

RESULTS OF USING ROTARY CULTIVATOR WORKING BODIES IN SOIL TILLAGE BETWEEN ROWS OF PLANTS.

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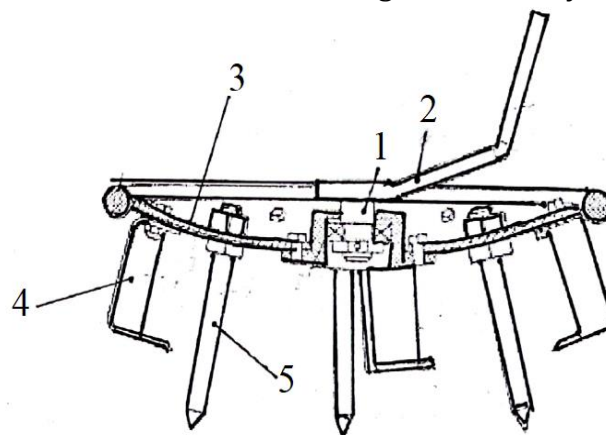
Abstract. The article describes the analysis of agrotechnical indicators of new design rotary working bodies used for tillage and weed control between rows of plants.

The structure, operational parameters and advantages of the rotary working body of the cultivator FAP02377, 2023 are explained by the results of experimental studies. It is shown that the use of the rotary working body in tillage between rows of plants allows for complete soil crushing and complete weed control in one tillage. Scientific conclusions are presented on the work performed.

Keywords: Tillage, row spacing, root zone, weeds, cultivator, rotary tiller, tine, soil compaction, compaction.

Introduction. In agricultural production, high-quality tillage of the soil between rows of plants is the most important link in the general processes of crop care. In mechanical tillage of the soil between rows, especially around the roots, it is very important to work the soil without excessive deformation, that is, to achieve high-quality loosening, and to achieve maximum loss of weeds in one treatment. In order to achieve the set requirements, extensive research and studies are being conducted on the application of active and passive rotary working bodies in tillage of the soil[1,2].

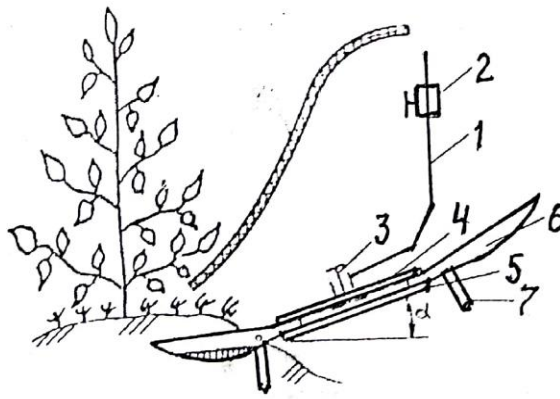
Studies have shown that when cultivating crops with a row spacing of 60-90 cm, the cultivator rotary working body developed in the Russian Federation (a.c.№1417806 A01B 39/20, 39/28, 1988) (Fig. 1) with its L-shaped blades fixed to a concave disk mounted on the axis of rotation provides high-quality soil cultivation[3]. However, the main drawback is the accumulation of moist soil in the bent position of the L-shaped blade and the fact that weed roots get stuck in the vertical wall of the blade, reducing the efficiency of the working body.



1-axle, 2-column, 3-disk, 4-knife, 5-pile.

Figure 1. Cultivator rotary working body (a.c. 14177806 A01B 39/20).

In addition, for use in tillage between cotton rows, a rotary cultivator working body (Fig. 2) was developed at the Scientific Research Institute of Agricultural Mechanization of Uzbekistan (ac. No. 1777679 A01B 39/16, 1992) for use in tillage. The working body has a structure consisting of blades placed on a flat disk mounted obliquely to the axis of rotation towards the crop row, and elements that engage the soil under each blade. The cutting surface of the blade is made with a hyperbolic curvature to penetrate the soil with minimal resistance. With this working body, it is possible to achieve high-quality loosening of the soil in the protective zone between the rows, and up to 98-100% removal of weeds present in the cultivated width [4].

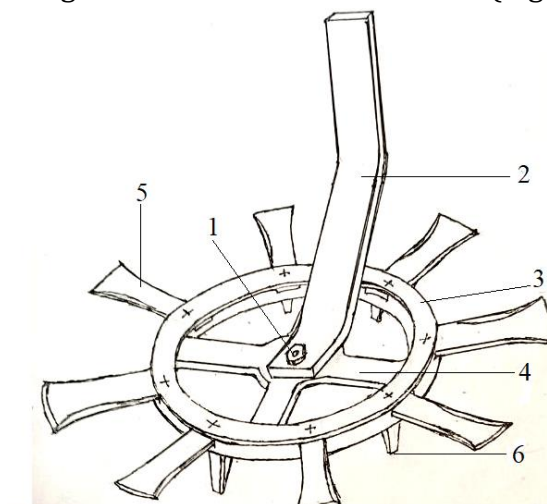


1-column, 2-lock, 3-axle, 4-disk, 5-ring, 6-knife, 7-pile.

