EVOLUTION OF HYDRO-PHYSICAL PROPERTIES OF A CAMBIUM CHERNOZEM FROM VOITEG, TIMIS COUNTY

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Abstract: *Research goal is to accumulate scientific data on development of components of agricultural land productivity, necessary to support of a methodology of their quality evaluation through a complex firm approach to physical and geographical conditions from Banat Plain. The objectives and activities is according with the current agricultural research and agricultural practice, on international and national level, for the study of the importance of hydro-physical characteristics of the edaphic coating in substantiation of tillage systems. The physical and chemical properties of soil samples (texture, pH, content of humus and N,P,K), and hydro- physical (momentary humidity U%) were analyzed in USAMVB-OSPA Timisoara Research Laboratory, after national norms and standards approved by the Standards Association from Romania (ASRO). The research of the ecopedologic conditions was made according to "The methodology of elaborating of pedological studies", vol. I, II and III elaborated by the ICPA Bucharest in 1987, completed with specific elements by the Romanian System of Taxonomy of Soils (SRSTS-2012).Knowledge of these features of the soil has of special theoretical and practical importance. Theoretical, it provides to specialist the possibility to interpret the phenomena that occur in soil and to predict soil evolution in particular and the environment in general, in terms of present and future health, and practical because warns the physician as what measures should be taken to bring the soil in optimal conditions for growth and development of plants cultivated or wild. Importance, originality and timeliness of work is the need to protect the edaphic layer and environmental protection by cultivated or wild plants.The accumulation of scientific data necessary to support technologies of conservative tillage and sustainable management of soil and water resources, Implementation of conservative tillage and sustainable management of physical, geographical and edaphic conditions from Banat Plain. Connected, intervention means at farmer disposal that could lead to yield growing capacity and quality improvement of soil are presented.*

Keywords: *properties, soil, climate, moisture, reserve.*

INTRODUCTION

Knowledge of natural conditions and ecological features of the proposed zoning of land for various utilities and some cultures have great social and economic importance both for large and for small farm producers.

Our country climatic drought trend , displayed by frequency and intensity growing of drought phenomenon, represents a real fact obliging us to accord it an increased attention.

A special attention was conceded to that subject in the Program of Drought Control , coordinated by ASAS (CANARACHE , 2000) and the work entitled " National Strategy and Action Program regarding desertification , soil decline and drought control " , elaborated by ICAS , ICPA ,INMH, ICVV , ICIM, ISPIF, ICITID-Baneasa , ICCPT Fundulea , and ICPCP Brasov , under MAPPM leadership.

Based on these considerations, the authors try to present in this paper, based on data extracted from scientific research topics and an impressive volume of data collected from the

archive OSPA Timisoara, some aspects of soil quality status and evolution of the main factors that contribute to its realization.

MATERIAL AND METHODS

The research is on the line of sustainable agriculture system and aims to highlight the main objective the quantitative and qualitative changes occurring in the agricultural eco-system in application to wheat and corn.

The experiences are placed on a cambium Chernozem,low gleyed, loamy clay / loamy clay, in the experimental field of Agricultural School Voiteg. To achieve objectives, the research was oriented towards both observations and measurements made in the field and experimental validation of these findings by laboratory analysis.

The research of the ecopedologic conditions was made according to "The methodology of elaborating of pedological studies", vol. I, II and III elaborated by the ICPA Bucharest in 1987, completed with specific elements from the Romanian System of Taxonomy of Soils (SRTS-2012).

RESULTS AND DISCUSSION

Following its settlement, the natural conditions (relief, litho logy, hydrology, vegetation) are specific to the low plains of subsidence, ramble and build where they formed and evolved main soil types who reflected by their geological, biological, chemical and morphological characteristics the main landscape characteristics defining and determining for the growth and fructification of the main cultivated plants.

The area in which the researches were made is part of Timis Plain (low Plain).

Low plains start at an altitude of about 80 m and are superimposed the subsidence area of the Pannonian Basin, composed of submerged sewage cones, who were identified under the fluvial-lacustrine deposits made under the swamp, then covered with different material: recent alluvium or wind deposits such as loess (which have grown old farming settlements practicing safer).

In the investigated area are found elements of flora and fauna are similar to those of the entire Western Plain, represented by historical provinces Crisana and Banat, but with several thermophilic and xerophytes species, Balkan ecosystems and Central European type.

In this context the highlighted importance have the woody species southern European, representative for the studied area, the species as: *Quercus cerris, Quercus pubescens, Till tomentosa, Fraxinus ornus, Cornus mas* is associated forming biocenosis to host a remarkable number of thermophilous grass species.

