



Design of a Portable Groundnut Sheller Machine

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ABSTRACT

Groundnut is the sixth most important oilseed crop in the world and it belongs to beans family. Shelling is a fundamental step in groundnut processing and it can be done by hand or machines. Hand shelling process is labour intensive, slow and tiresome. Numbers of groundnut Sheller machines are available in the market but they are large in size, costly and not suitable for domestic applications, they are best suitable for industrial applications where mass production is required. Hence it is essential to design and fabricate a portable groundnut sheller machine for domestic application.

Keywords- Groundnut, design, sheller, portable, domestic application

1. INTRODUCTION

Groundnut (*Arachis hypogaea*) is a species in the legume or beans family ([1], [8], [9]). It was first cultivated in Peru [9]. Its seed contains about 63% carbohydrate, 19% protein and 6.5% oil [1]. Groundnut is the sixth most important oilseed crop in the world. As the groundnut seed is contained in pod, which is usually developed underground, the pod is harvested by pulling or lifting the plant manually or by using the machine. The pods are stripped from the plant, dried, stored and processed. Shelling is a fundamental step in groundnut processing [1]. Shelling can generally be done by hand or machines.

The peanut pods are very hard and the cracking methods are still traditional in rural area. These cracking methods vary from locality to locality depending on the quantity produced [3]. Some

people beat groundnut pods on flat ground, some people put them into the cover and beat with sticks to decorticate the groundnut. Some people press the pod between the thumb and first finger so that the kernel is released [1]. While hand shelling keeps the rate of Kernel breakage low but it is labour intensive, energy requirement is high and leads to “sore thumb syndrome” when large quantities are handled. Also these methods are slow and tiresome [1]. Groundnut shelling output per-man is as low as 1-2.5kg-seeds/h [4].

2. LITERATURE SURVEY

Shelling is the removal of grains from their pod either by stripping, impact action and rubbing or any combination of these methods [4]. The most popular method of groundnut shelling, which is still widely used is the method of crushing or

pressing the pods in between the thumb and the first finger to break off the pods and release the seed. This method has low efficiency, it is time consuming, and has high demand of energy [4].

Groundnut shelling machine is a machine used to remove the shell of groundnut so as to obtain the groundnut seeds [9]. There are different machines have been fabricated and used to shell wide variety of groundnut pods [4]. These machines are too costly and complex in operation and maintenance [4]. The lowest price of the hand operated groundnut sheller machine is Rs-11,500/- . Some of these machines have very high shelling capacity. Shelling capacity varies from machine to machine ranging from 25kg-seeds/h to 215kg-seeds/h ([1]; [2]). Some hand operated sheller machines are suitable for domestic application but they only do shelling operation, separation of seeds we have to do manually by using traditional methods such as by using natural wind or by using sieve. A simple hand operated groundnut Sheller has a semi-cylindrical screen closed on both sides. A shaft carrying a lever at one end is fixed across the centre of the semi-cylinder as shown in the Fig.1 (a). On the lever is a pair of plate with shoes or beater bars, having blunts on their undersides. For successful operation of the machine, the operator stands by the side, then holding the operating lever (handle) and swinging it by pushing to and fro to provide shelling action on the shoes assembly [4]. The semi-rotary, action of the shoes shells the pods against the screen but this type of machines cannot do separation of shell and seed.

Shelling efficiency varies from machine to machine but mainly it is depends on the following parameters [1]

- Moisture content
- Variety
- Feeding rate
- Percentage of matured nuts
- Drying method
- Rotations per minute

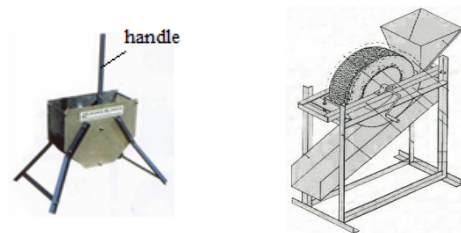
2.1 Classification of Groundnut Sheller Machines

Groundnut sheller machines are classified based on the following factors

a. Based on the power source ([2], [5])

Based on power source, groundnut sheller machines are classified in to two types.

- Manually operated (Fig.1)
- Power-operated (Fig.2)



a. Semi rotary type

b. Rotary type sheller [7]

Fig.1 Manually operated groundnut sheller machine

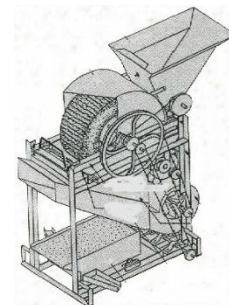


Fig.2 Power operated groundnut sheller machine [6]

b. Based on shelling mechanism [5]

Based on Shelling Mechanism, groundnut sheller machines are classified in to two types.

- Reciprocating
- Rotary

c. Based on cleaning components [5]

Based on cleaning components, groundnut sheller machines are classified in to four types.

1. Sheller with no separating device
2. Sheller with blower only
3. Sheller with sieve only
4. Sheller with blower and sieve

2.2 Findings on Literature Survey

Findings on literature are as follows

- a) Traditional groundnut shelling process is time consuming (1-2.5 kg-seeds/h manually) [4].
- b) Different types of groundnut shelling machines are available in the market but they are too costly and non-portable.
- c) Hand operated concave or semi-rotary type groundnut shelling machines are widely used locally [4].
- d) Shelling efficiency of machines are varies from 29% to 98.85% at different moisture content levels ([1]; [2]).
- e) There may be some portable and highly efficient machines are available in reasonable cost but could not found in the available literature.

