

Research Status of Garlic Harvester

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Abstract: The author analyzes harvesting process and harvesting approaches of garlic, summarizes research status of garlic harvesters at home and abroad, discusses problems existing in garlic harvester researches at home and abroad and indicates development trend of garlic harvesters, thus providing references for development of garlic harvesting technologies in China.

Introduction

Harvesting process of garlic mainly includes: excavation, separation of soil and garlic, picking up, cleaning, grading, shipment and gathering. Generally there are three harvesting approaches: separate harvesting, combined harvesting and combined harvesting by stages.

Separate harvesting is carried out with the help of simple excavating tools and cutting tools of different types to accomplish procedures of garlic head excavation, separation of soil and garlic, picking up, cleaning, grading, gathering and shipment. Machines and tools adopted in this method are with simple structures and low costs though, the harvested garlic is with high cleanliness and low damage rate. However, due to the facts that the process mostly relies on manpower, this method costs high labor intensity and long working time and hence produces low work efficiency.

Combined harvesting by stages refers to garlic farmers use small and medium-size garlic digging machines or excavators instead of manpower to dig out the garlics, and then use combine-harvesters equipped with pickups to conduct procedures of picking up, sundries elimination, cleaning, grading, shipment and gathering after 3 to 5-day airing in the fields as placed in strips. After airing, humidity in soil and weeds remained on the garlic decrease; therefore, combined harvesting by stages can improve working efficiency and reduce fault probability. However, twice combined harvesting by several stages cost more working power consumption, and plus with high compaction degree of earth surface, equipment investments are too large and working cycle is too long. The garlic cloves are easy to sprout or even mildew and rot in rainy days.

Garlic combine harvester can accomplish excavation, separation of soil and garlic, separation of garlic plants and gathering of garlic heads at one time. The working integration level is high, harvesting losses are low, production efficiency is high, and the labor intensity of garlic farmers are largely reduced. With the features of complicate structure, high cost and low use ratio, combine harvester is applicable to large-scale farms. At present, technologies of garlic combine harvester in our country are far from mature, and most of the combine harvesters are under prototype design and research or field trials. In view of all advantages of combine harvester, garlic combine harvester becomes an important orientation for future development of garlic machines in China.

Research status of garlic harvester in foreign countries

In countries like the U.S.A., France and Spain, entirely mechanized planting, field management and

harvesting has been realized in garlic industry long ago. During the planting process, garlic seeder can complete soil preparation, ditching, sowing seeds and earth covering at one time. Garlic harvesting operation entirely adopts mechanized harvesting which is with high work efficiency and high mechanization level. According to analysis on garlic harvesting process, harvesters are divided into two forms of harvesting, namely harvesting by stages and combined harvesting.

Typical machines adopting harvesting by stages are onion and garlic harvesters [1] produced by Top Air of the United States. GW2400 two-row garlic windrower (Fig. 1) is used to dig the garlics out of the soil and place in strips for airing in the first place, and then GL2400 two-row garlic pick-up machine (Fig. 2) is used to finish the follow-up work of picking up, cleaning and sorting and centralized encasement.



Fig. 1 GW2400 two-row garlic windrower Fig. 2 GL2400 two-row garlic pick-up machine

Driven by tractor and auto-control hydraulic motor system, digger blade of the garlic windrower dig garlics out of the soil, then the upper hand wheel throws mixtures of garlic and soil to the primary and secondary conveying chains, and the separation conveying chain conveys the garlics backwards, meanwhile, the chains vibrate up and down to let smashed soil blocks fall from gaps between the chains. The clean garlics without soil are paved in strips in the field by strip collector for airing. Then the stalks on upper part of the garlic heads are cut by integrating windrower and special top cutter system of Top Air. Top cutter system (Fig. 3) is composed of a pair of ring blades with notches which are relatively rotating and a round blade with sharply raised parts. Screw roller coated with Teflon coating is used to direct the top of garlic downward and two round plates above the screw roller is for fixing the head of garlic. Screw roller delivers the plants to the back rotary cutter, the rotary cutter cuts the stalks at certain distances with the garlic heads, and then winnowing device is used to eliminate shattered leaves and lighter impurities.



Fig. 3 Top cutter system of Top Air Company

Pick-up shovel of GL2400 garlic pick-up machine is used to pick up the aired garlics, and then deliver the garlics to the back separation conveying chain to eliminate soils and impurities. Cleaner equipped with winnowing system will eliminate sundries again and then the cleaned garlic heads are conveyed to manual sorting platform. Worker at one side of the sorting platform selects and