USING PEDOLOGICAL AND AGROCHEMICAL INFORMATION FOR THE IMPLEMENTATION OF NITRATES DIRECTIVE WITHIN THE ADMINISTRATIVE-TERRITORIAL UNIT SÂNTANA

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Abstract: *The study aims to collect, elaborate, and comprehend scientific data on the chemical, physical, and hydro-physical features of soil in order to offer the governmental authorities specialized technical support in the development of Sântana's administrative region. The importance, originality, and timeliness stem from the pressing need to safeguard the ecosystem and soil. This is accomplished by carrying out the execution of a program of action for areas at risk of nitrate contamination from agriculture. The study serves as a focal point for overseeing the enforcement of the Nitrates Directive concerning soil and crops, which is crucial for compiling the national report on the "Nitrates Directive" from Arad District. The physico-chemical properties of soil samples, encompassing pH, humus, texture, N, P, and K content, alongside the biodiversity of biochemical and pathogenic constituents within the samples, were scrutinized at OSPA Arad, adhering to national regulations and standards sanctioned by the Romanian Standards Association (ASRO). In terms of topography, the settlement is located in the Banato-Crisana Plain, which constitutes a segment of Romania's Western Plain. It signifies the farthest eastern point of the Arad Plain in the Cris-Mures interfluve, a region characterized by the collective influence of the Mures River. The 9860 hectares of arable land in the community are used for various purposes: arable land (93.1%), pasture (6.4%), grassland (0.2%), vineyards (0.2%), and orchards (0.1%). The predominant soil types resulting from the classification of land areas include Chernozem (5148 ha), Fhaeozoum (557 ha), Eutryc cambisol (831 ha), Pelosol (2070 ha), Vertisol (1165 ha), Solonetz (58 ha), and Technosols (31 ha). Understanding these unique soil characteristics holds both theoretical and practical significance. Theoretical importance stems from its ability to enable experts to comprehend soil phenomena and predict soil development in particular, as well as broader environmental impacts in terms of current and future health. This knowledge also advises farmers on the necessary actions to optimize soil conditions for plant growth and development.*

Key words: *sustainability, ecological, soil, pollution, land, assessment*

INTRODUCTION

For both big and small-scale agricultural companies, understanding the inherent circumstances and features of a land area's ecological potential for diverse uses and specific crops is crucial from an economic and social standpoint. The formation of soils is strongly related to the growth of the Tethys marine basin and the Pannonian lake, which influenced the geomorphological development of the area under study. These soils encounter two extreme limits during an agricultural cycle: an abundance of moisture in the winter and a deficiency of moisture in the warm season. These conditions both lead to different stress factors that negatively affect the agro-ecosystem's quality and production.

Water, substrate, and atmosphere are among the natural resources that are most vulnerable to harmful pollutants and are regularly exposed to them. This has direct and serious effects on the integrity of the environment, in particular on biodiversity in various aspects and the welfare of people.

Taking these factors into account, the authors hope to provide in this article some insights from years of thorough scientific study that were based on a significant quantity of data stored in OSPA Arad's archives. These insights include the following:

- Management of nutrients in regions where nitrate pollution is likely to occur;
- Information dissemination regarding nutrient management;
- Average manure nutrient pressure (kg N/ha);
- Filling in the system for data collection and processing in order to prepare the report for the Nitrates Directive.

MATERIAL AND METHODS

Out of the 10,714 hectares of the area under consideration, 9,840 hectares are set aside for agriculture. Gathering, evaluating, and interpreting scientific data about the physical, chemical, and hydrophysical properties of soils is the aim of the study. As the primary point of contact for tracking the soil-related aspects of the Nitrates Directive's implementation, this information aims to provide specialized technical assistance to government entities, formulate an action plan for addressing nitrate pollution from agricultural sources in the Sântana administrative region, and contribute to the nation's report on the directive. The study of pedological as well as ecological circumstances, data collection, and analysis followed the Romanian System of Soil Taxonomy and the "Methodology of Pedologic Study Elaboration" developed by ICPA Bucharest.

RESULTS AND DISCUSSIONS

Situated in the central-western part of Arad County (46º21'0" north and 21º30'0" east), with an altitude ranging from 90 to 100 meters, the town is positioned in the northern region of the Arad Plateau and is approximately 29 kilometers (18 miles) away from the county seat, Arad. It is intersected by county roads DJ791 and DJ792C, and within its administrative boundaries lie the villages of Sântana and Caporal Alexa.

