IMPACT OF AGRICULTURES OF TRAFFIC OVER PHISICAL OF MECHANICAL PROPERTIES OF SOIL IN OVER CROP YIELD

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Abstract

Anthropic soil compaction is a consequence of exaggerated traffic due to soil works, transport activities etc. In order to evaluate how the soil physical properties and the crop yield are affected by the traffic of the agricultural units soil compaction was evaluated for the autumn wheat. For each variant the bulk density and soil penetration resistance were measured, as well as the average weighted diameter and the hydric stability of the soil elements; the crop yield was also evaluated. Based on the experimental results the best variant was established, taking into account soil compaction.

Key words: soil, compaction, structure damage

Anthropogenic soil compaction occurs due to excessive traffic, irrational, made in the field to carry out agricultural works, transport or otherwise. This compaction is favored by using machines with high mass and high pressure on soil, increasing the number of passes on the soil, increase tire pressure, and largely the work undertaken and traffic on wet soil.

MATERIAL AND METHOD

In order to know the extent to which physicaland mechanical characteristics of soil and agricultural production of crops are affected by trafficking machinery have been studies that were pursued by different variants of the degree of soil compaction in autumn wheat crop. In order to know the extent to which attributes within each experimental variations on the degree of compaction were determined soil bulk density, its resistance to penetration, the weighted average diameter of the elements of soil structure, humidity stability of these elements and production of wheat per hectare. In the table 1 are experimental variations on the degree of soil compaction. Moldboard plow PP-3-30 used in aggregate with the farm tractor U-650. The complex aggregate AGPS-24DR, composed of rotating cutter Breviglieri FRB-3 and the universal pneumatics sowing SPU-24DR, worked in aggregate with the Valtra tractor T-90.

It states that this experience has been made in the agricultural year 2009-2010. It should be noted that machines to make tillage soil, seedbed preparation and sowing were made above, whereas on previous experience in this case established that best results are obtained compared with other types of machines.

In order to obtain various degrees of compaction (the experimental versions V2 and V3 from the *table 1*), the soil was compacted before the tillage soil.

Table 1

The experimental variations on the degree of soil compaction in the autumn wheat

Machinery used for tillage and sowing	The degree of soil compaction	The experimental variants
• moldboard plow PP-3-30 • complex aggregate AGPS-24DR (tillage cutter FRB-3 + sowing machine SPU-24DR)	without compaction	V_1 (control sample)
	one compaction	V_2
	twice compaction	V_3

Soil compaction without soil tillage once or twice, was done by the tractor Valtra T-190, so with its wheels. The tractor was driven so as to achieve ago near the end (after rear wheel), thus performing 100% of the surface land subsidence (no more and no less) to the compaction once and the compaction twice.

Experiments were conducted on a chernozem cambic soil type mezocalcaric weak bill degraded loamy clay texture and apparent density average values and humidity.

Longitudinal slope of the land was 1.5 - 2 degrees, prior to the sunflower plant.

After 10 days of wheat sowing, each experimental variant were determined four

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indicators of soil compaction and structure, and the wheat harvest was established seed production per hectare.

RESULTS AND DISCUSSIONS

In monofactoriale made to follow the influence of experience level of the index of soil compaction on soil compaction (bulk density of soil and soil resistance to penetration) and structure (weighted average diameter of the elements of soil structure and stability of retention of these elements) and the production of wheat per hectare. The results obtained in this experiment will be described below.

Soil apparent density. The experimental results obtained on this index, which shows how compaction (bulk) is the soil are presented in the *table 2*. The table shows the apparent density of soil for various depths (0-10 cm, 10-20 cm, 20-30 cm, 30-40 cm) and average value on the 0-40 cm depth.

The lowest values of soil apparent density were obtained from V_1 variant, if without compaction soil and highest values, the V_3 variant, where the soil was sunk twice by the tractor Valtra T-190. One can also notice that the apparent density of soil in all variants increases as depth increases. The biggest difference in terms of soil apparent density is found between soil layers 0-10 cm and 10-20 cm. This is because the soil layer 0-10 cm active cutter bodies acted FRB-3, causing a more pronounced loosening soil.

