Design And Development Of Cost Effective Tapioca Harvester For Agricultural Applications

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Abstract: Tapioca harvest home area unit additional galore in our country particularly in our state and it even have a good vary of advantages; it promotes cell growth and helps them to build powerful bones. In a standard manner, it had been harvested by mistreatment hand. It's terribly tough to reap the crop. The giant scale harvesters have harvest home attachments hooked up to the tractor. However the Indian farmer's financial condition isn't sensible, so that they not capable to shop for tractor, therefore we tend to commit to build harvest home machine that ought to be economical. The harvest home machine that contains of blade, motor, rotating actuation hooks and assembling receptacle area unit won't to build this machine terribly straight forward mechanism makes this machine to user friendly and fewer maintenance, therefore this sort of apparatus facilitate them to reap in low investment. It reduces the harvest home wages of farmers, these harvest home machine would be additional useful to farmers concerned in low scale cultivation.

Keywords: cassava, crop, pulling hook, plow, plug, tractor, tuber

1. INTRODUCTION

Cultivation of tapioca in the states of Tamil Nadu & Kerala is very huge number of places. So it is a familiar crop for people to cultivate in a low investment and less water supply needed. But harvesting of tapioca is very hard. Nowadays people are used to plug out the tapioca by using hand alone. That is very complex process and also huge time consumption. So we are decided to make a harvesting machine for tapioca, which is very economical for farmers. Most of the Indian farmers profit is not good, because they need to give wages for workers to plug the tapioca from the soil. It reduces the harvesting wages for farmers. Also, there is a shortage for skilled labour for agricultural purpose. Previous attempts at mechanized harvesting have been affected by constrains such as soil characteristics, nature, size of tapioca tuber depth, high tuber damage and root tuber breakage. These harvestings are available for usage, but they are not affordable. So our aim is to design the harvesting machine which harvests the cassava without any damage and to make effective machine available at normal prices. The mission is to create portable, user friendly and acceptable cost harvesting machine. Tapioca comes under the family of euphorbiacae. It can grow under condition where rainfall is low. The idea is to create the machine which is cheap and will reduce the labour required to harvest crops.

2. EXISTING METHODS OF HARVESTER

2.1 Manual Harvesting

Cassava is mostly harvested by hand, lifting the lower part of stem and pulling the roots out of the ground, then detaching them from the base of the plant by hand after the upper parts of the stem with the leaves are removed.

Fig.1. Harvesting with CTCRI Lever

The use of manual harvesting tools helps in loosening or reducing the soil forces on the cassava root tubers in order to make it easier to uproot them. For this study, three manual harvesting aids were used; CTCRI harvesting lever (Fig.1), harvesting aid prototype (Fig.2) .Manually uprooting the roots without any harvesting tool (Fig.3) was used as the control technique.

Fig.2. Harvesting with Prototype Harvester
In the Kerala state of Republic of India, the hoe is the common tool used for harvest all told cassava growing areas. The harvest aid paradigm was created with the thought of reducing the labour of farmers because of waist bending related to different other harvest tools that sometimes result in waist pains and other bodily weaknesses. The initial style was adopted from the International Institute of Tropical Agriculture (IITA) in Nigeria. Many modifications have since been created to beat a number of its style constraints (Amponsah, 2011). The harvest aid paradigm operates consistent with the ‘grip and lift’ principle. It consists of a frame to that associate degree unmovable gripping jaw is hooked up and a chisel tip that is the bottom for lifting cassava from the soil. The chisel tip may also be accustomed dig out cassava roots particularly in onerous and dry soils, wherever the grip and elevate principle becomes troublesome to use because of the tendency of high root tuber injury or breakage. The CTCRI manual cassava harvester was designed and fabricated at the Central Tuber Crops Research Institute, Kerala with the target of reducing labour concerned in manual cassava harvest. It operates on the second order lever principle. The peak of the pin at the way finish of the lever are often adjusted that facilitates uprooting of cassava plants raised on flat bed similarly as on mounds or ridges. A self-tightening mechanism is employed to grip the cassava stem. It's a ratio of 3.4 and also the total weight is 8 kg.

2.2 Mechanized Harvesting
Harvesting cassava automatically involves the utilization of a gathering implement integrally hitched to a tractor to dig out the cassava roots. The mechanized gathering shown within the fig. 4. Manual effort is also required when cassava uprooting to gather and detach the cassava root tubers. The subsequent field requirements/conditions are necessary to permit for associate optimum mechanical cassava gathering operation: a field free from hidden obstructions (rocks, roots, stumps etc. right down to 40 cm deep)of sizes which will interfere with lifting the tubers; smart weed management as weeds block the lifters; scaling down (coppicing) the cassava plant to a stalk level of about 30 cm before gathering to permit the tractor operator to figure in an exceedingly regular manner. Ridge cultivation of cassava in rows is most popular to facilitate higher orientation of stems for tractor operation throughout gathering.

