THE RESEARCH REGARDING THE MONITORING OF SOILS AND WATERS FROM NORTH WESTERN ROMANIA

Şandor Maria*, Colibaş Maria

*University of Oradea, Faculty of Environmental Protection, 26 Gen. Magheru, St. 410048 Oradea; Romania; e-mail: scdaoradea@yahoo.com

Abstract

Paper presents the research conducted in stationary experience for six years at Agricultural Research and Development Statiomn Oradea and the results makes a chemical characterization of groundwater, a middle-scale zoning levels and their chemistry, a schedule of the evolution of soils under influence of natural groundwater setting weight influence of weakly mineralized water and a high percentage of sodium on physical, chemical and hydrophysical properties of four types of soil and on the crop.

Monitoring of soil quality was achieved in drainage systems from Valea Ierului and Plain Salonta by sampling soil in spring and summer from 108 locations at Roşiori, Tămăşeu, Diosig, tarcea, Cadea, Săcuieni, Ghenci, Căuaş, Bereteu, Tăşnad, Răduleşti, Cefa, Inand, Salonta, Tulca, Ciumeghiu şi Barmod. In these points were determined wetting condition of the soil, groundwater depth, groundwater quality (Na%, type of salinization, mineral residue, electrical conductivity, SAR index Priklonski, Class Richard, CSR).

Keywords*: monitoring, soils, groundwater, quality, chemical properties*

INTRODUCTION

Institute of Pedology Bucharest in the national research program "Preventing and combating soil pollution" carried on "National system of monitoring soil quality." Within this theme, from 1968-1998 at Agricultural Research and Development Station of Oradea, and at other resorts in the country, was made the experience "Knowledge development of soil quality in some systems of land reclamation on secondary salinization and water logging." At the Agricultural Research and Development Station of Oradea in the laboratory of "Soil and Land Improvement" experience was made by I. Colibas and Maria Colibas.

An important achievement in the field of water monitoring in the area is the thesis conducted by Maria Colibas (1975) "Research on the influence of groundwater chemistry in the plains area Mures - Crisul Repede River on soil and agricultural plants" based on research conducted in stationary experience for six years, makes a chemical characterization of groundwater, a middle-scale zoning levels and their chemistry, a schedule of the evolution of soils under influence of natural groundwater setting weight influence of weakly mineralized water and a high percentage of sodium on physical, chemical and hydrophysical properties of four types of soil and on the crop.

MATERIAL AND METHOD

Monitoring of soil quality was achieved in drainage systems from Valea Ierului and Plain Salonta by sampling soil in spring and summer from 108 locations at Roşiori, Tămăşeu, Diosig, tarcea, Cadea, Săcuieni, Ghenci, Căuaş, Bereteu, Tăşnad, Răduleşti, Cefa, Inand, Salonta, Tulca, Ciumeghiu şi Barmod. In these points were determined wetting condition of the soil, groundwater depth, groundwater quality (Na%, type of salinization, mineral residue, electrical conductivity, SAR index Priklonski, Class Richard, CSR).

To characterize dynamics in time of chemistry and aquifer level were placed in the studied area 52 stationary experiences near the drilling of the national network. Their location was made in characteristic points in four major groups of soils, namely: chernozem, alluvial soils and saline soils and alkali marshy grounds.

Groundwater level measurements and sampling of water and soil for analysis were made twice a year in spring (March) under circumstances of abundant rainfall and summer in July and August (with rainfall in May low and highest temperatures), making each time drilling probe to groundwater.

At the water and soil samples collected following determinations were performed: pH with a glass-calomel electrode couple, mineral residue and the specific electrical conductivity conduct metric, alkali metal carbonates (CO_3-)and bicarbonate (HCO_3-) by titration with a solution of 0,01 H_2SO_4 N in the presence of phenolphthalein or methyl orange, chlorine by Mohr titration with 0,01 N $AgNO_3$ solution, sulfates, calcium and magnesium - Complex metric, sodium and potassium in the flame photometer. Na absorbed in the soil was determined by leaching with ammonium acetate

RESULTS AND DISSCUSION

Monitoring of soil and water from Valea Ierului and Salonta Plain. Hydrographyc basin of Valea Ierului covers an area of 1427 km^2 and is bordered to the north and east of Crasna river basin, in south by Bereteului basin and east of the border with Hungary. Plain Salonta is part of the Western Plain, place of plain digression, Crisurilor Plain district and is bounded on the north by River Crisul Repede, at east of sewer, at south by Crisul Negru River and west by border with Hungary.

