INTERNATIONAL JOURNAL OF DISCOURSE ON INNOVATION, INTEGRATION AND EDUCATION

Volume: 01 Issue: 02 | September 2020 ISSN: 2181-1067

http://summusjournals.uz/index.php/ijdiie

EFFECT OF QUALITY TREATMENT ON SOIL MOISTURE STORAGE AND SEED GROWTH

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ABSTRACT: The article examines the effect of soil moisture on seed germination before sowing of winter wheat between rows of cotton on the results of experimental studies. Technology and technical means have been proposed to prevent evaporation of soil moisture and increase moisture reserves

KEYWORDS: Soil, soil fraction, seed germination, germination, specific resistance, hardness

1. INTRODUCTION

Quality tillage should have a positive effect on the moisture reserve, density and level of compaction of the soil, ensuring full germination of seeds in a short period of time. In recent years, in our country and in other countries, great importance is attached to the study of moisture, density and its interaction with other physical, physicochemical and biological processes that ensure the development of plants.

Currently, the use of cotton cultivators in the sowing of winter wheat on cotton fields does not show a sufficient level of quality and efficiency. This is confirmed by the results of field studies on soil compaction, seed germination rate (Table 1).

Table 1

The degree of compaction of the soil between the rows treated with a self-cultivator

№	Number of passes, once	Soil fractions, %			
		>50 mm	50-25mm	25-10mm	10>mm
1	One time	25,4	41,6	20,2	12,8
2	Two times	11,6	37,5	37,6	13,3

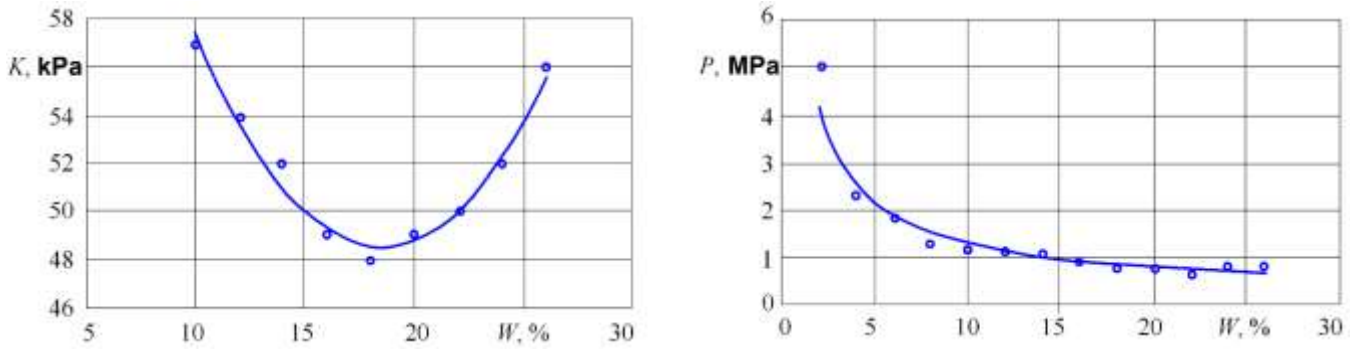
Field studies revealed the preservation of large fractions in the 1st and 2nd transitions of the cotton cultivator, an increase in soil moisture before the sowing period, an increase in water demand and late, sparse germination of seeds (Fig. 1).

Figure 1. Influence of large fractions on seed germination

It is difficult to know the essence of quality tillage without a sufficient understanding of the importance of the level of moisture, density and porosity of the soil between the rows of cultivated cotton in plant life. To do this, quality tillage technology should be evaluated by the efficiency of the workpieces, the efficiency criteria - the quality of the treated soil and moisture reserves.

Experimental studies have shown that during the cultivation period, the formation of large lumps of the fractional composition at values of soil moisture less than 8-11%, hardness 1.6-2.0 MPa and more, and grain does not fully meet the requirements of agro-technical conditions. In chronometric observations carried out in the places where most of the spraying methods were used, it was observed that the working parts of the cultivator did not sink well due to poor quality tillage and hardness of the soil in one pass, and 2-3 penetrations of the soil in preparation for planting. As a result, it was found that the sown seeds are not buried to the same depth, do not mix well with the soil, the quality of sowing is low, and the germination rate is low due to rising humidity. Observations in the fields sown with winter wheat showed that the seeds were sown at a depth of 0-15 cm, and germination was delayed by 25-30 days due to the fact that they were not buried up to 30%.

