UNIVERSITY OF EDUCATION, WINNEBA

COLLEGE OF TECHNOLOGY EDUCATION, KUMASI

RE-DESIGN AND MANUFACTURE A NEEM SEEDS THRESHER FOR EFFECTIVE THRESHING OF NEEM SEEDS.

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JUNE, 2021

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A DISSERATATION TO THE DEPARTMENT OF MECHANICAL AND AUTOMOTIVE TECHNOLOGY EDUCATION, FACULTY OF TECHNICAL EDUCATION, SUBMITTED TO THE SCHOOL OF GRADUATE STUDIES IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF MASTER OF TECHNOLOGY IN MECHANICAL ENGINEERING IN UNIVERSITY OF EDUCATION, WINNEBA.

JUNE, 2021

DECLARATION

STUDENT'S DECLARATION

I, **EMMANUEL DERY**, declare that this Dissertation, with the exception of quotations and references contained in published works which have all been identified and duly acknowledged, is entirely my own original work, and it has not been submitted, either in part or whole, for an-other degree elsewhere.

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SUPERVISOR'S DECLARATION

I hereby declare that the preparation and presentation of this work was supervised in accordance with the guidelines for supervision of Dissertation as laid down by the University of Education, Winneba.

NAME: **DR. GYIMAH K. OFFEI**

SIGNATURE: .....……

DATE …….....

DEDICATION

This research is dedicated to my beloved son Raphael Mwinkaara Dery and all my family and friends for their support and encouragement.

ACKNOWLEDEGEMENT

I am profoundly grateful to God the Mighty Father for His Mercy and knowledge bestoned on me for the successful completion of this Research, to DR. Gyimah K. Offei a lecturer and my supervisor as well at the University Of Education Winneba, College Of Technology Kumasi (UEW-K) who took pains and much time to read through the scripts and make the necessary correction notwithstanding the useful suggestion and comments.

I owned the Head of Department Dr Enock A. Duodu, Dr. Sherry K. Amedorme, Mr. C. K. Nworu infact to all my lecturers a lot of gratitude for improving my cognitive domain, and also for their encouragement and piece of advice.

Many thanks to the chief and people of Loggu, Liman-yiri communities for showing me the exact place where Neem Trees are abundantly located and the love they also gave to me during the research.

I will not forget of all my friends and family of their support. Sometimes is always a risks to go to some of the places to ascertain and get access of some of the material but they have never disappointed me whenever I call on them to accompany me.

In fact I will not ignore myself for the effort.

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ABTRACT

Neem seeds are one of the most sources of oil for both local and industrial use. Mostly it is always threshed manually either by pounding or by the use of stone to remove the kernels from the seeds. Threshing Neem Seeds by the method of pounding or crushing with stone normally contaminate the grains with debris and also crush the seeds when in contact with the ground during crushing with the stone. Grains are also lost due to scattering during crushing and pounding processes, thus reducing the quality of the seeds. This process is slow and tedious hence the output per man per hour is very low. It is on this view that this project is designed to provide a clean and quality Neem Seeds and reduce the labour intensive during threshing. This study will helps to thresh neem seeds fast, effective and efficient. Besides, the cost in threshing Neem Seeds is reduced and the efficiency of the threshing is improved. A manual/motorized threshing machine is thus manufactured to curtail the above mentioned situations. Hence with the presence of this machine, Neem Seeds can be thresh with ease and with a great output per day and quality seed . This artifact is designed to meet all ergonomic purposes the common material to be used for the manufacturing is mild steel because it is affordable and easy to weld.

However the fan blade should made to have enough air when revolving. This will help to blow the shells very easily from the kernels during the threshing process.

CHAPTER ONE

INTRODUCTION

1.1 Background to study

Neem seeds are gotten from a tree, which is a tropical evergreen native to India, it is also found in South East and West Africa countries. Neem seeds has been used in India since 2000-4000BC and was referred to in ancient Indian text as “the curer of all ailments”. All part of Neem trees were used – the leaves, twigs, and oil from nut. Figure 1.1 below shows the sources of obtaining fresher Neem seeds.

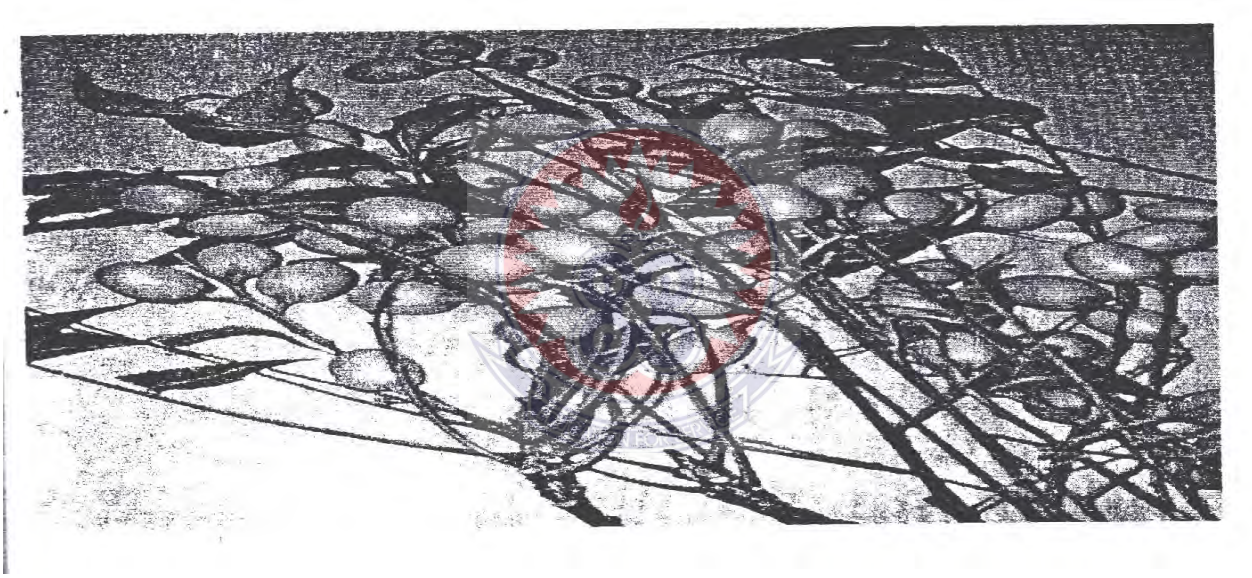


Figure 1.1 Fresh Neem Seeds
Sources: from field (Wa Liman-Yiri JHS)

1.2 Harvesting and Storage of Nee Seeds

Neem seeds take three month to mature, after which the matured seeds fall and is collected by hand picking or gathering with broom. The seeds are then soaked in a container for two days and after that, dried in the sun for one week to be completely dried. This time, the seeds are now crushed with stone and finally the pods are taken off by winnowing.

Figure 1.2: Dried Neem Seeds
Sources: from Field (Wa Liman-Yiri JHS)

1.3 Importance of Neem Seeds

Neem seeds are one of the useful parts of the tree, finding use in different use in different industries to make range of products. It contains a few chemicals that have sulphur; these photo-chemicals add the characteristics smell to the Neem oil. They attach additional curative properties to the oil; has a dark yellow colour which turns solid at a temperature below 23°c and not dry out. Raw Neem seeds can be used in powdered form as a soil conditioner and propagation the growth of the plants. It is to manufacture effective pesticides as seeds have highest content of Azadirachtin. It is also used for livestock production as it has a very high natural value.

