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Development and Evaluation of Manually Operated Sugarcane Mother shoots Cutter (Patent No:351648)

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Abstract

India has the second highest area under sugarcane cultivation next to Brazil. Sugarcane is cultivated in an area of 4.7 million ha with productivity of 72 tonnes/ha. Sustainable Sugarcane Initiative is one of the advanced methods of sugarcane cultivation technique that involves, use of less input like seed sett, water, land, labour and optimum utilization of fertilizers to achieve maximum yield. Removing the mother shoot is one of the main principles of Sugarcane Sustainable Initiative to get even tillers, increase more number of tillers and millable canes per plant. Conventional tool of secateurs, knife and sickle are not popular because the agricultural laborers need to bend down and hold the stem to remove the mother shoot of sugarcane. Probability is more for injuring the hands and eyes and also has more drudgery. Hence, sugarcane mother cutter was developed with components of main conduit pipe, secateurs, operating lever, handle and grip handle. It is operated manually in standing posture with less effort, due to 0.8 kg weight. It reduces cost of cultivation and human drudgery. The tool cuts 800 shoots/hr. It saves 16 per cent and 19 per cent time and cost respectively. The overall dimension of the tool is 950x320x270.

key words: sugarcane, mother shoot, cutter, SSI

1.INTRODUCTION

India has the second highest area under sugarcane cultivation next to Brazil. Sugarcane is cultivated in an area of 4.7 million ha with a productivity of 72 t/ha. About 7.5 million farmers are dependent on sugarcane cultivation and ancillary activities and 0.5 million workers are engaged in sugar mills in India (Singh et al 2020). Tamil Nadu ranks first in sugarcane productivity in our country recording more than 100 t/ha.

However, the area under sugarcane cultivation is decreasing due to increase in seed and labour costs, soil fertility and productivity related issues. Sustainable Sugarcane Initiative (SSI) is a suitable option to solve these problems. SSI is an innovative method of sugarcane production using less seeds, less water, optimal use of fertilizers and land to achieve more cane yields. Removing the mother shoot is one of the main principles of SSI to get even tillers. Plant should be cut just 25 mm above the ground after the establishment of sugarcane seedlings (Biksham et al 2009). This will ensure more number of tillers (Thirumurugan and Kavitha 2020) and millable canes per plant. (Mani G et.al 2017).

Conventionally, secateurs, knife and sickle are used for cutting sugarcane mother shoots. Existing conventional tools are not popular among our farmers because the agricultural labourers need to bend down, hold the stem and cut the mother shoot of sugarcane. Chances of injury to hands and eyes are more during manual cutting of sugarcane mother shoots using conventional tools due to the presence of sharp spines on the stem or the serrated margin of the leaves or tools. Agricultural labourers get backache during cutting the sugarcane mother shoot. Hence, a tool which can be operated in standing position for cutting the sugarcane mother shoots has been developed and evaluated in field.

2.MATERIALS AND METHODS

The tool consists of a main conduit pipe of 920 mm length and 12 mm internal diameter, secateurs, handle and grip handle (Fig.1). The top portion of the main conduit pipe is bent to 'L' shape as handle measuring 80 mm in length and 12 mm in diameter. A 'L' shaped aluminum pipe with dimensions of 130 mm length and 12 mm diameter is hinged at the bottom of the handle for operating the wire of 1.5 mm diameter and 1000 mm length which passes through a 6 mm plastic tube from the operating lever to the tail end of the secateurs. Left side handle of the secateurs is clamped at 120 mm from the bottom of the main pipe. A 15 mm diameter and 100 mm length mild steel rod is welded to the main pipe 200 mm from the top portion of the tool as grip handle which is covered with plastic tube. Front, side and top view of diagram of the developed sugarcane mother cutter is presented in Fig.2.

