# Tiller dynamic studies for realizing higher cane yield under ratoon management practices in sugarcane


**Abstract**

A field experiment was conducted at Regional Sugarcane and Rice Research Station, Rudrur, during 2021-2022 to study the effect of ratoon management practices on cane yield in sugarcane. Use of tractor drawn ratoon manager (which shaves stubbles and cut the older roots) and band application of 125 kg N/ha at the time of ratooning with ratoon manager followed by application of 62.5 kg N/ha at 45, 90 and 120 days after ratooning recorded highest cane yield of 81.96 t/ha which was 30.3% more over farmers practice (burning of trash and application N in 4 equal splits @ 62.5 kg/ha at basal, 45, 90 and 120 days after ratooning) where it was recorded only 57.13 t/ha. Use of tractor drawn ratoon manager and band application of 125 kg N/ha at the time of ratooning with ratoon manager recorded highest gross returns of Rs. 2,65,623/- which is 31.32% more than farmers practice with a BC ratio of 2.26.



***Keywords:*** *Tiller Dymanics, Ratooning, Sugarcane Cane yield, ratoon manager, Band application.*


## 1. Introduction

The quintessence of ratoon cropping lies in reduced cost of production, saving of energy and early maturity by 4 to 5 weeks. Ratooning of sugarcane is a common practice throughout the world and ratoon occupies almost 50 per cent of the total area under sugarcane cultivation and contributes 30% to the total cane production in the country (Ahmed and Giridharan 2000). The area under ratoons is relatively greater in the tropical states (50% - 55%) than in the sub-tropical states (40% - 45%). The decline in cane yield in successive ratoons is common in most of the sugarcane growing areas. The average yield gap between plant and ratoon crop in the country is 20% - 25%. The gaps arise mainly due to death of stubble bud, its failure to sprout owing to cold or mechanical injury and or bud damage by pests build-up (termites) at root zone. Reports are available that the poor sprouting, uneven and continuous tillering during entire period of crop results in sixty percent mortality of tillers and thus less millable canes at harvest (Bhale 1994). Any short in 3 viable stubbles/m row length leads to gappy crop stand. When such gaps exceed more than 15%, the loss in cane yield becomes inevitable. Ratoon productivity is the ultimate expression of interplay of several factors such as the ratooning ability of a given variety, the influence of environment and ratoon management practices (Zhou et al, (2003)). Sugarcane ratoon management practices that minimize tiller senescence and optimize the number of tillers that a variety can carry to maturity are likely to increase the number and size of millable stalks and may increase cane yield (Singh et al. 2010). Therefore, the aim of the present study was to study the effect of ratoon management practices on cane yield in sugarcane.

