COMPACTNESS OF THE SUBARABLE LAYER OF CHERNOZEM IN THE PRUT - JIJIA INTERFLUVIUM AREA ON THE LAND EXPLOITED BY S.C. AGROMIXT SPINENI S.R.L., IAȘI COUNTY

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Abstract

Chernozems have been and will continue to be the main support for agricultural production. Chernisols, and in particular chernozems, are the primary favourable factor for the main crops in the area. The aim of the research is to determine the anthropogenic influence, through tillage, on some physical properties of the soil, namely the process of sudden increase of bulk density and decrease of macro porosity, observed in the field through the appearance of the hardpan sub-horizon located immediately below the classical tilled horizon - seedbed preparation-seeding-crop maintenance-harvesting. The climate is characterised by an average annual temperature of 9.5 °C and average annual precipitation of 544 mm. In June 2021 soil samples were collected from each soil pedogenetic horizon from representative locations along a depth of up to 100 cm. In agricultural practice, soil texture is considered to be a virtually unchangeable property or very difficult to change only under certain climatic conditions and over a long period of time, through migration and deposition of clay particles by eluviation and illuviation processes. Following laboratory analysis of the soil samples and processing of the data obtained, it was found that tillage did not contribute to soil texture change in the surface and underlying horizons. Knowledge of soil texture is particularly important as it influences most of the physical properties of the soil, such as plough resistance, porosity, water and air permeability, water holding capacity, etc.

Key words: texture, compactness, chernozem

Soil texture is one of the important physical properties of soil. It represents the percentage combination of soil particles of different diameters in the weight of soil. It is generally divided into three types: sand, silt, and clay. Soil texture affects many dynamic physical properties, such as electrical conductivity (EC), organic carbon, cation exchange capacity, and so on.

The maximum diameter of the elementary particles of coarse sand is 2 mm, which is the separation limit between the soil base and the fine soil. According to the Romanian System of Classification of clay particle size fractions, the limiting diameters of sand, silt and clay are 0.02-2 mm, 0.002-0.02 mm and 0.002 mm. Particle size fraction determination according to the Atterberg scale (1912): sand: 2-0.02 mm; silt: 0.02-0.002 mm; clay: < 0.002 mm (Filipov F., 2005).

The percentage of these fractions in the soil defines the textural class of the soil. Depending on the particle size composition, each pedogenetic horizon can be classified into a group of textural classes, textural class and textural subclass. In Romania, according to the classification given by ICPA (1987), there are three textural class groups, six classes and 23 subclasses.

Texture is the main physical property of soil, with an important role in determining most other physical properties and many chemical properties. Texture is an essentially unchangeable property of soil, so agricultural and soil improvement technologies must take this characteristic into account for each soil type.

Knowledge of soil texture is considered when assessing soil compactness based on the results of bulk density and total porosity values (Canarache A. *et al*, 1990; Florea N. *et al*, 2004, MESP vol. III). Estimation of soil compactness can be carried out in the field by using pedomorphological indicators to describe the soil profile. These indicators are represented by the morphological type of structure, the size of structural aggregates, the degree of structure development, the uniformity of root distribution, the MESP compactness class.

Soil bulk density and shear strength are both related to soil texture and can greatly affect root growth due to mechanical constraints (Barbosa L.C. *et al*, 2018; Cai G. *et al*, 2021; Nunes M.R. *et al*, 2021).

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MATERIAL AND METHOD

For soil sampling on horizons, instead of opening a soil profile, the assembly consisting of a 110 cm long and 10 cm diameter auger is used, which is inserted vertically into the soil with an ATLAS COPCO COBRA drill (*figure 1*). After extraction the soil core, the removable part of the probe is detached and the soil is visualized, cleaned of impurities followed by refreshing and delineation of soil horizons and sub-horizons.

Figure 1 **Auger assembly**

The soil core was extracted from the Tarna land parcel with geographical coordinates determined by the Global Positioning System (GPS) with the following coordinates: latitude- 47o 29´ 35.41´´ N, longitude- 27o 19´ 47.80´´ E and altitude of 139 m. It is located in the upper part of a slope with a 7-10% gradient and eastern exposition, on carbonate diluvial deposit, with groundwater over 5 m deep and moderate overall drainage (*figure 2*).

