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DESIGN METHODOLOGY OF A CULTIVATOR'S ARROW LEG WITH LOCAL REINFORCEMENT ELEMENTS

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In modern agriculture, increasing the efficiency of soil treatment and the durability of working bodies of agricultural machinery are priority tasks. The arrow feet of cultivators are widely used for soil treatment due to their versatility and efficiency in the process of destroying the compacted soil layer. However, intensive mechanical loads and wear of working elements limit their service life, which causes additional operating costs and the need for frequent replacement.

One of the promising directions for increasing the wear resistance of arrow legs is the use of local strengthening elements that provide protection for the most worn parts of the working organs. The use of such reinforcing elements allows to significantly increase the strength and wear resistance of the structure, reducing the cost of maintenance and replacement of parts.

The purpose of this article is to develop a methodology for designing a cultivator arrow foot with local strengthening elements, which takes into account the mechanical and operational features of the design, and also ensures the optimal location of strengthening elements to achieve maximum efficiency in field conditions.

One of the effective methods of improving the cutting capacity of arrow paws is the formation of a serrated profile of the cutting edge due to the directed wear of

the paw material. Technically directed wear can be ensured by creating local strengthened zones on the surface. However, at the same time, it is necessary to find an algorithm for the location of such zones, their geometric parameters and the profile of the cutting edge itself. Solving this problem will allow creating an arrow paw with structural parameters that are maximally adapted to the tasks of inter-row and continuous tillage.

The analysis of theoretical and practical developments in the field of improvement of arrow paws indicates that the improvement of their cutting capacity and wear resistance is solved mainly due to the optimization of the profile of the cutting edge adapted to specific soil conditions. At the same time, the main direction of improvements is aimed at optimizing the trajectory of movement, creating a cutting mode with acceleration and sliding.

Maintenance of the cutting edge in a sharpened state on serial arrow feet is increased by applying a layer of wear-resistant material to the back surface of the blade. Due to the difference in the intensity of material wear, the phenomenon of self-sharpening of the blade has been observed for some time. However, the wear process is not controlled and therefore does not form a cutting edge of the desired profile.

In the development of this direction, the institute named after Paton proposed the design of drop application of a special alloy on the working surface of the blade. The use of this technology has proven itself well on the arrow legs of flat cutters for basic soil cultivation, or otherwise in conditions of increased pressure and, as a result, increased frictional forces. The given solution did not provide any particular advantages for the arrow-shaped claws of surface tillage.

Thus, the problem of creating an optimal mode of cutting with an arrow paw has not yet been solved and is relevant at this stage.

The main starting data for the design of a cultivator paw with local strengthening elements are:

- type of soil, its angles of external and internal friction, hail;
- the angle of inclination of the tangent to the tooth profile, degrees;
- angle of friction of weeds on steel, degree;

- grip width of the paw, mm;

- processing depth, mm;

- step between local strengthening elements, mm;

- is a function of the angle of inclination of local elements along the blade.

The angle of inclination of the tangent to the profile of the tooth [1] is taken from the condition of the emergence of weeds and soil along the blade of the paw, and is within .

The grip width 2b is accepted within 250, 270, 330 mm. This parameter must coincide with the standard width of the grip of the existing paws, since the placement of working bodies on cultivators of all brands is based on these dimensions.

The location step of local strengthening elements is taken from the condition of teeth formation and is within =20 – 50 mm [2].

The function of the angle of inclination of the elements along the blade is determined from the condition that the tooth profile is preserved as long as possible. This function is set experimentally.

Taking into account the characteristic activation of the cultivator paw in the toe zone, which occurs along a curved line, on the basis of the general model of the unfolding surface, it is possible to propose a composite surface [3].

When choosing the radius of the toe of the paw, it should be taken into account that at high stresses in the soil, it loosens due to compression energy, while low stresses provide only chipping of the soil layer, which leads to the formation of depressions.

Dependence of the angles of soil friction on steel, the angle of inclination of the guide is within $\gamma_0 = 27$ - 31^0 despite the fact that the dependence of the angle of soil friction on steel has a wave character.

Thus, the guide equation will have the form:

$$y^2 + (r - x)^2 = r^2, \text{ при } 0 \prec x \le x_B; \quad (1)$$

$$y = tg\gamma_0 x + r[\cos\gamma_0 - tg\gamma_0(1 - \sin\gamma_0)], \text{ при } x_B \le x \prec x_C. \quad (2)$$

In a simplified version of the design, when the angle of inclination of the forming element is taken as 310, the equation of the guide will have the form:

$$y^2 + (r - x)^2 = r^2 \text{ при } 0 \prec x \le x_B; \text{ (3)}$$

$$y = tg\gamma_0 x + 0{,}586r, \text{ при } x_B \le x \prec x_C. \text{ (4)}$$

The obtained data serve as the starting point for constructing the surface of the paw.

Conclusions. The study confirms that the introduction of local reinforcement elements in the design of the arrow-shaped paw cultivator increases its wear resistance and durability. This ensures more stable work during soil cultivation, reducing wear and tear on the key elements of the cultivator. By optimizing the design with the use of reinforcing elements, maintenance and replacement costs are reduced, which reduces total operating costs and increases the productivity of the equipment. The use of the latest wear-resistant materials for the manufacture of reinforced elements ensures the durability of the structure. This reduces the frequency of repairs and increases the profitability of using equipment in conditions of intensive agricultural production. The proposed methodology can be implemented in the industrial production of cultivators, which will make it possible to manufacture more reliable and durable models. It provides practical guidance on material selection, reinforcement configuration and structural geometry.

LIST OF USED SOURCES.

1. Кобець А.С., Пугач А.М. Обґрунтування кута нахилу напрямної поверхні культиваторної лапи // Агроінженерні дослідження / Вісник Львівського національного аграрного університету: – Львів, 2008. - №12. – Т. 1. с. 405 – 410.

2. Кобець А.С., Волик Б.А., Пугач А.М. Исследование износа культиваторных лап оснащенных элементами локального упрочнения рабочей поверхности // Механізація сільського виробництва / Вісник ХНТУ ім. Петра Василенка. – Харків. 2007. - №59. - с. 76 – 80.

3. Патент на корисну модель № 29516 МПК A01B 35/00 Робочий орган культиватора / Кобець А.С., Волик Б.А., Пугач А.М./10.01.2008 Бюл. №1. – 2 с.