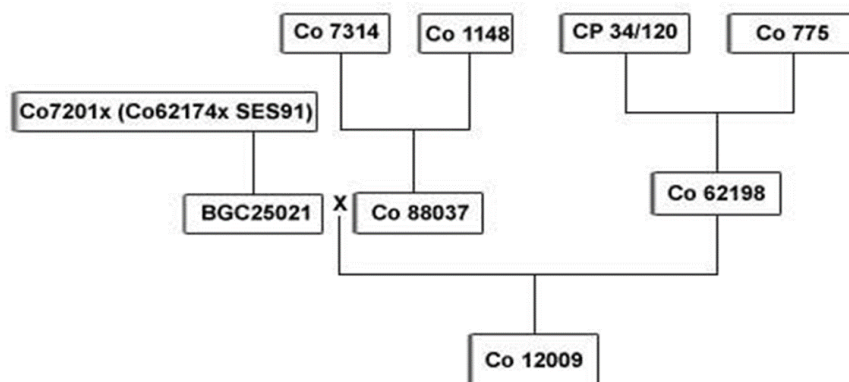
AVT (Two plant and one ratoon crops) were conducted in 14 centres of the Peninsular zone during 2017-2019. Co 12009 recorded 119.65 t/ha of cane yield, 17.31 t/ha of commercial cane sugar, 19.91 per cent of juice sucrose and 15.47 per cent of pol in the cane at 360 days of harvest (Table 1) and topped in 18 and 21 trials compared to all the standards for cane yield (t/ha) and sugar yield (t/ha), respectively. Co 12009 recorded an average CCS

yield of 17.31 t/ha from three crops (2P+1R) with an overall improvement of 10.40, 18.08 and 15.32 per cent for sugar yield over the best midlate standard Co 86032 (15.68 t/ha) and early standard varieties viz., CoC 671 (14.66 t/ha) and CoSnk 05103 (15.04 t/ha) from 21 trials. Co 12009 with an overall mean cane yield of 119.65 t/ha showed an improvement of 9.03, 23.42 and 7.92 per cent in comparison with the standards Co 86032 (109.73 t/ha), CoC 671 (96.93 t/ha) and CoSnk 05103 (110.85 t/ha), respectively (Table 2 and Table 3).

Co 12009 was the best entry in the ratoon trials with an improvement of 13.70 and 10.43 per cent for sugar and cane yield, respectively over Co 86032. It recorded 30.11 and 34.19 per cent improvement for sugar and cane yield, respectively over the early standard CoC 671.

Out of 33 locations tested, Co 12009 topped in 10 centres for juice sucrose % and 15 locations for Pol % cane. Co 12009 recorded 19.91 sucrose per cent with an improvement of 1.80 and 6.99 per cent over the midlate standard Co 86032 and early standard CoSnk 05103, respectively (Table 1). In ratoon crop, the entry showed an improvement of 2.52 and 8.07 per cent over the standards checks Co 86032 and CoSnk 05103, respectively. This entry performed well across the zone for cane and sugar yield, sucrose % and pol % cane. Among the 14 locations tested, Co 12009 topped in Padegaon, Basmathnagar and Perumalpalpe for juice sucrose % and CCS %. Co 12009 ranked first in five locations for Pol % cane. It recorded juice sucrose of 17.46 per cent at 300 days in comparison with Co 86032 (17.35 %) and CoSnk 05103 (16.34 %) with an improvement of 0.61 and 6.86 per cent over the checks, respectively.

The mean Pol% in cane in Co 12009 was 15.47 per cent which was 2.25 and 6.84 per cent improvement over the zonal standards Co 86032 and CoSnk 05103, respectively. It showed a 1.97 per cent improvement in Pol % in cane over the qualifying variety CoM 12085 (15.17 %). The entry recorded a mean CCS of 14.10 per cent across the zone with an overall improvement of 2.28 and 7.35 per cent over Co 86032 and CoSnk 05103, respectively.



