

Chinese Garlic Sowing Mechanization Status Quo

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Abstract

China is the world's largest garlic planting area and output of the country, followed by China is the world's most significant garlic export. Still, China's garlic planting and harvesting operations are low, such as mechanization. Sowing seeds do garlic cultivation, and the process is hugely inefficient if manual operation is used. So to improve the quality of Chinese garlic seed rate and, based on China's garlic planting technology, the status and the problems existing in the planter seeding machinery are discussed in this paper. Some reference suggestions were provided for the improvement of garlic sowing mechanization level, it is of great significance to further promote the growth of garlic yield in China.

Keywords

Garlic Cultivation; Mechanization; Planting Technology.

1. Quote:

China is the mainly manual operation for garlic planting, and its efficiency is much lower than the mechanical work efficiency. Generally, a young and middle-aged labor force can carry out sowing operations of about 130 m² every day. Using the existing mechanical plant, a seeder seeding efficiency can reach 0.08 ~ 0.10 hm/h, and Its operating efficiency can get 25 times manual seeding. And using manual seeding, for large and medium-sized garlic growers need to spend a lot of labor costs, especially in the busy period, there will often be a shortage of labor. So for garlic planting, research and development of a cost-effective seeder are essential and have great significance for the development of agricultural mechanization in China.

2. Garlic Cultivation in China

2.1 Garlic Cultivation Background in China

Garlic was introduced into China from Central Asia during the Han Dynasty, so it was used as an essential seasoning in ancient China. Some pharmacological effects of garlic were also highly sought after by Chinese people. Chinese people usually know garlic with sterilization, anticancer, fall blood sugar, promote metabolism, relieve fatigue, and accelerate wound healing and curative effect, especially after many people will first be mosquito bites with garlic juice friction bite, sterilization to itch. Therefore, garlic planted broad prospect of market, farmers' willingness to grow also very high. Although the price of garlic fluctuates wildly from year to year, it can be as high as rmb7 per 500g and as low as RMB1.55 per 500g. Although prices often change and change compared with general economic crops is more prominent, the farmers still choose each planting garlic, avoid misses a chance to get profits. Although sometimes garlic price is meager, relative to growing wheat and corn, available garlic income on average was more objective. Therefore, China's garlic planting area and yield are relatively stable.

2.2 Garlic Cultivation Technology in China

Garlic planting is sown in the way of seeds, and garlic belongs to the cash crop. The benefit is higher, so when garlic planting, to improve the emergence rate and increase the yield, growers generally choose film-covered sowing to ensure the quality of sowing. Garlic in the cultivation of garlic seeds in accordance with a certain number of sowing into the open ditch, after that cover it with soil, then cover the trench which has seeded by garlic seeds with a film. The area where the garlic seeds are planted is covered with some clods of earth to reduce the tension of the film that the garlic plants have to overcome when they come out of the ground. And because the plastic film is strong, garlic often need the help of artificial operation later to break the film. Garlic seeds are large, each grain of which can reach about 5g, so it is easier for operators to control the number of seeds when sowing.

2.3 Development Trend of Garlic Planting Area and Yield in China

According to statistics, the total output of garlic in China can reach 50% of global production, accounting for 70% of the total output in Asia. Shandong, Anhui, Henan, Jiangsu, and Hebei are the major garlic producers in China. Shandong is the largest garlic province in China, accounting for more than half of the total output and export volume of garlic in China. Garlic planting area in China can reach about 530000 hm squared, and the country has more than 100 counties that have grown garlic base. In Shandong province, there are 38 garlic planting area county, and garlic planting areas of our country to rising at an annual rate of 3% ~ 5% of stability, the growth prospects from overall relatively broad. China's garlic planting area is large, high yield, our people, can not be consumed internally, so 2/3 of China's garlic is sold abroad, but since China joined the World Trade Organization, the United States, South Korea, Japan, and other countries to China's garlic implementation of the suppression strategy, to protect their garlic, Therefore, China's garlic exports are generally sold to some countries in Southeast Asia.

In recent years, the global garlic planting area has shown an overall growth trend, and by 2020, the world's garlic planting area has reached 1.68 million hectares, an increase of 50,000 hectares compared to 2019. According to FAO statistics, global garlic production increased steadily from 2014 to 2020, and by 2020, its total output had reached 32 million tons. China ranked first in 2019 with 2,300.6 million tons of garlic, accounting for 75.9 percent of the global total, while India, which ranked second in the world, produced only 2.91 million tons, far behind China. By 2020, China's garlic planting area has reached 843,000 hectares. The export of garlic can reach 2.461,600 tons and obtain 2.563 billion US dollars of exports. Nowadays, garlic has become an important cash crop in China and is widely planted throughout the country.