According to Wikipedia, "neem seeds due to it unique composition, it has mostly magical effect on chronic skin condition that fails to respond to conversational treatments.

It has large quality of protein, which makes it all the more valuable such that in raw state and the extract form, is also used to manufacture facial creams, body lotion, cosmetics, preparation of drugs and medicines; both traditional and scientific such as Ayurveda". However, Neem seeds cannot be used for food because of its bitter taste and foul odour.

1.3.1 Nutritive Values of Neem Seeds

Neem seeds have very high nutrition values; the seed have qualities of proteins which makes it all the more valuable. The seeds are also used by agriculturalists and farmers as a natural pesticides and insecticides. Table 1.1 shows the nutritive value of Neem seeds.

Table 1.1: Nutritive values of Neem seeds

S/N	Content	Percentage (%)
1.	Nitrogen	1.5-5.0
2.	Phosphorous	0.1-0.6
3.	Potassium	0.5-1.5
4.	Sulphur	More than 1.0
5.	Magnesium	22mg per kg
6.	Zinc	50mg per kg
7.	Moisture content	10.0max
8.	Carbon	0.5

1.3.2 Composition of Neem Seed Kernels

Neem oil is vegetable oil pressed from and seeds of Neem (Azadirachta India) an evergreen tree which is endemic to the India subcontinent and has been introduced to many other areas in the tropics. It perhaps has the most important of the commercially available products of Neem for organic farming and medicines. Table 1.2 shows the composition of Neem seed kernels. (source: wikipedia)

Table 1.2: The composition of Neem seed kernels.

S/n	Content	Percent (%)
1.	Neem and herbal derivatives	60%
2.	Surfactant	25%
3.	Emulsifier	15%

1.4 Threshing of Neem Seeds

Several studies have been undertaking to prove on the threshing of Neem seeds for the above mention products particularly for oil. Machine has been developed for many of the processing operations. Recent studies reveal that it is possible to produce Neem seeds of good quality using threshing methods. However, some rural communities in the Northern Ghana have no opportunity to offer modern threshing machine to facilitate the threshing process. Finding made by this project work reveal that rural women are the ones mostly involved in the threshing of Neem seeds, and they thresh by either pounding the seed by mortar and pestle or crushing the seed by stones.

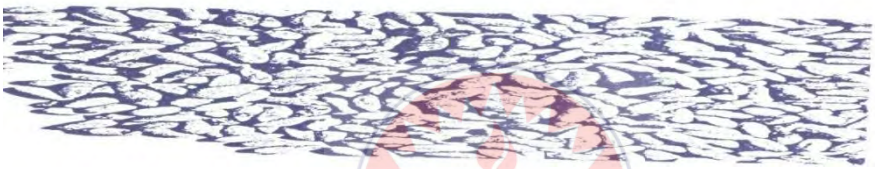


Figure 1.3: Threshed Neem seed
Source from field (Loggu JHS in the Upper West Region)

1.5 Problem Statement

The traditional way of threshing Neem seeds is by pounding and the use of stones which is labour intensive. In addition, the grains become contaminated with debris when in contact with

the ground during crushing with the stones. Grains are also lost due to the scattering during the crushing and pounding process. Pounding and crushing requires a great deal of workers, the output per man hour varies depending on the quality and energy of workers. However the pounding and crushing processes is slow and tedious, the output per man hour is however very low and its reported to be in range of about (1-2.5) kg. Therefore the traditional way of threshing Neem seeds consumes a lot of time. (Central institution of agric eng. 1981) the traditional method of threshing Neem seeds has so many demerits.

There has been a renewed interest in the role of machine manufacturing sectors in socio-economic development this crucial that the used of their type of mechanization should be greatly increased in Africa. The mechanization of the processing of Neem seeds is very similarly to the factory process of which the great experience has been obtained in most part of the world. The Centre For Scientific And Industrial Research (CSIR) all research and technological have undertaking extensive surveys, research and development work on the extraction of Neem oil (which basically use as pesticide and insecticide for the preservation of farm produce) especially Neem seeds threshing technique like electrical power machines, foot peddling machine and hand operating machine. All these design do not still meet the desire for the rural folk. It is the result of all these bottle necks that have called for this project work.

1.6 Objective

The main objective of this study is to design a machine for the effective threshing of neem seeds. This study is aimed at achieving the following:

a) To reduce intensive labour in neem seeds threshing
b) To improve clean and quality threshed neem seeds.
c) To improve the efficient of threshing neem seeds.

1.7 Justifications

Most Ghanaian farmers and business people who engage in Neem seed processing and products lack simple and affordable machinery in developing countries like Ghana, it will be good that emphases are place on methods that will assist in improving the threshing of Neem seed. Nevertheless, the improvement of the threshing process itself requires the injection of innovations and appropriate technology to invent efficient and cost effective threshing

machine to meet this challenge. If Neem seeds threshing are improved, among other factories, there will be quality seeds processing Neem products. Large qualities of Neem processing for other economic activities. This calls for justification to redesign an old threshing machine to solving the foregoing impediments in threshing Neem seed in Northern Ghana.

1.8 Limitations

The use of this machine has the following demerits:

- The machine cannot be used for threshing fresh Neem seeds
- If the Neem seeds are not well dried the grains, may be grind during the threshing process.

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

This chapter highlights the introduction of the threshing machine and the ways Neem seeds be threshed. In the 18th to 20th centuries, some threshing machines were made by Mr Adams Nawdo and GRATIS foundation for processes or separating grains is considerably less labour intensive than it had been previously. The previous process involved the manual removal of kernels from husk and the cleaning of any left- over material. During this era all labour carried out by men and livestock.

2.1 Design of the 18th Century Threshing Machine

One of their first threshing machines was introduce in 1786 by a Scottish mill Wright name Andrew Meikles. His machine was actually a combination of a thresher and a winnower for the threshing of Neem seeds and groundnuts. Both the thresher and winnower were powered by a belt from a common drive pulley. In this machine, shocks of grains come in contact with series of corrugate rollers. The grain was then conveyed to a farming mill, which blow off the chaff in a process known as winnowing. Following the introduction of the thresher winnower, an English inventor produce a similar machine, seemingly based on Meikles design. Instead of the corrugated rollers however, his model separated grains from chaff passing it between a drum and concave surface which were fitted with iron protrusion. This machine would serve as the basic for future design. (Source: Wikipedia)

around this period, most threshing machine were still operated by hand crank and required four men for the process, however some were driven horse tread mill or with an implement known as horse sweep. In the case of horse would walk on a moving on inclined platform

which intern would move a large pulley on the side of machine fitted with a leather drive belt. This process of powering a threshing machine with a horse sweep involved horse walking around a device that contained a gear box. This device would supply the machine with power by transferring it through a tumble shaft or rod. Threshing machine during this time had to be pegged to the ground so they would not detach from their tumble shafts while operating. This is thought to have led to the nickname "grounding thresher".

