SOIL QUALITY OF HIGH NATURAL VALUE FARMLAND BY SUCEAVA AREA

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Abstract

HNV agricultural systems were first described as agricultural systems of predominantly low intensity which imply a relatively complex relation with the environment. They preserve important habitats on both cultivated and grazed land and they include diverse landscape elements such as hedgerows, fruit trees, or lakes/ponds.

In the European Union Strategy framework of mitigating climate change, protecting the environment, and ensuring public health, following researches that undertook the task to build the first national soil data base from the high natural value areas (HNV). One of the eligible area for HNV compensatory payments, where was analyzed the fertility state of soils is located in the Suceava area. It was studied in six depth profiles and six adjacent agrochemical samples collected from the 0-20 cm layer. Chemical analyses showed that the soils prove to be rather poor, but within the limits frequently encountered in such areas, with an acceptable level of fertility and good conditions for characteristic plants growth.

Cationic exchange capacity is generally low. Excessive nitrates quantities were determined in the upper horizon of two of the analyzed profiles. Both of these profiles belong to the HNV administered territory therefore; compliance with the set of rules regarding HNV eligibility should be more attentively monitored.

Key words*: HNV farming, soil quality, agro-environment*

INTRODUCTION

HNV agricultural systems have been described first as agricultural systems with predominantly low intensity which involves a relatively complex relation with the environment (Baldock et al., 1993). They preserve important habitats on both cultivated and grazed land and contain different landscape elements such as hedgerows, fruit trees, or lakes/ponds. HNV agriculture was later defined as a practice located in areas where: (i) agriculture is the main land use; (ii) agriculture maintains (or is associated with) a great wild genera or habitats diversity, or the presence of genera of interest on a European/national/regional level, and (iii) these species and habitats preservation depends on specific agricultural practises continuation (Andersen et al. 2003).

Romania has one of the richest land resources that can be classified as having a High Natural Value, as a result of the great variety of species associated with agricultural land used as permanent meadows, through traditional mowing or grazing activities.

The research carried out on HNV lands, in a few publications, only tangentially touches on the problem of the soil, under a general descriptive aspect related to exposure to the phenomenon of erosion (Creamer and O'Sullivan, 2018) or regarding the phenomenon of soil degradation in the Portuguese "*montado*" system under excessive grazing, in conditions where the increase in the intensity of the phenomenon was observed with the gradual replacement of sheep flocks with cattle herds, as a result of the implementation of coupled incentive

payments for animals (Almeida et al., 2016).

In the phase of building the data base regarding HNV soils field researches were carried out in the south-eastern Transylvania HNV eligible area, in the Târnava Mare Natura 2000 site (Dumitrașcu et al., 2018). The study revealed good soil fertility and an adequate HNV administration. In this new phase the Suceava area was regarded.

Suceava county presents a varied relief, between Pietrosu Călimanului (2102 m) and the Siretului riverbed, at Dolhasca (233 m), being made up of mountain peaks separated by deep valleys and wide meadows set among hills with smooth ridges.

The territory of Suceava County is characterized by a boreal climate, with cold and wet winters, with the average temperature of the coldest month below -3°C and the average temperature of the warmest month above 10°C. The amount of water from precipitation is greater than that lost through evapotranspiration, being one of the coldest and wettest provinces in Romania.

The reserves in Suceava county are characterized by a great floristic, faunal and landscape diversity, determined by their geographical spread from the alpine to the lowlands.

MATERIALS AND METHODS

The HNV edaphic investigation area is located in the eastern part of the Eastern Carpathians, in the Rădăuti Depression, the Soloneț Depression and the Cacica Depression, in the Solca Plateau, following the HNV eligible areas in accordance with the existing information in the database of the Ministry of Agriculture and Rural Development.

At this stage, the fertility of the soils in the HNV eligible areas was studied.

The soils of Suceava County know a varied range of types, due to the complexity of natural conditions, as pedogenetic factors.

On the territory of Suceava county there are two national parks, Rodna and Călimani, and 22 nature reserves, representing 0.55% of the total area of the county.