Analysis of the results of preliminary experimental studies showed that the increase in drag resistance of working parts in areas with low humidity makes it difficult to cut the soil layer. As a result of the analyzes, empirical correlations were established representing the effect of soil moisture on hardness and specific resistance (Fig. 2).



$$K = 0{,}1255W^2 - 4{,}6361W + 91{,}316 \qquad P = 6{,}7536W^{-0{,}7096}$$

Figure 2. Variation of soil specific resistance (K) and hardness (R) with respect to moisture (W)

The effect of spraying and the proposed narrow (7.5… 8.0 cm) row sowing methods on seed germination dynamics, which are used in field research and observed to a depth of 5-6 cm, was observed in experimental fields once treated with a cotton cultivator. The results of the observations showed that the germination of seedlings was delayed by 10-20 days, the germination of all seeds was delayed by 30 days due to the increase in humidity in the sown areas compared to the sown areas (Fig. 3).

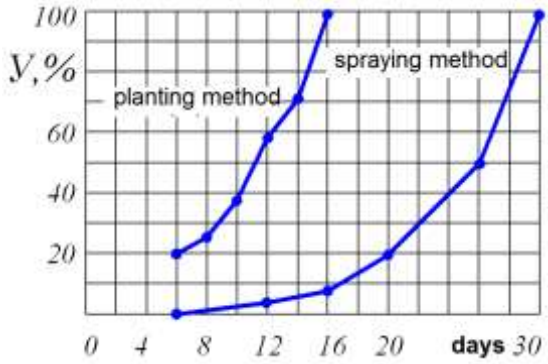


Figure 3. Dynamics of field germination of seeds in relation to moisture

Based on the above research, an energy-efficient technology has been developed to increase the quality of intercropping, soil compaction, water permeability and moisture reserves before sowing winter wheat (Figure 4).

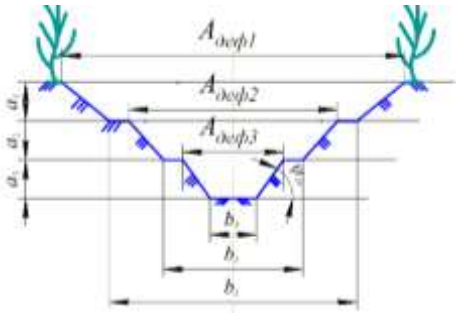


Figure 4. Cross-section profile between the rows, softened according to the proposed technology

The presented technology provides for layered tillage. The novelty of the technology is that it is carried out under the condition that the width of the tillage between the rows is the same.

$$b1>b2>bz \qquad (1)$$

where b1, b2, b3, - widths of processing of the first, second and third layers, respectively, cm.

The energy efficiency of the technology is characterized by the fact that the zone of deformation in each soil layer passes through the softened zone in the transverse and longitudinal sections.

To do this, the layered processing width is subject to the following expressions

$$b1=b2 + 2a2ctg\Psi yon$$
$$b2=bz + 2a3ctg\Psi yon \qquad (2)$$
$$b3=bq+2Luvtg\beta ctg\Psi yon$$

where a1, a2, a3 are the first, second and third layers of soil, cm; Luv - lifting height before soil erosion, cm; bq is the width of the softening layer, cm; β is the angle of rise of the soil to crushing, grad; Ψyon is the angle of refraction of the soil, grad.

In order to maintain the profile of the inter-row profile, the cutting and crushing operations of the soil layers are carried out in one pass of the working parts. As a result, it is formed between a well-crushed and softened row, which retains the shape of the edge. This technology provides quality and low energy consumption between the lines.

An adapted unit has been developed to implement the proposed technology. The technical novelty of the combined unit is protected on the basis of the certificate of authorship [1].

The combined unit consists of a frame 1, a grid 2, a column 3 with a lock 3 and teeth 5, 6, 7 and a blade 8 mounted on them with a soil layer (Fig. 5). The working part of the unit is designed for layered tillage in the form of double-sided 7 and three-sided 5, 6 pins.

