

Design of the Main Components of Garlic Harvester

Honggang Liu ^a, Ruzhen Zhao ^b and Chengbo Liu ^c

College of Mechanical and Electronic Engineering, Shandong University of Science and
Technology, Qingdao, China.

^a593961179@qq.com, ^b845391509@qq.com, ^c1182994965@qq.com

Abstract: At present, the growing amount of garlic is continuously expanding, and the planting area is also continuously increasing, and it has been continuously integrated into the dining table of ordinary people. Garlic not only has the effect of powerful sterilization, elimination and detoxification to prevent gastrointestinal diseases, but also has the special effect of preventing tumors and cancer, and preventing cardiovascular and cerebrovascular diseases. However, there is no good solution for laying down the means and machinery in our country. According to the reasonable interval while laying solid, but also can reduce the garlic in the damage in the process of laying rate, improve the survival rate of garlic, protect the environment, but also can greatly reduce the time of the collection of garlic, to reduce the cost to improve the economic benefit is of great significance. It is equipped with corresponding control system, transmission system and induction system to solve the problem of reasonable and scientific distribution of garlic. Moreover, it has a self-propelled device, which does not need to be equipped with additional power machinery. In the face of the continuous development of agricultural mechanization production, the new self-propelled garlic 4-row laying machine is more suitable to the current operating level.

Keywords: Garlic, Self-propelled, Efficient.

1. INTRODUCTION

Based on the study of garlic planting and reasonable arrangement of gaps, a self-propelled device with low damage rate, [1]high work efficiency, easy operation and corresponding power, corresponding control system [2] and inductive system were designed to make the placement machine. Ability to work with harvesters or work independently in the field [3]. Design a self-propelled garlic placement machine for rational placement of garlic after harvesting in agricultural production [4], requiring the safe preservation of garlic after harvesting and laying of garlic, and during the laying process The rate of damage to garlic is minimized. According to the characteristics of garlic placement requirements [5]. In the design process, it involves knowledge of mechanical principles, mechanical design, theoretical mechanics, and

agricultural mechanics. It is necessary to collect data, design calculations and structural design of the whole machine.

2. THE PLANTING OF THE GARLIC

According to the statistics of the United Nations food and agriculture organization, there are now 93 countries that grow garlic, with a total area of 1.2258 million square kilometers and a total output of 16.42 million tons. China ranks first in the world in both planting area and total production [6].

China has cultivated 694 thousand square kilometers, accounting for 56.6 percent of the global total. The total output is 12.58 million tons, accounting for 76.6 percent of the global total.

In recent years, the planting area and yield of maize in China have developed rapidly, and it is an economic crop with large planting area. At present, there are more than 70 garlic producing areas of a certain scale in China, centered in xuzhou, jiangsu province. The area with a radius of 500 kilometers is the area with the highest concentration of garlic planting in China, accounting for over 80% of the total area planted in China [7].

In shandong province is one of the largest garlic production area in China, the planting area of over 13.3 square kilometers, in jining jinxiang as the center radiation ChengWu, juye, pottery and other surrounding areas to form the largest garlic production base in our country in addition, shandong laiwu, shanghe, pingdu, liaocheng, qufu, planting area are also in more than 0.67 square kilometers.

Henan province is the second largest garlic production area in China, with a planting area of more than 120,000 square kilometers, mainly in qiqi county of kaifeng city and zhongmu county of zhengzhou city.

But for now still do not have a high level of mechanization of garlic in our country, in our country mainly rely on artificial to complete fertilizer, small plots of land to wow general is given priority to with artificial operation, garlic planting is given priority to with artificial, garlic harvest is still is given priority to with artificial, a few parts adopt garlic plough, a handful of areas use the garlic harvester, and this topic main research of the use of garlic laying machine is more less, thrown by artificial to complete. This is also the main reason of low efficiency and high rate of garlic breakage.

At present, the garlic mechanization in foreign countries has been very developed, and the garlic harvest equipment in Europe and the United States, especially the combined harvest machinery, has the characteristics of large scale, high efficiency, suitable for large field operations and so on. And Asia South Korea garlic cultivation and harvest machinery is relatively small, suitable for small plots of alignment cutting seedling characteristics such as the overseas technology, baling collection techniques such as laying machine for our research has a strong reference, but must be combined with the soil type, planting patterns, crop harvest, characteristics of consumer demand, independent innovation, the development conforms to the situation of miniaturization, suitable for small plots of production tools and laying machine.

The harvest time of garlic in China's main producing areas is from late may to early June, and the harvest span is not large. Therefore, the investment recovery period of relatively high price combined harvesting equipment is relatively long. In addition, garlic is a wet-loving crop, the soil moisture tends to be greater when the goods are received. It is sticky and heavy, and the garlic is easy to be damaged and damaged. Therefore, it has certain specificity to dig, remove soil, clean and take garlic before the harvest of garlic.

In general, the research and development of garlic mechanized planting and harvesting technology equipment in mainland China is still in the initial stage. Most of the equipment is still in the prototype stage.

Therefore, fully considering the national conditions, advancement, applicability and economic efficiency, specificity and generality, combining to combine for sharing platform, the garlic, seedling separation, to clean soil components such as modular design, through modular organization in Shared platform quickly switch to achieve a multi-purpose, improve equipment utilization, increase income.