Soil disturbed and undisturbed samples were collected from six profiles, by the identified genetic horizons, as follows: from Vicovu de Jos (P1), of a mowed HNV grass land, rich with plant genera with high fodder value, altitude 621 meter, southern exposure; from Cacica (P2), of a private farmland covered with natural grass land, mowed, with an > 15% slope, altitude 436 meter; from Comănești (P3), from a fragmented plot of land in terms of ownership, which has been abandoned, of HNV land covered from fodder plants vegetal cover, slope of 6% and altitude of 434 meter; profile P4, located in Păltinoasa, at an altitude of 520 meter and a slope of 6%, with a northern exposure of the slope is located on privately owned land covered with mowed hay; Moldovei Valley, the P5 profile is located at an altitude of 465 meter, a slope of 7% and a northern exposure of the slope, the land being covered by a natural meadow, well understood; and the last, the soil profile marked P6, located in Părtești de Jos, private property, exploited through controlled grazing, possibly with a large amount of organic matter due to the herd of cattle owned by the owner farmer. Disturbed samples were used for laboratory measurements according to established methodology and in force standards, as follows: structure, organic carbon content, pH, available phosphorus and potassium contents, total nitrogen, and cationic exchange properties. Undisturbed samples were taken in 200 cm^3 rings and used for bulk density (BD), penetration resistance (PR), total porosity (TP), soil moisture (SM), compaction index (CI), saturated water hydraulic conductivity (HC), and degree of soil compactness (SC) measurements.

Salinization intensity was assessed by the total soluble salts content in 1:5 aqueous extract.

RESULTS AND DISCUSSIONS

The soils in the area have a light to medium texture (loamy coarse sand to silty

loam) with a clay content (< 0,002 mm) ranging from a minimum of 9.0% to a maximum of 21.5%. The calcium carbonate is absent.

Regarding the values of the soil physical properties (Dumitru et al. 2009), the average soil bulk density in the first (upper) soil layer is 1.19 g/cm^3 (ranging in different sampled soil profiles from 1.06 to 1.36 g/cm^3) and the average soil total porosity is 54.51% v/v (ranging in different sampled soil profiles from 48.9 to 60.0% v/v).

Foto 1: Profil P5 - Valea Moldovei

The average values of penetration resistance range top-down from low to medium levels (17 kgf/cm^2 in the upper soil layer to 48 kgf/cm^2 in the depth layer). However, within the depth of some profiles, the values of penetration resistance may reach high levels (up to 75 kgf/cm^2), hampering the root development. The average values of the contraction index, with very slight differences along the profile (0.0050 on top to 0.0058 in depth) indicate a non-susceptibility for soil cracking. The average values of the saturated water hydraulic conductivity (19,36 mm/h in the upper soil layer and 5,37 mm/h in the depth layer) show a top-down high to medium soil permeability and an average fair level of soil internal water drainage. But in some depth layers, soil permeability may reach quite very low levels (up to 0.18 mm/h), exposing the roots to seasonal water-logging.

The average slightly compactness recorded is clearly not a subject of poor HNV soil conservation management in the area but a result of the soil genesis natural process.

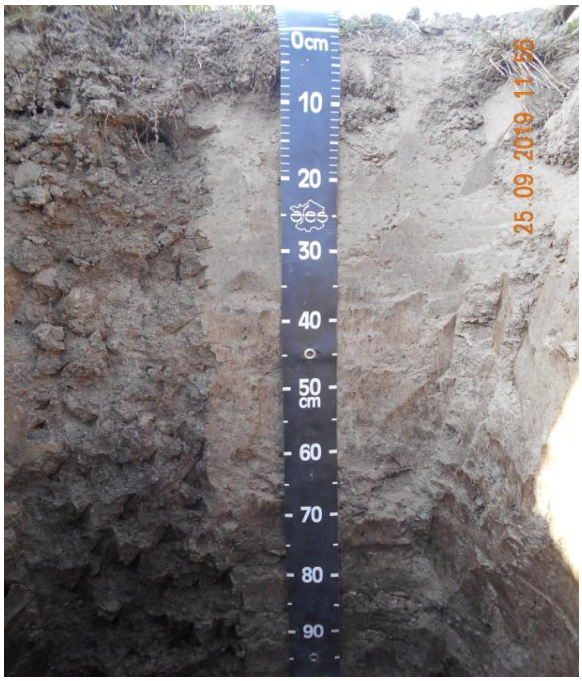

Foto 2: Profil P3 - Comănești

Soil reaction is moderately-slightly alkaline with pH values ranging from 4.48 to 5.64 (Tables 1; Florea et al., 1987) in the first horizon. The values are generally favourable for plants growth even if three of them from the upper layer are slightly below the inferior limit of the moderately acid domain. According to Vasu (1986) the characteristic values interval for constant grassland soils is 4.40-6.00.

