SOIL SALINIZATION AND ALKALIZATION IN THE TIMIŞ-BEGA PLANE

SALINIZARE-ALCALIZARE ÎN CÂMPIA TIMIŞ-BEGA

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***Abstract**:The area around the territories Foeni, Giulvăz, Peciu Nou and Uivar has a new soil layer extremely various, a large area being covered by the Hyposalic and Hyposodic soils, with various degrees of salinization and sodization reaching up to very strong Hyposalic and Endosalic Solonetz.*
The paper accentuates few of the main mechanisms of salinization and alkalization from the researched area and the dispersing and characteristics of soils. Prescriptions are made regarding the prevention and reducing the degradation of the territories affected by salinization and sodization and ameliorative – capitalization solutions for this area are proposed.

***Rezumat:** Zona aferentă teritoriilor Foeni, Giulvăz, Peciu Nou şi Uivar are un înveliş de soluri extrem de variat, o mare suprafaţă (30%) revenind solurilor salinice şi sodice, cu diverse grade de salinizare şi sodizare, ajungând până la foarte puternic salinizat şi soloneţuri salinice. Lucrarea evidenţiază câteva din principalele mecanisme de salinizare din arealul cercetat, răspândirea şi caracteristicile solurilor cu soloneţuri şi sodium. Se fac recomandări privind prevenirea şi diminuarea degradărilor terenurilor prin salinizare-sodizare şi se propun soluţii ameliorative şi de valorificare a acestor terenuri.*

***Key words:** Salinization, alkalization.*
Cuvinte cheie salinizare, alcalizare.

INTRODUCTION

Salsodisols (SRTS-2003) are soils that include two types of soils: Solochaks and Solonetz, but besides this two types of soils, in the group of this so called Saline and Alkali Soils are included the salinic subtypes (moderate-strong) with sc horizon, and alkali subtypes (low-moderate) with horizon ac.

Wide spread, but patch shaped Solonchaks cover a surface of 260-340 million ha, associated with Solonetz and Gleyosol (1).

The major dangers are the potential saline-alkali soils, that as a result of unreationally antropic interventions (irrigations, clogging, and dumps) can be quickly degraded and transformed into sterile land.

Salinization-alkalization of the terrain in the Low Plane Timiş-Bega by the rising of the pedophreatic waters heavily mineralized is a real phenomenon that occurred on an important surface after the large land reclamation works initiated after the year 1718 in Banat.

MATERIAL AND METHOD

The paper is based on the pedological studies effectuated in the area by the O.S.P.A. Timişoara pedologists between the years 1975-1995, and also the pedological studies made on a 1:10 000 scale by the authors in the years 1995-2007. There were used also scientifically papers with similar themes conducted by other researchers. The objective is to improve the knowledge about salinization and alkalization of the main soils from the Timiş-Bega area, with a low plane relief.

RESULTS AND DISCUSSION

Solonchaks are soils with high concentrations of salts at some time of the year in the topsoil. This may occur in areas where evapotranspiration exceeds precipitation for at least part of the year and where salts are present in moderate to high amounts, in the parent material of the soil (salinization). Often salinity is man-induced through agricultural and other practices.

The presence of these salts, the amount of osmotic pressure of the soil solution, on the toxicity of a given ion leads to special landscapes, depending on the degree of salinity.

- Calcium dominated saline soils. The ratio of Ca+Mg / Na+K is between 1 and 4 and Ca / Mg is 1 or more. A slight increase in pH may take place and the structure remains stable even after desalinization.

- Sodium dominated saline soil, with sodium fixed on the exchange complex. Ca+Mg / Na+K is less than 1. Strong alkalinization occurs after desalinization and the structure tends to degrade.

- Magnesium dominated saline soils are structurally similar to sodium dominated soils. Ca / Mg equals 1 or less and Na / Mg is less than 1. Upon desalinization occurs a strong alkalinization followed by structural degradation.

Under extreme climatic conditions (low rainfall, high evaporation) salts present in the soil solution precipitate at the surface. Degradation of the soil structure does not take place as long as significant quantities of salts are present in the soil solution. After desalinization cations from the soil solution may be adsorbed on the exchange complex and only the degradation will be enhanced.

