DESIGN AND FABRICATION OF GROUNDNUT THRESHER MACHINE

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Abstract :- **Groundnut is rich in protein and lipids and has a high energy valve. Groundnut is used commonly as eatable oil and commonly used for cooking purpose. At the present scenario there is a less worker at the field due to this cost of extraction increases. 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. In this paper we have explained about our groundnut thresher machine design and fabrication.**

Keywords : Groundnut, Groundnut Pods, Thresher machine,

1. INTRODUCTION

1.1 GROUNDNUT

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 in the order shown in the table 1. Indian groundnuts are available in different varieties as bold or Runner, Java or Spanish and Red Natal.

Table 1. Production of groundnuts in different countries.

Sl. NO.	PRODUCTION	PRODUCTION (MILLON TONNES)
1	China	17
2	India	9.5
3	Nigeria	3
4	United State	1.9
5	Myanmar	1.4

They have a rich nutty flavour, sweet taste, crunchy texture and above a relatively longer shelf life. Soil conditions in some producing regions are ideally suited for dry, clean and spotless Groundnuts in Shell. Groundnut is the major oil seed crop in India and it plays a major role in bridging the Vegetable oil deficit in the country. Groundnuts in India are available throughout the year due to a two-crop cycle harvested in March and October. Groundnuts are important protein crops in India grown mostly under rain-fed conditions. The awareness and concern for quality amongst the Indian groundnut sellers and processors are growing steadily. Multiple sorting and grading are fast becoming a norm. Indian manufacturer have the capability to prepare and supply edible peanuts conforming to highest standards. Figure 1. shows the groundnut legume and Figure 2. show the groundnut pod.

Figure 1 Groundnut legume

Figure 2 Groundnut pod

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 major growing state for groundnut is Gujarat, Andhra Pradesh, Tamil Nadu, Karnataka, Maharashtra Rajasthan, Madhya Pradesh, Orissa, and Uttar Pradesh.

1.2 CULTIVATION AND HARVESTING

Peanuts grow best in light, sandy loam soil with a pH of 5.9–7. Their capacity to fix nitrogen and they improve soil fertility. The crop cultivation land view is shown in the figure 3. Therefore, they are valuable in crop rotations. Also, the yield of the peanut crop itself is increased in rotations, through reduced diseases, pests and weeds. Adequate levels of phosphorus, potassium, calcium, magnesium, and micronutrients are also necessary for good yields. Figure 3. Groundnut Farm If it is too early, too many pods will be unripe. If too late, the pods will snap off at the stalk, and will remain in the soil. For harvesting, the entire plant, including most of the roots, is removed from the soil. The fruits have wrinkled shells that are constricted between pairs of the one to four seeds per pod. Harvesting occurs in two stages: In mechanized systems, a machine is used to cut off the main root of the peanut plant by cutting through the soil just below the level of the peanut pods. The machine

lifts the "bush" from the ground and shakes it, then inverts the bush, leaving the plant upside down on the ground to keep the peanuts out of the soil. This allows the peanuts to dry slowly to a little less than a third of their original moisture level over a period of three to four days. Traditionally, peanuts were pulled and inverted by hand. Harvesting usually consists of a series of operations comprising digging, lifting, windrowing, stocking and threshing. Some of these tasks can be combined or eliminated depending on the system applied. Among the field operations concerned with groundnut cultivation, harvesting is the most laborious and costly endeavor. The actual method of harvest employed depends upon the type of groundnut grown. In bunch types, pod development is confined to the base of the plant and the pegs carrying the pods into the soil are thick and strong. Almost all the pods are recovered with the plants when they are pulled out of the soil. The bunch type of groundnut is mostly harvested by pulling out the plants with manual labour in India. The diversity of the labour employed to harvest the crop depends on the location. For instance male laborers are used in Tamil Nadu and in Gujarat both male and female laborers' are employed. Usually 12 to 14 laborers' can harvest one-hectare area of groundnut crop in one day. Harvesting may sometimes become a problem especially when the crop has passed the stage of full maturity and the soil has hardened. In this case, it is customary to lift the plants by loosening the soil either by working a hand hoe, a plough or a blade harrow along the plant rows. If after lifting the crop manually it is observed that a good percentage of the pods have been left in the soil, the same implements may be used to pick the leftover pods. In the latter case, additional labour will be required. In the case of the spreading type, the process of uprooting the crop from the soil is a rather difficult operation as pod formation takes place all along the creeping branches of the plant. The pegs are comparatively thinner and more delicate.

