



A Single Row Top – Lifting Carrot Crop Harvester

R. Karthik Kumar, R. Sricharan, E. Thava Siva, M. S. Yuvashree, S. Gowtham

Abstract: Agriculture serves a serious role during a country's economy. The role of agriculture in economic development is crucial as a result of a majority of the population of developing countries build their living from agriculture. The most purpose of our project is to assist small scale farmers by coming up with small scale harvester machine to reap crops terribly with efficiency. Now a days, Agriculture equipment have ton of limitations and it needs additional energy to work. The crop cutting machine needs human effort associated it's terribly cheap for social class farmer because it has no sophisticated structure and conjointly simply operated by a human. Carrot crop cutter machines doesn't needs high maintenance. This harvester machine has 2 roller arrangement which are placed in parallel manner facing each other, combined to supply up lift torsion that may be applicable for the harvest crops like carrot, onion and radish etc. The facility unit for this machine may be a battery supply providing 12A. This power is transmitted through gear box, sprocket-chain mechanism to the roller motors and alternative power requiring mechanisms for performing arts harvest home operation. The most feature of this model is that it will save up to 70 % of energy consumption and 85 % of harvest home time. The most thought of this project is to supply a user friendly operation machines for farmers and it will cut back labor value as 1 person is enough to handle. At last the main motto is to make friendly equipment both for farmers and to our ecosystem, because the cost for labors and fuels are completely reduced.

Key Words: Battery supply, roller motors, gear box, sprocket chain.

I. INTRODUCTION

In India, harvesting is done traditionally and sickle is the only tool that is used for this purpose. Mostly, plain and saw-shaped sickles are used. After cutting, the crop is gathered at one place and made ready based on the market. Carrot, a fleshy edible root crop cultivated throughout the world irrespective of climate conditions.

The labor scarcity being felt as a major impediment in agriculture, this study has probed into its magnitude, impacts, causes and possible solutions. The study has revealed that

prevalence of acute labor scarcity, has affected the productivity levels of almost all crops and is even leading towards the permanent changes in the cropping pattern. The important reason identified for labor scarcity includes high labor wages in other locally available jobs, seasonal nature of agricultural jobs and presumption of an agricultural job to be of low esteem. To overcome this acute labor shortage many mechanization in the agriculture field is being carried out. This brings out farmers from the conventional method of harvesting to new technologies. Carrot is one of the most important root vegetable and it is one of the major root crops which is rich in Vitamin C. For the harvesting of carrot more manual works are involved and eventually cost of harvesting will become high. There are mechanical harvesters for most root crops but in case of carrot there is very few. The practical difficulty in using these mechanical carrot harvester is there size and a requirement of high fuel cost and skilled labors to operate those. Mostly in India, carrots are cultivated in hilly places not as of in other countries where they are usually cultivated in plain lands and they prefer giant structured harvester vehicles to pull off the carrots from the field, which is not possible in our country. In this project, we propose a solution methodology that is low cost and simple and eliminate the above problems. To make the harvesting process easy, it is proposed a simple, cost efficient single row top lifting carrot harvester. This results in reduction in cost and time. The important goal is to increase efficiency and reduce drudgery in the work.

II. LITERATURE SURVEY

Existing System

The labor scarcity being felt as a major impediment in agriculture, this study has probed into its magnitude, impacts, causes and possible solutions in India. The study has revealed that prevalence of acute labor scarcity in the district has affected the productivity levels of almost all crops and is even leading towards the permanent changes in the harvesting pattern. The important reasons identified for the labor scarcity include higher wages in other locally-available jobs, seasonal nature of agricultural jobs and presumption of an agricultural job to be of low esteem. The level of adoption of labor-saving implements and technologies by the farmers is very low for the reasons of higher cost, lack of skill and smaller size of holdings. The study has suggested that agricultural extension system of the district / state / country should be geared-up, to bring out farmers from the conventional methods of harvesting and to educate them on adoption of labor-saving implements and technologies. Also, a community level approach should be encouraged among farmers for adopting / availing highly expensive labor-saving technologies and implements cooperatively. Agricultural activist designed a manually operated template row harvester was designed and developed in manual method.

