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HYDRAULIC CASSAVA HARVESTER

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Abstract - *Cassava is one of the main sources of food carbohydrates in the tropics. Concerning 90% of total cassava production zone in India are limited in Salem, Namakkal, Erode and Villupuram quarter of Tamilnadu. Cassava is known for its starch & water content which ranges from 15% to as high as 30% and 70% respectively. Harvesting of cassava is often manual, when we fail to harvest at that time there will be deterioration in its nutritional values as it is a highly perishable crop. The main idea of this project is to harvest cassava without damaging its roots. In this we have provided a corrugated plate attached to the scissor like handle, which is used to clutch the tapioca stem with more taut. After ensuring that the release valve of the filter plug is closed, we will be able to uplift the saddle along with the extension screw of the bottle neck hydraulic jack by pumping the lever attached to the socket of it. Then the tubers of cassava are uprooted facilely. In the wake of uprooting, the harvested cassava can be put down by tilting the handle.*

Key Words: **Cassava, Hydraulic, Socket**

1. INTRODUCTION

Tapioca (*Manihot esculenta*) is the most commonly cultivated root crop in tropics and is grown through the whole of a broad range of agro-climatic conditions. Cassava is a substantial source of carbohydrates and also provides a small amount of fiber and minerals. Tapioca is a bosom crop which is cultivated around Kerala and Tamil Nadu. About 90% of total tapioca production areas in India are bound in Salem, Namakkal, Erode and Vilupuram district of Tamilnadu. An average potency of tapioca is highest in the world. Cassava continues to grow as a crop of significance around the world for curbing food security issues as well as a means of income and livelihood. Tapioca is shrubbery, tropical plant which is less in the temperate zone. It was first harvested manually by using hands, which was very difficult because of the shortage of proficient labor available. And so, the farmers have transitioned to use harvesters. Most of the Indian farmer's economic conditions are not good, so they are impotent to buy tractor or large harvesting machines. The harvesting implements of large scale harvesters redress the tubers of cassava, so our design is proposed to make a harvesting machine which will harvest the cassava without any injury and to make effective equipment available at nominal prices[1]. In this aspect, mechanization of cassava processing plays a crucial role in removing the negative imputes of the traditional processing techniques and promoting timely large-scale processing of the tubers in hygienic environments. This kind of equipment will help farmers to harvest in low cost [2].

1.1 ROOT

The cassava root is long and narrow with a resistant, homogeneous flesh draped in a removable rind, about 1mm thick, rough and brown on the outside The tuberous wholesome root, grown in clusters of 4-8 at the stem base. Roots are from 1-4 inches in diameter and 8-15inches long, although roots up to 3 feet long have been found.

1.2 HARVEST

Crops are often harvested at 9-11 months after planting. The main stem of the plant should be cut back to a height of 30 cm to 50 cm. There are basically three cassava harvesting options available to farmers; manual, semi-manual and mechanized[3]. In traditional method cassava is harvested using the bare hands. Semi-manual harvesters are harvesters embrace the lever principle to secure that quite human effort. Mechanical harvesting entails the use of a harvesting implement basically attached to a tractor to dig out the cassava roots

1.3 OBJECTIVES

The main objectives of this hydraulic cassava harvester are:

1. To reduce man power in uprooting of cassava.
2. To harvest cassava in bunches without damage.
3. To develop compact, portable and economical machine for the manufacturers.
4. To minimise the time requirement.
5. To reduce labour cost.

2. COMPONENTS DESCRIPTION

1. HYDRAULIC JACK:

The main application of this hydraulic jack is to lift heavy loads by applying a force through a hydraulic cylinder. Hydraulic jack raises loads using the force generated by the pressure in the cylinder assembly.

2. LEVER TYPE SCREW ACTUATED CLAMP MECHANISM:

It is a fastening device used to expand the scissor like structure which used to mesh the stem tightly (tubers of cassava in bunch) together to retire the cassava bunch from the soil. It acts a holder and holds the cassava that is be pulled out.

3. CORRUGATED HOLDING PLATE:

Corrugated structure is to ensure a firm grip to the holding pressure that will be provided to the cassava stem for uprooting. It holds the cassava and uproot it without any damage.

