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EVALUATION OF ECO-PEDOLOGICAL CONDITIONS FOR ORCHARDS CONVERSION OF LANDS FROM CLOPODIA-FERENDIA AREA

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Abstract

The issue addressed concerns an area of 1210 ha, located in two bodies: Clopodia (536 ha) in Timis County and Ferendia (674 ha) in Caras-Severin. This paper aims at obtaining background information on soil and agrochemical characteristics of soils to substantiate the defining elements of the scientific and technical quality status of land from Clopodia and Ferendia to orchard conversion. After a detailed presentation of the landscape needed to explain processes that occur in the soil and how these can be influenced by man in his farming activity, were followed two distinct sides of the production, characterization of farmland and of the elements that help define the productive capacity of land. On these restrictive elements that affect the production potential of the soil cover is required, on a case by case basis, corrective action by amending the acid reaction, periodic improvement of plant nutrition through fertilization, removing excess moisture through works to prevent and combat it (sewers, ditches, gutters, drains, etc..), preventing and mitigating soil erosion (earth walls, furrows, canals coastal, erosion curtains), along with orchards conversion measures.

Keywords: orchard, evaluation, conversion, land

1. INTRODUCTION

Representing a well-defined condition with a high variability in space but relatively stable over time, pedological factors are essential in characterizing certain land areas. Certainly, knowledge of natural conditions and the specific area of the ecological potential of land for various utilities and some cultures has an important economic and social importance, for both large and small farm producers. Therefore, at present, the development of a community cannot even be conceived without having a strategy based on new concepts based on knowledge of natural and the anthropogenically induced resources and their definition from ecologically point of view (Borcean et al., 1996; Dumitru et al., 2000; Răuţă and Cârstea, 1995; Rogobete and Ţărău, 1997; Ţărău et al., 2007).

Based on these considerations, the paper tries to present, based on themes drawn from scientific research conducted over many years and based on an impressive amount of data accumulated in the archives of OSPA Timisoara, some aspects on the soil quality and the evolution of the main factors that affect it.

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2. MATERIALS AND METHODS

The issues addressed relates to an area of 1209.55 ha in ADS Timis heritage, consisting of body I Clopodia (536.00 ha) in Timis County and body II Ferendia (673.55 ha) in Caras-Severin, from "TIMCLO Agroindustrial SA Clopodia". The characterization of ecopedological conditions specific to the investigated area, the definition of soil and land units, the limiting and / or restriction factors analysis of land productivity was made in accordance with the Romanian Soil Survey Methodology (Florea et al., 1987) and the Romanian System of Soil Taxonomy (SRTS-2003 and SRTS-2012).

3. RESULTS AND DISCUSSION

The major relief of the investigated perimeter is specific to a hilly area of Tirol Hills, which presents itself as a highly fragmented platform piedmont, with a SE-NW direction, crossed by broad and branched valleys, by narrow valleys with converge ravines, with an average elevation of 160 m.

Under the action of erosion have formed a number of landforms clustered in valleys, slopes and gently sloping flat surfaces. Large valleys are up to 300 m wide, eroding materials being deposited both from the slopes and from upstream.

The slopes are very different in length and declivity. The analyzed perimeter is limited by the convergence of two narrow valleys with a wider floodplain, which resulted in a mainly southwest exposition of the slopes.

The past of the investigated area belongs to the Quaternary, with upper alluvial formations arranged in marine deposits of the former Pannonian Lake and resting on a crystalline basement. Vertical movements during the eras drained the entire western area, explaining the various landforms of the area.

In the early Sarmatian, the western edge of the Western Carpathians, subjected to a process of tilting westward, allowed water ingress in the Pannonian Basin to the west. An upper Sarmatian emersion occurred when the marginal region was covered with rocks and sand brought by torrential mountain waters.

The strong erosion manifested has created a new phase relief washing largely the Tortonian and Sarmatian deposits.

Parental rocks on account of which soils formed are quite varied. The hilly area is dominated by clays and sands. On the valley bottom, the soils formed on account of material transported by water, with low homogeneity, which caused the presence of mottled soil profiles.

Hydrologicaly, the studied area belongs to the Southwestern water systems group, Timis basin, Moravita sub-basin. The river network of the area is represented by a series of streams with unsteady water flow, characterized by fluctuating flows, depending on the season and amount of rainfall. Maximum flow rates are usually recorded in spring, when winter snow melts, and in the early summer, when there are abundant rainfall during May to June. The minimum flow rate is registered in the late summer and early autumn. During the rainy periods, the water courses become torrential, resulting in a large amount of alluvial material and favoring erosion.

