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Effect of Different Implements for Improving the Productivity and Quality of Sugarcane Ratoons (Sacharum Officinarum L.)*

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ABSTRACT

Ratooning is a practice of growing a crop from the stubbles of previous crop. It saves the cost of preparatory tillage and planting material. It gets the benefit of residual manure and moisture and also it matures earlier than the plant crop and gives more or less same yield as that of plant cane. The objective of this study was to investigate biometric observations of growth parameters, yield attributes and yield. Accordingly, the effect of different implements on soil parameters and root growth was also recorded. Significantly highest and at par tiller number at 75 and 120 DAP, plant heights, millable canes, single cane weight, cane yield, sugar yield and cane girth(96.750ha^{-1}, 162.91, 333.60, 102.280, 1.39, 148.46, 19.80) were recorded in T_6 and T_5 (83.15, 152.07, 319.04, 99.643,1.36, 136.82,18.54, 2.88) treatments. While, significantly lowest and at par crop parameters were noted with T_1 and T_2 treatments. Higher root mass of 205.69 – 211.36 g was recorded in T_4, T_5 and T_6 treatments which involve the use of stubble shaver, disc off barrower and a ratoon manager. On the other side, the conventional treatments in which shaving was done manually has registered a root mass of 171.65 – 188.97 g. Maximum decrease of 1.38 gm cm^{-3} in bulk density was observed in T_6 while the minimum was observed in T_1. On the other hand, the pore space was maximum (38.85%) in T_6 and minimum in T_1 (31.62%).the results indicated that the use of modern implements for ratoon sugarcane crop improves the growth and yield of ratoon.

Key words : Implements for improving, Ratoons, Sugarcane.

Ratooning of sugarcane is a common practice throughout the India and ratoon occupies almost 50 per cent of the total area under sugarcane cultivation and contributes 30 per cent to the total cane production in the country. The area under ratoon 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 30 - 40%. In India, most of the cultural practices associated with sugarcane production are undertaken by using traditional tools and machinery. The mechanization of sugarcane cultivation is evolving as a shift occurs from traditional practices to modern cultivation methods. These include appropriate mechanization of tillage, planting, weeding and inter-row cultivation, plant protection, harvesting, loading, transport and other post-harvest operations including rationing. However, in conventional system the operations involved in ratoon crop like manual stubble shaving and inter row cultivation can be done manually by using cattle drawn plough or by other mode. Also, loosening the soil with hand hoe helps the plant to develop a deep root system which is important for nutrient uptake and water absorption from deeper soil profile. But in present conditions, scarcity of labour or limited availability with high wages which made sugarcane cultivation most expensive and non-remunerative.

Therefore, to increase net returns in ratoon sugarcane cultivation there is a need to integrate cost effectiveness by introduction of implements in sugarcane such as ratoon manager, stubble shaver, trash shedder, disc off barrier and ridger under mechanization is the immediate option through which there is a possibility of minimizing expenditure on human labour and improvement in soil structure and its physical properties there by the improvement in plant growth, tiller production and finally yield of the crop.

MATERIAL AND METHODS

The experiment was conducted in Agricultural Research Station, Basanthpur village of Medak district. The soil of the experimental site was red laterite type and sandy loam in texture.

Further the effect of different ratoon equipment on crop yield was carried out at farmers' fields with the following treatments. T_1 (Conventional with manual shaving + inter cultivation by draught animal + manual harvesting), T_2 (Conventional with manual shaving + inter cultivation by tractor + manual harvesting) and T_3 (Conventional with manual shaving + inter cultivation by tractor + Mechanical harvesting) , T_4 (Improved method running with ratoon manager + intercultivation by tractor + manual harvesting), T_5(Improved method running with stubble shaver + inter cultivation by tractor +mechanical harvesting) ,T_6 (Improved method running with stubble shaver + disc off barrier + inter cultivation by tractor +mechanical harvesting) . The different crop parameters like tiller count, cane girth, cane yield, no of millable canes, sugar yield were calculated by taking three replications in each plot. They were calculated by selecting the cane randomly among the experimental field and the data was recorded. The same procedure is adopted for all the treatments in the experiment.

