Soil Quality in the Poganis, Ramnei and Doclin Hills
Measures of improvment

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*The purpose of current research is part of the current scientific work and practice regarding the accumulation of knowledge on the structure and characteristics of the edaphic envelope and its quality in order to establish measures for its improvement. The researched issue covers an area of 113940 ha (of which **77039** ha, 67.61% are agricultural land), located in the Poganis, Ramnei and Doclin hills, namely Barzavei Plain. The paper provides basic information and methodological elements regarding the classification and evaluation of soil resources, thus integrating itself in the broader field of complex studies of natural resources and their valorisation thus assuring the environmental protection. This research takes place at a time when there is a high demand of education in soil-related issues from its perspective as a basis for the existence of human communities, component and support of terrestrial ecosystems. From this perspective, the physico-geographic conditions of soil formation and evolution are briefly, but succinctly presented, mentioning the way in which the particularities of the area within the space taken into consideration, of only 113940 ha as a stretch, determine a great diversity of ecological conditions. They are generated by the variability of the factors (cosmic-atmospheric and telluric-edaphic), for which the main processes of formation and evolution have achieved a different development and intensity, the result of which are different genetic types of soils (related or totally different) in constant evolution and demanding specific improvement measures.*

Key words: soil, quality, hills, improvement

FAO's 2018 World Food and Nutrition Status Report indicates that there is a direct link between soil health (soil quality and functionality) and the health status of food (plants, animals). The effect of soil properties on human health can be both positive and negative.

A healthy food grown on agricultural soils should contain seven macro elements (Na, K, Ca, Mg, S, P, Cl) and seventeen micro elements (Fe, Zn, Cu, Mn, I, F, B, Se, Mo , Ni, Cr, Si, Ca, Li, Sn, V, Co). Human food made up of plants and animals grown on poor soil deficient in these essential nutrients and affects negatively human health and well-being.

Therefore, the bioavailability of these elements needs to be strengthened in agroecosystems through a judicious management of the physical, chemical, biological and ecological properties of the soil. Improving soil health by replenishing organic matter through integrated fertility management can improve the nutritional value of food products based on the concept of a strong link between soil and human health, on the one hand, and environmental health and economic development, on the other hand.

Numerous studies and research at the national level have shown that there are interdependence relations between the agricultural technology systems of plant cultivation, the state of the environment, the level of economic development and the quality of life [1-3] which is why a responsible intervention on behalf of the state is necessary by providing the necessary funds for such programs.

Taking into consideration these aspects, our data from the paper is based on the pedological information existing in the OSPA archive in Timisoara, [4] the largest on classical support, as well as on the SPED1 information system and the BDUST-B system implemented in the territory by ICPA Bucharest, but also on the basis of the research carried out in time by the authors (OSPA, USAMVB) [5-7]. The paper contains some aspects related to pedoclimatic characteristics as elements defining fertility and soil quality in order to provide field users with specialized support for establishing the requirements and improvement measures in relation to the particularities of the space taken in consideration [8-11].

Experimental part

Material and methods

Our research issue covers an area of 113940 ha (table 1) out of which 77039 ha (67.61%) are agricultural land (41494 ha respectively 36.41% being arable land) and 30826 ha (27.05%) land with forest vegetation, situated in the upper and middle course of Beregsau, which from the administrative point of view, belongs to 12 territorial administrative units (TAU), one in Caras-Severin County.

The research of the ecopedological conditions has been done according to the *Methodology of Elaboration of Pedological Studies* [5,6,12,13] and other normative acts updated by MAAP Order 223/2002, respectively Order MADR 278/2011, based on the pedological information from the OSPA archive in Timisoara (for more than 65 years), but also on the basis of the research carried out in time by the authors (within OSPA, USAMVB Timisoara) [4,12]. The latter studies have been completed with recently collected items from the field.

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Table 1
SITUATION OF THE LAND FUND IN THE POGANISULUI, RAMNEI AND DOCLIN HILLS, BARZAVEI PLAIN.