From climate perspective Voiteg area is characterized by an annual average air temperatures of 10.9 ° C and an amount of rainfall (annual average) to 629.9 mm (Table 1).

The average amount of precipitation would provide favorable conditions for most crops if they have a corresponding distribution on months or vegetation phenophases.

The rainfall in summer and the winter have the same ratio value between those stations, but the differences were more pronounced in summer to the cold, the most pronounced differences were recorded in the spring and in early summer , in the rainy months when cyclone activity is higher.

Table 1

Monthly and annual average rainfall at Voiteg station (mm)

Agricultural year	Month												Annual
	IX	X	XI	XII	I	II	III	IV	V	VI	VII	VIII	
12-13	17.6	74.4	24.8	53.4	59.3	56.3	97.8	40.2	79.5	45.7	37.0	46.3	632.3
Normal	46,1	54,8	48,6	47,8	40,9	40,2	41,6	50,0	66,7	81,1	59,9	52,2	629,9
Difference													
12-13	-28.5	+19.6	-23.8	+5.6	+18.4	+16.1	+56.2	-0.8	+12.8	-35.4	-22.9	-5.9	+2.4

To assess the impact of climate conditions on land productivity, the data were recorded in both stationary for significance compared with rainfall (reference limits in relation to the requirements of agriculture (tab. 2) using data from the Agroclimatic Resources of Timis county (BERBECEL, 1979).

Table 2

The significance of rainfall
(the reference limits range with the agriculture requirements)

Interval	Semnification of rainfall quantityes				
	Very dry	Dry	Satisfactory	Optimal	Excedentary
September-octomber	Under 40	41-60	61-80	81-150	Over 150
November-march	Under 100	101-150	151-200	201-300	Over 300
April	Under 20	21-30	31-40	41-70	Over 70
May-july	Under 100	101-150	151-200	201-300	Over 300
Annual	Under 350	351-450	451-600	601-700	Over 700

The analysis of rainfall data from the 2012-2013 crop year, that in his anamblul was a optimal year (tab. 3).

Table 3

The significance of rainfall
range with the agriculture requirements at Voiteg

Agricol year	Characteristic intervals									
	IX-X	Semnif.	XI-III	Semnif.	IV	Semnif.	V-VII	Semnif.	Anual	Semnif.
12-13	92.0	Optimal	291.6	Optimal	40.2	Satisfactory	162.2	Satisfactory	632.3	Optimal

In close conjunction with various geomorphological factors that determine the existence of varied landscape units, those geo-lithological leading to a great diversity of parental material and the climate or the hydrological and the various human interventions, resulted in a large population of soils with specific characteristics.As a result of the cosmic-atmospheric and telluric factors intervention, under specific vegetation to the forest steppe, in the zone were created cambium chernozem, specific to the researched perimeter.

The experiences are on a cambium Chernozem,low gleyed, loamy clay / loamy clay, on middle finely loessoid material ay with profile type: Ap- Atp -Am – AB - Bv – Bvg1 – BCg1-Ccag1-Ccag2-Ccag3 (tab.4) in the experimental field of Agricultural School Voiteg.

Soil's texture, a very stable physical feature, is medium clay on the whole profile.

Bulk density (g/cm^3) have high values 0-27 cm, (Ap and Atp), in the range 27-78 cm that showing medium values. Total porosity (PT%) show very small values in 27-78 cm, low between 0-27 cm.The analyzed soil have a low acid reaction (pH) in the range 0-62 cm, neutral between 62 and 87 cm, and weakly alkaline between 87-205 cm, respectively at the base of soil profile. Nitrogen index (IN) has medium values in 0-62 cm layer. Humus reserve

(t/ha) in 0-50 cm layer is very highly (231.83).Nutrient supply status indicates a small mobile phosphorus content (ppm) in the horizon of 0-62 cm, big content of mobile potassium (ppm) between 0-62 cm.

From chemical characteristics that influence the composition and the way of life of phytocoenosis and have an important role on soil fertility, are important: soil reaction, the reserve of humus and nutrients insurance, etc. status (DUMITRU ET AL. 2000).

Regarding the evolution of soil moisture, the observations (by soil sampling and laboratory determinations) in the two cultures have highlighted a number of issues on how to achieve the ecological functions of soil in agro-ecosystems, namely those related to main features embedded in the concept of eco-pedological profile.

