

## YIELD CAPACITY LIMITATIVE FACTORS IN ARAD PLAIN SOILS

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**Abstract:** Soil, represent a major component in agriculture due not only to its own characteristics but also to its aggregant capacities for other environment factors influence. As agroecosystem element, the soil may favour productivity through a range of defined specific properties, such as: pH, granulometry, nutritive elements equilibrium, organic matter, thermic and hydric regime, mineralogic composition, etc. Practical action requires complex study of soil properties in interaction with soil genetics, climate and biologic factors. Approached issues in this paper refer to a 182.080 ha of agricultural terrain, belonging from the geomorphologic point of view to Aradului plain and from the hydrographic point of view to a part of Romanian south-west hydrographic system, improved by hidro – ameliorative works. We also describe microclimate (temperature, groundwater and rain regime) and phytogeographic characteristics of this area. As a result, pedogenetic factors interaction generate a numerous soil species with evolving specific characteristics. We note that soil properties cover fundamental geographical characteristics: in our research area follows the same step distribution as relief or climate. All the interpretations, evaluations and classifications have as support the pedological information resulted using soil survey methodology as it follows: Ecopedological conditions research, data organizations and processing were made accordingly to „Pedological studies Elaboration Methodology”, issued by ICPA Bucuresti in 1987, copleted by „Romanian Soil Taxonomic System (SRTS 2003). Soil chemical, fisica, hidrofisical characteristics determinations were performed after standard methodology elaborated by tutelary scientific Institute –ICPA, in OSPA Arad laboratory. Samples harvestind and terrain evaluation were made by qualified staff accordingly to standard methology. Within this system was elaborated the Romanian lands pedo-climatic grouping, soil rating and technological characterization of the area. In overall caracterization, the paper presents data referring to soil quality status in our considered area, as basic element in its ecological and technical approach. In the same time demonstrates the necessity of correct crop assignation due to certain limitative factors.

**Key words:** factor, composition element, area, agroecosystem, rural

### INTRODUCTION

Representing a well defined environment condition, having a wide variability in space, but being relatively stable in time, pedological factors, through their major components have an essential role in land quality characterization.

In time, conception upon soil and their function evoluate, displaying various modifications.

Now a day it is widely accepted the fundamental role of soil through its functions in biodiversity and climatic modifications, in environmental protection, economic and social development.

Based on these considerations the authors try to present supported by pedological and agrochemical studies data detained by OSPA Arad archive, some aspects that refer to pedological factors as components of rural area.

#### MATERIALS AND METHODS

Approach issues refer to a 182.080 ha of agricultural terrain.

Ecopedological conditions research, data organizations and processing were made accordingly to „Pedological studies Elaboration Methodology”, issued by ICPA București in 1987, completed by „Romanian Soil Taxonomic System (SRTS 2003)

#### RESULTS AND DISCUSSIONS

From the geomorphologic point of view, the researched area is a part of the great physical geographic unit called Banato-Crișană plain, sub-unity Mureș-Crișul Alb interfluve field, known as Aradului plain.

Mureș-Crișul Alb interfluve have a great diversity of geological units and many geomorphologic ones the most importing being: Crișului plain, Curticiului field, Șiriei plain, Livadei (Aradului) plain, Ierului plain, Nădlacului plain and the flood plain. (fig. 1.)

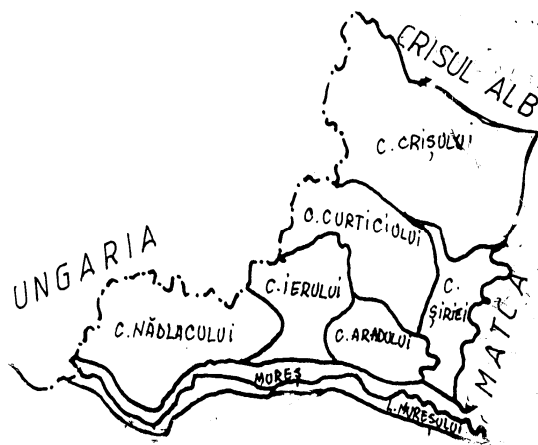


Figure 1. Main physical and geographical unities in Arad Plain

The geologic history of the researched area is part in the formation of great sediment basin called Panonică Depression, its east edge resulting from the step by step clogging process during “Pleistocene –Quaternary”.