Figure 3 Groundnut farm

2. LITERATURE SURVEY

Yasir Mahmood et al[1] Designed a modified thresher machine for minimizing the problem of choking in the concave. As surveyed in the district of Dantaramgarh, Rajasthan, the major hitch faced by the farmers in employing multi-crop thresher machine is the choking of straw and chaffin concave clearance as the speed of feed is increased. As the feed is increased, the chaff aggregate increases considerably and is forced down the clearance and chokes it subsequently. To resolve the issue, a design was suggested that entailed a concave frame to hold the concave instead of being an integral part of mainframe of machine. The mechanism introduced to move the concave frame was termed as anti-choking mechanism.

Huynh et al[2] Stated that the seed separation from stalks and passage of seed through the concave gate is a function of some variables such as feed rate, threshing speed, concave length, cylinder diameter and concave clearance. These variables affect the threshing losses also seed separation efficiency.

WR Nave et. al[3] Observed that the threshing efficiency increased with increasing drum speed and decreasing feed rate. The threshing efficiency attains the maximum value as 99.76 % at drum speed of 21.25 m/s (1400 rpm), and feed rate of 15 kg/min. The grain damage was 0.90 % of visible grains under operating condition.

Gol and Nada et. al[4] Concluded that the important factors affecting the efficiency of mechanical pod stripping elements are operation speed and crop conditions. Percentage of stripping pods increased by increasing of peripheral drum speed which ranged from (473 rpm) 0.1m/s to (675 rpm) 3 m/s.

3. COMPONENT OF GROUNDNUT THRESHER MACHINE

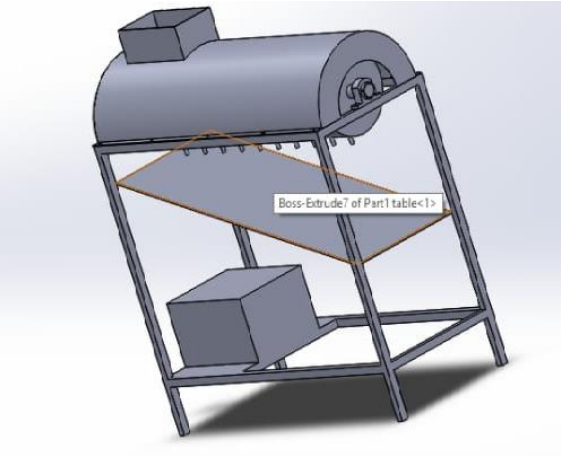


Figure 4 Groundnut thresher machine

The component used in our groundnut thresher machine are :

1. Table
2. Feeder
3. Threshing Drum
4. Plumber block
5. Perforated sheet
6. Fan and Blower
7. Motor

3.1 TABLE

All the part of the machine are mounted on the table. Table acts as a foundation and all the load acts on the table. Hence it must be strong enough to bear all the loads.

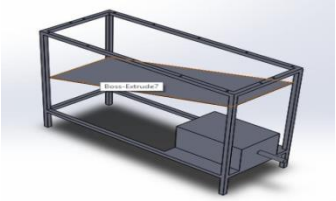


Figure 5 Thresher table

3.2 FEEDER

The groundnut legume is fed through this part.

