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JUSTIFICATION OF THE SHARPENING ANGLE OF THE DISCS OF THE COMBINED MACHINE ROLLERS USED IN THE PRE-SOWING TREATMENT OF NEWLY PLOWED LAND

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Annotation. The article presents the results of theoretical studies based on the sharpening angle of the discs of the rollers of the combined machine used in cultivated land. It was determined that the sharpening angle of the discs should be in the range of 55-65° to ensure high-quality tillage.

Keywords: cultivated land, combined machine, disc, disc roller, soil, sharpening angle.

Аннотация. В данной статье представлены результаты теоретических исследований по углу заточки дисков катков комбинированной машины, применяемой на обрабатываемых землях. Определено, что угол заточки дисков должен находиться в пределах 55-65° для обеспечения качественной обработки почвы.

Ключевые слова: пашня, комбинированная машина, диск, дисковый каток, почва, угол заточки.

Аннотация. Мақолада шудгорланган ерларга изма-из ишлов беришда қўлланиладиган комбинациялашган машина ғалтакмолалари дискларининг ўткирланиш бурчагини асослаш бўйича назарий тадқиқотлар натижалари келтирилган. Тупроққа сифатли ишлов беришни таъминлаш учун дискларнинг ўткирланиш бурчаги 55-65° оралиғида бўлиши кераклиги аниқланди.

Калит сўзлар: шудгорланган ер, комбинациялашган машина, диск, дискли ғалтакмола, тупроқ, ўткирланиш бурчаги.

Introduction. In our country, crops such as winter wheat, which are planted in areas freed from repeated crops, and vegetables and potatoes, which are sown as repeated crops in areas freed from it, are planted in new, i.e. directly before sowing, plowed areas. In this, plowed land is prepared for row planting and then planting activities are carried out.

The preparation of newly plowed land for planting is carried out by passing through the same place many times with toothed and disc harrows and various levelers. This leads to deterioration of the physical and mechanical properties of the soil, a lot of moisture loss from the soil, and an increase in fuel consumption and other costs.

The analysis of the scientific and technical achievements achieved at the world level and the research carried out in our Republic [1-2] shows that the shortcomings in the preparation of newly plowed land for planting are all technological processes for preparing the soil for planting in one pass through the field (full compaction of the plowed field, leveling and grinding of the surface of the field) can be eliminated by developing a machine that ensures that it is fully processed in one pass before planting. The use of such a machine in the pre-planting treatment of newly plowed land can increase productivity, improve the quality of soil cultivation, prevent moisture loss, and reduce the number of trips of aggregates through the field while

reducing fuel consumption and other costs due to the addition of technological processes and the reduction of the number of aggregates passing through the field. It allows to plant and collect the seeds [3-4].

Based on this, a combined machine consisting of disc rollers, a leveler, and a plate roller mounted on a common frame was developed in cooperation with Andijan engineering and agricultural and agrotechnological institutes for the preparation of newly plowed land for planting (Fig. 1) [5].

Figure 1. A combination machine used in the cultivation of newly plowed fields

Method. Theoretical mechanics, agricultural mechanics, laws and rules of mathematical statistics, mathematical planning of experiments and tensometric methods were used in the research process, and existing normative documents (Tst 63.04:2001 “Испытания сельскохозяйственной техники. Машины и орудия для поверхностной обработки почвы. Программа и методы испытаний” [6] and Tst 63.03.2001 “Испытания сельскохозяйственной техники. Методы энергетической оценки машин” [7]) were used.

Economic efficiency of the combined machine used in row cultivation of newly plowed land RD Uz 63.03-98 “Испытания сельскохозяйственной техники. Методы расчета экономической эффективности испытываемой сельскохозяйственной техники” [8].

Result and discussion. In order for the disc rollers of the combined machine to grind the surface of the plow to the depth for planting repeated crops and wheat seeds, and to compact the lower layer at the required level, their depth of immersion in the soil (h_T) should be equal to or slightly greater than the depth of planting seeds (h_y).

Based on this, we accept the depth of immersion of roller discs into the soil in the range of 5-6 cm [9-10].