Groundwater level is closely related with factors of relief, season and amount of rainfall, existing hydro works. In the hilly area, the ground water is deeper than 10 m, not influencing soil formation. In the valley area, the groundwater depths vary largely, from 0.5 m to over 10 m. Thus,

due to the fine texture water infiltrates the soil horizons, favoring the emergence of excess surface moisture.

Peculiarities of the microclimate of the studied area are determined by its geographical position, so that it is characterized by a moderate continental climate, with mild and short winters, being frequently under the influence of cyclone activity and air masses crossing the Mediterranean and Adriatic Sea. Its general features are marked by diversity and irregularity of atmospheric processes.

Dominant air masses during spring and summer are temperate, of oceanic origin, which bring significant rainfall. Frequently even in winter, arriving from the Atlantic humid air masses bring significant rainfall and rarely cold waves.

The investigated perimeter vegetation is represented by woody species such as: *Quercus robur, Quercus cerris, Tilia grandiflora, Ulmus glabra, Acer campestris, Carpinus betulus, Cormus mas, fraxinus excelsior, Malus silvestris, Prunus spinosa, Salix sp., Rossa sp.,* and herbaceous species: *Festuca sulcata, Poa pratensis, Agrostis tenuis, Lotus tenuis, Lotus corniculatus, Trifolium repens, Achillea millefolium.* The wide valley bottom meadows are in some areas affected by excess moisture, predominant vegetation consisting of *Lollium perene, Agrostis tenuis, Poa pratensis, Agropiron repens, Tripholium repens, Lotus tenuis.*

Based on recent observations collected in the field, as well as information gathered in OSPA Timişoara archive, each soil and ground units were characterized using 23 indicators of evaluation and technological characterization, indicators which are usually found in pedological mapping works developed after 1987 (Table 1).

For body II Ferendia were identified and characterized the soil types presented in Table 2.

Table 1. Technical indicators of evaluation-Clopodia

TEO	Type, subtype	3C	4C	14	15	16	17	23A	23B	29	33	38
15.01	El vs-st	10.5	575	0	2	00	00	52	61	2	12	00
18.01	EL vs-st	10.5	575	0	2	00	00	43	61	2	12	00
19.01	EL vs-st	11,5	525	0	2	00	00	53	61	2	17	00
19.02	EL vs-st	10,5	575	0	2	00	00	53	61	2	17	00
24.01	EL vs-st	10,5	575	0	3	00	00	52	61	2	07	00
25.01	EL vs-st	10,5	575	0	3	00	00	52	52	2	12	00
26.01	EL vs-st	10,5	575	0	3	00	00	52	52	2	07	00
28.01	EL vs-st	10,5	650	0	3	00	00	52	61	2	03	00
29.01	EL vs-st	10,5	650	0	4	00	00	52	52	2	01	00
31.01	EL vs-st	9,5	525	0	2	00	00	43	43	2	17	00
32.01	EL vs-st	9.5	525	0	2	00	00	43	43	2	17	00
32.02	EL vs-st	11,5	525	0	2	00	00	43	53	2	17	00
37.01	EL vs-st	10,5	575	0	3	00	00	43	61	2	07	00
38.01	EL vs-st	10,5	575	0	3	00	00	43	52	2	12	00
46.01	EL vs-st	10,5	650	4	3	00	00	42	53	2	01	00

Table 1. - continuation

TEO	Type, subtype	39	40	44	61	63	69	133	144	181	271
15.01	EL vs-st	7	2	+15	0	5,6	87	175	140	2	00
18.01	EL vs-st	15	0	+15	0	5,2	65	175	090	3	00
19.01	EL vs-st	15	0	+05	0	5,6	79	175	140	2	00
19.02	EL vs-st	15	0	+05	0	5,6	79	175	140	3	00
24.01	EL vs-st	15	0	+25	0	6,1	79	175	180	3	00
25.01	EL vs-st	15	0	05	0	5,6	65	175	180	3	00
26.01	EL vs-st	15	0	+25	0	5,6	87	175	180	3	00
28.01	EL vs-st	15	0	+25	0	6,1	87	175	140	2	00
29.01	EL vs-st	15	0	+25	0	5,2	87	175	225	2	00
31.01	EL vs-st	15	0	+15	0	5,6	65	175	140	2	00
32.01	EL vs-st	15	0	+05	0	5,6	79	175	140	2	00
32.02	EL vs-st	15	0	+05	0	5,6	79	175	140	2	00
37.01	EL vs-st	15	0	+15	0	7,0	96	175	140	3	00
38.01	EL vs-st	15	0	+15	0	5,2	65	175	140	3	00
46.01	EL vs-st	1,4	2	+05	1	6,6	87	175	140	1	00