Details of crop parameters to be recorded in study

Tiller count (000ha^{-1}) at 75 & 120 DAP

In a net plot area, the shoot population i.e., the number of tillers were counted at 75 & 120 days after planting(DAP) and expressed in thousands per hectare('000ha^{-1}).

Millable canes (000ha^{-1}) at harvest

All the canes from each net plot were cut, dressed, counted and recorded as number of millable canes per plot. These were expressed as thousands of millable canes per hectare. At the time of harvest only meallable canes was counted for recording stalk population.

Cane height (cm)

Plant height was measured from the base of the plant to the top fully opened leaf of the main shoot at harvest. Measurements were taken from the main shoots in each treatment and average height of the single plant was calculated and expressed in cm by using scale.

Cane girth (cm)

Girth of the middle internodes was measured by using vernier callipers and expressed in cm.

Cane yield (t ha^{-1})

All the canes in the plot were cut to the ground level at harvest. The tops and fresh were removed and cane yield per plot was recorded by weighing procedure. The cane yield was expressed in tonnes per hectare

Sugar yield

Sugar yield was calculated using the following formula.

$$\text{Sugar yield (t/ha)} = \frac{\text{CCS\% x cane yield (t/ha)}}{100}$$

Commercial cane sugar (*CCS*) is calculated from Brix

Statistical analysis

The statistical analysis was carried out by using STAR software for each treatment with 3 replications and the level of significance was measured at 0.05 which was significant.

RESULTS AND DISCUSSION

The data included with replications for all the below crop parameters and all the statistical analysis of the crop parameters done by using STAR software.

Tiller Count

The data on tiller count of Sugarcane in different treatments recorded at 75 and 120 days after ratooning varied significantly. At 75 days after ratooning, the tiller count of the ratoon ranged from 72.51 to 96.75 (000'ha^{-1}) in different conventional and mechanically managed plots. The maximum number of tillers (96.75) was recorded in T_6 compared to the other treatments. Whereas, the treatments T_1, T_2 and T_3 with tiller counts of 72.51, 75.40 and 79.28, respectively were found significantly at par and lower compared to the other treatments.

The tiller count doubled as the crop growth advanced from 75 to 120 days after rationing. At 120 days after rationing, the tiller count ranged from 130.10 to 192.91 ('000 ha) in conventional and mechanical treatments. The treatments, T_6 and T_5 being at par registered significantly highest tiller number (162.91 and 152.07, respectively) than the other treatments. Contrastingly, with tiller number of 130.10 and 139.25 ('000 ha^{-1}), in the treatments T_1 and T_2 registered comparably lower tiller count

