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Article

Adjustment of the Improved Chizel-Cultivator to the Determined Depth

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Abstract: The development and application of energy-efficient, high-performance and high-quality pre-sowing tillage machines is a world leader. "Today, the world spends $ 1.8 billion annually on sowing the seeds of agricultural crops. Given that the area is cultivated per hectare, the machines used in pre-sowing tillage should be energy-efficient, high-quality and productive. In this regard, it is important to improve the techniques used in pre-sowing tillage on a scientific basis. Targeted research is being carried out around the world to create resource-saving technologies for the preparation of fields for sowing of agricultural crops and new models of equipment, to develop scientific and technical bases for improving existing ones, to ensure resource efficiency in the work process.

Keywords: Energy, energy-efficient, new machines, chisel cultivators, improving agro-technical performance, productivity.

Introduction

This research was carried out in accordance with the priorities of the development of science and technology of the republic "Energy, energy and resource conservation." [1]

In world practice, various devices and technical means have been developed to increase the efficiency of pre-planting tillage processes. They were recommended to design bureaus to create new machines. J.Ba laton, Spoor Gordon (Germany), R.Blackstein, J.V. have been working abroad to increase the agro-technical performance and productivity of chisel-cultivators and similar equipment, reduce energy consumption [2]. Stafford, A.Geiki (England), K.Araya, K.Kawanishi, R.Soucek, S.Anisch, S.Woif (USA), I.M.Panov, N.M.Orlov, G.V.Plyushchev, Research work was carried out by G.M. Prokopenko, V.A. Lim, D.A. Tryapitsin, V.I. Vetoxin (Russian Federation) and other scientists [3]. Research in this direction in our country GM Rudakov, RI Boymetov, FM Mamatov, A. Tokhtako'ziev, IT Ergashev, BS Mirzaev, QB Imamkulov, H. Begimov, M. Performed by Mirakhmatov, AA Nasriddinov, FU Juraev and others [4]. The pre-sowing tillage machines created as a result of these studies are being used in agricultural production with some positive results [5]. However, these studies are mainly focused on the development of pre-planting tillage technologies and equipment, which do not adequately study the issues of reducing the energy consumption of existing chisel cultivators, improving agro-technical performance and productivity [6].

The purpose of the study is to increase the quality and productivity of pre-sowing tillage and reduce energy consumption due to technical and technological improvements of existing chisel cultivators.

Materials and Methods

The object of the research was an improved chisel-cultivator intended for pre-sowing tillage, as well as serially produced chisel-cultivators and combined machines of a similar purpose. The agrotechnical requirements for pre-sowing tillage were adopted in accordance with the standard technological maps for the care and cultivation of agricultural crops [7]. The parameters of the rear-mounted hitch linkage of the tractor were taken in accordance with GOST 10677-2001 [8]. The interaction of the working bodies with the soil and the conditions for the penetration of the chisel-cultivator to the specified depth were analyzed on the basis of the theory and calculation of tillage machines [9]. The design parameters of the machines were substantiated using the generally accepted methods of designing agricultural and land reclamation machines [10]. The tractive resistance of the working bodies was assessed on the basis of the methods for determining the resistance of tillage working bodies [11].

In the course of the research, the design schemes of the improved chisel-cultivator and of comparable machines were analyzed, and the influence of the position of the lower hitch points relative to the base plane of the machine on the penetration of the working bodies to the specified depth, the stability of the working depth, and the transport clearance was studied.

Results and Discussion

The general view of the improved chisel-cultivator is shown in Fig 1.

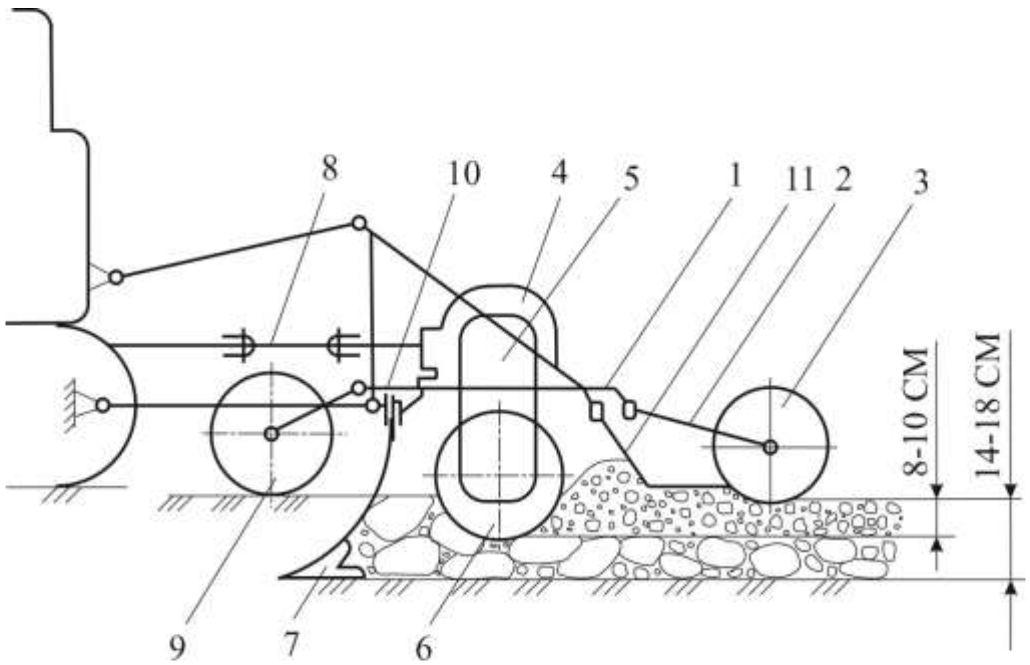

Figure 1. General view of the improved chisel-cultivator: *1 – frame of the device; 2 – drawbar; 3 – reel; 4 – central reducer; 5 – side reducer; 6 – rotor; 7 – softening working body; 8 – cardan shaft; 9 – base wheels; 10 – support wheel mounting bracket; 11 – straightening apron.*

The quality of soil crumbling and the tractive resistance of such machines are determined primarily by the interaction of their working bodies with the soil [12]. A chisel-cultivator with a spring-loaded softening working body is shown in Fig 2. The spring suspension of the working body maintains a constant vertical load and reduces the dynamic loads arising when the working body interacts with the soil [13].

