PEDOLOGICAL AND AGROCHEMICAL STUDY IN THE AXINTELE AREA, IALOMIȚA COUNTY, COVERING AN AREA OF 300 HECTARES, WITH THE DEVELOPMENT OF A FERTILIZATION PLAN FOR CROPS

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Abstract

The study was conducted based on research contract no. 378/02.04.2025, concluded between USAMV in Bucharest and SC LUXCOM SRL, regarding the pedological and agrochemical mapping in the Axintele area, Ialomița County, in the floodplain of the river of the same name.
The pedoclimatic conditions are specific to the plain area, but with a microclimate specific to the floodplain on alluvial deposits and a groundwater level situated between 3-5 meters deep. Two surveys have been conducted in two fields used for arable land as well as on pasture.
Soil samples were conditioned in the laboratories of USAMV in Bucharest, and the chemical analyses were conducted by the company S.C. Cartare Agrochimică S.R.L.
For all collected samples, a list of routine analyses (pH, humus, P, K, Ah, SB, carbonates, etc.) was prepared, while others were determined indirectly (IN, V%). The morphological characterization was partially determined in the field, and finalized in the laboratory based on the determined analyses.
Based on the results obtained, the fertilization plan for crops was replaced, depending on the planned yield, the nutrient reserves in the soil, the preceding crop, etc.
***Key words**: pedological mapping, calcareous alluvial soil, agrochemical mapping, fertilization plan*

INTRODUCTION

In addition to the quality of the soil and the level of rainfall or water intake through irrigation, fertilizers are the next input that leads to an increase in yields by up to 55% in developing countries (FAO, 2000).
The use of fertilizers represents the essential technological link, which integrated in a set of agricultural technical-economic measures, increases the productivity of soils and implicitly of crops. Worldwide, forecasts show that about 3030 million hectares of the total area of the globe of 13340 million hectares, are potentially arable, the difference being cold lands, with excess moisture, too dry or with low edaphic volume (Dumitru, 2003). In addition, the average area of arable land per capita decreased from 0.28 hectares in the period 1990-1991 to 0.17 hectares in 2025.
In Romania, the reduction of the arable area is amplified by some phenomena such as water or wind erosion, compaction, acidification, uncultivation, etc. After 1990, the consumption of nutrients per unit area

was reduced by 3-4 times, and the applied quantities averaged 30-50 kg s.a. NPK/ha., I only support obtaining a maximum of 2.0 t/ha. The current consumption of chemical fertilizers in Romania is about 30 kg/ha., nitrogen, 12 kg / ha., phosphorus and 4 kg/ha., potassium. The most important soil nutrients are nitrogen and phosphorus, but pH conditions the accessibility of basic cations: Ca, Mg, K and microelements especially Fe, Zn, Mn, B, considered the main determinants of soil fertility (Wim De Vries, 2022).

In the current period, there were found certain entropic disorders, acting on the soil, such as: depletion of soluble fertilizing substances, decrease in humus content, leaching of some nutrients, structure degradation, compaction, decrease of water retention capacity and vice versa, acidification, reduction of soil fauna (defaunization), water and wind erosion (Georgescu et al., 2001). In the USA, 50% of fertilizers are applied to compensate for losses due to soil degradation, and in Zimbabwe, nutrient losses through erosion are 3 times higher than the total amount of fertilizers applied (Derpsch and Moriya, 1998). In the Republic Of Moldova, throughout history, there was only one period of intensive chemisation (1970-1990), when a positive balance of soil nutrients was found (Sofroni et al., 1999). On about 60% of the agricultural area, a subsistence agriculture of mining type is practiced, in which the nutrients extracted with the harvest are not returned to the soil, it definitely leads to the decrease of the nutrient reserves and implicitly of the productions.