Solonetz are developed under the influence of such salts as $NaHCO_3$, Na_2CO_3, Na_2SiO_3 and $MgCO_3$. Salt accumulation takes place in the summer (dry) season and downward movement during the winter (rainy) season.

The natric horizon associated with humus-risk surface horizons and saline subsoils is characteristic for Solonetz. The natric horizon is a dense subsurface horizon which has a greater clay content than the overbying horizon similar to the argic horizon but with a high amount of exchangeable sodium and / or magnesium. Soil reaction is strongly alkaline with a pH_{H2O} of more than 9.0 until 11.

The Timiş River that bounds at south the Low Plane Timiş-Bega, has a slow bent and refills the phreatic that has a very high level (0.4-1.4 m). The ground water bed is made from acvitard horizons composed from clay and marl that not allow the lateral water transport. The multiannual oscillation amplitude of the piezometric gradient varies between 1-2 m, levels maintained 6-7 months.

The dissolved salts quantity in the pedophreatic waters varies between 0,15-5 g/l. the smaller concentrations appear in the bordering area of the Timiş, Timişaţ and Bega Rivers and the higher concentrations in the Cruceni-Foeni-Giulvăz-Diniaş area.

Conditioned by an exudative hydric regime, with ascendant phreatic waters rich in carbonates and Na and Mg bicarbonates, that after evaporations at the soil surface enrich the soil profile in salts, salinizations of a few soil types occurs. Thereby, in the Foeni territory moderate-strong salinizations occur on a surface of 369 ha (4%), at Uivar on 168 ha (1%). A Cruceni profile with a Salinic Solonetz has the following characteristics:

Table 1

Depth	0-7	-18	-32	-50	-75
pH H2O	10.40	10.50	9.98	10.45	10.40
PSA	22.6	46.5	58.6	39.0	35.4
Soluble salts (mg/100 g soil)	378	812	1204	868	476

We see that the salic horizon (1204 mg/100 g soil) is present from the first50 cm and the soil could be considered Saline Soil but ulterior determinations did not reveal contents over 1000 mg/100 g soil.

The majority of soils present low salinizations, but alkalization is dominant and especially the salsodic subtype where salinizations and alkalization associates. For example in Uivar, CZss covers 1161 ha (6.2%), VSss covers 3167 ha (18%), CZac covers 2232 ha (13%), VSac covers 856 ha (5%), ASac covers 134 ha (0.8%).

The physic-chemical characteristics of a few Solonetz Soils from the Low Plane are presented in the 2 and 3 table.

Table 2

Analytical data of the profile 1
Calcaric-Saline Solonetz with moderate salinity between 0-20 cm very strong sodic, on alluvial deposits, plane.

HORIZON								
Depths (cm)	0-4	-27	-48	-70	-92	-110	-130	-150
Coarse sand (2,0-0,2 cm) %	2.4	1.3	0.2	0.2	0.2	0.2	0.3	0.2
Fine sand (0,2-0,02 cm) %	55.0	43.4	39.6	38.1	48.3	42.2	43.7	53.0
Silt (0,02-0,002 cm) %	28.5	30.3	28.7	29.5	27.0	29.4	30.3	25.9
Clay 2 (sub 0,002) %	14.1	25.0	31.5	32.2	24.5	28.2	25.7	20.9
Physic clay	29.0	40.3	44.7	47.0	38.3	44.4	42.2	35.1
pH (in H_20)	6.20	9.20	10.00	10.65	10.08	10.47	10.18	9.84
Carbonates ($CaCO_3$ %)	-	0.77	2.24	4.14	12.07	10.00	24.84	5.34
Humus (%)	5.76	2.22	1.32	-	-	-	-	-
N-NO_3 (ppm)	28.8	-	11.4	3.0	-	-	-	-
N-NH_4 (ppm)	1.32	-	3.78	1.26	-	-	-	-
P total (ppm)	3.0	9.2	-	-	-	-	-	-
P mobile (recalculated)	2.9	0.0092	-	-	-	-	-	-
K mobile (ppm)	114	143	-	-	-	-	-	-
NaT (me)	-	6.75	11.75	13.05	-	-	-	-
TNa (me)	-	16.81	23.32	16.81	-	-	-	-
Na sch	-	4.79	9.74	11.25	-	-	-	-
PSA (%)	-	28.49	41.76	66.92	-	-	-	-
BSP	10.41	-	-	-	-	-	-	-
Exchangeable hydrogen (SH me)	9.53	-	-	-	-	-	-	-
CECs (T me)	19.94	-	-	-	-	-	-	-
Degree of base saturation V (%)	52.20	-	-	-	-	-	-	-
ECe (mg/100 g sol)	-	258.7	307.2	229.6	-	-	-	-