3. PROBLEM IDENTIFICATION

The available groundnut sheller machines are costly and non-portable; hence people cannot

afford such machines for domestic application. Hence it is essential to design and fabricate a portable groundnut sheller machine for domestic application.

4. OBJECTIVES OF STUDY

Following are the objectives of the proposed work

- To design and fabricate portable groundnut sheller machine
- To consider DFMA principles in developing the machine

5. PROPOSED GROUNDNUT SHELLER MACHINE

Proposed groundnut sheller machine is as shown in the Fig.3. It consists of different parts such as main disc, front disc, axle, hopper, handle etc. Main disc, front disc are made from wood. Axle is made up of steel and that of hopper is made from thin metal sheet. Axle of the machine may be horizontal, vertical or inclined.

In between main disc and front disc there is a crushing zone, groundnut pods enters in to the crushing zone through hopper. As the front disc rotated manually by using handle, pods are crushed in between the two discs and falls down.

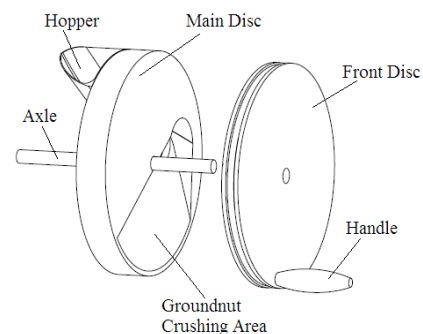


Fig.3 Proposed machine

6. SCOPE OF WORK

It is assumed that only dry groundnut pods are used to shell in this machine.

7. EXPECTED OUTCOME OF WORK

The outcome of the work undertaken will be a portable groundnut sheller machine.

8. CONCLUSION

Groundnut pods are hard and cracking methods are still traditional in rural areas. Groundnut shelling output per-man is as low as 1-2.5kg-seeds/h. hence to increase the production rate, Sheller machine is required. Most of the available Sheller machines are power operated, non-portable; hence design and fabrication of a portable, manually operated Sheller machine is essential. Proposed Sheller machine is used to shell only dry pods and it can be used as a groundnut Sheller machine for domestic application.

REFERENCES

1. N. Gitau, P. Mboya, B. N. K. Njoroge, M. Mburu, "Optimizing the Performance of a Manually Operated Groundnut (Arachis hypogaea) Decorticator", scientific research, Open Journal of Optimization, 2013, pp. 26-32.
2. M. A. Helmy, A. Mitroi, S. E. Abdallah, Mohamed A. Basiouny, "Modification and Evaluation of a Reciprocating Machine for Shelling Peanut", FARM MACHINERY AND POWER, Misr J. Ag. Eng., 24(2), pp. 283-298.
3. F.A. Oluwole, A.T. Abdulrahim, and M.B. Oumarou, "Development and performance evaluation of impact bambara groundnut sheller" Department of Mechanical Engineering, University of Maiduguri, Maiduguri, Nigeria. Int. Agrophysics, 2007, 21, pp. 269-274.
4. Ikechukwu Celestine Ugwuoke, Olawale James Okegbile, Ibukun Blessing Ikechukwu "Design and Fabrication of Groundnut Shelling and Separating Machine" Department of Mechanical Engineering, Federal University of Technology Minna, Niger State, Nigeria. International Journal of Engineering Science Invention ISSN (Online): 2319 – 6734, ISSN (Print): 2319 – 6726 www.ijesi.org Volume 3 Issue 4, April 2014, pp.60-66.
5. "Philippine Agricultural Engineering Standard" PAES 220: 2004Agricultural Machinery - Peanut Sheller – Specifications.
6. "Peanut and the Thai Food System: a Macro Perspective" Peanut in Local and Global Food Systems Series Report No. 8, Robert E. Rhoades, PI/Virginia Nazarea, Co PI, Department of Anthropology, University of Georgia 2003.
7. Del Hagen, Shaheer Hussam, Rafiq Mohdramli, and Alexander Yip "A Low-Cost Peanut Sheller for Use in Developing Nations" Final Application for IDEAS April 10, 2003.

8. Ajayi, A. B., Olasunkanmi, L. K.
“Development of Groundnut Chaff
Removing Machine” Dept., of
Mechanical Engineering, Faculty of
Engineering, University of Lagos. Lagos.
Nigeria. International Journal of
Engineering Science Invention ISSN
(Online): 2319 – 6734, ISSN (Print): 2319
– 6726, Volume 2 Issue 8, August 2013,
pp.45-51.
9. Abubakar Mohammed and Abdulkadir B.
Hassan, “Design and Evaluation of a
Motorized and Manually Operated
Groundnut Shelling Machine”,
Department of Mechanical engineering,
Federal University of Technology, Minna,
Nigeria. International Journal of Emerging
trends in Engineering and development,
Issue 2, Vol. 4, (May 2012), ISSN 2249-
6149, pp. 673-674.