The bottom of this depression contains an Carpathian wall formed from crystalline units and sediments from Paleozoic, Mesozoic and Neozoic-Paleozoic period, which intercalated with deposits from Pliocene, Pleistocene period. During Halogen period the entire area suffered from sinking several times, being overflowed by the sea (Tetis sea), allowing the formation, between these land blocks, of limnic and swamp areas, which existed until the beginning of the last century (they have limited their surfaces during years).

The last deposits of materials from Pleistocene and Halogene, are represented by the clay, sand, stones, loess, and loess deposits from the east areas (hills and mountains) eroded continuously by waters. These also represent the pedo-genesis process materials on which the

soils were the result of drainage process during the overflow of Danube in the area Portile de Fier. This phenomenon took place during Mindel and Riss glacial period.

From the hydrographic point of view the studied area is a part of south-west hydrographic system, hydrographic basin of Mureş (which is situated at south from the researched area) and that of Crişul Alb basin (which is flowing north from the researched area) and the hydro-ameliorative system Mureş- Crişul Alb.

The main hydro-ameliorative activities are the Matca channel and the complex of channels (Turnu, Dorobanţi, Sânpaul, Sederhat, etc) from the Ier system.

Another important aspect is the pedo-phreatic water level from the studied area, which depends on the meso- and micro-relief forms, hydro-geo-pedological horizon's nature and depth, seasons, the level of rainfall and current hydro-ameliorative tilling activities.

In the negative forms of relief (left meanders) the water level is 1,0 m deep, the areas with water deep of 1,1-2,0 m overlapping the areas less wavy, whereas at the levee form of relief the water is of 2,1-4,0 m deep or even 3,1-5,0 m deep.

The microclimatic characteristics of the researched area depend on its geographical position having a moderate continental temperature with short and warm winters, its climate being an average between the Banat region climate and that of Crişan region. The area is under the influence of cyclones and the air mass coming from the Mediterranean and Adriatic Sea.

The multi-annual average temperature in this area, as registered at the Arad meteorological-station, between 1943-2007 was of 10,4 °C, in the last ten years this level changing to 11 °C.

From the phytogeographic point of view the researched area belongs to the geo-botanical region of central Europe being strongly influenced by its border with south European geo-botanical region. Here we can meet different natural floristic elements depending on their background: European, Euro-asian, Boreal, Balcanic, Mediterranean, Iliric, at which we can add a large number of endemic plants.

As a consequence, soil cover fundamental geographical characteristics in our research area follows the same step distribution as relief or climate. Pedogenetic factors interaction generate a numerous soil population with evolving specific characteristic.

Accordingly to Romanian Soil Taxonomy System (SRTS 2003) we identified in our area 7 classes and 8 Soil Types (table 1).

Table 1

Main types and soil associations in Arad Plain,  
(hectares and percentage of agricultural terrain)

Nr. crt.	SRTS 2003	ARAD	
		Ha	%
1	Alluvial soils	4570	2,51
2	Chernozem	81007	44,49
3	Phaeozem	15386	8,45
4	Brown forest soil	40131	22,04
5	Alluvial argillic brown soil	2677	1,47
6	Vertsols	22268	12,23
7	Gley soil	9686	5,32
8	Sodic soil	6355	3,49
Total		182.080	100,00

The diversity of geomorphologic and geolithic factors that bring to a great diversity of parental materials, and to a various anthropic interventions has as result a wide soil population. This soil diversity according to Romanian Soil Taxonomy System (SRTS-2003) from the researched area can be presented as follows: Chernozem 44,49%, Vertsols 12,23 %, Alluvial soils 2,51%, Sodic soil 3,49 %, Brown forest soil 22,04 % Gley soil 5,32%, Phaeozem 8,45%, Alluvial argillic brown soil 1,47%.