Table 4

Physical, hydro-physical and chemical properties of the cambium Chernozem,low gleyed, loamy clay / loamy clay, on middle finely loessoid material

Indices	Depth (cm)									
	15	30	47	62	75	87	110	135	185	205
Horizonts	Ap	Atp	Am	AB	Bv	Bvg1	BCg1	Ccag1	Ccag2	Ccag3
Coarse sand (2.0 – 0.2 mm)	2.4	2.1	1.1	1.4	0.6	0.5	0.6	0.4	0.4	0.4
Fine sand (0.2 – 0.02)	29.7	30.2	27.9	28.8	29.6	27.5	34.1	34.3	34.3	34.3
Silt (I + II) (0.02-0.002 mm)	29.8	28.9	34.9	30.2	29.1	32.1	29.9	33.4	30.4	31.4
Coloidal clay (sub 0.002)	38.1	38.8	36.1	39.6	40.7	39.9	35.4	31.9	34.9	33.9
Phisical clay (praf II +arg col)	52.8	53.8	55.4	55.9	55.9	56.4	50.9	50.9	50.9	50.9
TEXTURE	TT	TT	TT	TT	TT	TT	TT	LL	TT	TT
Specific Density (Ds)	2.67	2.68	2.66	2.67	2.69					
Aparent density (Da)	1.55	1.54	1.40	1.40	1.41					
Total phorosity (Pt)	41.92	42.54	47.36	47.57	47.58					
Aeration phorosity (Pa)	4.88	6.20	14.32	14.25	14.02					
Degree of compaction (GT)%	17.40	16.80	10.00	7.54	7.84					
Higroscopical coefficient(CH)	8.50	8.20	9.80	9.80	9.80	9.50	8.0			
Fadind coefficient (CO)	12.75	12.30	14.70	14.70	14.70	12.75	12.30			
Field capacity (CC)	23.90	23.60	23.60	23.80	23.80	23.90	23.60			
Utile water capacity (CU)	11.15	11.30	8.90	8.10	9.10					
Total capacity (CT)	27.05	27.62	33.83	33.98	33.74					
pH in water	6.04	5.96	6.52	6.70	7.23	7.21	7.80	8.03	7.90	7.90
Carbonates ($CaCO_3$)	0.00	0.00	0.00	0.00	0.00	0.00	6.40	16.10	14.10	14.10
Saturation in base degree (V)	88.06	88.14	91.78	93.38						
Humus	3.08	3.17	2.75	2.62						
Nitrogen index (IN)	2.71	2.79	2.52	2.45						
Humus reserve (50 cm)	85.93	107.40	38.50	**231.83**						
P mobile	18.70	17.50	16.90	14.30						
K mobile	290.0	290.0	224.0	224.0						

Knowing these features of agro-ecosystems in terms of air and hydro resource has a great theoretical and practical importance. Theoretical, it provides to the specialist the possibility to interpret the phenomena that occur in the soil-plant-technology relations and predict breakneck development, and practical as practitioner warns the measures to be undertaken to bring the soil under optimal conditions.

Based on measurements taken, namely momentary humidity (U%) and density (g/cm3 DA) was calculated reserve of water (W mm), on profile depth on intervals respectively: 0-10 cm, 10-25 cm, 25-50 cm, 50-75 cm, 75-100 cm, 100-125 cm, and the intervals 0-25 cm, 0-50 cm and 0-100 cm, in maize (tab. 5, tab. 6).

Table 5

Soil water reserve (mm) compared with field capacity values-CC (mm)

Location/Date		Interval 0-10 cm			Interval 10-25 cm			Interval 25-50 cm		
		Water reserve (mm)	CC (mm)	Difference (mm)	Water reserve (mm)	CC (mm)	Difference (mm)	Water reserve (mm)	CC (mm)	Difference (mm)
Voiteg (Mays)	28.03.2013	49.65	37.05	+12.6	72.79	54.52	+18.27	90.62	82.60	+8.02
	10.04.2013	41.56	37.05	+4.51	68.05	54.52	+13.53	83.27	82.60	+0.67
	24.04.2013	23.30	37.05	-13.75	56.83	54.52	+2.31	71.79	82.60	-10.81
	10.05.2013	36.33	37.05	-0.72	46.45	54.52	-8.07	72.49	82.60	-10.11
	26.06.2013	35.36	37.05	-1.69	44.95	54.52	-9.57	64.02	82.60	-18.58
	12.08.2013	22.46	37.05	-14.59	36.06	54.52	-18.46	64.75	82.60	-17.85

By comparing the values thus obtained with values of field capacity (CC mm) can be determined accurately the excedent or deficit of soil moisture and then how to bring optimum soil moisture values. Could be found that soil water reserve (W mm) comparing with field capacity values (CC mm) have, in almost all cases, values below those of field capacity, which is due largely low quantities of rainfall in the 2012-2013 crop year, in particular the conditions of the year 2013 when, in the first 5 months, was recorded a deficit of 136.76 mm (tab.5).