No.	Locality	Arable land	Pastures	Meadows	Vineyard	Orchards	Total agricultural land	Forests	Rivers and lakes	Other categories	Total
1	Berzovia	7723	2269	128	75	100	10295	1830	104	846	13075
2	Brebu	1318	1510	673	0	597	4098	2933	32	392	7455
3	Constantin Daicoviciu	2323	1694	158	1	453	4629	7727	128	531	13015
4	Copacele	1090	1566	711	0	1	3368	1563	6	221	5158
5	Doclin	3382	1677	315	516	135	6025	4080	60	388	10553
6	Farliug	4039	4197	1881	0	155	10272	2127	61	587	13047
7	Forotic	2381	3835	489	0	338	7043	2229	81	426	9779
8	Maureni	7783	1364	231	0	0	9378	332	34	356	10100
9	Ramna	2836	3649	191	0	282	6958	2180	37	424	9599
10	Sacu	2417	691	128	0	61	3297	460	108	253	4118
11	Vermes	4827	2463	161	0	256	7707	3273	50	411	11441
12	Zorlentu Mare	1375	1967	367	0	260	3969	2092	20	519	6600
TOTAL		41494	26882	5433	592	2638	77039	30826	721	5364	113940
% total area		36.41	23.59	4.78	0.52	2.31	67.61	27.05	0.63	4.71	100
% total agricultural land		53.87	34.89	7.05	0.77	3.42	100	-	-	-	-

Results and dicussions

The object of the current study is the area of 113940 ha (table 1) out of which 77039 ha are agricultural land (67.61%) located in the Poganis, Ramnei and Doclin hills, namely the soil and ground units (TEO) identified in the perimeter where soils have been formed with a series of specific characteristics. These phenomena have taken place in close correlation with the variety of geomorphological factors that determine the existence of diversified relief units, of the geolithological and hydrological ones, as well as of the various anthropic interventions. As a result, some elements of that geographic space will be presented in the following part of the present study [14] .

The Poganisului (Buziasului) hills, also known as the Sacos Hills, named after one of the oldest villages in the area, are a northwest continuation of Dognecei Mountains crystalline, over which the Sarmatian and Pontian deposits have been settled, represented by sandstone, marne, clay, and later heterogeneous deposits of pebbles and sands.

The Poganis hills are bordered to the north and east by the Timis river and to the south by Poganis (tributary of the Timis river), being known in the specialty literature as Buzias Hills, Sacos Hills or Sacos-Zagujeni Hills.

In the northwest, Buzias ascends a ridge of crystalline shale, whose foundation is east of Silagiu in the Dealul Scaunelor (324 m) or below the Blauca peak (355 m). To the southeast, over the crystal waters of Visag, the crystalline foundation appears on the surface in Magura Poenii (434 m).

The peaks are in the form of large plateaus, lying around a 300-meter elevation, bordered by smooth slopes, partially eroded by the valleys of the tributaries of Timis and Poganis.

The *Ramna Hills*, located between Poganis Valley and Barzavei Valley, have a minimal extension, only a few divergent peaks that make the connection to the terraced plain, which is only 6-8 km far from the foothills of the Arenis Mountains, representing a great cone of dejection located at their foot, bordered by torrential structures and erosion valleys that have burst here since the end of the tertiary. Both the Pannonian pebbles and sands, as well as the banatites from the Arenis Mountains, are covered with a blanket of clay and Pleistocene clays.

Doclin Hills, bounded by the Barzava and Caras rivers, stretch from Bocsa to Secaseni, under the Dognecei Mountains, separated from this massif by a denivelation that sometimes exceeds 200-400 m [7,10,11,15].

The peaks, which rarely exceed 200 m in altitude (237 m Teius), are separated by valleys with broad river meadows (Ciornovat, Caras and their tributaries).

As in the case of the above-mentioned hills, the substrate made of lightweight rocks (sands, gravel, etc.) is covered with Pleistocene clays.

The *Barzavei Plain* is a piedmont plain that was born through the deposition of poorly terraced glaciers, and fractured in the shape of a fan by the waters that cross it, dividing it into several fields: Poganisului Plain (to the north of Poganis) Sipet- Gataia (between Poganis and Barzava) Semlacului Plain (between Barzava and Moravita) Campia Clopodiei (southwest at the foot of Doclin Hills). The plain descends gradually, from the Dognecei Hills area, from altitudes ranging from 160-170 m to 100-110 m to the region of subsidence and ends quite abruptly, in the low plain on the line of Latunas-Jamu Mare-Moravita-Gaiu Mic-Denta-Opatita-Folea-Liebling-Sacosu-Buzias. Overall, it is a piedmont plain with flat interfluves, fragmented by wide diverging valleys.

Due to the pedo-hydro-climatic and floristic conditions, as well as to the human intervention (starting with the pre-Roman period and up to now), the soils in the researched area show a great diversity, according to the Romanian Soil Taxonomy System (SRTS-2012) 12 soil types have been identified: Litosoils, Aluviosoils, Faeisomes, Eutricambosoils, Preluvosoils, Luvosoils, Vertosoils, Stagnosoils, Gly-soills and Antrosoils (table 2) comprising 7 of the 12 soil classes (Protisoils, Cernisoil, Cambisoils and Antrisoil).

