Soil Health Assessment under the Conditions of Practicing the Conservative Farming System

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ABSTRACT

The aim of this paper was to assess soil health in accordance with the requirements of the European Commission through its "Soil and Food Health" (2021) program, in a farm (from the south of Romania) that practices a conservative farming system. A minimum system of soil tillage was applied for the maize crop, in an irrigated system. The fertilizer dose was established as optimal economic (177 kh/ha N, 50 kg/ha P and 22.5 kg/ha K). Soil samples were collected from three profiles, every 10 cm, up to a depth of 50 cm. Soil structural hydrostability (HA) was very high in the first 10 cm (43%) and high up to a depth of 50 cm; the dispersion (D) represented by the microformations with a diameter of <0.01 mm had extremely high values and leaded to very high values of the structural instability index (SI). In all three soil profiles, the texture was dusty-clay, and the carbonate content at a depth of 50 cm had average values (2-8%). The level of nutrient supply is normal and has not been negatively influenced by the production technologies applied. Analyzing the physical and chemical state of the soil, it is possible to appreciate its very good quality, in accordance with the local pedoclimatic conditions and it is capable of providing good quality productions and biomass. The technologies applied through the conservative system have led to a continuous improvement in soil fertility, expressed through the high yields obtained.

Keywords: soil health, alluvial soil, conservative agriculture, fertilization.

INTRODUCTION

Agriculture, a primordial economic branch in the evolution of humanity, carried out all over the globe, depending on the agropedoclimatic and social conditions, has known a multitude of variants, which have allowed a continuous development, being evaluated by its production capacity, by its degree of mechanization, chemicalization and integration and by the impact it had on the environment. Thus, various systems of agriculture have developed, specific to different places, to various historical stages of socio-economic development, with different characteristics, but having a common goal: to increase the production and quality of agricultural production, with a greater degree of stability of the level of production, for an ever-growing population.

The European Commission, in its "Soil and Food Health" programme (2021) appreciates the existence of three farm systems to be developed: 1) organic farms (certified or in the process of certification); 2) integrated crop management system and 3) conservative agriculture: reduced tillage, conservation of stubble and crop residues, cover crops and crop rotation.

Conservative agriculture is scientifically regarded as a holistic concept, which is based on all the components of the technological system: from reduced tillage and fuel consumption to the complex management of plant residues, crop rotation, protective crops, fertilization, irrigation, crop protection, harvesting and transport (Dumitru et al., 2005; Cociu, 2016).

Conservative agriculture excludes conventional tillage by ploughing with furrow turning, requires that the soil surface, throughout the year, be covered (at least 30%) with a live vegetation carpet or vegetable mulch (plant residues from the previous crop), requires long-lasting soil including legumes crops (*Lolium multiflorum,*

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sp. de *Medicago, Trifolium*, contrasting and associative plants: cereals along with nitrogen-fixing and/or cruciferous plants), with moderate and balanced fertilization and effective control of weeds, diseases and pests. Among the most well-known methods of tillage are the following: no-till or direct sowing in stubble, tillage with cizel ploughs and paraploughs, sowing in balls, sowing in strips, working in controlled traffic) under the conditions of keeping on the surface the plant residues from the previous crop (Marinca et al., 2009; Cociu and Alionte, 2011).

Soil conservation practices have significantly reduced the rate of erosion by water and wind. These practices include terraces, residue management, cover crops, soil covers, water and sediment control basins, contour strip crops, grassy wind barriers, and grassy strips as a filter (Loinachan et al., 1999, Cizmaş et al., 2021).

The great diversity of agricultural systems will lead to more or less specific changes in soil characteristics, which requires that when law No. 246/2020 of November 10, 2020 on the use, conservation and protection of the soil is applied, they must be specified and evaluated, because the law requires the issuance of soil quality certificates, which will be entered in the cadastral register.

In order to assess soil quality, various standards have been developed in Romania, which sought to take into account the levels of risk to the environment caused by various concentrations of pollutants (Order 756/1997) or assessed the level of nutrient supply and the physical condition of the soil (Methodology for the development of soil studies, 1987). I think it is very difficult to talk about soil health, but we can talk about soil characteristics and restrictive factors of production capacity and the execution of ecosystem services or soil functions.

