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# Research and Optimization of Yam Harvesting Machine

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## Abstract

The stalk of yam is long and deep underground, so it is difficult to harvest. If the harvesting technology is not mature enough, the stalk is easy to be destroyed. The yam harvester studied in this paper is to improve the structure of the existing machinery.

## Keywords

Harvester, yam, optimize.

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## 1. Introduction

People have been eating yam since ancient times. It is one of the earliest plants for human consumption. Nowadays, the medicinal and edible value of yams is more and more sought after by people[1]. Therefore, it is an urgent need to realize the mechanization of yam production and harvest as soon as possible.

For a long time, the harvest of yams took time and effort. As the stem of yam is longer, deep underground, difficult to harvest. If harvesting techniques are not mature, the roots can easily break. If mechanical automation can be realized, yam mining and harvesting technology will effectively promote the scale of yam planting, significantly reduce the production cost, reduce labor intensity, increase planting income and improve the economic benefits of agricultural production[2].

This paper discusses the development status of Chinese yam harvest mechanization, and discusses the future research direction of yam harvester. It provides a theoretical basis for the way of yam harvest, the promotion of yam harvest mechanization and the improvement of yam production efficiency.

## 2. Overview of the Overall Structure of the Yam Digging and Harvesting Machine

According to the patent of the yam harvester and the actual situation, the working principle and component of the yam harvester can be obtained.

The components of yam harvester can be roughly divided into supporting part, power part, working part and driving part[3].

Supporting component: The main part is the frame of the yam harvester and the connection part between the yam harvester and the tractor.

Power section: Power used to connect the transmission of the tractor to the transmission part of the yam harvester.

Drive part: Transfer power and slow down.

Working portion: This part of the soil, with the spiral drill pipe trench, achieve the purpose of harvesting yams.

### 3. The Working Principle of Yam Harvester

Take the tractor as the power source. The auger mechanism is installed at the tail of the tractor for drilling, and the two auger pipes are in the front to open the ditches. After the trench is made, the loose soil machine at the back of the frame is used to move the soil, so that the machine can cut a deep trench through the place.

### 4. Plan Optimization Analysis and Determination

Through the analysis of the current situation of the yams harvester, the successful development of yams harvester in the market analysis. Through the analysis of the current situation of the yams harvester, the successful development of yams harvester in the market analysis. The optimum design of yam harvester was determined.

Firstly, the task of designing yam harvester is summarized: (1) The function of yam harvest can simplify the yam harvest and improve the efficiency of yam harvest. (2) The device will not damage the yam tubers when harvesting yam. (3) The design of yam harvester should be as simple as possible, and the scheme meets the actual situation.

### 5. The Overall Structure of the Harvester

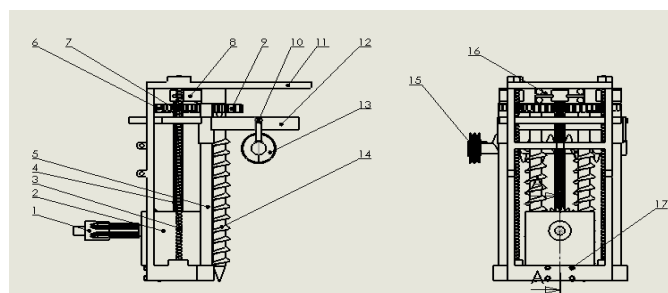


Fig.1 Two-dimensional diagram

- 1.Spline shaft 2. Equational box 3.Lead screw 4.The drive shaft 5.Sliding sleeve 6.The gear 7.The gear 8.Bearing 9.The gear 10.Bolts 11.The shelf 12.The chassis 13.Soil transfer machine 14.Screw drill pipe 15.Pulley 16.Bearing 17.Nut

The device also grooves both sides of the yam. After the trench is opened, the soil surrounding the yam is released using a simple device. Therefore, the subsequent process of yam harvest can greatly reduce human labor. If the yam loose land, people follow the way of accepting the yam not only by digging little by little from the ditch, but also can more directly and simply harvest the yam. This reduces damage to the tubers. This simple device does not bring much resistance to the harvester, and the previous trench equipment provides good forward space. After the transmitter is used, the trench will be raised to the ground of the soil on either side of the trench, where the machine passes through to open a deep trench. So people can go down the mountain to get the yams.