In developed countries and some agricultural societies in Romania, where there are modern and diversified irrigation systems (drip or sprinkler), there was an increase in the consumption of liquid fertilizers, because they have efficacy of 15-20% compared to the classical ones, provide higher uniformity, much lower costs, controllable content of active substance, high complexity and can be applied in complex with insecto-fungicides or/and biostimulators.

MATERIALS AND METHODS

1) *Pedoclimatic characterization of the studied area*

The studied area belongs to the locality Axinte, located in the central-western part of Ialomita County, respectively the Central Baragan, the subunit lunca Ialomitei (Figure 1.1.).

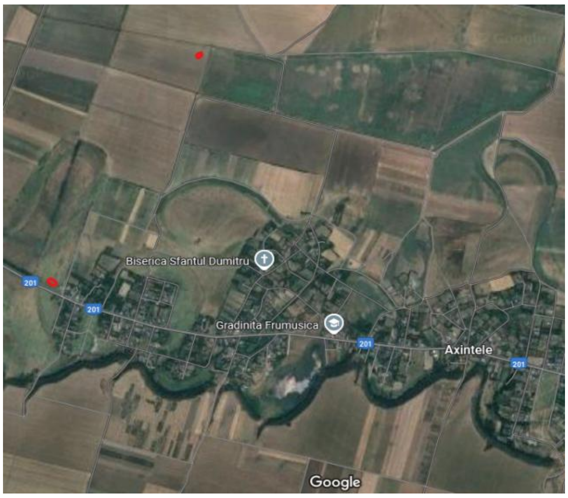

Figure 1. Location of the studied area

The relief specific to the Romanian Plain is characterized by flat surfaces, quasi-horizontal, with small bumps, from place to place with depressionary areas and groves that denote old water courses in the direction N-E. It belongs entirely to the Mostistea Plain, near Galatui Lake, on its Left Bank. This sector, is the lowest of the Roman Plain, with the altitude between 4 and 80 m in most of it. Mostistea plain, develops between the dejection cones of Dambovita and Ialomita, built over a lacustrine, quaternary plain. On the right of Mostistei, there is a high and smooth field, very similar to Baraganul (C. Ciornuleasa), which ends in wide terraces towards the Danube and to the north is fragmented by tributary valleys Mostistei and Dambovita. The Mostista sector corresponds to the stratigraphic complex with the same name and appears in numerous geological profiles, as follows: a horizon of calcareous marls at the base, fine fossiliferous sands with gravels of calcareous concretions all these covered by a loess blanket of about 8-10 m. in the Romanian Plain, due to the lowland relief where loessoid deposits predominate, a clear zonality of soils is observed. In parallel with the change of climatic conditions, they follow from the Danube to the hilly-plateau areas, areas predominantly occupied with chernozems. The studied area represents a sector of ialomitei Meadow, framed in Mostistei Baraganului, formed on alluvial materials of different granulations. The studied area is characterized by a climate of type Dfax, according to the Koppen nomenclature. The surveyed territory is located in climatic zone I (warm-dry), with sufficient thermal resources for good development of plants but with a high frequency of dry years. The climate is characteristic of the Romanian Plain, Western Baragan, with average annual temperatures of 10.50 C, average January (-3^{0}C) and July (22.3^0 C), average annual rainfall of 550 mm. The thickness of the snow cover usually reaches 50-70 cm. The potential evapotranspiration exceeds the amount of precipitation, achieving a moisture deficit in the soil of 170 mm, which necessitates the application of irrigation. The aridity index is 26 and the evapotranspiration above 650 mm. The average annual cloudiness is 5.7 with a maximum in December (9.4) and a minimum in august (3.8). The wind regime is represented by Crivat, which blows from the north-east direction, with an average speed of 4.5 m/s, and a frequency of 21.6 %.The austrus comes from the south/west, with an average speed of 2.6-2.9 m / s and a frequency of 15%. Natural vegetation is characteristic of the steppe-forest-steppe zone, mostly represented by the genus *Quercus* (*pedunculiflora, pubescens, frainetto, cerris, robur*, etc.), associated with shrubs of the genera: *Ligustrum, Crataegus, Rhamnus, Rosa*, etc.). Grassy vegetation is represented by associations formed by *Carex, Poa, Festuca, Stipa, Botriochloa*, etc. The soils formed are fully consistent with the local conditions of rock, vegetation and climate, resulting mostly chernozems different subtypes. The zonal soil type, specific to the studied area is typical chernozem, and the azonal one, formed on account of the zonal pedo-climatic conditions, is limestone alluvial.

