The importance of cultivating cotton rows with row-mounted cultivators and analysis of working bodies

Makhmudova Maftuna Makhsud kizi

Bukhara State Technical University, basic doctoral student

e-mail: maftunamaxmudova40@gmail.com

Abstract: This article presents information on the importance of cultivating cotton rows with a row cultivator, the layout of its working parts, and their functions.

Keywords: cotton, cultivator, disk, spring, hinge, knife, hook, cultivator, chopper, feeding device, arrow arch, claw, disk-star, okuchnik, ditch opener

Introduction. In agricultural production in our republic, special attention is paid to reducing labor and energy consumption, saving resources, growing agricultural crops based on advanced technologies, and developing highly productive agricultural machinery. The Decree of the President of the Republic of Uzbekistan No. PF-5853 “On Approval of the Strategy for the Development of Agriculture of the Republic of Uzbekistan for 2020-2030” stipulates the implementation of a number of reforms in the field of agriculture and food security. The Strategy of Actions for the Further Development of the Republic of Uzbekistan sets out, among other things, the tasks of “...further improving the reclamation condition of irrigated lands for the modernization and accelerated development of agriculture, developing a network of reclamation and irrigation facilities, introducing intensive methods into the field of agricultural production, primarily modern agrotechnologies that save water and resources, and widely using highly productive agricultural machinery.” In carrying out these tasks, it is necessary to solve issues such as increasing the agrotechnical performance of existing cultivators, reducing material and energy consumption, ensuring resource efficiency through their technical and technological modernization, and increasing the quality and productivity of work.

It is known that inter-row tillage with cultivators is one of the most important agrotechnical measures in cotton farming. Timely and high-quality inter-row tillage improves the water-physical, microbiological properties, air exchange, and nutrient regime of the soil, and eliminates emerging weeds. As a result of cultivating cotton, air exchange in the soil improves, weeds are eliminated. Cultivation between cotton rows is carried out taking into account soil properties, terrain, water supply, and its depth, number of treatments, and duration are determined.

The first tillage between cotton rows begins when 75-80% of the cotton seedlings have sprouted and the rows are visible. If the soil is treated qualitatively during the first cultivation, the 20-25% of the seedlings that have not yet emerged will quickly sprout, the soil will become fine-grained, allowing the plant root system to develop freely. When tilling, it is necessary to place the rotary star, blades and deep loosening paws on the cultivator (if the soil surface is loose).

For inter-row tillage of cotton and other technical crops, KRT-4 and KXU-4 cotton cultivators mounted on TTZ 60.11, TTZ 80.11, and MTZ 80X walk-behind tractors are mainly used. In order for the cultivators to achieve the expected results in inter-row tillage, they must be fully equipped with 7 types of working parts.

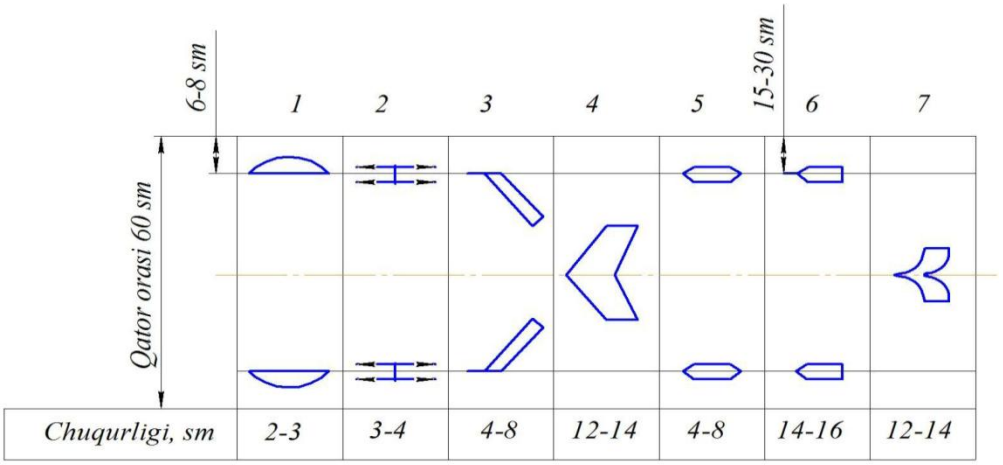

Figure 1. Working parts of the cultivator and their working depth

1-blade (disk); 2-star; 3-blade; 4-deep loosener; 5-stubble loosener; 6-fertilizer spreader; 7-stubble picker

Depending on the cultivation method, when the row spacing is 60-70 cm, the cultivator is equipped with a maximum of 7 working parts per row, for a total of 28, and when the row spacing is 90 cm, the cultivator is equipped with 9 working parts per row, for a total of 36.

Grass-cutting or straight-cutting blades differ in shape and size. They are one-sided (razor) and arrow-shaped (Fig. 2a, b). The vertical blade of the blade cuts the soil, preventing the formation of lumps near the roots. Since the lower edge of the vertical jaw is inclined (23°), it is subject to forces that tend to pull it out of the soil, so the claw cannot sink too deep into the soil. In addition, since the claw is one-sided, the lateral forces are not balanced, and if the handle or ridge is low, it will tilt to the side. The blade of the claws is sharpened at an angle of 8-10° from the upper side. The thickness of the blade is 0.5 mm.