Before 1966, when they made extensive drainage works, correcting beds of rivers and dams in the hydrographic basin of Valea Ierului 8500 ha from the area were occupied by swamps and marshes, 8200 ha were flooded every 1-2 years and 16500 ha were affected by temporary excess moisture. In Plain Salonta approx. 42,000 ha were affected by excess moisture from precipitation and groundwater.

In 1984 there were in the hydrographic basin of Valea Ierului 15317 ha of permanent excess moisture without salinization and / or alkalization, 9785 ha were occupied by marshy grounds, solonetz 6154 ha, 2906 ha were affected by temporary excess moisture, 1061 ha were alluvial soils saline, and 653 ha chernozems were affected by salinisation. In Plain Salonta 11090 ha were affected by temporary excess moisture, 8458 ha were marshy grounds, permanently excess moisture deprived of salinity was present on 7113 ha, 6023 ha were occupied by saline chernozem, solonetzs occupied 5013 ha and 3023 ha of alluvial saline soils .

Groundwater level in the investigated soils had lower depths in the spring than in summer. Differences in level from spring to summer reached at 1-1,5 m in some stationary. The average values of these differences are higher (40-70 cm) in areas with solonetzs and marshy grounds and lower (20-40 cm) in areas with chernozem and alluvial soils.

Mineral residue values indicate a wide range of mineralization of groundwater in the area and the Valea Ierului and Salonta Plain. The vast majority of the 108 groundwater wells had a middle mineralization. Higher mineralization were encountered in shallow wells located on the solonetz Radulesti (6,6 g / l) on marshy grounds from Săcuieni (2 g / l) in Valea Ierului and on solonetzs from Barmod and Ciumeghiu (2,2 – 2,69 g / l), respectively marshy grounds from Cefa (1,8 g / l) and Ant (up to 2,6 g / l).

Monitoring groundwater from Mures and Crisul Repede River - Results regarding on the aquifer level. Groundwaters in the area are generally confined to shallow, the average area of 2,28 m and 2,18 and 2,50 m ranging between three interfluves. The highest average levels (2,18 and 2,21 m) are in sub areas Crişul Alb, Negru and Repede (Table 1).

Groundwater level variation depending on soil type, presented the following aspect: the highest average depth of groundwater occurs in alluvial soils and chernozems (2,92 respectively 2,74 m), followed by solonetzs (1,80 m) and then marshy grounds with the lowest multiannual average of 1,61 m. The amplitude variation of ground water depth from spring to summer, shows the highest values in the alluvial soils (0,55 m) followed by that of chernozems (0,37 m) and marshy grounds (0,27 m). The lowest seasonal variation occurs in Solonetzs, explained by the fact of defective vertical movement of water in these soils.

Table 1.

Hydrostatic level and chemical composition of groundwater in the plain areas Mures-Crisul Repede