The geographical location of the village places it within the Banato-Crişana Plain, specifically in the Mureş-Crişul Alb interfluve field, also recognized as the Arad Plain, part of the sub-county of Diving Field, within the Crișurilor Plain district.

The village's perimeter falls within the Criș hydrographic basin. No permanent watercourses are found within the studied area, with the closest ones being the Crişul Alb and Mureş rivers, both at approximately equal distances of around 28 kilometers.

Running almost axially from south-southeast to north-northwest, the territory of Caporal Alexa village is crossed by a former abandoned channel, possibly belonging to Crișul Alb, which collects and accumulates water during precipitation mainly in the section of the riverbed passing through the village. The depth of this channel reaches approximately 0.5-1.0 meters. The albia of this prival reaches about 0.5-1.0 m deep.

The climate in the area exhibits a moderately continental temperate character with Mediterranean influences, characterized by mild winters and moderately warm summers, with an average annual temperature of 11.2°C and an average yearly rainfall of 594.5 mm, recorded at the Chișineu Criș station.

The examined area is located in the geo-botanical region of central Europe, with its boundary with the geo-botanical region of south Europe having a significant influence from a phytogeographic standpoint. Along with a significant number of indigenous plant species, the region is home to a variety of natural floristic features, including European, Euro-Asian, Boreal,

Balkanic, Mediterranean, and Illyrian. Wheat, barley, maize, sunflower, alfalfa, and a range of vegetables are the main crops grown locally.

Upon the classification of land units (UT), the prevailing soil types emerge as follows:

1. Chernozems (typic, cambic, pelic, gleyed, vertic-gleyed, cambic-gleyed), 5148 ha;
2. Fhaeozoum (typic, pelic, vertic, cambic, cambic-gleyed, cambic-stagnant), 557 ha;
3. Eutryc cambisol (mollic, gleyed, mollic-gleyed, vertic-gleyed, vertic-stagnant), 831 ha;
4. Pelosols (typic, gleyed, gleyed-stagnant), 2070 ha;
5. Vertosols (typic, gleyed, gleyed-stagnant, saline-sodic), 1165 ha;
6. Solonetz, (vertic-gleyed, gleyed-stagnant), 58 ha;
7. Technosoil (mixic), 31 ha.

Concerning the fertility classes for arable land, the following distribution is observed:

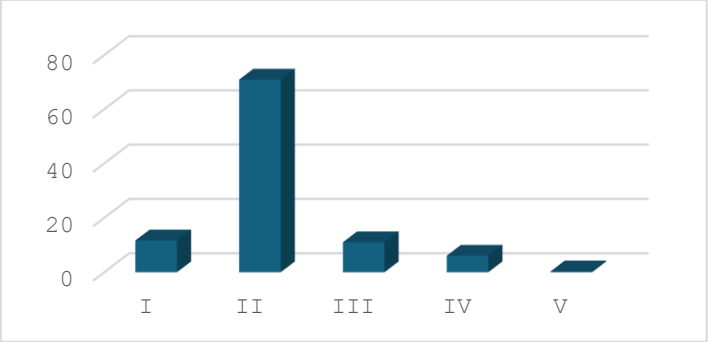

Figure 1. Performance classifications.

The major factors limiting soil quality include:

- low soil reaction values (94.67%);
- humus reserves (moderate 9.33%, lower 87.99%, very lower 2.68%);
- fine texture (moderate-fine 78.68%, fine 6.77%);
- compaction degree (moderate 41.9%, high 50.63%);
- excess groundwater moisture (severe 10.12%, moderate 23.13%, lower 66.75%);
- excess surface moisture (severe 7.50%, moderate 74.78%, lower 17.72%);

RESTRICTIONS

1. Soils;
    - Vertosols: 11.82%;
    - Pelosols: 20.99%;
    - Solonetz: 0.59;
2. Soil texture and the hydroclimatic equilibrium;
    - clay texture and hydroclimatic surplus: 6.77%;
3. The level of compactness;
    - highly packed: 50.63%;
4. Groundwater depth, by itself or in conjunction with the soil's or groundwater's erratic characteristics;
    - below 2 m: 11.31%;
    - between 2 and 3 m: 50.12%;

- between 3 and 5 m: 32.12%;
- between 5 and 10 m: 6.45%.

