Status Analysis on the Research of the Garlic Planter

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Abstract

Garlic is an indispensable ingredient in daily diet and is of much benefit to human body. In China, the garlic planting area has shrunk constantly, so the annual production of garlic has declined and the garlic sales price has increased year by year. This is attributed to the labor shortage caused by a decline in the laboring population. Therefore, garlic planting mechanization is quite urgent in the garlic-planting process. In the research and development of the garlic-planting machine, it is an important direction to figure out how to develop a reasonable, efficient and production-increasing garlic-planting machine.

Keywords

Garlic Planter, Status Analysis.

1. Introduction

Garlic comes from the lily family and has effects of inhibiting and killing a variety of harmful bacteria, fungi, such as Shigella, Escherichia coli, Bacillus subtilis and diphtheria bacillus, and even Staphylococcus aureus, because the “alliin” in garlic can have a strong enzyme reaction under the activation of allinase, and the alliin will be resolved into allicin to kill harmful bacteria and fungi [1-2]. Garlic can not only serve as seasoning, but also help people in disease prevention and fitness, so it is often honored as the “natural antibiotics”. Along with the improvement of people’s living standards, garlic has aroused more and more attention.

According to a report of the China Commodity Marketplace website, China is the world’s major garlic producer and exporter. China has a garlic planting area of over 4 million mu, which accounts for 1/2 of the total garlic planting area in Asia and 1/3 of the global garlic planting area. It produces about 10.58 million tons of garlic, accounting for 75% of the world garlic production. And over 5 million households have been involved in garlic planting. In China, garlic production bases are mainly distributed in Shandong, Jiangsu, Anhui, Henan, Guangxi, Guangdong, Shaanxi and other places. Garlic is also planted in few basins of Guizhou. The planting area in Sichuan, Yunnan and Shandong is larger than other places. Affected by the geographical position, the boundary of 4 provinces (Shandong, Jiangsu, Henan and Anhui) which are quite close to the garlic-exporting destination has a particularly large area of garlic planting. .

At present, China’s garlic planting has not yet been mechanized, and still largely depends on manual operation. In garlic planting, a furrower is used to open a shallow furrow; garlic cloves are pushed into the soil at the right spacing. In accordance with agronomic requirements, garlic cloves should be placed with their backs against the furrow wall and with their tips facing up and root facing down, in their upright position. This garlic-planting method is conducive to the growth of garlic and the realization of the garlic quality-improving and yield-increasing goal. However, this method has shortcomings, such as the high labor intensity, low work efficiency and poor planting quality, so it fails to meet requirements for improving the labor productivity and input-output ratio, lowering the labor intensity, reducing garlic-planting costs and increasing revenues [3-4]. The garlic machine planting has advantages, such as the uniform spacing of planting, high efficiency and low cost, so it will be a major development trend of garlic planting.

China is the world's largest garlic producer and consumer. After years of development, China's garlic industry has gradually developed to be large-scale in the planting area, standardized in production, balanced in market, industrialized in operation, export-oriented in products and networked in services. Garlic has become a new bright spot of agricultural structural adjustment in many Chinese places, as well as an important source of revenue increases for farmers in these places.

In garlic production of the United States and other developed countries, large-scale cultivation and standardized management have been basically achieved. Planting, field management and harvest of garlic in these countries have been mechanized. However, China's garlic production still largely relies on manual operation, so it is time-consuming and labor-intensive. Steps of garlic planting in China are: using the hoe to open a shallow furrow, placing garlic cloves with manpower and covering the planted cloves. Main bottlenecks of the garlic planter are the pointing direction and uprightness of garlic bulbs in the garlic planting.

2. Analysis on the Market Demand of the Garlic Planting Machine

Garlic is the main economic crop and export of China. It has wide-range application and huge social demands, and it is mainly planted in Shandong, Jiangsu, Anhui, Henan, Guangxi, Guangdong and Shaanxi. In recent years, the garlic price has continued to go up. This stimulates the enthusiasm of farmers for garlic planting, so the garlic-planting area has expanded constantly. Purely relying on manual labor is clearly unable to meet demands for large-scale garlic planting. Moreover, the manual garlic planting has increased the cost of garlic planting, and will lead to a further rise in the garlic price.