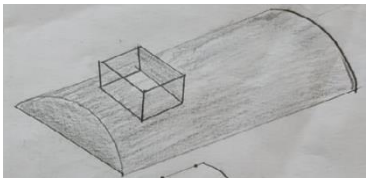


Figure 6 Feeder

3.3 THRESHING DRUM

It is the active or rotating portion of the machine. It consist of the cylindrical drum which is spirally bolted with bolts and it also consist of Shaft and two covering plate.

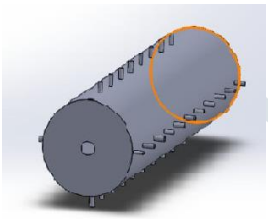


Figure 7 Threshing drum

3.4 PLUMBER BLOCK

It is used for the supporting of the rotating shaft.

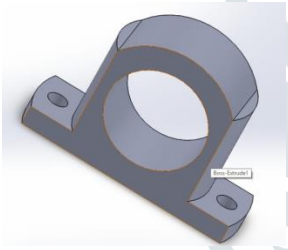


Figure 8 Plumber block

3.5 PERFORTED SHEET

With the help of this sheet the groundnut pod and plant get separated.

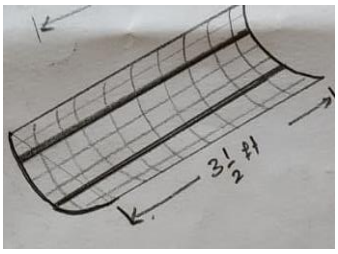


Figure 9 Perforated sheet

3.6 FAN AND BLOWER

It is used for blowing away the dust and other plants parts. The air flow is maintained in such a speed that the groundnut pod will fall to ground and the dust particle will flow away from the groundnut falling area. Such that only clean pod we can get easily thus removing the cleaning process.

3.7 MOTOR

Motor are used to convert the electrical energy to mechanical energy. It is used as the driver. It rotate the threshing drum through the chain transmission. the sprocket is provided with required ratio.

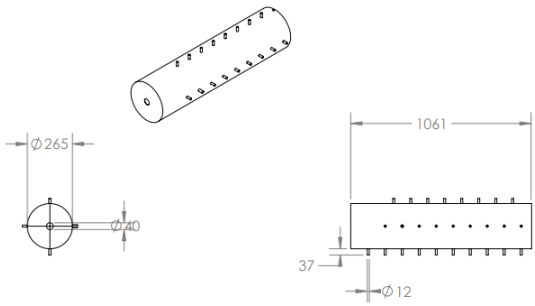
4. DESIGN OF THE THRESHER MACHINE

4.1 GROUNDNUT SPECIFICATION

A single groundnut plant contains 20 to 30 groundnuts.
On average,
Length of groundnut root = 30 mm
Length of groundnut = 20 mm
Width of groundnut = 10 mm

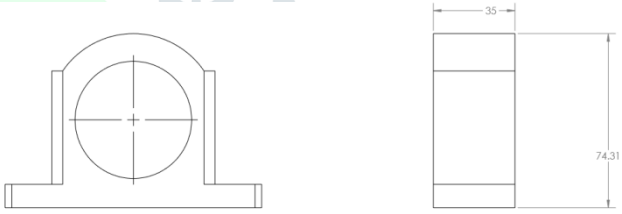
4.2 THRESHING DRUM SPECIFICATION

Drum Dia = Φ265 mm
Drum length = 1061mm



4.3 PLUMBER BLOCK

Inner dia =40 mm



4.4 CALCULATION OF TORQUE

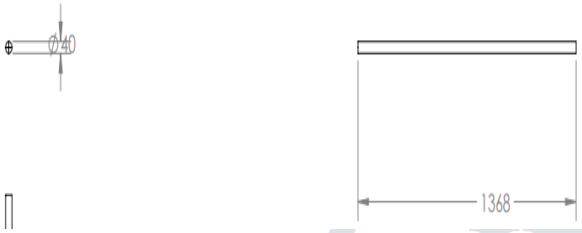
A research paper by J.M.Troeger, E.J.William and J.L.Butler the peg attachment force or the tensile force required to separate peg from pod is 22.26 N.
Here we use up to ten ground nut plants so the maximum force that is required to remove groundnut pod is up to 300 N with considering the weight of shaft and other mountings.
Torque, T = Force x Perpendicular distance
Force, F = 250 N
Perpendicular distance is the distance from the axis of the drum to bolt mounted on the periphery of the drum is 132.5mm.
Torque T = 250*132.5= 33.125N-mm
T = 33.125-mm