In the mid-19th century, threshing machine were becoming increasingly well known, often winning prize at agriculture farms in Canada, they could also often be seen in manufacturer advertisements, it was common for manufactures to sell their threshers with a corresponding power source. A threshing machine capacity was measured by the width of its cylinder – most ground hop types comprise a cylinder with a diameter of less than 24 inches (60cm).
The thresher operated manually found bound sheared in the machine. They were then threshed between a cylinder's teeth and a concave. Once this process was complete, kernels had to be cleaned manually with winnowing baskets of farming mill unlike in Andrew Meikles combined thresher winnower. This type of thresher was capable of processing about 70 bushes of gram each day; this amounted to 10 times the out of a single worker using a flail to thresh grains. Other development surfaced in the early 1860,s including the "little giant thresher" which was a large seized ground on two wheels produced by Stratford agriculture works. The machine itself was available for $100but the four horses require for its operation cost an additional $100. Around this time, certain comprised a slotted conveyor belt or endless apron and integral forming mill. The straw was fed in to the thresher and then carried forward the back via the slotted conveyer through which kernels would drop into the farming mills hopper. Rather than a conveyor this machine incorporated a sense of straw walkers.

It had row of finger made of metal or wood that would catch and shake threshed stalks as they exited the cylinder the remaining straw was transport to the rear of the threshing machine.

2.2 20th Century Threshing Machines

In the 20th century, the first metal threshing machine was introduced; previously threshers were made of wood. The metal thresher was introduced in 1904 by J.I Cases plow works of Racine Wisconsin. The company switched to metal in order to produce a machine that could better withstand the strain of operation at full speed. Many companies followed J.I Cases lead and began producing metal threshers. Until the 1920s threshing machines had been getting larger in size and capacity. This decade however brought the advent of smaller threshers. This machine was suitable to be towed by smaller multipurpose such as those produced by Ford son. Ferguson Threshers Company was one of the companies that began to focus on smaller models.

The hand operated threshing machine (decorticator). Figure 2.1 shows a hand operated threshing machine which is used for separating Neem seeds kernels from the shell or pads. It has a capacity of 30 to 60kg per hour and use for light duty operations.

2.3 The Hand Operated Machine (Decorator)

Figure 2.1 shows a hand operated threshing machine, which is used for separating Neem seeds kernels from the shell or pods. It has a capacity of 30 to 60kg per hour and use for light duty operations. The hand operated machine is made up of disk with protection (teeth) which does the threshing, a cover plate with opening where the Neem seeds is poured and the shaft which is welded to the disk is connected to the hand which rotates the sieve as the shaft propel. The working principle of the machine is that Neem seeds are poured into the opening

wheel while turning the handle connected to the disk. As a result, the grains are dis-shelled in the shelling chamber and both the broken shell and kernels are discharged through the bottom sieve.

Fig 2.1: Hand operated threshing machine

Source from field (Mr. Adam Nawdo fabrication shop Wa)

2.4 The Foot Operated Thresher (Soka Type)

Figure 2.2 shows a foot-operated thresher (Soka type) for threshing Neem seeds. This type of Neem seed thresher is similar to that of the hand-operated thresher in that, it consists of a disk with projection a shaft welded to the disk through a bushing and a cover around the sieve. But where the hands are used to operate to the former, the legs are used to operate the Soka type of threshing machine. The other end of the shaft from the disk keyed to the sprocket with teeth of flexible change link is then connected from the sprocket to a crank where two bars with paddles are provided.

A seat and a steer also provided so that the operator consist and hold the steer during the paddling process. The steer is to ensure balance of the operator so that she / he do not fail when the Neem seeds are poured to the receiver, the operator paddles the driver, which intends drives the driven staff, which is connected to the disk rotate, bringing about the

removal of the seed from the shell. The output here is higher as compared to the hand-operated type (decorticator) but its initial cost is high.

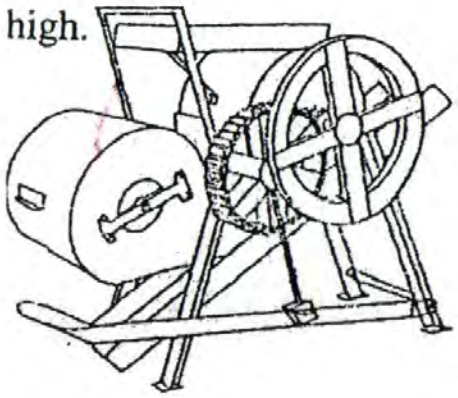


Figure 2.2: Foot operated thresher machine

Source: From internet (manual operated machine)

2.5 The Hand Operate Thresher (Boss Type)

The boss type hand thresher is designed for the attractive of small farmers. It is designed to meet small quality and economically priced. There are no gears in this type of machine but the cylinder shaft is directly driven by the crank wheel paddle. It has a capacity of 3.5 to 70kgs per hour approximately. The working principle is that, the Neem seeds are poured into the receiver. The pedal is then propelled which rotates the shaft thus disc-shelled the seed and the kernels are discharged through the chute which then collected.

2.6 The Hand Operated Thresher Machine (Compactable Type)

Figure 2.3 shows the hand operated threshing machine, it is design such that it performs heavily duties operations. It has a single piece crushing chamber, no separated joints of fabrication for the outlet. based on its designed it would have been suitable for threshing Neem seeds with ease but it cannot be used by electricity since the designed exclude a motor where powered would have been transmitted to increase the speed of the shaft. This would

have increase production and faster return on investment. The machine is compactable in size dust free operation, no wastage of production and no pollution hazard.

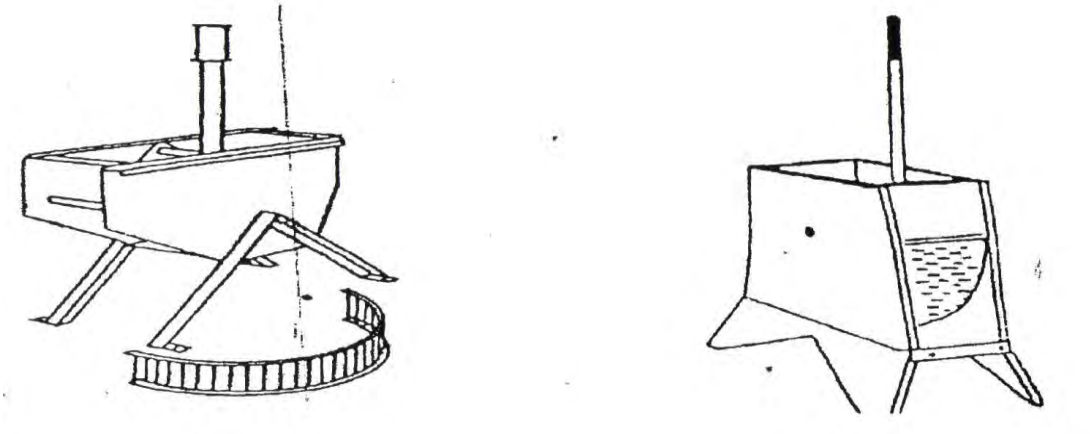


Figure 2.3: Hand Operated Thresher machines
Source: from Field (Wa GRATIS Foundation)

It has a capacity of 10kgs per hour approximately. As such three numbers perform round holed screen are supplied with the machine. The working principle is the same as the others.

