

Design of Automatic Four-Row Garlic Orderly Laying Machine

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Abstract: At present, the country's main garlic harvest machinery mainly is the tractor traction type, considering the tractor ownership in rural areas, the most likelihood this way can make the farmers quickly familiar with the use, but in the actual process will still have the tractor tyre crush garlic, garlic sour seedling rate is high. Therefore, self-contained four lines of the garlic order laying machine, not only efficient but also can realize the walk, in the field of its carefully designed the device, not only can avoid the phenomenon of garlic press in the process of operation, and can be implemented in the field to keep optimal moving at a constant speed, and in order to make the pull garlic garlic, left behind when using chain instead of the belt, the clamping force is larger and more efficient. Moreover, the garlic is transported to the rear, and the garlic is spread on both sides with the laying board, which will not affect the harvest of the later work.

Keywords: Garlic, Self-propelled, Efficient.

1. INTRODUCTION

Garlic has rich nutrition, unique flavor, and a wide range of USES. It is widely used in food, chemical industry, health care products, cosmetics and other fields [1]. Garlic not only has the effect of strong sterilization and detoxification to prevent gastrointestinal diseases, but also has the special effect of preventing tumors and cancer [2] and cardiovascular and cerebrovascular diseases. Over the past few years with the progress of science and technology and the tireless efforts of researchers, medical value of garlic was mined, now found it in the treatment of high cholesterol, heart disease, diabetes and breast cancer has a unique effect, and with the deepening of the research, the medicinal found will be constantly into the actual medical domain contribute to human health [3]. Its unique medical effect makes unceasing enhancement, the same degree of care in recent years there have been five international conference on the onion garlic crops was held, used to show all the garlic in the role of the health care industry.

2. DEVELOPMENT STATUS OF GARLIC HARVESTING MACHINERY

2.1 The Development of Garlic Laying Machinery in China

At present, there are two main harvest methods used in major garlic producing areas in China [4] :

The first is to use a garlic plow, which is pulled by human, animal and hand tractors. See figure 1.1.

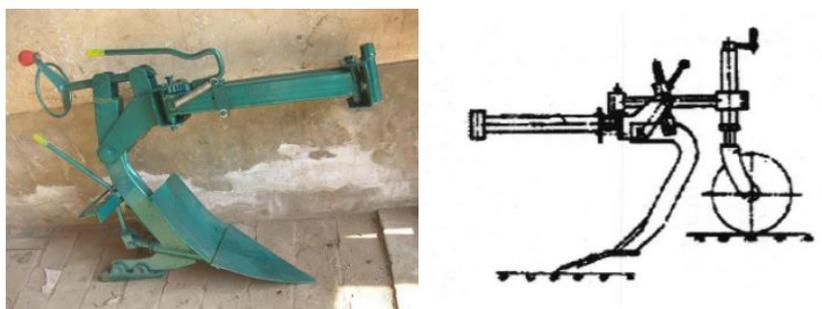


Figure 1.1 Mining Plough

At work, plough soil digging around to garlic and garlic, but the harvest way didn't separate the garlic and soil features, also not laying function, need later in a lot of artificial garlic. It's only semi-mechanized. In addition, tractors are required to be pulled in the course of operation, and the tires of tractors are easy to cause harm to garlic in the course of operation. The loss rate of garlic is high, time-consuming and laborious, not suitable for garlic harvest.

Second, garlic harvester, there are more than 10 kinds of domestic harvesting machinery Which are quite popular in shandong jinxiang is 4 ds - type 2 garlic excavators (figure 1.2), and its mount tai - 12 tractor to cooperate, this type of machine is applicable to 180-300 - mm spacing of garlic harvest, harvest 4 line at a time, using hydraulic lifting. In the working process, the root system of garlic was cut off with a rotating cutter to loosen the soil around it, and then the arched garlic head was pushed to both sides by the front and rear puller. The problem of crushing garlic on tractor tires during operation was avoided.