Fig. 1: Manually operated sugarcane mother shoot cutter

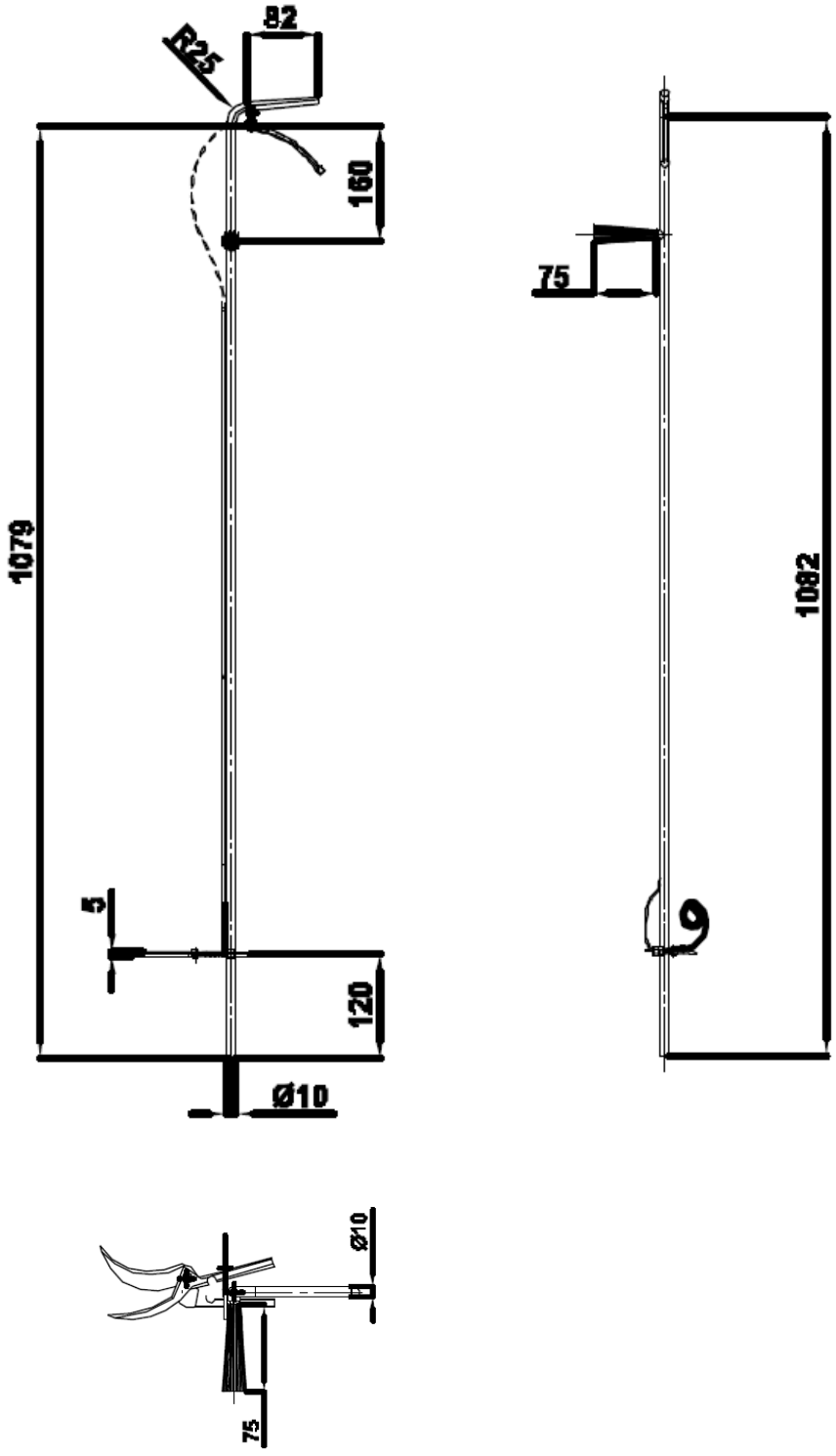

Fig.2: Manually operated sugarcane mother shoots cutter (2D)

Test Conducted in actual sugarcane field after 30 to 40 DAP to find the output of the invented tool. Number of mother shoots cut by the tool counted after operating the tool for one hour in different districts of Tamil Nadu. Cost of the tool was determined. Cost of operation of the tool calculated as per the specifications of the Bureau of Indian Standards. From the above data, operational cost of the tool removing the mother shoots for 1 ha is calculated in comparison with conventional method.

3.RESULTS AND DISCUSSION

The manually operated sugarcane mother shoot cutter was developed with the specifications shown in Table 1. Field evaluation of the developed tool was conducted (Fig.3) in six different locations including four districts of Tamil Nadu after one month of planting of sugarcane plants (Anbumani *et al*., 2019). Out of six field performance evaluations, two were in Sugarcane Research Stations (Trichy and Cuddalore), one in Krishi Vigyan Kendra (Dharmapuri), one in TNAU farm (Coimbatore) and two in farmers' fields (Trichy and Dharmapuri). The field observations are shown in Table 2. The hand tool can be operated in standing posture with less effort and minimum human drudgery. The invented tool and conventional tool (sickle) could cut 800 shoots/h and 670 shoots /h respectively (Fig.4). The operational cost of invented and conventional tool is 744 Rs/ha and 884 Rs/ha respectively. The overall dimension of the invented was 950x320x270 mm and the weight was 0.8 kg. So, women can easily operate the tool in standing posture without any difficulty. The tool is light weight and sturdy and suitable for start-up manufacture. The cost of the tool is Rs.720.

