

A Review on Performance of Sugarcane Cleaner-Cum-Washer

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ABSTRACT

Sugarcane is a major cash crop of India and many countries. Sugarcane stalks cleaning and juice clarification is to be very important for jaggery production. There are lots of impurities sticking to sugarcane, which directly goes into juice when the cane is crushed. So it is advisable to clean the sugarcane stalk prior to crushing. For this purpose, a sugarcane cleaner-cum-washer (SC-c-W) has been developed at ICAR-Indian Institute of Sugarcane Research (IISR), Lucknow for cleaning of sugarcane prior to juice extraction for jaggery making. This machine has 6 rollers. These rollers are move at different speed and direction for better rubbing action is obtained. Water spray arrangement has also attached for washing the sugarcane stalk. The machine may be useful for large scale juice vendors.

Keywords: Sugarcane, sugarcane cleaner-cum-washer, jaggery and juice.

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INTRODUCTION

Sugarcane is a major cash crop of India. Major sugarcane producing states in India are Uttar Pradesh, Karnataka, Tamil Nadu, Maharashtra, Bihar and Andhra Pradesh. It is grown in about 5 million hectare of land producing about 350 millions of sugarcane annually. It is used for making sweeteners like sugar, jaggery (*gur*) and *khandsari*.

Sugarcane (*Saccharum Officinarum*) is a giant grass belonging to the family gramineae. The Sanskrit word 'SARKARA', from which the word 'SACCHARUM' has been derived also indicates the antiquity knowledge of sugarcane in India [20]. Sugarcane juice is also a type of drink. It is very refreshing and is a very popular drink in India but still it is rarely available commercially in packaged form. Quality of jaggery also depends on the effectiveness of cleaning and clarification process. There are lots of impurities sticking to sugarcane stalk like trash, dust, roots, wax, gum, dry leaves, soil particles, chlorophyll and other colour compounds *etc*. In jaggery making, mostly sugarcane is crushed directly and all these unwanted materials go into the sugarcane juice. Although sugarcane juice clarification is performed using vegetative clarificants; yet it is advisable to clean cane prior to crushing.

A sugarcane cleaner-cum-washer (SC-c-W) has been developed at ICAR-Indian Institute of Sugarcane Research (IISR), Lucknow for cleaning and washing of sugarcane prior to crushing for jaggery making. The unit consists of six rollers; two feed rollers having rubber flaps for gripping and cane feeding and four scrapping rollers (two sets of two rollers each) having steel wire brush for removal of impurities sticking to sugarcane stalks. Washing arrangement has also been provided at two places. The unit was evaluated for best

performance. It was found that the roller set was that in which upper rollers moved with 50.63 and 75.95 rpm and lower rollers moved with 60 and 90 rpm in 1st and 2nd set respectively. It was due to differential speed of rollers which gave best rubbing and scrapping action.

SUGARCANE PEELING MACHINE

There are many impurities present on the surface of sugarcane stalk and all these impurities goes into juice during crushing process. Since jaggery is consumed directly as a food material also, it is advisable to clean maximum possible impurities prior to crushing. For this purpose, many devices have developed.

Scott *et al.* [15] studied that both tops and trash have pronounced adverse effects on juice purities and clear juice quality, while trash also reduces extraction. All the effects were statistically highly significant and increased linearly with extraneous matter contents of up to 30%.

Bernhardt, [6] reported that dry cleaning of sugarcane, the effects of delivering and crushing green cane, which contains all of the associated extraneous matter, on the cost of production and the quality of sugar are well known. In consequence of these effects the different options for dry cleaning the cane are being considered.

Cansee [8] showed the use of leaf-removal machinery in the post-harvest production of sugarcane to reduce harvest production time and contaminant. The quantity of leaves and leaf sheaths affect the speed of harvest production. Traditional methods for sugarcane harvest without removing leaf took 37 h to complete, but sugarcane leaf-removing could reduce the sugarcane harvest process to 11.4 h. Songsermpong and Jittanit [16] determined the different methods of sugarcane peeling, squeezing and juice concentration were compared. The experimental results indicated that the sugarcane should be peeled by the abrasive tool and squeezed by the roller in order to achieve high yields with shorter process time.

Lin *et al.* [14] estimated that large-scale sugarcane stripper with automatic feeding, which included automatic feeding module, cleaning leaves module, collecting module and control module. The machine was an important part of the segmental type sugarcane harvester, used to solve the highest labour intensity problem of cleaning leaves.

