THE FAVORABILITY OF RED SOILS FOR AGRICULTURE CULTURE FROM THE SUBCARPATHIAN DEPRESSION OF OLTENIA -THE AREA BETWEEN OLTET AND MOTRU

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Abstract.*The soils from the Subcarpathian Depression of Oltenia (the area between Oltet and Motru (are the result of soil shaping processes specific to natural conditions. The dominant soils are the luvisoils and the cambisoils. Along these, on restraint areas we distinguish soils that are from the same classes but which colors vary; they are red on more or less on all control area. This paper covers the red soils in the Subcarpathian Depression of Oltenia (the area between Oltet and Motru) with regards to:*

- *The surfaces covered by red soils;*
- *The causes of the rubefaction process;*
- *The main red soil (subtype level). Morpho-phisical-chemical characteristics and their distribution in the Romanian Taxonomy System;*
- *The production potential of the red soils. The researches were organized and conducted by the Pedological and Agrochemical Institute Gorj. On the field, the research activity was done in an expeditionary system and consisted of:*
- *execution of soil profiles*
- *drawing soil samples*
- *individualizing red type of soil on the working plans.*

The soil samples were analized in the Institute laboratories as in the ICPA Bucuresti methodology and the integration of the soils in the Roumain Clasification System was made on SRTS 2012. Fallowing the research in expeditionary system there were identified red soil an area of 6230 Ha: soil evaluated in natural different condition. According to the solification rocks we can two groups of red soils:

- *Soils that have evolved on granite rocks;*
- *Soils that have evolved on limestones;*

The favorability of these types of soils is the following:

- *Red soils that have evolved on granite rocks: The species with deep roots (fruit trees and grapevines) have a good to medium favorability, while the crops have medium to low favorability. The indicators that decrease the final scoring are the mould content and the reaction of the soil.*
- *Red soils that have evolved limestones: The species with deep roots have a medium favorability, while the crops have low and very low favorability. The indicators that decrease the final scoring are the temperature, the mould reserve and last but not least the acidity. The presented results partial research.*

Key words: *soil shaping, color, rubefaction process, subtype, potential*.

INTRODUCTION

The western half of The Subcarpathian Depression of Oltenia is bounded naturally by river Oltet on est, river Motru on west, the southerner carpation choin (the Parang, the Valcan and partially , the Mehedinti mountains), on the north and The Piemont Getic Hills on South.

This is the researched area were we find the red soils:

- The red soils developed on chad and pebbles, granitic drift or on the materials resulted from their wathering. We find them on the Gilort Terrace on the Subaria of The Subcarpathian Depression of Oltenia.

- The red Soil developed on bedrocks on materials resulted from their wathering. We find them on the southerner limit of the southerner carpatian chain in the contact area with the Subcarpathian Depression of Oltenia. Geomorphologically speaking those soil are found on bedrock chines and mountainsides, as well as, on their base (in the contact area winth the depression) as diluvia and colluvia.

MATERIAL AND METHODS

The researches has been organized and executed by OSPA Gorj in the fied and laboratory.

In the fied, the research activity has been done on a expeditionary way and sonsisted in:

- the implementation of soil profiles
- the relevation of soil samples
- the individualization of red soil on the working project.

The researches of soils on the fiels has been done after ICPA methodology. The analysis of soil samples has been done in OSPA Gorj laboratory.

The executed analisis were: the soil reaction, the total nitrogen, the humus, phosphorus, aluminium, the sum of hydrogen, the saturation degree in alkalies, the granulometric analisys.

Iron (total forms), has been analised in ICPA Bucuresti laboratories. The framing of soils in SRTS has been made after SRTS 2012.

RESULTS AND DISCUSSIONS

A. The distribution of red soils in The Subcarpathian Depression of Oltenia – The Sector between Oltet and Motru.

As a result of the research executed in an expeditionary way, has been identified red soil on a surface of 6250 ha (fig. no1), soil developed an different natural condition as:

1. Red soil developed on granitic roks or material resulted from their wathering. We find them in Tg-Jiu Depression – Campu Mare, on third terrace of Gilort (850 ha) and the second terrace of Jiu (250ha). The 850 ha that are found on the superior terrace of Gilort are in a compact area but those 250ha of the second terrace of Jiu are scattereal. In both cases, the surface are plane and easy inclined (0-2%).
2. The red soils developed on bedrocks or material resulted from their wathering. We find them on the southern limit of southern Carpathian chain in the contact area with the internal subregion of the Subcarpathian Depression of Oltenia. The red soil overlop on beadrock barrier on the south of the mountain chain.