In fact, the EUSO Soil Health Dashboard presents the "proportion of land affected by land degradation in the EU". The map shows the number of degradation processes currently in existence, based on a large number of descriptors on the basis of which soil health is assessed: water erosion, wind erosion, tillage erosion, harvest erosion, copper concentration, mercury concentration, nitrogen surplus, phosphorus deficiency, excess phosphorus, soil organic carbon, soil biodiversity, soil compaction, soil salinization, soil cover, peatland degradation, erosion caused by fires, zinc contamination.

New descriptors have been introduced, such as tillage erosion and harvesting erosion, which until now were not evaluated and were assessed as influencing factors for water and wind erosion. We do not see how much they influence soil health and whether research in this direction is worth developing.

The EU Soil Strategy for 2030 estimates that soil is home to more than 25% of all biodiversity on the planet and underpins the food chains that feed humanity and, above it, biodiversity. Under these conditions, it is very difficult to assess whether there is a loss of soil biodiversity, due to the unevenness of soil characteristics and climatic conditions that change the structure of species, due to soil resilience and the diversity of cultivated plants. Kibblewhite et al. (2008) considers that soil health is dependent on the maintenance of four major functions: the carbon cycle, nutrient cycles, maintaining soil structure and counteracting pest and disease activity. Each of these functions manifests itself as an aggregate of a diversity of biological processes supported by a diversity of soil organisms that are interacting under the influence of the abiotic environment in the soil. Measuring individual groups of organisms, processes or soil properties is not enough to show the state of soil health.

Kibblewhite et al. (2007) at the end of the ENVASSO project considered that due to the complexity of the soil ecosystem and the limited current knowledge about the action of soil biodiversity within its functions, it would be naïve at present to choose one or more generic indicators to assess the decline of soil biodiversity.

Under these circumstances, I do not understand what method they applied in assessing soil biodiversity losses that it was possible to assess that many of Romania's soils are diseased (EUSO). No matter how important the biodiversity that is lost through the desiccation of peatlands and the loss of organic soils may be, we cannot say that the remaining and cultivated soils are diseased. At most, we can show that there is some impact on the environment. Just as we cannot appreciate that the renaturation of peatlands leads to the restoration of the health of soils and people.

Some imbalances in the soil are natural, for example there are soils with a deficiency in some microelements (Zn, Fe, Cu), there are soils with a higher load of heavy metals, salty and/or solonetized soils, extremely sandy or clayey soils, naturally eroded soils, soils with excess water, etc. Other negative characteristics of the soil are produced by agricultural technologies: secondary salinization, heavy metal loading, pesticides, nutrient imbalances, excess water, accentuation of erosion, etc.

The soil quality is the ability of a given soil to function within a natural ecosystem or used by man, to support the productivity of plants and animals, to preserve or increase the quality of water and air and to ensure the health of living things and habitats, (Florea and Rizea, 2008). The assessment of soil quality is done on account of a set of measurable indicators.

We appreciate that it is not possible to obtain a soil health certificate but a soil quality certificate.

The European Green Deal has an ambitious roadmap to transform the Union into an attractive and prosperous society with a modern and competitive economy that uses resources efficiently, aims to protect, preserve and enhance the Union's natural capital and protect the health and well-being of citizens. As part of the Green Europe Pact, the Commission adopted the EU Biodiversity Strategy for 2030, the Farm to Fork Strategy, the Zero Pollution Action Plan, the EU Strategy for Adaptation to Climate Change and the EU Soil Strategy for 2030.

Law 246/2020 (Romanian Parliament) requires that the report on the state of soil quality contain information on:

- land history, land uses and location in protected areas;
- pedological observations accompanied by physical, hydrophysical, chemical, agrochemical analysis bulletins and the degree of loading with potentially polluting elements, as the case may be;
- soil quality indicators for establishing the creditworthiness score and classification in quality classes. The creditworthiness note will be established for arable land and for the existing use;
- the existence of archaeological sites protected by law;
- the existence of cultural heritage objectives.

MATERIAL AND METHODS

For this soil quality assessment exercise, soil samples were collected from the Filipoiu farm, located on the Big Island of Brăila, where a conservative agriculture system is applied. The farm has an area of 975.49 ha, of which 82.26 ha are affected by excess moisture and is part of the Filipoiu Complex which has an area of 7517.4 ha, and consists of 7 farms (Stăvilaru, Filipoiu, Rușava, Gemenele, Prundu, Lunca and Corotișca). The relief is made up of a succession of specific micro-relief forms: banks, intergrinds, flat alluvial plains, former lake bottoms, abandoned meadows, japșes, etc.