Tagare *et al.* [17] successfully fabricated a sugarcane peeling machine, which is one of the major challenges in sugarcane processing. This work was intended to help solve some of the problems hindering a successful design and manufacturing of a sugarcane peeling machine. Canes were graded into small, medium and large sizes. Machine was tested by abrasive tool and efficiency upto 59.66% was achieved.

G. Xinfeng [18] studied the sugarcane peeling machine in simulated conditions and the results show that the machine can peel sugarcane successfully with convenient, fast and uniform speed. Bastian and Shridar [5] reported that the detraging is the removal of leaves and top from harvested cane stalk. The operating parameters of a high speed rotating brush type detraging mechanism were investigated so as to aid the development of a combine harvester. Ahmat *et al.* [2] designed and developed a sugarcane bark/skin peeling machine with new design was proposed to solve the peeling method by designing a new blade installed with rollers to push in and out the sugarcane stalk in blade compartment. By following engineering design process the idea was transformed into CAD data and prototype was built.

Zhang Dehui, [10] showed that sugarcane peeling machine based on motion controller, it can realize the automation of input, peeling and output. Kuri and Naik [13] developed a sugarcane bud chipping machine and indicated that the equipment has reduced /totally eliminated the manual effort, as required for generating the sugarcane buds as compared to traditional tools. The whole equipment is very compact and simple with additional safety measures. Anonymous [3] developed a manual sugarcane scrapper-cum-cutter was developed to clean and cut unwanted portion of sugarcane with less effort. This is very useful for juice vendors and is being used by the Jaggery Unit at ICAR-Indian Institute of Sugarcane Research, Lucknow for supply of clean and fresh sugarcane juice being sold at Ikshu Hub of the institute.

Chavan *et al.*, [9] conducted the automatic sugarcane node cutting machine with the variation in size of individual stalk inter-nodes with position on the stalk and with crop

growth. In tradition planting method, great human force and high volume of sugarcane stalk in hectare is required. To solve this problem, they suggested the application of machine vision system and image processing methods to identify nodes from sugarcane and to plant it. Bhangé *et al.*, [7] determined the automated sugarcane node cutting machine via image processing as sugarcane planting with traditional methods is costly, time-consuming and necessary compression of buds in the field is not achieved easily because of stalk planting in sugarcane. In traditional planting method, great human force and high volume of sugarcane stalk per hectare is required. To solve this problem, they suggest the application of machine vision system and image processing methods to identify nodes from sugarcane and to plant it as a seed by planting machines. Anonymous., [4] a cleaner-cum-washer has been developed at Indian Institute of Sugarcane Research, Lucknow for pre-cleaning of sugarcane prior to crushing for jaggery making. This unit has feed and scrapping rollers for cleaning and arrangement of water spray for washing of sugarcane. El. Yamini *et al.* [19] evaluated the performance of a new small-scale sugarcane peeler machine. The maximum machine production efficiency (88.85%) and the minimum electrical power consumption (5.56kW) were achieved with no. of feeding canes per minute of 3 canes, respectively. Also, the minimum machinery unit cost was 67.49 LE/Mg and 9 cans/min feeding rate.

Abarna *et al.* [1] designed a sugarcane bud removal machine which cuts the sugarcane buds in smaller size for the plantation purpose, where these buds are smaller in size compared with the earlier plantation method. Jadhav *et al.*, [12] conducted a sugarcane node cutting by using machine vision technique to be used in sugarcane node cutting while plantation it saves the time and it is safer than conventional one.

Gadekar *et al.* [11] developed a sugarcane peeling machine and it's aimed that providing a base for the commercial production of sugarcane peeling machine. This work was intended to help solve some of the problems hindering a successful design or manufacturing of sugarcane peeling machine. Sugarcanes were graded into small, medium or large sizes. Machine was tested by abrasive tool and efficiency upto 59.67% was achieved [20].

CONCLUSION

Quality of jaggery and juice largely depends on the cleaning and clarification process in jaggery production. There are many impurities sticking to sugarcane stalks, which go into juice when sugarcane is not cleaned prior to crushing. Manual cleaning of sugarcane is arduous and time and labour consuming. To ease out this operation, ICAR-Indian Institute of Sugarcane Research (IISR), Lucknow has developed a 'sugarcane cleaner-cum-washer', is the best from impurity removal point of view. The capacity of machine matches with normal sugarcane crushers being used by jaggery manufacturers. Colour of juice and jaggery improved with impurity removal. It justifies development of such machine. The machine may be useful for large scale juice extraction for juice sale purpose.

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