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[ijirset@gmail.com](mailto:ijirset@gmail.com)

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# Design and Fabrication of Groundnut Pod Separating Machine

**Prof. S. A. Khalkar<sup>1</sup>, More Sumit<sup>2</sup>, Sawant Aniket<sup>3</sup>, Patil Prasad<sup>4</sup>, Kapse Rohit<sup>5</sup>,**

Assistant Professor, Department of Mechanical Engineering, Jaywant College of Engineering and polytechnic, K. M. Gad, Maharashtra, India<sup>1</sup>

U.G. Student, Department of Mechanical Engineering, Jaywant College of Engineering and polytechnic, K. M. Gad, Maharashtra, India<sup>2-5</sup>

**ABSTRACT:** Small scale industries play an important role in Indian economic. It has emerged as powerful tool in providing relatively larger employment next to agriculture. It contributes more than 50% of the industrial production in value addition terms and generate one third of the export revenue. Global markets are continuously changing and demanding product of high quality and low cost. Such products can be produced using lean manufacturing, a management philosophy that aimed to reduce all types of wastes at all levels of product manufacturing so as to reduce product cost. This report deals with the design and fabrication of the Groundnut pod separation machine.

**KEYWORDS:** Groundnut pod, separation, quality

## I. INTRODUCTION

Groundnut or peanuts is a species in the legume or "bean" family. The peanut was probably first domesticated and cultivated in the valleys of Paraguay. It is an annual herbaceous plant growing 30 to 50 cm tall. The leaves are opposite, pinnate with four leaflets two opposite pairs; no terminal leaflet, each leaflet 1 to 7 cm long and 1 to 3 cm broad. Peanuts are known by many other local names such as earthnuts, ground nuts, goober peas, monkey nuts, pygmy nuts and pig nuts. Despite its name and appearance, the peanut is not a nut, but rather a legume. India is the second largest producer of groundnuts in the world. Indian groundnuts are available in different varieties as bold or Runner, Java or Spanish and Red Natal. Apart from raw edible peanuts, India is also in a position to supply Blanched Peanuts, Roasted Salted Peanuts and Dry Roasted Peanuts and a variety of peanut based products. The photographic view of groundnut is shown in the figure 2. The major growing state for groundnut is Gujarat, Andhra Pradesh, Tamil Nadu, Karnataka, Maharashtra Rajasthan, Madhya Pradesh, Orissa, and Uttar Pradesh. Threshing operation varies from the age-old procedure of using sticks and racks to the modern power threshers. In India the smallholder and marginal farmers do manual threshing using sticks and rakes. Variations also exist in stripping pods from the plant. After harvest bunch type plants are stacked in heaps with the pod-end exposed. After the crop has remained in this state for a week or so the pegs become brittle and the pods are plucked from the plants with labor. This operation is comparatively difficult as the attachment of peg to pod is stronger in bunch type, but drying the plants for a few days facilitates this operation. Sometimes the stripping of the pods is also performed side by side with the harvest when the crop area is small and laborers are available. In this case, the pods are dried immediately after stripping. The usual practice is to separate pods by beating the pod-end of the plants against a rough stone or a thick iron rod. This process damages a small percentage of the pods. The photographic view of traditional method is shown in figure 1.



Figure no 1: Traditional method of ground nut threshing.

## II. LITERATURE REVIEW

Mr. Marotrao Sarode [1], Design and Fabrication of Groundnut Shelling and Separating Machine Groundnut are the sixth most important oilseed crop in the world. It contains 48-50 per oil and 26-28 per protein, and is a rich source of dietary fibres, minerals and vitamins. It grows best on soils that are well drained, loosely textured and well supplied with calcium, potassium and phosphorous. Over 100 countries world-wide grow groundnut. Developing countries constitute 97 per of the global area and 94 per of the global production of this crop. The production of groundnut is concentrated in Asia and Africa (56 per and 40 per of the global area and 68 per and 25 per of the global production, respectively)

