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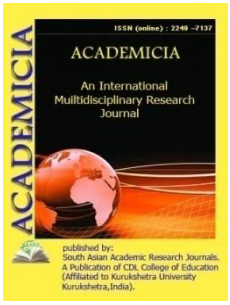

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RESEARCH IMPACT OF DRIVING SYSTEMS OF TRACTORS AND WORKING BODIES OF TILLAGE MACHINES ON SOIL

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ABSTRACT

The article presents the results of a study of the impact of the running systems of tractors and working bodies of tillage machines on the development of the root system of farmland and on productivity. It has been established that the presence of a compacted layer in the subsoil leads to the suppression of microbiological processes and depletes the soil in nutrients. Additional loosening of the subsoil horizon contributes to increased crop yields.

KEYWORDS: *MTA Running Systems, Impacts, Compaction, Loosening, Crop Yield.*

INTRODUCTION

With the intensification of agricultural production processes, the problem of the compacting effect of machine-tractor units (MTA) on the soil arose. Multiple passes through the field of tractors, combines and other mobile equipment led to the spraying of the upper and compaction of the lower layers of the soil, which negatively affected its fertility and crop productivity.

Studies [1] found that during agricultural work, the MTA running systems cover with tracks from 40 to 80% of the field surface, and the headlands are exposed to 8-10 times impact. Due to the increase in the mass of tractors and agricultural machines, not only the arable, but also the subsurface horizons are compacted. As a result of compaction, erosion processes intensify, soil density and its resistance to processing increase by 1.5-2 and 1.3-1.9 times, respectively, and the total and capillary porosity of the fertile layer decreases.

Studies [2] also found that an increase in soil density and hardness leads to a decrease in the vital activity of soil microflora and, as a result, to a shortage of 20-40% of the crop. In connection

with the excessive use of moldboard plows and other working bodies, the so-called "plow bottom" is formed, which prevents the penetration of irrigation water, precipitation into the underlying layers and the evaporation of excess moisture from the lower horizons. This contributes to the development of water erosion on sloping lands, and on the plains and lowlands - the formation of wet "saucers" in which melt and rainwater stagnate. All of the above negative factors led to the degradation of the fertile soil layer and the expansion of the area of erosion processes. The fight against over consolidation is closely related to both the ecological stability of arable land and the ecology of the environment in general. Therefore, according to the authors of [3], the ecological assessment of the state of arable land, as well as various technologies of mechanical soil cultivation, in the future should prevail over all others.

Soil compaction is highly dependent on the farming system. In primitive agriculture, the soil can experience only small loads with multiple passes of agricultural implements, while with a high degree of mechanization, it is accompanied by large loads on the soil.

In cotton cultivation, the soil profile consists of arable and subsoil layers. The periodically cultivated topsoil covers the subsoil, which is loosened much less frequently or not at all. This leads to dramatic changes in bulk density in the soil profile.

Compaction of the soil can reach a depth of 30-60 cm. The soil is compacted when the wheels of tractors act on it to the depth of the arable layer. All researchers point out that the greatest compaction from the tractors' passes is exposed to the surface layers of the soil from 0 to 20 cm, subsequent passes through the field cause a weak compaction in the upper layers compared to the previous one and an increase in density in the deeper ones.

It has been established that the compacting effect of the running systems of tractors and machines on the soil depends, on the one hand, on the humus content of the soils, their particle size distribution, structure, moisture and other physical properties, the nature of agricultural use and, on the other hand, on the design of the tractor and its running system, on its mass, specific pressure, axle load, slippage, travel speed, tire brand or track and suspension structure. The greatest soil compaction occurs most often in two cases: with excessive moisture and when machines are moving on freshly worked soil. It has also been established [4] when the soil is compacted, the filtration coefficient drops sharply due to a decrease in the number of non-capillary pores, aeration deteriorates and the concentration of carbon dioxide in the soil air increases. According to the authors of [5], an increase in soil density leads to a decrease in the moisture available for plants in the moisture content of a stable set.

By numerous passes of agricultural machines in the soil, the root system of plants develops poorly, the rate of root elongation decreases, the roots are strongly deformed, bent and have less branching. Compaction of the soil reduces the germination of seeds, increases the duration of germination and ultimately lengthens the growing season of plants.

At present, the study of the impact of running systems in the field on changes in physical, mechanical and technological characteristics, soil fertility and crop productivity is carried out mainly by three methods: “continuous rolling”, “on the track outside the track” and “general assessment”. The methods developed [4] for determining the characteristics of the processes occurring in the propeller-soil system made it possible to establish that the running systems of the tractor, by compacting the soil, as a result, affect the yield. It was found that with an increase

in the compaction effect on the soil, the yield of agricultural crops decreases. These data were obtained using the “continuous rolling” technique.

In medium loamy soils, the influence of the running systems of tractors on the agrophysical properties and productivity of agricultural crops was studied by the author of works [6]. He found that the compaction deformation extends to a depth of 40 cm and the plow layer deforms to a greater extent than the sub-plow layer, and its main compaction is noted during the first pass of the tractor. In the subsoil, permanent deformation accumulates. The increase in density in a layer of 20-40 cm after 10 passes of tractors for 5 years, even on physically ripe soil, is from 0.05 to 0.13 g / cm ^{3} .

The researcher also notes the deterioration of the soil conditions of plant life after the passage of tractors: the development of spring crops also deteriorates, the growth rate of plants slows down, the passage of development phases lengthens, and the accumulation of organic matter is slower.

This article studied the negative impact of the running systems of tractors and working bodies of tillage machines on the development of the root system of cotton and the cotton harvest. It has been established that the presence of a compacted layer in the subsoil leads to the suppression of microbiological processes and depletes the soil in nutrients.

Studies have found that most researchers propose measures that limit the compacting effect of the running systems of agricultural machines on the soil. They believe that the fight against soil overconsolidation should be carried out by improving the physical conditions of soil fertility, i.e. the cultivation of soil layers, the improvement of the technology of cultivation of agricultural crops and the design of machine-tractor units.

Studies have also established that so far the permissible loads on the soil have not been determined, and the properties of the soil when calculating the propellers are taken into account in terms of the limit of the bearing capacity without limiting the degree of its compaction and the requirements of crops for the physical conditions of fertility.

Therefore, the study of the harmful compacting effect of agricultural machinery on the soil, on the basis of which the development of methods and techniques for reducing the mechanical impact is the most important national economic task.

In laboratory-field experiments carried out on the takyr soils of the Karaulbazar massif, with an average soil hardness of 3.5-4.0 MPa, absolute moisture content of 12-13%, the traction resistance of the two-story plow PYa-3-35 was more than 30 kN. The increase in traction resistance is due to the formation of a compacted core on the plow blade and solid blocks. At the same time, the movement of the layer cut by the share on the dump becomes difficult, the soil deformation occurs with a compacted core. Taking this into account, in the subsoil, where the soil density is, as a rule, overestimated, working bodies should be used that exclude the formation of a compacted soil core.

Studies have established that the formation of a compacted soil core was found in front of the subsoiler strut and the soil-dredging share in the working area of the plow sole. To exclude this phenomenon, we used knives-rippers with an opening angle of 45 ^{0} as a working body of the soil deepener .

It was also found that additional loosening of the subsoil horizon contributes to an increase in cotton yield by 2.3-4.5 c / ha. An increased soil compaction of headlands was established, where its hardness reaches 1.95-2.80 MPa.

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