Figure 2. Rotary working body of the cultivator (A.s. 1777679 A01B,39/20, 1992)

However, the cross-section of the blade, which has a hyperbolic curve design, decreases as it is pushed towards the blade tip. This, in turn, causes rapid wear of the blade and shortens its service life. In addition, as a result of the change in the diameter of the center of gravity during the rotation of the working body, the function of the soil-engaging element to perform the kinematic mode of the working body is disrupted. This, in turn, negatively affects the operational requirements placed on the working body and the quality of work.

Research object and materials. As a result of research and studies conducted to achieve soil loosening and weed removal at the specified agrotechnical level with minimal deformation of the soil between plant rows, a new cultivator rotary working body was developed at Gulistan State University (F.M. FAP No. 02377 2023), which was improved and the above-mentioned shortcomings and defects were eliminated (Figure 3).



1-axle, 2-column, 3-ring, 4-handle, 5-knife, 6-soil-engaging peg.

Figure 3. Rotary cultivator working body (FAP No. 02377.2023).

The newly developed cultivator rotary working body achieves the agrotechnically required level of loosening the soil in the working width around the crop row and the complete removal of weeds. Another important advantage is that the working body does not cause additional harmful compaction of the layer below the cultivated soil layer. This ensures good soil aeration in the crop root zone[5].

The working body has the following structure: an axis of rotation located at an angle to the horizontal, a housing mounted on it, eight soil-engaging elements are regularly installed under the flange located along the outer circumference of the housing. The circle where the center of gravity of the working body is located is diametrically located exactly on the diameter of the flange. Such an arrangement is of particular importance, as it ensures that the blade is in the kinematic mode of movement during $\lambda = 1,4 \dots 1,7$ the rotation of the working body together with the soil-engaging element. The fact that the flange is cast into the body instead of the disk in the above-mentioned working bodies, four holders eliminate the accumulation of soil on the surface of the working body. Eight blades are bolted to each soil-engaging element in special grooves on the surface of the flange.

To ensure the blade's long-term flawless operation, it was designed in a unique way, that is, it works in a double-edged cutting mode, which allows one side to be replaced with the other when it wears out. In addition, the cross-sectional area of the blade increases with increasing diameter, ensuring that the blade can work for a long time without wearing out [6, 7].

For tillage of the soil in each complete row of crops, two rotary working bodies are installed with the $\alpha = 15^\circ$ right and left mounting and $\beta = 10^\circ$ entry angle.

The outer diameter of the working body is 420 mm, which cultivates the soil to a width of 160-190 mm and a depth of 50-70 mm.

Our studies of tillage of the soil around the root zone of crops with a flat cutting blade in existing tillage cultivators have shown that the cut soil layer is not sufficiently crushed, the loss of weeds is 60-70%, and most importantly, harmful compaction of the soil layer under the blade occurs. The above-mentioned disadvantages of tillage with a flat cutting blade are eliminated by using a rotary working body instead of them[7, 8].

By using a rotary tiller to loosen the soil between rows and remove weeds, it is possible to perform the work of flat-cutting tines and avoid their use. The results of experimental studies conducted to determine the quality of work of cultivator tillers are shown in Table 1.

Quality indicators of cultivator working bodies in soil cultivation around plant roots.

Table 1.

Name of the working body	Soil compaction			Weed loss (%)
	0-25 mm	25-50 mm	50-75 mm	
Rotary working body (a.c.№1777679 A01B, 39/16. 1992) 92 8 0 98-99	92	8	0	98-99
Serlyal cultivator flat cutting claw	14	57	29	68-72
3 Rotary working body	91	9	0	97-98

(F.M.№FAP 02377. 2023)				
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Conclusion. Based on the results of theoretical and field tests, the use of rotary-type working bodies in inter-row tillage of the soil shows a number of advantages in terms of the quality of the work performed:

- soil crushing reaches the agrotechnical level, that is, 98-100% of the fraction of 0-25 mm
- 100% destruction of weeds in the working width
- no additional harmful compaction of the soil layer below the working depth
- use instead of flat cutting bars in the set of cultivator working bodies.

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