The surface of 5150ha (arable) of those soils we met indifferent relief condition: bedrock chines and mountainsides with decline from 5 to 45% diluvian and coluvia on the base of the mountainsides with decline from 5 to 10%.

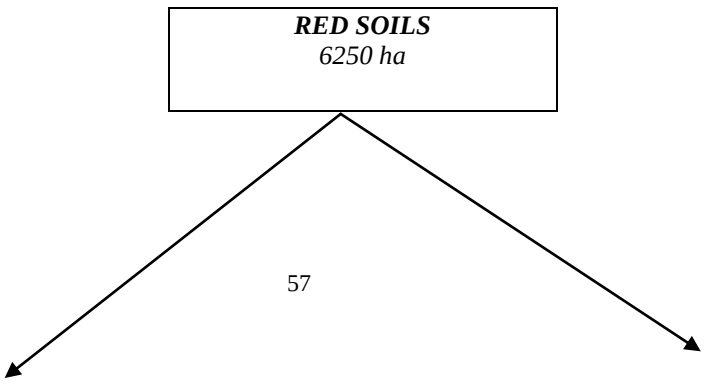

Fig. 1 The distribution of red soils in the researched area

B. The main natural condition that influenced the evolution of red soils and the causes of their rubefaction process. (table 1)

Table 1

The main natural condition which teh red soil

RED SOILS	NATURAL CONDITIONS					
	Geomorphology	Temperature – T° C			Precipitation-mm	I_{ar}
		Multiannual average	Average		Multiannual average	
			winter	summer		
Developed on granitic rocks or material resulted from their weathering	*Plane surface, or inclined, or terrace*	10,2-10,5	-0,67	20,63	764,4	37,65
Developed on bedrocks or material resulted from their weathering	*Chines and mountainside, deluvia, coluvia.*	8,8-9,8	-1-1,2	18,0-19,9	901,9-958,7	45,55-50,99

a) natural condition that influenced the evolution of red soils:

1) Red soil developed in a continental temperate climate with influences from the Mediterranean woods aria (subaria of quercineae woods). The average multianual temperature extended between 10,2 and 10,5 ^{0}C, the average multianual rain fall of 764,4mm and the dryness index is between 36,5 and 38,5. The solification base is made of chad and peldbles drifts of granitic nature and /or material resulted from their wathering.On this surface of 1100 ha, the solification fallowed different direction of solification:

- solification dominated by washing processes and deposition establishing the formation of soil from luvisoluri, class as preluvosoluri and luvosoluri.
- solification dominated by wathering process in situ establishing the formation of soils from cambisoluri class, as eutricambosoluri, and districambosoluri.

2) The red soils developed on bedrocks or material resulted from their wathering.

Soil developed in a continental temperate climate with mediteraneean tones in the woods area(subarea of quercineae woods and beech woods). The average multiannual temperature is from 8,8 to 9,8^{0}C, average multiannual rainfall is from 901,9mm to 958,7mm and the dryness index is from 45,55 to 50,99.

The solification base is made of bedrocks or material resulted from their wathering. In this surface of 5150 ha, the solification has fallowed different direction as:

- the solification dominated by washing deposition processes, establishing the formation of soil from luvisoluri class, as preluvosoluri and luvosoluri.
- The solification dominated by wathering processes in situ, establishing the formation of soils from cambisoluri class, as eutricambosoluri.
- Not evoluated soils wich are framed in the protisoluri class, as litosoluri and regosoluri.

Exceptng the red soils which are faund on diluvia and coluvia, the compact rock appears on the surface until 150 cm.

b) rubefaction process

Romanian and foreign speciality literature asserts that rubefaction process is long and its essence is passing of iron into hydrated forms which give to the soil the browny colowe and/or ocher in oxidized forms which gives to the soil the red colour.

Synthetizing three conditions which must fulfilled to produce rubefaction: the solification rock which contain iron, temperature and rain/all.