In the context of the information presented so far, the quality of agricultural lands, as a result of the diversity of physical and geographical conditions and their intrinsic attributes, as well as of the anthropogenic interventions occurring in time, presents many differences in the area. That is why the Romanian methodology for the evaluation of agricultural lands that includes the synthesis of specialized knowledge [13], defines the land in ecological terms in relation to the cosmic-atmospheric and technical-edaphic factors.

The basic principle of the assessment methodology developed in our country is the following: for each unit of

Table 2

THE MAIN TYPES AND ASSOCIATIONS OF SOILS IN THE POGANIS, RAMNEI AND DOCLIN HILLS. BARZAVEI PLAIN

No.	Territorial - adminstrative Unit	Agri ha	Type, subtype of soil														
			1. LS	2. RS	3. AS	4. FS	5. EC	6. DC	7. EL	8. LV	9. PL	10. VS	11. PE	12. SG	13. GS	14. AT	15. Asc
1	**Berzovia**	10295	-	-	-	409	1269	-	-	6273	469	113	106	69	724	174	689
2	**Brebu**	4098	-	-	883	398	338	-	-	825	708	-	-	295	88	563	-
3	**Constantin Daicoviciu**	4629	-	-	93	926	602	-	-	278	1481	-		370	185	139	555
4	**Copacele**	3368	-	-	51	44	68	-	-	88	657	101	-	30	30	54	2245
5	**Doclin**	6025	-	-	-	136	224	-	142	763	4554	-	-	-	-	-	206
6	**Farliug**	10272	-	-	361	1062	792	-	102	1882	4763	-	-	5	10	1295	-
7	**Forotic**	7043	-	-	-	705	611	-	-	995	1427	-	211	749	352	1033	960
8	**Maureni**	9378	-	-	-	331	720	-	-	5536	185	113	454	1032	477	530	-
9	**Ramna**	6958	323	-	406	669	821	-	290	1872	2286	-	66	-	-	-	225
10	**Sacu**	3297	-	-	-	593	231	-	-	923	1153	-	-	165	164	68	-
11	**Vermes**	7707	-	-	-	701	210	-	-	2004	2496	-	351	68	360	1050	467
12	**Zorlentu Mare**	3969	-	-	80	192	280	-	-	1725	962	-	90	120	60	460	-
Caras-Severin		77039	323	-	1874	6166	6166	-	534	23164	21141	327	1278	2903	2450	5366	5347
% out of the total agricultural land		100	0.42	-	2.44	7.98	8.00	-	0.69	30.07	27.44	0.43	1.66	3.78	3.18	6.97	6.94

homogeneous ecological territory (HET) within a territorial administrative unit (TAU), defined according to the current Methodology for Development of Pedological Studies using the 23 indicators which are usually found in the pedological mapping works developed after 1987 by the territorial OSPA under the methodological guidance of ICPA Bucharest, its quality is established by grades from 1 to 100.

Each of the identified units within the investigated area was characterized according to the Methodology of Elaboration of Pedological Studies [5], using the 23 indicators, namely climatic indicators (indicator 3C - average annual temperature - corrected values , indicator 4C- average annual precipitation - corrected values), indicators of morphological, chemical, physical, hydro-physical characteristics and volume of soil cover (indicator 14 - gleaning, indicator 15 - stagnogleization, indicator 16 or 17 - salinisation or alkalisation (indicator 61 - total $CaCO_3$ content on 0-50 cm, indicator 63 - soil reaction in Ap or the first 20 cm, indicator 144 - humus reserve in the 0-50 cm layer, indicator 23A -, texture in Apor first 20 cm, indicator 44 - total porosity in the restrictive horison, indicator 44 - total porosity in the restrictive horison, indicator 133 - the usable edaphic volume), indicators of the relief characteristics (indicator 33 - slope, indicator 38 - landslides), hydrography, hydrology and drainage indicators (indicator 40 - floodability, indicator 181 - excess humidity, indicator 39 - pedo-ground water depth), indicators relating to some anthropic interventions (indicator 29 - pollution indicator 271 - land improvement approaches), as well as interactions between these values of characterisation of natural and anthropically induced properties.

Therefore, on the basis of pedological information processed according to the Methodology for the Development of Pedological Studies [5] and other normative acts updated by Order MADR278 / 2011, the agricultural lands of the researched area can be grouped (from 20 to 20 points) in V classes (quality) according to their vocation for arable use (table 3).