In order to mitigate the impact of pollutants, a comprehensive management system for soil and livestock waste is imperative.

The issue lies in utilizing the physical, chemical, and biological characteristics of soil as a medium for waste disposal, aiming to minimize negative impacts on cultivated plants, soil quality, groundwater, and surface water.

For both economic and environmental reasons, the effective handling of fertilizers in agricultural settings is essential. A strategic approach involving the tailored allocation of nitrogen fertilizer and other essential nutrients to specific crops, fields, or plots is crucial. The Sântana administrative region provides a breakdown of nutrient production in individual households, as detailed in the subsequent table.

The capacity of soil to absorb and process livestock waste varies based on several factors. Numerous factors affect how well soil can filter and absorb animal excrement. Biological soil treatment—absorption, oxidation, chemical precipitation, fauna and flora intake, and ion exchange—are examples of potential methods.

As a center for biological processing, soil may decompose complex organic materials based on its own composition and the climate in which it is found. The choice of manure management system is contingent upon the unique circumstances and positioning of each facility. Ideally, livestock farms should be situated in agricultural zones, downwind from residential areas, with ample space for waste treatment, controlled release, and mitigation of potential leaks.

Table 1

Transfer of nutrients with relation to territorial administrative area of Sântana and their output.
(kg N / year)

Animal class	Size (kg)	Quantity	Nitrogen transfer coefficient	Azote production
Young Calves	0-50	161	20	3220
Calves (0.6–2 year)	50-250	216	55	11880
Cows	>400	205	81	16605
Pigs	98	834	13	10842
Pregnant sows	125	678	10	6780
Pigs (males)	160	0	13	0
Sheep	45	9351	7	65457
Goats	45	183	7	1281
Breeding Birds	1.8	2050	0.36	738
Poultry fattening	0.9	950	0.36	342
Horses	450	36	45	1620
Global				118765

Cation exchange capacity, base saturation degree, biological condition, infiltration rate, type of plant cover, drainage, porosity, aeration, humidity, and soil tillage are some of the factors that affect how well soil functions as a cluster of purifiers.

Applying agricultural dosages to improve soil fertility without generating nitrogen or salt pollution is part of managing livestock farm wastes with the goal of achieving maximum output. The suggested annual quantity of manure per acre, comprising one hundred and seventy

kilograms of azote, follows the Guidelines for Good Agricultural Practices to prevent water contamination by agriculturally derived nitrates.

CONCLUSIONS

The authors of this paper aim to shift the descriptive theoretical approach towards alternative analytical methods and propose practical solutions for the sustainable management of soil resources in response to risks stemming from natural phenomena and unreasonable human interventions.

Pollutants, such as toxic or harmful substances, have the potential to accumulate in concentrations exceeding permissible levels in ground and surface waters, including groundwater. Examples of such pollutants encompass animal manure, metropolitan residue, and by-products from various processing activities. Therefore, particular emphasis should be placed on devising a fertilization strategy, especially regarding the utilization of semi-liquid and liquid organic wastewater from farms, as they might harbor elements like heavy metals that can amass in the soil, leading to toxic effects within the food chain.

The application of mineral and organic fertilizers, 170 kilograms of azote per ha should be the maximum annually, incorporating the element straight from waste onto the grazing land. In regions susceptible to nitrate-induced water contamination, adherence to the specified application rates is crucial.

A profound understanding of the fruitful and mechanical attributes of factors influencing agricultural output, whether contributory, constraining, or limiting, can act as a useful instrument for organizations that make decisions (such as governmental bodies and local administrations) in devising appropriate measures to enhance plant biomass production, thus ameliorating living conditions for humans and the community at large. Lasting farming practices and anthropogenic resources represents a contemporary approach to land stewardship, striving to sustain and enhance soil fertility to support long-term, superior food manufacturing.

The manuscript provides foundational information and methodological components for the assessment and description of man-made and natural resources, with the aspiration that the insights provided will pique the interest of decision-makers. In the foreseeable future, environmental protection in agricultural research and practice will aim for the development of interdisciplinary studies, as it is impossible to discuss nutritious soil regardless of a healthy environment.

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