2.7 The Cottage Thresher

Figure 2.4 shows the cottage threshing machine, this machine is supplied with four different sieves 8mm, 9mm, 9.5mm and 10.75mm. The output per hour is about 9.6kgs per hours of shell kernels at 100 re/min (rpm). It also works by a handle, which rotates the shaft to thresh the Neem seeds

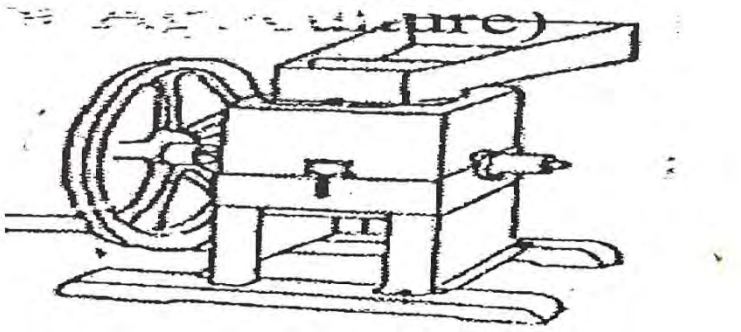
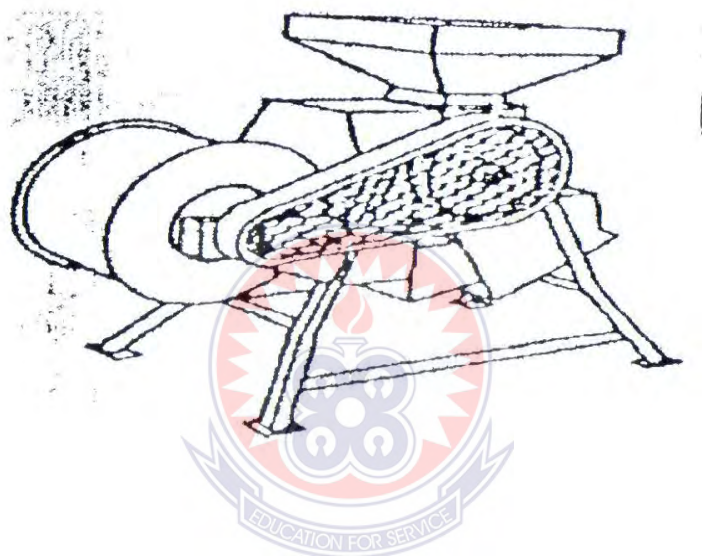


Figure 2.4: The cottage thresher

Source: from internet (manual operated thresher machine)

2.8 The Super Gayor Rotary Thresher

Figure 2.5 shows the supper Gayor rotary thresher, this is similar to that of the compactable type of machine expect it uses chain drive thus complicating the design. The working principle is that, the handle is propelled which trend the chain connected between the two sprocket thus revolving the beater in the top housing thereby threshing the Neem seeds. The output of the machine is 150kgs shelled nut / hour.



2.9 The Motorized / Manual Neem Seeds Thresher Machine

Figure 2.6 is the motorized / manual Neem seeds thresher; this type of thresher uses both manual and electricity as source of power to drive the system. The driven mechanisms of this machine are belts and two pulleys, motor and flexible belts which drives the beater. The rotation of the beater with the teeth removes the grains.

in case of power off or a place where there is no electricity the machine can still be used because there is a provision of a handle which is also connected to the beater such that when rotated, will revolve the better with the teeth which intends to thresh the Neem seeds. The output here is high because a basin of Neem seeds can be threshed at a go especial when using the electric power. However, the cost involves to purchase the motor is high this pare

way for the provision of the manual mechanism for easy affordability especially those who are financial handicap.

One alternative method for this machine is that, an engine (e.g. generate) can be used to supply power for the operation of the machine.

This alternative is mostly common in the Northern zone of Ghana electricity from the national grid is not widely spread.

The advantage here is that it can be moved to where it is needed (i.e. either a community that use electricity or without electricity).