From a climatic point of view, the Big Island of Brăila from Romania is located within the dry steppe zone, characterized by hot and dry summers due to the continental air masses, being under the influence of high values of solar radiation (125 $Kcal/cm^2$), low rainfall, torrential and unevenly distributed, cold winters without a stable and continuous snow layer and influenced by the Siberian anticyclone.

In the Brăila area, the multiannual climate framework presents the following parameters: annual precipitation (agricultural year) 447 mm, average annual temperature of 10.9°C, potential evapotranspiration of 705 mm and a climatic water deficit of 258 mm. From a bioclimatic point of view, the territory falls within the area of the Danube steppe. The humidity regime is the most important factor of differentiation (zoning) of vegetation in relation to landforms (Dragu et al., cited by Dumitru et al., 2021).

The dominant associations in the Big Island of Brăila are closely correlated with the soil cover and the hydrological and saline regime of the area.

In order to see how we should issue this soil quality certificate, soil samples were collected and analyzed from the Filipoiu farm on the Big Island of Brăila, after the soybean crop. The samples were collected from three points, at depths of 10 every 10 cm, up to a depth of 50 cm. The information on the applied technology was made available by the Agrochemistry Laboratory of the IMB.

The following methods were used to perform the laboratory analyses:

- pH measurement report in aqueous suspension at a 1:2.5 ratio;
- humus: wet oxidatio;
- Nt: total nitrogen, Kjeldahl method;
- P_{AL}: extractable phosphorus in -ammonium acetate-lactate method;
- K_{AL}: extractable potassium in ammonium acetate-lactate;
- $S\text{-}SO_4^{2-}$: soluble sulfates, turbidimetric method;
- P_{Total}: total phosphorus, colorimetric method;
- K_{total}. Total potassium determined by the flame photometric method;
- $T\text{-}NH_4$: total cation exchange capacity;
- structural hydrostability;
- Cu, Zn, Fe, Mn: mobile forms, extracted in ammonium acetate solution - EDTA, Assay by atomic absorption spectrophotometry;
- Zn, Cu, Fe, Mn, Pb, Cr, Co, Ni: total contents by atomic absorption spectrometry;

The interpretation of the results was carried out according to "Methodology of Elaboration of Pedological Studies" (Florea et al., 1987) and "Global Soil Chemistry, Processes, Determinations, Interpretations" (Lăcătușu et al., 2017).

RESULTS AND DISCUSSION

In the exploitation of the Big Island of Brăila there are major risks that can lead to degradation:

- the risk of flooding due to the overflow of the Danube in large floods, which requires permanent maintenance and the careful monitoring of their operation in large floods, in order to be able to take appropriate measures when malfunctions occur;
- the risk of formation of excess water from the aquifer or from rains on the soil surface, if the drainage dewatering network is not properly maintained, in working order, and the accumulated surplus water is not evacuated in time and to the necessary extent; in fact;
- the risk of water deficit in the soil due to climatic moisture deficit (drought), if it is not irrigated properly, according to the phase of crop development;
- the risk of soil degradation by salting, if measures are not taken to prevent the accumulation of salts or measures to periodically wash the salts accumulated in the soil.

The soil are part of two classes: hydrisols and protisols. Hydrisosols (gleiosols of different subtypes) occupy 83 ha. Alluvial soils have the largest share.

The method of preparing the land and fertilizing the corn crop is presented in Table 1. For the maize crop, the optimal economic dose of fertilizers (177 kh/ha N, 50 kg/ha P and 22.5 kg/ha K) was calculated for an achievable production of 9100 kg/ha of corn grains, but the expected production by the farmer was 12800 kg/ha, and the production obtained was 15144 kg/ha, with a difference of 2344 kg/ha (18.3%), which shows a balanced fertilization system that offers a high degree of valorization of the nutrients applied with fertilizersIn addition, after harvesting the corn the soil had a medium content of humus, total nitrogen, mobile phosphorus and mobile potassium.