## 2. Materials and Methods

A field experiment was conducted at Regional Sugarcane and Rice Research

Station, Rudrur (India) from 2021-2022 situated at an altitude of 286.3 m above mean sea level (amsl) at 18° 49'41" N latitude and 78°56'45" E longitude. The experimental site is in Northern Telangana agro climatic zone of Telangana state, India and experiences semiarid climate. According to Trolls classification, the site falls under semi arid tropics (SAT). The long-term (2020-2022) temperature and precipitation data of the site, collected from weather station (RS&RRS, Rudrur, station). The climate is sub tropical-monsoonic with an average rainfall of 1059 mm, 70-80 per cent of which occurs during June to September. The summer months are very hot with maximum temperature ranging from 40 to 45°C in April and May whereas, December and January are the coldest months (lowest January temperature as low as 13-15 °C). The weekly mean relative humidity ranged from 50.9 to 83.15 while average relative humidity was 72.5 %. Prior to the start of experiment, a composite soil sample from 30 cm depth was analyzed for various physicochemical characteristics of the soil. For analysis of nitrogen (N), phosphorous (P) and potash (K) soil sampling was done after the harvest of the crop. Texturally, the soil in the study site was heavy black soil in the 0–30 cm soil layer. The bulk density of the soil were determined by drying the samples in oven at 105 °C for 24 h and recorded 1.02 g/cm³. The pH of soil is 7.50 and organic carbon 0.36% with EC of 0.153 d $Sm^{-1}$. The soil was low (193.5 kg N $ha^{-1}$), high (65.01 kg $P_2O_5$ kg $ha^{-1}$) and high (370.3 kg $K_2O$ $ha^{-1}$) in available nitrogen, phosphorus and potassium, respectively. The experiment was laid out in Randomized Block Design with four treatments viz., $T_1$: Burning of left over trash and broadcasting of basal fertilizer doses (farmer's practice). $T_2$: Chopping and surface retention of trash and broadcasting of basal fertilizer doses. $T_3$: Use of ratoon manager and band application of basal doses of fertilizers. $T_4$: Same as $T_3$ + double dose of basal fertilizer (N) replicated five times. Each plot (9 x 9 m) was separated by 1m of transition zone while replication was demarcated by a buffer zone of 1.5 m in between. Recommended dose of fertilizers (RDF) were applied at the rate of 250:100:120 kg $ha^{-1}$ to the main crop. Except at basal application (broadcasted), top dressing was done by spot application of fertilizers at 5 cm below soil. The crop variety selected was 'Co 86032' which is having high profuse tillering nature. Tiller count was taken at 90 and 120 DAP. Cane length, single cane weight and cane yield was recorded at the time of harvest. The data were analyzed statistically by applying the technique of analysis of variance for randomized block design and significance was tested by F-test. Critical difference for treatment means tested for their significance was calculated at 5% level of probability.

## 3. Results and Discussions

### 3.1 Tiller count at 90 and 120 DAP:

Data pertaining to tiller count was presented in table 1. After ratooning, stubble sprouting initiated 12 days after ratooning treatment. Data regarding tiller count at 90 DAP indicated that, use of ratoon manager and band application of double dose of basal N fertilizers treatment recorded significantly highest number of tiller (46.48) and it was at par with ratoon manager and band application of basal doses of fertilizers treatment (41.24). Lowest number of tillers were recorded in farmers practice that is burning of left over trash and broadcasting of fertilizers (34.94). At 120 DAP, use of ratoon manager and band application of double dose of basal N fertilizers treatment recorded significantly highest number of tillers (85.83). The higher tiller population was mainly due to higher number of buds

sprouted/ unit area and supported by application of fertilizer. This was followed by ratoon manager and band application of basal doses of fertilizers treatment (72.97). Lowest number of tillers were recorded in farmer's practice (57.42). These results are in conformity with the findings obtained by Shukla et al. (2009).

### 3.2 Yield Attributes

Higher doses application of fertilizer improved the yield attributes, *viz.*, number of millable canes, cane length and stump weight, significantly.

#### 3.2.1 Cane length (cm):

Data regarding cane length was presented in table 1. Significantly highest cane length was recorded in use of ratoon manager and band application of double dose of basal N fertilizers treatment (278.4) and it was followed by ratoon manager and band application of basal doses of fertilizers treatment (254.1) and surface retention of trash and basal application of fertilizer (245.5). These finds are in relation with Singh et al (2005). Lowest number of tillers were recorded in farmers practice that is burning of left over trash and broadcasting of fertilizers (233.3).

#### 3.2.2 Number of Milleable Canes ('000/ha):

Data regarding NMC was presented in table 2. Significantly highest NMC was recorded in use of ratoon manager and band application of double dose of basal N fertilizers treatment (74.45) and it was followed by ratoon manager and band application of basal doses of fertilizers treatment (63.28). This might be due to higher higher sprouting and higher viable tiller population. These finds are in agreement with Lalitha et al. (2021). Lowest NMC was recorded in chopping and surface retention of trash and thereafter broadcasting of basal fertilizer doses treatments (58.10).

#### 3.2.3 Stump Weight (kg/stump):

Use of ratoon manager and band application of double dose of basal N fertilizers treatment recorded statistically highest stump weight (8.93) which was followed by ratoon manager and band application of basal doses of fertilizers treatment (7.60) and chopping and surface retention of trash and thereafter broadcasting of basal fertilizer doses treatments (7.09) (Table 2). These results were in confirmity with Patel and Vejapara (2016).