3. Problems Existing in the Application of Garlic Sowing Machinery Abroad in China

Now some developed countries in the world have realized agricultural mechanization. For example, China and the United States, the most extensive agricultural land globally, have used a lot of advanced agrarian machinery to operate in large farms with high efficiency and low labor intensity. In addition, the terrain of the United States has a significant advantage compared with China, which is more suitable for planting crops. The geography of The United States covers less area in hilly areas and more room in plains. The terrain of China is characterized by the large size of hilly and mountainous regions, accounting for about 1/10 of the total area of China and as much as 50% of the total arable area of China. Therefore, China's agricultural mechanization is challenging to achieve a high development speed. In addition, since Deng Xiaoping came to power in China, it began to implement the household contract responsibility system. Each family has its land, so China's agriculture is scattered more; sizeable agricultural machinery for continuous hard work often need to be continually steered. Transformation operations site operation. In addition, China's terrain is mostly hilly and mountainous, and the land for agricultural planting is rugged, making it difficult for large and medium-sized machinery to pass through. While Japan is a hilly agricultural country, and its agricultural mechanization and automation level of development in the world, the Japanese policy of transforming hilly in recent years, the hilly transform is more suitable for farming plains. Agricultural countries to the United States and other developed countries are primarily large farms. The research and development of agricultural machinery are also large; therefore, now foreign research and garlic sowing machinery are not suitable for China's sowing operations.

4. Existing Garlic Seeding Machinery in China

4.1 Traction Type Garlic Seeder

Garlic in the garlic sowing needs to meet the requirements of single-seed sowing and make the scale bud toward the top, but this is often a big problem hindering the development of garlic sowing machinery. However, some developed countries have developed a high-precision garlic seeder. Still, these seeders are large, complex structures, expensive, and can only be applied to large farms and other wide roads in the field driving, not applicable to China's field sowing. Therefore, the traction type garlic seeder has carried on specific research on single seed sowing and ensuring that the scale bud is sowing. The garlic seed drill is mounted using a spring and spring elastic centralizer to achieve switching mode. Through the duck-billed seeding manner of operation, the machine also can accomplish a one-time furrowing and then take a, in the case of centralizer plant operation at the same time, to meet the demand for planting garlic. The main components of the garlic seeder are the frame, seedbox, spring (used for centralizer), duck beak type seeding mechanism and ditching device, etc. The system of the seeder mainly has a power system and air pressure lifting system.

The garlic seeder in the starting work, the need to start the engine to drive the machine to move forward, and at this time the double-disc type ditch opener will be ditching operation, the mechanism through the chain transfer power in the seed taking mechanism, the seed taking mechanism through a particular design and research can achieve only one seed requirements, And the taking mechanism through the garlic seeds are transported to a pipeline to accomplish the garlic centralization so that the garlic scales bud up. The seeder is connected with the transmission pipeline. Finally, garlic seeds will be sown through the seeder opened in the ditch complete the garlic sowing operation.

The seeder is based on the existing garlic seeder in our country to carry out innovative design research and obtained, can achieve a more reliable single seed getting and be able to make the garlic seed scale bud up. And with the combination of electricity and air pressure technology, the machine can automatically complete some processes like ditching, taking seeds, centralizing and seeding, so that the work efficiency is high. The intensity of labor has been dramatically reduced. By analyzing the parameters obtained in the experiment, it can be determined that the machine has specific stability and reliability and can work continuously. The process is safe and stable.