The total nitrogen contents balance well the organic matter contents.

Excessive nitrate nitrogen ($N\text{-}NO_3$) quantities (Lăcătușu, 2016) occur in the upper horizons of the P5 Valea Moldovei and the Comănești profiles.

The mobile phosphorus contents, soluble in the he ammonium acetate lactate solution at pH 3.7, are extremely low – low (Florea et al., 1987) as in many other Romania areas, not only meadows and grass lands, studied down the years.

Foto 3: Profil P1 - Vicovu de Jos

On the other hand the mobile potassium contents, soluble in the same extracting solution vary from low to middle (Florea et al., 1987).

There are practically no differences between the samples collected from HNV or conventionally managed land.

The cation exchange capacity (T = BS + Ah) is generally low. According to the base saturation degree the soil is oligo basic – moderately mesobasic (Florea et al., 1987).

Foto 3: Profil P4 - Păltinoasa

Table 1 Chemical properties of the collected samples

Sampling point Administration type	Depth cm	pH	Humus	Nt	$N\text{-}NO_3$	P_{AL}	K_{AL}
			%		mg/kg		
Vicovu de jos, P1	0-14	5.27	5.98	0,444	2	8	108
	14-25	5.44	3,08	0,308	2	1	97
	25-30	5.67	1,24	0,160	2	2	152
	30-55	5.74	0,18	0,103	2	1	207
Agrochemical sample	0-20	5,28	4,38	0,273	2	4	81
Cacica; P2	0-24	5,53	2,84	0,166	7	8	91
	24-39	5,70	1,48	0,070	3	8	110
	39-53	5,66	0,95	0,074	3	6	146
Agrochemical sample	0-20	5,68	3,02	0,184	9	8	170
Comănești; P3	0-26	5,52	2,90	0,166	3	7	81
	26-35	5,90	1,18	0,077	3	7	47
	35-50	5,87	0,41	0,039	2	10	37
Agrochemical sample	0-20	5,59	2,78	0,578	3	7	79
Păltinoasa; P4	0-10	4,97	4,14	0,239	2	7	65
	12-26	5,25	1,24	0,084	2	4	39
	26-47	5,56	0,65	0,037	2	5	59
Agrochemical sample	0-20	5,09	3,49	0,183	2	8	61
Valea Moldovei; P5	0-10	4,48	5,86	0,546	8	21	162
	10-20	4,66	5,21	0,451	4	8	73
	20-35	5,32	2,84	0,156	3	2	24
	35-60	5,8	0,65	0,046	2	3	22
Agrochemical sample	0-20	4,7	6,22	0,279	2	3	45
Pârteștii de Jos; P6	0-24	5,64	3,02	0,273	4	5	59
	24-42	5,86	2,01	0,166	3	4	65
Agrochemical sample	0-20	5,74	2,96	0,074	3	12	61

CONCLUSIONS

Physical and chemical of the soil samples collected from six depth profiles and six additional agrochemical samples (0-20 cm) in a Suceava County hilly area eligible for HNV payments showed that the studied soils have a good fertility because the analytical values mainly range in favourable intervals for plants growth.

As an essential ecological factor, soil is one of the most important natural resources, being the central foundation of agricultural activity. Soil protection measures maintain its productive capacity and the environmental effects of various uses or technologies applied can have special implications on the degree of sustainability of the agro-ecosystem, whether it is semi-natural or cultivated. Often ignored, the role of soil is complex, and of the six major characteristic functions, three have ecological determination and the others are related to cultural, social, economic and technical aspects.

Problems regarding HNV management compliance arise regarding specific requirements for compensating payments associated with rural development program because of some excessive values of the nitrates contents in the first horizon of two plots administered in HNV system.

HNV areas deserve support, not only for the conservation of the natural diversity they maintain, diversity that ensures ecological balance, resilience to climate change and nutritious food, but also for their economic and agricultural productivity that ensures the livelihood of many farming communities.

The support offered to these areas contributes to the prosperity of local communities, by opening opportunities for the diversification of economic activity, such as the development of rural tourism offers and businesses based on quality and healthy products.

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