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THE IMPACT OF DIFFERENT TILLAGE SYSTEMS ON THE QUALITATIVE INDICATORS OF SOWING WORKS AND WHEAT CULTURAL DEVELOPERS

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Abstract

Soil tillage methods have complex effects on the physical, chemical and biological properties of the soil with the influence on the crop. In the paper it was proposed to study the effect that agricultural works for the preparation of the germination bed have on the work of sowing wheat or the degree of sunrise. The studies started in the southwestern part of Olt County, on an area of 4.5 hectares divided into plots of 0.5 hectares. Germination bed preparation works were carried out on each plot as follows: conventional works for autumn sowing, land covered with mowed vegetable waste (TAV), reduced work using heavy disc harrows on land covered with plant debris (LDG), work with harrow with vertical rotors. (LGR). After the execution of the works for each plot, the soil moisture, the degree of crushing, the degree of compaction, the uniformity of the incorporation depth of the seeds were determined. The study will be continued by tracking the crop throughout the growing season, including crop production.

Key words*: soil tillage methods, TAV, LDG, LGR.*

INTRODUCTION

Soil tillage methods have complex effects on the physical, chemical and biological properties of the soil. Due to changes in the physical and chemical properties of the soil through tillage methods, the biological properties of the soil can also change. These changes are indirect results of tillage. The modified physical and chemical properties of the soil through soil tillage methods affect parameters directly related to soil microbial activities such as organic matter, soil moisture, temperature and ventilation, as well as the degree of interaction between soil minerals and organic matter. As a result of these effects, significant differences can be observed in the population of soil microbial activities (Wardle, 1995; Lavelle, 2000; Kladivko, 2001; Sagar et al., 2001).

In this study, the effects of three different tillage systems on the degree of plant emergence were investigated.

MATERIALS AND METHODS

Land area of 4.5 hectares
CLASS CELTIS 446 RC Tractor
Plug PP 3-30 + star harrow type GS-1,2
V3 type heavy disc harrow
GRC type 3 rotary harrow
SUP seed drills 29
Wheat GLOSA variety with MMB = 43 g
Humidometer type Delta-T Devices Hh2 Moisture Meter
Penetrometer type Fieldscout SC900
Three granulometric sieves with a diameter of 25 mm orifices; 50 mm and 100 mm respectively, a frame with an area of 1 m^2 presented below:

Field of study

This study was carried out on a soil in the southern part of Olt County on an area of 4.5 hectares which is an agricultural company. According to the soil taxonomy classification system, the soils are chernozem zonal, whose properties are presented in table no.1 Soils are simple and almost simple, inclined 0 + 1% and deeply profiled, located on very old alluvial subsoil.

Climate conditions

The land surface, which is in the temperate-transitional continental climate zone, has a mild winter with frosty days and nights, along with climate change, slightly humid. Free from rain and snow a dry and hot summer climate.

According to the average climate data of 30 years, the average annual temperature is 19.1°C.

The field work was carried out on 1.5 hectares sub-plots on which different methods of tillage were applied. Three tillage methods were established and each tillage method was replicated three times, yielding 18 sublots. Each plot was 12 m wide and 40 m long, covering an area of 480 m.

Soil tillage methods

Three different tillage methods were applied in this study. These methods were conventional soil tillage with residues (TAV), reduced heavy tillage (LDG) tillage, low tillage with rotary rotor harrow (LDR). These methods have been replicated three times. Details of the tillage operations applied for Glosa winter wheat are given in Table 2.

Prior to the determination of the qualitative work and energy indices, the soil parameters and the conditions under which the experiments were carried out were determined, respectively the resistance of the soil to penetration, the degree of crushing and the soil moisture.

Table 1 shows the soil moisture values at 3 test points, at a depth of 30 cm, maximum working depth.

To determine the degree of compaction of the soil, the resistance to penetration was determined using a penetrometer provided with a rod with a penetration cone of 1 cm^2 and 60° the top angle to which the rod was attached to the cone by screwing and mounting them to the "data logger".

The measurements were performed to a depth of 30 cm, at an average humidity of 12.36%.

The distribution of the forces of resistance to the penetration of the cone in the soil layers, in kPa measured in 5 test points, is presented in Table 2.

