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Development of Sugarcane Peeler



Abstract- India is a nation mostly engaged in agriculture. The production of a wide variety of agricultural crops makes sugarcane one of the most important output crops in India. Sugarcane is often identified as the source of sugar for everyday use. Sugarcane has several applications, including medicinal usage, as a food additive, and as a rapid source of energy. The peeling procedure is essential for obtaining sugarcane juice. This procedure eliminates dirt, dust, black spots, and other contaminants from the outer layer of the sugarcane. This study aims to develop and fabricate a sugarcane peeling machine. To address the issue of manual sugarcane peeling, a sugarcane peeling machine has been invented. This apparatus comprises an electric motor, bearings, peeling blades, gears, and a chain drive. This study seeks to minimize the overall time needed for manual peeling and alleviate operator fatigue resulting from the laborious peeling process. The time needed to physically peel a 50 cm length of sugarcane is 90 seconds, but a sugarcane peeling machine does the same task in 20 seconds. The suggested equipment is anticipated to peel sugarcane more rapidly with less fatigue.

Keywords: Sugarcane, peeling, sugarcane juice, agricultural crop, fatigue

INTRODUCTION

The cultivation and harvesting of sugarcane is an effective method for the production of both food and bioenergy, making it one of the most well known industrial crops in the modern world. Sugarcane is one of the six to thirty-seven species that fall within the broad group of perennial grasses, as stated by the taxonomic categorization. Sorghum, Johnson grass, and maize are all members of the same family as this tropical grass, which belongs in the same family. The sugarcane plant is a multipurpose crop that may be used to produce sugar, juices, jaggery, and a variety of other products. There are a number of countries, particularly India, that like drinking fresh sugarcane juice as a sweet beverage. One of the most important sugarcane-producing states in India is Uttar Pradesh, which is responsible for 38.61% of the country's total sugarcane production. According to the rankings, the states of Maharashtra and Karnataka are the second and third largest producers, respectively. In addition to the leading producers, the states of Bihar, Assam, Haryana, Gujarat, Andhra Pradesh, and Tamil Nadu feature prominently. Numerous places, ranging from roadside kiosks to dining rooms in five-star hotels, provide customers with the opportunity to purchase sugarcane juice.

Peeling is done before extracting juice from sugarcane, which is the first step. Peeling is the first step in the whole process, which begins with harvesting and continues through processing. An extensive number of research have been conducted to explore the process of peeling sugarcane. Sugarcane stalks are removed from the field to be harvested during the harvesting process. There is a possibility that sugarcane may make a contribution to the economy of the country. At the present day, sugarcane stalks are used as a raw material in a variety of industries, such as the chemical industry, the animal feed industry, the pharmaceutical industry, the mushroom culture industry, and the fertilizer industry. It is advised that sugarcane be cultivated in order to provide a supply of sugar raw materials and to improve the economic well-being of those who produce sugarcane.

Peeling is a process that includes removing the outer layer of sugarcane, as well as any black spots, mud, and other pollutants like as dust and dirt. This is followed by the removal of the outer layer. The use of sugarcane or sugarcane juice that contains these toxins will have a detrimental effect on the health of this population. In order to improve the quality of sugarcane juice, the process of peeling sugarcane is necessary. The amount of sugar that is present in sugarcane juice varies according on the type, maturity, environmental conditions, growing techniques, and the presence of compounds that are not sugar. The process of manually peeling sugarcane is a labor-intensive activity that causes weariness in the workers. It is possible that the workers may get injuries as a result of the

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manual peeling process that involves the use of blades or knives. It may be possible to find a solution to this problem by creating a machine that can function without human intervention, hence reducing the amount of time and effort required by humans. Our goal is to create an automated sugarcane peeling machine that is not only economically feasible but also solves the problems that are connected with devices that are operated manually.

LITERATURE REVIEW

Professor S. J. Kadam Sarita Sutar, Prathamesh Shinde, Kiran Shelke, Amrapali Patil, "Design and Fabrication of a Sugarcane Peeling Machine" March 10, 2018

India is a nation mostly engaged in agriculture. The production of several agricultural crops makes sugarcane one of the most important output crops in India. This proposal addresses the concept of a sugarcane peeling attachment. Numerous small-scale sugarcane juice producing facilities need hand washing of sugarcane. The cleaning of sugar cane prior to its introduction into the juice extraction equipment is a time-consuming and laborious process. The objective of this project is to develop an automated sugarcane peeling attachment. The objective of this project is to reduce the total time required for hand peeling and to alleviate operator fatigue caused by the arduous peeling procedure.