Revised Manuscript Received on March 30, 2020.

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In other countries, it is designed a tractor mounted/huge vehicle mounted carrot harvester with adjustable row spacing. Carrot Harvester is tractor mounted equipment that plows the soil and pull off the carrot from the loosened soil.

Lifting Mechanism

A typical harvesting machine for carrot crops are of top lifting and share lifting. These are usually used to harvest carrot in a particular manner and provide healthy crops.

Top Lifting Harvesters

A. Multi Row Harvester

Top lifters use rubber belts to grab the leaves of the carrot and pull them from the soil. The plant gets loosened by a share which pushes under the plant. The belt pulls off carrots from the top, and gets pulled in to the machine where the tops are cut off where the leaves and bottom fleshy part and green tops are dropped back on to the field and carrots are collected in a separate collecting bucket or transferred over the elevators to collecting vehicle. Two heavy-duty pinions ensure perfect synchronization of the knives. By this technique, the carrots remain undamaged and the blades last longer. The top lifting harvesters are available either as self-propelled, mounted type, with multiple rows.



Fig 2.1 Multi Row Harvester

B. Share Lifting Harvester

A share lifter uses a share to get the carrots out of the ground from underneath. The machine have a topper to cut off leaves the carrot. The carrots travel along a longer path to get out the soil. Since carrots are mechanically harvested by undercutting the roots and elevating them out of the soil and into the machine by grasping the leaves. Thus, it is important that healthy leaves are to be maintained until the carrots are harvested. Carrots are transported to the packing-shed in trucks or trailers and unloaded into water to reduce root abrasion. They then pass through a rotary root washer and sizer before moving to the packing line. The carrot roots flow through multiple webs to get rid of the soil attached to the carrot. The carrots are collected in a storage part on the machine.



Fig 2.2 Share Lifting Harvester

C. Mini Potato / Carrot Harvester

In this kind of harvesting machine, it is difficult to plough of various heights of carrots. Normally carrot heights varies from 2 inches (Paris market) to 8 inches (imperative). So there are possibilities of occurrence of damage during lifting and harvesting. And there is a requirement of 2 to 3 skilled labors for the alignment and movement of the machine. This machine have successful for harvesting potato crops but in case of carrot it shows above problems. Moreover the method of harvesting of carrot in China which is different from other regions due to varied climatic conditions that prevailed in all over the top carrot cultivators and they used to raise the carrots up-to some 10 inches in nursery. In this strategy, there is a need for fuels which leads to additional expenses. But these problems are not being addressed today.



Fig 2.3 Mini Potato/ Carrot Harvester

III. PROBLEM IDENTIFIED

Manual Harvesting

During manual harvesting, the labors have to dig the soil to harvest carrot. The manual method of harvesting, results in low harvesting, spacing efficiencies and drudgery in their work. There is a serious back ache for the farmers during harvesting the carrot and also there is a need of huge labor source and high labor cost which is shown Fig 3.1. In current technology, the farmers are using tractor mounted carrot harvester with adjustable row spacing. This semi-automatic machine also need 5 to 6 labor and increase in diesel usage cost for tractor. It also creates noise pollution and emits greenhouse gases.



Fig 3.1 Manual Harvesting by Farmers

Disadvantage in Manual Plucking

The following are the drawbacks of manual method:

- ✓ Results in low harvesting
- ✓ Spacing efficiencies
- ✓ Serious back ache for the farmer which limits the size of field that can be planted.
- ✓ High labor cost

Vehicle Mounted Carrot Harvester

To overcome the problems faced in manual harvesting vehicle mounted machines were used. In this semi-automatic machine, 2-3 operators are needed including tractor driver. But that harvester also needs some labors for the field work. Moreover the method of cultivation of carrot in other countries is different from other regions due to varied climatic conditions that prevailed in all over India and they used to raise the carrot up-to some 8 inches in nursery. In this strategy, there is a need for fuels which leads to additional expenses. But these problems are not being addressed today.



Fig 3.2 Vehicle Mounted Harvester

Disadvantages in Vehicle Mounted Harvester

The following are the demerits of tractor mounted method:

- ✓ Fuel cost is high
- ✓ Large amount of CO₂ is emitted
- ✓ Increase in use of fossil fuels
- ✓ Noise pollution is created.