4.5 POWER CALCULATION

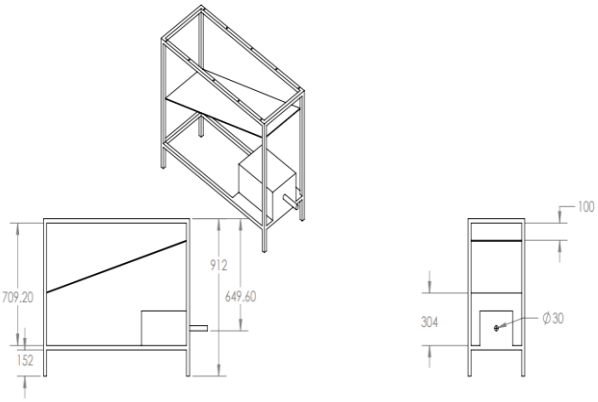
Power , P= 2∏ NT/ 60
Speed required N = 330 rpm
P= 2∏* 330*33.125/60
P= 1144.71 W
P= 1.5HP
So we are using 1.5 HP motor.

4.6 SHAFT DESIGN

Torque T = $\prod\tau d^3/16$
Allowable stress τ = 40N/ mm^2
34= 3.14*40* $d^3/16$
d = 1.62 m = 16mm(approx)
The obtained shaft diameter is 16.11 mm. In order to do weld attachment on the shaft, diameter of the shaft is chosen to 40 mm.
Diameter of shaft, d = 40 mm.
Shaft length used, L = 1368 mm



4.6 TABLE SPECIFICATION



Length L = 1370mm
Breadth B = 300mm
Height = 912 mm

5. FABRICATON

The first step in our fabrication is preparation of the threshing drum . The hole was drilled in the cylindrical drum for bolting spirally. After the hole the 154 bolts were bolted into the cylinder. After that the drum has to be closed at the both end by the plate. Before closing the drum the first plate was machined from 304.8mm to 260m by lathe and the second plate was cut by gas cutting method. In the plate 40mm hole was made for shaft mounting. After this both the plate was welded at both end of the drum.
Frame for table has been prepared by cutting the L angle frame. And the shaft was machined from 41mm to 40mm dia also the key also made for assembling the sprocket. The shaft was assembled into the threshing drum.
The feeder plate was prepared and perforated sheet also prepared parellely. After preparation of all the parts assembly was done. Firstly the threshing drum along with plumber block has been assembled on the table. After this the sprocket of 68 teeth is fitted. The feeder plate is assembled on the top thus providing the covering and way for feeding the groundnut legume. At the bottom of the threshing drum the perforated sheet is also assembled. Finally the motor is mounted on the table. And the chain and sprocket also fitted. The fan and blower along with the switch is mounted. Thus the complete fabrication is done.

Figure 10 Fabrication process

Figure 11 Spirally bolted threshing drum

6. FUTURE WORK

1. Performance analysis of the machine has to be done.
2. As the power supply is not possible everywhere, to supply the power all the time Solar panels are to be added along with the storage battery.

7. CONCLUSION

Groundnut thresher machine is a useful machine . It saves time and energy of the farmer also it reduces the cost and time. The feeder and spirally bolted threshing drum reduces the human intervention. The farmer has to feed the groundnut legume and the machine will take entire plant inside and thresh the pod by the spiral mechanisms. Also this machine are low cost and reliable for our farmer. The area occupied by this machine is less therefore it can be used anywhere thus it can be used in unconditional climatic condition also. If solar panels are added it will be more advantage for our farmer.

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