4. BASE FRAME WITH ADJUSTABLE HANDLE:

It is the primary component which gives prop up for the whole equipment to withstand and to harvest the cassava. The handle may also tilt to settle down the harvested cassava in an another place**.**

3. WORKING PRINCIPLE

In this we have provided a corrugated plate attached to the scissor like handle, which is used to clutch the tapioca stem with tauter. After ensuring that the release valve of the filter plug is closed, we will be able to uplift the saddle along with the extension screw of the bottle neck hydraulic jack by pumping the lever attached to the socket of it. Then the tubers of cassava are uprooted facilely. In the wake of uprooting, the harvested cassava can be put down by tilting the handle.

Place the setup near the cassava plant. Now hold the stem tightly by adjusting the actuated clamp of the corrugated plate fixed with the scissor like structure. Make sure that release valve of filter plug is closed, and then uplift the saddle by pumping. Now the uprooted cassava tubers are placed on the either side by tilting up the rear wheel.

4. RESULTS AND DISCUSSIONS

After completion our machine was taken to agriculture field for the entire test performance. The experiment was done at a tapioca field, Kaspapettai, Erode district. During this experiment 4 tapioca plants were harvested by manual and other 5 tapioca plants were harvested by using the hydraulic cassava harvesting machine.

Based on the results observed the following chart designate the performance of the harvester.

Table-1: Performance of Manual harvesting Vs Hydraulic cassava harvester.

Sample	Time taken in manual harvesting (seconds)	Time of operation in hydraulic harvester (seconds)
Plant 1	33	26
Plant 2	44	35
Plant 3	52	42
Plant 4	36	28

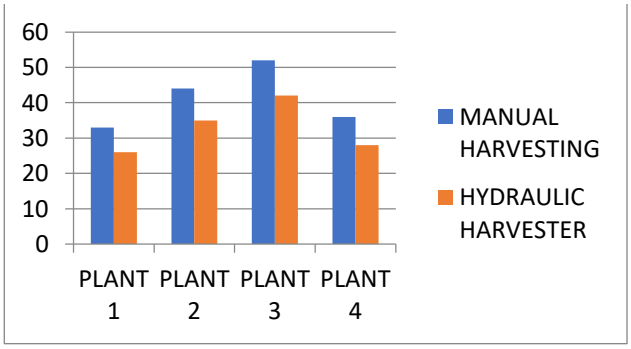

Chart -1: Performance of Manual harvesting Vs Hydraulic cassava harvester.

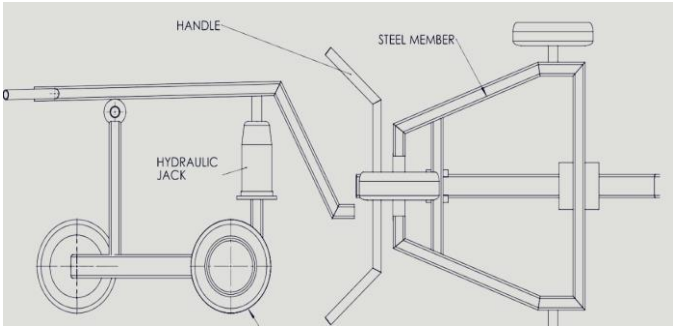

Fig -1: Hydraulic cassava harvester

5. CONCLUSIONS

Manual operating (harvesting) of cassava is too strenuous, and it is also time consuming. Hydraulic harvester to uplift the cassava without any mar to roots and it is not necessary to spend much force while doing harvesting in the field. Harvester attached with tractor is chafe to do operation in the field; it also easily damages the roots which lead to dull market value. These nodes on the stem cause pain to the farmer's hands while uprooting it with high man power. But our proposed machine ensures that it doesn't causes any pain to the farmers.

Preliminary evaluation of the device on 4 stands of randomly selected mature cassava stands at 63% soil moisture content recorded a minimum time of 26 seconds and a maximum time of 42 seconds respectively while there was no damage recorded on the tubers and stem girth during the harvesting procedure as the gradually applied load ensured minimal disturbance caused to the soil.

In future, Internet of Things (IoT) based sensor to predict the tubers growth including its grown width, length and the grown directions etc., which can be attached along with the equipment. This IoT smart farming solution is a system that is built for monitoring the crop field with the help of sensor which is obliging for the farmers to keep a track of the field conditions from anywhere.

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