THE INFLUENCE OF THE ANTHROPOGENIC COMPONENT ON THE SOIL EVOLUTION IN THE BĂIŢA - ŞTEI AREA FROM THE BEIUŞ BASIN

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Abstract

After 1990 there was a period of transition in Romania. This period was represented by the transition from a socio-political and economic system characterized by collective ownership or from a centralized economy to a market economy. In this context, agriculture as a branch with a strategic role in the market economy required the allocation of considerable financial resources for innovation, reorganization, restructuring and modernization.

Organizing villages and peasant households, as well as in the whole country, and in the Băiţa - Ştei area from the Beiuş basin, with the restoration of land owners' rights and the purchase of agricultural equipment from the former cars batch of the Cooperative (CAP) and of the State agricultural enterprise (IAS), changes since 1990 and the following years.

The effect of subsistence and semi-subsistence is almost entirely manifested in the small and very small forms of private property in which the agri-food products are only for self-consumption, the number of animals decreases due to the lesser workforce, the aging population and the low efficiency of strongly fragmented land, which also leads to higher production costs.

Due to the mechanization performed on the small plots of land, the repeated passage of the machines for carrying out the agricultural works to a high value of the degree of humidity, the degree of compaction of the soils increases, to a lesser or greater extent with the fragmentation of the land surfaces.

Key words: property, profitability, efficiency, mechanization, machinery, compaction.

INTRODUCTION

The * 90s, the end of the 20th century and the beginning of the 21st century are characterized by:

- the increasing the greenhouse effect; CO2 emissions, car parts, expansion of areas and intensification of industrial activities, deterioration of the ozone layer, deforestation, pollution of the plastic component and hydrocarbons;

- the deregulation of weather cycles in different areas of the Earth (climate inversions, floods, torrential rains, with massive flows in a very short time, which is manifested by a very low degree of infiltration into the ground and a very high coefficient of flow to the surface which generates landslides);

- the atypical circulation of air masses, tornado-like events in Central Europe and the Eastern European part, including Romania.

The intracolonial Beiuş basin is the result of the action of the Crişul Negru and its many tributaries that created a system of valleys with terraces and meadows.

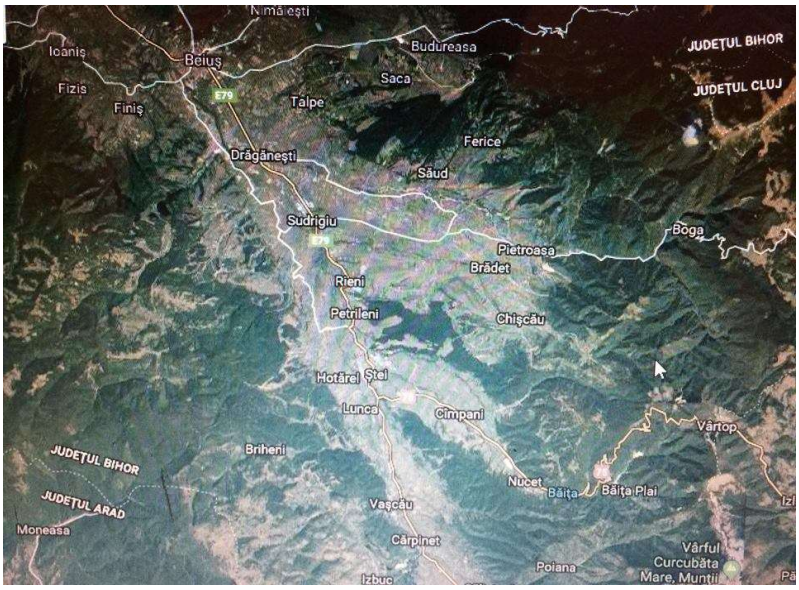

Fig. 1. Bihor County the S-E area (after Google maps, 2019)

The solification process takes place in the S-E area of the Beiuș basin in a specific way. Due to the presence of the weather and the anthropic elements of the relief it is important to mention that they have an equal influence and they place their imprint on the solification process.

Fig. 2. The S-E of the Beiuș basin

Soil compaction is a real problem for the agriculture in Romania. In addition to the primary (natural) compaction, there is a secondary (anthropic) compaction, which occurs during the agricultural work, due to repeated passes with the machines, especially when the soil has a higher degree of moisture. Compaction modifies the soil quality indicators, the porosity and the permeability.

MATERIAL AND METHOD

The research methods consisted of: field observations, discussions with landowners and owners, consultation of the archived documents, discussions with the staff of local authorities in Băița - Ștei area, sampling and analysis of the soil samples. The samples were made with the pedological probe on land surfaces in Ștei - Băița area, the analyzes were carried out in the laboratories of the Faculty of Environmental Protection Oradea and at OSPA Oradea.