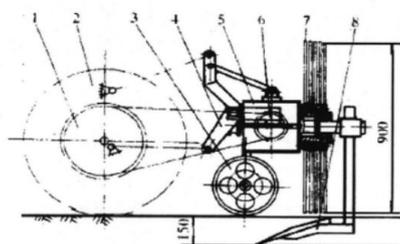


Figure. 1.2 Schematic Diagram of The Complete Machine Structure of Type 4DS-2 Garlic Harvester

In addition, there are tl-vs120 garlic harvesters produced by tailong machinery factory in feicheng city. Developed by NongJiJu in laiwu city of 4 ss - II garlic harvester and by xuzhou city, jiangsu province agricultural machinery technology developed by extending stations 4 s - 85 garlic harvesting machine [5].

2.2 Development of Garlic Laying Machinery Abroad

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 Japan 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. A typical example is Japan's HN402C four-row self-propelled garlic harvester (figure 1.3). The machine is 2200mm in length, 1500mm in width and 1750mm in height. It weighs 530 kilograms. Standard three-point connection is adopted. 45-60kw universal horsepower. The operating speed is between 0.8 and 2.0km/h. During the whole ridge, the garlic plant is pulled out synchronously, and the harvest is not delayed. It can also be used normally in rainy days. It is well designed for grasping garlic plants and can be harvested continuously without damage and at high speed. The harvested garlic plants are arranged on either side of the row by a carefully designed residual plant discharge device without affecting the next row's operation.

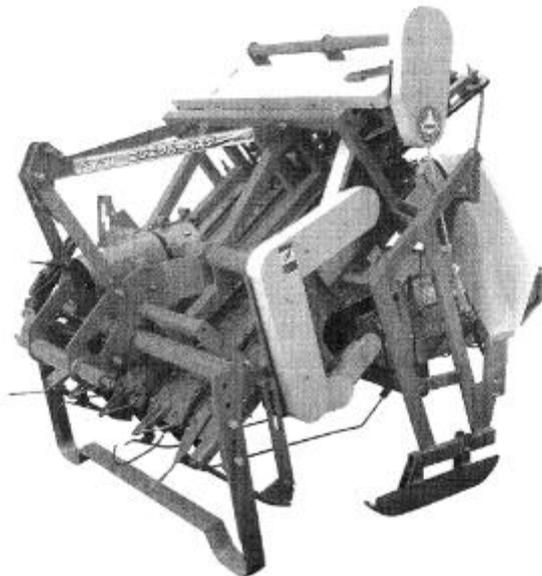


Figure 1.3 Japan HN402C Garlic Harvester

2.3 Garlic Planting Model in China

In our country garlic is mainly planted on bare land. Bare planting is a traditional planting model in China. It can be divided into flat, high - furrow, ridge.

Here we mainly take the planting model of jinxiang county of shandong province as the template. The longest root length of garlic is about 50cm, but it has been studied that its main root group is distributed in the soil layer between 5cm and 25cm, and the horizontal length range of roots is generally 30cm[6]. The plant height of garlic is usually about 35cm. The row spacing and plant spacing of garlic planting vary from region to region due to topography,

climate and labor habits [7]. The row spacing is about 20cm, and the plant spacing is about 15cm.

3. THE OVERALL DESIGN

3.1 Determination of Relevant Parameters of Mining Shovel

According to the relevant data and the actual investigation in jinxiang county, shandong province, garlic fruit is generally about 10 to 12 centimeters away from the ground. When the garlic laying machine is working, the force of the excavated soil on the blade surface is shown in figure 2.1.

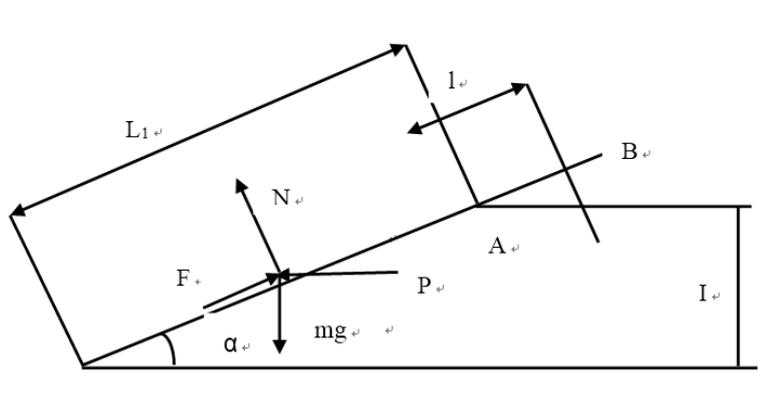


Figure. 3.1 Soil Stress On the Blade Surface

According to d 'alembert's principle, soil reentry needs to satisfy the following formula:

$$\begin{cases} P \cos \alpha - T - G \sin \alpha \geq 0 \\ R - G \cos \alpha - P \sin \alpha = 0 \\ T = R\mu \end{cases}$$

$$p \geq G \tan(\alpha + \varphi)$$

By referring to the data collected from the school library, the relationship between the Angle of the cutter shovel and the rate of leakage is drawn, as shown in figure 2.2.

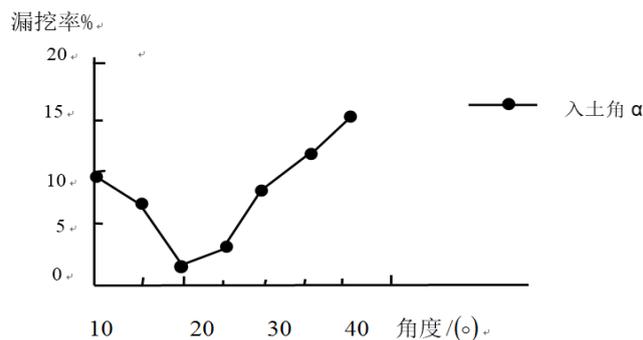


Figure. 3.2 schematic diagram of the relationship between the incidence Angle and the rate of excavation leakage

According to the relationship of above, we can see clearly that when the grave Angle is small, garlic dig leakage rate is higher, but as the Angle of the grave within 10 to 20 degrees increases gradually, the leakage rate of digging gradually become low, and fell to the lowest level shown in the figure. Subsequently, with the gradual increase of the entry Angle, the rate of excavation

leakage increases rapidly, and is higher than the highest level of the entry Angle at 10 to 20 degrees. Therefore, according to the figure, the optimal entry Angle of garlic laying machine is 20 degrees.

3.2 Selection of Supporting Power

Laying machine of the total power calculation, garlic garlic laying machine power consumption is mainly by the consumption of digging shovel forward resistance N_1 and mechanical power transmission and transmission device consumes power N_2 in two parts. 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.

3.3 The Whole Machine Assembly

The engine is powered by a diesel engine, which sends a portion of the power to the rear wheel through the gearbox attached to it, thus propelling the whole machine forward. To wheeled through universal shaft transmission power at the same time, the pulley to transfer power to rotate the gear drive transmission chain, make its turns clamping chain, at the same time with the front of mining to dig up the garlic garlic yield, put it to order at the end of the shop, garlic and orderly on the field, the whole machine assembly as shown in figure 2.3

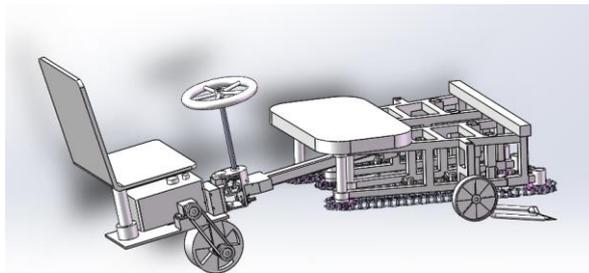


Figure. 3.3 whole machine assembly drawing display

4. CONCLUSION

Traditional garlic harvester on tractor drive to provide power, low efficiency, and easy in the process of work pressure, the machine belong to a relatively new type of machine, the current domestic for self propelled garlic laying machine study is less, after the market is expected to

cause larger repercussions. On the basis of the original garlic harvester in China, the machine has been greatly improved and some parts and components have been redesigned so that it has a lighter weight and higher harvest efficiency.

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