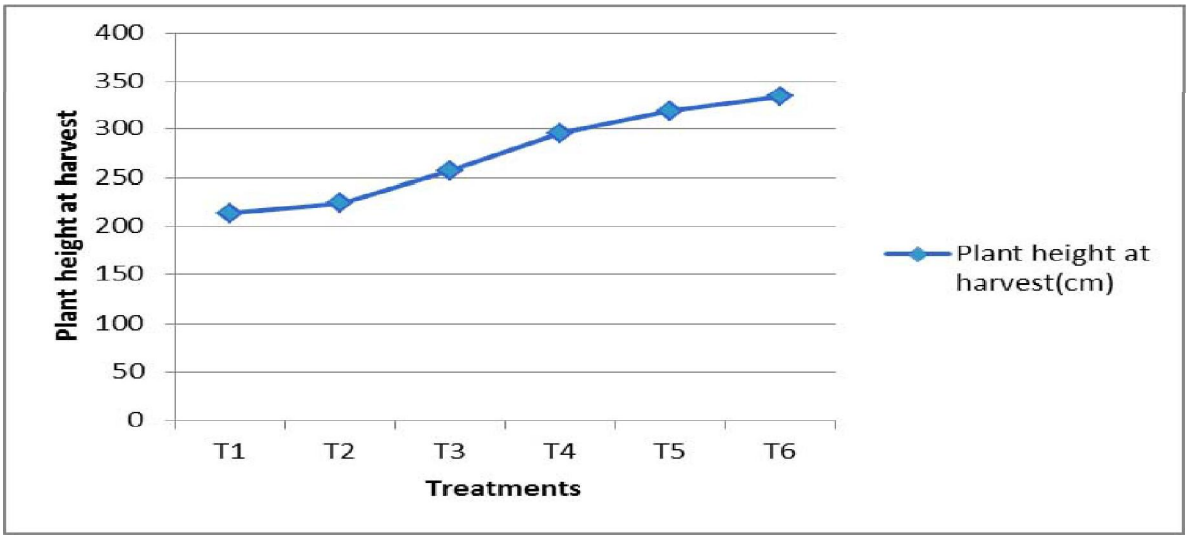

Fig: 1 Effect of different treatments on tiller population and plant height

than the other treatments. Obviously deep stubble shaving facilitated by stubble shaver in T_6 and T_5 treatments had favored the crop to put forth maximum number of tillers than the other treatments. An increase in the tiller number due to stubble shaving attachment was also noticed by Vengal Reddy (2007).

Plant Height

The data on the plant height of Sugarcane recorded at harvest are presented in Fig 1. The plant height at harvest in different treatments ranged from 213.65 to 333.60 cm. Reduced soil compaction, deeper root system and good anchorage due to stubble shaving and disc off barrier in T_6 had made the ratoon to put forth steady and taller canes (333.6 cm), compared to the other treatments. However, the ratoon in T_5 has found to be at par to T_6 with a plant height of 319.04 cm. The shoots emerging from the lower portion of the stubble due to stubble shaving were found better in terms of stalk length, diameter and dry matter production (Indra mani, 2007).

Conversely, manual shaving and lower depth of inter cultivation using conventional plough drawn by draught animals in T_1 and T_2 has not supported the crop to develop deeper root system for better nutrient and moisture absorption which has resulted in significantly lowest plant height (213.65 cm) than the other treatments.

Number of Millable Canes

The data on number of millable canes was elucidated in the Fig.2 The number of millable canes in the ratoon crop as affected by conventional and mechanical management was found significant.The treatment, T_6, T_5 and T_4 (Improved method running with ratoon manager + intercultivation by tractor + manual harvesting) being at par had recorded significantly higher number of millable canes

