



E-ISSN: 2278-4136
P-ISSN: 2349-8234
JPP 2019; 8(4): 1520-1522
Received: 15-05-2019
Accepted: 18-06-2019

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Potential future technology: Mechanised harvesting of sugarcane

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Abstract

The energy consumption in production of sugarcane is highest as compared to many other crops such as potato, maize, wheat, paddy, sorghum etc. sugarcane is labour intensive requiring about 3300 man-hrs per hectare for different operations. Considering the present trend of availability of labour for sugarcane production, it has been experienced that the use of modern machinery is inevitable. Use of machinery helps in labour saving and timeliness of operations, reduces drudgery, helps in improving quality of work, reduces cost of operation and ensures effective utilization of resources (Javed ali, 2015). A Front Line Demonstration on Mechanical harvesting of sugarcane sanctioned to Krishi Vigyan Kendra, Bagalkot for the year 2018-19 was implemented in two villages of Bagalkot district namely Jambagi K.D. of Mudhol taluka and Gangur of Bagalkot taluka. Method demonstration on mechanised harvesting was conducted followed by interaction with farmers. The group discussion on the pros and cons of mechanical harvesting Have been discussed at length and are delineated in this paper.

Keywords: Mechanised harvesting, sugarcane

Introduction

Sugarcane is one of the main commercial crops of Bagalkot district, cultivated in an area over 100000 ha including planted and ratoon crop. There are about 13 sugar factories actively involved in cane crushing in the district. The total crushing capacity of these factories put together is around 805569 MT of Sugarcane with 926215 MT of sugar production and an average sugar recovery of 10.70. Cane is grown under the command areas of Krishna, Ghataprabha and Malaprabha with good tonnage of 100t/ha, still there is a scope to improve the productivity. The reasons for low yield are low yielding varieties, narrow spacing, weed infestation, insect pest, disease, non availability labour scarcity of water etc.,

In recent years, the labour availability is a serious issue, which has made an impact on reduction of yield as well as sugar recovery by delayed harvesting. Proper manual cutting results in minimum loss of cane and the highest quality of the product. About 850-1000 man-hour per ha is required for sugarcane harvesting with the traditional tools. (Yadav *et al.* 2002) [6]. Manual sugarcane harvesting is a very labor-intensive and laborious activity. Harvest laborers can easily fatigue due to excessive stress on the joints and muscles (Clementson and Hansen, 2008) [4] and are exposed to harmful pests from plantations, creating safety concerns (Carvalho, 2012) [3]. The advent of mechanical harvesting systems frees harvest laborers from the drudgery of field operations. To harvest one hectare of sugarcane, it requires 3.3-4.2 machine-h by mechanical harvesting whereas 850- 1000 man-h by manual harvesting. Mechanical harvesting also makes green cane harvesting possible, which reduces Green House Gas emissions from pre-harvest burning necessitated by manual harvesting (Braunbeck *et al.*, 1999) [2].

Sugarcane harvesting involves base cutting of sugarcane, stripping and retracing of sugarcane, detopping, bundle making and finally transport of sugarcane to the sugar mills Gradually, timely harvesting of sugarcane at affordable cost is becoming a problem particularly in the tropical region. Managing a big fleet of labourers to give timely supply of cane to the mill is not easy any more. Delayed harvesting affects the quality of sugarcane, yield, juice quality and sugar recovery. Under these circumstances, the sugar industry is looking for alternate mechanical means for harvesting the sugarcane crop at a reasonable wage rate. In subtropical India, normally, sugarcane harvesting is free of cost in exchange for green tops and, as such, in near future the problem does not appear to be of a major concern. Efforts may be made to develop efficient hand tools for harvesting sugarcane crop so as to improve the quality of cutting and output/man/day with reduced energy input. The productivity of manual cutters can be improved by giving them proper training, the use of correct cane knife, balanced diet, etc. Thus, Mechanical harvesting deemed to be given utmost importance.

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In this connection ICAR-Krishi Vigyan Kendra Bagalkot has made an analysis of mechanical harvesting of sugarcane by conducting Front Line Demonstrations, Group discussions and field visits. The present analysis is based on the reports of group discussions held with 67 farmers, one at first December, 2018 at Jambagi K.D. of Mudhol taluka with 42 farmers another at Gangur village of Bagalkot taluka on 18.01.2019 with 25 farmers. At both places method demonstration on mechanised harvesting were done. Another discussion was also held with staff of Sri. Prabhulingeshwar Sugar factory Nayanegali which is being managed by EID Parry group on 28.05.2019. The factory has got around 5000 MT of cane crushing capacity.

The mechanisation was started during 2013-14 on experimental basis in Bagalkot. Three farmers were assisted financially to purchase the mechanical harvesting machine. Now these are around 55 mechanical harvesters in the district covering more than 10% of the total sugarcane being harvested by machines.

Mechanical harvesting under drip irrigation system

The subsurface drip method on which Sugarcane is cultivated in paired row makes it difficult for machine harvesting as the clumps entangle the pipe and it becomes difficult to manually roll the drip line, while in the single drip line with four feet row spacing it is possible to harvest sugarcane mechanically, once the drip line is rolled manually.

Method of payment

For both manual harvesting and machine harvesting advance payment need not be made by the farmers in Bagalkot district as Fare Remunerative Price (FRP) covers harvesting and transport of the cane, which costs around Rs. 700/ton. In Southern regions of Karnataka state it is the farmers who have to harvest the Sugarcane and supply to the factories. Hence, the sugarcane growers in Bagalkot are relieved of harvesting and transport hassles.