GeXinfeng, "Design of Sugarcane Peeling Machine," AJFSAT, February 25, 2015. The sugarcane peeling machine was developed to resolve the challenges associated with manual sugarcane peeling. It comprises a motor, groove wheel, cutting area, slider crank mechanism, reducer (incorporating belt drive and chain drive), and other components. A simulation of the planned sugarcane peeling equipment demonstrates that the machine can effectively peel sugarcane in a convenient, rapid, and uniform way.

El-Yamani, A. E. and M. A. Basiouny, "Performance Evaluation of a Novel Sugarcane Peeling Machine Prototype", Vol. 7, 2016.

The objective of the present investigation was to develop and evaluate the efficacy of an innovative small-scale sugarcane peeling apparatus. Empirical evaluations were performed on the developed machine prototype during the 2014–2015 agricultural season at a private sugarcane facility in Kafrel Sheikh province. The investigations demonstrated the outcomes of the principal design and operational factors on the efficacy of the equipment and the quality of the end output. Three distinct parameters were analyzed in the research. There are three distinct varieties of peeling drum brushes: zigzag and spiral. There are four peeling drums. Three feedings are integrated with a peeling drum. The device's efficiency in machine production, the efficacy of cane stalk peeling, and the retention of peel on the peeled stalks.

Rita Maria Veranika, Madagascar, Selvia Aprilyanti, Tine Aprianti, "The Manufacture of Sugarcane Peeler and Squeezer," AUSTENIT Vol. 14, April 2022

This project aims to develop and fabricate a sugarcane extraction equipment powered by a combustion engine. The manufacturing process of this machine employs a propulsion system of combustion engines, pulleys, v-belts, gears, shafts, pegs, rollers, and bearings. The outcomes derived from the design and fabrication of this sugarcane squeezer machine indicate that the energy and time used are more efficient, and the processing of sugarcane occurs at a quicker rate compared to manual methods. The tool's design parameters include a 0.5 Hp engine capacity, 220 volts, and a rotation speed of 2500 rpm.

Sreedevi Pandraju, Madhava M, Amith Padhi, "Development of a cost-effective sugarcane peeler for small vendors," The Pharma Innovation Journal 2021; SP-10(3): 248-253

A cost-effective sugarcane peeling equipment was designed for small-scale sellers. The machine's performance was assessed for peeling efficiency, production efficiency, cane stalk weight reduction, power consumption, and speed, with results compared to hand peeling. Following the peeling procedure, juice was taken from the peeled canes, and the quality of this juice was compared to that obtained from manually peeled canes. The mechanical peeler attained an output capacity of 109.6 kg/h, with a production efficiency of 75.4%. The automated sugarcane peeler demonstrated a labor savings of 66.6% and a time savings of 164% compared to human peeling.

PROBLEM STATEMENT

Bacterial development and black spots develop on the outer layer of sugarcane during the off-seasons, notably in the wet and winter months. The outer layer of sugarcane includes contaminants such as grit, dust, and mud. Most sugarcane juice is sold by small businesses using a traditional manual peeling equipment to remove the outer layer of the sugarcane prior to juice extraction. The manual procedure for peeling sugarcane is labor-intensive and time-consuming. Removing the outer layer of sugarcane requires some time. The hand peeling technique results in significant waste of valuable sugarcane flesh and leads to uneven removal of the outer layer, exacerbating the loss. Manual operation requires considerable human effort. There is a potential danger of harm to the worker executing the peeling process. If the sugarcane remains unpeeled, healthy juice cannot be extracted, resulting in inferior juice quality due to the contaminants present. When sugarcane is placed in the juice extraction machine without peeling, the hard nodes may harm the equipment, hence diminishing its performance and efficiency.