The operation of classifying agricultural land in quality classes based on the assessment marks highlighted a series of limiting factors that influence the agricultural production capacity, within the researched area among which we mention: the granulometric composition (soil texture), the reserve of humus, soil reaction, compaction

Table 3

CLASSES FOR THE USE OF *ARABLE* LAND (HA) IN THE POGANIS, RAMNEI AND DOCLIN HILLS. BARZAVEI PLAIN

Territorial -adminstrative Unit	Year	Arable	Class I (81-100 points) ha	Class II (61-80 points) ha	Class III (41-60 points) ha	Class IV (21-40 points) ha	Class V (0-20 points) ha	Weighted average score
1. Berzovia	2003	7723	0	167	5199	2073	284	*44*
2.Brebu	1971	1318	0	700	68	33	517	*30*
3.C-tin Daicoviciu	1995	2323	0	233	1370	550	170	*44*
4.Copacele	1995	1090	0	17	568	295	210	*38*
5.Doclin	2006	3382	0	105	2295	982	0	*42*
6.Farliug	2012	4039	3	272	2517	743	504	*44*
7.Forotic	1965	2381	0	115	925	1021	320	*40*
8.Maureni	1986	7783	0	61	2523	4427	772	*38*
9.Ramna	2009	2836	0	339	1642	686	169	*42*
10.Sacu	1995	2417	0	36	1002	1179	200	*38*
11.Vermes	1987	4827	0	942	3303	458	124	*52*
12.Zorlentu Mare	1970	1375	0	258	619	399	99	*42*
Total CS (ha)		**41494**	**3**	**3245**	**22031**	**12846**	**3369**	-
Total CS (%)		**100**	**0.01**	**7.82**	**53.09**	**30.96**	**8.12**	-

Table 4

SITUATION OF FIELDS WITH SURFACE AND GROUNDWATER HUMIDITY EXCESS WIN THE POGANISULUI, RAMNEI AND DOCLINULUI HILLS. THE BARZAVEI PLAIN.

No.	Township city Municipality	Total ha (agricultural)	Out of which, field with:					
			Excess surface moisture			Excess groundwater		
			weak	moderate	powerful; excessive	moderate	powerful	Very powerful; excessive
1	Berzovia	10295	163	332	70	103	38	730
2	Brebu	4098	1661	385	295	591	874	88
3	Constantin Daicoviciu	4629	130	449	370	320	420	190
4	Copacele	3368	815	485	130	232	335	32
5	Doclin	6025	1693	1427	0	356	420	0
6	Farliug	10272	4172	2781	5	1224	950	10
7	Forotic	7043	1420	1053	749	477	424	360
8	Maureni	9378	3077	3578	1081	586	769	479
9	Ramna	6958	960	750	0	216	960	0
10	Sacu	3297	980	813	165	180	670	164
11	Vermes	7707	1168	2253	70	834	690	360
12	Zorlentu Mare	3959	3313	646	120	481	390	60
Total CS (ha)		***77039***	***19552***	***14952***	***3055***	***5600***	***6940***	***2473***
Total CS (%)		***100***	***25.37***	***19.40***	***3.96***	***7.26***	***9.00***	***3.21***

Table 5

SITUATION OF LAND AFFECTED BY COMPACTING AND ACIDIFICATION IN THE POGANISULUI, RAMNEI AND DOCLINULUI HILLS. BARZAVEI PLAIN

No.	Township city Municipality	Total ha (agriculure)	Out of which fields with:					
			compacting			acidification		
			weak	moderate	powerful excessive	weak	moderate	powerful excessive
1	Berzovia	10295	3130	2999	2680	3420	3108	450
2	Brebu	4098	1394	1341	1190	1435	1877	810
3	Constantin Daicoviciu	4629	1105	2064	1281	1575	1530	845
4	Copacele	3368	690	1249	1096	813	2064	625
5	Doclin	6025	2410	2100	990	2056	1946	1680
6	Farliug	10272	2944	2743	1220	3199	1925	2212
7	Forotic	7043	1420	1053	500	2655	642	960
8	Maureni	9378	7385	2316	296	2792	1836	1025
9	Ramna	6958	2560	1197	790	2234	250	1860
10	Sacu	3297	1210	924	242	1428	1228	824
11	Vermes	7707	4311	1182	960	3978	1341	1680
12	Zorlentu Mare	3969	1533	1626	640	1623	1059	790
Total CS (ha)		***77039***	***30092***	***20794***	***11885***	***27208***	***18806***	***13761***
Total CS (%)		***100***	***39.06***	***26.99***	***15.43***	***35.32***	***24.41***	***17.86***

degree or compactness, excess humidity, some of which are exemplified by the affected areas (tables 4-5).