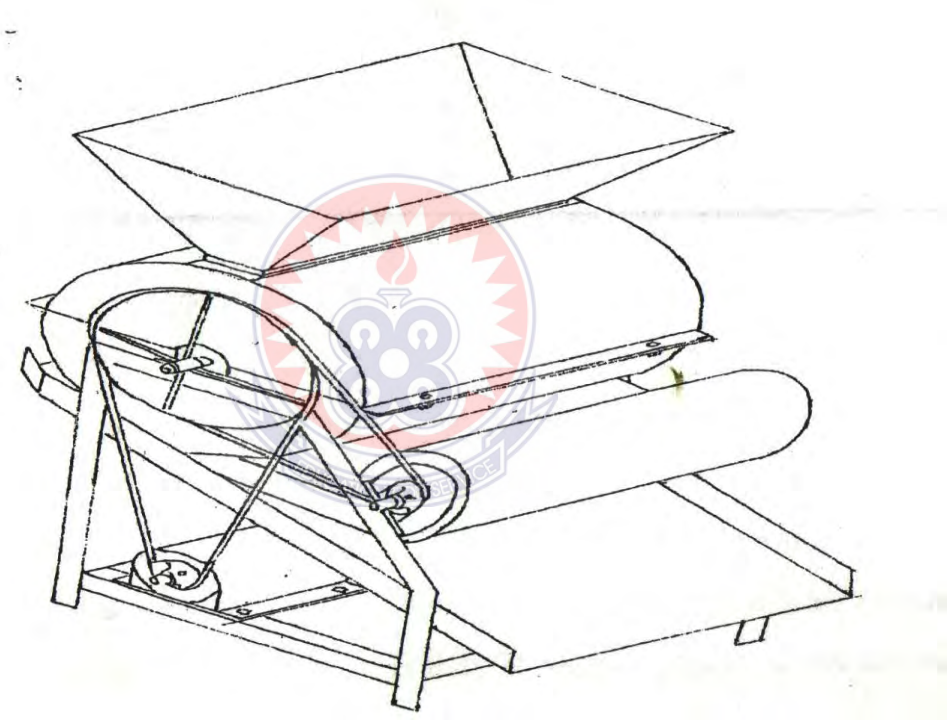


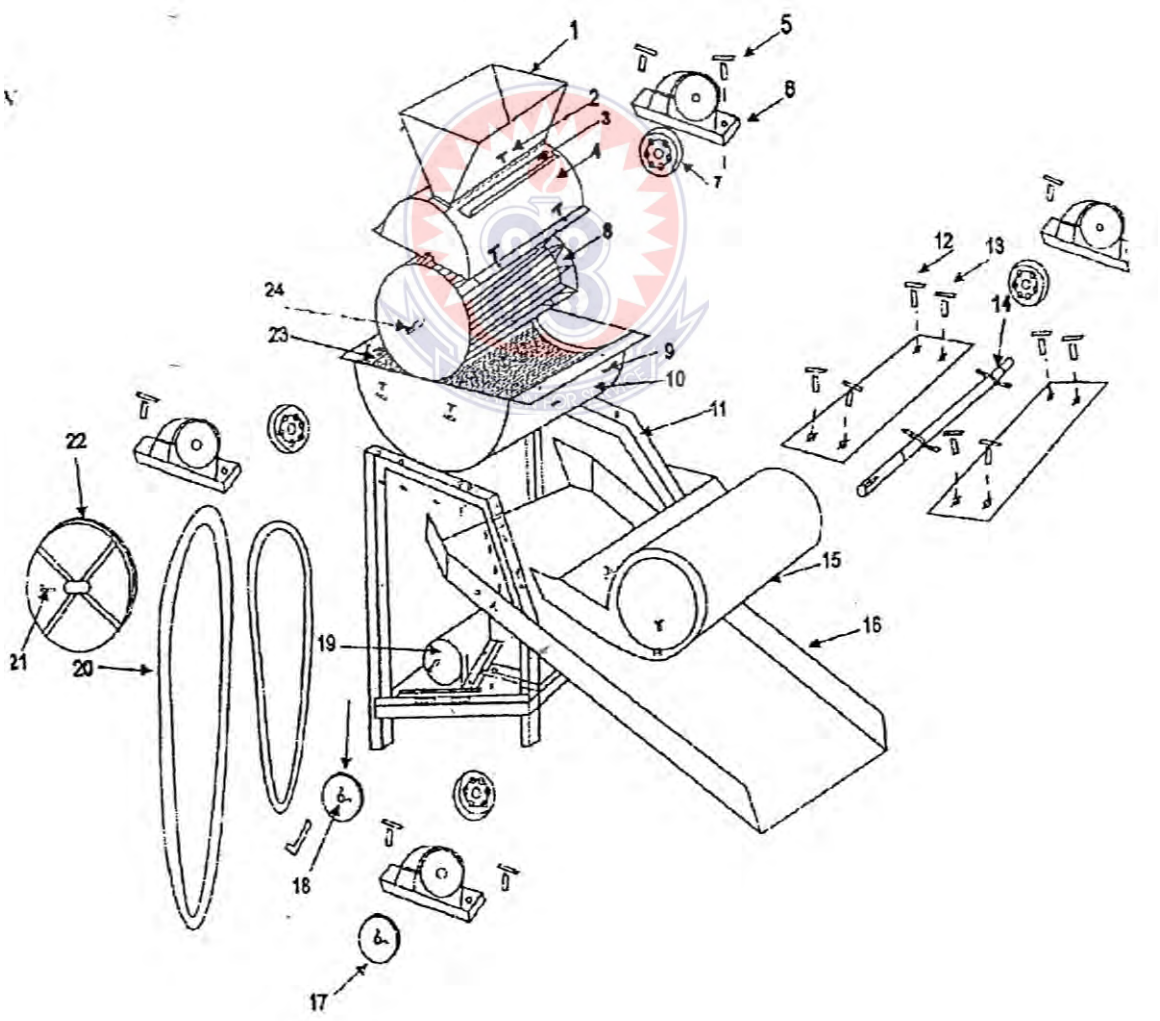
Figure 2.6: Motorized / manual Neem seed thresher

Source: Re-designed and manufactured project

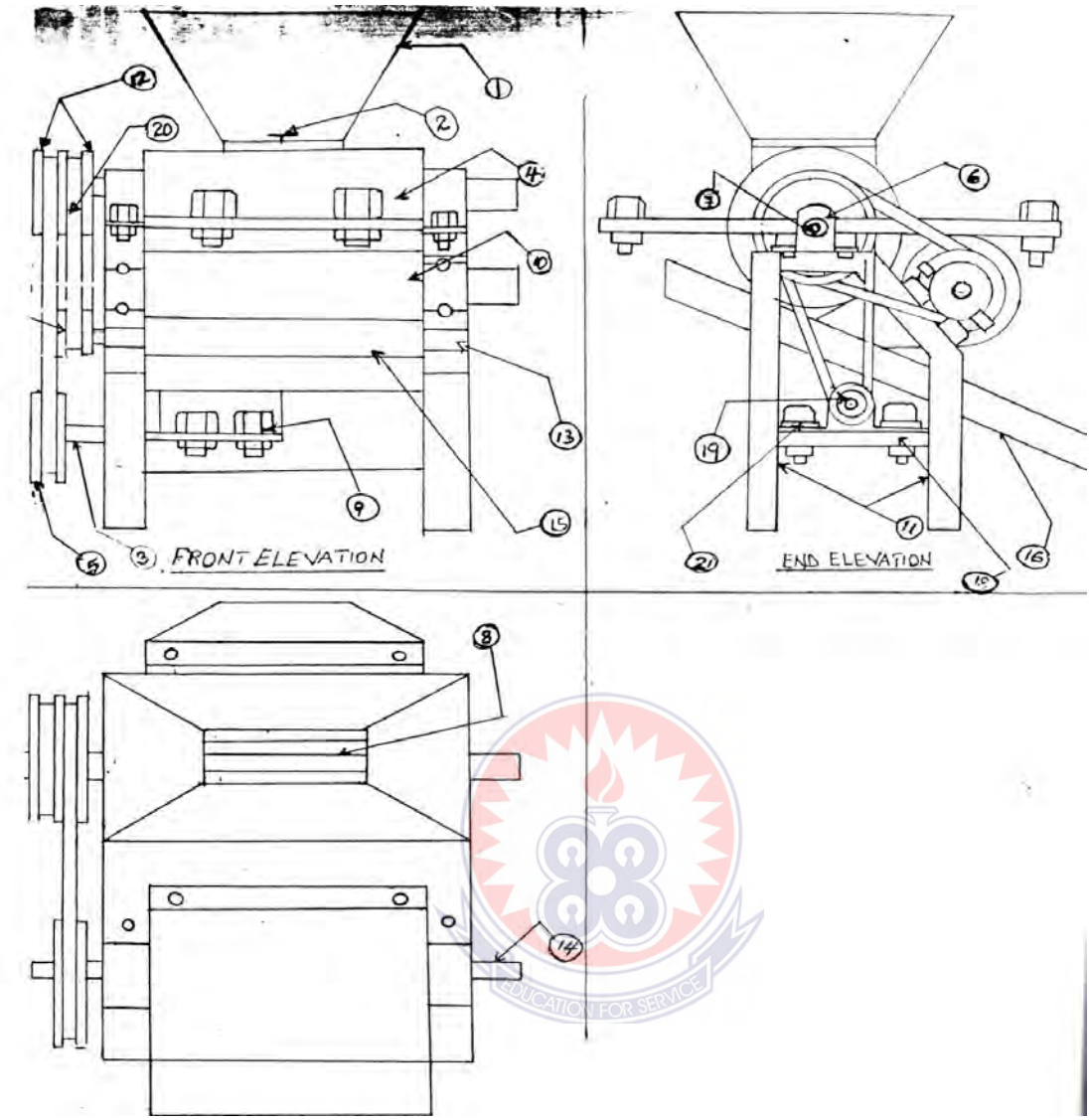
2.10 The Exploded View of the Motorized / Manual Machine