In China, garlic planting still largely relies on manual operation, which requires intensive labor but has low productivity. For example, each laborer can just planted 133.3 m^2 per day[5]. That is to say, 5 laborers are needed to plant 1 mu for one day. The existing garlic-planting area of China is about 10 million mu. If the garlic planting is assumed to complete in 1 day, at least 4 million laborers are needed for each garlic-planting season. The work efficiency of the garlic planter is over 25 times of labor power. About 200,000 garlic planters can be used to replace labor power to complete mechanized garlic planting. However, at present, garlic planters are not mature enough, so they have not been popularized. efficient and reliable garlic planters have broad market prospects.

3. Status Analysis on the Research of the Garlic Planter

3.1 Analysis on the Technology, Patents and Other Intellectual Property at home and abroad

At present, China has 2 kinds of garlic planters. One is the self-propelled garlic planter (with the Patent No. 02148764.2). As its advantages, this garlic planter can ensure a higher garlic uprightly-standing rate, meet requirements of garlic planting and have high productivity. This planter can plant 0.33-0.4 hectares of garlic each day, over 25 times of the manual planting. The planter has solved many technical problems. For example, it can achieve automatic feeding of garlic cloves, make sure that garlic cloves face up when falling down and stand upright when placed into the soil, and prevent cloves from being hurt in the falling-down process. However, if large-size garlic cloves fall down transversely, they may block the outfall place and prevent other cloves from falling down from the outfall place, thus causing injury to garlic cloves and miss-seeding. The other one is the point-plugging garlic planter with the Patent No. 200720018421.2. Through point plugging, this garlic planter ensures that garlic cloves stand upright and have a proper spacing in the row and line, but cannot ensure that garlic tips face up in the garlic planting. Therefore, before this garlic planter is used for planting, garlic cloves must be sorted, and this will reduce the work efficiency of the garlic planter.

At abroad, advanced technology of garlic planting is developed by Japan and South Korea. The hole-extruding garlic planter is commonly seen and used. First of all, the garlic planter is used to extrude hemispherical holes. After that, garlic cloves are placed into the hemispherical holes and the direction that bulbs face is controlled through the spherical surface of the holes. The garlic planter,

produced by France, the Czech Republic and Slovakia, uses a specific structure to ensure that tips of garlic cloves face to a proper direction, and uses a direction finder to solve the direction-finding problem of garlic cloves in the garlic feeding. This technology has basically solved the problem of the direction that the bulbs face, but failed to guarantee the uprightness of bulbs. Moreover, this garlic planter has a complex and huge structure, to guarantee the cloves-feeding accuracy. According to an analysis of its status, the research and development of garlic planters has been presented with following 3 problems. First of all, limited work has been done to make integration. The current research is just limited to the integration of labor power with the machine, but the computer technology, single chip and other advanced technologies have not been integrated to garlic planting. Secondly, the rate of empty seed is quite high, because the operation of this garlic planter is instable. Thirdly, existing technologies have poor control of the direction that tips of garlic cloves face and the uprightness of garlic cloves, not to mention the precise control. Therefore, further research and exploration are still required to achieve precise control of which direction clove tips face and how cloves stand.

3.2 Analysis of the Development Trend of Technology at home and abroad

With the continuous development of image processing technology, it has been applied in more and more fields. Besides the traditional image information change, it has also been used to the shape recognition. For example, 2-D images can be used to analyze and identify the area, edge, maximum length and maximum width of rice, so as to grade the rice. Image processing technology can also be used to analyze the length, width and shape of cucumber, thus reducing measurement errors. Images of the shape and color of flax seeds can be analyzed to form cultivation types, and maize can be graded by measuring the shape of maize seeds. It is quite difficult to control the direction that garlic bulb tips face and the uprightness of garlic cloves, so more and more researchers have begun to use the image processing technology to control the direction and uprightness of the bulb tips. Although an efficient and reliable garlic planting identification system has not been built, it is a quite important direction in the future development and research of garlic planters.

In short, in the current research and development of the garlic planter, following problems are presented. Automation technology and image processing technology and other technology have not been integrated to garlic planting. Garlic planters show a low adaptability to the shape of garlic cloves, so cloves usually get struck in the garlic planter. Moreover, the sorting structure is integrated with the garlic planter. Therefore, in the case that garlic cloves are struck in the planter, the planter will go out of work, and the work efficiency will be affected.

4. Conclusion

According to the analysis of the garlic planting status, it can be seen that garlic planting mainly relies on labor power, which is time-consuming, labor-intensive and low in productivity. Mechanized garlic planting will become a major development trend of garlic planting. In this paper, the existing research on garlic planting machinery was analyzed, and bottlenecks in the research of garlic planting machinery were identified, to guide the direction of the research and development of the garlic planting machinery.

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