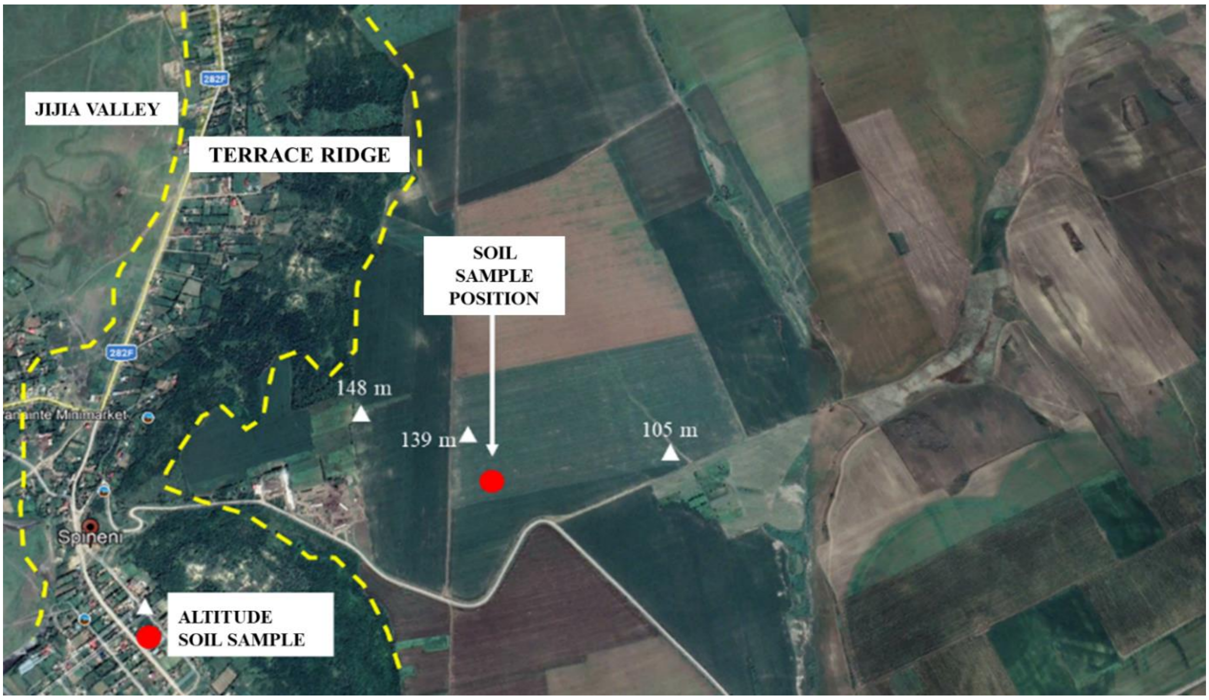

Figure 2 **Geographical location of the soil sample**

RESULTS AND DISCUSSIONS

The soil profile with arable use category is characterised by the following sequence of pedogenetic horizons: Ap (tilled A horizon) - Atp (ploughed A horizon) - Bv-rg (regraded cambic B horizon) - BC (transitional sub-horizon) - Ck (carbonate horizon below 12%) - Cca (carbonate accumulation C horizon) (*figure 3*) with the following morphological characteristics:

Ap 0-17 cm; medium clay loam (40.8% clay); soil reaction is slightly alkaline (pH 8.1), medium humus content (2.29%), low in total nitrogen (0.118%), medium in mobile phosphorus (25 ppm) and good supplied in assimilable potassium (227 ppm); very dark greyish-brown (10YR 3/2) in wet state and dark greyish-brown (10YR 4/2) in dry state; loosened; glomerular - granular; friable in wet state, hard in dry state; non-plastic; non-adhesive; frequent small and medium pores; common thin roots; passage clear;

Atp 17 - 28 cm; medium clay loam (37.6% clay); soil reaction is slightly alkaline (pH 8.1), medium humus content (2.8%), medium in total nitrogen (0. 141%), low in mobile phosphorus (18 ppm) and medium in assimilable potassium (198 ppm); very dark greyish-brown (10YR 3/2) in wet state and dark greyish-brown (10YR 4/2) in dry state; loosened; granular-prismatic compressed; compact; friable in wet state; hard in dry state; very small pores; thin roots; passage clear;

Bv-rg 28-50 cm; medium clay loam (38.2% clay); soil reaction is slightly alkaline (pH 8.2), low humus (1.9%), medium calcium carbonate (8%), very low total nitrogen (0.098%), low mobile phosphorus (11 ppm) and medium assimilable potassium (159 ppm); dark greyish brown colour (10YR 3.5/2) in wet state and dark greyish brown (10YR 4.5/2) in dry state; with very fine $CaCO_3$ capillary films; loosened; medium subangular polyhedron; friable in wet state; hard in dry state; small-medium-frequent pores; frequent crotovines and cervotocines; rare thin roots; gradual passage;