Arjun Vishwakarma et al [2], Shelling is the removal of grains from their stalk, pod or cub, either by stripping, impact action and rubbing or any combination of these methods. The most popular method of shelling which is still widely used in the northern part of Nigeria is the method of crushing or pressing the pods between the thumb and the finger to break off the pods and release the seed. The description of the drum type stripper developed at Zonal Research Centre, Tamil Nadu Agricultural University, Coimbatore. Drum type strippers consist of a hollow drum formed by two metal discs at the ends, connected on the periphery of 5 1/2 inch M.S. rods inserted inside and covered by thick and soft rubber tubes. This drum is mounted on pedestal bearings and is free to rotate. It is fixed on a framework at a conventional height so that the operator can stand and beat the root portion of handful of plants over the rubber-covered roads of the revolving drum. To avoid scattering of pods, a hood frame is also provided. The roof as well as the three sides, i.e. other than the operator's side is covered with a canvas or gunny bag. One man can carry the unit.

Amol Junnarkar, et al [3], Main purpose of this paper is to understand the design and fabrication of Groundnut Plucking Machine. Design is eco-friendly and the mechanism is as kept simple as possible. The concept of the project is such that the knowledge of designing, mechanism and plucking forces are increased. Some plucking forces are needed to pluck the Groundnut from its plant. This project consists of designing and development of a machine to pluck Groundnut so that the farmer can sell it directly in the market and can achieve more profit. This project can be directly applied for commercial purposes to produce number of identical machines as agricultural equipment. This project includes the process of designing and fabrication of different parts of this plucking machine considering plucking forces, economical and ergonomic factor for people to use. Main purpose of this project is to generate new technology of Groundnut plucking that would reduce human efforts and to make things easier than before. After the design and fabrication, it was transformed to its real product which made the objectives accomplished. We are going to design and fabricate such machine that will eliminate most of the problems which were faced by farmers to pluck the Groundnut from its plant. Productivity increased, efforts are reduced and hence farmers earn more profit.

Rajasekar M. et al [4], Groundnut or peanuts is a species in the legume or "bean" family. The peanut was probably first domesticated and cultivated in the valleys of Paraguay. It is an annual herbaceous plant growing 30 to 50 cm tall. The leaves are opposite, pinnate with four leaflets two opposite pairs; no terminal leaflet, each leaflet 1 to 7 cm long and 1 to 3 cm broad. Peanuts are known by many other local names such as earthnuts, ground nuts, goober peas, monkey nuts, pygmy nuts and pig nuts. Despite its name and appearance, the peanut is not a nut, but rather a legume. India is the second largest producer of groundnuts in the world. Indian groundnuts are available in different varieties as

bold or Runner, Java or Spanish and Red Natal. Groundnuts have been used since the origin of humanity. It is rich in oil and protein and has a high energy value. Oil extraction from groundnut is more common at village in most of the developing countries. Groundnut is very common and eatable item and its oil is used as a cooking medium. Also the by-product groundnut cake after oil extraction also contains 43 to 65 percent protein and 6 to 20 percent fat which is mostly used as food for cows and goats. At present there is a lack of workers in the field of agriculture and due to more cost in harvesting. Due to the above factors, farmers are not involved in groundnut cultivation. The removing of groundnut pods is a time consuming process and cost expensive. Temperature is very high at harvesting time so people finds difficult to work. To overcome these difficulties groundnut thresher is used in groundnut pod removing process which minimize the time and cost.

Deshmukh Shubham et al [5], Developing countries constitute 97% of the global area and 94% of the global production of this crop. The production of groundnut is concentrated in Asia and Africa (56% and 40% of the global area and 68% and 25% of the global production, respectively). India is an agricultural based country. Since last 50 year's lot of changes has been occurred in agriculture sector. Many new agricultural based industries have been started new varieties and species of plant have been discovered. In our country most of the people can be depend on the agriculture sector/field. The Groundnut is one of the major seed crop. This product in the cultivated in abundant quantity. There is lot of time waste in old method of groundnut pod separating. The time required for 1 Kg of groundnut pod separating from this groundnut is about 1 to 2 hours. So we have we have produces new machine for fast groundnut pod separating.

