WWW.IJRPR.COM

International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

Design and Fabrication of Multipurpose Rugged Cutting Machine for Agriculture

[1]S. Lokesh, [2]M. Gowtham Sai, [3]Nasrat Bhanu, [4]P. Charan Teja, [5]B. Sankara Rao, [6]D. Paresh, [7]A. Manoj Kumar, [8]D.H.V. Manish Reddy, [9]V. V. S. S. R. Krishna Murthy. Ch

[1,2,3,4,5,6,7,8]U. G Scholars, Dept. of Mechanical Engineering, N S Raju Institute of Technology, Sontyam, Visakhapatnam, AP, India

[9]Assistant Professor, Dept. of Mechanical Engineering, N S Raju Institute of Technology, Sontyam, Visakhapatnam, AP, India

ABSTRACT:

As agriculture is one of the main occupations in India, it is very essential to discover and implement new ideas in this field, although a lot of work has been done in this area. It is a pity that these ideas are not properly implemented in the real field. This is due to the high cost and difficult for the rural population. Multi-purpose agricultural cutting equipment is the basic and main equipment involved in agriculture for maximum performance. The conventional method of planting and growing crops is a laborious process, and therefore there is a shortage of manpower, resulting in a delay in agriculture to overcome these difficulties. Multi-purpose agricultural equipment is designed. Agriculture plays a vital role in the Indian economy. Over 70% of rural households depend on agriculture. Agriculture is an important sector of the Indian economy, contributing approximately 8.4% to the total GDP and providing employment for over 60% of the population. Indian agriculture has experienced impressive growth over the past few decades.

KEYWORDS — Agriculture, cutting equipment

1. INTRODUCTION

Agriculture is one of the most significant sectors of the Indian Economy. Agriculture is the only means of living for almost two thirds of the workers in India. The agriculture sector of India has occupied 43% of India's geographical area, and is contributing 16.1% of India's GDP. In India agriculture has been facing serious challenges like scarcity of agricultural labour, not only in peak working seasons but also in normal time. This is mainly for increased non-farm job opportunities having higher wage, migration of labour force to cities and low status of agricultural labours in the society. On the other hand cultivable land is decreasing due to urbanization. Agricultural mechanization is one way to overcome this problem. Fortunately, there are many opportunities to move forward with agricultural mechanize

1.1 Sugarcane

India is one of the largest sugarcane producers in the world, producing around 300 million tons of cane per annum. For plantation of sugarcane, the sugarcane seed has to be planted in wet soil. This sugarcane seed is nothing but part of sugarcane. Sugarcane has approximately 15-18 seeds. In traditional way farmers use to cut whole sugarcane in 5-6 parts, in such a way that each part having 2-3 seeds. Then those cut parts are planted in soil. About 4 million sugarcane farmers and a large number of agricultural labours are involved in sugarcane cultivation and auxiliary activities, constituting 7.5% of the rural labour force.

1.2 Straw

Straw is remaining part of Jowar and Maize plant, after removal of corn part. Farmer use to cut this straw and use this cut parts as a food for pet animals like buffalos, cows, ox and goat etc. Initially this straw is of around 150-200 cm. And this should be cut into small pieces.

1.3 Groundnut

Groundnut is one of the important agriculture products in India. Farmer use to separate groundnuts from its plants by manually. This require more man power as 20-30 labours per acre, and also this is time consuming operation. A single groundnut plant contains 20 to 30 groundnuts.

Specification groundnut on average basis as below,

Length of groundnut root = 30 mm

Length of groundnut = 20 mm

Width of groundnut = 10 mm

1.4 Paddy

Rice is one of the favourite foods of India. Paddy is the initial stage of it. Farmers removing this paddy from paddy plant called as paddy stripping, and this is done by several methods. Most of the time farmers use to remove paddy from its plant by manually. Also there are several machines available for paddy stripping.

2. LITERATURE REVIEW

[1] Mayank Kumar Gupta, Pradeep Tyagi, Shubham Chauhan (2017) 'Design and Fabrication of Multi Crop Cutter', International Journal of Advanced Research in Science, Engineering and Technology, 4(5), pp. 256-259.

[2] This paper titled “Design and fabrication of multi crop cutter” has stated The research work focusing on harvesting operation to the small land holder to cutting varieties of crop in less time and at low cost.

Lakshmipathi Yerra, K Sandeep Kumar, M Anil Kumar (2017) 'Development of Multipurpose Agricultural Cutter', International Journal for Research in Applied Science & Engineering Technology (IJRASET), 5(V), pp. 2321-9653.

This paper titled “Design and Fabrication of Multipurpose Agriculture Vehicle” has stated that harvester design is based on the design of brush cutter.

[3] Marco Bentini, Roberta Martelli (2013) 'Prototype for the harvesting of cultivated herbaceous energy crops, an economic and technical evaluation', elsevier, 7(57), pp. 2 2 9e2 3.

Here is the list of machines or operations on which literature survey is carried out.