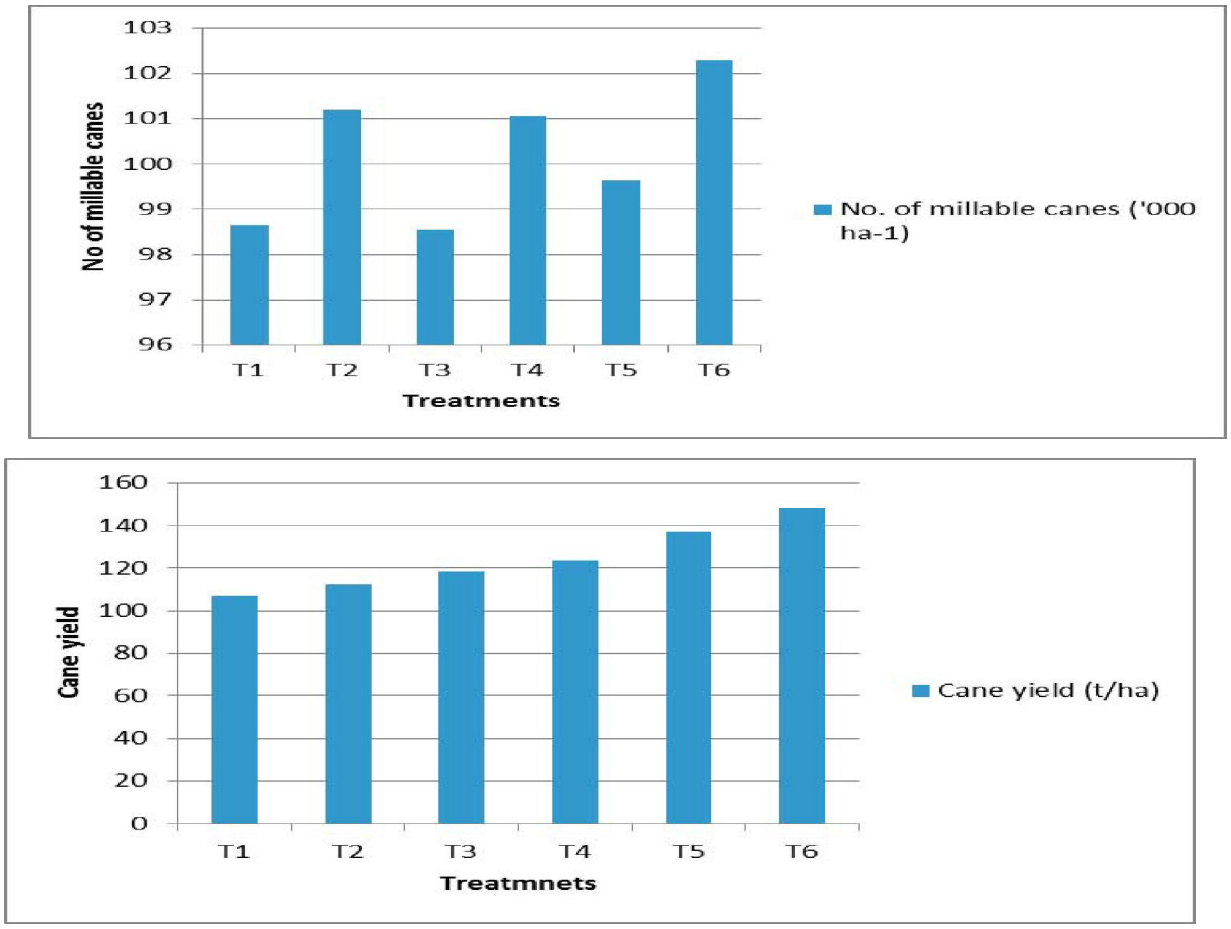

Fig: 2. Effect of different treatments on No of millable canes and cane yield.

(102.28, 99.64 and 101.05 ha^{-1}, respectively) over the other treatments. Though the tiller mortality in these treatments was more, higher tiller population at active tillering stage had made the crop in the above treatments to maintain higher millable cane number over the conventional treatments. The results are in agreement with Indramani (2007) and Vengal Reddy (2007).

On the other side, T_1, T_2 and T_3 treatments with lower tiller population throughout the crop growth stood at par and recorded lower millable cane number than the other treatments.

Cane Yield

The cane yield of Sugarcane as affected by conventional and mechanical management of ratoon was presented in Fig. 2. Significant variation in growth and yield attributes have resulted in significant cane yield data in response to conventional and mechanical treatments.

Higher tiller population, millable cane number, cane height and single cane weight has resulted in significantly superior and at par cane yields (148.46 and 136.82 t ha^{-1}, respectively) due to T_6 and T_5 treatments in comparison to other treatments.On the other side, lower tiller population, millable cane number, cane height and single cane weight in T_1, T_2 and T_3 treatments had registered lowest cane yields (106.68, 112.12 and 118.27 t ha^{-1}, respectively).

Sugar Yield

The sugar yield data of ratoon cane has recorded significant variations due to conventional and mechanical practices.Significantly higher cane yield in T_6 and T_5 treatments also has resulted in higher sugar yield of 19.80 and 18.55 t ha^{-1}, respectively. Similarly lowest cane yields in T_1 and T_2 has registered lowest sugar yields of 12.96 and 13.82 t ha^{-1} respectively. Higher sugar recovery

with higher sugar yields due to stubble shaving was also reported by Nagendran (2014) and Vengal Reddy (2007).

Cane Girth

The cane girth at harvest in different treatments ranged from 2.22 to 2.97 cm. Reduced soil compaction, deeper root system and good anchorage due to stubble shaving and disc off barrier in T_6 had made the ratoon to put forth steady and increased cane girth (2.97cm), compared to the other treatments. However, the ratoon in T_5 has found to be at par to T_6 with a cane girth of 2.83 cm. The shoots emerging from the lower portion of the stubble due to stubble shaving were found better in terms of stalk length, diameter and dry matter production (Indra mani, 2007) Conversely, manual shaving and lower depth of inter cultivation using conventional plough drawn by draught animals in T_1 and T_2 has not supported the crop to develop deeper root system for better nutrient and moisture absorption which has resulted in significantly lowest cane girth (2.22cm) than the other treatments.

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