THE INFLUENCE OF AGRICULTURAL WORKS ON SOIL PROPERTIES IN SÂNANDREI, TIMIȘ COUNTY

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Abstract. *The studies were carried out outside the built-up area of Sânandrei commune, during 2022 and 2023. This paper addresses a pressing problem, namely the influence that agricultural works have on the soil and especially on its physical properties. Two of the most representative types of soil are chosen in terms of the occupied areas on the territory of Sânandrei commune, soils that have in the middle of the soil profile, a layer richer in clay (Bt), a layer of soil that is harder to work and that is impermeable to water and air and to the roots of plants. The depth at which this horizon appears, however, is different, in the preluvosols it is found in the first 20-30 cm, but the clay content is lower compared to the phaeosem, at which it appears below 75 cm, but whose clay content is much more significant and the roots of the plants can have problems. These researches were oriented towards determining and knowing the physical properties of two types of soils taken in the study, namely, Preluvosols and Phaeozem, soils on which corn for grains and wheat were grown. Knowing the physical properties of these soils will help us to look for solutions for the use of high-performance tractors and agricultural machinery in the future that do not lead to soil compaction and degradation of important physical, physical-mechanical and water properties, such as the degradation of the soil structure, the decrease of total porosity and soil aeration, cutting the capillarity of the soil, that is, to try to take the necessary measures to increase the production capacity of these soils and therefore to obtain higher and good quality productions.*

Keywords*: agricultural works, soil, physical properties, Sânandrei*

INTRODUCTION

Tillage is the main link in crop technology (TONEA CORNELIA, 2005). With the passage of time, as a result of the increase in population and food requirements, man was forced to cultivate larger and larger areas, thus expanding the area of crops (ȚĂRĂU A., ET AL., 2014). Over time, this led to a worsening of the soil's properties, due to the exaggerated number of passages on the one hand and the weight of agricultural machinery and machinery at inadequate humidity on the other hand (VĂJE, P.I. 2007).

Even if over time, the main purpose of agricultural works was to obtain high and good quality productions, lately, due to a complex of pedo-climatic factors, it is necessary to preserve and improve the soil, without destroying ecosystems and the environment (ȘTEFANIC GH., 1999; Țărău D. ET AL 2007

When carried out at appropriate humidities, tillage improves the physical condition of the soil, thus ensuring favorable conditions for the activity of soil bacteria and ensuring good soil aeration. This also causes soil fertility to increase, with crop plants and soil microorganisms thus finding favorable conditions for growth and development (GRUHN, P., ET AL., 2000; VANLAUWE, B., ET AL., 2010).

As a result of numerous studies and researches carried out over time, it has been observed that agricultural machinery has a great influence on soil properties and especially on the physical, physical-mechanical and hydrological ones, from decreasing the degree of compaction and obtaining lower values of density and bulk density to a good structuring of the soil and obtaining higher values in terms of soil porosity (KATALIN JUHOS, ET AL., 2015; IANOȘ GH.,

PUȘCĂ I., ET AL., 1994; ELIAS, E. 2002). All this leads to the creation of favorable conditions for the activity of microorganisms that carry out a faster release of nutrients from the soil (KI LATO, ET AL., 2010).

Considering the above, the paper addresses the influence that these agricultural works have on the main physical properties of two types of soil that have a greater spread, namely Hapludalfs and Phaeozems on the territory of Sânandrei commune in two different periods of the year, spring and autumn for corn and wheat crops ((VIORICA ROBU, ET AL., 2016). Thus, in the spring and autumn of 2023, ploughing and weeding works were carried out.

The locality of Sânandrei is part of Timiș County and is located at a distance of 12 km north of the municipality of Timișoara (VIORICA ROBU, ET AL., 2016). The commune is composed of the villages of Carani and Covaci and is crossed by the county road DJ692, which 4 km to the south connects with the national road DN69 Timișoara – Arad (figure 1).