1. Hopper
2. Adjustable Screw
3. Adjustable Plate
4. Top Housing
5. Button Housing
6. Bearing Housing
7. Bearing

8. Cheater
9. Nut
10. Button Housing
11. Frame
12. Screw
13. Fan Plate
14. Fan Shaft
15. Blower Case
16. Chute
17. Blower Pulley
18. Motor Pulley
19. Motor
20. Fan Belt
21. Key
22. Drum Pulley
23. Concave Sieve
24. Drum



Orthographic View



NO	NAME OF PARTS	NO	NAME OF PARTS	NO	NAME OF PARTS
1	Hopper	**8**	Beater	**15**	Blower Case
2	Adjustable Plate	**9**	Bolted Nut	**16**	Chute
3	Motor Shaft	**10**	Button Housing	**17**	Blower Pulley
4	Top Housing	**11**	Frame	**18**	Motor Seat
5	Motor Pulley	**12**	Double Vee Pulley	**19**	Motor
6	Bearing Cup	**13**	Blower Shaft	**20**	Fan Belt
7	Bearing	**14**	Fan Shaft	**21**	Washer

CHAPTER THREE

MATERIALS AND METHODS

3.1 Introduction

This chapter highlights on Materials selection, Method of manufacture, functional requirement and design considerations.

In the selection of material for the redesign and manufacture of this machine, the factors that are considered include; cost, workability, maintenance and durability. Cost iron and mild steel are selected because of their uses, properties and availability. The material used for the various parts are staked as follows:

3.1.1 Bearings

A bearing is a machine device to allow constrained relative motion between two or more parts typically rotation or hire's movements.

i. bearing material are made of high carbon steel with a carbon content varying from 0.8% is 1.5% and a high thermal conductivity so as is permit the rapid removal of heals generated by friction.
ii. Bearings material posses a reasonable long life span
iii. The material should not rust or corrode away under the action of lubrication
iv. It must possibly be anti-friction type (J.LNayer)
v. Bearing steel has a destiny of 7 85 gm / cm3, coefficient of linear expansion (i.e. change in length per unit length resulting from 1 degree rise in temperature of 0.00001 per kernel conductivity of 30-40 wmk)

3.1.2 Shaft

The shaft is a short metallic bar machine to precision which is made of mild steel. The shaft is made from mild steel which consist of iron and carbon with carbon content varying from 0.5% to 0.3% it is made to resist compressive force, tensile force and bending moment.

Mild steel is chosen for the shaft because of cheapness, good surface finish, ductility, much inability ad resistance to shock. (Greed & Howell 1972).

3.1.3 General Design and Fictional Requirements

The threshing machine of this projection consists of the following units.

3.1.4 The Housing

The drum and sieve is found in the housing. The housing serves as the outer chamber where threshing takes place and also gives support to the above listed component. It is made of mild steel plate, mild steel is choose for the housing because of its cheapness, ductility, easy to weld and good surface finish.

3.1.5 The Concave Seive

This is placed at a critical distance below distance below the rotation drum, will help operate the size pods from broken shells and the whole nuts. It will be inter changeable depending on the size of the Neem seeds.

The concave sieve is made from mild steel which consist of iron and carbon with carbon content varying from 0.15% to 0.3%, mild steel is chosen for the concave sieve because of its cheapness and ductility.

3.1.6 The Beater

The beater bar assembly is form of a chute assembly and intermitting, oriented, rotating cylinder drum having a plurality of extending teeth forming racks of combs. The beater rotation helps to crack the pods against the sieve which then sieve the shell and the nuts. It's made of mild steel because of it ductility.

3.1.7 The Hopper

The hopper is considered as the path way in which the Neem seed is fed into the system for threshing to take place.

3.1.8 The Chute

This is a path way through which the shells and kernels is pass to the receiver, put in different direction. It also help its minimize losses for both equality and quantity and easy handling of nuts made of mild steel, mild steel is chosen for the chute because of its ductility cheapness and easy to weld.

3.1.9 The Adjustable Plate

It is allocated in between the Hooper and the housing; it controls the fed rate of the pods entering in to the system

3.2.0 THE FRAME

The frame is made up of mild steel which are as one of the strongest material used for the construction in various industries. The material is available and affordable and also having the capacity is withstanding the load acting on it during operations. It can last for long period

of time when properly protected (greasing and oiling lubrication) mild steel is chosen for the frame of time of its ductility and easy to weld.

3.2.1 The Blower

The blower contains a fan which provide air that separate the shells from the kernels

3.2.2 The Pulleys

A pulley is also called a sheared or drum, is a mechanism composed of a wheel on an axle or shaft that have grow between two flanges around its circumference. A rope cable, belt or chain usually runs over the wheel and inside the groove if present. Pulleys are used to change the direction of an applied force, transmit rotational motion, or realized a mechanical advantage in either a liner or rotational system of motion. Since the violet ratio is the inverse ratio of the diameter in order to have a desire velocity ratio, the pulleys must be perfect align in order to allow the belt to traced in line normal to the pulleys faces, the pulleys are made of cast iron because of its good lubrication and wear characteristics (resistance)

3.2.3 Design and Construction

From the above mention units, the following are require to meet a satisfactory design

3.2.4 The Drum

- It should be able to withstand all form of stresses
- It must be tough enough
- It must be resistance it corrosion
- The teeth should not be two sharp, in order not to cause injury to the nut

3.2.5 The Frame

- It must be firm and grid
- It must be resistance to corrosion
- It should withstand all forms of vibrations
- It must be strong to withstand dynamic and static load
- It should with stand friction force during operation

3.2.6 The Concave Sieve

- The material must be durable
- It must be sample to used
- It must be a non-toxic material
- It must have a smooth surface finished

3.2.7 The Housing

- The internal surface of the material should not corrode under the action of lubrication
- The housing should be strong enough to withstand all forces and vibrations

3.3 Design Calculation

It is very essential to know the total force acting on the pulley which serves as a major of power.

Maximum Tension (T) =1440N

Pulley Diameter (D) = 400mm

Shaft Diameter (d) = 30mm

Design Ratio () = 1:8:1

$= \frac{T1}{T2}$ = 1.8 but T1 = 1440N……. (3.1)

$= \frac{1440N}{T2} = 1.8$

$= T_2 X 1.8 = 1440.N X 1$

$$= \frac{1.8T2}{1.8} = \frac{1440}{1.8}$$

$$T2 = \mathbf{8000N}$$

Torque (T) = (T1-T2) R/2……. (3.2)

but D= 400, T1= 1440N and T2 = 800N

Where r = D/2

T = (T1-T2) D/2…….. ……..(3.3)

T = (1440-800) 0.4/2

T = 640 X 0.2 = **128N**

Also Torque (T) = Force (F) X radius (r) …… …….. (3.4)

but T = 128N

T = Fr Where r d/2 but d = 0.03mm

r = 0.03/2 = 0.015mm

128 = 0.015F

$F = \frac{128}{0.015} = \mathbf{8533N}$

F = The force acting on the shaft.