The claw's coverage width is β=85-250 mm (165 and 182 mm for cotton cultivators). The opening angle of the claw wings is 2γ=60° (γ=30°), the angle of inclination of the wing to the horizon (angle of inclination) is β=10-15°. Arrow-shaped tines (Fig. 2b) are installed on hoes, ridgers and other cultivators. They differ not only in the width of coverage, but also in the opening angle of their wings 2γ and the angle of inclination α (the angle of installation of the tines wings relative to the bottom of the furrow). According to the angle of inclination, arrow-shaped tines are divided into straight-cutting (β=12-18°) and universal (β=25-30°) tines. The main parameter of flat cutting blades is the angle γ, since the cutting mode depends on the size of this angle, and the cut can be with or without sliding. The values of the parameters of the axially arcuate, flat cutting blades: coverage width b=145, 150, 160, 220, 250, 270 and 330 mm; 2γ = 60-70°. Grinding angle i=12-15°. Processing depth 4-6 cm.

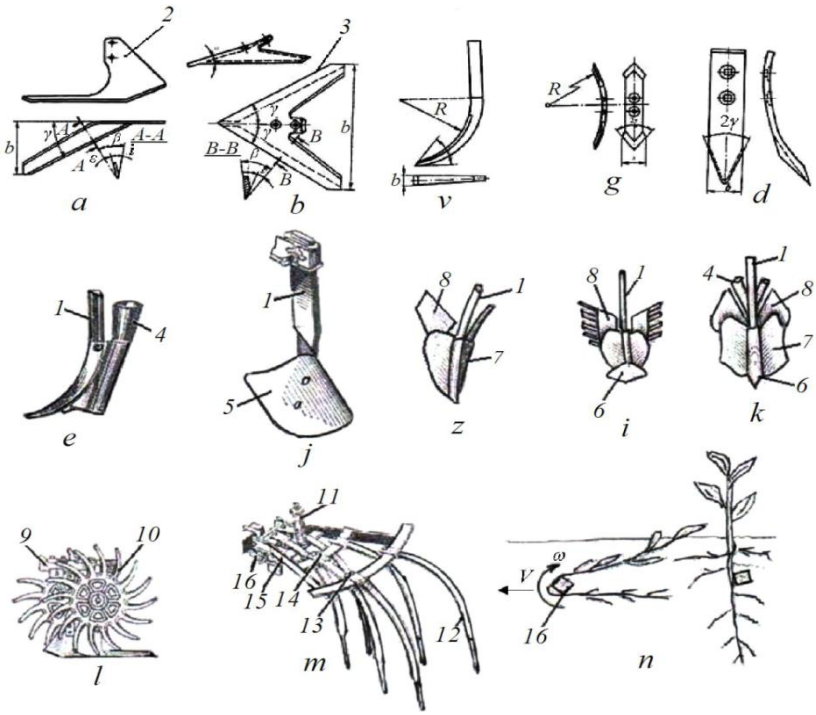

Figure 2. Working bodies of cultivators.

a - one-sided flat cutting blade; b - arrow-shaped blade; c - wedge-shaped blade; d - rotary blade; d - spear-shaped blade; e - feeder blade; j - blade-turning blade; z - harrow body; i - harrow body with blade-turning blade; k - harrow-harrow holder; l - star-shaped disk; m - spring-shaped teeth; n - working body with a bar.

1- handle; 2 - lunge; 3rd stitch; 4 - funnel; 5 - flipper; 6 - naralnik (lighter); 7 - tipper; 8 – wing; 9 – Nina; 10 - a disc with a rim; 11- spring; 12 - tooth; 13 - bolt; 14- rama; 15 - bracket; 16 - barbell.

Universal tines have a fairly large crushing angle (β=25-30°), thanks to which they not only cut weeds with their blades, but also crush the soil. The coverage width is β=220, 270, 330 and 385 mm. The opening angle of the blades: 75-80° for working on sandy soils, 55-60° for sticky and loose soils.

A wedge-shaped rake (Figure 2c) is a rake that is made up of a single piece of wood and a handle. The wedge-shaped rake has a width of 20 mm and is mainly used to loosen row spacings up to 15 cm.

Rotary blades (Figure 2g) can be mounted on fixed or spring-loaded handles. Rotary blades are a double-edged plate that is locked into the handle. To extend the service life between sharpenings, the blade is rotated with the other end when one end is extended. The thickness of the rotary blades is 7-10 mm. They are made of 65G steel strip with a width of b=35-55 mm. The working depth is 22-25 cm. The radius of curvature should be equal to the radius of curvature of the tail of the arrow-shaped blades. In this case, different blades can be installed on one handle. The opening angle of the blade part is 2γ=60-70°, length L=260 mm. The angle of immersion in the soil formed between the tip of the blade and the bottom of the trench is β = 38-41°.

The function of the spear-shaped claws (Fig. 2d) is the same as that of the hoe, but they are better at separating weeds by raking them. They are installed on cultivators for tillage and are used to raking perennial rhizome weeds on light soils. One end of the claw is sharpened, 2γ = 48°.

This cultivator also has working bodies depending on the type of work to be performed. Based on the above analysis, the purpose of the research is to develop a disk working body for a cotton cultivator and justify its parameters, which will prevent the formation of large clods when cultivating cotton between rows, cultivate between rows without damaging cotton seedlings and their root system, and thereby ensure energy and resource efficiency, increase work quality and productivity.

Conclusion. The conducted research and analysis of the literature, as well as the analysis of the designs and working bodies of existing cotton cultivators, showed that by developing a disk working body for a cotton cultivator and substantiating its parameters, taking into account the natural climatic conditions of the region and the physical and mechanical properties of the soil, it is possible to achieve high-quality processing without damaging cotton seedlings and their root system during the processes of inter-row cultivation and weed removal.

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