Areas and subareas	The types of soil and season		Depth	pH	miliechivalent/liter							
					CO_3^{-}	HCO_3^{-}	Cl^{-}	SO_4^{-}	Na^{+}	K^{+}	Ca^{++}	Mg^{++}
Mureş – Crişul Alb	Chernozem		3.26	7.95	0.99	6.85	1.24	0.87	3.50	0.06	1.98	4.41
	Alluvial soils		3.08	7.80	0.79	5.52	1.22	1.61	4.31	0.04	2.06	2.72
	Marshy soils		1.63	7.72	0.75	5.75	5.81	4.89	9.34	0.08	4.06	3.69
	Solonetz		1.88	7.95	1.52	14.47	7.27	1.82	20.34	0.04	1.54	3.15
	Average		**2.50**	**7.88**	**1.07**	**8.67**	**3.92**	**2.06**	**9.69**	**0.06**	**2.28**	**3.67**
Crişul Alb – Crişul Negru	Chernozem		5.02	8.02	1.55	11.20	1.54	1.01	9.64	0.33	1.66	3.67
	Alluvial soils		3.07	7.86	0.98	7.35	2.64	4.23	4.94	0.12	4.69	5.38
	Marshy soils		1.74	7.97	0.75	7.03	1.26	3.15	5.08	0.03	3.01	4.05
	Solonetz		1.95	7.20	1.74	10.26	4.59	3.51	16.65	0.02	0.89	2.53
	Average		**2.21**	**7.66**	**1.30**	**8.38**	**2.91**	**3.24**	**10.09**	**0.10**	**2.45**	**3.77**
Crişul Negru – Crişul Repede	Chernozem		3.07	7.80	0.57	4.58	1.17	0.16	0.97	0.06	3.37	2.07
	Alluvial soils		2.75	7.87	0.46	5.56	2.10	2.24	2.01	0.07	5.06	3.27
	Marshy soils		1.52	7.93	0.58	5.48	0.90	1.32	3.38	0.02	2.20	2.68
	Solonetz		1.55	8.15	1.50	9.61	1.0	0.12	10.13	0.02	0.85	1.23
	Average		**2.18**	**7.95**	**0.82**	**6.44**	**1.17**	**0.81**	**4.50**	**0.04**	**2.52**	**2.19**
Area averrage Mureş – Crişul Repede	Chernozem	Spring	2.60	7.97	1.18	6.25	1.04	0.95	3.74	0.17	2.52	2.99
		Summer	2.97	7.87	0.90	8.84	1.60	0.42	5.67	0.13	2.15	3.78
		Average	2.74	7.93	1.08	7.19	1.24	0.75	4.44	0.15	2.38	3.28
	Alluvial soils	Spring	2.70	7.91	0.82	6.10	2.03	0.59	4.00	0.06	4.90	3.52
		Summer	3.25	7.78	0.67	6.22	1.95	1.79	3.51	0.07	2.99	4.07
		Average	2.92	7.86	0.76	6.14	1.99	1.06	3.80	0.06	4.14	3.73
	Marshy soils	Spring	1.49	7.89	0.61	6.08	2.55	3.95	6.13	0.04	4.06	2.95
		Summer	1.76	7.86	0.76	6.12	2.77	2.29	5.75	0.05	2.13	4.00
		Average	1.61	7.87	0.68	6.09	2.65	3.20	5.96	0.04	3.19	3.42
	Solonetz	Spring	1.76	8.17	1.82	11.23	5.78	2.31	16.65	0.02	1.44	3.00
		Summer	1.83	8.03	1.36	11.66	2.79	1.33	14.76	0.03	0.85	1.60
		Average	1.80	8.09	1.55	11.48	4.05	1.74	15.55	0.03	1.04	2.18
	Media	Spring	2.13	7.98	1.11	7.41	2.85	2.70	7.63	0.08	3.23	3.11
		Summer	2.45	7.89	0.92	8.21	2.27	1.45	7.42	0.07	2.00	3.36
		Average	2.28	7.94	1.02	7.78	2.58	2.12	7.53	0.07	2.66	3.22

The quality for irrigation of surface water from Mures and Crisul Repede. The waters of the river from plain Mures-Crisul Repede River area are waters "weak to moderately mineralized" (from 0,15 to 0,39 g / l mineral residue, respectively 227-596 microm / cm EC). On the same river degree of mineralization and sodium content is different, are lower upstream and downstream are more pronounced (Table 2)

The waters of the rivers are generally type of bicarbonate- calcium and presents no danger of soil alkalizing. For use in irrigation waters are "excellent" Crisul Negru (Priklonski-Laptev index of 64-115, Group I and Class Richards irrigation C.2-S.1); "Very good" Crisul Alb, Crisul Repede and Teuzul (with Priklonski index of 55-87, group II of irrigation and class Richards and C.2-S.1 and C.1 - S.1) and "good "water like Mures and Sarteş (with Priklonski index 16-41, group III of irrigation and qulity class C.2-S.1). Waters of the main channels that cross the area are "weak and medium mineralized" calcium- bicarbonate-type (Collector and Culiser Canals) bicarbonate-Na (Pogonier and Budier Canal) and bicarbonate-magnesium (Morilor Canal at Pil and Cigher Canal to Zărand)

Concerning to quality of irrigation water are"excellent waters" – Collector Canal at Ghioroc (v = 125, irrigation group I and quality class by C.2-S.1) "very good waters " Collector Canall at Giriş and Inand, Culişer Canal at Salonta and Morilor Canal at Socodor "good waters " – Morilor Canal at Pil and Canal Cigher to Zărand and "acceptable water " for carbonate and light soils such as water from Canals Budier and Pogonier.