**Table 1. Performance of Co 12009 (2P+1R) across 14 centres in Peninsular zone in advanced varietal trials (2017-2019) at 360 days**

| Entries/<br>Standards             | CCS<br>(t/ha) | Cane<br>yield<br>(t/ha) | Sucrose<br>% | CCS<br>% | Purity<br>% | Pol %<br>in cane | Cane<br>diameter<br>(cm) | Cane<br>length<br>(cm) | Single<br>cane<br>weight<br>(kg) | NMC<br>ooo/ha |
|-----------------------------------|---------------|-------------------------|--------------|----------|-------------|------------------|--------------------------|------------------------|----------------------------------|---------------|
| Co 12009                          | 17.31         | 119.65                  | 19.91        | 14.10    | 92.50       | 15.47            | 2.81                     | 294.36                 | 1.17                             | 93.02         |
| Co 86032                          | 15.68         | 109.73                  | 19.55        | 13.79    | 91.87       | 15.13            | 2.81                     | 252.66                 | 0.98                             | 97.70         |
| CoC 671                           | 14.66         | 96.93                   | 20.81        | 14.78    | 93.22       | 16.20            | 2.81                     | 251.83                 | 1.01                             | 84.30         |
| CoSnk 05103                       | 15.04         | 110.85                  | 18.61        | 13.14    | 91.11       | 14.48            | 2.48                     | 282.65                 | 0.80                             | 115.43        |
| % improvement<br>over Co 86032    | 10.40         | 9.03                    | 1.80         | 2.28     | 0.68        | 2.25             | -0.02                    | 16.50                  | 19.19                            | -4.79         |
| % improvement<br>over CoC 671     | 18.08         | 23.42                   | -4.30        | -4.57    | -0.77       | -4.51            | -0.18                    | 16.89                  | 15.58                            | 10.34         |
| % improvement<br>over CoSnk 05103 | 15.32         | 7.92                    | 6.99         | 7.35     | 1.52        | 6.84             | 13.13                    | 4.14                   | 46.78                            | -19.41        |

In Coimbatore, Co 12009 recorded a cane yield of 119.60 t/ha with an improvement of 21.60 per cent against Co 86032 (98.36 t/ha). It recorded a sugar yield of 17.05 t/ha in comparison with standard checks Co 86032 (13.78 t/ha), CoC 671 (13.80 t/ha) and CoSnk 05103 (14.74 t/ha) and showed an increase of 23.68, 23.56 and 15.65 per cent for sugar yield, respectively. In Padegaon, it recorded a sugar yield of 20.21 t/ha with an improvement of 11.64 and 9.62 per cent over CoC 671 and CoSnk 05103, respectively (**Table 2 and Table 3**).

Co 12009 performed well in Navsari, Padegaon, Pravaranagar, Perumallapalle, Kolhapur and Sankeshwar centres for cane and sugar yield. It performed well for juice sucrose % in Coimbatore, Padegaon, Kolhapur, Pune, Rudrur, Sankeshwar and Thiruvalla.

It recorded an overall improvement (2P+1R) of 9.48, 27.14, 28.47 and 19.16 per cent for cane yield over popular variety Co 86032 in Kolhapur, Navsari, Perumallapalle and Sankeshwar centres, respectively.

Co 12009 has the ideal plant characters of very tall, erect, thick canes and early fast growth with high tillering ability. The clone possesses tall canes of 294.36 cm in length. It recorded 16.50 per cent improvement for cane height over Co 86032 and 16.89 per cent over CoC 671. Single cane weight, the major component of yield trait was high which ranged from 1.21 kg (Rudrur) to 2.06 kg (Pravaranagar) and recorded an improvement of 19.19 per cent over Co 86032 (**Table 1**). Under wide row spacing of 120 cm between rows, Co 12009 recorded a cane yield of 158.83 t/ha with an improvement of 16.24, 11.61 and 10.41 per cent over CoC 671, Co 86032 and CoSnk 05103, respectively. The clone performed well under 125 % RDF (recommended dose of fertilizer) condition for cane yield and it was superior to standards viz., CoC 671, Co 86032 and CoSnk 05103 with an improvement of 11.50, 4.50 and 5.76 per cent, respectively (**Table 4**).