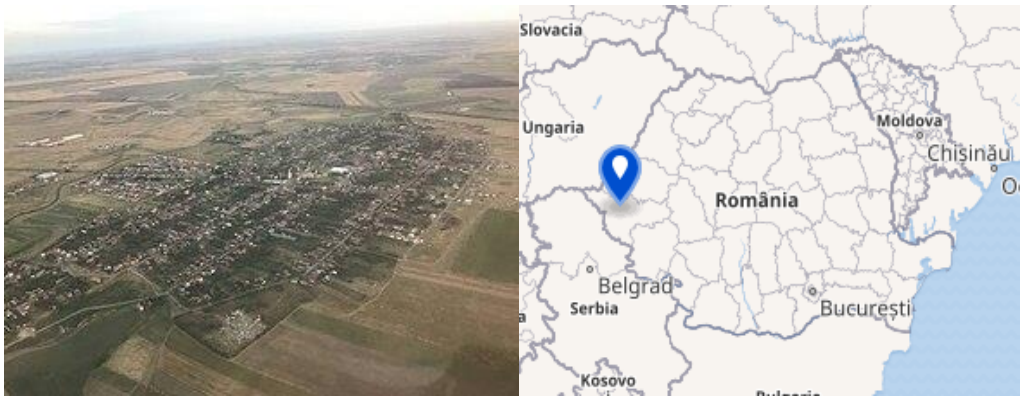

Fig. 1. The locality of Sânandrei at the level of our country

The soils in the researched area were formed in the conditions of a moderate temperate continental climate. The forest-steppe vegetation caused a moderate accumulation of humus. The humidity from the precipitation favored the alteration and leaching processes (GOIAN M., IANOȘ GH. ET AL., 1993; DUMA-COPCEA ANIȘOARA, ET AL., 2013). The calcium carbonate was eluviated from the upper part of the profile and deposited in an accumulation horizon below the limit of 80 cm deep. The leaching of calcium carbonate and lighter colloidal clay is followed by a partial debasification of the clay-humic complex (MIHALACHE M., 2006; NIȚĂ LUCIAN-DUMITRU, 2007).

MATERIAL AND METHODS

Two of the basic crops in the Sânandrei area were chosen, corn and wheat. The soil samples were taken in two different periods of the year, respectively spring, in april, and autumn, in october.

The analyses were carried out in accordance with the current STAS.

The determination of the main physical properties of the soils was carried out on soil samples collected in natural settlement, on two depths: 0-20 and 20-40 cm.

The studies were carried out on two representative soil types: Hapludalfs and Phaeozems.

The soil samples were taken at two times of the year: in autumn, in October, after the ploughing work, and in spring, at the end of April, after the weeding work, for two crops: Corn and Wheat, both on preluvosol and on phaeozyom.

RESULTS AND DISCUSSIONS

1. Results regarding the study area

According to the data obtained from the Sânandrei City Hall and those on the OSPA Timișoara website, as well as the information acquired as a result of consulting the specialized bibliography, the cadastral area is 9240 ha, of which almost 90%, i.e. 8227 ha, which represents 89.04% of the studied territory is represented by agricultural land and only 0.25% by forest, that is, 23 ha. This fact is primarily due to its geographical location, in the Vinga Plain, which has the appearance of a large plateau, with low heights, formed by different flat-bottomed valleys or crovs (FLOREA N., 1985).

Following the numerous field trips, it was concluded that the main soil types identified are those shown in table 1.

Table 1.

The main types of soil in the perimeter of Sânandrei commune

Nr. Crt.	Soil class	Type of soil	Total area, in ha
1	Molisols	Chernozems	9240
		Phaeozems	
2	Luvisols	Hapludalfs	
		Haplic Luvisols	
3	Cambisols	Eutric Cambisols	
4	Vertisols	Vertisols	
5	Anthrosols	Anthrosols	
6	Hidrisols	Gleysols	
7	Alfisols	Solonetz	
8	Soil associations		

2. Tillage studies

As a result of the extension of some soil degradation processes due to the practice of conventional agriculture and technological mistakes (made over the years), the so-called "conservative agricultural technologies" have been studied and implemented in practice, which have contributed over time to the improvement and a real improvement of the fertility and productivity status of the soils and the environment in general.

The most important component of the conservative technological systems is the tillage, namely the way of loosening, processing and sowing.

The transition from conventional tillage systems to conservative ones was not easy and gave rise to a lot of questions to which pertinent, scientifically well-founded answers were needed, some of them being obtained through fundamental and applied research carried out in specific local conditions.

The agricultural works were carried out at different times of the year, depending on the crop. For both crops, the plowing was done in autumn, in September immediately after the land was released, while the work was done at the end of September for the wheat crop and in April for the corn crop.

