DESIGN AND DEVELOPMENT OF POTATO HARVESTER

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ABSTRACT

This study aimed to develop a multipurpose digger for harvesting potatoesas well as separating and transporting them over soil surface with minimum losses, mechanical damage. Potatoharvester is developed by adding a successful vibrating separating mechanism that should base on separating potatoes with minimum losses and damage. The developed digger is tested at three levels of forward speeds (1.8, 2 and 2.6 km/h), for potato, (1.4, 1.8 and 2.3 km/h), for peanut and three different tilt angles (12 ،۱۸and 24). The experiments are carried out during two successful agricultural seasons of 2007 for peanuts at El Assasin country, El Sharkia Governorate and 2008 for potato at Manzala city, El Dekahlia governorate. From the obtained results, it is cleared the proper conditions to operate the developed digger are22 cm harvesting depth, 2.6 km/h forward speed and 0.31 rad (18) tilt angle for potato crop and 15 cm harvesting depth, 2.3 km/h forward speed.

Key words**:** *mechanical harvesting, potato, damage tubers, sandy soil.*

1.INTRODUCTION

1.1 Problem statement

By traditional harvesting process, we can harvest 1 acre potatoes in 2 days. It is highly time consuming and low efficient. At the time of harvesting, the harvesting process takes too much time hence potato harvesters are machines designed for potato harvesting Potato harvesters are machines designed for harvesting. This machine can finish mining, soil and potato separation in one time and can harvest the potato with the potato stems. It is a multifunctional machineThis is very efficient and also reduces damages of potatoes during harvesting..

1.2 Objective

1. To determine the composition of the potato ridges.
2. To give proof of seperation mode for stony and cloddy soil.
3. To test qualitative parameter of the alternative riddling device in real condition

1.3 Scope

Now a days, the automation of agriculture is the need of time. By traditional ways we harvest potatoes in the field of one acre in about two days but our project harvest one acre potatoes in five hrs which is very efficient and time saving.In future this project is use for any type of harvesting like peanut and sweet potatoes.

1.4 Methodology

. This project is attempted to show how we can atomies the potato harvesting in simple ways and using simple mechanism

The potato harvester dig the potatoes by the digger web. The machine harvest the potatoes by lifting the potatoes from the bed using a share. Soil and potatoes are transferred onto a series of webs where the soil and the potatoes are sieved out and the potatoes are separated from the soil.

Several field and vegetables crops, from tubers and roots below the surface of the soil. Those crops could be termed root crops and they may be classified according to the strategic important into major and minor root crops. The major root crops are potatoes, beets for sugar, sweet potatoes, onions and peanuts**.** Potato and peanut consider two of the major root crops. Potato is occupied in India the first position according to exportation vegetables crops, yearly producing about 2.5 million ton, it is exported from about 200 to 250 ton, it is raised to 430 ton in as a fresh and frozen potatoes to Arabian and European countries, according to **Agricultural Researches Station.** Peanut is considered from the main summery crops, Egypt is occupied the second position at peanut production in the quantitative production was about 1.5 million ton, India is exported from about 30-35 % to Arabian and European countries, according to **Agricultural Researches Station.**

Developing, testing and evaluation of agricultural machines are become a big problem should be studied and that is because expanding at agricultural areas, the agricultural machines are become the main factor to increase agricultural production, mostly the agricultural machines which tested in some country is not give the same results whichit obtained in another country and that is maybe because local conditions (soil, fuel, oil, workers and climate conditions), and these conditions could be influence the properties of those machines, so developing, testing and evaluation those machines again is very important under local conditions, Harvesting is one of the most critical operation for potato and peanut production. Root crops are grown below the surface of the ground, therefore it requires specially designed machines to dig and separate them from the soil. The subject of vibrating diggers has drawn the attention of many researches.[9]

2. DESIGN

2.1. Components

Such development had been introduced to overcome the problems noticed under the harvesting operation using the ordinary digger, the digger unsuitable for harvesting root crops successfully, high percentage of losses as well as damage are resulted during the harvesting operation.

2.1.1: Frame:

The frame is made of square pipe of 1.5" of mild steel. The frame takes a rectangular shape with dimension of 650x550 mm, include elements to fix (a spindle transports the vibrating movement to a cam at the end of it and vibrating system). The digger frame is carried by two tire wheels of 180 mm'diameter and 45 mm thickness

2.1.2: Separating unit

The separating unit is consists of a blade with 545X200X6mm, which has 16 rods, 30 mm the distance between rods, this frame is connected to vibrating blade by nuts and bolts, also at the end of that frame longitudinal frame 500X450X10 mm is provided.

2.1.3:Transmission system

The transmission system consists of a spindle transmit rotating motion from to a pulley to the cam. The cam converts rotary motion into reciprocating motion tolinkage shaft. This shaft is connected through the longitudinal frame to digger blade.

2.1.4 Eccentric (Arm):

The main function of the arm is convert the rotating motion of the cam to reciprocating motion.Cam and follower are linked together by means of 2 bolts of M22.

2.1.5 Shaft

The shaft is made up of MS materialhaving diameter of 30 mm. The diameter of the transmission shaft was calculated according to design of shaft for transmit the power considering the bending moment, axial load, and the torque acting on shaft.

2.1.6Wheels:

Wheels are used to support and carry the load of whole body of project. The wheels are used of diameter 200 mm for reduce height of project from ground level & project can work properly for underground root crops.