The limiting factors that affect the potential soil cover within this area, is mainly referring to limitations due to excess of stagnant humidity and groundwater (table 4), soil acidification (table 5) and compaction degree (compression) facts for which it is being imposed, on a case-by-case basis, pedo-hydro-ameliorative (desiccation, drainage, deep raising, etc.) for the achievement of a balanced aero-hydric regime and of measures that would favor the conduct of the concentration of the nutritive elements and those of the within the soil organic matter (ameliorative fertilization, long-lasting planting with herbaceous plants and perennial grasses, etc.).

All the measures aimed at raising soil quality will take in account the pursuit of the procedures, leading to the concentration of nutrients and organic matter. In order for the physical degradation of the soil to be prevented, it is necessary to minimize its preparation works, to perform the agrotechnical works at the optimal humidity, as well as to ensure an adequate structure of the ameliorative plant crops.

Taking in account that a good part of the township's soils of the agricultural terrain are being affected during the vegetation period of humidity excess, which negatively affect the agricultural productions, the specific technologies will equally aim at increasing the aeration porosity as well as the water's permeability, through deep-lying work, associated with agrotechnical works executed at the right time and of good quality.

Referring to the acid soils these occupy within the researched field a surface of ha within the agricultural fields (table 5), thus grouped according to the acidification's intensity*: weak-pH between 5,8-6,8 moderate-pH between 5,1-5,8, strong-excessive with pH value under 5,1.*

These soils present a common characteristics, respectively the low *p*H values could be, based on the type of the soil-formation, separated in two big groups, with implication on the aerodynamic regime, respectively

Table 6

ALPINE-STAGNANT LUVOSOIL, MEDIUM CLAY / MEDIUM CLAYEY CLAY, FARLIUG, CARAS-SEVERIN COUNTY

Horizons	UM	Aow_2	AEw_3	Eaw_4	BtW	Btw_3	BC	C
Depth	cm	0-18	-45	-65	-81	-110	-137	-164
Coarse sand (2.0 – 0.2 mm)	%	5.4	6.3	9.6	4.1	1.9	3.4	4.2
Fin sand (0.2 –0.02 mm)	%	41.4	40.5	38.2	32.0	31.7	32.1	32.4
Dust (0.02 – 0.002 mm)	%	31.6	32.8	32.1	30.7	26.7	29.2	35.9
Colloidal clay (under 0.002 mm)	%	21.6	20.4	20.1	33.2	39.7	35.3	275
Physic clay (under 0.01 mm)	%	37.6	37.5	36.5	47.0	52.3	50.7	48.7
TEXTURE		LL	SS	SM	TT	TT	TT	LP
Apparent density (Da)	g/cm^3	1.29	1.53	1.68	1.69	-	-	-
Specific density (Ds)	g/cm^3	2.61	2.64	2.66	2.70	-	-	-
Porosity of aeration (PA)	%	23.7	13.8	5.6	0.4	-	-	-
Degree of compression (GT)	%	-5.1	11.0	23.3	24.1	-	-	-
Hygroscopicity coefficient (CH)	%	5.1	4.8	4.7	7.3	-	-	-
Coefficient of wilting (CO)	%	7.6	7.2	7.1	11.0	-	-	-
Field capacity (CC)	%	21.2	19.1	18.7	22.4	-	-	-
Total capacity (CT)	%	39.5	28.1	22.0	22.5	-	-	-
Usable water capacity (CU)	%	13.6	11.9	11.6	11.4	-	-	-
Hydraulic conductivity (K)	mm/h	8.6	3.1	1.2	0.4	-	-	-
pH in water		5.27	5.33	5.56	5.48	5.42	5.78	6.30
Humus	%	2.73	2.02	0.73	-	-	-	-
Azote index (IN)		1.51	1.11	0.41	-	-	-	-
Humus reserve	to/ha	63.4	83.4	6.1	152.9	-	-	-
Mobile Phosphorus (P mobile)	ppm	43.2	36.0	34.8	-	-	-	-
Mobile Potassium (K mobile)	ppm	132	118	110	-	-	-	-
Exchange bases (SB)	me/100	10.29	8.79	8.14	11.36	15.65	17.37	17.16
Changeable hydrogen (SH)	me/100	8.25	7.12	6.05	5.94	6.92	4.97	3.23
Cationic exchange capacity (T)	me/100	18.54	15.91	14.19	17.30	22.57	22.34	20.39
Saturation degree in bases (V)	%	55.50	55.24	57.36	65.66	69.34	77.75	84.16
Mobile aluminum	me/100	0.48	-	-	-	-	-	-