Pratik M. Patila et al [6], while finishing up this part, well very battled in having finished the venture task well on time. We had tremendous down to earth understanding on the assembling timetables of the working venture demonstrate. We are hence, glad to express that the teaching of mechanical inclination ended up being an exceptionally helpful reason. We are in that capacity overwhelmingly elated in the landing at the focused on mission. Without a doubt the joint wander has had every one of the benefits of intrigue and enthusiasm appeared by every one of us the credit goes to the solid appointment of our cluster associate in drawing out an asset satisfaction of our task depicted by the university. Although the outline rule forced testing issues which in any case were welcome by us because of accessibility of good reference books. The choice of decision of crude materials helped us in machining of the different parts to close resilience and in this manner limiting the level of wear and tear. In this report, we built up a branch and bound approach which is combined with fast. The plan of control design was an essential part of study in light of the fact that a solid association between the wide ranges of parts was required.

### III. PROBLEM IDENTIFICATION AND METHODOLOGY

#### Problem Identification

- In the beginning the peanuts were groundnut pod separated by the workers. This method is very harmful for the workers, because of that damaging the fingers of the worker.
- The output got from this method, was very low and it does not fulfill the market demand because it was very time consuming process.
- It was also a boring work for the worker.
- Introduction gives knowledge that the traditional method is not a sufficient method for separating the groundnut pod from the plant.
- Due to this manual process, identify some major problem & to over-come this problem some idea or concepts generates.
- According to generated ideas deciding objective of project. Formers and small businessman are facing.

#### Research Methodology

- Research methodology deals with design & fabricated all of component which is to be used in the machine with required modification. Firstly synthesis the all the problem which are consult with project.
- After that design complete electrical operated machine, then regarding development done on separating machine. Parameters will be selected according to objectives. It components and assembled machine and line diagrams with labeling.
- The various instruments used for fabrication of machine. Another problem is that nuts with minimizing time consuming and damages of nuts, capacity also improve. The approach will be synthesis, design, development & testing of the machine.

#### IV. CONSTRUCTION

The project contains following components

**Frame:**

The frame is used to support all the components. Material of frame is cast iron and height up to 1m.



Figure no 2: Construction of Frame

**Motor:**

The motor are used to rotate the shaft at required speed to remove the pods. Motor and shaft are connected by use of belt.



Figure no 3: Electric Motor

**Pulley**

A pulley is a wheel on an axle or shaft that is designed to support movement and change of direction of a taut cable or belt along its circumference. Pulleys are used in a variety of ways to lift loads, apply forces, and to transmit power.



Figure no 4: Pulley

**Belt:**

A belt is a loop of flexible material used to link two or more rotating shafts mechanically, most often parallel. Belts may be used as a source of motion, to transmit power efficiently, or to track relative movement. Belts are looped over pulleys and may have a twist between the pulleys, and the shafts need not be parallel. In a two pulley system, the belt can either drive the pulleys normally in one direction, or the belt may be crossed, so that the direction of the driven shaft is reversed. The belt and pulley arrangements are shown in the figure.



Figure no 5: Belt

**Bearing:**

A bearing is a machine element that constrains relative Motion to only the desired motion, and reduces friction between moving parts. The design of the bearing may, for example, provide for free linear movement of the moving part or for free rotation around a fixed axis; or, it may prevent a motion by controlling the vectors of normal forces that bear on the moving parts. Many bearings also facilitate the desired motion as much as possible, such as by minimizing friction. The ball bearing is shown in the figure.



Figure no 6: Bearing

**Shaft:**

A shaft is a rotating member, usually of circular cross section used to transmit power or motion. It provides axis of rotation, or oscillation, of element such as gears, pulley, flywheel, crank, sprockets. In order to transmit power various member such as pulley and gears are mounted.

**Cutting Plate:**

A Cutting plate consists of V shape teeth for separating the groundnut pods from the plant. Plate contains two holes at the ends. Plate is attached with the shaft using nut and bolts for any replacement if necessary. A shaft contains two plate, they are fitted with angle 180°. A plate is continuously rotated with the help of shaft. Groundnut plants are feed perpendicular to the rotation of plates. The photographic view of cutting plate is shown in the figure 5.6



Figure no 7: Cutting plate

V. DESIGN OF GROUNDNUT POD MACHINE

**Groundnut Specification**

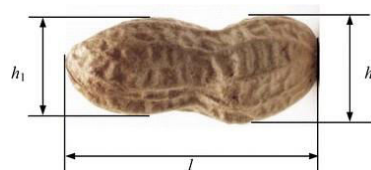


Figure no 8: Groundnut Specification

A single groundnut plant contains on average 20 to 30 groundnuts.Length of groundnut root = 30 mm