The following are the main parameters of the combined machine disk windings that affect its quality and energy indicators (Fig. 2) [9-11]:

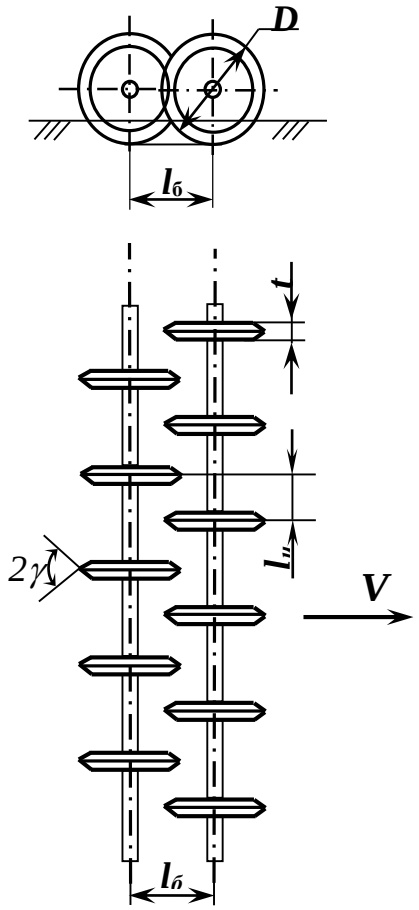

Figure 2. Parameters of combined machine windings

D – diameter of the discs of the rollers, m;

2γ – the angle of sharpening of the discs of the rollers, degrees;

t – thickness of discs of rollers, m;

l_u – width between tracks of roller discs, m;

$l_б$ – longitudinal distance between the coils, m;

Q – Vertical load applied to each disc of the rollers, N.

Studies on the justification of these specified parameters of combined machine disc rollers S.Aminov, A.O.Khadji-Murodov, A.D.Nuriddinov, Q.B.Imomkulov, D.R.Norchaev, J.R.Norchaev, B.A. It was conducted using the research conducted by Artikbaev et al. [11-18].

In the working process of the combined machine, the disc rollers grind and compact the upper layer of the plowed field, i.e., the repeated crops and wheat seeds are planted, the leveler flattens the plowing surface treated by the disc rollers, and the plate roller compacts the plowing surface to the required level and forms a soft layer to collect moisture. becomes [19-20]. The sharpening angle of the roller discs is also important for this.

We determine the sharpening angle of the discs according to the following expression, which is derived from the condition that the soil does not stick to their working surfaces[9-11].

$$2\gamma = 90^{\circ} - \varphi_1 . \qquad (1)$$

Taking φ_1=25-35° [21-22], we determine that according to expression (1) 2γ angle should be in the range 55-65°. We accept 2γ=60° or γ=30° as the final result. Because it provides good compaction of the lower soil layer [9-11].

Conclusion. The justification for the sharpening angle of the discs on combined machine rollers used in the pre-sowing treatment of newly plowed land involves several factors:

Soil Type: Different soil types require different levels of aggressiveness in tillage. For instance, sandy soils may require shallower angles to prevent excessive soil disruption, while clay soils may need steeper angles to effectively break up clods.

Depth of Tillage: The depth at which the discs penetrate the soil affects the angle required for optimal performance. Deeper tillage may necessitate a sharper angle to maintain effectiveness throughout the soil profile.

Residue Management: The amount and type of crop residue left on the field after harvesting can impact the required disc angle. Sharper angles may be needed to effectively cut through tough residue, while gentler angles may suffice in fields with minimal residue.

Desired Soil Structure: The desired soil structure after tillage also influences the sharpening angle. For finer seedbed preparation, a shallower angle may be preferable to avoid excessive soil disruption, while deeper angles may be used for more aggressive soil loosening.

Machinery Design: The design of the combined machine rollers, including disc size, spacing, and rotational speed, affects the optimal sharpening angle. The angle should complement the machinery design to ensure efficient soil tillage and minimal wear on the equipment.

Field Conditions: Factors such as moisture content, compaction, and previous tillage practices can impact the effectiveness of the disc angle. Adjustments may be necessary based on field conditions to achieve optimal results.

Overall, the sharpening angle of the discs on combined machine rollers should be selected based on a combination of these factors to achieve efficient soil tillage, proper seedbed preparation, and minimal wear on equipment. Experimentation and field testing may be necessary to determine the most suitable angle for specific soil and field conditions.

The sharpening angle of the discs of the combined machine rollers should be 60° to ensure high-quality processing of plowed lands with low energy consumption.

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