3. Studies on the determination of physical properties of the hapludalfs and phaeozems

Density - is determined by the ratio of the weight of the unit volume of the solid phase (CANARACHE A. 1997).

In 2022 and 2023, soil samples were collected at depths of 0-20 cm and 20-40 cm to calculate soil density. In tables 2. and 3. data on soil density are presented.

Table 2.

Determination of soil density (g/cm^3), on Preluvosol

Crop	The month in which the samples were collected	Depth of sample collection (cm)	Years	
			2022	2023
Corn	April	0-20	2.42	2.43
		20-40	2.43	2.44
	October	0-20	2.45	2.46
		20-40	2.46	2.47
Wheat	Aprilie	0-20	2.44	2.43
		20-40	2.45	2.45
	October	0-20	2.45	2.46
		20-40	2.47	2.47

From the data presented above, it can be seen that, on Hapludafs, the soil density recorded values between 2.42 g/cm^3, at 0-20 cm ad for corn in April 2022 and 2.47 g/cm^3, at 20-40 cm ad, in October 2022 and 2023.

Table 3.

Determination of soil density (g/cm^3), on Phaeozems

Crop	Month	Deep. (cm)	Years	
			2022	2023
Corn	April	0-20	2.45	2.46
		20-40	2.46	2.47
	October	0-20	2.46	2.47
		20-40	2.48	2.48
Wheat	April	0-20	2.44	2.45
		20-40	2.45	2.46
	October	0-20	2.45	2.46
		20-40	2.47	2.49

On Faeoziom, the density had values between 2.44 g/cm3, in 2022 for corn, at 0-20 cm, in April 2022 and 2.49 g/cm3, for Wheat, on ad. 20-40 cm, in October 2023.

The bulk density defines the weight of the unit of total volume, pores and particles, so it depends especially on the degree of loosening of the soil.

Determining the bulk density of the soil is essential for the evaluation of the chemical composition, soil compaction, porosity and reservation of various specific soil components. Bulk density values are shown in Table 4. and 5.

Table 4.

Determination of the apparent density of the soil (g/cm3), at Hapludalfs

Crop	Month	Depth (cm)	Years	
			2022	2023
Corn	April	0-20	1.17	1.18
		20-40	1.18	1.19
	October	0-20	1.18	1.19
		20-40	1.20	1.21
Wheat	April	0-20	1.14	1.15
		20-40	1.16	1.17
	October	0-20	1.18	1.19
		20-40	1.20	1.21

Table 5 shows that, at Hapludalfs, the bulk density of the soil recorded values between 1.14 g/cm3, at 0-20 cm for wheat, in April 2023 and 1.20 g/cm3, at 20-40 cm, in October 2022 and 2023.

Table 5.

Determination of the apparent density of the soil (g/cm3), on Phaeozems

Crop	Month	Depth (cm)	Years	
			2022	2023
Corn	April	0-20	1.27	1.28
		20-40	1.28	1.29
	October	0-20	1.30	1.31
		20-40	1.33	1.34
Wheat	April	0-20	1.26	1.27
		20-40	1.28	1.29
	October	0-20	1.27	1.28
		20-40	1.30	1.30

On Faeoziom, the values of the bulk density of the soil ranged from 1.26 g/cm3, for corn, at ad. 0-20 cm, in April 2022 to 1.35 g/cm3, at ad. 20-40 cm, in October 2023.

Another indicator of the relative volume of pores in the soil is total porosity. There is a link between bulk density and total porosity that can be used to classify soils according to porosity.

Soil total porosity is essential because plants and microorganisms can only live within certain limits of soil aeration and moisture. The values of the total porosity level are presented in Table 6 and 7.

Table 6.

Determination of total soil porosity (%), at Hapludalfs

Crop	Month	Depth (cm)	Years	
			2022	**2023**
Corn	April	0-20	45	45
		20-40	44	44
	October	0-20	43	43
		20-40	42	41
Wheat	April	0-20	49	47
		20-40	47	46
	October	0-20	46	45
		20-40	45	44

The Hapludalfs had total porosity values between 41%, for the corn crop with a depth of 20-40 cm, in October 2023 and 49%, for the wheat crop, at ad. 0-20 cm, in April 2022.

Table 7.

