PRESENT ENVIRONMENT AND SUSTAINABLE DEVELOPMENT, VOL. 6, no. 2, 2012

THE IMPACT OF HYDRAULIC WORKS ON THE HYDRIC AND SALINE REGIME FROM THE DAMMED MEADOW OF PRUT RIVER IN ROMANIA

Lăcrămioara Mirela Vlad[1], Iosif Bartha[2], Victor Gabor[3]

Key words: floodplain, hydric and salt regime, impact of hydraulic works .

Abstract. On the Prut River floodplain, for returning the flooded land to agriculture and for flood protection of those lands, have been conducted a series of hydraulic, hydro-improvement and agro-pedologic-improvement works. It is the case of the dammed enclosure Albita Fălciu, located in major floodplain of the Prut River in Romania, which is the case study. In this paper are analyzed the factors influencing the hydric and salt regime of the enclosure, is rated the impact of hydraulic works on the development of water-salt regime of soils and are proposed hydraulic solutions for improving it.
.

Introduction

The paper analyzes the factors involved in the change and variation of the water-salt regime of the soils from the Albita–Falciu dammed enclosure, from the floodplain of the river Prut and their influence. Solutions are proposed to improve the water-salt regime of the pre-terrace soils from the enclosure by optimizing the hydro-improvement works.

Flood embankment works protect an area of 18655ha and arrangement works (drainage, draining, irrigation) allowed their recovery in terms of agriculture. The paper analyzed the impact of arrangement works on salt and water balance of the soil. Because in the study area, appeared phenomena unwanted like salinization, the paper presents solutions to improve the hydric-saline regime of the soil located near preterasice area, by optimization solutions of arrangemnt works: rehabilitation of drainage, draining and irrigation.

1.Case study and methods

The dammed enclosure Albita Falciu (Fig. 1) is part of a series of works that were made on the middle and lower sector of the river Prut, in order to eliminate

---

[1] PhD., "Gheorghe Asachi" Tehnical University of Iasi, mlvlad2@yahoo.com
[2] Prof. PhD., "Gheorghe Asachi" Tehnical University of Iasi, i_bartha@yahoo.com
[3] PhD., "Gheorghe Asachi" Tehnical University of Iasi, vicgabor@yahoo.com

flooding from these lands and exploit them for agricultural purposes. The enclosure is located on the middle sector of the river Prut, in Vaslui County, in Romania.