Table 2. Technical indicators of evaluation – Ferendia

TEO	Type, subtype	3C	4C	14	15	16	17	23A	23B	29	33	38
13.01	El vs-st	11,5	575	0	2	00	00	61	61	2	12	00
14.01	EL vs-st	10.5	575	0	2	00	00	52	52	2	12	00
19.01	EL vs-st	11,5	525	0	2	00	00	53	61	2	17	00
22.01	EL vs-st	10,5	650	0	3	00	00	52	52	2	01	00
24.01	EL vs-st	10,5	575	0	3	00	00	52	61	2	07	00
27.01	EL vs-st	10,5	575	0	3	00	00	52	61	2	12	00
27.02	EL vs-st	10,5	650	0	3	00	00	52	61	2	12	00
28.01	EL vs-st	10,5	650	0	3	00	00	52	52	2	03	00
29.01	EL vs-st	10,5	650	0	4	00	00	52	61	2	01	00
30.01	EL vs-st	10,5	525	0	4	00	00	52	43	2	03	00
31.01	EL vs-st	9,5	525	0	2	00	00	43	43	2	17	00
32.01	EL vs-st	9.5	525	0	2	00	00	43	43	2	17	00
33.01	EL vs-st	11,5	575	0	2	00	00	42	61	2	12	00

Table 2. - continuation

TEO	Type , subtype	39	40	44	61	63	69	133	144	181	271
13.01	El vs-st	15	2	+25	0	5,6	87	175	140	2	00
14.01	EL vs-st	15	0	+25	0	6,1	65	175	090	3	00
19.01	EL vs-st	15	0	+05	0	5,6	79	175	140	2	00
22.01	EL vs-st	15	0	+25	0	6,1	79	175	140	3	00
24.01	EL vs-st	15	0	+25	0	6,1	79	175	180	3	00
27.01	EL vs-st	15	0	25	0	5,2	65	175	180	3	00
27.02	EL vs-st	15	0	+25	0	5,2	87	175	180	3	00
28.01	EL vs-st	15	0	+25	0	6,1	87	175	140	2	00
29.01	EL vs-st	15	0	+25	0	5,2	87	175	225	2	00
30.01	EL vs-st	07	0	+05	0	7,0	65	175	140	2	00
31.01	EL vs-st	15	0	+15	0	5,6	79	175	140	2	00
32.01	EL vs-st	15	0	+05	0	5,6	79	175	140	2	00
33.01	EL vs-st	15	0	+25	0	6,1	96	175	140	3	00

By this methodology were established grades of evaluation for main crops (GR, OR, PB, FS, CT, SF, SO, MF, IU, IF, NC, LU, TR, LG), and category of use (PS, FN), as they are shown in the following (tab 3):

Table 3. Main crops used in the evaluation process

PS = pasture	CS = apricot	PB = maize	IU = in
FN = hayfield	PC = peach	FS = sun-flower	IF = in
MR = apple	VV = vineyard	CT = potato	CN = hemp
PR = pear	VM = vineyard	SF = beet	LU = alfalfa
PN = plum trees	GR = wheat	SO = soya	TR = clover
CV= cherry	OZ = barley	MF= pea beans	LG = vegetables

Table 4. Evaluation marks – Clopodia

TEO	Typ , subtyp	PS	FN	MR	PR	PN	CV	CS	PC	VV	VM	GR	OR	PB	FS
15.01	EL vs-st	**64**	45	52	58	**65**	52	52	47	58	52	58	58	52	52
18.01	EL vs-st	58	40	37	47	52	47	47	41	47	37	47	47	41	41
19.01	EL vs-st	58	40	46	52	58	52	45	39	58	43	52	52	45	39
19.02	EL vs-st	58	40	36	41	41	41	40	35	51	38	52	52	45	39
24.01	EL vs-st	58	50	36	46	47	41	41	41	46	41	52	52	47	47
25.01	EL vs	64	50	41	52	52	47	47	41	52	46	58	58	52	52
26.01	EL vs	58	50	36	46	47	41	41	41	46	41	52	52	47	47
28.01	EL vs	**73**	58	58	58	**66**	52	52	52	58	58	**66**	58	58	58
29.01	EL vs	66	58	45	52	51	41	35	35	32	26	65	58	50	50
31.01	EL vs	58	40	47	52	58	52	45	35	52	31	52	52	41	35
32.01	EL vs	58	40	52	58	58	58	50	39	58	35	58	58	45	39
32.02	EL vs	58	40	41	41	47	52	50	43	58	43	52	52	45	39
37.01	EL vs	64	50	33	47	47	47	52	47	52	47	52	52	47	47
38.01	EL vs	64	45	37	47	52	47	47	41	47	41	47	47	42	42
46.01	EL vs	**57**	52	9	23	4	8	11	15	15	15	26	26	35	35