Identification and release of variety with resistance to new pathological or entomological stresses and improved adaptation to abiotic stresses like drought will have a great impact on sugarcane productivity. This variety with resistance to red rot and adaptation to varied environments is a boon for the Peninsular zone. Co 12009 was MS-MR (Plug) at Coimbatore, Navsari and Thiruvalla centres and resistant (Nodal) to red rot in all centres and smut in all centres except Pune (**Table 5**). However, no natural incidence of smut was observed during the evaluation period. Co 12009 is less susceptible to top borer in Mandya. It was less susceptible to moderately susceptible for early shoot borer, internode borer, mealy bug (except in Padegaon) and scale insect (**Table 6**).

The variety has distinct morphological characters (**Table 7**). It has very tall, erect, thick, greenish wax coated canes with smooth, zigzag, cylindrical to bobbin shaped long internodes, yellow orange growth ring and light yellow dewlap. It is characterized by prominent deep bud grooves, small ovate buds, open tip droopy leaves and a green sheath with very light spines.

The identified midlate variety was compared with Co 86032 for its juice sucrose % and cane yield at 360 days. It combines high yield and quality in comparison with Co 86032 at ten and 12 months of age indicating its potential as a high yielding clone for the tropical zone. Co 12009 possess high and stable yield and better quality characteristics in plant and ratoon crops across the 14 centres of the Peninsular zone in comparison with the popular variety Co 86032. It combines red rot resistance and would certainly suit cultivation in the Peninsular zone. Co 12009 (THE GAZETTE OF INDIA :3099 4773/G/2020) is viewed as a potential midlate variety and is expected to produce higher cane and sugar yield in the states of the Peninsular Zone.

Table 2. Performance of Co 12009 in Peninsular zone for CCS (t/ha)

