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Research Article

WORKING BODY OF A ROW CULTIVATOR

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ABSTRACT

This article examines the care and maintenance of row crops, focusing on the efficiency of active and inactive working bodies of cultivators. The study provides a detailed analysis of their impact on soil aeration, weed control, and crop productivity. Particular attention is given to the design and functionality of a newly developed tool for loosening soil in the row-spacing of cotton. The innovative mechanism is designed to improve soil permeability, enhance root development, and optimize moisture retention. The article also presents preliminary research findings, highlighting the tool's effectiveness compared to conventional cultivation methods. The results indicate that the new design reduces soil compaction while maintaining the necessary structural integrity for plant growth. These insights contribute to the advancement of precision agriculture and sustainable cotton cultivation practices.

KEYWORDS

Cotton plant, cultivator, working bodies, roller, hub, flange, protective zone, axis of rotation, loosening elements, tool.

INTRODUCTION

Row cultivators cultivate the soil between rows of cotton crops to destroy weeds and loosen the soil both between rows and in protective zones, preserving the loose and fine-grained topsoil. Four to six inter-row cultivations are carried out for plants during the growing season. After the first cultivation, a delay leads to rapid development of weeds, delayed flowering and maturation of plants and, ultimately, to a decrease in yield.

METHODS

The cultivator's working parts are placed at the required distance from the row so as not to damage the plants. Thus, after the cultivator has passed, a free strip remains on both sides of the row, which serves as a protective zone. The width of the protective zone depends on the following factors: the type of crop, variety, degree of plant development, depth of soil loosening, quality of irrigation (straightness of rows), the magnitude of horizontal deviations of the cultivator's working parts located perpendicular to the direction of movement, and the types of tools used for inter-row cultivation. The wider the inter-row strip processed by the cultivator's working parts, the less area remains for manual processing.

Rotary cultivator working bodies reduce the protective zone compared to traditional passive working bodies [1,2,3,4,5]. When processing with standard loosening working bodies, they are installed at a depth of 14-15 cm, and when weeding at a depth of 6-10 cm. The protective zone is 15-20 cm in both cases.

In recent years, new machines for inter-row soil cultivation have been developed in our country and abroad. These include implements with rotary working bodies that rotate due to interaction with the soil or from the tractor power take-off shaft. The agronomic and technological advantages of such implements exceed traditional ones; in particular, they are distinguished by the high quality of soil cultivation and rational use of tractor engine power [6,7]. However, due to the low productivity and complexity of the design of rotary working bodies rotating from the PTO, tractors are rarely used and only in difficult areas that are difficult to cultivate with conventional equipment. The possibilities of using cultivators with wireless rotary working bodies should be expanded.

The Swiss companies "HG Haruwy" and "Muller" produce various types of tools for inter-row cultivation with a horizontal axis of rotation [8-10]. Soviet specialists used such tools at their machine testing stations to evaluate the quality of work.

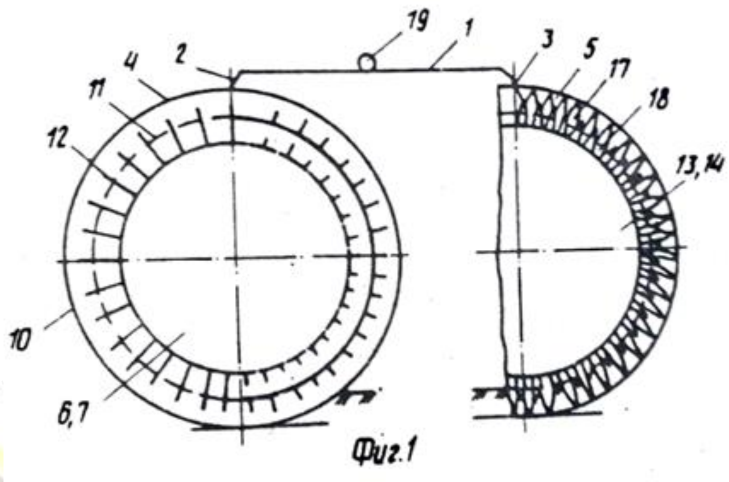

Fig. 1. New working element of a row-crop cultivator.

The new tool pertains to agricultural machines, in particular cultivators, which are used for loosening the soil crust on cotton crops. The aim is to improve the quality of soil cultivation when loosening the crust on cotton crops. This device for cultivating row crops comprises rollers 4 and 5, which are successively mounted on frame 1 using rotations 2 and 3. Two hubs 6 and 7 of the front roller 4 are separated by a replaceable bushing and are mounted on a horizontal axis. For stages 6 and 7, disc knives 10 and transverse loosening elements 12 are used. Hubs 13 and 14 on the rear roller 5 have the shape of truncated cones, which face each other with their smaller bases. Conical loosening elements 17 are located on the conical surface of hubs 13 and 14. To limit the depth of loosening, axially located flanges 11 and 18 are located on hubs 6, 7, 13, and 14. Roller four breaks the longitudinal strip of the earth's crust, and roller five breaks it into smaller pieces.

This tool consists of fork-shaped leads 2, and 3 of the front and rear rollers 4, and 5, which are attached to frame 1.

Two 6, 7 are pivotally mounted on a transverse horizontal axis 8, pivotally mounted on a leash 2. Hubs 6 and 7 are located at some distance from each other and have the shape of a cylinder relative to the longitudinal axis of the implement. On axis 8 between hubs 6 and 7 an adjacent bushing 9 is installed. Each cylinder has a radial disk knife 10 with a cutting edge protruding beyond the surface of the cylinder, fixed on a more distant axis of the longitudinal axis of the implement. To limit the depth of the loosening elements 12 of the roller 4 on the side surface of the disk of the knife 10 or directly of the cylinder (depending on the location of the knife attachment) there is an axially located annular projection 11 (flange). On the cylindrical surface of the hubs of these elements, there are elongated

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radial projections located transversely to the direction of their rotation.

Two hinges 13,14 are pivotally mounted on a transverse horizontal axis 15, which is pivotally mounted in a driver 3. Hubs 13 and 14 have a truncated cone. They are connected to each other by smaller bases of the cones and are separated from each other by a replaceable bushing 16. Loosening elements 17, having radial projections of a conical shape, are located on the conical surface of hubs 13 and 14. In order to limit the deepening of elements 17, an annular projection or flange 18 is located axially on the large bases of the cones.

Conclusion

The results of testing the new tool demonstrate its efficiency in breaking and loosening the soil crust. The front roller effectively cuts a longitudinal strip of the hardened soil layer, initiating the breaking process, while the rear roller further fragments and loosens the crust into smaller pieces. This dual-action mechanism ensures improved soil aeration and water infiltration. Moreover, the tool has shown potential for application in rough and compacted soils, expanding its usability beyond cotton row-spacing to other crops requiring similar cultivation techniques. These findings contribute to the development of more efficient and sustainable soil management practices in modern agriculture.

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