Table 1. Measured soil moisture values

Measuring depth, cm	Humidity value, %
10	12.50
20	12.80
30	11.80
Average	**12.36**

Table 2. Determined values for penetration resistance

Measuring depth, cm	No. test/Resistance to penetration, kPa					
	1	2	3	4	5	Mediated
10	75	95	125	115	105	103
20.0	210	350	455	350	312	335
30.0	512	650	680	775	665	656

Soil resistance to penetration is classified according to the I.C.P.A. methodology, middle class (260-500) kPa.

The SUP 29 seed drill has been set for 270 kg/ hectare, respectively position C-18 in the Northon box, and the distance between rows of 12.5 cm. At the sowing test, the grains were counted for 1 m^2 of sowing, the result being 558-560 seeds/m^2.

RESULTS AND DISCUSSIONS

Degree of soil shredding

To determine the degree of crushing of the soil, three sieves with a diameter of 25 mm were used; 50 mm and 100 mm, respectively, a frame with an area of 1 m^2, and a food dynamometer for weighing.

By size fractions, for each plot on which the experiments were performed it is presented in Table 3.

Table 3 Degree of soil shredding

Degree of crushing	Agricultural work	Value, %		
		Fractions below 25 mm	Fractions between 25-50 mm	Fractions over 50 mm
Subplot no. 1	• Chopping vegetable waste • Plowing 28 cm + harrowing • Sowing wheat to a depth of 4 cm	71	17	12
Subplot no. 2	• Chopping vegetable waste • Disc with heavy disc harrow 16-18 cm (2 times) • Sowing wheat to a depth of 4 cm	76	15	9
Subplot no. 3	• Chopping vegetable waste • Processed soil with a rotary harrow 16-18 cm • Sowing wheat to a depth of 4 cm	82	16	2

The establishment of culture

The SUP 29 sowing machine was regained for the amount of 270 kg/hectare, respectively position C-18 in the Northon box, and the distance between rows of 12.5 cm.

At the sowing test, the seeds were counted for 1 m^2 of sowing, the result being 558-560 seeds/m^2.

Land preparation before sowing

Figure 1. Disc with heavy disc harrow 16-18 cm (2 times)

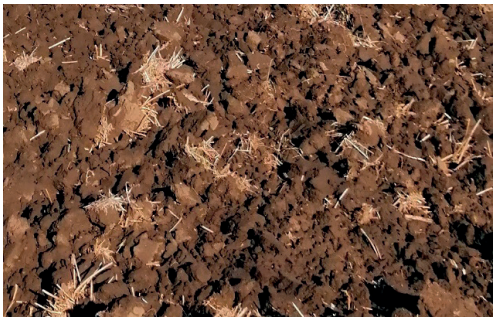

Figure 2. Chopping vegetable waste Plowing 28 cm + harrowing

Figure 3. Processed soil with a rotary harrow 16-18 cm

Determination of the degree of emergence

It was done by counting the plants grown on an area of 1 m^2.