### 3.3 Cane Yield (t/ha):

Data regarding cane yield was presented in table 2. Two years pooled data indicates that, significantly highest cane yield was recorded in use of ratoon manager and band application of double dose of basal fertilizers treatment (81.96 t/ha) and was followed by ratoon manager and band application of basal doses of fertilizers treatment (71.74 t/ha) and was statistically on par with chopping and surface retention of trash and broadcasting of basal fertilizer doses treatments (68.52 t/ha). Use of ratoon manager and band application of double dose of basal fertilizers treatment recorded 30.29%, 16.39% and 12.46% higher yield than farmer's practice, surface retention of trash and use of ratoon manager and band application of basal doses of fertilizers respectively. The current result was in agreement with works of Sakaigaichi et al. (2013).

### 3.3 Economics:

Data regarding economics presented in table 3. Significantly highest gross returns (₹/ha 2,65,623) and net returns (₹/ha 1,46,063) and BC ratio (2.26) was recorded in use of ratoon manager and band application of double dose of basal N

fertilizers treatment which was followed by ratoon manager and band application of basal doses of fertilizers treatment. Lowest gross returns (₹/ha 1,82,414) and net returns (₹/ha 80,669) and BC ratio (1.81) was recorded in burning of trash that is farmers practice. These findings are in agreement with Lalitha et al. 2021.

## Conclusion

All the ratoon management practices exhibited effective tiller count over farmers practice. However, use of tractor drawn ratoon manager (which shaves stubbles and cut the older roots) and band application of 125 kg N/ha at the time of ratooning with ratoon manager followed by application of 62.5 kg N/ha at 45, 90 and 120 days after ratooning recorded highest cane yield of 81.96 t/ha which was 30.3% more over farmers practice (burning of trash and application N in 4 equal splits @ 62.5 kg/ha at basal, 45, 90 and 120 days after ratooning) where it was recorded only 57.13 t/ha. Use of tractor drawn ratoon manager and band application of 125 kg N/ha at the time of ratooning with ratoon manager recorded highest gross returns of Rs. 2,65,623/- which is 31.32% more than farmers practice (Rs. 1,62,414/-) with a BC ratio of 2.26.

## References


1. Ahmed S, Giridharan N. Study on the influence of management practices on sugarcane ratoon crop. Indian Sugar 2000; 49 (10):835-837.
2. Bhale VMG. Effect of Growth Regulators and Cultural Treatment on Productivity of Ratoon Cane. Indian Sugar 1994; 44 (8): 645-651.
3. Lalita Rana, Manish Kumar, Navnit Kumar, Anil Kumar, Singh AK. Multi-ratooning in sugarcane. Indian Farming 2021; 71(05): 28–30.
4. Patel SS, Vejapara VP. Adoption of ratoon management practices by the sugarcane growers. Gujarath Journal of Extension Education 2016; 27 (2): 175-176.
5. Sakaigaichi T, Terajima Y, Terauchi T, Hattori T, Ishikawa, S, Hattori I et al. Effect of stubble shaving after high-level cutting on the growth and yield of forage sugarcane, KRFo93-1, under multiple ratooning cultivation. Plant Production Science (2005); 16, 183–190.
6. Singh GK, Yadav RL, Shukla SK. Effect of planting geometry, nitrogen and potassium application on yield and quality of ratoon sugarcane in sub-tropical climatic conditions. Indian Journal of Agricultural Sciences 2010; 80 (12):-1038–1042.
7. Singh RK, Singh SP, Singh SB. Correlation and path analysis in sugarcane ratoon. Sugar Tech, 2005; 7, 176–178.
8. Shukla SK, Yadav RL, Singh PN, Singh I. Potassium nutrition for improving stubble bud sprouting, dry matter partitioning and nutrient uptake in winter initiated ratoon. European Journal of Agronomy . 2009; 30 (1): 27–33.
9. Zhou MM, Singels A, Savage MJ. Physiological parameters for modelling differences in canopy development between sugarcane cultivars. Proceedings of South African Sugar. Technology Association 2003; 77, 610-621.