IV. BLOCK DIAGRAM

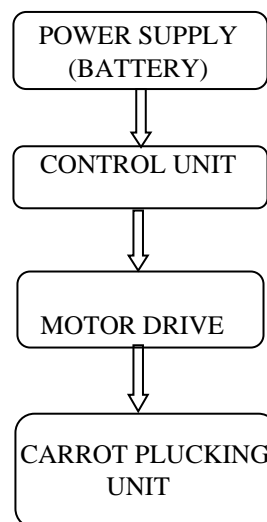


Fig 4.1 Block diagram

Over View

The proposed system consists of three main blocks: a battery which acts as source, a conveyor unit and a ploughing unit. The ploughing unit comprises of main components: a claw system to align carrot leaves in order to get stuck between conveyor belts and also to loosen the soil, the conveyor is used to grab those leaves which are visible and are on the top of surface. The proposed work block diagram is shown in fig 4.1.

Power Supply

A power supply is an electrical device that supplies electric power to an electrical load. The primary function of a power supply is to convert Electric Current from a source to the correct voltage, current, and frequency to power the load. As a result, power supplies are sometimes referred to as Electric Power Converters. A container consisting of one or more cells, in which chemical energy is converted into electricity and used as a source of power. Lead acid batteries are usually consists of two 6-volt batteries in series, or a single 12-volt battery.

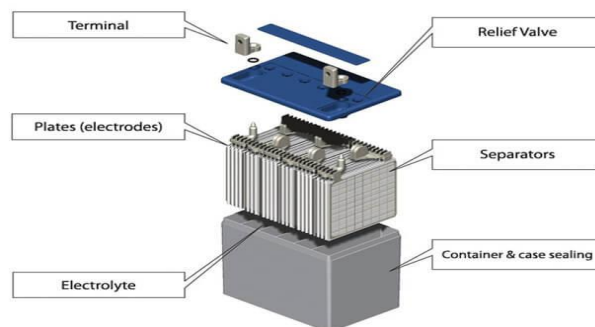


Fig 4.1 Construction of Lead Acid Battery

Plucking Unit

Claw Arrangement

This arrangement is provided to dig the soil in the sides of carrot. If in this case it provides easy grabbing of carrot leaves in the rolling conveyor belt. This helps to decrease the efforts to plug carrots hard.



A Single Row Top – Lifting Carrot Crop Harvester

This makes the efficiency and speed of increasing the harvesting and makes easy harvesting.

Conveyor Unit

This conveyor unit is provided to lift carrots from soil to the storage unit. In this machine, top lifters are because of easy and good efficiency comparatively to existing models. This top lifters require DC gear motor because of its low speed and high torque characteristics. Since high torque is required to pull out carrot from soil by leaves.

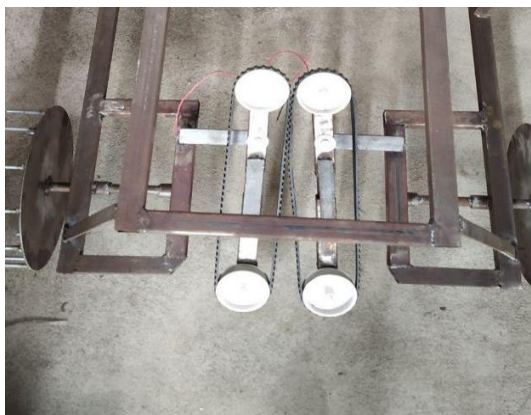


Fig 4.2 Conveyor Belt Arrangement

DC Gear Motor

A dc motor with gear arrangement for lifting the roller setup and another dc wiper motor for harvester movement are accompanied with switches to align the movement of machine. For top lifting movement a dc motor is mounted with spur gear arrangement which drives the rear wheel in order to move the vehicle. This type of motor is used for its high torque while maintaining a low speed requirements. Gear motors are primarily used to reduce speed in a series of gears, which in turn creates more torque and thus it uses the basic principles of speed reduction to increase torque or force. Thus, the high torque is completely necessary for the lifting to raise the carrot from soil to the storage area. Two belt setup arrangement is made with two fixed gear motors which face each other. These two belts are used to drift the carrot from the soil to the storage basket.

