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Reduction Of Soil Compression Making Friable Tractor Trace At Pre-Sowing Soil Preparation

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ABSTRACT

The article is devoted to the analysis of technology for cultivation of agricultural crops in case of the Republic of Karakalpakstan, and research results of MTA's passage impact on the change of main physical soil features are provided. Along with this the structure and working principle of offered trace-loosen scratcher for «Magnum-8940» for soil loosening along tractor's wheel tracks. The trace-loosen scratcher fairly suits the tractor "Magnum-8940".

KEYWORDS

System, passage-soil-crop, the negative impact of tractor's passage, change of soil features, solidity, soil hardness, loosening.

INTRODUCTION

During cotton cultivating in case of the Republic of Karakalpakstan measures directed to get a rich harvest of cotton and other growing are defined. One of the most importance refers to pre-sowing preparation of soil which includes loosening and levelling

of field surface, in conjunction with soil compression till optimal meanings. In case of qualified realization of these operations congenial conditions for amicable shoots, their growth in the vegetative period, are

created and will outcome positive impact on the harvest of cultivated crops [1].

However, it is known that irrigated soils in Central Asia have a high tendency to compression under tractor and agricultural machines' passage, irrigation and cultivation because of their poor humus content and structure [2].

MATERIALS AND METHODS

In conditions of the Republic of Karakalpakstan, a technology of cultivating agriculture crops provides a high number of tractors and machines' passage that leads to deterioration of physic-mechanical and agro physical characteristics of soil followed by tracks. The last is defined as an increase of solidity and hardness of soil's productive layer, clodiness and quantity of erosion-hazardous parts along with other negative effects reducing fertility and productivity of agricultural crops.

According to this, the field experiments were provided in both Uzbek scientific research institute of mechanization and electrification in agriculture (USRIMEA) and Karakalpak scientific research institute of agriculture named after Sh. Musaev (KSRIA) during 1998-1999 years. It studied the impact of "Magnum-8940" tractor's passage, made by "Case" company of USA and is currently used in the Republic of Karakalpakstan, on physical-mechanic characteristics of the soil. The experiments on spring follow were carried out in experimental farmland of KSRIA in early spring period after washing irrigation and

USRIMEA in soil preparation for cotton sowing along land background plagued in autumn for spring sowing [3].

The front tires were fitted with GOOD YEAR 15.9 R30 with an air pressure of 0.16 MPa, the rear – with GOOD YEAR 710/70 R38 with an air pressure of 0.18 MPa.

The soil of KSRIA experimental land is old-irrigated, medium salted, meadow type with a depth of subsoil water between 2.0...2.5m, by mechanical composition – medium argillaceous. In USRIMEA the land is old irrigated serozem with a depth of grand water between 10...15m, by mechanical composition – medium loamy, the relief is even.

RESULTS AND DISCUSSION

In order to assess the impact of tractors' passage on soil its density and hardness, footprints depth and width, rut's transverse section was determined. The solidity was found by the method of sampling with cutting cylinder in the layer between 0...60cm, with 10cm interval, hardness – by hardness measurer of VICHM design with a point of 1cm² square in the same layer with the same interval.

To determine the size of rut's wheel the profilograms of soil surface were taken. The damp ground in horizons of 0...10, 10...20, 20...30, 30...40, 40...50 and 50...60 cm was 16,3; 17,7; 18,4; 20,0; 20,9 and 21,53 % respectively. The study results are provided in Tables 1 and 2, and studies held in USRIMEA fields – in Tables 3 and 4.

Table 1. The study results

horizon, cm	Soil density, g/cm ³		Soil hardness, MPa	
	Out of tracks	On tracks	Out of tracks	On tracks
0... 10	0,90	-	0,19	-
10... 20	1,09	1,55	0,67	2,73
20... 30	1,12	1,64	1,09	3,61
30... 40	1,17	1,58	1,25	3,53
40... 50	1,51	1,51	2,87	2,92
50... 60	1,46	1,47	2,15	2,26

Table 2. The study results

figure	meaning, cm	
	average	deviation
Depth of tracks	15,3	0,58
Width of tracks	69,2	0,66

Table 3. The study results

horizon, cm	Soil density, g/cm ³		Soil hardness, MPa	
	Out of tracks	On tracks	Out of tracks	On tracks
0... 10	1,07	-	0,58	-
10... 20	1,21	1,38	0,96	1,67
20... 30	1,24	1,45	1,18	2,05
30... 40	1,25	1,43	1,36	1,89
40... 50	1,37	1,38	1,65	1,68
50... 60	1,33	1,35	1,53	1,58