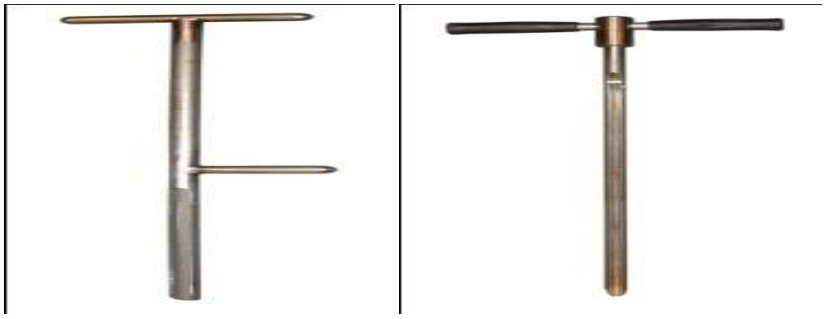

Figure 3. Pedological probe

The granulometric determination method was performed according to STAS 7184 / 10-79.

The humus determination method was performed according to STAS 7184 / 21-82.

Method of determining apparent density (AD)

The soil sampling probe with foot rest was used for this operation, for depth 0-25m, and also the soil sampling probe with hammer head for depth 25-50cm. The probe was then emptied of the soil, which was transferred into bags and transported to the laboratory. Then the soil samples were dried in the drying stove at 105 ° C for 10 hours and finally the dried soil was weighed.

Table 1

Granulometric soil analysis from Câmpani (2000)

Depth (cm)	0-25	25-50
Coarse sand(2.0-0.2mm)%	25.7	26.0
Fine sand(0.2-0.02mm)%	29.1	26.1
Dust(0.02-0.002mm)%	13.4	17.4
Clay(>0.002)%	31.8	30.5
Texture	LN	LL
AD (g/m^3)	1.33	1.82
Humus%	2.38	0.97

Table 2

Granulometric soil analysis from Câmpani (2019)

Depth (cm)	0-25	25-50
Coarse sand(2.0-0.2mm)%	24.8	22.1
Fine sand(0.2-0.02mm)%	32.1	27,4
Dust(0.02-0.002mm)%	12.2	17,8
Clay(>0.002)%	30.9	32.7
Texture	LN	LL
AD (g/m^3)	1.84	2.15
Humus%	2,40	1.08

In the Câmpani area on the land where soil samples were taken (in 2000 and 2019), due to the mechanization on small areas of land, the carrying out of agricultural works at a higher level of moisture and the weather factors, the degree of compaction increased by 38% in the 0-25cm layer and by 18% in the 25-50cm layer.

Table 3

Granulometric soil analysis from Ştei (2000)

Depth (cm)	0-25	25-50
Coarse sand(2.0-0.2mm)%	21.3	21.7
Fine sand(0.2-0.02mm)%	22.8	17.6
Dust(0.02-0.002mm)%	23.7	28.9
Clay(>0.002)%	32.2	31.8
Texture	LL	LL
AD (g/m^3)	1.40	1.87
Humus%	2.43	1.04

Table 4

Granulometric soil analysis from Ştei (2019)

Depth (cm)	0-25	25-50
Coarse sand(2.0-0.2mm)%	13.5	14.6
Fine sand(0.2-0.02mm)%	31.9	26.4
Dust(0.02-0.002mm)%	25.2	27.7
Clay(>0.002)%	29.4	31.3
Texture	LL	LL
AD(g/m^3)	1.99	2.17
Humus%	2,39	0.98

In the area of Ştei on the ground where soil samples were taken (in 2000 and 2019), due to the mechanization on small areas of land, the carrying out of agricultural works at a high level of moisture and the weather factors, the degree of compaction increased by 42% in the 0-25cm layer and by 16%in the 25-50cm layer.

The compaction occurs when pressure is applied to the soil surface when passing agricultural equipment during the soil work.

The mechanization on small plots of land intensifies the compaction process which unfavorably influences the soil quality indicators (the porosity and the permeability), reduces the degree of infiltration and intensifies the one of surface leakage, especially on the inclined surfaces. It decreases the number of pores and capillaries which determines a lower

water and oxygen reserve in soil, higher mechanical resistance to agricultural work, the root system development being hindered.

The presence of a low permeability layer also makes the upper soil layer prone to water saturation and therefore heavier. This upper layer is exposed to a risk of erosion due to the higher amount of surface runoff and landslides.

In the plain area the compaction leads to water supersaturation causing the destruction of the aggregates and the crust forming. The soil structure can be improved with some organic matter, by reducing its predisposition to compaction, erosion and landslides.

The mechanization carried out on small areas of land that replaced more or less the carrying out of agricultural works caused changes in the structure but especially in the texture of the soil in the studied area, a phenomenon that is reflected on our entire country.