Table 7

SHADOW DISTRICAMBOSOIL, MEDIUM SAND / MIDDLE CLAY, FARLIUG, JUDETUL CARAS-SEVERIN

Horizons	UM	At	Auw_1	Bvw_2	BC	C_1q_2	C_2q_2
Depth	cm	0-7	-43	-85	-120	-140	-165
Coarse sand (2.0 – 0.2 mm)	%	17.0	15.0	13.4	31.2	31.4	24.2
Fine sand (0.2 –0.02 mm)	%	34.9	32.4	32.8	32.8	16.6	18.4
Dust (0.02 – 0.002 mm)	%	31.7	33.7	32.3	23.5	14.2	5.2
Colloidal clay (under 0.002 mm)	%	16.4	18.9	21.5	12.5	7.8	7.2
Physical clay (under 0.01 mm)	%	32.4	35.5	38.3	27.9	15.5	10.4
TEXTURE	-	SM	SS	LL	SM	UG	UG
Skeleton	%	-	-	-	-	30	45
Apparent density (Da)	g/cm^3	1.28	1.43	1.51	-	-	-
Specific density (Ds)	g/cm^3	2.61	2.67	2.69	-	-	-
Total porosity (PT)	%	51	47	44	-	-	-
Porosity of aeration (PA)	%	26.0	20.0	14.7	-	-	-
Degree of compression (GT)	%	-7.0	2.2	9.3	-	-	-
Hygroscopicity coefficient (CH)	%	3.9	4.5	5.1	-	-	-
Coefficient of wilting (CO)	%	5.8	6.7	7.6	-	-	-
Field capacity (CC)	%	19.5	18.9	19.4	-	-	-
Total capacity (CT)	%	39.8	32.9	29.1	-	-	-
Usable water capacity (CU)	%	13.7	12.2	11.8	-	-	-
Hydraulic conductivity (K)	mm/h	6.2	5.1	3.0	-	-	-
pH in Water	-	5.35	5.22	5.31	5.89	7.03	7.09
Humus	%	2.02	0.94	0.41	-	-	-
Azote index (IN)	-	1.01	0.41	0.19	-	-	-
Humus reserve	to/ha	18.1	48.4	4.3	70.8	-	-
Mobile Phosphorus (P mobile)	ppm	43.2	40.8	-	-	-	-
Mobile Potassium (K mobile)	ppm	110	105	-	-	-	-
Change bases (SB)	me/100	6.61	5.15	6.19	10.57	-	-
Changeable hydrogen (SH)	me/100	6.58	6.47	6.88	3.70	-	-
Cationic exchange capacity (T)	me/100	13.19	11.62	13.07	14.27	-	-
Saturation degree in bases (V)	%	50.11	44.32	47.36	74.07	-	-
Mobile aluminum	me/100	-	0.92	-	-	-	-

the first group brings the soil types that have horizon B argiloluvial ***(Bt):*** Preluvosoil, Luvosoils (table 6), Planosoil, Stagnosoil together and the second, soils with horizon B cambic (Bv) Districambosoils (table7).

Taking in account the bioclimatic zone and the material on which it was formed (table 2) the reaction presents, on large zones, some specific characteristics, indicating inappropriate anthropogenic interventions. The Low *p*H values in the processed layer indicate rather high debase (*p*H:5.8-6.8), caused, in the researched space, by repeated fertilization with fertilizer with acid reaction, on a surface ha (table 5), in this table, while presenting data referring to the surface with acid soils within in the researched space administrative territorial repartition.

The purpose of the present analysis is to offer to the deciding person an image on the territorial repartition of the acid soils, knowing these aspects could represent a great theoretical and practical importance.

It has a theoretical value because it offers the specialist the possibility to interpret the phenomena that take place within the natural resources and to forecast their evolution, in particular, and of the environment, in general, from the current and future health point of view. The practical importance is given by the fact that it warns the practitioner on the measures that should be taken so that these resources are being brought to optimal conditions for the harvested or spontaneous plant's development and growth. Acidity, expressed through the current acidity (*p*H) and titratable (of change and hydrolytic) expressed acidity, causes a high density of hydrogen ions in the soil solution as well as of hydrogen and aluminum ions absorbed in the colloidal complex, that directly affect the by the root system developed plant's nutritional process.

The acidity profoundly influences the metabolism process itself, through disorder of the formation of the protean substance, because of which, the nitrogenous substances remain at the within the route accumulated aminoamides.

The damaging effects of acidity have indirect implications as well.

The surface of the colloidal particles are saturated with H^+, solubilizes the Al hydroxides with release of an aluminum ionic complex in the solution, which at the end is absorbed into a complex and blocks the permanent negative loads of the silicate layers so that the total capacity value of effective change (Tef) varies between 6-57 me/ 100 g soil.