In irrigation conditions, it is absolutely necessary to apply fractional nitrogen to the soil. Research carried out by Marin (2020) showed that nitrogen is washed out of the soil 6-8 weeks after administration, so at an interval of 5-6 weeks we must fertilize again.

Table 1. Tillage and fertilization in farm

Tillages, Fertilizers	Applied doses	Dose N (kg/ha)	Dose P (kg/ha)	Dose S (kg/ha)
Scarified at 40 cm	-	-	-	-
Processed field with the Joker at 8-10 cm	-	-	-	-
Fertilized with 20.20.0 9S concomitantly with sowing	250 kg/ha	50	50	22.5
Fertilized with UAN (Urea Ammonium Nitrate) liquid fertilizer	184 l/ha	70	-	-
Fertilized with UAN (Urea Ammonium Nitrate) liquid fertilizer by pivot fertigation	150 l/ha	57	-	-
Total		**177**	**50**	**22.5**

The assessment of the data in Table 2 in accordance with the values of these indices presented by Canarache (1990) shows that the structural hydrostability of the soil (HA), represented by structural macroformations stable to the action of water, is high up to a depth of 50 cm. The dispersion (D), represented by the microformations with a diameter of <0.01 mm unstable to the action of water, has extremely high values and leads to very high values of the structural instability index (SI). In all three soil profiles, the texture is clayey-dusty, and the carbonate content at a depth of 50 cm has average values (2-8%) (Table 3). The analyzed data correspond to three soil profiles (Pr1, Pr2, Pr3), each evaluated at multiple depths (0-50 cm) to capture textural and structural variations.

Table 2. Macronutrient content in the soil after harvesting the corn crop

Depth (cm)	pH	Humus (%)	N (%)	P_{AL} (mg/kg)	Pt (%)	K_{AL} (mg/kg)	Kt (%)	$S\text{-}SO_4^{2-}$ (mg/kg)	AH (%)	D (%)	IS
0-10	8.24	3.38	0.226	34	0.116	192	1.24	21	43	24	1
Interpretation	low alkaline	medium	middle	middle	high	middle	good	high	very large	extremely large	very high
10-20	8.25	3.48	0.219	34	0.118	174	1.57	21	25	28	1
Interpretation	low alkaline	middle	middle	middle	high	middle	good	high	large	extremely large	very large
20-30	8.27	3.32	0.216	33	0.118	175	1.47	19	22	29	1
Interpretation	low alkaline	middle	middle	middle	high	middle	good	high	large	extremely large	very large
30-40	8.23	3.14	0.207	28	0.100	160	1.01	19	21	32	2
Interpretation	low alkaline	middle	middle	middle	high	middle	middle	high	large	extremely large	very large
40-50	8.31	3.06	0.204	23	0.100	149	1.13	20	22	22	1
Interpretation	low alkaline	small	middle	middle	high	middle	middle	high	large	extremely large	very large

Table 3. Texture and carbonate content of the soil from the Filipoiu Farm

Identification	Depth (cm)	Particle size fractions (in mm) (% of the mass of the mineral part of the soil)											Symbol Textural Class	Carbonates
		Coarse sand				Fine sand				Dust	Clay			
		2.0-0.2	2-1	1-0.5	0.5-0.2	0.2-0.02	0.2-0.1	0.1-0.05	0.05-0.02	0.02	<0.002	<0.01		(%)
Pr1	0-10	0.5	0.1	0.1	0.3	19.5	0.2	0.1	19.2	36.3	43.7	69.1	TP	5.0
	10-20	1.2	0.5	0.2	0.5	22.2	0.5	0.1	21.6	35.6	41.0	67.6	TP	4.8
	20-30	0.7	0.1	0.1	0.5	17.9	0.2	0.1	17.6	37.2	44.2	70.4	TP	5.9
	30-40	0.6	0.2	0.1	0.3	18.8	0.2	0.0	18.6	36.8	43.8	70.6	TP	5.9
	40-50	2.9	2.0	0.5	0.4	19.6	0.2	0.1	19.3	36.5	41.0	68.8	TP	4.6
Pr2	0-10	0.3	0.1	0.1	0.1	20.4	0.2	0.0	20.2	35.3	44.0	69.0	TP	5.2
	10-20	0.8	0.3	0.1	0.4	19.1	0.3	0.0	18.8	35.6	44.5	70.2	TP	6.7
	20-30	0.4	0.1	0.1	0.2	18.6	0.2	0.1	18.3	37.0	44.0	70.3	TP	6.3
	30-40	0.6	0.3	0.0	0.3	18.9	0.2	0.0	18.7	35.9	44.6	71.2	TP	6.9
	40-50	2.4	1.4	0.4	0.6	18.8	0.3	0.1	18.4	35.3	43.5	68.7	TP	5.9
Pr3	0-10	0.5	0.2	0.1	0.2	20.6	0.2	0.3	20.1	37.0	41.9	68.2	TP	3.8
	10-20	0.5	0.2	0.1	0.2	21.6	0.2	0.1	21.3	35.3	42.6	68.4	TP	4.6
	20-30	0.8	0.2	0.1	0.5	16.6	0.4	0.0	16.2	38.6	44.0	71.0	TP	4.2
	30-40	2.0	1.1	0.4	0.5	21.1	0.4	0.1	20.6	36.1	40.8	66.2	TP	3.1
	40-50	2.5	1.5	0.4	0.6	19.8	0.3	0.1	19.4	37.3	40.4	67.6	TP	2.5