Determination of total soil porosity (%), on Phaeosems

Crop	Month	Depth (cm)	Years	
			2022	2023
Corn	April	0-20	45	44
		20-40	42	41
	October	0-20	42	41
		20-40	41	40
Wheat	April	0-20	46	47
		20-40	45	45
	October	0-20	44	45
		20-40	44	45

On Phaeozems, the total porosity values were 41%, in corn, in ad. 20-40 cm, in October 2022, and for wheat, on ad. 0-20 cm, in April 2023, the values reached 47%.

Determination of aeration porosity (AP)

Like total porosity and aeration porosity, it is of great importance for plants and especially for corn. When the AP values are low, the roots cannot grow and do not develop properly, which leads to a decrease in yields (tables 8 and 9).

Table 8.

Determination of aeration porosity (PA) in Hapludalfs

Crop	Month	Depth (cm)	Years	
			2022	2023
Corn	April	0-20	13,90	13,30
		20-40	12,60	12,00
	October	0-20	12,70	11,40
		20-40	12,10	10,90
Wheat	April	0-20	14,30	14,40
		20-40	13,70	13,90
	October	0-20	13,90	14,10
		20-40	13,40	13,30

On Hapludalfs, the aeration porosity was 10.90% for corn at 20-40 cm in October 2023 and 14.40% for wheat, at 0-20 cm in April 2023.

Table 9.

Determination of aeration porosity (%), in Phaeozems

Crop	Month	Depth (cm)	Years	
			2022	2023
Corn	April	0-20	12,40	12,20
		20-40	11,30	11,00
	October	0-20	10,20	10,10
		20-40	9,40	9,60
Wheat	April	0-20	13,60	13,70
		20-40	12,90	13,10
	October	0-20	12,80	12,90
		20-40	12,10	12,00

On Phaeozems, the soil aeration porosity varied between 9.40% for corn, at a depth of 20-40 cm, in October 2022 and 13.70% for the wheat crop, at a depth of 0-20 cm, in October 2023.

CONCLUSIONS

According to data from the Sânandrei City Hall and OSPA Timișoara, the cadastral area of Sânandrei commune is 9240 ha, of which 8227 ha (89.04%) are agricultural land and 23 ha (0.25%) is occupied by forest. This situation is mainly explained by its geographical location (in the Vinga Plain), which has a flat land with low heights, made up of various flat-bottomed valleys or formed by various crovs.

Tillage is a key element in agricultural technology. As time progressed, due to population growth and the need for food, people were forced to expand the cultivated areas to meet the needs. Over time, this has led to a degradation of soil qualities due to the large number of passes and the weight of agricultural equipment on soils with inadequate moisture. Although previously the focus in agriculture was on obtaining high and quality productions, now it is necessary to preserve and sustainably use the soil, without affecting ecosystems and the environment.

As for the soil types on which these studies were carried out, representative were Hapludalfs and Phaeozoms.

From the data presented, we can conclude the following:

Soil density D. (G/CM3). On the Hapludalfs, it had values between 2.42 g/cm3, at 0-20 cm in corn in April 2022 and 2.47 g/cm3, at 20-40 cm, in October 2022 and 2023. On Phaeozems, the values ranged from 2.44 g/cm3 in 2022 for corn at 0-20 cm in April 2022 and 2.49 g/cm3 for wheat at 20-40 cm in October 2023.

Bulk density – DA. (g/cm3). On the Hapludalfs, it had values of 1.14 g/cm3, at 0-20 cm for wheat, in April 2023 and 1.20 g/cm3, at 20-40 cm, during October. On Phaeozems, the values were 1.26 g/cm3, for corn at ad. 0-20 cm, during April 2022 and 1.35 g/cm3, at ad. 20-40 cm, in October 2023.

Total porosity PT. of the soil (%). On the Hapludalfs it had values between 41%, for corn, at ad. 20-40 cm, in October 2023 and 49%, for wheat, at ad. 0-20 cm, in April 2022. On Phaeozems, the values were 41%, for corn at ad. 20-40 cm, in October 2022 and 47% for wheat, at ad. 0-20 cm, in April 2023.

Aeration porosity PA. (%), On Hapludalfs, it was 10.90%, for corn at ad. 20-40 cm, in October 2023 and 14.40%, for wheat, at ad. 0-20 cm, in April 2023. On Phaeozems, the aeration porosity values were 9.40% for corn, at 20-40 cm ad, in October 2022 and 13.70% for wheat, at ad. 0-20 cm, in April 2023.

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