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Article

Floor Formation Technology for Rice Cultivated Areas

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Abstract: The article highlights information about the technology for forming floors in rice fields. Based on the results of the research conducted, it was found that the devices used to form floors in rice fields lack compacting mechanisms, which prevents their durability from being ensured. As a result, in necessary cases, the formed floors require additional manual labor for processing, leading to excessive costs.

Keywords: Rice, Longitudinal, Transverse, Floor, Technology, Research, Area, Device, Compactor, Manual Labor, Processing, Efficiency, Consumption, Cost, Productivity

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1. Introduction

Tetrazole Scientific research is being conducted worldwide to develop scientific and technical solutions aimed at creating resource-efficient technical tools for effective irrigation of agricultural crops. In this regard, it is particularly important to design a device with a compacting working mechanism to form durable floors in rice fields and to substantiate its parameters, ensuring that the technological process is carried out in accordance with agronomic requirements.

Before planting rice, scientific research has been conducted worldwide to explore the essence of the technological process of compactors equipped with compacting working mechanisms for soil preparation. Studies have also focused on creating and improving various designs of floor-forming machinery and technology equipped with compacting mechanisms, as well as substantiating the optimal parameters of compacting working mechanisms. Notable researchers in this field include S.P. Singh, R.K. Solanki, M.K. Singh, K. Singh, A.I. Voronin, G.G. Kazakov, A.I. Shabaev, V.F. Strelbitsky, V.A. Panfilov, N.T. Semenov, V.V. Kurushin, I.A. Sharanov, V.I. Kurdyumov, and others.

In our country, research has been conducted by A.E. Teshabaev, M.A. Akhmedzhanov, A.V. Sergienko, and T. Avazturdiev on designing machines equipped with compacting working mechanisms for floor formation and substantiating their optimal parameters. Additionally, N. Murodov, H. Olimov, A. Murtazoev, N. Abdualimov, and other scientists have focused on creating and improving working mechanisms for devices that form longitudinal floors in cotton row-spacing.

2. Materials and Methods

All Although floors have been formed using the devices developed as a result of these studies, sufficient scientific research has not been conducted to create new designs of compacting working mechanisms, expand their capabilities, and substantiate their parameters to ensure the quality and durability of the formed floors.

The soil-compacting working parts used in agriculture are similar in terms of their impact on the soil, but some of them are designed for specific functions or purposes. Examples of such components include rollers with different designs.

Rollers are designed for soil compaction, leveling, and loosening, and are related to working mechanisms. They are similar in terms of the nature of their impact on the soil. Compaction working parts can be classified based on five main characteristics: the shape of the working surface, the shape of the soil surface formed, the method of impact on the soil, the way energy is utilized, and the shape of the cross-section of the working parts.

According to the shape of the working surface, compaction working parts are divided into various types such as wheel-shaped, plank-shaped, steel-rope, conical, cylindrical, toothed, disc-shaped, star-shaped, spiral-shaped, and barrel-shaped (Figure 1).

Plank-shaped compaction working parts (Figure 1, a) are made of a cylindrical plank drum, which is fixed to a disc axle. Around this, additional working parts are attached to the planks, which are shaped to resemble a cylinder. When circular cross-section compaction working parts are used instead of plank components, the compaction working mechanism takes the form of a circular cross-sectional surface. Plank-shaped and circular compaction working parts are used in machine aggregates that work the soil by combining soil overturning, leveling, and partial compaction.

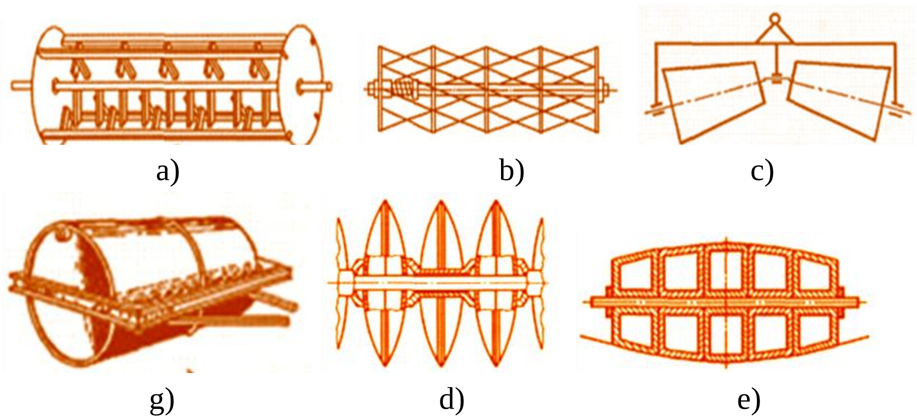

Figure 1. The main types of soil compacting working parts.

compacting working parts, respectively, are a-plank; b – steel rope; v – conical; g-cylindrical; d - disk; e – barrel-shaped compactors

Steel-rope compaction working parts (Figure 1, b) consist of a series of movable and fixed discs mounted on an axle, with steel ropes placed using a sliding sleeve in the mesh. The steel ropes in these compaction working parts are arranged in a screw-like, intersecting, and parallel manner. Such compaction working parts are designed to crush large soil clods, and they are positioned on the soil surface, primarily compacting the soil surface itself.