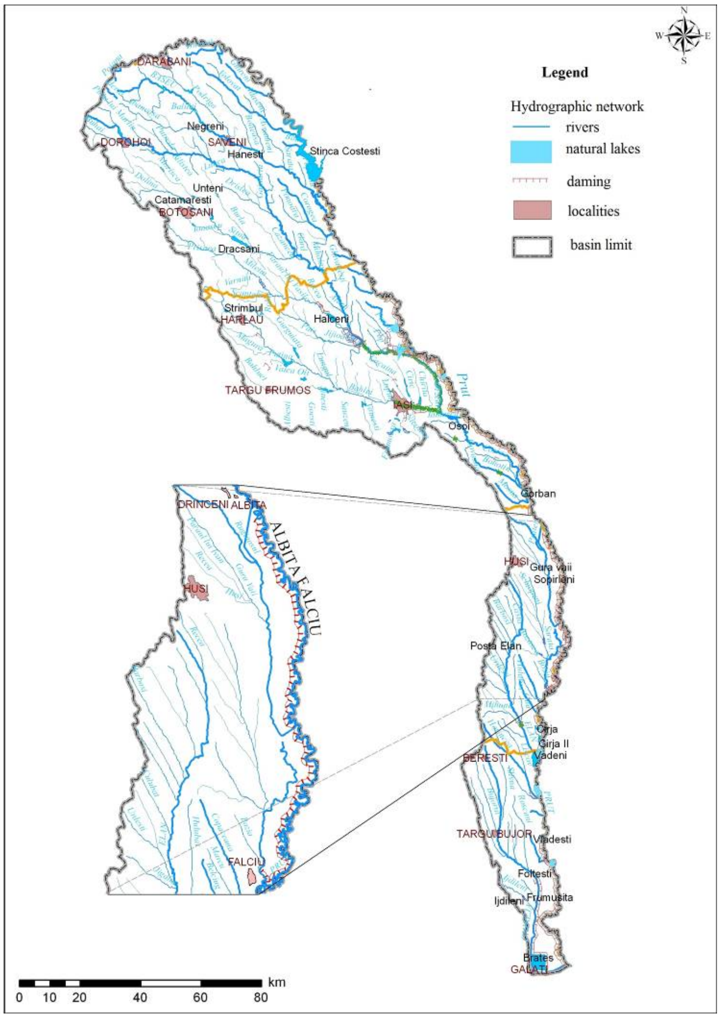

Fig. 1 - Prut catchment; the dammed enclosure Albita - Fălciu

For the proposed land use, in the enclosure the following works were made by stages [6]: embankment works (Phase I), were made between 1966 to 1968, drainage works (Phase I) were formed simultaneously with the embankment, irrigation facilities [Phase II (1970-1977), Phase III (1977-1980)] - total area equipped for irrigation reached 18,640 ha. The draining works were carried out between 1977 to 1980 (phase III), on 560 ha during 1984-1988 (stage IV), on 1006 ha.

The arrangement works influence the hydro-saline balance of the soil. Because in the study area, appeared phenomena unwanted like salinization, the paper presents solutions to improve the hydro - saline regime of the soil located near preterasice area, by optimization solutions of arrangement works: rehabilitation of drainage, draining and irrigation.

For this, we determined the amounts of salts (t/ha) which rises by capillarity, from the phreatic in the active layer of the soil, using the model UPFLOW v.2.2. We determined the salt balance of the soil under optimal artificial drainage in following variants: natural washing, irrigation (irrigation norm of 1800m/ha), irrigation and washing (washing norm of 2000 m³ / ha applied in years when the excess of water in cold period was low), in version of scarified and non-scarified terrain.

2.Assessment of the impact of hydraulic works and analysis of the impact factors on the hydro-saline regime of the enclosure

2.1.Evolution of the salinization status of soils in Prut meadow, the Falciu Albita sector. Under natural conditions, the soils were weakly or moderately saline and evolved under the influence of salinization-desalinization reversible processes (Tab. 1) [2].

Tab.1. Soil salinization in natural regime [2]

Soil and salinization status		Natural regime	
		ha	(%)
Protosols and alluvial soils	-Non-salinized	9100	49
	- Swamped non-salinized	3036	17
Total		12136	66
Salinized soils with different degrees of salinity	Low	698	4
	Moderate	5343	29
	Strong and / or very strong f.	209	1
Total		6259	34
Total		18386	100

Depending on the TCSS (total content of dissolved salts) in the upper horizon, saline soils are classified as: weak saline (0.10 to 0.25%), moderately saline (0.26-0.60%), strongly saline (0.61 to 1.00%), very strong salty than 1.00%.

After damming (Tab. 2) [8], originally the salinization is due to an interruption of the natural hydrologic regime: the natural washing regime is interrupted; salts gradually concentrate in the soil and eventually appears the salting phenomenon. Then, the salinization processes, except those of swamping, depend on the balance of moisture created in the soils from the enclosure (drainage, irrigation).

Tab. 2 - Soil salinization in anthropogenic regime: evolution of soil salinization degree by arrangement works performed [8]

Soil and salinization status		After damming					
		2nd stage 1975		3rd stage 1984		4th stage 1990	
		ha	(%)	ha	(%)	ha	(%)
Protosols and non-salinized alluvial soils (swamped non-salinized)		8288	45	7657	45	10792	63
Salinized soils (Salinization intensity)	Low	6267	34	8876	52	6240	37
	Moderate	3457	19				
	Strong and / or very strong f.	499	2	540	3		
	Total	10223	55	9416	55	6240	37
Total		18511	100	17073	100	17032	100

In the first stages after the embankment, there was an expansion of soil salinization and then followed a cameback stage to the original state, which indicates positive influence in time of the arrangement works for soils evolution and salinisation process. Through gradual changes of the factors like removing flood, surface drainage, irrigations and draining took place after about 15 years a decrease in the degree of soils salinization (it is about CTSS), like a space distribution on levels of salinity.

3.2. The influence of the dynamics of underground water levels and mineralization on the water-salt regime of soil. Enhanced mineralization of the groundwater inside Albita -Falciu enclosure is determined by underground supply from the slopes, with dissolved salts in the aquifer from the Sarmatian marls in the geological structure of this area. The pedologic-phreatic water from this enclosure contributes mostly to soils salinization, and not to an improvement of their hydric regime.