Table 4. The study results

figure	meaning, cm	
	average	deviation
Depth of tracks	10,72	0,39
Width of tracks	69,08	0,50

Analyzing data from Tables 1, 3, it follows that when soil being harrowed with aggregate “Magnum-8940” under its wheels there is significant compression of the soil. The solidity on footprints of passage in the horizon of 0...40 cm rises its optimal measure (1,1...1,3 g/cm³), which provides the most comfortable

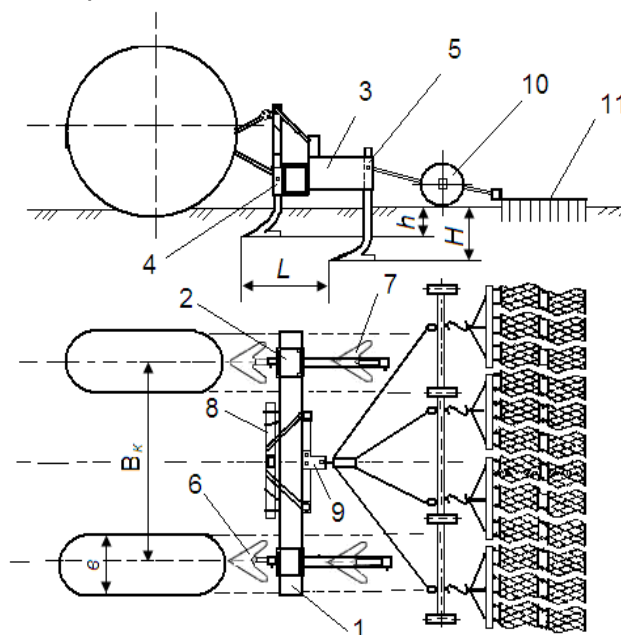
conditions for the growth of crops. Here the highest solidity of wheel footprints was found in 20...30 cm layer with the amount of 1,64 g/cm³. Moreover, it was established that the main soil compression occurs after the first

passage, and tractors follow passages on the same footprint give less increase of soil solidity and hardness.

Measurements demonstrated the rut till 15 cm in depth and approximately 70 cm in width after the passage of “Magnum-8940” tractor (tables 2, 4). As a result, while cultivating crops’ seeds are not covered steadily according to an ordered depth that does not allow to get proper shoots, crops grow slowly and give poor harvest in reform places.

Provided materials are evidence of the negative influence of “Magnum-8940” tractor’s passage on the soil in the zone of salted land, mainly in washing water-lands in Karakalpakstan.

In accordance with this, the USRIMEA has developed a trace-loosen scraters for «Magnum-8940» which provides soil loosening along tractor’s wheel tracks (look at the picture).



Picture. Scheme of harrowing aggregate for “Magnum-8940” tractor with trace-loosen scraters 1-girder, 2-holder, 3-bracket, 4 and 5-front and rear holders for working parts, 6 and 7-working parts of the top and bottom layer, 8-scraters tilt, 9-clamp, 10-harrows’ clutch, 11-harrow.

This aggregate is mainly used in the period of preparation of the soil to sowing along with machines and tools for pre-sowing soil preparation (such as harrowing aggregate, leveller and so on).

Trace-loosen scraters, demonstrated in the picture below, contains girder 1, which is fastened to bracket 3 with a holder that has front 4 and rear 5 holders aimed to fix sowing

tools 7 of the bottom layer. Girder 1 is linked to tilt mechanism of a tractor with tilt 8. In

order to provide track loosen scraters’ work with different width of rut working parts on girder are linked with displacement ability along its axis and clamp 9 to fix to crossbeam of cultivating machines and aggregates.

The trace-loosen scraters works according followed. By moving holders 2 on girder 1 working parts 6 and 7 are fixed on tractor’s

track. Driving to the field they are fixed till necessary depth. The depth of their movement is regulated by the prop of working parts 6 and 7 on holders 4 and 5.

CONCLUSION

With an aim to define the impact of pre-sowing aggregate for the soil on track-loosen scraper's agro technical figures experiments were held in the field using toothed harrow as agricultural pre-sowing implements.

It is established that the combination of track-loosen scraper with toothed harrow significantly improves the quality of soil loosening. Moreover, the trace surface's profile becomes even and get the level of field surface, which has not been compressed under wheels. The solidity of the soil before cultivation reaches 1.59g/cm^3 in the average arable horizon (0...30cm). After cultivation with track-loosen scraper this number declined in an optimal interval of $1.16\text{...}1.19\text{g/cm}^3$.

Then, usage of track-loosen scraper provides soil decompression after wheel trace along with aggregation with tools for pre-sowing preparation of soil.

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