Relating red soil found in the researched area to those three condition whish we mentioned we can say:

1) red soils developed on granitic rocks

The Romanian speciality literature doesn't mention the presence of red soils on granitic rock or an material resulted from their wathering.

- Under the reservation that tests of the solification rock, iron content haven't been made we can say that it has iron thinking that on the control section the iron content (total forms) has values from 2045mg/kg (0-20cm) to 29046mg/kg (80-100cm) with an average of 24203mg/kg.The color is 5YR on the superior side of the soil profile and of 2,5YR on this base.

Without mentioning peculiarly temperature limits to start the rubefaction process, the speciality literature mention that the rubebaction process in case of red – browny soils has produced on temperature bigger than 10^0C.

Red soils developed on granitic rocks in the reseaeched area have been developed in a termic system with values from 10,2 to 10,5^{0}C.

The rain/all is of 764,4mm (multiannual average) influencing the condition of short rainy periods in the alternance with worm periods.

2) red soils developed on bedrocks.

As concerns of the solification rock, the speciality literature mentions that the materials resultes from thewathering of bedrocks are rich in iron. The iron tests (total forms) mark out values from 32719/kg (in the first 20 cm) to 53140 mg/kg (80-100 cm) with an average on the control section of 44589mg/kg.

Refering to the thermic conditions the soils developed on bedrocks has been met on a thermic system from 8,8 to 8,9^{0}C. Refering to the fact the some researchers consider red soil as relict , we can accept the possibility of meeting those soils in the area with low temperature. The rain/all has multianual average values from 901,9mm to 958,7mm.

C. **The main morpho-phisical-chemical properties of red soil met in the researched area and the possibility of framing them in SRTS.**

1) Red soils developed on granitic rocks or on materials resulted from their wathering

Red soils that we met on the surface of the researched 1100ha are framed in two classes:

- luvisoluri class with the fallowing types and subtypes:
- luvosol rodic on granitic rocks – lutos (LV)
- preluvosol rodic distric on granitic rocks – lutos (EL)
- cambisoluri class – with the fallowing types and subtypes:
- eutricambosol rodic distric on granitic rocks – lutos (EC)
- districamosol rodic on granitic rocks – lutonisipos (DC)

Soils are red all over the control area with a light conteint of humus, intense dealkalis, unaccomodated with the main nutritives, average pattern on the control area.

Referring to the subtypes, SRTS doesn't allowed the framing of soil this way:

- for preluvolsoluri doesn't exist the distric subtype
- for eutricambosoluri doesn't exist the distric subtype even it it is mentioned in the definition
- for districambosoluri doesn't exist the rodic subtype

2) the red soil developed on bedrocks or on materials resulted from their wathering.

Red soil developed on bedrocks are been found on the researched surface (5150 ha), is framed in three classes:

- The luvisoils class:
- luvosol albic rodic planic on clay (argillaceous) – LV
- preluvosol rodic on bedrocks (LNA) – EL
- preluvosol rodic district on bedrocks – EL
- The cambisoluri class – with the fallowing types and subtypes
- Eutricambosol rodic on bedrocks (EC)
- The protisoluri class – with the fallowing types of soil:
- Litosol rodic on bedrock (LS)

Soil are red all over the control area, with a light content of humus at the level of bioaccretion horizon, unaccomodated with the main nutritives, average pattern on the control section.

Referring to the subtype SRTS doesn't allowe the framing of soils this way:

- for preluvosoluri doesn't exist the distric subtype
- for litosoluri doesn't exist the rodic subtype

D. The production capacity of the main red soils from The Subcarpathian Depression of Oltenia

1) The production capacity of the main red soil developed on granitic rocks or on materials resulted from their wathering

In the 12^{th} and 13^{th} tables is presented their potential of production to rodic preluviosoil and eutricambosoils developed on granitic rocks.

On preluvosoils, for deep-rooted species, the most favorable are: apple tree, cherry tree, sour cherry tree, as well as the grape vine for wine.

Referring to the field crops the most favorale is wheat.

On rodic eutricambosoils the most favorable are corn and wheat,

On the red soils developed on granitic rocks, no matter what crops we are talking about the more fertile are eutricambosoils than preluvosoils.

2) The production capacity of the main red soil developed on bedrocks or materials resulted from their wathering.