2) Soil sampling

Methods of analysis used to determine chemical characteristics:

Organic matter (humus): determined volumetric by wet oxidation method after Walkley-Black, in Donut modification-STAS 7184/21-82;

$CaCO_3$ (carbonates): gasometric method using the Scheibler calcimeter, after SR ISO 10693: 1998 (%);

The nitrogen content was determined indirectly (by calculation) based on the humus content and the degree of saturation with bases;

IN = humus x V / 100;

Accessible phosphorus (mobile P): after the Egner-Riehm-Domingo method and colorimetrically dosed with molybdenum blue, after the Murphy-Riley method (reduction with ascorbic acid);

Accessible potassium (K): extraction by Egner-Riehm-Domingo method and dosing by Flame photometry;

pH: potentiometrically determined, with combined glass and calomel electrode, in aqueous suspension at the soil/water ratio of 1/2. 5 - SR 7184/13-2001;

Hydrolytic acidity - extraction with sodium acetate at pH 8.2;

Sum of bases - Kappen Schoffield method by extraction with normal 0.05 hydrochloric acid.

Methods of analysis used to determine physical characteristics:

Determination of granulometric fractions:

- pipette method for fractions of 0.002 mm;
- wet sieving method for fractions 0.002-0.2 mm and dry for fractions > 0.2 mm. The results are expressed as a percentage of the material remaining after pretreatment.

Bulk density (DA): method of metal cylinders of known volume (100 cm^3) at momentary soil moisture (g/ cm^3);

Total porosity (PT): by calculation (%by Volume - % v/v);

Aeration porosity(PA): by calculation (%by Volume - % /v);

Degree of subsidence (GT): by calculation GT = [(PM-PT – / PMN] x 100 (% of Volume - % v / v), in which: PMN-minimum total porosity required, varied according to the clay content of the respective sample, is calculated with the formula PMN = 45+0.163 A (% of Volume -% v/v); PT = total porosity (% v/v); A – clay content (% w/w);

Hygroscopicity coefficient (CH): drying at 105 kg C of a soil sample previously moistened at equilibrium with an atmosphere saturated with water vapor – in the presence of a solution of H_2SO_4, 10%) - % by weight (%w/w);

Withering coefficient (CO): by calculation, by multiplication by 1,5 of the hygroscopicity coefficient, determined by the modified Mitscherlich method (without vacuum, with blank sample) – % by weight (% w/w).

Initial soil moisture (wi): by drying the soil sample in the etuve at a temperature of 105^0 C (weight % compared to dry soil at 105^0C);

Field capacity for water (CC): BY estimation based on texture and apparent density, according to the "Methodology of development of Pedological studies", ICPA, 1987.

RESULTS AND DISCUSSIONS

3) Characterization of the soil cover in the studied area

Two soil surveys were conducted, and characterized physicochemically and morphologically.

Survey 1. Coordinates: N: 44.617988; E: 26.718166; alluvial limestone (AS-ka); Relief: meadow; use: pasture; Rock: fluviatile deposits; ground water: 3-5 m.