Studies conducted on enclosure’s groundwater regime revealed that the phreatic layer is influenced by the aquifer pressure, being distinguished a real and an apparent level of groundwater [8].

3.3. Research on salt-water regime of soil inside the Albita-Falciu enclosure under the action of hydro-improvement works

3.3.1. Simulation of lift processes by capillarity of salts from the groundwater in the active layer of soil inside Albita-Falciu enclosure. A simulation of groundwater salts lifting process has been carried out with the UPFLOW V.2.2. [9]. With this model we can estimate the capillary lifted flow of groundwater and the amounts of salts that reach the active soil stratum. The basic elements for the calculation were [9]: the ground stratification down to groundwater and the hydraulic and physical characteristics of the strata from ground level to groundwater; the depth of the active stratum; root distribution in the active stratum (the vertical distribution of roots moisture adsorption); groundwater table depth; salt concentration in groundwater; average daily evapo-transpiration; hydric status of soil (dry soil, well water supplied soil, very wet soil).

In the case of very wet soil (soil moisture is between field water capacity - CC and saturation capacity - CS), the capillary flow is limited by the magnitude of the evapotranspiration processes, being impossible to exceed this value. If the soil is wet (at field water capacity), the flow of capillary lifting is conditioned by the other factors (stratification, hydraulic and physical features, groundwater depth, etc.). If the humidity is dropping, the matrix potential is increasing and the flow increases, but is limited by the other factors: the depth of groundwater table, the soil's and subsoil's characteristics [4]. The amount of salts derived from groundwater is the product of the capillary lifting flow and the salt concentration in groundwater [11].

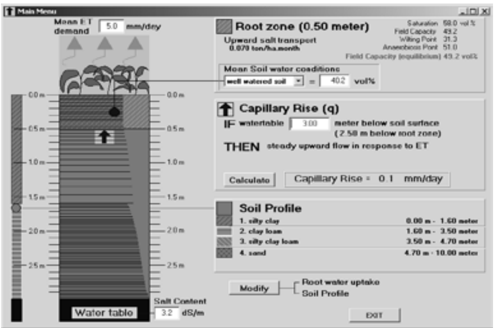

Fig. 4. UPFLOW v.2.2. software – calculation example

The next stratification data for soil and subsoil have been considered (pre-terrace zone) [1]: 0 – 1.6 m earthy clay K = 0.09 m/day; 1.6 – 3.5 m dusty sandy clay K = 0.08 m/day; 3.5 – 4.7 m clayish dust K = 0.11 m/day; 4.7 – 10 m sand

Tab. 3. The real depth (m) of the ground water in F3 drilling-A.B.A. PRUT BARLAD dates [1]

Year/ Month	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
1995	4.52	4.20	5.38	5.35	5.48	4.86	4.79	5.37	4.70	4.44	4.38	4.50
1996	3.65	3.42	4.26	3.56	3.35	3.31	3.62	4.41	3.18	2.79	2.85	2.58
1997	3.02	2.79	4.00	4.58	4.31	3.34	3.49	4.00	3.25	3.35	3.29	3.38
1998	3.30	3.25	3.77	2.96	2.42	1.95	1.60	1.71	1.90	2.65	2.77	2.96
1999	2.96	2.77	3.30	3.04	2.96	2.68	2.79	2.88	2.40	2.13	2.26	2.37
2000	2.24	1.35	2.16	2.52	3.17	3.35	3.98	4.68	3.87	4.03	4.00	3.91
2001	3.51	3.34	4.76	4.60	4.78	3.82	4.18	4.99	4.25	3.90	3.55	3.84
2002	4.65	4.26	5.56	5.25	5.46	4.95	5.31	4.65	3.92	3.83	3.40	3.63
2003	2.93	2.05	2.05	2.60	3.40	3.78	4.00	4.34	3.75	3.77	3.57	3.48
2004	4.18	3.78	4.10	4.50	4.76	4.57	4.95	5.22	4.57	4.27	4.11	3.97
2005	3.15	2.96	3.51	3.51	2.91	2.79	3.69	4.47	4.07	4.20	4.00	3.88
2007	3.07	2.86	3.70	3.77	4.05	3.67	4.97					