Table 4. Some physical characteristics of the soil

Identification	Depth (cm)	AH	D	IS
Pr1	0-10	40	25	1
	10-20	24	29	1
	20-30	17	24	1
	30-40	21	36	2
	40-50	22	32	1
Pr2	0-10	42	23	1
	10-20	21	32	2
	20-30	16	32	2
	30-40	19	35	2
	40-50	16	25	2
Pr3	0-10	48	24	0
	10-20	31	23	1
	20-30	32	32	1
	30-40	24	31	1
	40-50	28	28	1

The efficient use of nutrients from the soil by cultivated plants has led to the reduction of nutrient losses through surface runoff and washouts on the depth of the soil profile, avoiding possible pollution of water bodies.

The data presented in Table 4 show a very high structural hydrostability at the depth of 0-10 cm and with high values at the other depths. The values of dispersion and structural instability index are very high. The high values of structural hydrostability show good management on the farm, practicing a system of conservative agriculture. The analyzed data correspond to three soil profiles (Pr1, Pr2, Pr3), each evaluated at multiple depths (0-50 cm) to capture textural and structural variations.

Table 5. Influence of agricultural technologies on some chemical characteristics of the soil cultivated with corn from the Filipoiu Farm

Identification	Depth (cm)	pH	Humus (%)	Nt (%)	P_{AL} 1) (mg/kg)	K_{AL} (mg/kg)	$S\text{-}SO_4$ (mg/kg)	P_{total} (%)	K_{total} (%)	$T\text{-}NH_4$ (me/100 g)
Pr1	0-10	8.24	3.40	0.241	34	197	44	0.113	1.05	29.02
	10-20	8.28	3.40	0.211	36	171	35	0.117	1.46	28.52
	20-30	8.29	3.40	0.219	27	171	36	0.118	1.63	28.52
	30-40	8.22	3.10	0.208	28	163	36	0.099	1.29	28.52
	40-50	8.29	2.98	0.209	22	146	39	0.089	1.04	30.52
Pr2	0-10	8.25	3.34	0.213	33	188	36	0.113	1.05	29.52
	10-20	8.20	3.34	0.218	34	178	38	0.117	1.44	28.52
	20-30	8.24	3.28	0.218	41	180	31	0.115	1.29	29.52
	30-40	8.28	3.22	0.209	30	163	36	0.104	0.86	27.52
	40-50	8.35	3.16	0.205	22	150	35	0.105	0.92	31.02
Pr3	0-10	8.24	3.40	0.223	35	190	36	0.121	1.61	28.02
	10-20	8.27	3.70	0.228	32	173	40	0.120	1.81	29.02
	20-30	8.29	3.28	0.212	30	175	30	0.121	1.50	29.02
	30-40	8.18	3.10	0.203	26	154	26	0.098	0.89	28.02
	40-50	8.29	3.04	0.199	26	152	32	0.106	1.44	31.52

Soil profiles

The data presented in Table 5 regarding some chemical characteristics of the soil from the Filipoiu farm, classified in supply classes after Florea et al. (1987), highlights the variation across three soil profiles (Pr1, Pr2, Pr3), each analyzed at multiple depths (0-50 cm) to assess chemical composition and nutrient availability.