The evaluation of production capacity has been made only to those soil wich relief allow the access of agricultural machinery to the district rodic preluvosoil and the rodic preluvosoil.

On the 14^{th} and15^{th} tables we can see which crops are the most favorable, as well as their production potential.

In the case of distric rodic preluvosoil at the deep-rooted species the most favorale ar the apple tree, followed bythe cherry tree and sour cherry tree.

For the field crops it doesn't work as well as for the trees.

The crops are more favorable for the rodic preluvosoil than the distric rodic preluvosoil.

So, for the deep-rooted species, the most favorable are the apple tree and the plum tree and for the field crops, the most favorable is the corn.

On the red soils developed on bedrocks, for the crops, the more favorable are the rodic preluvosoils than the distric rodic preluvosoils.

BONITATION NOTES, FAVORABILITY CLASSES AND POSSIBLE PRODUCTION, THE MAIN CROPS ON THE RED SOIL

A. The main red soils developed on granitic rocks or materials resulted from their wathering (i ≠ 10%):

Table 2

1. The Preluvosoil rodic-distric:

Culture	Apple	Seeam tree	Plum tree	Chery tree	Vine	Vine for table	Wheat	Porum	Potato
Note	73	65	65	73	73	65	65	58	51
Favora-bility	III	IV	IV	III	III	IV	IV	V	V
Possible production	58400	52000	32500	32500	16060	14300	4550	5220	30600

Table 3

2. The Eutricambosoil rodic:

Culture	Apple	Seeam tree	Plum tree	Chery tree	Vine	Vine for table	Wheat	Porum	Potato
Note	81	81	81	81	81	72	72	72	57
Favora-bility	II	II	II	II	II	III	III	III	V
Possible production	64800	64800	40500	40500	17820	15840	5040	6480	34200

B. The main red soils developed on bedrocks or material resulted from their alteration(i ≠ 10%):

Table 4

1. The Preluvosoil rodic-distric:

Culture	Apple	Seeam tree	Plum tree	Chery tree	Vine	Vine for table	Wheat	Porum	Potato
Note	58	45	45	51	26	8	40	41	36
Favora-bility	V	VI	VI	V	VIII	X	VII	VI	VII
Possible production	46400	36000	22500	25500	5720	1760	2800	3690	21600

Table 5

2. The Preluvosoil rodic:

Culture	Apple	Seeam tree	Plum tree	Chery tree	Vine	Vine for table	Wheat	Porum	Potato
Note	65	65	65	58	32	12	50	52	37
Favora-bility	IV	IV	IV	V	VII	IX	VI	V	VII
Possible production	52000	52000	32500	29000	7040	2640	3500	4680	22200

CONCLUSIONS

The surface of red soil in the Subcarpathian Depression of Oltenia, the sector between Oltet and Motru, is of 6250ha, as:

- 1100 ha, red soil developed on granitic rocks and/or materials resulted from their wathering
- 5150 ha red soil developed or bedroks or materials resulted from their wathering
- Refering to natural conditions, real soil developed on granitic rocks fulfill rubefaction conditions.
- Under the reservation that the red soil developed on bedrocks are not paleomorph soil, referring to the temperature, they do not fulfill the rubefaction conditions
- The iron content (total forms) of red soil developed on bedrocks is almost double than the one from red soils developed on granitic rocks.
- On the base of moderate acidity all the tested soils are intense dealkalised, unaccomodated with humus, the patern being average on the entire control section. The soil we have met in the researched area, are framed in the following classes:
- Luvisoil Class
- Cambisoil Class
- Protisoil Class

The framing of soil in SRTS at subtype level, has the fallowing problems:

- the preluvosoil doesn't have the distric subtype
- the eutricambosoil doesn't have the district subtype, even if it is mentioned in the definition
- the districambosoil doesn't have the rodic subtype
- the litosoil doesn't have the rodic subtype.

On the red soils developed on granitic rocks, the deep-rooted species (fruit trees and grape vine) have been more favorable than, field crops, the index which, has an important influence are acidity and humus.

On red soils developed on bedrocks, deep-rooted species are more favorable than field crops, but less favorable than those on red soils developed on granitic rocks. The index which has an important influence are temperature, acidity and humus.

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