3. OBJECTIVE OF THE PROPOSED WORK
The main objectives of the proposed work is to easily pluck out the tapioca from the soil system without using any manual harvesting tools like hoe, bare hands, earth chisel, machete and mechanized harvesting.

4. DESCRIPTION OF THE PROPOSED WORK
We are imposing a new and innovative idea of introducing a new machine, that will be easier this process in a faster manner, in such a way that the machine is used to plug out the tapioca from the soil surface. Before that we need to cut the stem completely. So we are cutting the stem by the action of rotating blade. This will rotate in enormous speed of 1000 RPM action to cut the stem. After the stem cutting, machine moves forward by the moment of hand lever. Here we have a plow to loosen the soil. Basically the tapioca will grow under the ground about 1 to 2 feet long. So we need to fix the plow for 1.5 feet depth, so that we can loosen the soil without making any problem to the tapioca. By this action, the tapioca alone came out from the soil. Normally this tapioca is in a bound or unit manner. All the roots are grabbed by a single stem, so this is the major advantage for us to take the tapioca from soil. To take the tapioca out of the soil to the storage, we have rotating hook operate by the motor at a speed of 60 RPM. This hook will rotate continuously an any part of the lifted tapioca will be connect with the hook an taken out from the soil to the storage tank. If the storage is getting filled, we can unload it and continue the process.

5. METHODOLOGY

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<table>
<thead>
<tr>
<th>Cutting blade</th>
<th>Rotating pulling hook</th>
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<tr>
<td>Wiper motor (1000 RPM)</td>
<td>Wiper motor (60 RPM)</td>
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<td>Switch</td>
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Fig. 3. Manual Uprooting of Cassava

Fig. 4. Mechanical Cassava Harvester
The various blocks presents in this methodology shown within the figure 5. The 12V battery is source for all the wiper motors. Cutting blade is used to cut the stem 0.1m above the stem, that motor need to run in the high speed of 1000 RPM. So the source is given by the battery. After cutting the stem, the cassava inside the soil needs to loose. For that we are using plow to plug out the tapioca from the soil. After taken the tapioca from the soil, which need to store in the tank. So hook is used to take the tapioca completely from the soil to the storage tank. So the hook needs to run in slow manner. For that we are using 60 RPM wiper motor.

6. SOFTWARE IMPLEMENTATION
We use mechanical CATIA software to design the complete software setup of our model shown within the fig. 6.

7. HARDWARE IMPLEMENTATION
We have shown that the hardware setup of tapioca machine from the fig. 7. In this setup we used two motors, one is with 1000RPM for stem cutting and another one is for taking the tapioca from the soil to the storage box. If we turn on the switch of blade motor, then it will rotate at high speed and it will cut the stem above 0.1m of the stem. Then we add the plow in this model for loosening the tapioca inside the soil. And also it will lift the tapioca from the soil to the ground level. After that we designed the hook setup to collect the ground level tapioca to the storage box. We added more hooks to avoid the escaping of tapioca on the ground. And also the plow setup can be adjustable based on the tapioca field. This plow can capable of working in the dry land also without damaging the tapioca root. This can be operating in manually without the help of tractor. And we use polymer tiers to move the tapioca machine in the field.

8. FUTURE SCOPE OF THE MACHINE

8.1 WEIGHT SENSOR
Implementation of weight sensor to the storage box of harvesting machine. This used to measure the weight of the tapioca after collecting in the box. So no need of going to the weigh bridge, we can measure the amount of tapioca collected on the spot alone.

8.2 BLOCKING ROD
During the stem cutting, if we cut the stem means the stem leaves will come towards the machine and it will create some unavoidable damages to the machine. So if we place the rod in the front side of machine, it will resist the machine by removing the stem leaves. So the smooth operation of machine can be possible.

9. CONCLUSION
Tapioca harvester is easy compact structure and may operate simply. This unit is provided with a wheeled frame as its supporting power. The foodstuff stem would be higher of the bottom so the operation of each created by removal and plucking square measure performed in one stroke. If the creating by removal depth is adjusted different deep frozen crops like cassava have even be harvested. The creating by removal half and frame may be adjusted consistent with any foodstuff fields. No foodstuff root breakage was ascertained throughout the gather procedure and giving the high lifting potency. Many ways of reducing the assembly value ought to be investigated to create the study a lot of appealing to the agricultural farmers. We have enforced associate in nursing automatic and improved cultural practices of foodstuffs gather which will enhance for the reduction of labour charge and time.

10 REFERENCES