3.WORKING PRINCIPLE

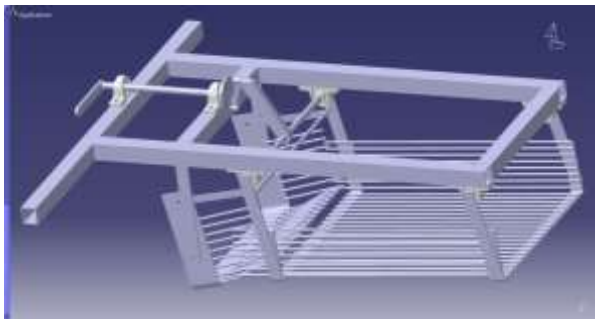

Fig.1 potato harvester

This is simplest mechanism can used in project. The basic concept is that power transmission from one shaft to another shaft using two sprocket and chain but due to more noise and more cost and maintenance we can-not use this mechanism in this project.

The flat belt transmit very flow amount of power due to less friction of grip. It is require more space which increase the cost of project it give low velocity ratio while power transmit mission also the end of flat belt are joined so drive is not smooth.

Therefore, working principle of potato harvester is ,

POWER TAKE OFF (PTO)

PTO is any of several methods for taking power from power source such as running engine and transmitting it to an application such as an attached impliment or separate machines.

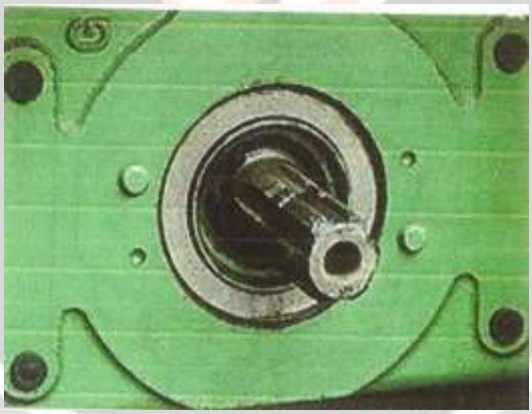

Fig.2 Power Take Off shaft

Most commonly it is system comparising a splined output shaft on tractor, designed so that PTO shaft a kind of drive shaft can easily connected and disconnected, and a corresponding input shaft on application end. The PTO allows impliment to draw energy from engine. The PTO and its associated shafts are couple by universal joints. The original type calls for operation at 540 RPM. A shaft that rotate at 540 rpm has 6 splines on it, having nominal diameter 35 mm. Agriculture PTOs are standardize in dimensions and speed.

INERMEDIATE SHAFT

Universal joint more commonly known as U joints, allow positive transmission of rotating power at much larger angle than is permissible with a flexible coupling.

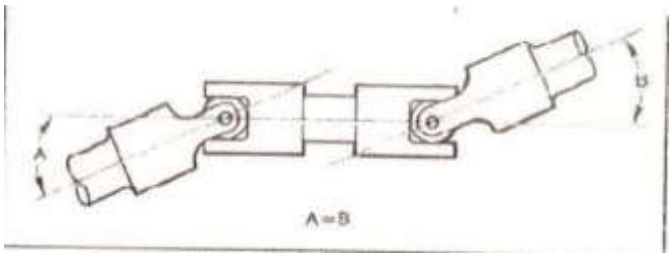

Fig.3 Intermediate Shaft

Millions of U joint are installed each year in all types of power transmission system thousands more are used to connect PTO drive shaft in off – highway tractors that operate drawn machinery such as rotary grass mowers , grain wagon with unloaders, feed grinder etc. Likewise, U joint widely used in industrial application
U – joint used to join the drive shaft (PTO) and diffrential (machines).

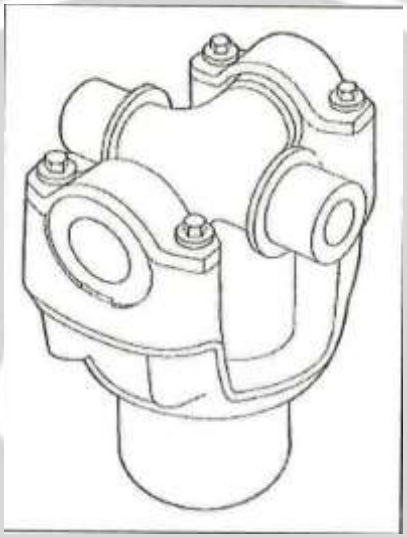

Fig.4 Universal joint

4. ADVANTAGES

1. This potato harvester machine can used for harvesting varieties of underground plants.
2. The machine is suitable for all kinds of soil, such as sandy soil, clay soil and roam.
3. The machine is with simple and compact structure and can connect with the tractors easily.
4. This potato harvesting equipment can harvest the potatoes with the potato vine.
5. Less man power require for operation.
6. It can use for multipurpose.
7. It saves the maximum time of operation than the manual.
8. It completes the operation without damaging the potatoes.

5.APLLICATIONS

In majority of potato growing area digging is done with hand tools like khurpa, spade, plow and animal drawn plows. In recent years improvements have been made and multipurpose digger, digger shaker and digger windrower have been developed. So, for save the man power & time required for harvesting we design a suitable machine for easy to harvest root crops.

1. Potato Harvesting.
2. Peanuts Harvesting.
3. Sugar Beet Harvesting.
4. Sweet Potato Harvesting.

6.CONCLUSION

It is machine which separate potatoes from soil. The vibration reaches relative seperation speed but cause less damage on potato. Mechanical harvesting of potato had a greater influence on lifted, unlifted and damaged tubers which was not favored for crop use. The effect of the forward speed and chain speeds was remarkable on lifted and unlifted tubers. The lifted tubers tended to be increased with increasing the forward speed until 6.4 km/h. While, using the forward speed of 8.6 km/h was led to the lowest lifted tubers as compared with the other forward speeds.

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