Table 2.

Characterization of the major water surface in the plain area Mures-Crisul Repede, in order to use them for irrigation

Water name and locality	pH	Residue g/l	CE x 10^6	Na % from ∑me	Type of minera-lization	SAR	(v) Priklonski - Laptev	Irrig. group Florea	Qualit. class Richards
Rivers									
Mureş (Arad)	8.1	0.39	596	17.5	Cl-Ca	1.5	16.7	III	C.2-S.1
Crişul Alb (Bocsig)	7.8	0.22	333	4.2	B-Ca	0.3	81.4	II	C.2-S.1
Crisul Alb (Chişineu Cr)	8.2	0.31	469	5.5	B-Ca	0.4	67.8	II	C.2-S1
Crişul Alb (Vărşand)	8.1	0.31	469	9.1	B-Ca	0.6	55.2	II	C.2-S.1
Truz (Mişca)	7.6	0.15	227	11.0	B-Ca	0.5	68.0	II	C.1-S.1
Sarteş (Vînători)	7.4	0.28	424	13.6	B-Ca	0.9	40.9	III	C.2-S.1
Crişul Negru (Tinca)	7.9	0.19	286	2.4	B-Ca	0.9	64.6	I	C.2-S.1
Crişul Negru (Zerind)	8.0	0.23	348	2.7	B-Ca	0.2	115.2	I	C.2-S.1
Crişul Repede (Cheresig)	8.1	0.21	318	8.7	B-Ca	0..5	87.1	II	C.2-S.1
Canals									
C. Morilor (Socodor)	8.1	0.33	500	10.3	B-Ca	0.8	57.5	II	C.2-S.1
C. Morilor (Pil)	8.1	0.40	606	12.7	B-Mg	1.1	58.0	III	C.2-S.1
C. Pogonier (Socodor)	8.3	0.90	1363	20.1	B-Na	1.9	28.3	IV-a	C.3-S.1
C. Budier (Grăniceri)	8.1	0.70	1060	27.6	B-Na	3.9	26.9	IV-a	C.3-S.1
C. Budier (Pil)	8.4	0.70	1060	27.9	B-Na	4.4	21.0	IV-a	C.3-S.1
C. Cigher (Zărand)	8.0	0.39	590	9.9	B-Mg	0.7	41.3	III	C.2-S.1
C. Culişer (Salonta)	7.6	0.28	424	7.4	B-Ca	0.5	93.4	II	C.2-S.1
C. Colector (Giriş)	7.5	0.20	303	8.5	B-Ca	0.5	78.0	II	C.2-S.1
C. Colector (Inand)	7.8	0.27	409	11.9	B-Ca	0.8	59.8	II	C.2-S.1
C. Colector (Ghiorac)	8.2	0.23	348	1.8	B-Ca	0.1	125.2	I	C.2-S.1

CONCLUSIONS

At the Agricultural Research and Development Station of Oradea in the laboratory of "Soil and Land Improvement" experience was made by I. Colibas and Maria Colibas. Mineral residue values indicate a wide range of mineralization of groundwater in the area and the Valea Ierului and Salonta Plain. The vast majority of the 108 groundwater wells had a middle mineralization. Higher mineralization were encountered in shallow wells located on the solonetz Radulesti (6,6 g / l) on marshy soils from Săcuieni (2 g / l) in Valea Ierului and on solonetzs from Barmod and Ciumeghiu (2,2 – 2,69 g / l), respectively marshy grounds from Cefa (1,8 g / l) and Ant (up to 2,6 g / l).

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Researches on domain level of and chemistry of groundwater, water surface, underground deep (artesian) and the irrigation of the plain area Mures – Crisul Repede, allowed outlining the conclusions and recommendations of particular importance.

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