The drum is made up of medium carbon steel which has a density of 7.85mg/m^3. (Source: mechanics of Materials by David Roylance). It consist of four different parts welded together These are:

a. Beater

b. Cylinder

c. Shaft

d. Round Plate

3.3.1 Volume of the Beater (A)

Length (L) =332mm = 0.332m

Breath (B) = 100mm = 0.01m

Thickness (t) = 2mm = 0.002m

Volume of A = L X B X T…… (3.5)

= 0.332 X 0.01 X 0.002 = 0.0000664m^3

Number A = 1

Volume of A = 0.0000064 X 16 = 0.0001624m^3

3.3.2 Volume of the Cylindrical Plate (B)

Length (L) = 1225mm = 1.225m

Breath (B) = 260mm = 0.26m

Plate Thickness (t) = 0.002m

Volume of B = L X B X t

= 1.225 X 0.26 X 0.000637m^3

3.3.3 Volume of the Round Shaft (C)

Diameter of shaft = 390mm = 0.39m

But C = $2\pi R$……(3.6)

R = D/2 = $\frac{0.39}{2} = 0.195$

C = 2 X 3.152 X 0.195 = 1.225m^2

Volume of C = 1.225 X 0.002 = 0.002 = 0.00225m^2

Number of C =2

Volume of C 0.00245 X 2 = 0.0049m^3

3.3.4 Volume of the Shaft (D)

Diameter (D) = 30mm = 0.03m

Length (L) = 510mm = 0.51m

Circumference = 2π

Where r = radius = d/2

r = $\frac{0.03}{2} = 0.015m$

C = 2 X 3.142 X 0.015 = 0.09426m^2

Volume of D = 0.09425 X 0.510 = 0.048726m^3

3.3.5 Total Volume of the Drum (VT)

VT = VA + VB + VC + VD……..(3.7)

VT = 0.0001624 + 0.000637 + 0.0049 + 0.0480726

VT = 0.05377m^3

The force exerted by the drum is given by F = VTgp……(3.8)

Where VT = Total Volume, g = acceleration due to gravity and ρ = Density of the drum

F = 0.05377 X 9.81 X 7.85 = 4.1407 X 1000 = 4141N Force = 4141N

3.4 Material Selection

The materials use to construct the Neem-Seed threshing machine are obtained from industries.

However, local materials are also used. Below are the various types of material selection with their properties.

Table 3.1: Material selection

Materials	Properties	Uses
Iron rod (mild steel) $\frac{1}{4}$rod	Very strong metal can withstand high temperature and can rolled in its cold state	Use to form the sieve net
Steel plate (mild steel)	Is an alloy of iron and carbon. It contains about 0.1% - 0.3% carbon content, it is easy to bend, easy to weld and it is affordable.	Used for the construction of the body
Welding rod	Non rusting malleable metal	Use for the filling gaps to form seam
Coolant	Sodium solution	Use for cooling the welded joints and tool bit during machining on the centre lathe
Angle iron (mild steel)	Very strong metal which can withstand high temperature and rigidity	Use to fabricate the frame

Table: 3.2: Specification List

Part Number	Part Name	Material	Quality
1.	Bearing	Plain carbon steel	4
2.	Drum	2mm mild steel plate of 30mm shaft	$\frac{1}{2}$, 16inch shaft
3.	Concave sieve	Mild steel ¼ rod	4
4.	Blower	20mm shaft and 22mm plate	16 $\frac{1}{2}$ inch,
5.	Bolt and nut	Size 13	22
6.	Chute	2mm mild steel plate	$\frac{1}{4}$
7.	Housing	2mm mild steel plate	$\frac{1}{2}$
8.	Frame (stand)	1.5inch angle iron	1

Part list

No	Name	Material	Quality
1.	Hopper	Mild Steel	1
2.	Adjustable Screw	Mild Steel	1
3.	Adjustable Plate	Mild Steel	1
4.	Top Housing	Mild Steel	1
5.	Bolt And Nut	Mild Steel	22
6.	Bearing Cup	Mild Steel	4
7.	Bearing	Plain Carbon Steel	4
8.	Beater	Mild Steel	1
9.	Button Housing	Mild Steel	1
10.	Frame	Mild Steel	1
11.	Screw	Mild Steel	1
12.	Fan Plate	Mild Steel	1
13.	Fan Shaft	Mild Steel	2
14.	Blower Case	Mild Steel	1
15.	Chute	Mild Steel	1
16.	Bower Pulley	Cast Iron	1
17.	Motor Pulley	Cast Iron	1
18.	Key	Mild Steel	2
19.	Drum Pulley	Cast Iron	1
20.	Concave Sieve	Mild Steel	1
21.	Drum	Mild Steel	1

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1 Introduction

The performance of the thresher was evaluated at the various machine spindle speed, neem seeds content levels with an average feed rate of 25 kg/h. The separating efficiency, percentage breakage, and throughput capacity were calculated with equation 2, 3 and 4 respectively. Figure 4.1, 4.2 and 4.3 shows the results of the performance test.

4.2 Throughput Capacity

The throughput capacity ranged from 78.3 kg/hr to 96 kg/hr at a threshing speed of 47 to 71m/min when tested with the dry mixture while it ranged from 45 kg/hr to 85 kg/hr when tested with wet mixture under the same variations. Figure 3 shows that the machine throughput capacity of 96 kg/hr yielded the best result at 71 m/min for the dry and wet mixture levels respectively. Though hypothetical, the throughput capacity should increase with an increase in machine shaft speed at the same repeated conditions, the results show otherwise. This was due to the manual design arrangements and spacing of the beaters to optimize the threshing efficiency at a moderate speed as results shown in figure 2.3.

4.3 Threshing Efficiency

The threshing efficiency of the machine ranged from 78.4% to 98.6% at a threshing speed of 47 to 71 m/min when tested with the dry mixture while it ranged from 48.3% to 68.4% when tested with wet mixture under the same variations. From figure 4, it shows that the threshing efficiency is significantly high at 71 m/min of machine speed for dry mixture. Therefore, it is recommended that the neem seed mixture be dried before threshing as the results closely follow that report.