In order to ensure the quality of the soil during pre-sowing tillage and the importance of the working depth of the workpieces, the grill is equipped with a blade 8, which acts as a support wheel. The 8 forms of the roller have the parameters corresponding to the profile between the rows, and are made in a design equipped with cutting and grinding blades. During the machining process, the knife blade grinds the space between the rows to a high quality.

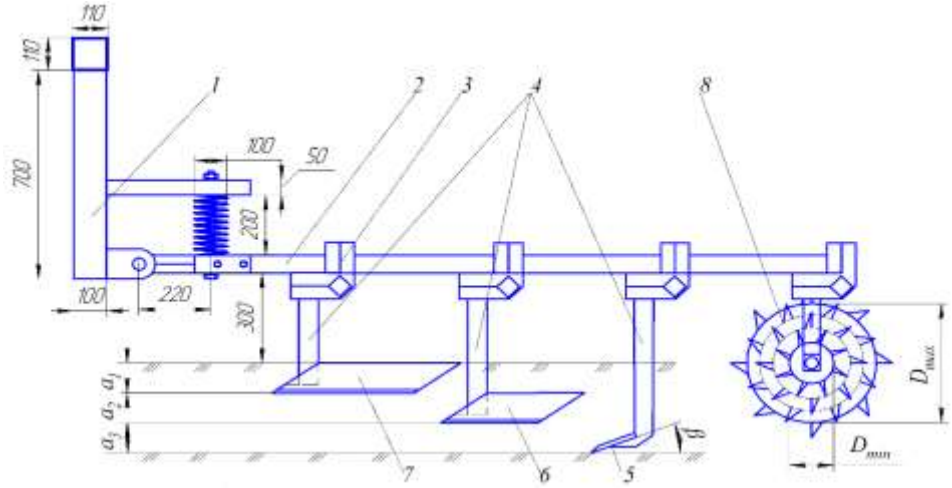


Figure 5. Scheme of construction and parameters of pre-sowing combined aggregate working parts
1-frame; 2-gryadil; 3-lock; 4-columns: 5-double-sided teeth; 6.7-sided teeth;
8-blade roller

Preliminary studies show that as a result of mathematical processing of the measured values, the shape of the inter-row profiles (Fig. 6) varied in depth from 12.5 to 17.0 cm, with an average value of about 13.5 cm [2].

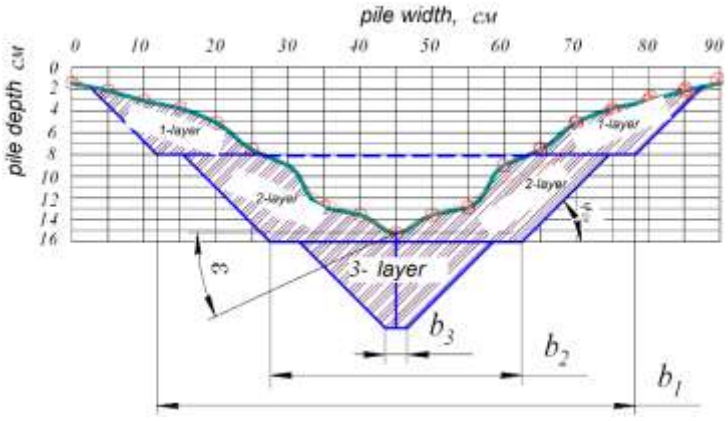


Figure 6. Scheme of distribution of processing volume by layers

Based on the results obtained, the distribution of the processing volume by layers was developed (Figure 6). From Fig. 6 we can see that the first layer corresponds to the edge of the ridge, the second layer to the right and left of the arrow line between the rows of cotton, and the third layer to a depth greater than the depth of the previously formed ridge. The proposed technology and technical means of intercropping allow to soften the soil, increase moisture reserves, and germinate seeds quickly in a comfortable environment. This can be done at the expense of uncomplicated constructive re-equipment of the central section of the cotton cultivator.

The proposed combined aggregate working tools were prepared and placed in one section according to Figure 5. Extensive testing is currently planned.

Conclusion

The passage of deformation in the cross-section and longitudinal section of the softened zone in layered tillage is an energy-efficient technology that provides high-quality soil compaction, increased water permeability and reserves, rapid germination of sown seeds.

Moisture reserve of the soil and germination of seeds can be achieved in the selected parameters according to the profile between the rows of layered tillage workers.

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