



E-ISSN: 2278-4136
P-ISSN: 2349-8234
JPP 2018; 7(2): 1638-1640
Received: 22-01-2018
Accepted: 25-02-2018

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Design of straw size cutting machine for mushroom production

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Abstract

Paddy straw mushroom is also known as “warm mushroom” as it grows at relatively high temperature. A local equipment cleaver knife (*Katti*) is used to cutting of paddy straw. The cleaver knives (*Katti*) have many problems to the operator. Due to repetitive action many times the fingers of the operator got injured and also discomfort to the shoulders. There is no any suitable machine for cutting paddy straw in different size. After development of the machine its performance test was carried out in farmers field at Kisanpur, Pithora Block of Mahasamund district. The chaff cutter is a hay cutting machine which is used in uniform chopping of the fodder for livestock or mushroom production. The power operated paddy straw size cutter was tested at different paddy straw bale. The drawing of the conceived straw cutter was prepared using AutoCAD software. The machine consisted of main frame and belt drive attachment, blade, blade cover, column, shaft and electric motor. The construction of the machine was the main study.

Keywords: paddy straw mushroom, straw cutter, cutting mechanism, cutter blade

Introduction

Chhattisgarh is the major paddy growing state in India with a production of 7.65 million tonnes (Anonymous, 2015) and at the same time a huge amount of paddy straw i.e. 50% is also generated in this state. Therefore, till such time diversification of cropping pattern to reduce the area under paddy becomes reality, an effective policy for management and utilization of paddy straw needs to be put in place. Paddy straw mushroom is also known as “warm mushroom” as it grows at relatively high temperature. This mushroom can use wide range of cellulosic materials and the C: N ratio needed is 40 to 60, quite high in comparison to other cultivated mushrooms. It can be grown quite quickly and easily on un-composted substrates such as paddy straw and cotton waste or other cellulosic organic waste materials (Ahlawat and Kumar, 2005) [5]. The straw is tied in bundles of about 8-10 cm in diameter. The bundles are then cut to a uniform length of about 50-60 cm by the use of cleaver knife (*Katti*). Sizing of straw is one of the most labour-intensive processes for mushroom cultivation. Hence a suitable machine is required for doing the cutting operation smoothly, smartly without any drudgery to the body with quick action and efficient cutting of paddy straw without clogging. The main objective is to design a cutting unit for making suitable paddy straw size which can be utilized for mushroom production with ease and thus reducing the manual work of farmers.

Methodology

- 1. New cutting technology:** The research work in this domain was studied and new methods were developed to achieve desired goal.
- 2. Single phase operation:** The power supplied to machine is single phase so to make it easy to operate at any location.
- 3. Safety:** Highest priority is given to safety of the operator.

Construction and working of paddy straw size cutter

The main components of power operated paddy straw size cutter are as below-

1. Main frame

The whole assembly was mounted on a tubular frame constructed by angle iron frame. A rectangular frame was developed with suitable dimensions to be mounted on this frame. Frame is the main base of the vehicle on which body is mounted with circular blade and belt conveyor.

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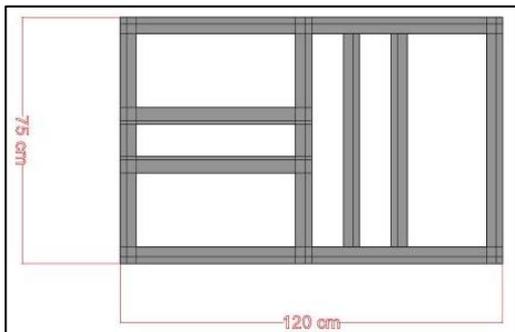
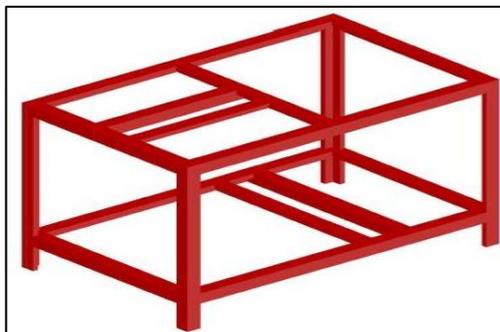


Fig 1: AutoCAD design of frame with dimensions



2. Design of shaft

A solid shaft rotating at 1440 rpm is assumed to be made of mild steel. A Shaft is a rotating element, usually circular in cross section, line shaft is used to transmit power from one shaft to another, or from the machine which produces power, to the machine which absorbs power. The diameter of shaft taken is 25 mm which is safe.



Fig 2: Design of shaft with dimensions

3. Design of circular cutter blade

The cutter blade is the cutting device which is having cutting teeth on its periphery. Stainless steel blade of having diameter of 300 mm and no. of teeth is 100. They have sharp edge, they used to cut paddy straw into suitable size.