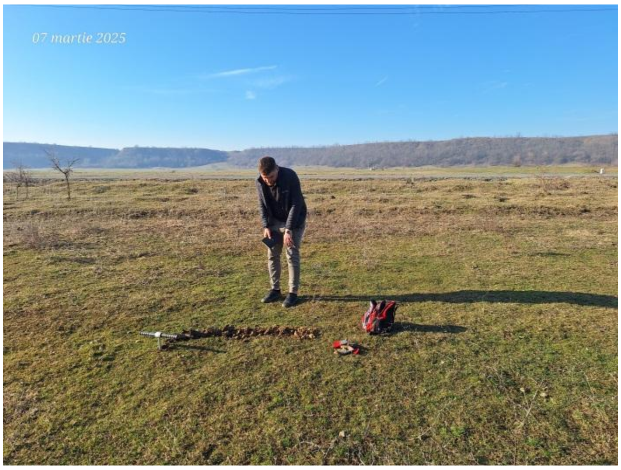

Figure 2. Calcareous alluviosol

Morphological characterization of Survey 1.

Aot (0-16 cm); *dusty sandy clay, light brown (10 YR 3/2 to wet and 10 YR 4/3 to dry), poorly developed grainy structure, weak compactness, moderate biological activity, weak plastic, weak adhesive, frequent fine pores, thin roots very common from natural vegetation, weak effervescence, wavy gradual transition;*

Ao (16-28 cm); medium sandy loam, light brown (2.5 Y 4/3 to wet and 2.5 Y 5/4 to dry), grainy structure poorly developed, strongly tamped, frequent fine roots, moderate effervescence, wavy gradual transition;

AC (28-46 cm); fine clay sand, yellowish brown (2.5 Y 4/4 to wet and 2.5 Y 6/4 to dry), crumbly, unstructured, non-plastic, non-adhesive, frequent coarse pores, frequent fine roots, moderate effervescence in its lower half, clear passage;

C1 (46-72 cm); medium clay sand, light yellowish (2.5 Y 5/3 to wet and 2.5 Y 6/6 to dry), unstructured, rough, friable, common CaCO3 pseudomycelia, strong effervescence, clear straight passage;

C2 (72-135 cm); coarse clay sand, pale yellow (2.5 Y 5/4 in wet and 2.5 Y 6/6 in dry), unstructured, rough, very friable, common $CaCO_3$ pseudomycetes, strong effervescence, clear straight passage.

The analytical data for calcareous alluvial soil in the studied area are presented in Table 1.

Survey 2. Coordinates: N: 44.631238; E: 26.729861; alluvial limestone (AS-ka); Relief: floodplain; use: arable; Rock: fluviatile deposits; ground water: 3-5 m.

Morphological characterization of Survey 2

Ao (0-38 cm); clay clay-dusty, light brown (2.5 Y 4/3 to wet and 2.5 Y 5/4 to dry), grain structure poorly developed, strongly tamped, frequent fine roots, moderate effervescence, clear wavy passage;

AC (38-76 cm); medium clay clay, yellowish brown (2.5 Y 4/4 to wet and 2.5 Y 6/4 to dry), crumbly, unstructured, non-plastic, non-adhesive, frequent coarse pores, frequent fine roots, moderate effervescence in its lower half, clear straight passage;

C1 (76-98 cm); light yellowish dusty sandy loam (2.5 Y 5/3 wet and 2.5 Y 6/6 dry), unstructured, rough, friable, common $CaCO_3$ pseudomycelia, strong effervescence, clear straight passage;

C2 (98-126 cm); coarse sandy loam, pale yellow (2.5 Y 5/4 to wet and 2.5 Y 6/6 to dry), unstructured, rough, very friable, common $CaCO_3$ pseudomycetes, strong effervescence, clear straight passage.

The analytical data for calcareous alluvial soil in the studied area are presented in Table 2.

4) Development of the fertilization plan

The fertilization plan was drawn up based on the results obtained from the field, on the supply of nutrients, the expected (planned) harvest and the previous plant.

On the entire surface is applied an unconventional technology, usually minimum tillage, observing the rotation, including beans, especially soybeans, because it brings a considerable nitrogen intake, restores the soil structure, leaves the land cleaner from weeds and the texture is predominantly clay-clay.