Table 2

Apparent density of the soil after sowing the autumn wheat

The experimental variants	Depth (cm)				
	0 - 10	10 - 20	20 - 30	30 - 40	Average (0 – 40)
	Apparent density of the soil (g/cm^3)				
V_1 - control sample	1.101	1.369	1.382	1.453	1.326
V_2	1.237	1.441	1.457	1.484	1.405
V_3	1.331	1.504	1.578	1.674	1.522

Agro-technical requirements determine that the soil bapparent density for clay loamy texture should be from 1.05 g/cm^3 to 1.58 g/cm^3. *Table 2* shows that soil apparent density values correspond to practically all the options and requirements for all depths, except the depth of 30-40 cm in the V_3 variant. Agro-technical requirements shows that apparent density is low (slightly bulk soil) it has a value of 1.19 to 1.31 g/cm^3, middle (low soil compaction) when has a value of 1.32 to 1.45 g/cm^3 (variants V_1 and V_2) and high (moderate soil compaction) when has a value of 1.46 to 1.58 g/cm^3 (variant V_3). We mention that for employment in different categories of soil variations on apparent density value was given to its average for the four depths. We believe it is important that even if the soil was compaction twice by the tractor Valtra T-190, soil apparent density is appropriate.

First, with the lowest apparent density (the best) are the V_1 variant.

Soil penetration resistance. And this index, like the previous one, shows the extent to which the soil was compacted. Results of the experiments, soil penetration resistance data are presented in the *table 3*.

Table 3

Soil penetration resistance after sowing the autumn wheat

The experimental variants	Depth (cm)								
	0-5	5-10	10-15	15-20	20-25	25-30	30-35	35-40	Average (0 – 40)
	Soil penetration resistance (MPa)								
V_1 - control sample	0.103	0.155	0.170	0.105	0.255	0.327	0.385	0.417	1,326
V_2	0.164	0.257	0.257	0.313	0.347	0.385	0.422	0.479	1,405
V_3	0.272	0.321	0.323	0.362	0.386	0.458	0.547	0.611	1,522

This soil penetration resistance is presented on eight depths (five centimeters) and average of this resistance on depth 0-40 cm.

It is noted that the lowest values of soil penetration resistance were obtained from variant V_1, where the soil was not compaction, and the highest values, the variant V_3 in this case the soil is compaction twice by the tractor Valtra T-190.

It also notes that soil penetration resistance at all experimental variants, increases with increasing depth.

It should be noted that agro-technical requirements provide several classes of soil penetration resistance values: very low resistance to penetration below = 1.1 MPa, lower = 1.1 to 2.5 MPa, medium = 2.5 to 5.0 MPa, high = 5.1 to 10 MPa, high = 10.1 to 15 MPa, very high = 15 MPa. If these requirements are compared with results obtained agro, it appears that soil resistance to penetration is "very small" (very good) in all variants and all depths. Agro-technical rules established that the resistance of the soil up to 2.5 MPa penetration plant roots grow normally. Comparing the results with these requirements are found in all versions and all depths are conditions for normal growth of plant roots of wheat. In this index, first, with the lowest penetration resistance (best) is situated variant V_1.

Weighted average diameter of the structural elements of the soil. This index shows the extent to which structural elements of soil have degraded. In the *table 4* are presented the results in terms of weighted average diameter of the structural elements of the soil in three ways. The values of this index structure has three soil depths (0-10 cm, 10-20 cm and 20-30 cm) and the average index in the depth 0-30 cm.

Table 4

Weighted average diameter of the structural elements of the soil after sowing the autumn wheat

The experimental variants	Depth (cm)			
	0 - 10	10 - 20	20 - 30	Average (0 – 40)
	Weighted average diameter of the structural elements (mm)			
V_1 - control sample	3.138	3.921	4.105	3.720
V_2	2.579	3.240	3.919	3.240
V_3	2.478	2.779	3.244	2.830

Analyzing the results shows that the highest values of the weighted average diameter of the structural elements of the soil were made at V_1 variant, where the soil was not compaction, and the lowest values, the V_3 variant, which the soil was twice compaction before the moldboard, with the Valtra T-190 tractor.