Due to reductions in livestock in the area lately, fertilization with manure is declining which changes the chemical mineralogical composition, or mineral dowry of the soil and it had contributed to the intensification of the phenomenon of compaction.

In the area of the existing villages, there are no associative forms regarding agricultural areas.

The compaction can be eliminated by: administering organic fertilizers (manure), incorporating plant residues under the fence, carrying out agricultural works at suitable humidity, scarification, deep plowing, carrying out agricultural work with minimum machine passes and so on.

CONCLUSIONS

The *90s represent the transition from a socio-political and economic system, characterized by collective ownership, to the market policy in which the CAER system is abandoned. This market policy is oriented towards the European Union and its purpose is the development of the market economy. The individual property rights on agricultural land are restored.

The re-ownership restores the rights of the owners from the agricultural areas. The machines with animal traction are gradually replaced. The owners have the possibility to buy tractors at low prices from the car batch of the Cooperative (CAP) and the State agricultural enterprise (IAS).

In a very short period of time the agriculture in Romania changes essentially, from very large areas belonging to the Cooperative (CAP) and to the State agricultural enterprise (IAS), to small and very small farms (individual households) that coexist with the medium and large farms.

Once Romania enters the European Union, the agricultural activities are highlighted and the agrarian economy confirms that small and very small households (family and individual households) are inefficient, unviable and unprofitable in the current European and world context.

Global and local weather phenomena influence the soil quality indicators.

The use of mechanized equipment (tractors, agricultural combine machines and so on) requires wider and consolidated access paths, compatible with the gauge of the used machines.

An annual cycle involves plowing, sowing, maintenance and harvesting, the presence of machinery on agricultural land for a relatively long period of time which determines the modification of the structural indicators: structure and texture.

Due to the strong fragmentation of the lands, the access roads, the maneuvering spaces and the changes of the walking direction remove 10 - 20% of the agricultural circuit.

Mechanization on small batches means higher production costs and deterioration of soil quality indicators resulting in lower productiveness.

Due to the constantly declining workforce, the aging population and the low efficiency of the highly fragmented land areas, it is necessary to reorganize them in the form of associations, establishing a common composting platform.

The vegetal material will be used, either by incorporation under the furrow to improve the compaction effect or by composting for soft materials, grinding and briquetting the cellulose parts that are eventually being used for combustion.

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REFERENCES

1. Alexandri C., et al, 2002, Agricultura românească în ultimul deceniu – o analiză sectorială, Institutul de Economie Agrară, București;
2. Bandici Gh. E., Borza I., Ardelean I, 2007, Ecoagricultura, Ed. Universităţii din Oradea, Oradea;
3. Berindei I., 1977, Țara Beiușului, în volumul Câmpia Crișurilor, Crișul Repede, Țara Beiușului, Cercetări în geografia României, Ed. Științifică și Enciclopedică, București;
4. Brejea R., Domuța C., 2009, Refacerea și protecția terenurilor din carierele de bauxită din munții Pădurea Craiului, Ed. Universității din Oradea;

5. Brejea R., 2009, Tehnologii de protecție sau refacerea solurilor, Ed. Universității din Oradea
6. Brejea R., 2010, Ştiinţa solului – îndrumător de lucrări practice. Ed. Universităţii din Oradea
7. Brejea R., 2011, Practicum de tehnologii de protecție a solurilor, Ed. Universității din Oradea
8. Brejea R., Domuţa C., 2011, Practicum de pedologie, Ed. Universităţii din Oradea
9. Coste I., 2001, Ecologie generală şi agricolă, Ed. Orizonturi Universitare, Timişoara;
10. Domuța C., 2005, Agrotehnica terenurilor în pantă din nord – vestul României, Universității din Oradea
11. Domuţa C., Brejea R., 2010, Monitoringul mediului, Ed. Universităţii din Oradea
12. Ileana Ardelean, 2013, Agrotehnica, Ed. Universității din Oradea, Oradea;
13. Indrieş C., Indrieş A., Zona Geografică Beiuș, Ed. Primus, Oradea, 2015
14. Luiza Chivu, 2002, Competivitatea în agricultură – analize și comparații europene, Academia Română, Centrul Român de Economie Comparată și Consens, Ed. Expert, București
15. Măhara Gh., 1977, Câmpia Crișurilor, în volumul Câmpia Crișurilor, Crișul Repede, Țara Beiușului, Ed. Științifică și Enciclopedică, Oradea
16. Otiman I. P., Popescu M., 2002, Agricultura României, Ed. Agroprint, Timişoara
17. Posea G., Câmpia de Vest a României, Ed. Fundaţiei România de Mâine, Bucureşti, 1997
18. LEGE privind recensământul general agricol din România în anul 2020
19. https://www.icpa.ro/
20. http://www.insse.ro/cms/
21. https://www.madr.ro/