

Wax Gourd Harvesting Machinery Based on Agricultural Mechanization

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Abstract: Agriculture is the foundation of China's national economy and the basic industry supporting the construction and development of China's national economy. With the continuous development of agricultural industry in China, the trend of agricultural mechanization is gradually obvious. At the same time, due to the country's continuous attention to innovation and development, a variety of mechanization tools suitable for agricultural production have emerged in the field of machinery. Based on this, this paper shows the significance of agricultural mechanization and expounds the application of machinery in agriculture. At the same time, this paper indicates the inevitability of agricultural mechanization. In addition, this paper also puts forward a harvesting machine model for wax gourd which is a common agricultural product. This model provides a new idea for harvesting this kind of agricultural products.

Keywords: Machinery; Agricultural Mechanization; Machinery Innovation

1. The trend and significance of Agricultural Mechanization

1.1 The trend of Agricultural Mechanization

1.1.1 Steady growth of mechanization level

After the founding of the people's Republic of China, Chairman Mao Zedong once attached great importance to and paid close attention to the mechanization of agricultural production, and also made continuous exploration. Under the constant leadership and promotion of Chairman Mao, China's agriculture has been continuously developing. At the same time, it also laid the foundation for mechanized production and contributed to the development of agricultural mechanization after the reform and opening up ^[1].

General Secretary Xi Jinping showed that the implementation of the Strategy of Rural Revitalization is a major decision-making arrangement made by the Nineteenth National Congress of the Party, when he was participating the deliberations of the Shandong delegation at the thirteen session of the National People's congress. The five aspects of implementing the Rural Revitalization Strategy are "promoting the revitalization of rural industry", "promoting the revitalization of rural talents", "promoting the revitalization of rural culture", "promoting the revitalization of rural ecology" and "promoting the revitalization of rural organizations". Among them, "promoting the revitalization of rural industry" refers to the large-scale concentration of agricultural land, which provides favorable conditions for the promotion of agricultural machinery ^[2]. Until 2018, the total power of mechanization machinery in China's agriculture has exceeded 1 billion kilowatts, which has been greatly improved compared with the early days of the founding of New China. And the mechanization rate of farming income is about 70% ^[3].

1.1.2 problems in the trend of Agricultural Mechanization

After the machinery enters the farmland, it needs certain manual operation. These operations are either simple or quite complicated for novices. Therefore, in the process of using mechanical products, it is not friendly for novice operators, which requires a period of familiarity and operation training. The survey shows that in agricultural production, due to the limitation of age and economic conditions, some farmers have not received formal education. And they are very unfamiliar with the use

of some machinery, and they even feel obscure ^[4]. Therefore, for crops, harvesting machinery is different. Some machines are simple but the others are complex. At the same time, the operator's level is still uneven, which also adds difficulty to the idea of centralized training.

1.2 significance of Agricultural Mechanization

1.2.1 It can promote green development of agricultural production

Agricultural production needs to apply fertilizer to crops. In order to ensure the yield and growth of crops and avoid insect pests, pesticides are often applied to crops. This method destroys the acid-base environment of soil and the pre-existing microbial flora in soil to a certain extent. At the same time, the accumulation of straw from coarse grain crops such as corn may be burned, which will pollute the environment. With mechanized production, on the one hand, it can spray fertilizer accurately, loosen soil regularly and reduce the use of fertilizer and pesticide. On the other hand, such as the situation of straw after harvest, it can be directly crushed by mechanized farm tools, vehicles and directly mixed with soil, which can avoid straw burning polluting the atmosphere and improve soil fertility ^[5]. Therefore, agricultural mechanization reduces the use of pesticides, realizes the return of crop residues to the land after harvest, and reduces pollution.

1.2.2 It can improve the efficiency of agricultural production

The traditional harvest method used by common people is to employ labor force to realize the sowing, watering and harvesting of crops. However, on the one hand, the use of manpower directly consumes a lot of labor. And at the same time, the efficiency is not improved. Mechanized equipment is used to realize the above function. A machine can work longer than manpower, and the machine can continue to work except the rest time. Compared with manpower, it can work longer in a day, which improves the efficiency ^[6]. On the other hand, a machine may only need one person, or even no need operator to operate, which saves human resources.