Table 5

Soil water reserve (mm) compared with field capacity values-CC (mm)-continuation

Location/Date		Interval 50-75 cm			Interval 75-100 cm			Interval 100-125cm		
		Water reserve (mm)	CC (mm)	Difference (mm)	Water reserve (mm)	CC (mm)	Difference (mm)	Water reserve (mm)	CC (mm)	Difference (mm)
Voiteg (Mays)	28.03.2013	87.36	83.30	+4.06	83.05	83.90	-0.85	81.11	83.90	-2.79
	10.04.2013	77.49	83.30	-5.81	82.56	83.90	-1.34	84.67	83.90	+0.77
	24.04.2013	67.27	83.30	-16.03	73.00	83.90	-10.9	79.45	83.90	-4.45
	10.05.2013	66.54	83.30	-16.76	67.15	83.90	-16.75	74.03	83.90	-9.87
	26.06.2013	72.28	83.30	-11.02	73.46	83.90	-10.44	70.18	83.90	-13.72
	12.08.2013	73.19	83.30	-10.11	67.57	83.90	-16.33	65.92	83.90	-17.97

Situations where soil water reserve (W mm) recorded positive values to the values reported of field capacity (CC mm) were extremely rare and short-lived, manifesting only in the winter at wheat (table 5) and maize (tab. 6), except that the wheat they were recorded only in the upper third of the soil profile.

Table 6

Soil water reserve (mm) compared with field capacity values-CC (mm)

Location/Date		Interval 0-25 cm			Interval 0-50 cm			Interval 0-75 cm		
		Water reserve (mm)	CC (mm)	Difference (mm)	Water reserve (mm)	CC (mm)	Difference (mm)	Water reserve (mm)	CC (mm)	Difference (mm)
Voiteg (Mays)	28.03.2013	122.43	91.56	+30.87	213.05	174.16	+38.89	300.41	257.46	+42.95
	10.04.2013	109.61	91.56	+18.05	192.87	174.16	+18.71	270.36	257.46	+12.90
	24.04.2013	80.12	91.56	-11.44	151.91	174.16	-22.25	219.18	257.46	-38.28

	10.05.2013	82.79	91.56	-8.77	155.27	174.16	-18.89	221.81	257.46	-35.65
	26.06.2013	80.31	91.56	-11.25	144.32	174.16	-29.84	216.60	257.46	-40.86
	12.08.2013	58.52	91.56	-33.04	123.27	174.16	-50.89	196.45	257.46	-61.01

Table 7

Soil water reserve (mm) compared with field capacity values-CC (mm)-continuation

Location/Date		Interval 0-100 cm			Interval 0-125 cm			Interval 50-100 cm		
		Water reserve (mm)	CC (mm)	Difference (mm)	Water reserve (mm)	CC (mm)	Difference (mm)	Water reserve (mm)	CC (mm)	Difference (mm)
Voiteg (Mays)	28.03.2013	383.46	341.36	+42.1	464.57	425.25	+39.32	170.41	167.20	+3.21
	10.04.2013	352.92	341.36	+11.56	437.59	425.25	+12.34	160.05	167.20	-7.15
	24.04.2013	292.18	341.36	-49.18	371.63	425.25	-53.62	140.27	167.20	-26.93
	10.05.2013	288.96	341.36	-52.40	362.98	425.25	-62.27	133.69	167.20	-33.51
	26.06.2013	290.06	341.36	-51.30	360.24	425.25	-65.01	145.74	167.20	-21.46
	12.08.2013	264.03	341.36	-77.33	332.22	425.25	-93.03	140.76	167.20	-26.44

Regarding the yields obtained from the one culture, they were statistically assured, noting that, in the 2012-2013 agricultural year, the climatic conditions have optimal influenced the soil moisture regime and especially the production obtained from wheat and lower high at maize.

CONCLUSIONS

Periodic measurements of soil moisture from researched area concerns the field, at both nationally and globally level, in the context of climate change from last decades.

Based on measurements taken, namely momentary humidity (U%) and density (g/cm^3 DA) was calculated reserve of water (W mm) depth profile intervals, respectively: 0-10 cm, 10-25 cm, 25-50 cm, 50-75 cm, 75-100 cm, 100-125 cm and the intervals 0-50 cm, 50-100 cm and 0-125 cm. Values thus obtained could be compared with values of field capacity (CC mm), so can be determined accurately the surplus or deficit of soil moisture and how to bring optimum soil moisture values.

Regarding the evolution of soil moisture, the observations (through soil sampling and laboratory determinations) in the maize cultures have highlighted a number of issues on how to achieve the ecological functions of soil in agro-ecosystems, namely those related to main features embedded in the concept of eco-pedological profile.

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