Fig 3: Design of cutter blade

4. V-Belt pulley

To transmit power from motor to cutter blade shaft this V pulley is used.

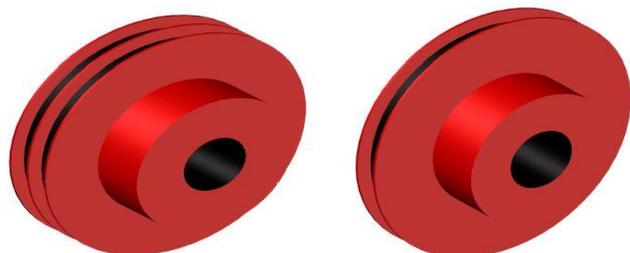


Fig 4: Design of multiple and single pulley

Design of V-belt drive

V belt drive arrangement is used to transmit power from motor to shaft which is connected to cutter mechanism. The

use of V-belts in multiple, allowed drives with a much variable range of horsepower capacity than ever before obtainable using single belt drives.

5. Design of belt conveyor

Horizontal conveying length and conveying lift, characteristics of material to be conveyed and capacity requirement.

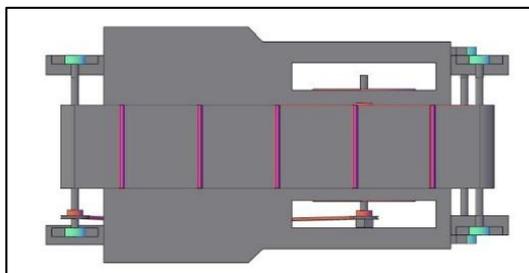


Fig 5: Top view of straw size cutter

6. Housing

Housing covers the cutting blade. Whatever chopping action is done it takes place within the housing. It protects the worker from any injury during operation.

Assembly: Isometric view of the driving system of the straw size cutter

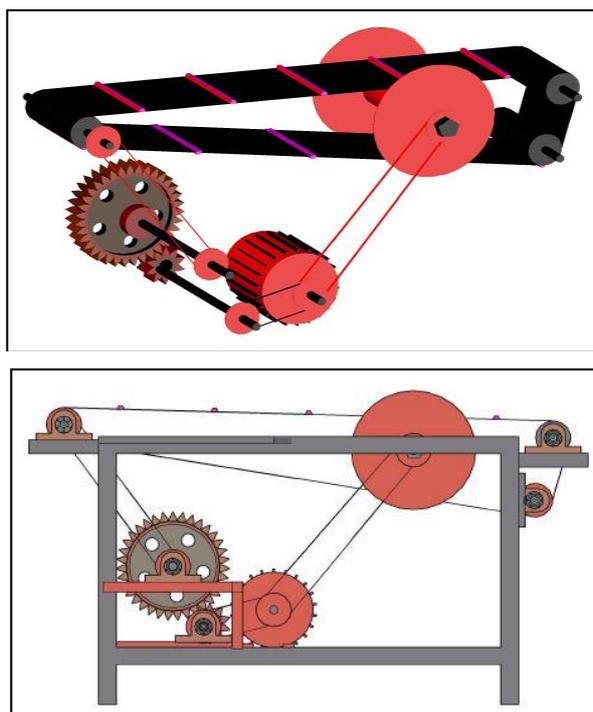




Fig 6: Straw size cutter machine after fabrication

7. Electric motor

An electric motor is a device for converting electrical power to mechanical power. Electric motors are essentially inverse generators: a current through coils of wire causes some mechanical device to rotate. The core principle underlying motors is electromagnetic induction. By Ampere's law, the current induces a magnetic field, which can interact with another magnetic field to produce a force, and that force can cause mechanical motion. Like generators, electric motors consist of a stator and a rotor and the three ingredients: electric current, magnetic fields, and something rotating.

Procedure

The power transmission system in used 1 hp motor to generated power to drive the multiple pulleys. The multiple pulleys used to distribute the power are blade drive and belt conveyor drive. The driver pulley which is attached to the driven shaft rotates the circular blade through v-belt drive mechanism. Two cutter blades were fitted in the cutting device with cutting teeth on its periphery. Another driven pulley that is connected to the longer shaft will transmit the power to the either side of the spur gear through the shaft. The longer will be mounted between the two plumber blocks which proved support the shaft. The rotating spur gears are in turn connected to pulley with the flat belt conveyor through roller which rotates the belt.

Conclusion

The paddy straw size cutter is designed and fabricated. This machine employees any use of power equipment's such as DC motors. The use of this machine makes the cutting process faster hence reduce most of the cutting time and labour required to operate the machine is also less. This machine is helpful for small as well as big firms. This power operated machine will help to improve an economical condition. This is new type of machine which is different to the other cutting machine which are used for cutting purpose till now.

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