Figure 4. Sunrise after 10 days

Figure 5. Sunrise after 10 days

Figure 6. Sunrise after 10 days

Figure 7. Sunrise after 10 days General view for thesurface of 4.5 ha

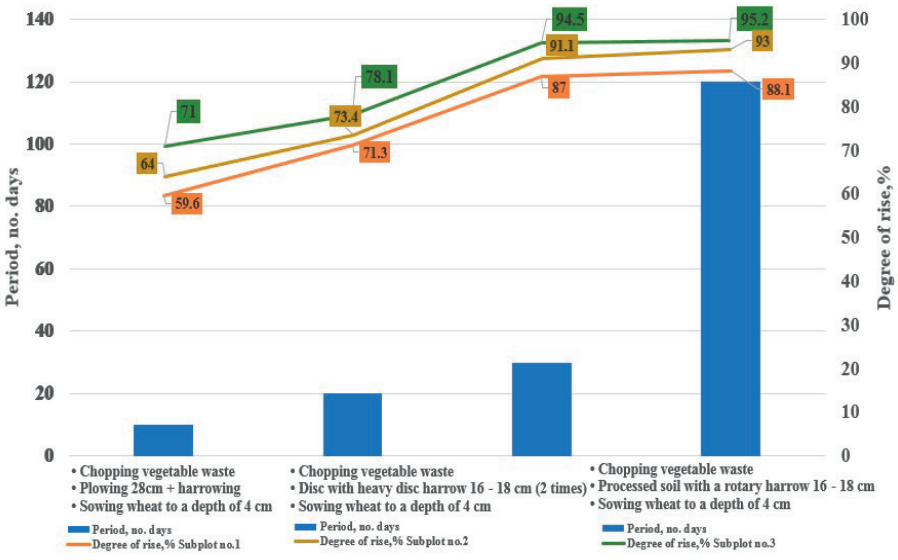

Figure 8. Degree of emergence after 10, days, 20 days, 30 days, 120 days depending on the land preparation works

Table 4. Statistical-mathematical analysis of the degree of seed germination

No	Groups	Frequencies	Relative frequencies	Cumulative absolute frequencies	Cumulative relative frequencies
1	59-66	2	0.17	2	0.17
2	67-74	3	0.25	5	0.42
3	75-82	1	0.08	6	0.50
4	83-90	2	0.17	8	0.67
5	91-98	4	0.33	12	1.00
	Total	12			

From the statistical-mathematical analysis by grouping the statistical data by intervals, we can interpret that only 33% of the sown grains emerged between 91-98% representing the highest percentage.

We can also observe that after analyzing the absolute cumulative frequencies, 8% of the grains manage to achieve an emergence of up to 82%, representing 50% of the total grains according to the cumulative relative frequencies, and 25% of these grains emerge in a percentage between 67-74% (Table 4).

A percentage of 17% rose in a percentage of 59-66% and 83-90%, respectively.

The degree of emergence is thus influenced by the agricultural works performed for the preparation of the germination bed

CONCLUSIONS

In this study, the effects of three different tillage methods on germination and wheat germination. Every effect the soil is subjected to has positive or negative reactions. Soil is a living, dynamic system whose physical, chemical, and biological properties are constantly interacting with each other, and changes in any properties affect other properties. By tillage, the chemical and biological characteristics of the soil are also affected due to the physical manipulation to which the soil has been subjected.

The results of the study showed that most of the physical properties of the soil are adversely affected by conventional tillage methods to which three tillage operations apply. There were differences between tillage methods and these differences proved to be significant.

In general, the best results related to the degree of germination of wheat crop were obtained with rotary rotor harrow (LDR). (LDG), led to a decrease in the degree of emergence and even a uniformity of emergence

From similar studies, the effects of tillage methods may differ depending on climatic, regional and environmental factors. These factors must be taken into account before applying the tillage methods. Otherwise germination and emergence are affected. It can be considered that in the year in which the study was carried out the decrease in the degree of emergence was also influenced by climatic conditions and lack of humidity and low temperatures.

It is recommended that the method of preparing the germination bed with a rotary harrow (LDR) can be used for tillage.

REFERENCES

Guş, P., Rusu, T., Ileana B. (2003). *Sisteme convenţionale şi neconvenţionale de lucrare a solului.* Editura Risoprint, Cluj Napoca

Leonte, P. (2011). *Dinamica agregatelor complexe de pregătirea patului germinativ pentru reducerea consumurilor energetice şi protecţia solului*, Teza de doctorat, Universitatea Transilvania, Braşov

Mărunţelu, I., Rus, F. (2017). Determining the soil compaction degree by measuring the penetration resistance. In: *Proceeding of the 7th International Conference Computational Mechanics and Virtual Engineering, COMEC 2017*, Braşov, November 2017, Vol. II, pp.43- 47

Mihalache, M. (2006). *Pedologie - geneză, proprietăţile şi taxonomia solurilor*, Editura Ceres, Bucureşti.

Ţopa, D. (2010). *Influenţa unor sisteme neconvenţionale de lucrare a solului asupra însuşirilor productive ale acestuia*. Teza de doctorat, USAMV, Iaşi

***https://www.recolte.eu/arhive/harta-diferitelor-tipuri-de-soluri-din romania9508.html, 17.05.1019

***https://www.finantariagricole.ro/sfat/pregatirea-patului-germinativ/, acces. 28.11.2018 [137]

***https://www.icpa.ro/documente/coduri/Cum_poate_fi_lucrat_solul.pdf, acces. 28.11.2018