From the morphological, chemical, physical and hydrophysical proprieties that influence directly plants' environment and also other soils' proprieties, a great importance have: the gleyzation, stagno-gleyzation, salinization, alkalization, humus reserve, soil texture, soil porosity, edaphic volume.

Taking into account the particularities of environment's factors and conditions common to the researched area, each identified soil and land unit were characterized according to Pedological Studies Elaboration Methodology (vol.I, II, III).

The rating marks show the following aspects regarding soil quality:

- it determines each land unit capacity for certain activities in order to find its most suitable use,
- it determines each land unit capacity for planting certain crops in order to find which crop is more suitable to plant,
- it determined land production capacity for different activities or for certain crops by using a certain technology.

The soil rating activity brought to surface various limiting and restrictive factors that influence agricultural land production capacity:

- soil reaction with low values 22,3% (8,1% strong acid, 14,2% moderate acid) or high values 20,1% (7,8% strong and excessive alkaline, 13,3% moderate alkaline), 26,3% of the surface suggesting a low acid reaction and 6,9% of the surface showing a low alkaline reaction,
- fine texture 50,7% (38,4% clayey-loamy, 22,3% loamy-clayey) and thick texture 10,2% (sandy and sandy-clayey),
- low humus reserve 28,7% ( 16,3% being low and 12,4% very low),
- surface humidity excess 30,3% (10,3% strong, 10,2% very strong, 9,8% the strongest),
- depth humidity excess 26,8% (16,7% strong, 7,3% very strong, 2,3% the strongest),
- low portanta 13,6%,
- strong compaction degree 84,4%.

Upon these restrictive factors that affects soils production potential is necessary to take protection and correction measures. These correction measures regard the acid reaction correction by periodical liming or that of alkaline reaction through gypsing. Also, these measures refer to plants nutrition condition improving by ameliorative fertilizations, by assuring an optimal air-hydric regime through activities for preventing and eliminating the humidity excess (channels, drainage, etc, and eliminating the aridity tendencies (irrigation, protection curtains, use of adequate crops). It is necessary to use some technology of soil tilling that should avoid its de-structuring and the appearance of hardpan.

On this direction, the pedological factors, which are a very important variable in time and space, through their components, play an essential role in characterizing a soil unit.

It is very important to know which are the natural conditions and zonal particularities of agricultural lands ecological potential for main crops, in order to define land production capacity and to establish the expected level of yields.

### CONCLUSIONS

It can be concluded that in the condition of a high natural ecological potential of the researched area the general condition of soil is not satisfactory due to the existence of certain limiting and restrictive factors.

Specific physical and geographical conditions met in surveyed area determined extremely diverse soil categories formation; from sandy to loamy, from alkaline to acid, from low humic and nutritive elements constant, to equilibrate content soils.

Despite an apparently good natural ecological potential we qualify soil quality general situation as unsatisfactory: most of acreage is affected by one or more limitative or restrictive factors.

Generally land use distribution is consistent to pedoclimatic conditions nature presenting balanced structure on most area. However not all time land exploitation fit to durable land resources management.

Each land unit localization and definition in the studied area and also its morphological, genetic and ecopedological characterization is very important. Upon this we can base the researches to determine the ecopedological conditions which constructs the adequate environment for plant growth and crops, and neither the less on this base we can identify land capacity to be used in different activities, for certain crops.

Applied technological systems had a vigorous impact on soil compactness progression and soil profile limitation due to a very compact soil layer (20-35,45 cm) creation.

Their presence, even on most fertile soils, leads to productivity decrease and costs raise.

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