| Crop           | Entry                | Coim batore | Akola  | Basmat hnagar | Kolha pur | Mand ya | Nav sari | Pade gaon | Peruma lapalle | Pravar anagar | Pune   | Rud rur | Samee rwadi | Sankes hwar | Thiru valla | Mean |
|----------------|----------------------|-------------|--------|---------------|-----------|---------|----------|-----------|----------------|---------------|--------|---------|-------------|-------------|-------------|------|
| I Plant        | Co 12009             | 15.34       | 14.33  | 22.57         | 16.03     | 17.30   | 22.71    | 13.47     | 20.51          | 21.12         | 8.67   | 6.44    | 18.15       | 8.95        | 18.15       |      |
|                | Co 86032             | 14.43       | 8.88   | 17.31         | 12.32     | 12.99   | 20.58    | 14.69     | 22.10          | 19.68         | 13.08  | 8.43    | 12.72       | 10.72       | 15.57       |      |
|                | CoC 671              | 15.28       | 10.86  | 17.05         | 11.50     | 15.14   | 20.04    | 17.41     | 20.24          | 19.12         | 16.43  | 4.72    | 13.80       | 8.73        | 16.04       |      |
|                | CoSnk 05103          | 14.29       | 12.27  | 17.15         | 9.32      | 11.84   | 18.55    | 15.03     | 16.37          | 18.94         | 9.75   | 6.33    | 12.44       | 6.76        | 14.62       |      |
|                | % over Co 86032      | 6.31        | 61.37  | 30.39         | 30.11     | 33.18   | 10.35    | -8.30     | -7.19          | 7.32          | -33.72 | -23.61  | 42.69       | -16.51      | 16.57       |      |
| II Plant       | % over CoC 671       | 0.39        | 31.95  | 32.38         | 39.39     | 14.27   | 13.32    | -22.63    | 1.33           | 10.46         | -47.23 | 36.44   | 31.52       | 2.52        | 13.13       |      |
|                | % over CoSnk 05103   | 7.35        | 16.79  | 31.60         | 72.00     | 46.11   | 22.43    | -10.38    | 25.29          | 11.51         | -11.08 | 1.74    | 45.90       | 32.40       | 24.15       |      |
|                | Co 12009             | 17.31       | 2.08   | 14.88         | 12.12     | 17.74   | 20.66    | 18.16     | 19.55          | 16.54         | 21.31  | 25.91   | 17.18       | 11.97       | 17.84       |      |
|                | Co 86032             | 14.12       | 3.00   | 15.20         | 14.76     | 14.69   | 21.95    | 12.91     | 19.37          | 17.55         | 16.62  | 29.45   | 17.01       | 12.53       | 17.15       |      |
|                | CoC 671              | 13.36       | 1.84   | 13.87         | 14.73     | 13.79   | 21.31    | 10.65     | 17.17          | 16.77         | 13.61  | 21.61   | 16.73       | 12.54       | 15.54       |      |
| Ratoon         | CoSnk 05103          | 14.64       | 5.80   | 15.86         | 15.85     | 13.68   | 20.26    | 11.25     | 17.77          | 16.50         | 11.07  | 26.93   | 15.88       | 12.41       | 15.92       |      |
|                | % over Co86032       | 22.59       | -30.67 | -2.11         | 10.83     | 20.76   | -5.88    | 40.67     | 0.93           | -5.75         | 28.22  | -12.02  | 1.00        | -4.47       | 4.02        |      |
|                | % over CoC 671       | 29.57       | 13.04  | 7.28          | 16.54     | 28.64   | -3.05    | 70.52     | 13.86          | -1.37         | 56.58  | 19.90   | 2.69        | -4.55       | 14.80       |      |
|                | % . over CoSnk 05103 | 18.24       | -64.14 | -6.18         | 24.95     | 29.68   | 1.97     | 61.42     | 10.02          | 0.24          | 92.50  | -3.79   | 8.19        | -3.55       | 12.06       |      |
|                | Co 12009             | 18.49       | 14.40  | 14.40         | 11.39     | 14.22   | 17.25    | 15.25     | 20.54          | 19.54         | 12.50  | 7.60    | 14.11       | 8.96        | 15.77       |      |
| Mean 2P+1R     | Co 86032             | 12.80       | 12.82  | 12.82         | 13.32     | 11.49   | 16.47    | 9.13      | 21.57          | 17.34         | 15.06  | 10.43   | 8.73        | 9.97        | 13.87       |      |
|                | CoC 671              | 12.75       | 10.48  | 10.48         | 7.54      | 11.06   | 12.95    | 11.64     | 18.34          | 12.63         | 17.13  | 2.57    | 6.68        | 8.41        | 12.12       |      |
|                | CoSnk 05103          | 15.29       | 13.38  | 13.38         | 16.02     | 11.54   | 16.49    | 9.93      | 17.28          | 16.47         | 15.38  | 13.27   | 11.32       | 9.12        | 14.31       |      |
|                | % over Co 86032      | 44.45       | 12.32  | 12.32         | -14.49    | 23.76   | 4.74     | 67.03     | -4.78          | 12.69         | -17.00 | -27.13  | 61.63       | -10.13      | 13.67       |      |
|                | % over CoC 671       | 45.02       | 37.40  | 37.40         | 51.06     | 28.57   | 33.20    | 31.01     | 12.00          | 54.71         | -27.03 | 195.72  | 111.23      | 6.54        | 30.11       |      |
| *Weighted mean | % over CoSnk 05103   | 20.93       | 7.62   | 7.62          | -28.90    | 23.22   | 4.61     | 53.58     | 18.87          | 18.64         | -18.73 | -42.73  | 24.65       | -1.12       | 10.20       |      |
|                | Co 12009             | 17.05       | 14.33  | 14.88         | 13.18     | 16.42   | 20.21    | 15.63     | 20.20          | 19.07         | 16.91  | 25.91   | 16.48       | 11.97       | 17.31*      |      |
|                | Co 86032             | 13.78       | 8.88   | 15.20         | 13.47     | 13.06   | 19.67    | 12.24     | 21.01          | 18.19         | 15.84  | 29.45   | 12.82       | 12.53       | 15.68*      |      |
|                | CoC 671              | 13.80       | 10.86  | 13.87         | 11.26     | 13.33   | 18.10    | 13.23     | 18.58          | 16.17         | 15.37  | 21.61   | 12.40       | 12.54       | 14.66*      |      |
|                | CoSnk 05103          | 14.74       | 12.27  | 15.86         | 13.73     | 12.35   | 18.43    | 12.07     | 17.14          | 17.30         | 13.23  | 26.93   | 13.21       | 12.41       | 15.04*      |      |
| % over Co86032 | % over Co86032       | 23.68       | 61.37  | -2.11         | 18.46     | 25.76   | 2.75     | 27.63     | -3.87          | 4.82          | 6.72   | -12.02  | 28.55       | -4.47       | 10.40       |      |
|                | % over CoC 671       | 23.56       | 31.95  | 7.28          | 17.09     | 23.18   | 11.64    | 18.09     | 8.70           | 17.89         | 9.99   | 19.90   | 32.87       | -4.55       | 18.08       |      |
|                | % over CoSnk 05103   | 15.65       | 16.79  | -6.18         | -4.01     | 32.92   | 9.62     | 29.47     | 17.85          | 10.19         | 27.83  | -3.79   | 24.72       | -3.55       | 15.32       |      |