4.2 Rotary Tillage Garlic Seeder

Rotary tillage garlic seeder is generally used in the Xinjiang region of China, so the seeder is designed for the terrain of Xinjiang and the shape characteristics of the garlic species in Xinjiang, improve the original rotary tillage garlic seeder to improve the reliability of the single case of sowing, and reduce the sowing hole rate and replay rate. China's Xinjiang region has the characteristics of sparse land, can realize the agricultural operation of large machinery, and Xinjiang's contribution to China's agricultural products and fruits and other products is vast. Therefore, to improve the agricultural machinery in Xinjiang, improving the level of agricultural mechanization in Xinjiang has essential significance. The main improvement point of this machine is to realize single seed selection, realize the upward sowing of garlic seed and scale bud and improve the reliability of vertical sowing. The device can also be one-time rotary tillage, the ground, take a bulbil centralizer, downward. A series of seeding work, its central structure frame, rotary cultivator machinery, the ground device, box, disseminator, and wheel mechanism, wherein the planter's chain drive and the disseminator USES is a duck-billed vertical plug-in. The most important mechanism of the seeder is its seed-taking mechanism, which is composed of a seed box, seed-taking mechanism, chain drive mechanism, driveshaft, and chute. Uniform distribution chain in a certain distance with kinds of institutions (shape similar to the spoon), usually have eight, the layout of the device working process can be divided into four stages, namely vertical rise teaspoons garlic get species, cant conveying garlic and straightforward clean up extra garlic, horizontal transportation to the chute and clean up the garlic species and drain with teaspoons garlic kind of single grain seed. Because the seeder uses a chain drive mechanism to transfer power to a mechanism, the ground wheel will be indirectly connected with the seed picking device, so the speed of the seeder will affect the reliability of its single case seeding to a certain extent.

When the seeder works, it needs to be dragged by a power drive device. Generally, a tractor with larger power will be selected for traction. At the same time, the rotary tillage garlic sowing mechanism will occasionally drive forward under the action of tractor traction, rotary cultivator began to rotate the arable land, flat device at the same time flat, the ground wheel will also be given by the ground friction and rotation, and then drive the seed taking device to take seeds through the chain. At the same time, the rotary tillage garlic sowing mechanism will occasionally drive forward under the action of tractor traction, rotary cultivator began to rotate the arable land, flat device at the same time flat, the ground wheel will also be given by the ground friction and rotation, and then drive the seed taking device to take seeds through the chain.

The rotary tillage garlic seeder through taking garlic mechanism innovation design, and through the field experiment to obtain parameters, according to the parameters of the study found that the seeder garlic replay rate and hole rate can be reduced by 5%, so the performance of the garlic seeder has been improved. The seeder also passed the garlic seed experiment of different scale bud length and structure and added a driving speed variable in the experiment process to investigate the performance of the seeder, according to the structural analysis of the role of the seeder cannot be affected by the length and shape of the garlic scale bud. The whole rate and reseeding rate of garlic seed could be reduced by improving the condition of the seed picking device and the tractor's speed. It has a relatively easy improvement method.

5. Conclusion

China's garlic planting area and output rank first globally, and the garlic export industry is ranked first in the world. Still, China's planting mechanization development is slow. The level is low, so the planting process is low efficiency, high labor intensity, high labor cost. Now some foreign developed countries have researched and successfully invented some sowing machines, although they can achieve higher accuracy, but the price is expensive, so they are not suitable for China's decentralized planting mode. Hence, it is essential for China to speed up the research of sowing machinery, improve the mechanization level of garlic sowing in China, in order to improve the profit level of garlic.

References

- [1] Bai Yucheng, Liu Zandong, Di Mingli. Current Situation and Development Trend of Garlic Planting Machinery [J]. Journal of Agricultural Mechanization Research, 2007(11): 247-248.
- [2] Yang Jing, Lin Guocang, Zhang Runlong, et al. Study on the standardized cultivation technology of high-quality Garlic in Xinjiang [J]. Rural Science and Technology, 2017(10):50-52.
- [3] Li Xiaoyu, Geng Aijun, Hou Jialin, et al. Research Status and Prospect of Garlic seeder [J]. Agricultural Machinery, 2017(02):105-107.
- [4] Guo Yi, Zhang Zuli, Yu Liying, et al. Research status of garlic sowing machinery [J]. Journal of agricultural mechanization research, 2009,31 (6) : 221-223.
- [5] Xu Tao, Song Jingling, Cui Zhichao, et al. Analysis and research on correlation characteristics of garlic seed and mechanical sowing [J]. Journal of agricultural mechanization research, 2018,40 (5) : 137-141.
- [6] Li Xiaoyu, Geng Aijun, Hou Jialin, et al. Research status and the prospect of garlic seeder [J]. Agricultural Machinery, 2017(2) : 105-107,109.
- [7] Wen En-yang, Wu Yan-qiang, Li Tian-hua, Hou Jia-lin. Design of traction garlic seeder [J]. Agricultural Mechanization Research,2020(01):96-100. (in Chinese).
- [8] Jia Shengtao, Shi Xin, WANG Xuenong, Yang Huimin, LIU Xuanfeng, LI Yandong, Niu Changhe. Optimization and Performance test of key Components of rotary tillage Garlic seeder [J]. Journal of Agricultural Mechanization Research,2021(02):190-194.