When determining the types and doses of chemical fertilizers, ICPA indications were used, which correlated the results from long-term experiences with fertilizers on different soil types with the agrochemical indices characteristic of these soils and the evolution of agrochemical fertility. Results of agrochemical analyses based on samples collected from the area of 300 ha., are given in Table 3 and agrochemical recommendations on application of fertilizer doses on crops, are presented in Table 4*.*

Table 3. Chemical analysis

Area	Specificatie					
	pH	Humus (%)	Phosphorus (mg/kg)	Potassium (mg/kg)	IN (%)	V (%)
Axintele	7,45	1,98	48	258	1,9	96
Axintele	7,38	2,17	54	272	2,06	95

Table 4. Recommendations on doses of chemical fertilizers based on agrochemical analyzes

Surface (ha)	Early culture	Current culture	Harvest (kgha)	N kg s.a./ha	P_2O_5 kg s.a./ha	K_2O kg s.a./ha
187	Wheat	Soybeans	4 000	90	70	60
113	Soybeans	Corn	12 500	140	120	120

Table 1. *Physical and chemical analysis for calcareous alluviosol, pasture*

Orizon	Aoț	Ao	AC
Depth (cm)	0-16	16-28	28-46
Sand gr. (2-0. 2 mm)	9,8	14,2	14,1
Sand end (0.2-0.02 mm)	30,9	38,7	45,9
Dust (0.02-0.002 mm)	40,8	30,5	28,4
Clay (<0.002 mm)	18,5	16,6	11,6
Texture	SS	SM	UF

Table 2. *Physical and chemical analysis for calcareous alluviosol, pasture*

Orizon	Ao	*AC*	C_1	C_2
Depth (cm)	0-38	38-76	76-98	98-126
Sand gr. (2-0. 2 mm)	5,2	10,3	22,6	37,3
Fine sand (0.2-0.02 mm)	22,4	25,6	20,5	19,5
Dust (0.02-0.002 mm)	35,8	28,4	38,6	26,7
Clay (< 0.002 mm)	36,6	35,7	18,3	16,5
Texture	TP	TT	SS	SG
pH	7,8	8,1	8,4	8,7
Humus (%)	1,76	0,97	0,52	0,14
Bulk density (g / cm^3)	1,39	1,51	1,53	1,48
Total porosity (%)	44	43	43	46
Degree of subsidence GT (%)	moderate	moderate	moderate	weak
Degree of saturation (V%)	96	100	100	100
Carbonates (%)	0,7	2,1	7,4	11,2
Nitrogen index (IN)	1,68	0,97	0,52	0,14
P mobile (ppm)	41	28	11	-
K mobile (ppm)	137	119	78	-
Hygros coefficient. (%)	8,6	9,2	7,4	-
Wilting coefficient %	12,9	13,8	11,1	-
Field capacity %	23,4	25,1	20,2	-
Useful water capacity %	10,5	11,3	9,1	-
Total capacity (%)	31	26	27	-
Humus Reserve (t / ha)	93	55	18	-

CONCLUSIONS

The studied territory belongs to the extravilan of the locality Axinte, jud. Ialomita, located in the central part of the county, geographically framed in Baraganul Mostistei, characterized by a steppe climate, with groundwater at over 3 m;

The surface taken in the study is about 300 ha, land with current arable use, from which were harvested a number of 70 soil samples, in natural settlement (metal cylinders) and disturbed settlement (plastic bags);

The purpose of the paper was to know the morphological and physico-chemical characteristics of the soil in order to judiciously use it and develop the fertilization plan on crops.

The soil cover is consistent with the physical and geographical conditions of the area, being identified only one type of soil, namely: calcareous alluviosol.

The parent material consists of fluviatile deposits, on account of which a coarse-textured soil with contrasting distribution on the soil profile was formed.

The studied territory is mostly drained by the Ialomita river, with its tributaries having a permanent course sometimes temporary (dry periods).

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