Table 3. Performance of Co 12009 in Peninsular zone for Cane yield (t/ha)

| Crop           | Entry              | Coimbatore | Akola  | Basmat Innagar | Kolha pur | Mand ya | Nav sari | Pade gaon | Perumal apalle | Pravar anagar | Pune   | Rud rur | Sameer wadi | Sankesh war | Thiru valla | Mean   |
|----------------|--------------------|------------|--------|----------------|-----------|---------|----------|-----------|----------------|---------------|--------|---------|-------------|-------------|-------------|--------|
| I Plant        | Co 12009           | 112.91     | 112.95 | 141.56         | 119.55    | 128.70  | 149.85   | 106.84    | 137.31         | 144.32        | 66.58  | 54.63   | 122.78      | 68.54       | 127.68      |        |
|                | Co 86032           | 108.00     | 79.57  | 122.14         | 94.37     | 106.20  | 139.57   | 109.44    | 138.42         | 139.02        | 99.03  | 71.14   | 100.07      | 87.29       | 113.68      |        |
|                | CoC 671            | 102.61     | 84.22  | 104.89         | 81.93     | 108.15  | 123.55   | 122.55    | 131.30         | 124.18        | 128.52 | 34.18   | 89.45       | 65.00       | 107.28      |        |
|                | CoSnk 05103        | 114.68     | 90.10  | 124.38         | 69.71     | 109.26  | 129.73   | 131.48    | 115.10         | 134.61        | 78.37  | 56.02   | 87.29       | 57.41       | 110.63      |        |
| II Plant       | % over Co 86032    | 4.55       | 41.95  | 15.90          | 26.68     | 21.19   | 7.37     | -2.38     | -0.80          | 3.81          | -32.77 | -23.21  | 22.69       | -21.48      | 12.32       |        |
|                | % over CoC 671     | 10.04      | 34.11  | 34.96          | 45.92     | 19.00   | 21.29    | -12.82    | 4.58           | 16.22         | -48.19 | 59.83   | 37.26       | 5.45        | 19.02       |        |
|                | % over CoSnk 05103 | -1.54      | 25.36  | 13.81          | 71.50     | 17.79   | 15.51    | -18.74    | 19.30          | 7.21          | -15.04 | -2.48   | 40.66       | 19.39       | 15.41       |        |
|                | Co 12009           | 121.47     | 16.71  | 111.65         | 120.67    | 90.41   | 127.47   | 135.11    | 132.63         | 134.19        | 112.37 | 153.93  | 93.87       | 128.49      | 96.94       | 119.94 |
| Ratoon         | Co 86032           | 98.84      | 23.11  | 93.38          | 115.09    | 103.90  | 146.98   | 98.14     | 135.23         | 123.22        | 145.47 | 102.35  | 125.46      | 92.50       | 113.62      |        |
|                | CoC 671            | 84.83      | 14.39  | 94.37          | 103.80    | 96.63   | 135.95   | 73.47     | 116.71         | 110.79        | 100.58 | 81.94   | 113.85      | 92.22       | 99.78       |        |
|                | CoSnk 05103        | 106.43     | 46.60  | 110.47         | 107.15    | 116.67  | 140.97   | 95.58     | 124.48         | 120.35        | 112.78 | 89.50   | 122.26      | 96.81       | 111.32      |        |
|                | % over Co86032     | 22.90      | -27.69 | 19.57          | 4.85      | -12.98  | -8.08    | 35.14     | -0.77          | -8.81         | 5.82   | -8.29   | 2.42        | 4.80        | 5.56        |        |
| Mean 2P+1R     | % over CoC 671     | 43.19      | 16.12  | 18.31          | 16.25     | -6.44   | -0.62    | 80.52     | 14.98          | 1.43          | 53.04  | 14.56   | 12.86       | 5.12        | 20.20       |        |