Tab. 4 Mineralization of pedo - phreatic water in F3 Râşeşti (TCSS-total content of dissolved salts) - A.B.A. PRUT BARLAD dates [1]

Year	Spring	Autumn-winter
	g/l	g/l
1995	1.172	0.830
1996	1.19	0.689
1997	0.692	0.712
1998	0.489	0.750
1999	2.768	0.755
2000	2.746	2.889
2002	1.955	2.35
2003	0.823	0.820
2004		0.740
2005	1.238	1.851
2006	2.027	0.71
2007	2.362	

Tab. 5 Amounts of salts (t/ha) TCSS that are rising from aquifer towards soil's active stratum in the pre-terrace area (by Feflow programme)

Year/ Month	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Total year
1995		0.043	0.038	0.043	0.055	0.055	0.063	0.063		0.043			0.387
1996				0.06	0.09	0.092	0.076	0.054					0.372
1997		0.038	0.048		0.053	0.09	0.082		0.096				0.407
1998		0.029	0.021	0.035	0.052	0.109	0.158	0.140	0.187				0.731
1999			0.165	0.09	0.275		0.310	0.291	0.118				1.25
2000			0.61	0.281	0.237	0.211	0.145	0.104		0.115			1.45
2001			0.068	0.073	0.086		0.112	0.078		0.129			0.54
2002	0.071	0.084	0.05	0.046	0.054	0.066		0.074	0.099			0.116	0.66
2003			0.123	0.079	0.061	0.061	0.043	0.036	0.049		0.055	0.027	0.53
2004			0.009		0.006	0.007	0.005	0.005	0.007	0.009			0.05
2005			0.015			0.057	0.022	0.011	0.022	0.021			0.15
2006			0.015			0.077	0.022	0.012	0.023	0.021			0.17
2007			0.077	0.107	0.119	0.147	0.079						0.53

(the aquifer stratum itself). Simulations (Fig. 4) have been conducted with data measured in the F3 Râşeşti, drilling, that is, depths of pedo-phreatic water (tab. 3) and measured salt concentrations (tab. 4). Salt concentrations values have been considered as annual averages between test results from May to September.

As an average figure, the annual inflow of salts in the active stratum is 0.577 t / ha in the pre-terrace area, 1.35 t / ha in the central area and 0.144 t / ha in the sandbank area [10]. In current conditions, it is realized a low salt washing during the cold period, manifested especially near drainage channels that have sufficient depth, however, midway between channels their action is reduced.

Tomita Octavian, (1999) shows that the action of drainage channels (at 375-400 m distance, deepened to 2 – 2.3 m) occurs midway under natural rainfall and irrigation on a shallow depth of 20 cm from the soil surface. If there are any consecutive years without hydric excess during the cold period, without using irrigation, soil salinity can increase during the vegetation growing season to values that produce reductions in agricultural production.

4. Solutions to improve the hydric and salt regime of pre-terrace soils inside Albita Falciu dammed enclosure by optimizing hydro-improvement works

Due to projected soil salinity values calculated, drainage system rehabilitation works and periodic washing, through the following works are necessary:

- resize district and main collecting channels for an increased specific flow rate, considering intensifying the drainage function and land improvement in the future and restore calculations for precipitation derived flow, following the increase in recent decades of maximum rainfall intensity in 24 hours. It is proposed a specific rate flow of 0.9 to 1 l/s/ha;
- increasing the collection and transport capacity of the collecting channels, it is necessary to act towards channel deepening and less to the change of their bottom width.
- by-pass channels are to be resized according to an increased specific flow rate, considering the updated calculation of maximum rainfall.

In order to improve the hydro-saline soil regime efficiency, on a climate change background in recent years, from previous researches [3] has resulted the need for drainage efficiency by establishing a modernized drainage system that changes the current drainage system by thickening excess water capture network from the lower layers of soil with absorbent PVC drains located at a distance of 10m, at a laying depth of absorbing drains of 1.2 m, with the drainage standard of 0.8 m.

4.1. Solutions to improve the hydro-saline regime by washing the pre-terrace soils on an optimal drainage state. Washing is done in rounds either due to excess rainfall in the cold rain, especially (October-February), or by watering in washing purposes. To reduce salinization in the case of a clay-dust horizon (with the lowest washing efficiency), results, for different layers of water, the following values of washing efficiency, seen as the ratio between the concentration of residual salts (Sr) and initial salt concentration (Si) (Tab. 6) [3].