Table 4. - continuation

TEO	Typ , subtyp	CT	SF	SO	MF	IU	IF	CN	LU	TR	LG	AR	LV	Vie
15.01	EL vs-st	33	37	52	58	**65**	47	58	**65**	42	40	50	54	55
18.01	EL vs-st	26	29	41	47	41	38	41	47	34	32	40	45	42
19.01	EL vs-st	23	29	45	52	58	47	52	58	37	29	42	49	51
19.02	EL vs-st	21	24	41	52	58	33	47	58	33	29	41	39	45
24.01	EL vs-st	30	38	47	52	46	38	46	46	42	47	46	42	44
25.01	EL vs	29	37	52	58	52	43	52	52	42	45	50	47	49
26.01	EL vs	30	38	47	52	46	38	46	46	42	47	46	42	44
28.01	EL vs	42	52	58	58	58	52	52	58	52	52	56	56	58
29.01	EL vs	29	39	50	50	43	41	43	43	52	50	49	43	29
31.01	EL vs	26	32	45	52	58	58	52	58	42	29	42	48	42
32.01	EL vs	29	36	50	58	64	64	58	64	47	32	47	53	47
32.02	EL vs	23	29	41	52	58	40	47	58	32	29	42	46	51
37.01	EL vs	31	43	47	52	52	43	47	52	30	42	46	46	50
38.01	EL vs	26	33	42	47	47	43	42	47	34	33	41	45	44
46.01	EL vs	23	35	29	35	35	31	27	20	31	35	31	12	15

The evaluation marks for orchard use category are calculated as the arithmetic mean of the six tree species, and for the vineyards the arithmetic mean of the two species. For arable use category, the natural evaluation note is the arithmetic average of the eight evaluation marks for given culture (GR, OR, PB, FS, CT, SF, SO, MF). Classes of quality (fertility) are those specified in the regulations:

- class I from 81 –100 points,
- class II from 61 –80 points,
- class III from 41 –60 points,
- class IV from 21 –40 points,
- class V from 0 –20 points.

The next operation after defining map and ground units is their overlap on the cadastral plan. The cadastral plan is a plan that represents the thematic structure, land inventory (by category of use and owner), recording the contour shapes of parcels, their configuration and hence their limitations. This means that outside of these elements (points of triangulation, leveling, etc.), all other elements reported on the cadastral plan must have a definite shape to be able to determine the area, the utilization or the holder.

When all the reported data and information are collected, they enter a process of sorting and centralization for determining the area of each unit of soil and land (UT or TEO) superimposed on a certain plots, and then calculating weighted average marks, finally yielding a weighted average mark of 46 points of evaluation for agricultural use category which falls within the area of 536.00 ha in the III grade quality.

For ORCHARD usage category was obtained a weighted average mark of 45 points of evaluation (Class III quality).

Among the limiting factors affecting the productive potential of land we can mention the excess moisture rainfall over an area of 252.80 ha (47.16%), the moderate acid reaction

over an area of 317.60 ha (59.26%), small humus reserve in the first 50 cm on an area of 333.50 ha (62.22%) and very low on 52.70 ha, high compaction on an area of 211.70 ha (39.50%) and very high on 164.60 ha (30.71%), moderate surface erosion on an area of 111.70 ha (28.81%) and high surface erosion for an area of 194.50 ha (36.29%).

For body II Ferendia, were obtained the following notes of evaluation (Tab 5).