|                | % over CoSnk 05103 | 14.13      | -64.14 | 1.07           | 12.62     | -22.51  | -4.16    | 38.76     | 7.80           | -6.63         | 36.49  | 4.88    | 5.10        | 0.13        | 7.74        |        |
|                | Co 12009           | 124.42     | 91.63  | 79.03          | 105.65    | 113.62  | 113.99   | 146.49    | 131.46         | 104.70        | 64.14  | 101.32  | 74.57       | 111.23      |             |        |
|                | Co 86032           | 88.23      | 86.00  | 96.89          | 81.95     | 115.89  | 67.55    | 154.19    | 122.68         | 123.50        | 79.20  | 70.36   | 76.80       | 100.72      |             |        |
| *Weighted mean | CoC 671            | 78.03      | 67.91  | 50.26          | 79.33     | 91.03   | 80.85    | 80.52     | 123.18         | 84.09         | 127.42 | 21.67   | 46.82       | 66.57       | 82.89       |        |
|                | CoSnk 05103        | 119.76     | 92.36  | 116.60         | 91.94     | 120.85  | 92.49    | 92.49     | 133.11         | 119.41        | 129.32 | 107.84  | 88.90       | 70.55       | 110.47      |        |
|                | % over Co 86032    | 41.02      | 6.55   | -18.43         | 28.92     | -1.96   | 68.75    | -4.99     | 7.16           | -15.22        | -19.02 | 44.00   | -2.90       | 10.43       |             |        |
|                | % over CoC 671     | 59.45      | 34.93  | 57.24          | 33.18     | 24.82   | 40.99    | 18.92     | 56.33          | -17.83        | 195.99 | 116.40  | 12.02       | 34.19       |             |        |
| Mean 2P+1R     | % over CoSnk 05103 | 3.89       | -0.79  | -32.22         | 14.91     | -5.98   | 23.25    | 10.05     | 10.09          | -19.04        | -40.52 | 13.97   | 5.70        | 0.69        |             |        |
|                | Co 12009           | 119.60     | 112.95 | 111.65         | 120.61    | 132.86  | 117.82   | 139.33    | 129.38         | 109.04        | 93.87  | 117.53  | 96.94       | 119.65*     |             |        |
|                | Co 86032           | 98.36      | 79.57  | 93.38          | 107.74    | 98.39   | 134.15   | 91.71     | 142.61         | 128.31        | 112.34 | 102.35  | 98.63       | 92.50       | 109.73*     |        |
|                | CoC 671            | 88.49      | 84.22  | 94.37          | 92.20     | 76.27   | 116.84   | 92.29     | 123.73         | 106.35        | 61.13  | 81.94   | 83.37       | 92.22       | 96.93*      |        |
| Mean 2P+1R     | CoSnk 05103        | 113.62     | 90.10  | 110.47         | 107.96    | 100.99  | 130.52   | 106.52    | 124.23         | 124.79        | 110.31 | 89.50   | 99.48       | 96.81       | 110.85*     |        |
|                | % over Co86032     | 21.60      | 41.95  | 19.57          | 9.48      | -2.09   | -0.96    | 28.47     | -2.30          | 0.84          | -2.94  | -8.29   | 19.16       | 4.80        | 9.09        |        |
|                | % . over CoC 671   | 35.16      | 34.11  | 18.31          | 27.93     | 26.30   | 13.71    | 27.66     | 12.61          | 21.65         | 78.38  | 14.56   | 40.97       | 5.12        | 24.08       |        |
|                | % over CoSnk 05103 | 5.26       | 25.36  | 1.07           | 9.25      | -4.62   | 1.80     | 10.61     | 12.15          | 3.68          | -1.16  | 4.88    | 18.14       | 0.13        | 7.93        |        |

