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### 大蒜果秧分离试验装置的设计与测试

### Design and testing of head-stem segregation equipment for garlic

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英文关键词: [agricultural machinery](#) [separators](#) [combines](#) [garlic](#) [semi-feeding](#)

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中文摘要:

为提高大蒜联合收获果秧分离作业性能,解决果秧分离过程中留茎长、伤损率高等问题,该文研制了一种大蒜联合收获果秧分离试验装置,该试验装置由夹持输送装置、排序-对齐装置、切割装置、机架等组成,能够完成大蒜的夹持、排序、对齐、切割分离等工序的作业。并进行了大蒜果秧分离试验台作业参数优选试验,得出最优组合参数为夹持高度190 mm,夹持角度79°,主夹持链速度1.06 m/s,此时大蒜的平均留茎长度为37.56 mm,伤损率为2.33%,满足大蒜果秧分离作业质量的要求。该研究可为大蒜联合收获果秧分离机构的研发提供参考。

英文摘要:

Abstract: Garlic is one of the major cash crops in China. Production, acreage, and exports of garlic in China are the highest in the world. As a seasonal operation, garlic harvesting in China is still mainly manual work, having the problems of low efficiency, high labor intensity, and huge occupation of farming season, which has constrained the further development of the garlic industry. The current domestic garlic harvesters are basically simple segmented machinery. The techniques of garlic combine harvesting is still in its infancy. Picking is the core technology on garlic combine harvesting, but it has not been refined well. In order to enhance operational performance of picking, a new kind of garlic picking testbed was designed to carry out the studies on optimization design on structural and working parameters of a garlic-picking device. Lower damage and less stem are the two primary objectives in garlic harvesting. The garlic picking testbed consists of a clamping delivery device, a ranking/alignment device, a cutter, and an electric control system, which carry out garlic clamping, transport, ranking, alignment, and cutting at one time. The clamping delivery device of which core components are front track and middle track uses two tooth-shaped chains. Through the guidance of the two tracks, the trajectory and clamping style of the chains is changed, achieving the transition from double chain clamping to chain-board-hairbrush clamping. The core components of the ranking/alignment devices are guidance rods, a ranking disk, finger, an alignment chain, and a hairbrush. In the test, the garlic was artificially fed. First, garlic plants are gripped by the clamping delivery device and transported backward. Under the interaction of ranking/alignment devices and clamping/delivery devices, garlic plants are ranked automatically and garlic bulbs are aligned automatically. After the garlic bulbs are aligned, garlic stems are cut by disc cutters to achieve garlic bulbs whose stems are consistent and much shorter. The method of alignment is that garlic bulbs are forced to pull down by the rank/alignment devices. This paper mainly studied the structural and working principles of clamping/delivery devices, ranking/alignment devices, and the finger of garlic-picking testbed, optimally selecting the position and speed data between the clamping/delivery device and the ranking/alignment device. When the speed ratio is 1.02 between the two components, the cut face of the stem is perpendicular to garlic stem. Through use of the testbed, the relationships among clamping height, clamping angle, speed of main clamping chain with picking performance indexes were optimized. Primary & secondary factors and the significance level of the influence on the picking performance indexes were analyzed. Utilizing a fuzzy comprehensive evaluation method, the combination of optimum parameters was determined. The results show that the optimum parameters include a clamping height of 190mm, a clamping angle of 79°, and a chain speed of 1.06 m/s for the main clamping chain. When the optimum parameters are used, the residual stem length is 37.56 mm, and the damage rate is 2.33%. The research results provided a theoretical design basis for a garlic-picking device on a combine harvester.

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