Structure of DC Gear Motor

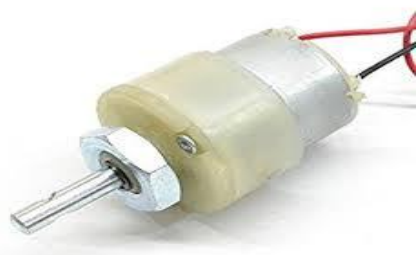


Fig 4.3 DC Gear Motor

DC Wiper Motor

The standard voltage requirement for the wiper motor is 12 volts DC. The electrical system in a running automobile usually puts out between 13 and 13.5 volts, so it's safe to say the motor can handle up to 13.5 volts with no problem.



Fig 4.4 DC Wiper Motor

Wiper motors are devices in the wiper system that functions on a power supply in order to move the wiper blades in a smooth motion. Like other motors, the wiper motor rotates continuously in one direction which is converted into a back and forth motion the wiper switch sends the signal to the control module. The motor activates linkage that moves the wiper arms back and forth. The control module operates the wiper relay that sends 12-volt power to the wiper motor. The motor rotates a little arm that through links moves the wiper arms. A wiper motor has two permanent magnets that serves as a field for the motor, arranged around the armature where the power is connected to the commutator of the armature with two brushes, the armature is a set of electro-magnetic coils that is each connected to its own two segments in the commutator so that the power is connected to only one coil at a time to generate a magnetic field in the armature, this field will oppose the field of the permanent magnet field, where the one field will push the other away and make the motor to turn.

V. HARDWARE AND EXPERIMENTAL RESULT

The hardware model of proposed system is shown in Fig5.1



Fig 5.1 Hardware for the Proposed Project

As is well known, carrots are grown in the field in earthed-up rows, with furrows being left along each side of the rows, and once the carrots are ready for harvesting, the carrot harvester is drawn behind and is usually able to lift-up the carrots and any attached soil of the row at one time during each pass down the field.

During each pass, the wheels of the harvester run in the furrows between adjacent rows of carrots. Most existing harvesters either have a temporary box store which is filled progressively with carrots and then emptied at required intervals, or else discharges the carrots as they are harvested to a separate collector vehicle which moves with and alongside the harvester. In this mode of operation, the main portion of the elevator may be adjusted so as to extend substantially horizontal, or at a small upward inclination to the horizontal, and the tail portion is adjusted to extend downwardly of the end of the main portion so that its lower end can be located close to the ground surface and thereby reduce the distance through which the crop must fall onto the ground and minimise the risk of damage to the crop. The harvesting frame mounts opposed endless harvesting or lifter belts having adjacent reaches for grasping and lifting the tops of the carrots. A pair of rubber belts facing sideways are inclined above a downstream portion of the lifter belts and these belts are inclined in upwards from the lifter belts at an acute angle of about 30-40 degrees for independently grasping the tops to pull the tops up through the underlying lifter belts, bringing the tops of the carrot crops. The rollers are driven at a linear speed by using a DC gear motor at a speed of about 7% greater than the machine running speed to ensure the efficiency of the top lifters. The carrot crop harvesting machine comprising a rolling elevator, a pair of rollers operating in diagonally crossed vertical planes, mounted with in the harvesting machine, rollers pivotally mounted on the cross bars and cooperating with the elevators in gripping carrot tops. Inclined rollers onto which carrots are delivered, a collecting bucket placed at the end of the rollers getting the carrots on to it.

VI. CONCLUSION

The carrot crop harvester was designed. From this machine, carrot crops are lifted from the soil by using a top lifting mechanism. So that, it is possible to pluck crops without damage and leaves are not cut off while harvesting when compared to share lifting harvester. It greatly reduces the cost for labours, fuels and harvesting time are less. This project is helpful for farmers, because it is semi automatic and easily controllable. It also focuses on plucking the carrot without much need of labours and overcome the drawbacks arised during traditional methods. Compared to existing methods, time for harvesting and rate of defective carrots during harvesting is reduced upto 20-25 %. This innovative project will make a remarkable point in the field of agriculture.

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