**Table 1 Effect of ratoon management practices on growth parameters of sugarcane**

| Treatments | Tiller count ('000/ha) | | | | | | Cane length (cm) | | |
|---|---|---|---|---|---|---|---|---|---|
| | 90 DAP | | | 120 DAP | | | | | |
| | 2021 | 2022 | Pooled | 2021 | 2022 | Pooled | 2021 | 2022 | Pooled |
| $T_1$ | 33.46 | 36.43 | 34.94 | 69.63 | 45.20 | 57.42 | 240.9 | 225.8 | 233.3 |
| $T_2$ | 41.21 | 40.70 | 40.95 | 83.53 | 52.80 | 68.30 | 276.9 | 214.0 | 245.5 |
| $T_3$ | 35.57 | 46.90 | 41.24 | 79.79 | 64.40 | 72.97 | 265.8 | 242.3 | 254.1 |
| $T_4$ | 35.59 | 57.40 | 46.49 | 92.82 | 78.83 | 85.83 | 288.8 | 267.9 | 278.4 |
| SEm (±) | 1.88 | 2.86 | 1.82 | 3.44 | 3.41 | 3.23 | 8.64 | 8.70 | 7.67 |
| CD (p=0.05) | 5.80 | 8.80 | 5.68 | 10.62 | 10.51 | 9.03 | 26.63 | 24.89 | 23.53 |

**Table 2 Effect of ratoon management practices on yield parameters and yield of sugarcane**

| Treatments | Number of Milleable Canes ('000/ha) | | | Stump weight (kg/stump) | | | Cane yield (t/ha) | | |
|---|---|---|---|---|---|---|---|---|---|
| | 2021 | 2022 | Pooled | 2021 | 2022 | Pooled | 2021 | 2022 | Pooled |
| $T_1$ | 69.4 | 50.83 | 61.32 | 7.03 | 4.13 | 5.58 | 76.37 | 38.20 | 57.13 |
| $T_2$ | 70.1 | 46.1 | 58.10 | 8.67 | 5.51 | 7.09 | 92.07 | 44.85 | 68.52 |
| $T_3$ | 71.74 | 54.83 | 63.28 | 8.70 | 6.50 | 7.60 | 99.25 | 46.00 | 71.74 |
| $T_4$ | 88.02 | 60.17 | 74.45 | 9.19 | 8.68 | 8.93 | 106.1 | 57.80 | 81.96 |
| SEm (±) | 4.93 | 1.96 | 3.21 | 0.53 | 0.29 | 0.34 | 5.75 | 2.85 | 3.20 |
| CD (p=0.05) | 15.23 | 7.15 | 9.89 | 1.62 | 1.05 | 1.02 | 17.71 | 8.55 | 9.01 |

**Table 3 Effect of ratoon management practices on economics of sugarcane**

| Treatments | Gross returns (₹/ha) | | | Net returns (₹/ha) | | | BC ratio | | |
|---|---|---|---|---|---|---|---|---|---|
| | 2021 | 2022 | Pooled | 2021 | 2022 | Pooled | 2021 | 2022 | Pooled |
| $T_1$ | 231128 | 133700 | 182414 | 132758 | 28580 | 80669 | 2.35 | 1.27 | 1.81 |
| $T_2$ | 278875 | 156975 | 217925 | 176190 | 41015 | 108603 | 2.70 | 1.31 | 2.01 |
| $T_3$ | 305330 | 161000 | 233165 | 199151 | 39810 | 119481 | 2.88 | 1.35 | 2.12 |
| $T_4$ | 328946 | 202300 | 265623 | 216226 | 75900 | 146063 | 2.92 | 1.6 | 2.26 |
| SEm (±) | 12985 | 8147 | 7114 | 10627 | 3891 | 5055 | 0.09 | 0.05 | 0.04 |
| CD (p=0.05) | 40011 | 21266 | 19002 | 32745 | 11990 | 13426 | 0.30 | 0.11 | 0.11 |
| CV (%) | 10.21 | 14.71 | 11.07 | 20.15 | 12.58 | 14.52 | 13.04 | 13.56 | 10.28 |