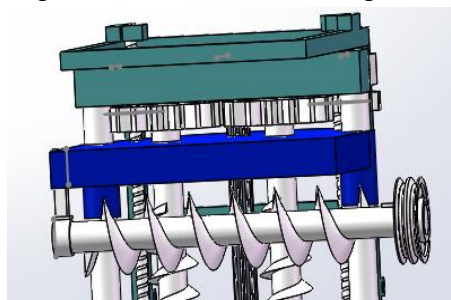


Fig.2 Soil transfer machine

This is the side view of the design device. As can be seen from the side, the front two auger pipe grooves. After the trench is opened, earth is placed on both sides of the trench by a soil delivery device

mounted on the back of the frame for enhanced yam cultivation. In order to explain the design of this scheme more intuitively, we can combine the front view and see the soil feeder in the process of yam harvest playing a role.

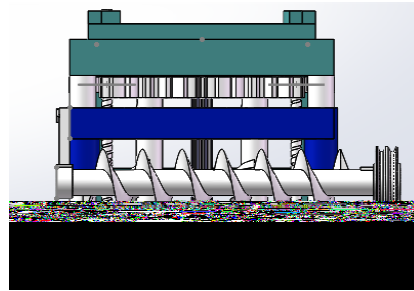


Fig.3 Soil machine elevation drawing

In the elevation view, the two screw rods were excavated on both sides of the row planting line and worked simultaneously by gearing. The lower part of the trenching device will be raised to the ground after the ditching and a deep trench will be opened across the sides of the machine.

## 6. Global Design

### 6.1 Design of Box Frame

According to the requirements of yam harvesting operation, it is necessary to determine the overall structure design of yam harvesting device, and design a special and simple frame. The rack not only supports the auger drill pipe and soil feeder, but also lifts and drops the auger drill pipe

### 6.2 Design of Soil Delivery Machine

The design of the soil feeder can better lift the loose soil mass of the screw drill pipe to both sides of the trench, greatly improving the superiority of the yam harvesting device. The soil feeder should cross the yam planting line and connect with the frame to play a fixed role. The conveyer is connected to the tractor's pulley via a pulley, so that the tractor can drive the conveyer to work.

### 6.3 Determination of Transmission Scheme

The transmission scheme should consider not only the conversion of input power and output power, but also the specific situation of yam harvest.

The unit is selected to be equipped with 24 tractors of 17.7 kw. When the device is operated, the tractor speed reaches 2000r/min. The tractor and the harvesting device are driven by bevel gears. The driving shaft of the tractor transmits power to the transmission shaft of the yam harvesting device through two bevel gears. The driving shaft transmits power to the spiral drill pipe through the gears, and the two spiral drill pipes rotate at the same speed. Through investigation, it is determined that the trench depth of the yam harvesting device is 1000mm, the trench width is 400mm, and the trench speed is 400-500m/h[4].

## 7. Conclusion

For a long time, yams are harvested by traditional manpower, and the roots of yams are long, deep underground and difficult to harvest. If harvesting techniques are not mature enough, the rate of root damage can be high. Through this study, the Chinese yam mining and harvesting machine was optimized to make it more suitable for agricultural use and yield. It is hoped that this research can give some help to the yam growers, and also play a role in attracting jade to the research, so as to provide a design idea for the general readers.

## References

- [1] Ming Miao, Research and Development of Mechanized Planting Technology of Yam [J]. Jiangsu Agricultural Mechanization., 2002: 40-42

- [2] Baihe Liu Super, Low Speed Tractor and Trencher [J]. Agricultural Machinery, 2010.12: 59-60.
- [3] Zhongde, Hong, Concise, Mechanical Design Manual [M]. Shanghai: Tongji University Press, 2002: 16-17.
- [4] Zuomo Chen, Wen jie Ge. Mechanical Principle [M]. Beijing: Higher Education Press. 2006: 51-53.