Length of groundnut = 20 mm

Width of groundnut=10 mm

**Table Specification:**

Length of table, l = 600mm Breadth of table, b = 960 mm Height of table, h = 920 mm

Floor space required (Area), A = 0.576 m<sup>2</sup>

**Specification of Cutting Plate:**

Length of the blade= 470 mm

Thickness of the blade= 4 mm

Gap between tooth= 6 mm

Length of the teeth= 10 mm

**Power Calculation:**

Power,  $P = 2 \pi NT / 60$

Speed required N = 200 rpm

$P = (2 \times \pi \times 200 \times 34.5) / 60 P = 722.2 \text{ W}$

$P = 0.968 \text{ HP}$

So for application we choose 1HP

**Design of Shaft: Torque,**

$T = \pi \tau d^3 / 16$

Allowable shear stress,  $\tau = 42 / \text{mm}^2$  Torque,

$T = (3.14 \times 42 \times d^3) / 16$

$34.5 = (3.14 \times 42 \times d^3) / 16$

Diameter, d = 16.11 mm

The obtained shaft diameter is 16.11 mm. In order to do weld attachment on the shaft, diameter of the shaft is chosen to 30 mm.

Diameter of shaft, d = 30 mm. Shaft length used, L = 770 mm

**Specification of Pulley:**

For the load calculated the value range from 0.7 to 3.5kW, the type of belt to be used is a series.

Pitch diameter of pulley,

D = 160 mm Pitch width,

w = 50 mm, Groove angle,  $2\beta = 32^\circ$

**Specification of Belt:**

For usual load, P = 0.746 KW Type of belt = A

Nominal top width, W = 8 mm

Nominal thickness, T = 10 mm

**Calculation of Torque:**

A research paper by J.M.Troeger, E.J.William and J.L.Butler the peg attachment force or the tensile force required to separate peg from pod is 22.26 N. Here we use up to ten ground nut plants so the maximum force that is required to remove groundnut pod is up to 300 N with considering the weight of shaft and other mountings.

Torque,  $T = \text{Force} \times \text{Perpendicular distance}$  Force, F = 300 N

Perpendicular distance is the distance between the shaft axis and the plate edge is 115 mm

Torque,  $T = 300 \times 115 = 34500 \text{ N-mm}$ .

Torque,  $T = 34.5 \text{ Nm}$

## VI. ASSEMBLY AND WORKING

### Working Principle:

By utilizing electrical motor, the pivoting minute exchanged with the assistance of belt to the rotor shaft and fan shaft. The progression pulley is kept up on the electrical motor shaft. At the point when rotor turning the groundnut falls in the container and afterward groundnut squeezed between the rotor and flame broil. Around then groundnut seed and case isolated. The groundnut case and groundnut seeds fall in the plate. Because of high fan speed the high speed of air is made by utilizing this high speed air the light weight unit is tossed out from the machine and the groundnut seed falls in the plate because of this weight. We gather the seeds in the pot of pack.

The assembly of the project was done as follows:



Figure no 9: Assembly of project

#### VII. PERFORMANCE ANALYSIS

Based on the working of the groundnut thresher the following performance analysis was made. According to the analysis,

Number of workers required = 2 Collection of groundnuts per hour = 48 kg

Total working time period = 7 hours

Collection of groundnuts per day = 336 kg

Cost per labor = ₹ 170

Total cost = Labor cost = 340

Total cost = ₹ 340

Picking cost per kg = ₹ 340/360 = ₹ 0.945

Manual cost = ₹ 1500

By using groundnut pod separating machine we can save more money and less manual work. Now-a-days the climate is very hot and the labors find difficult to work in the farm. And also it is difficult to get worker in more areas. It will help the farmers to harvest with minimum time and money.

#### VIII. CONCLUSION

Our groundnut separator machine will help to improve the threshing efficiency of small farmers where electricity is available or not. It will also help to reduce both threshing cost and threshing time. Requirement of more number of workers will be eliminated as only two workers can carry out the complete threshing operation. The project objectives originally are to build a groundnut pod separator and cleaner using engineering principles to process groundnut. This machine can be used to collect medicine plants from environment where humans cannot go. Handicap person can increase his productivity or efficiency using this machine.

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