The mobile forms of aluminum in the soil, Type Al^{3+} $Al(OH)^{2+}$, $Al(OH)_2^+$ have a strong negative effect on the phosphorus and molybdenum mobility. Soluble monophosphate ions from the phosphor fertilizers ($H_2PO_4^-$), the only ones that form out of salts of phosphoric acid in soil with strong acid are easy to be absorbed on the surface electropositive charge of the aluminum hydroxide.

$$Al(OH)^+_2 + H_2PO_4^- \rightarrow Al(OH)_2H_2PO_4$$

the typical reaction to fixate the anions through the protonic mechanism [11].

The soluble phosphates suffer however within the soil and the insolubilization process through chemical retain, so that the phosphate cannot be anymore assimilated by plants:

$$Al(OH)_3 + H_3PO_4 \rightarrow AlPO_4 + 3H_2O$$

Through the reactions of absorption and precipitation it is much more reduced in the acid soils and the mobility of ions of molybdian MoO^-_4, which explains the molybdenum deficiency. The aluminum ions present in the soil solution worsen de ions' absorption of potassium, calcium, magnesium and ammonium, because the initial ions absorption on the surface of the radicular hairs is proportionate with the rapport between the active concentration of those ions in the soil solution.

This deficiency in the absorption of potassium, calcium, magnesium and ammonium explains as well the chemical fertilization of the acid soils. A Aluminum concentration of even 1-2ppm is toxic for the majority of the harvested plants [15]. Corresponding to the equation:

$$pAlm = 2pH - 4.41$$

so that for a concentration of aluminum in the soil of 108 ppm, 43 ppm and 1.7 ppm the *p*H values reach 3.4, 3.6 and 4.3.

The negative effect of the mobile forms of aluminum in soil, could be eliminated through the raise of the pH value through the effect of limestone or the submersion of the soil in a few weeks before the beginning of harvesting. The danger, in case of humidity excess is the surface of the Fe^{2+} ions [15].

$$Eh = 1.058 - 0.059 \lg Fe^{2+} - 0.177\,pH$$
$$pE = 17.87 + pFe^{2+} - 3pH$$

The toxicity of iron can be limited as well through the appearance of limestones and MnO_2 addition. Calcium carbonate increases the *p*H and decreases the Fe^{2+} concentration in water. Manganese stops the reduction, lowers the Fe^{2+} concentration and eliminates the ion's toxic effect contrary to iron.

On the heavy acid soils even manganese can accumulate in big quantities, under a bivalent form, becoming as such toxic for the plants, especially during the periods with excess water. An indirect negative effect on the growth of the harvested plants on acid soils this being determined by the reduction of the azote and nitrifications fixing microorganism's activity whose optimal should be found with the *p*H limits of 6.5-7.5.

Instead, the activity of cellulosic bacteria and actinomycetes is stimulated which develops well and at a pH de 4-5. In acid soils and anaerobiosis caused by water stagnation reduction phenomena take place [15].

$$4Fe(OH)_3 + 4CaSO_4 + 9CH_2O =$$
$$= 4FeS + 4Ca(HCO_3)_2 + CO_2 + 11H_2O$$
$$FeS + S = FeS_2$$

The formed pyrite is oxidized through drainage until ferric sulfate and ferric hydroxide. Oxidation is all the more intense as the humidity decreases from 40 to 10%. The over 0.15% in the acid and humid soil air accumulated carbon dioxide has as well a shrinking effect on the absorption of water and nutritive salts, limiting roots growth and even provoking wilting of plants.

Taking in account all these considerations depending on the concrete situation on a case-by-case bases, the with calcium periodic amendments of the soils bring to improvement nutrition conditions of the plants next to ameliorative fertilization and hydro-extraction works for draining and exhausting excess water (groundwater and precipitation).

Referring to the *calcium amendment* (known as calcification) generally is appreciated, that the need of calcium amendments, for optimizing reactions and the in bases saturation state, appear at soils with a *p*H<5.8 and in base saturation degree V<75 and the presence of interchangeable aluminum in easy measurable quantities (higher the 0.2-0.3 millimass equivalent at 100 g soil), for field plants with the exception of crop rotation of leguminous plantations and walnut and strawberry plantations. For leguminous crops, it is recommended the values of the *p*H to be amended below 6 and V below 80% [2].

The aluminum ion penetration into the roots and the manifestation of the phytotoxic effect is proportional with the rapport between the activity of the main ion species out of the acid soils solution $(Al^{3+})^{1/3}/(Ca^{2+} + Mg^{2+})^{1/2}$, considering that the main ion species and the magnesium have an *moderating* effect on the Al, it could be appreciated that the relation between A1 and the sum of the exchangeable bases an added plus of certitude, because of which the phytotoxic effect of aluminum will differ in relation to the sum of the exchange bases, consisting predominantly of calcium and magnesium.