- a weakly alkaline reaction of the soil;
- a total cation exchange capacity that falls within the middle class;
- low values of the level of humus in the soil,
- an average total nitrogen content in the soil;
- the soil is medium supplied with mobile phosphorus and mobile potassium;
- the soil content in total potassium has low values and the total phosphorus values are classified at the medium level (Lăcătușu, 2016).

The presence of carbonates in the soil leads to the appearance of tricalcium phosphates with reduced mobility, which increase the level of total phosphorus supply of the soil. It is therefore necessary to increase the dose of phosphorus in order to have enough mobile phosphorus for plant nutrition.

The low level of humus and mobile phosphorus in Romanian soils compared to that in soils in Europe is known (Toth et al., 2016).

The conservative technologies applied at the Filipoiu farm have led to the harmonization of the fertilization system with this reality and with the nutrient needs of the crop.

Muntwiler et al. (2024) estimated that the average total phosphorus input to European soils in the period 2010-2019 was 13.0 kg P ha-1yr-1, ranging from 4.4 to 23.6 kg P ha-1yr-1, with the highest fertilizer rates (>17.4 kg P ha-1yr-1) found in Ireland, Denmark, Belgium and the Netherlands. In absolute values, the P fertilization of four countries with the largest arable area, France, Germany, Poland and Spain, recorded over 52% (1.06 million t/year) of the inputs from the EU and the UK. The average inputs of organic P, excreted by animals from livestock farms and applied to the field as manure, were 6.5 kg P ha-1yr-1. The countries and regions with the highest input of total P coincide with the regions that received the most organic phosphorus (>10.0 kg P ha-1yr-1). The highest exports of phosphorus (>19.0 kg P ha-1yr-1) were found in the regions receiving the highest inputs of P. The lowest exports of P (<10.0 kg P ha-1yr-1) were found in the Baltic countries, the Scandinavian countries, Portugal, Bulgaria, Slovakia, Romania, Cyprus, Malta, Croatia and Hungary. The average mobile phosphorus content of soils in the EU and UK, determined by the Olsen method, on the depth of 0-30 cm was 77.4 kg P ha-1. The regions with the highest accessible phosphorus content (above 120 kg P ha-1) were not exclusively the countries with the largest pool of total P. Countries that received high phosphorus inputs (parts of Spain, Greece and Poland) have high basins of affordable phosphorus (75-225 kg P/ha). Between 2012 and 2019, an average of 39 kg/ha of nitrogen, 15 kg/ha kg P, 5 kg/ha K and 1543 kg/ha of manure were applied to arable land in Romania. The annual nutrient deficit in the soil was -45.00 kg/ha N, -26.01 kg/ha P and -57.83 kg/ha K. The increase in phosphorus deficiency (<-1.0 kg P ha-1an-1) in agricultural soils leads to a decrease in crop yields in the long term (Muntwiler et al. 2024), but also to a reduced risk of pollution and a higher efficiency of P use.

The total content of heavy metals in the soil of the Filipoiu farm (Table 6) is within the normal limits for all the elements analyzed (Cu, Zn, Pb, Cr, Mn, Fe, Co, Ni). These values were determined for three soil profiles (Pr1, Pr2, Pr3), each examined at multiple depths (0-50 cm) to assess the distribution of heavy metals throughout the soil profile.

Table 6. Influence of agricultural technologies on the total heavy metal content of the soil on the Filipoiu Farm

Identification	H (cm)	Zn (mg/kg)	Cu (mg/kg)	Fe (mg/kg)	Mn (mg/kg)	Pb (mg/kg)	Cr (mg/kg)	Co (mg/kg)	Ni (mg/kg)
Pr1	0-10	91.1	38.2	32.853	681	45.5	53.8	4.5	55.9
	10-20	91.6	36.1	32.285	669	45.5	52.9	8.0	50.1
	20-30	88.1	36.2	32.540	656	56.2	51.8	4.5	47.5
	30-40	72.0	39.2	36.722	737	66.9	55.9	14.7	69.3
	40-50	95.1	39.9	37.319	535	56.2	55.0	15.6	63.8
Pr2	0-10	92.0	37.3	33.230	673	45.5	54.8	8.0	54.9
	10-20	91.5	37.8	32.755	679	45.5	55.7	4.5	51.5
	20-30	90.9	36.7	34.151	691	45.5	54.0	4.5	47.8
	30-40	90.0	38.5	36.315	707	56.2	50.9	13.8	63.3
	40-50	94.6	39.6	37.583	555	56.2	53.0	16.0	60.8
Pr3	0-10	91.1	37.7	33.049	665	34.8	56.5	8.0	54.2
	10-20	91.8	37.6	33.528	704	45.5	53.7	8.0	53.0
	20-30	75.0	39.6	36.718	731	45.5	60.1	10.6	62.7
	30-40	94.2	39.6	37.266	554	56.2	54.8	14.9	62.2
	40-50	93.8	38.7	35.909	525	45.5	51.1	12.8	57.4