It is also noted, however, that the weighted average diameter of the structural elements of the soil increases as depth increases. This is explained by the fact that the surface structure degradation is increasing due to fragmentation of its elements by active movable parts of the soil tillage machinery.Agro-technical requirements established for several classes of values weighted average diameter of the structural elements of the soil: very good weighted average diameter = 2-5 mm, good = 1-2 and 5-7 mm, acceptable = 0.25 - 1 and 7 - 10 mm, poorly = below 0.25 and above 10 mm. By comparing these requirements with the results, it appears that the weighted average diameter of the structural elements of the soil is very good at all options and all depths.

Considering the average values of the weighted average diameter of the structural elements of the soil, it was established that first, the weighted average diameter closest to 3.5 (mid-range 2...5), lies variant V_1.

The moisture stability of soil structure elements - the index I_1. And this also indicates the previous index, shows the degree of degradation of soil structure elements. The *table 5* presents the experimental results obtained on the retention of its structural stability of the soil. This index was determined at three depths (0-10 cm, 10-20 cm and 20-30 cm), the table is presented to the average, the depth of 0-30 cm.Given the results established that the highest index values I_1 were made in the V_1 variant and lowest values, the V_3 variant.

It also notes that moisture stability of the structural elements of the soil (index I_1) increases with increasing depth. The explanation was given to the weighted average diameter of the structural elements of the soil. There is, however, that increasing the index I_1 is much higher at the beginning, ie the transition from depth 0-10 cm depth of 10-20 cm, because the first layer of soil (0-10 cm) acted more types of organ active, fragmenting structure elements. Agro-technical rules provide for retention index I_1 stability of the structure, several classes of values: I1 indicate the value 3-5 = very good structure, indicating the

value from 0.61 to 3 = good structure etc. Given the agro-technical requirements and the average values in the table, it appears that soil structure is very good alternative variants V_1 and V_2 and V_3 good. First, the index I_1 closest 4 (mid-range 3 5), V_1 variant is located on the 2nd, variant V_2, and the number 3, variant V_3. Production of wheat per hectare. It should be noted first that seed production depends on many factors, among them is the system of tillage was applied. The *table 6* contains the results on seed production of wheat produced in different versions on the degree of soil compaction.

Table 5

The moisture stability of soil structure elements - the index I_1 after sowing the autumn wheat

The experimental variants	Depth (cm)			
	0 - 10	10 - 20	20 - 30	Average (0 – 40)
	The moisture stability of soil structure elements (the index I_1)			
V_1 - control sample	1.904	4.327	4.578	3.603
V_2	1.432	3.356	4.045	2.944
V_3	1.118	3.215	3.705	2.679

Table 6

The seed production of the autumn wheat

The experimental variants	The seed production (kg/ha)
V_1 - control sample	5834.660
V_2	4518.680
V_3	025.340

Most seed production of wheat seed was obtained from variant V_1 (soil without compaction) = 5834.660 kg/ha. The second option lies V_2 (one compaction) = 4518.680 kg/ha, and the third, variant V3 (ground sunk twice) = 4025.340 kg / ha. It is clear that soil compaction causes a drop in production of wheat seed.

CONCLUSIONS

Soil apparent density lowest (best) was recorded at the V_1 variant, and most, the V_2 variant. In all versions and all depths of the apparent density is appropriate. Soil resistance to penetration is very low (very good) in all versions and all depths. The lowest values of this index were obtained for the V_4 variant, and the larger the V_3 variant.

Weighted average diameter of the structural elements of the soil is very good at all options and all depths. The ranks first the V_1 variant, and the last, the V_3 variant. The moisture stability of soil structure elements (index I_1) is very good alternative to V_1 variant and good for the V_2 and V_3 variants. The ranks first the V_1 variant, 2nd, the V_2 variant and 3rd, the V_3 variant. Most seed production of wheat per hectare was obtained from the V_1 variant, and lowest in the V_3 variant.

It is noted that the variant who have obtained the best results is V_1.

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