Conical compaction working parts (Figure 1, c) are made in the shape of a truncated cone. These compaction working parts are equipped with various additional working components, which improve the soil loosening quality. In terms of operating principle, conical compaction working parts are almost identical to cylindrical compaction working parts.

Cylindrical compaction working parts (Figure 1, g) can have a smooth surface or be made up of elastic working components, bulges, spirals, and teeth. The drawback of smooth compaction working parts is the formation of a hard soil layer after compacting moist clayey soil. Smooth-surfaced compaction working parts do not effectively crush or break up the soil; instead, they apply pressure to the upper layer of the soil. Depending on the design, additional working parts can be installed to not only crush and break up the soil effectively but also to loosen the upper soil layer.

Disk compaction working parts- (Fig. 1, d) consists of spherical disks, which are installed in a pair with the concave side to each other along a straight line or in a checkerboard pattern.

Barrel compacting working parts-(Fig. 1, e) the working surface will be symmetrically constructed from the logarithmic slope, depending on the center of the compacting working body. Such compacting working parts consist of a set of wheels, each of which has the shape of a truncated ellipsoid when it rotates.

The shape of the soil surface can be changed into smooth, furrowed, grooved or bumpy forms when it is traversed by different tillage compaction working parts. Therefore, the profile shape of compacting working parts is selected based on climatic conditions and soil properties.

According to their effect on the soil, the katoks are divided into compacting, softening, crushing, leveling and universal types.

According to the method of energy use, it is divided into active, passive and combined types. Depending on the shape of the cross section, it is distinguished as elliptical, rhombic, rectangular, circular and trapezoidal. Most of the tillage compaction implements are generally used for the condition of flat fields.

The studies conducted were conducted using existing methods. At present, the farms specializing in rice cultivation are using existing machines and devices or their adapted versions, since special machines for preparing the land for planting rice have not been developed.

3. Results

In order to study the existing technologies used in the formation of floors in rice cultivation, researches were conducted on a farm specializing in rice cultivation in Pakhtaabad district of Andijan region (Fig. 2). Analysis of the obtained results, based on currently available technologies, when preparing land for planting rice, the area plowed for planting rice is first leveled with a basic leveler, and the floor is taken with the help of tools and hands (Fig. 2, a, b). Then, the resulting floors are watered, treated with a harrow, prepared for planting and the seeds are sown.

When preparing the field for planting as a repeated crop, the areas cleared of grain crops are cleaned of grain residues and plowed to a depth of 15-20 cm. The plowed field is chiseled and leveled with a trowel, and the floor is formed with the help of adapted floor extraction devices and by hand (Fig. 2, a and b).

Then it is watered, harrowed and prepared for planting, and seeds are sown or seedlings are planted.

a) b)

Figure 2. Processes of land preparation for rice planting.
a)-manual flooring processes; b)-the process of obtaining a floor using devices

The quality of the longitudinal and transverse floors in the fields where rice is planted depends primarily on the fact that the preliminary soil treatment process is carried out based on agrotechnical requirements.

4. Discussion

When The quality of the longitudinal and transverse floors in the fields where rice is planted depends primarily on the fact that the preliminary soil treatment process is carried out based on agrotechnical requirements.

If the soil is tilled when there is not enough moisture in the soil, large pieces of soil are separated in the tilled area, the resistance of the working bodies to the traction increases, because a lot of energy is required to cut and grind the soil layers with the help of the working bodies. In turn, high humidity also leads to an increase in frictional forces.

Irregularities in rice fields prevent the field from receiving even water, causing rice plants in some floors to become dehydrated or not drink water at all. The best way to prevent this is to get longitudinal and transverse floors in the right place and in sufficient quantity.

The following requirements are set for obtaining a floor in rice fields:

a. Floors are taken where required;
b. Taken at the specified height and width when creating floors;
c. Floors should be strong and sufficiently dense to retain water in the field.

It should be noted that the technical means of creating a longitudinal floor in rice fields do not have devices for compacting the floors, so that their strength is not ensured. It leads to densification and increase in strength through additional processing. This, in turn, causes a decrease in the efficiency of the performed technological process and excessive costs. Failure to prepare the land for rice planting in time, failure to plant seedlings and seeds at the appointed time, will cause productivity to decrease several times.

5. Conclusion

The development of energy-efficient devices with high productivity for creating a floor in rice fields is crucial, as current devices create a longitudinal floor but lack compacting mechanisms, compromising strength and durability. To address this, new constructions of compacting working bodies must be developed to ensure quality and longevity. The absence of compacting devices necessitates additional manual labor and processing, leading to decreased efficiency and increased costs. Furthermore, delays in land preparation for rice planting result in postponed sowing of seedlings and seeds, significantly reducing productivity.

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