3. THE OVERALL DESIGN

3.1 Estimation of diesel engine power

The total power of the garlic laying machine is calculated. The power loss of the garlic laying machine is mainly composed of the power N_1 consumed by the resistance of digging and shoveling forward and the power N_2 consumed by the mechanical transmission and conveying device. Is:

$$N = N_1 + N_2$$

According to the formula, the resistance of digging shovel is:

$$F = \varepsilon abV^2 + Kab + fG$$

$$F = F_1 + F_2 + F_3 = 240N$$

$$N_1 = \frac{FV}{102\mu} = 3.08KW$$

$$N' = \frac{\lambda Vab\gamma \sin \beta}{102\mu} = \frac{0.6 \times 12 \times 60 \times 2.35 \sin 25}{102 \times 0.8} = 4.25KW$$

$$N_2 = (1 - \eta) \times N' = 1.7KW$$

$$N = 4.78kW$$

According to the calculation, the garlic laying machine needs a diesel engine with more than 5KW.

3.2 The selection of the diesel engine

According to the data of power loss of garlic laying machine and the information of power output of diesel engine, R175 diesel engine was selected. The machine has the advantages of simple and compact structure, flexible operation, light weight, reliable operation and convenient maintenance.

Basic parameters: rated traction: 1700N

Various theoretical speed (km/h): I II III IV V falls VI I II

Calibration power: 5.88kw.

3.3 The design of steering gear

Since the placement machine designed in this paper is self-propelled, it is necessary to consider the problem of machine steering. When designing the steering device of this garlic placement machine, it mainly relies on the meshing between the two gears (Fig. 1). The power of the steering is provided by the steering wheel, and the power is transmitted to the gear 1 connected thereto, and then the gear 1 drives the gear 2 that meshes with it, the gear 2 is connected to the diesel engine tray, and the rear wheel as the forward wheel is fixed on the diesel engine tray, thereby Rotating the rear wheel drives the entire machine to turn.

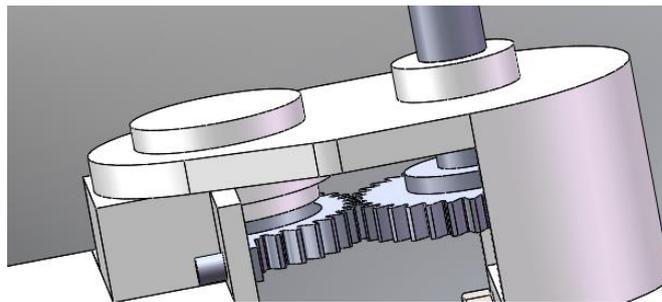


Fig. 1 two gear meshing parts show

4. THE WHOLE MACHINE ASSEMBLY

The engine is powered by a diesel engine, which sends a portion of its power to the rear wheel through a connected transmission, thus propelling the whole machine forward. At the same time, the driving force is transferred to the belt wheel through the universal axis, and the driving force is then transferred to the rotating gear that drives the drive chain to rotate, so that it can drive the gripping chain to rotate. Meanwhile, the garlic and garlic plants dug in the previous section are combined with the excavated garlic and garlic plants and sent to the orderly laying at the tail, so that the garlic can be spread in the field in an orderly manner, as shown in Fig. 2.

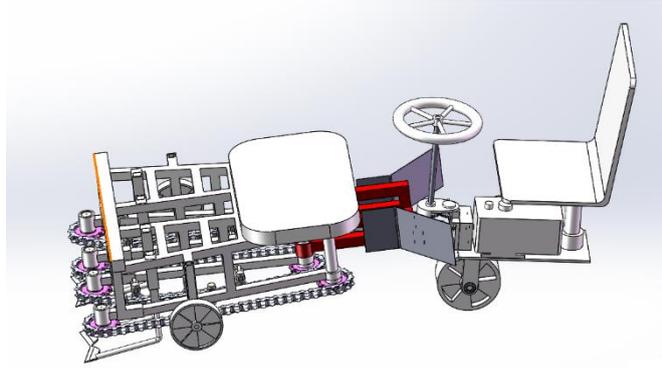


Fig. 2 whole machine assembly drawing display

5. CONCLUSION

The machine adopts self-propelled type and relies on its own diesel engine to provide power. It has strong power and is easy to operate without the traditional traction mode of tractor. During the operation, the chain is used as a clamping device to ensure that no garlic plants fall during the transfer process, and the accuracy is improved to ensure the stability of the whole machine. A well-designed steering unit is used to ensure that steering is done while working. This is important for a machine that is positioned as a self-propelled machine.

REFERENCES

- [1] Zhang Y.L. Application and improvement of computational fluid dynamics (CFD) in solid particle erosion modeling[D], Tulsa: The University of Tulsa, 2006.
- [2] TJ Olson, RV Ommen. Optimizing hydrocyclone design using advanced CFD model[J], Minerals Engineering, 2004, 17(5): 713-720.
- [3] Cheng XingTian. Current Situation and Development Prospects of Harvesting Machinery [M]. Journal of Agricultural Machinery and Food Machinery, 2008.12-16.
- [4] Shen LinSheng. Economic Crop Harvesting Machinery, Structure and Calculation [M]. Shanghai Science and Technology Press, 2010.88-89.
- [5] Liu JianJun, Song JianWei, et al. Analysis and Discussion on Garlic Harvesting Technology [J]. Agricultural Mechanization Research, 2008.32-34.
- [6] Wang DeJuan, Gong Jing. Current status and development trend of China's garlic export trade. Anhui Agricultural Sciences, 2006.66-67.
- [7] Li Jiangong. Mechanical Design. Beijing: Mechanical Industry Press, 2007, 126.