**Table 4. Adaptability to Agronomic Variables**

| Trait             | Row Spacing                       | Co 12009   | CoC 671 | Co 86032 | CoSnk 05103 |
|-------------------|-----------------------------------|--|---------|----------|-------------|
| Cane yield (t/ha) | Normal                            | 158.83   | 136.63  | 140.38   | 142.30      |
|                   | Wide row                          | 126.31   | 119.07  | 132.03   | 127.30      |
|                   | Percentage gain or loss when sown | i) Normal : 16.24, 11.61 and 10.41 % higher cane yield over CoC 671 , Co 86032 and CoSnk 05103<br>ii)Wide row : 6.08 % higher than CoC 671   |         |          |             |
|                   | Fertilizer                        | The response of new promising elite genotype Co 12009 to higher level of fertilizer i.e. 125 % RDF (350:78.13:150 kg NPK/ha) was studied and it gave 11.50 %, 4.50 and 5.76 % higher cane yield over CoC 671, Co 86032 and CoSnk 05103 respectively. |         |          |             |

**Table 5. Reaction of Co 12009 to major diseases**

| Disease | Method of evaluation | Trial             | Test Centers |     |       |     |     |     | CoC 671 |
|---------|----------------------|-------------------|--------------|-----|-------|-----|-----|-----|---------|
|         |                      |                   | Plug         |     | Nodal |     |     |     |         |
|         |                      |                   | CBE          | NAV | TVA   | CBE | NAV | TVA |         |
| Red rot | Artificial           | IVT (2015-16)     | MS           | MR  | MR    | R   | R   | R   | HS      |
|         |                      | AVT-I (2017-18)   | -            | MR  | MS    |     | R   | S   | HS      |
|         |                      | AVT- II (2018-19) | -            | MR  | MS    |     | R   | S   | HS      |
| Smut    | Artificial           |                   |              | KLP | PDN   | SKW | NAV | PNE | Co 740  |
|         |                      | IVT (2015-16)     |              | MS  | MS    | R   | MS  | HS  | HS      |
|         |                      | AVT-I (2017-18)   |              | MS  | MR    | MS  | HS  |     | HS      |
|         |                      | AVT- II (18-19)   |              | MS  |       |     | MS  | HS  | HS      |

Testing centers: CBE- Coimbatore, NAV- Navsari; TVA- Thiruvalla; KLP- Kohlapur; PDN- Padegaon; SKW- Sankeshwar; PNE- Pune; AKL- Akola