Operation: Upon activation, the motor imparts motion to the hollow shaft and worm gear. When the motor rotates, power is delivered at a 90-degree angle owing to the worm and worm gear mechanism. This is used to spin the rollers perpendicularly to the plane. The inner race of the bearing and the hollow shaft are rotated by direct drive from the motor. As sugar cane is processed via the revolving hollow shaft, it first encounters brushes. These brushes first cleanse the sugar cane and eliminate the black carbon contained on it. Subsequently, the sugar cane interacts with the spring-loaded blade assembly, where the actual peeling of the sugar cane occurs. Variations in the size of sugar cane result in corresponding differences in the diameters of the blades due to the springs. The variation in the size of sugar cane can be offset by using a spring-loaded blade assembly. Subsequent to the passage of the sugar cane between two rollers operating in opposing directions. This roller is used to extract the peeled sugar cane from the hollow shaft.

CONSTRUCTION AND WORKING

A sugarcane peeler was designed and built to automate the peeling of sugarcane, replacing the traditional method. This concept features a semi-automatic sugarcane peeler designed for both small vendors and high-capacity stores. a structure including a frame, 6-8 peeling blades, two sprockets (one smaller associated with the motor and the other with the design blades), chains, bearings, two semi-circular clamps, tire rubber, and a power capacitor. The frame is designed to support all interior components of the sugarcane peeler. In the design of the sugarcane peeler, the frame column is positioned at an angle that ensures optimal contact with the ground surface. The design, at a certain angle, ensures optimal contact with the surface and minimizes vibration during the operation of the sugarcane peeling machine. The motor used in this peeler is crucial for transmitting power from the motor to the blades. This experiment employs a total of 6-8 adjustable peeling blades, according to the diameter of the sugarcane. The four higher angles and four lower angles are affixed to the stand's legs by electric welding. The angle in this study is composed of mild steel material.

Blade markings on grooves are used for the precise peeling of sugarcane. The chain is used to provide rotating motion to the sprocket for the purpose of peeling. When electricity is supplied to the motor, it initiates rotation of the motor's sprocket, which in turn turns another sprocket attached to the peeling blade, facilitating the peeling of sugarcane by the action of the blades. In this research, the sugarcane moves horizontally while the blades exhibit rotating motion. Sugarcane juice extractors are basic apparatuses used to extract juice from sugarcane stalks. They are extensively used in small-scale juice production and are operated manually by human labor. The fundamental elements of a manual sugarcane juice extractor, as seen in fig.1, include a metallic framework, a series of rollers, a feeding chute, and a collecting tray. The sugarcane stalks are first stripped using a specialized sugarcane peeler machine to eliminate dirt and debris. They are then sent into the feeding mechanism, which channels them towards the rollers. The rollers are the primary elements involved for extracting juice from sugarcane stalks. The rollers move in opposing directions. They are often composed of metal and are engineered to spin in opposing directions. The rollers exert pressure on the sugarcane stalks, crushing them and extracting the juice. The juice exits through the gap between the rollers and is gathered in a tray positioned underneath the extractor. The integration of the peeler and juice extractor sections is seen in Fig 2.

03	Stand	Mild Steel
04	Chain	Plain carbon steel
05	Sprocket	High carbon steel

RESULT AND DISCUSSION

The sugarcane length ranges from 220 to 255 cm, while its diameter varies from 20 to 34 mm. A comparison between the hand peeling procedure and the sugarcane peeling machine has been conducted. The time needed to physically peel a 50 cm length of sugarcane is 90 seconds, but a sugarcane peeling machine does the same task in 20 seconds. In one hour (i.e., 3600 seconds), 180 pieces of sugarcane, each measuring 50 cm in length, may be peeled. The specifications of the designed sugarcane peeler were measured and are shown in the following table.

Parameter	Details (machine)
Overall Height	86cm
Overall Length	54cm
Overall Width	54cm
Peeling Mechanism	Blade Type
Power Source	0.14Hp
Speed of Motor	1200RPM
No. of Blades	08

CONCLUSION

The sugarcane peeling machine, equipped with a 0.2HP electric motor and eight blades, operates at a quicker pace than hand peeling. The goal of designing and constructing a machine to reduce the time needed for manual sugarcane peeling has been accomplished. The issues arising from hand peeling, such as labor weariness, time consumption, danger of harm to workers, and unclean sugarcane, have been significantly mitigated. The machine's overall performance is very efficient. The maintenance cost of the machine is comparatively lower. The sanitary peeled sugarcane, free from dirt, dust, germs, and black spots, is obtained for further juice extraction.

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