In addition, human farming often occurs that fertilization is not in place and harvest is not complete, which leads to crop death and misses harvest, thus leading to waste. Mechanical farming can avoid this problem. As long as the mechanical equipment sets a good path and plans the scope, it can reduce the loss of fertilization and the loss of that harvesting is not in place.

2. Innovative design of wax gourd harvester

2.1 Introduction to the mechanization

In view of the current trend of agricultural mechanization, we know that for such huge vegetables as wax gourd, the harvest method has always been manual harvest, and the harvest efficiency of farmers is low. Therefore, in view of the fact that there is no efficient harvesting mode similar to tomato harvester and potato harvester for wax gourd, an automatic mechanical device is designed. Firstly, the color sensor is used to judge whether the wax gourd is mature. If it is mature, the scanning device is used to determine the shape, growth direction and specific position of the pedicel of the wax gourd. Then the signal is transmitted to the mechanical arm. Secondly, the manipulator grabs the wax gourd and cuts off the pedicel. Finally, the manipulator transports the wax gourd to the carriage. It improves the efficiency of wax gourd harvesting and saves manpower.

2.2 Realization scheme of mechanization

2.2.1 Judgment of wax gourd maturity

The simplest way to judge the maturity of wax gourd is appearance. Generally speaking, green wax gourd is immature. Melons have green hairs when they are tender. However, when the wax gourd is mature, the green hairs on the wax gourd will become rare with the growth of it. The light green wax gourd will grow white frost and the color will vary greatly when it is mature. Therefore, this paper uses the basic RGB color sensor ^[7]. Through different RGB values of different colors, the light signal of wax gourd was transformed into current signal. The signal feedback of the sensor is adjusted to a specific color so that the whole device can identify the mature wax gourd and retain the immature wax gourd. The structure is simple and the judgment of wax gourd maturity is completed by this way.

2.2.2 Positioning of wax gourd before harvest

After skipping the immature wax gourd and identifying the mature wax gourd, we need to locate the position of wax gourd in the field to facilitate the subsequent collection. This task can be accomplished by using the vision global positioning sensor [8]. The sensor collects the positioning image through the image sensor, calculates the image by using the coordinate calculator, and obtains the two-dimensional image coordinates and three-dimensional positioning information of the target. At the same time, the transceiver transmits three-dimensional information to the computer, so that the machine can accurately locate and complete the follow-up tasks.

2.2.3 Grasping structure of wax gourd

After determining the specific location of wax gourd, we use the mechanical arm structure to grasp. Of course, the grasping force of the manipulator is not as perceptible as the palm of human. For different sizes of wax gourd, the opening size of the manipulator's grip is different. Therefore, we use piezoelectric pressure sensor to judge the grasping force [9]. In piezoelectric sensors, when the crystal is subjected to a fixed direction of external force, phenomenon of electrode is occurring inside. At the same time, opposite symbol charge is generated on two surfaces. When the external force is removed, the crystal returns to the uncharged state. When the direction of the external force changes, the polarity of the charge also changes. The amount of charge produced by the force on the crystal is proportional to the size of the external force. Piezoelectric sensors are mostly made of positive piezoelectric effect. Based on this, when the gripping force reaches the threshold, the mechanical arm is no longer clamped by the negative feedback adjustment of the electrical signal, which can achieve the purpose of gripping the wax gourd and ensuring that the wax gourd is not broken.

3. Advantages and disadvantages of mechanical structure

3.1 structural advantages

The structure integrates optical, mechanical and electrical technologies. It ingeniously solves some problems such as identification of mature wax gourd, automatic identification and picking of wax gourd in different growth directions. The scheme is novel and ingenious, and has certain innovation and practicability.

The mechanical device can realize the automatic harvest of wax gourd. By programming the computer, the device can move forward according to the path of wax gourd field and collect wax gourd. And the design of the device saves human resources, improves the picking efficiency, and promotes the development of agriculture to mechanization and automation.

In order to increase the yield of wax gourd and reduce the waste of direct abandonment of immature wax gourd, the positioning harvest of wax gourd and the color discrimination sensor are used to not harvest the immature wax gourd. At the same time, the cutting device of the manipulator for the stem of wax gourd protects other wax gourd vines and does not affect the growth of other wax gourds.

3.2 Structural defects

The structure is complex and needs further improvement. At the same time, different melon fields have different shapes, so different path planning is needed for different melon fields.

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