Cost of operation

At present the factories paying about Rs. 400/ton for mechanised harvesting and Rs. 280/ton for manual harvesting. A group of around 14-20 labours harvest on an average 18-20 ton/day while mechanised harvesting capacity ranges with the capacity (HP) of the tractor from 20/tons/hr to 40 tons/hr. Provided are in even crop growth at a large area. In the fragmented land holdings, it is difficult to get this condition

hence up to 120 tons/day in the average quantity of Sugarcane harvest, if harvested mechanically.

Trash management

If harvested mechanically, there is around 2.5 tons of trash chaffed back to fields. The percentage of trash is more in 91010 variety where in the leaf sheath are and dead cane percentage is more. In manual harvesting there is less percentage of non cane factor because of two reasons. First being the labors de-trash the tops as well as side trash and secondly the ground level clearance is not there. In fact is the first node of the cane just about the ground which is heavy and increases the tonnage that is neglected in manual harvesting. The farmers need to engage another four labors to remove these stubbles @ Rs 2000/ac. Thus double burden of retaining the stubble 2-3 tons sugar loss/ac of worth Rs. 4000/-. Thus a total of Rs 6000 is saved by taking care of harvesting to ground clearance, which is possible in mechanised harvesting. Regarding the decomposition of trash in and blown off back to the field which is easily decomposed, while in manual harvesting the trashes dead caned need to costing around Rs. 2000/ac.

The farmers need to bear around Rs. 2000 as added cost of production. However the percentage of farmers going for burning the trash has been reduced. It is estimated that around 50% farmers in Bagalkot and Badami taluka and 80% farmers in Mudhol and Jamakhandi taluka are going in for trash decomposition and mulching soil with trash is a positive change. Climate change factors also play an important role in this change due to scarcity of water, availability of decomposing cultures and increased awareness about organic cultivation as well as skyrocketing prices of chemicals and fertilizers.

A field analyses carried out by the factories to find out the non-cane percentage revealed that about 13% of non cane material was found in mechanically harvested cane when compared to manually harvested cane. This trash adds to crushing bulk, wear and tear of machineries. Hence, the factories have a set of rule that there is 10 % deduction for mechanically harvested cane especially for CO-91010 because of heavy areas and cane 5-8% for other varieties. But the farmers are of the opinion that there is reduction in tonnage. In total, it was inferred that factories are spending Rs 400/ton for mechanical harvesting of sugarcane over 280/ton for manual harvesting is because of labour scarcity and is economically profitable to farmers. The economical analysis is as follows.

Table 1: The Particulars Quantity of harvest

Particulars	No of labour	Quantity of harvest (tonne)	Duration (Hrs)	Cost per/tonne	Cost per ha
Manual harvesting	20	18	8	280	5040
Mechanical harvesting	2 *	100	7.5	400	40000

* With mechanized harvester

Due to non availability of labours, the mechanical harvester uses only two labours to harvest 100 tonnes in 7.5 hrs, while in the manual harvest, uses 20 labour to harvest 18 tonnes in 8 hours. In short time, we can cover larger area, with the mechanical harvester. This is one of the advantages of mechanical harvesting. With this, crushing days of the factory will be reduced. For instance, a factory takes 180 days of crushing which has been reduced to 130 days presently. This

reduced 50 days will save natural resources such as water, electricity, fuel and manpower.

Table 2: This reduced 50 days will save natural resources such as water, electricity, fuel and manpower

Sl. No.	Date	Place	No. of participants
1	1/12/2018	Jambagi K.D., Mudhol tq.	42
2	18/1/2019	Gangur, Bagalkot tq	25

Table 3: Comparative analysis of mechanical harvesting vs manual harvesting of sugarcane.

Criteria	Mechanized harvesting	Manual harvesting
Drip method	The subsurface drip method on which Sugarcane is cultivated in paired row makes it difficult for machine harvesting	Suitable
Payment	Made by factory @ Rs. 400/ton	Made by factory @ Rs. 280/ton
Cost of operation	Upto 120 ton/day	18-20 tons/day by 14-20 labours
Noncane percentage	13%	Nil
Additional bulk due to non cane percentage	Yes	No
Row spacing	Min. 4ft row spacing is compulsory	NA
Ground level clearance	The last node of the cane is also harvested	The labours leave the last node which contains more sugar than other nodes
Trash brought back to field	2-3 ton of trash finely powdered is chaffed back to field	Either burnt/used for mulching
Waiting for the queue in factory for crushing	No	Yes
Standard deduction	10%	5-8%
Savings made		
1. Farmers lose 2-3 tons of sugarcane by complete harvesting of stubbles	Rs.4000	-
2. By reducing Stubble removal	Rs.2000	-

Conclusion

From the above analysis it may be inferred that, mechanised harvesting of sugarcane is a potential future technology. The availability of the labour is an important factor in agriculture, and it influences the timely agricultural operations. Hence there is need for mechanization in agriculture. The study also reveals that, through the cost of operation is much higher for mechanised harvesting when compared to manual harvesting, still the sugar factories are promoting mechanised harvesting just to overcome from the problem of labours.

In the past, cane burning has been a common practice carried out before harvesting. This operation greatly improves the harvesting rate and efficiency. However, the increased Green House Gas (GHG) emission has been a great environmental concern (S. Ma *et al.* 2014)^[5]. The number of harvesting machines operating in the district is also on the rise indicating the people acknowledging the new technology). At present about 10% of the total sugarcane being harvested by the machines in Bagalkot district, there is still large scope to expand the mechanised harvesting of sugarcane.

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