For the Low Plane Timiş-Bega that includes territory like Foeni, Uivar, Giulvăz, Peciu Nou, Salsodic Soils covers about 10% from the surface and adding the soil complex (with Salinic Solonetz) results over 19% from the surface. If we consider the sodic and/or salinic soils we reach 30% from the territory. The presence of these soils shaped like patch is explained by the existence of isolated layers of pedophreatic water located on lenticular clay layers. It is obvious tjat the process of salinization-alkaliaztion by the phreatic water is dominant, which means that in all cases this soils are also gleyic.

CONCLUSIONS

The Low Plane Timiş-Bega, with cavity, accumulative relief and a slow bent and an obvious subsidence is covered with fluvio-lacustrine deposits with various granulometries, from gravel until smectite clays. The phreatc waters fed from The High Pain anf from the

Timiş-Bega Rivers are mineralized, with the dominance of Na+K over Ca+Mg and a ratio Ca/Mg ≤ 1. In the droughty years it reaches to the soil solutions concentrations and depositing the Ca carbonates. The balance of Na and Mg salts grows, so these ions reach into the colloidal complex and destroy the structure and heavily increase the alkalinity. The territory with strong alkalizations and salinizations are unfavorable to the agrarian culture and requires huge mounts of money for their ameliorations. We consider thereby, that where are large, compact surfaces of Solonetz Soils and Alkalic-Salinic Soils, the employment to remain as meadow, eventually floristic reservations. Where dominant are the typical soil (CZ, FZ, AS, etc) low alkalic-salinic eventually with patches of alkalic-salinic soils, strongly-moderate this can be ameliorate.

Table 3

Analytical data of the profile 2 - Calcaric-Saline Solonetz, strong saline between 20-50 cm

HORIZON								
Depths (cm)	0-9	-30	-59	-90	-120	-150	-170	170-
Coarse sand (2,0-0,2 cm) %	0.4	0.4	0.2	0.2	0.2	0.2	0.2	0.2
Fine sand (0,2-0,02 cm) %	50.2	42.4	37.5	43.2	46.8	40.9	47.3	67.3
Silt (0,02-0,002 cm) %	29.7	25.1	26.4	26.3	26.2	31.4	30.0	16.6
Clay 2 (sub 0,002)%	19.7	32.1	35.9	30.3	26.8	27.5	22.5	15.9
Physic clay	34.0	43.5	48.3	45.3	38.9	43.2	37.3	24.4
pH (in H_20)	5.79	8.76	9.07	9.21	9.16	9.36	9.32	9.40
Carbonates ($CaCO_3$ %)	-	0.17	3.89	10.03	18.46	14.53	21.94	3.28
Humus (%)	6.72	1.80	1.08	-	-	-	-	-
N-NO_3 (ppm)	37.2	-	10.8	4.2	-	-	-	-
N-NH_4 (ppm)	1.86	-	3.72	1.68	-	-	-	-
P total (ppm)	9.2	10.6	-	-	-	-	-	-
P mobile (recalculated)	9.2	0.954	-	-	-	-	-	-
K mobile (ppm)	98	120	-	-	-	-	-	-
SB (mg/100 g soil)	11.655	-	-	-	-	-	-	-
NaT (me)	-	7.18	11.75	11.75	-	-	-	-
TNa (me)	-	17.90	17.90	16.81	-	-	-	-
Na sch	-	6.09	8.16	8.38	-	-	-	-
PSA (%)	-	34.02	45.58	49.85	-	-	-	-
BSP		-	-	-	-	-	-	-
Exchangeable hydrogen (SH me)	8.96	-	-	-	-	-	-	-
CECs (T me)	20.61	-	-	-	-	-	-	-
Degree of base saturation V (%)	56.52	-	-	-	-	-	-	-
ECe (mg/100 g soil)	-	148.7	646.8	679.2	-	-	-	-

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