- Sugarcane Seed Cutting

Manually Operated Sugarcane Seed Cutter

- Straw Cutting

By Traditional method

By Using Straw Cutter Machine

- Groundnut Stripping

By Traditional method

Groundnut Stripper

- Paddy Stripping

Hammering on metal beds

Paddy Stripping Machine

3. COMPONENTS

A. Shaft

A solid shaft rotating at 300 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.

Fig 1. Shaft

B. V-Belt

To transmit power from motor to cutter blade shaft this V pulley is used. 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 power capacity than ever before obtainable using single belt drives.

Nominal top width: 13mm (DDHB)

N Nominal thickness: 8mm

Maximum velocity: 25m/s

Power range: 250-350 Watt

Fig 2. V-Belt

C. Power Source(Motor)

The electric motor is an electric machine used to convert electrical energy into mechanical energy, for smaller loads such as in domestic applications. Although traditionally used in fixed speed services, induction motors are increasingly used with variable frequency drives in variable speed services. Power of motor = 1/4 hp. Speed of motor 300 rpm.

Size: 250-350 watts

Speed: 800RPM

Fig 3. Motor

D. Plumber Block

It has two Plumber block are extensively used for furnishing support for a rotating shaft with the help of compatible compartments. It's used for long shafts taking intermediate support.

Material Type: Casting

Internal Diameter: 25 mm P 205

Width: 35 mm

Fig 4. Plumber Block

E. Pulleys

A pulley is a wheel that carries a flexible rope, cord, cable, chain, or belt on its rim. Pulleys are used singly or in combination to transmit energy and motion.

Material of pulley Casting

Diameter of smaller pulley: 50mm

Diameter of larger pulley: 300mm

Fig 5. Pulley

F. Bearings

Bearings are "parts that assist objects' rotation". They support the shaft that rotates inside the machinery. Machines that use bearings include automobiles, airplanes, electric generators and so on.

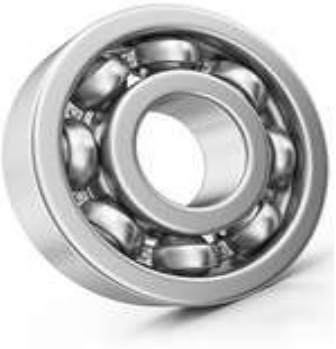


Fig 6. .Bearing

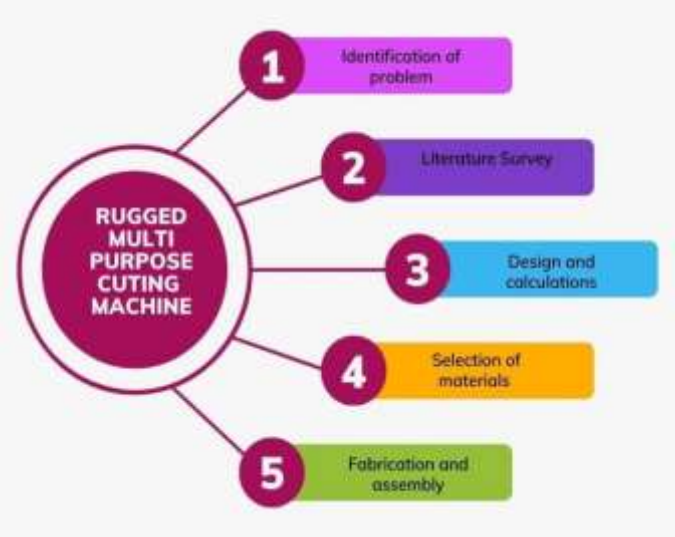
4. METHODOLGY

1) Sugarcane Seed Cutting :The sugarcane seed cutting machine is mainly based on cam operation. One shaft placed vertically, the sharp blade is placed at the bottom of this shaft Rotator motion of the cam is converted into reciprocating motion of shaft. A pin is placed at the base so that waste of sugarcane and sugarcane with seeds will be separated.

2) Groundnut Stripper : Groundnut stripper consists of rubber blades mounted on the small shaft which will rotated by motor. The power of motor is transmitted to the blades through shaft. The groundnut plant will be feed to blades with the help of slider by manually. Then rotating blades will separate the groundnut from the plant.

3) Straw Cutter : Straw cutter consists of three blades which are mounted in circular ring that is connected to motor through belt drive. The power of motor is transmitted to the ring with the help of pulleys and belts. That rotating blades will cut the straw in small pieces.

4) Paddy Stripper : Paddy stripper consists of two rims. These rims are mounted on one central shaft, and that shaft will connected to motor through pulleys and belt. The power of motor is transmitted to rims. The rotating rims will separate the paddy from plants.