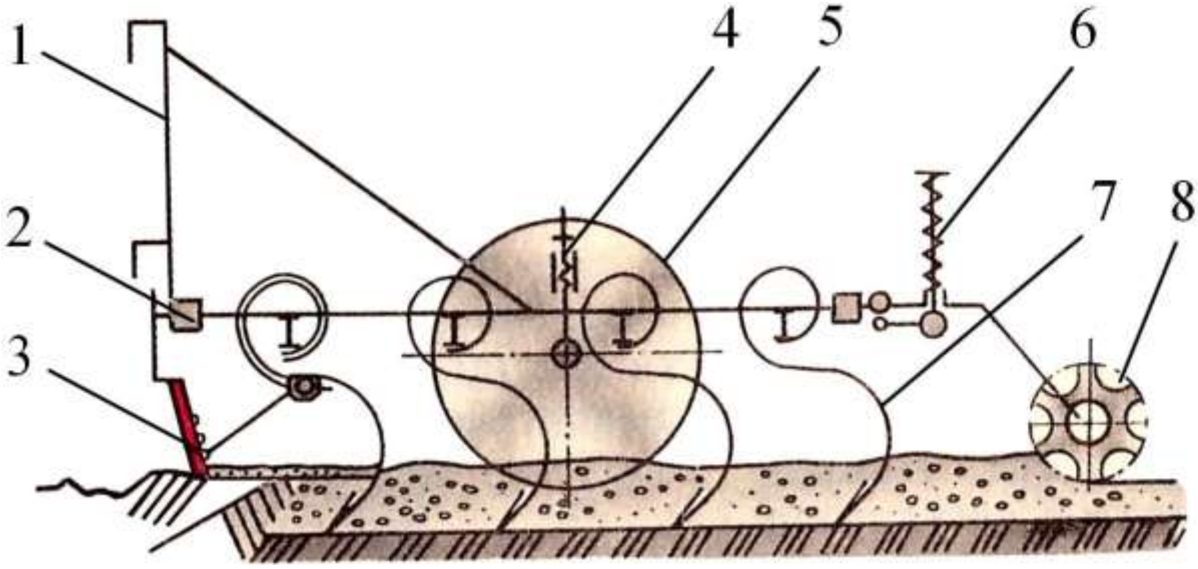

Figure 2. Chisel-cultivator with a spring-loaded softening working body: *1 – hanging (hitch) device; 2 – frame; 3 – levelers; 4 – working depth adjusting screw; 5 – support wheel; 6 – pressure spring; 7 – softening working body; 8 – reel.*

The KM-3.0 combined machine (Fig 3) performs softening of the soil, application of fertilizers, and leveling of the field surface in a single pass.

Figure 3. KM-3.0 combined machine: *1 – frame; 2 – fertilizer spreader; 3 – base wheel; 4, 5 – soil softening working bodies; 6 – coulter; 7 – leveler; 8 – toothed-plank reel.*

The working bodies of the chisel-cultivator are shown in Fig 4. The geometry of the tines has a decisive influence on the penetration of the machine into the soil and on the stability of the working depth [14].

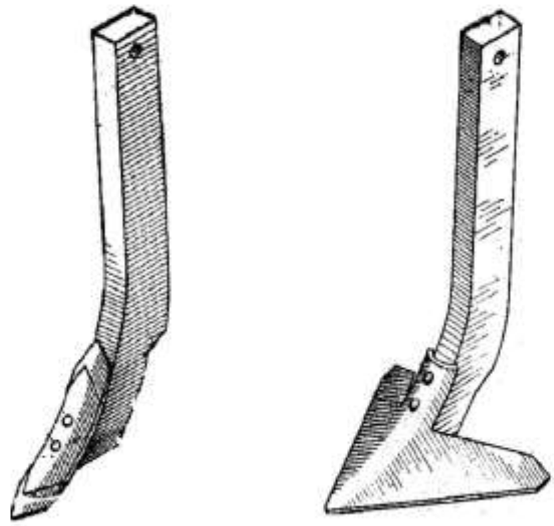

Figure 4. Working bodies of the chisel-cultivator: *a – softening claw; b – occlusal claw.*

The analysis showed that the penetration of the improved chisel-cultivator to the specified depth and the stability of its operation at this depth depend substantially on the vertical distance from the base plane of the machine to the lower hitch points. The agronomic requirements for the quality of pre-sowing tillage in the conditions of cotton growing impose additional restrictions on the choice of this parameter [15]. At the same time, the application of resource-saving tillage technologies requires that the necessary transport clearance of the machine be provided [16].

Conclusion

The vertical distance from the base plane of the chisel cultivator to the lower hanging points should be in the range of 50-60 cm in order to ensure that the improved chisel cultivator sinks to the specified depth and stays stable at this depth and provides the required level of transport clearance.

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