**Reaction :** R- Resistant, MR-Moderately resistant, MS-Moderately susceptible , HS –Highly Susceptible

**Table 6. Reaction of Co 12009 to insect pests**

| Pest              | Method of evaluation | Trial                 | Name of variety: Co 12009 |     |     |     |     |     |     |
|-------------------|----------------------|-----------------------|---------------------------|-----|-----|-----|-----|-----|-----|
|                   |                      |                       | PDN                       | CBE | NAV | MDY | PUN | AKL | PWD |
| Early shoot borer | Natural              | IVT Midlate (2015-16) | MS                        | LS  | LS  | LS  | LS  | LS  | MS  |
|                   |                      | AVT-I (2017-18)       | MS                        |     |     |     | MS  | -   | MS  |
|                   |                      | AVT II (2018-19)      |                           | MS  |     |     |     |     |     |
| Internode Borer   | Natural              | IVT Midlate (2015-16) | MS                        | HS  | LS  | MS  | LS  |     |     |
|                   |                      | AVT-I (2017-18)       | LS                        | HS  |     | LS  | MS  | -   | -   |
|                   |                      | AVT II (2018-19)      |                           | LS  |     |     |     |     |     |
| Top Borer         | Natural              | IVT Midlate (2015-16) |                           | LS  | LS  | LS  |     |     |     |
|                   |                      | AVT-I (2017-18)       | -                         |     | -   | LS  |     |     |     |
| Mealy bug         | Natural              | IVT Midlate (2015-16) | MS                        |     | LS  |     | LS  |     |     |
|                   |                      | AVT-I (2017-18)       | HS                        |     | -   | -   | LS  | -   | -   |
| Scale insect      | Natural              | IVT Midlate (2015-16) | MS                        |     | LS  |     |     |     |     |
|                   |                      | AVT I (2017-18)       |                           |     |     | -   | -   | LS  |     |
|                   |                      |                       | MS                        |     |     |     |     |     |     |

**Testing centres:**NAV –Navasari, PDN – Padegaon, MDY-Mandya, PUN – Pune, AKL – Akola

**Reaction :** MS-Moderately susceptible : LS –Less susceptible ; HS –Highly Susceptible  
Adaptability to Agronomic Variables

Table 7. Distinguishing morphological characters

| S. No. | Traits                  | Description   |
|--------|-------------------------|---|
| 1.     | Parentage               | [[{(Co7201x(Co62174xSES91))*Co 88037}]] x Co 62198  |
| 2.     | Stool habit             | Erect   |
| 3.     | Stem colour (E)         | Light green (Yellow green)  |
| 4.     | Stem colour (UE)        | Light green (Yellow green)  |
| 5.     | Ivory marks             | Absent  |
| 6.     | Corky patches           | Absent  |
| 7.     | Internode shape         | Cylindrical – Bobbin  |
| 8.     | Internode alignment     | Straight - slightly zigzag  |
| 9.     | Internode diameter      | 2.9 cm  |
| 10.    | Splits                  | Absent  |
| 11.    | Wax                     | Heavy   |
| 12.    | Node swelling           | Absent  |
| 13.    | Root zone colour (E)    | Green   |
| 14.    | Root zone colour (UE)   | Yellow green  |
| 15.    | Number of root eye rows | Three   |
| 16.    | Arrangement             | Irregular   |
| 17.    | Bud size                | Small   |
| 18.    | Bud shape               | Oval, pointed   |
| 19.    | Bud cushion             | Absent  |
| 20.    | Gerpore position        | Apical  |
| 21.    | Bud groove              | Deep, near bud prominent  |
| 22.    | Growth ring colour      | Yellow orange   |
| 23.    | Leaf length             | 1.4 m   |
| 24.    | Leaf width              | 6.0 cm  |
| 25.    | Lamina colour           | Green   |
| 26.    | Leaf carriage           | Open, tip droopy  |
| 27.    | Leaf sheath colour      | Green   |
| 28.    | Leaf sheath waxiness    | Medium  |
| 29.    | Leaf sheath spines      | Very light  |
| 30.    | Leaf sheath clasping    | Tight   |
| 31.    | Dewlap colour           | Light yellow  |
| 32.    | Ligular process         | Transitional on one side and short lanceolate on other side   |
| 33.    | Shape of ligule         | Straight with lozenge   |
| 34.    | Flowering               | 30%   |
| 35.    | Salient characteristics | Greenish, wax coated, long internodes, prominent bud groove, tall canes, closed droopy canopy and slightly bobbin shaped canes. |

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