BC 50-70 cm; texture medium clay loam (37.3% clay); soil reaction slightly alkaline (pH 8.3), medium calcium carbonate content (10.2%), colour yellowish brown (10YR 5/4) in wet state, light yellowish brown (10YR 6/4) in dry state; loosened; large subangular polyhedron; friable in wet state; moderately hard in dry state; frequent small to medium pores; frequent coprolitic; rare roots; gradual transition;

Ck 75-85 cm; medium clay loam (43.1% clay); soil reaction is slightly alkaline (pH 8.3), medium calcium carbonate content (11. 8%), wet greyish brown (10YR 5/2) and dry light brownish gray (10YR 6/2); granular, loosened; massive; friable in wet state; hard in dry state; slightly cohesive; slightly plastic; small-medium-frequent pores; $CaCO_3$ as frequent efflorescences; gradual passage;

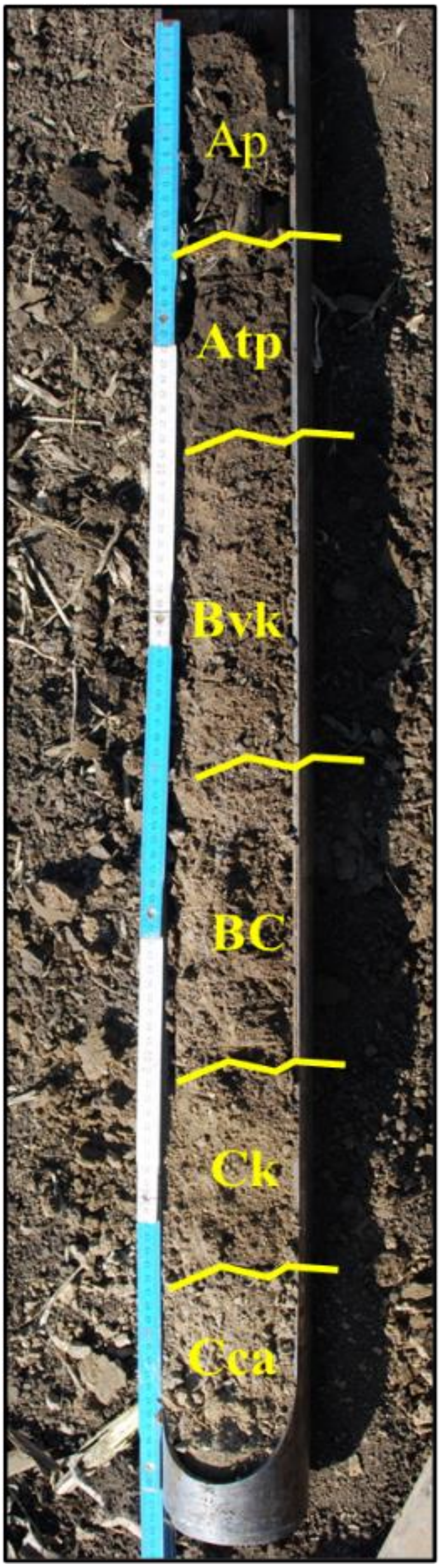

Figure 3 **Macromorphology of soil cores**

Cca 85-120 cm; texture medium clay loam (45.0% clay); soil reaction slightly alkaline (pH 8.3), high calcium carbonate content (19.3%), very pale brown (10YR 7/3) in wet state and light gray (10YR 7/2) in dry state; loosened; massive; friable in wet state; hard in dry state; frequent medium pores; strong effervescence in bulk; $CaCO_3$ in the form of frequent veins, concretions and efflorescences.

According to the Romanian Soil Taxonomy System (SRTS 2012), the studied soil is a strongly regraded cambic chernozem. The topsoil layers have some moderately and strongly modified physical characteristics due to repeated tillage during the growing season and soil tillage systems carried out before to crop cultivation.

CONCLUSIONS

Large and medium-sized polyhedral and prismatic structural aggregates in the subsoil layer indicate considerable soil compactness which is why periodic loosening of the hardpan layer is recommended.

Irregular root distribution, particularly on the sides of the structural aggregates, is another complementary indicator of strong compactness of the subsoil layer.

The current state of compactness of the fine-textured chernozem requires loosening of the sub-arable layer to improve deeper infiltration of the moisture front and root system development.

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