Table 7. Influence of agricultural technologies on the microelement content of the soil on the Filipoiu Farm

Identification	Depth (cm)	Zn (mg/kg)	Cu (mg/kg)	Fe (mg/kg)	Mn (mg/kg)
Pr1	0-10	1.3	5.2	6.4	27.0
	10-20	1.2	5.5	7.6	26.3
	20-30	1.2	5.5	7.9	27.6
	30-40	1.1	5.7	8.8	25.5
	40-50	1.1	6.6	11.2	23.2
Pr2	0-10	1.2	5.3	7.0	26.4
	10-20	1.3	5.3	7.0	27.7
	20-30	1.1	5.3	7.5	27.9
	30-40	1.2	5.5	8.1	25.6
	40-50	1.2	6.3	10.1	23.9
Pr3	0-10	1.3	5.4	6.7	27.8
	10-20	1.3	5.3	7.3	25.9
	20-30	1.2	5.4	7.6	27.1
	30-40	1.1	5.9	9.5	24.2
	40-50	1.2	6.1	9.1	24.2
Supply status	Low	<1.5	<0.5	<5	<15
	Medium	1.6-3.0	0.6-1.5	5-25	16-30
	High	>3.0	>1.5	>25	>30

The data presented in Table 7 show a low soluble zinc content, a high soluble copper content, and a medium manganese and iron content (assessed according to Lăcătușu et al., 2017). These values were determined for three soil profiles (Pr1, Pr2, Pr3), each analyzed at multiple depths (0-50 cm) to evaluate the vertical distribution of these elements in the soil.

CONCLUSIONS

Analyzing the physical and chemical condition of the soils from the Filipoiu farm, located on the Big Island of Brăila, reveals very good soil quality, consistent with the local pedoclimatic conditions. The conservative agricultural practices applied have continuously improved soil fertility, as reflected in the high yields achieved. The preservation of favorable physical characteristics (e.g., structural macroformations with high stability against water action, ensuring good permeability) is attributed to the adoption of conservative agriculture and the implementation of an optimal low-pressure central pivot irrigation system. The level of nutrient supply is considered normal and has not been negatively affected by the production technologies applied. The soil meets the criteria for classification as healthy and supports good-quality yields.

The soils of analized farm exhibit slightly alkaline pH values ranging from 8.18 to 8.35, which are favorable for certain crops but may limit the availability of micronutrients like iron and zinc, necessitating potential adjustments through acidifying fertilizers. The humus content remains stable across profiles (2.98-3.70%), reflecting good organic matter levels that support fertility and soil structure, though maintaining these levels requires continuous organic inputs like cover crops or compost.

Nitrogen levels (0.199-0.241%) are sufficient and align with the applied fertilizer rates, demonstrating the effectiveness of the fertilization strategy in supporting high yields. Phosphorus levels (22-41 mg/kg) show variability, with lower values at deeper layers, suggesting the need for additional applications, especially in carbonate-rich soils, to improve availability. Potassium levels (146-197 mg/kg) are generally adequate, indicating well-managed potassium supply.

Structural stability is high in the upper layers (43%), ensuring good water infiltration and aeration, but deeper layers show high dispersion values (<0.01 mm), which may lead to structural breakdown under stress, highlighting the need for careful water and tillage management. The maize yield achieved was 15,144 kg/ha, surpassing both the expected yield of 12,800 kg/ha and the target yield of 9,100 kg/ha by 18.3%, illustrating the efficiency of conservative agricultural practices and optimal fertilization. These results confirm that nutrient supply is balanced, supporting crop nutrition while preserving soil fertility reserves.

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