Depending on the requests of the harvested plants face to the reaction and the presence of calcium amending of calcium shall be recommended in relation with (Al/SB x 100) in the harvested layer of soil exceeds 5 (crops without perennial leguminous) over 2.5 (crops with perennial leguminous) or over 6 (in trees plantations -wine-growing).

The calcium carbonate doses should be higher than the equivalent of soil aluminum due to the following causes: uniform mixture of the amendment within the soil masses will be gradually achieved through multiple ploughings and disking, the uneven distribution of the amendment making the overdose necessary; dissolution of the amendment and neutralization of the acidity is developing in parallel with the profoundly leaching the bases and the ones to be consumed; loss of calcium within the amended soils are higher than the not amended ones, intensified once with the growth of the amended doses; the efficiency duration grows in parallel with the applied doses.

It is considered that neutralization of ¾ until 1/1/ of hydraulic acidity of the shows layer corresponds the correction, in practice the calculated doses with the relation [9,10].

$$CaCO_3\ t/ha = SBi\left(\frac{Vd}{Vi} - 1\right) \times H \times 0.06 \times \frac{100}{PNA}$$

where:

SBi -initial amount of the exchange bases, me/100 g soil.

Vd -desired saturation degree (calculated with Ah) to be achieved in soil and that has values: 100% for crops with perennial leguminous 90% for the rest of the field plants, walnuts and strawberries, 75% for trees plantations -wine-growing plantations and 70% for meadows,

Vi -saturation degree within the initial bases.

H -depth of the soil layer necessary to be amended: 25 cm for field crops and trees plantations -wine-growing plantations; 40 cm at creation of a tree plantations -wine-growing plantations and 10 cm for meadows.

0.06 - coefficient for recalculation in t/ha.

PNA - the power to neutralise the used amendment.

Using the above mentioned relation and the chemical characteristics of an albic - stagnic luvsoil, medium clay/ medium loamy clay (table 6), respectively change bases (SB) in the processed state (Ap) de 9.87 at me/100 gr sol, V% de 55.24 the dolomite limestone has been calibrated (PNA=90), at a crop for field crops, this being of *10.36 t/ha.*

For the shading Districambosoil, middle sandy clay/ medium clay (table 7) having SB (summed bases)in the first 10 cm of 6.20 at me/100 gr sol and V% of 48.3 the dolomite calcar doses has been calleted (PNA=90) for the usable category of meadow, this being for *1.85 t/ha.*

The effects of the amendments have at their basis the reaction that is being produced within the colloidal complex of the soil and the lime powder passed into the solution (a more intense solubilisation in case of combining the calcification amendments with organic fertilisation).

Limestone:

$$CaCO_3 + H_2O + CO_2 \rightarrow Ca(HCO_3)_2 \quad \textit{which hydrolyzes alkaline}$$

$$Ca(HCO_3)_2 + 2HOH \rightarrow Ca^{2+} + 2OH + 2H_2CO_3$$

$$\underset{H^+}{Sol\ Al^{3+}} + 2Ca^{2+} + 4OH \rightarrow \underset{Ca^{2+}}{sol\ Ca^{2+}} + Al(OH)_3 + H_2O$$

Decreasing acidity, immobilizing exchangeable alumina, increasing the solubility and availability of phosphorus and potassium are the main changes in the amended soils and reasons for increasing fertility. From a biological point of view, an increase in the activity of fixing microorganisms of azote and nitrifying fixation microorganisms has been observed.

Conclusions

The knowledge of the natural conditions and especially of the ecological potential of the lands (defined according to MESP-ICPA Bucharest) for the main categories of use and crops is of particular importance in carrying out the qualitative evaluation of the lands and the analysis of the limiting factors, and has as main purpose to offer to specialists in agriculture a global picture of the phenomena that are taking place within the elementary units of the pedological landscape through which the overall strategy for the set of ameliorative measures will be shown.

In this framework, the determination of the land production capacity as well as the foundation of the improvement of these technologies improvement can constitute for the decision-maker (Government, Local Public Administration) an effective tool for choosing working procedures that favor the efficient use of the land resources within the researched area in accordance with the specific pedoclimatic conditions, for processing and selling agro-food products, thus proving itself an ecological and efficient solution for the future.

Systematic pedological and agrochemical mapping of the soils, conducted by the Pedological and Agrochemical Offices of our country offers valuable data concerning the evolution of the quality of soils, the establishment and application of crop technologies in a differentiated way, land assessement and establishment of favorability for different cultures, the establishment of land work for improvement and of ameliorative technologies, the organisation and systematisation of territory, which justifies the genuineness and necessity of continuing these activities.

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