Table 1. Specifications of sugarcane mother shoot cutter

S.No.	Particulars	Materials	Dimensions, mm
1	Conduit pipe	Mild steel	920x12
2	Secateurs	Steel casting	200x45x12
3	Operating wire	Steel rope	1000x1.5
4	Rod	Mild steel	100 x10
5	Lever	Aluminum	130x12
6	Handle grip	Mild steel	100x15
7	Handle grip cover	Plastic	80x25
8	Spring	Hardened steel	50x1
9	Overall dimensions, mm	-	950x320x270
10	Weight, kg	0.8	

Table 2. Field performance of sugarcane mother shoot cutter

S. No.	Place	Days after planting (DAP)	No. of mother shoots cuts /h	
			Tool	Manual
1	SRS, Cuddalore (D1)	30	875	700
2	SRS, Trichy (D2)	32	785	680
3	KVK Dharmapuri (D3)	30	804	684
4	TNAU Coimbatore (D4)	35	815	668
5	Puvalur, Trichy (D5)	32	725	616
6	Ayyarkottai, Dharmapuri (D6)	40	795	675

Fig. 3: Field demonstrations of sugarcane mother shoot cutter

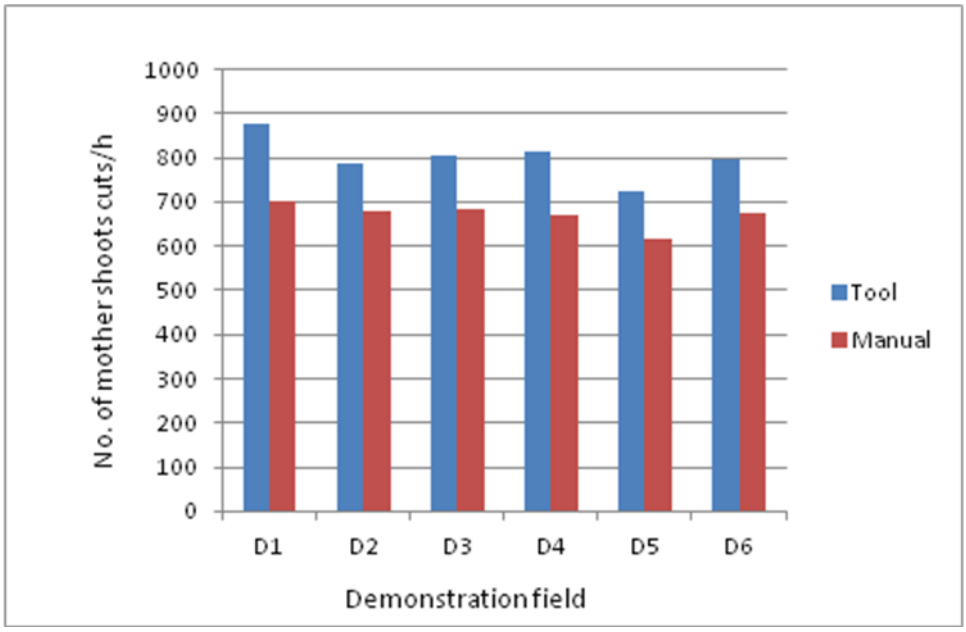

Fig.4: Performance of sugarcane mother shoot cutter

4.CONCLUSIONS

This invented tool is used for removing the sugarcane mother shoots for satisfying the main principles of SSI to get even tillers and increased numbers of tillers per plant. It is portable to use the tool in standing posture for cutting the mother shoots of sugarcane plants under sugarcane sustainable initiative cultivation. While cutting the sugarcane mother shoots, injuries caused to the hands and eyes can be minimized. The tool is light weight, strong, women friendly and easy to manufacture. It saves 16 per cent and 19 per cent time and cost than conventional tool.

REFERENCES

1. Anbumani, S., Sivakumar C., Manickam S.: Studies on sustainable sugarcane initiative (SSI) technology in north eastern agro climate zone of Tamil Nadu. International Journal of Chemical Studies (2020) 8(1): 520-523.
2. Biksham, G., Loganandhan, N., Goud, V. N., Agarwal, M., Dalai, S.: Sustainable Sugarcane Initiative (SSI) Improving Sugarcane Cultivation in India. ICRISAT - WWF Project (2009).
3. Mani, G., Thirusenduraselvi, D., Utharasu, S.: Sustainable Sugarcane Iinitiative (SSI) - The choicest method of sugarcane cultivation in India. Everyman's Science (2017) 12(3).
4. Singh, A., K., Verma. A.K., Triloki, N., Singh, S. K.: Glimpses of Sugarcane Cultivation. Directorate of Sugarcane Development, Government of India, Lucknow (2020).
5. Thirukumaran, K., Kavitha, K.: 2020. Impact of cane growth, yield and water productivity under Sustainable Sugarcane Initiative (SSI) Technology. Int. J. Curr. Microbiol. App. Science (2020) 9(4): 2306-2310.