Table 5. Evaluation marks - Ferendia

TEO	Typ , subtyp	PS	FN	MR	PR	PN	CV	CS	PC	VV	VM	GR	OR	PB	FS
13.01	El vs-st	47	33	34	30	38	34	37	33	42	29	47	37	33	33
14.01	EL vs-st	58	45	47	52	58	47	47	41	52	46	65	58	51	51
19.01	EL vs-st	58	40	46	52	58	52	45	39	58	43	52	52	45	39
22.01	EL vs-st	**73**	65	58	58	**66**	52	52	52	58	58	**73**	65	65	65
24.01	EL vs-st	58	50	36	46	47	41	41	41	46	41	52	52	47	47
27.01	EL vs-st	58	45	33	41	47	37	37	33	41	37	52	47	41	41
27.02	EL vs-st	58	45	33	41	47	37	37	33	41	37	52	47	41	41
28.01	EL vs-st	73	58	58	58	66	52	52	52	58	58	66	58	58	58
29.01	EL vs-st	66	58	45	52	51	41	35	35	32	26	65	58	50	50
30.01	EL vs-st	73	58	44	58	50	45	39	39	36	29	58	58	51	51
31.01	EL vs-st	58	40	47	52	58	52	45	35	52	31	52	52	41	35
32.01	EL vs-st	58	40	52	58	58	58	50	39	58	35	58	58	45	39
33.01	EL vs-st	52	36	29	33	37	34	37	33	41	33	47	47	37	37

Table 5. - continuation

TEO	Typ , subtyp	CT	SF	SO	MF	IU	IF	CN	LU	TR	LG	AR	LV	Vie
13.01	El vs-st	16	20	33	37	36	23	29	37	29	25	32	34	36
14.01	EL vs-st	33	36	51	58	58	42	58	58	47	45	50	49	49
19.01	EL vs-st	23	29	45	52	58	47	52	58	37	29	42	49	51
22.01	EL vs-st	47	58	65	65	58	52	58	58	58	65	63	56	58
24.01	EL vs-st	30	38	47	52	46	38	46	46	42	47	46	42	44
27.01	EL vs-st	24	29	41	47	41	34	41	41	38	36	40	38	39
27.02	EL vs-st	24	29	41	47	41	34	41	41	38	36	40	38	39
28.01	EL vs-st	42	52	58	58	58	52	52	58	52	52	56	56	58
29.01	EL vs-st	29	39	50	50	43	41	43	43	52	50	49	43	29
30.01	EL vs-st	30	39	51	51	49	46	44	49	47	45	49	46	33
31.01	EL vs-st	26	32	45	52	58	58	52	58	42	29	42	48	42
32.01	EL vs-st	29	36	50	58	64	64	58	64	47	32	47	53	47
33.01	EL vs-st	18	21	33	41	36	24	33	41	29	28	34	34	37

For the category of agricultural use weighted average mark of evaluation for a surface of 673.55 ha is 52 points (2^{nd} quality class). For orchard usage category was obtained a weighted average mark of 48 points (3^{rd} quality class).

Among the limiting factors affecting the productive potential of land are rainfall excess moisture on an area of 388.05 ha (57.61%) and moderate acid reaction over an area of 124.80 ha (18.53%), small humus reserve in the first 50 cm on an area of 151.95 ha (22.56%) and very low on 16.05 ha (2.38%), high compaction on an area of 18.75 ha

(2.79%) and very high on 519.25 ha (77.10%), moderate surface erosion for an area of 203.30 ha (30.19%) and high surface erosion for an area of 37.70 ha (5.60%).

4. CONCLUSIONS

This paper aims at obtaining background information on soil and agrochemical characteristics of soils so as to define the scientific and technical base elements of the quality status of land from body I Clopodia and body II Ferendia.

Economically, the evaluation of farmland consists in establishing evaluation marks of soil properties and environmental characteristics that lead eventually to fertility status of soil.

Incorrect or incomplete strategies seriously affect both quantitatively and qualitatively not only agricultural production but especially soil resources. The lands of body I Clopodia are covered with weeds and invaded by shrubs. The terraces are preserved by natural fallow except for an area of approx. 2-3 ha affected by landslides and erosion. The trees that once formed orchard are mostly dried, the land being invaded by offshoots. Lands of the body II Ferendia have the same stage of invasion by weeds and even by some tree species.

On these restrictive elements that affect the production potential of the soil cover is required, on a case by case basis, corrective acid reaction action, periodic improvement of plant nutrition by ameliorative fertilization, removing excess moisture by works to prevent and combat it (sewers, ditches, gutters, drains, etc..), preventing and combating soil erosion (earth walls, furrows, canals coastal erosion curtains), agro-pedo-ameliorative measures aimed at ensuring an optimal air and hydric regime by introducing long-term crop rotation, protective and ameliorative plants.

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