4.3. Percentage Breakage

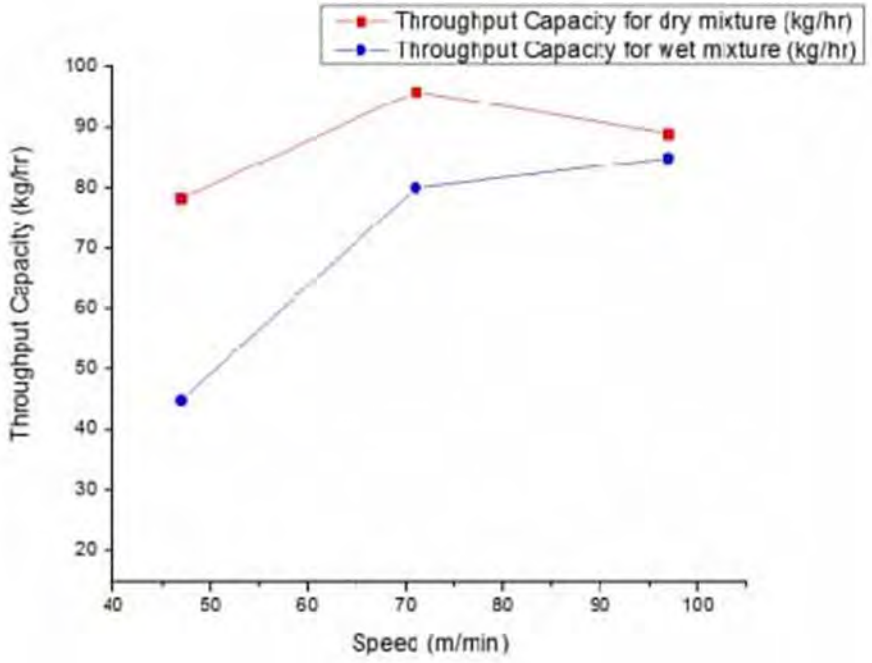


Figure 4.1: Performance test of Throughput Capacity of the machine

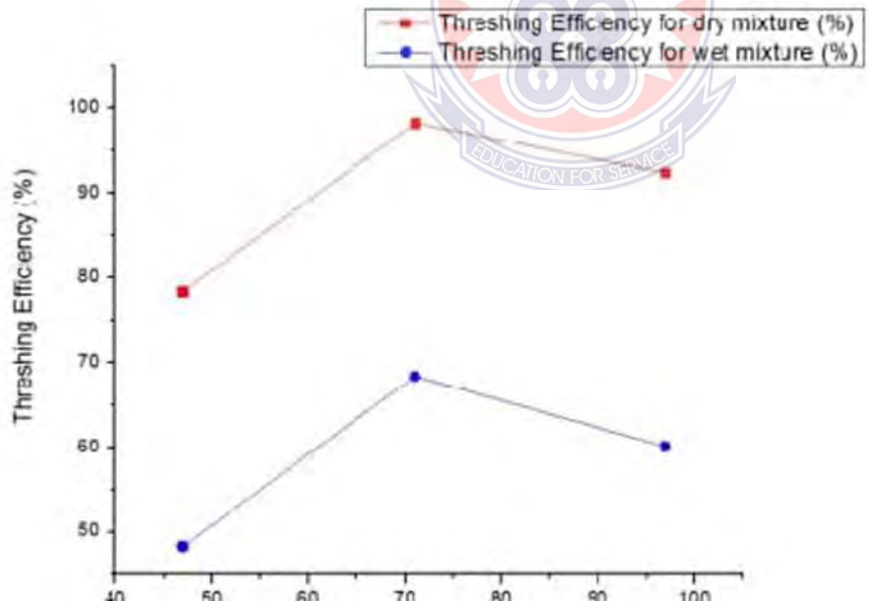


Figure 4.2 Performance test of threshing efficiency of the machine.

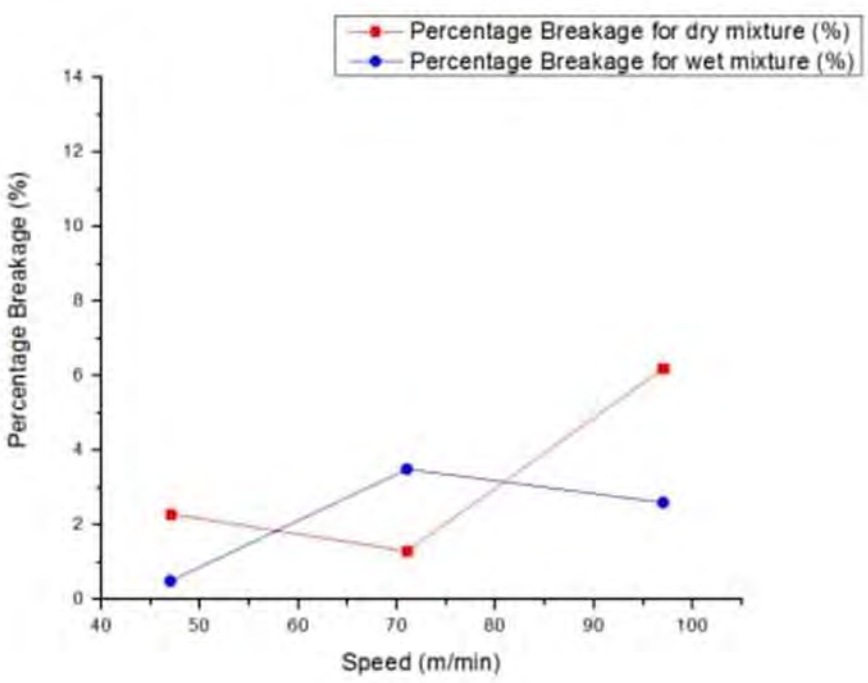


Figure 4.3: Performance test of Percentage Breakage of the machine.

The percentage breakage is the product of the weight of damage over the weight of damage plus the weight of undamaged grains. Figure 5 shows that the extent of percentage breakage was influenced significantly by the machine speed and moisture content of the sample mixture. The percentage breakage was least at 3.5% at 71 m/min of the machine speed when tested with the wet mixture while at 1.3% and at 71 m/min high when tested with dry mixture. As too wet mixture makes the grain moisture content high, is difficult to crack the grains and also results in trapped grains in the stalks while the dry sample mixture has less moisture content level which makes the grains brittle resulting in excessive grain damage at high speeds. This shows that, for optimal quality of grains, the threshing should be done when the mixture is moderately dry.

CHAPTER FIVE

SUMMARY OF FINDINDS, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This chapter highlight on the summary, Conclusion, Recommendation and Reference.

5.2 Summary

Neem seeds are gotten from a Neem tree known as azardrachhtin. It is found in the southeast and some West African countries. The seed are mature within a period of three months (90 days). In the communities most farmers thresh the Neem seeds by using stones, pounding in a mortar to remove the pods and winnowing to separate the pods from the kernels. These methods of threshing the Neem seed are hectic; in addition, the grains may be ground, with dirty particles or fly away affect and reduce the productivity. Therefore, this project is mixed designed to deduced and curb such problems. Improper threshing methods affects the market price leading to profits losses in production, the materials used in the manufacturing of this machine is cast iron and mild steel. The manufacture consist of a beater, housing frame and shaft, the machine is started while inserting the Neem seeds pods into the machine, the threshed grains are then collected into a container.

5.3 Conclusion

It is important to realize that, increasing the production of Neem seed alone is not enough to challenge the production of oil and its Neem products. The reduction of post harvest losses and production of quality and sate through processing, depend upon the proper use of the existing thresher and the recent developed thresher derived from mechanical engineers department.

The project has been written to compile and evaluate the availability of informing, the processing and some uses of Neem seeds.

Finally, after given the importance of and reduction of post harvesting losses, quality handling and improvement of Neem seed and its products, we hope this creative and innovation technology will help local farmers who will go in for this machine will increase their level of technology, income level awareness and the reduction of post-harvesting losses.

5.4 Recommendations

- Only Dried Neem Seed should be used
- The input should not be too much
- The rate of operation and precautionary measures should be adhered to as to enhance its life span
- Substance farmers in the rural areas who can afford the imported high cost machine can go in for local manufactured one
- The institution should endeavor to advertise designs and manufactured projects carried out by student in the job market seminars, for exhibition attract more customers and sponsors to encourage students projects
- Government and private sector should commit funds to student project, since it enhance industrialization and technology which are the keys in nation
- Government should endeavor to subsidize the price of materials in order to enable students carry out their projects works

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