Process flow chart of our project work

5. RESULT

Fig. 5.1 Top view of our project after assembly

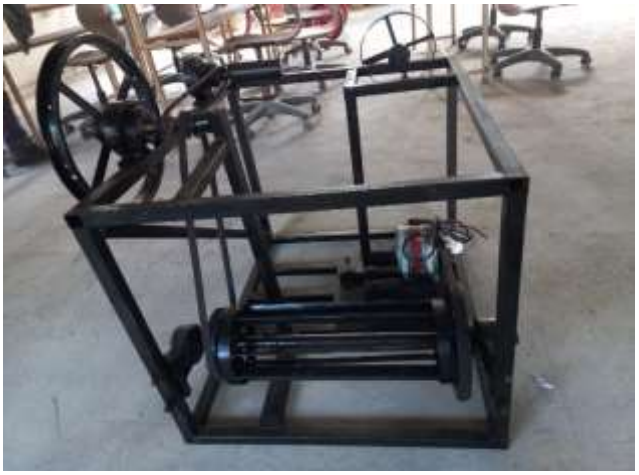


Fig. 5.2 Front view of our project after assembly

6. CONCLUSION

The rugged multipurpose cutting machine combines four individual operations, reducing the need for manual labor and increasing efficiency. Our design focuses on minimizing costs and ensuring ease of operation for small farm units. By performing multiple operations, the machine saves processing time and reduces waste. For example, in sugarcane seed cutting, the machine allows for easy control of sugarcane wastage and produces cut seeds that are suitable for sowing. In groundnut stripping, two laborers can replace the work of 10-20 when using the machine. Similarly, in paddy stripping, the machine reduces wastage and can replace the work of 5-6 laborers with only two. Widespread adoption of this machine by farmers can alleviate the labor crisis and improve efficiency. The machine's ability to perform multiple operations with flexibility and a balanced mechanism represents a significant technological improvement in the agricultural sector and will motivate farmers to adopt it..

6. FUTURE SCOPE

Advanced sensors and microcontroller devices can be used to make this machine more comfortable for human operators while reducing costs. The potential for this machine in the future is vast. Currently, separate machines for individual operations are available in the market, but they are often expensive. It is possible to combine additional operations with the same machine, while some operations can still be done manually. By utilizing worm gears, the straw cutting operation can be automatically fed with straw. Furthermore, in addition to groundnut stripping, the same machine can be used to produce nuts with reduced cost and time.

REFERENCES

[1] Design of machine elements textbook by V.B Bandari.

[2] Design data hand book by P.S.G. College of Coimbatore.

[3] Mayank Kumar Gupta, PradeepTyagi, Shubham Chauhan (2017) 'Design and Fabrication of Multi Crop Cutter', International Journal of Advanced Research in Science, Engineering and Technology, 4(5), pp. 256-259.

[4] Dhatchanamoorthy.N, Arunkumar.J, Dinesh Kumar.P (2018) 'Design and Fabrication of Multipurpose Agriculture Vehicle', International Journal of Engineering Science and Computing, 8(5), pp. 17553-17560.

[5] Rudolf Charles D'Souza, Karthik Shenoy B., Keith Royston D'Silva, Rolin Antony D'Souza (2017) 'Design and Fabrication of Crop Cutter for Multipurpose Application', Journal of Mechanical Engineering and Automation, 4(7), pp. 109-111.

[6] LakshmipathiYerra, K Sandeep Kumar, M Anil Kumar (2017) 'Development of Multipurpose Agricultural Cutter', International Journal for Research in Applied Science & Engineering Technology (IJRASET), 5(V), pp. 2321-9653.

[7] Marco Bentini, Roberta Martelli (2013) 'Prototype for the harvesting of cultivated herbaceous energy crops, an economic and technical evaluation', elsevier, 7(57), pp. 2 2 9e2 3

[8] Amar B. Mule, Pravin T. Sawarkar, Akshay A. Chichghare ,Akash N. Bhiwapurkar , Dhananjay D. Sirsikar ,Kapil R.Gaurkar (2018) 'DESIGN AND FABRICATION OF HARVESTING MACHINE', International Research Journal of Engineering and Technology (IRJET).

[9] M.V.Achutha, Sharath Chandra, Nataraj.G.K (2016) 'Concept Design and Analysis of Multipurpose Farm Equipment', International Journal of Innovative Research in Advanced Engineering (IJIRAE), 3(2), pp. 30-36.

[10] M.V.Achutha, Sharath Chandra, Nataraj.G.K (2016) 'Concept Design and Analysis of Multipurpose Farm Equipment', International Journal of Innovative Research in Advanced Engineering (IJIRAE), 3(2), pp. 30-36.

[11] Dr. U.V. Kongre, "Fabrication of Multi Crop Cutter", IJIERT - International Journal of Innovation in Engineering Research and Technology, Vol.3, Issue 4, 0 April 2016, ISSN: 2350-0328.

[12] Bharaneedharan Muralidharan, "Design and Fabrication of Manually Operated Lawn Mower Applicable for Grass Cutting", IJIERT – International Journal of Innovation in Engineering Research and Technology, Vol.3, Issue 4, April 2014, ISSN: 2277-8179.