Tab. 6 - Washing efficiency using different washing standards (mm) for a clay-dust textured soil and depth of 0.5 m [3]

Washing standard (mm)	250	125	62,5	30	15
Efficiency (Sr/Si)	0.55	0.70	0.85	0.92	0.97
Salinity reduction (%)	45	30	15	8	3

Moisture excess (during cold period) was considered for loosened terrain 70% of the total value and for non-loosened terrain 30% of the total value (Fig. 5).

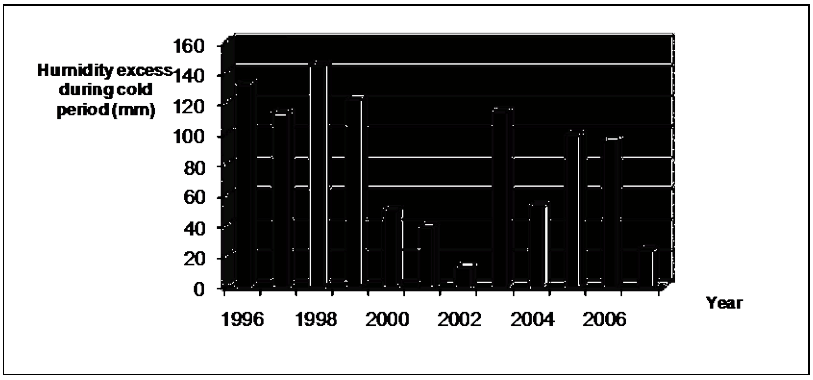

Fig. 5 - Moisture excess during cold period

Reducing the salinity following natural washing during cold season was determined using the values in Tab. 6. TCSS in 1995 (beginning of saline balance) at the depth of 0.5 m was determined based on tests conducted by O. Tomita for pedologic-hydrogeological stationeries from 1988. During this year, the average TCSS value was 680 mg/100g soil. The salinity evolution in the coming years until 1995 was established starting from these values. Salinization rate during 1988-1995 was considered equal to the average rate of salts accumulation in the warm season for the period 1995-2007 of 9.04 mg/100 g soil, resulting in a value of 734 mg/100 g soil in 1995.

We analyzed the salt balance in the following versions:

Version I: Determining the saline balance under optimal artificial drainage and natural washing [10].

Tab. 7 - Saline balance for artificial drainage conditions and natural washing for pre-terrace area inside Albita-Falciu enclosure (70%) – scarified terrain

Year	Excess humidity in the cold period (mm)	Washing percentage	Salts input from groundwater layer		Initial concentration (mg/100g soil)	Concentration change (mg/100g soil)
			(mg/100g soil)	t/ha.year		
1995			5,95	0,387	734	577,4248
1996	92.26	22.1424	5.72	0.372	577.4248	473.0414
1997	79.45	19.068	6.25	0.407	473.0414	364.5354
1998	101.08	24.2592	11.2	0.731	364.5354	300.8977
1999	85.54	20.5296	19.2	1.25	300.8977	293.0123
2000	34.65	9.001538	22.3	1.45	293.0123	293.4428
2001	27.51	7.463692	8.4	0.54	293.4428	296.7897
2002	8.61	1.722	10.1	0.66	296.7897	249.6995
2003	80.29	19.2696	8.2	0.53	249.6995	234.3686
2004	36.61	9.423692	0.74	0.05	234.3686	195.9709
2005	69.58	16.6992	2.27	0.15	195.9709	166.931
2006	66.57	15.9768	2.5	0.17	166.931	163.2657
2007	17.08	3.693333	8.13	0.53	163.2657	171.3957

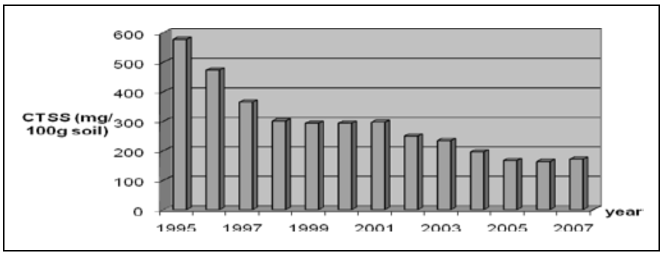

Fig. 6 - Changes in salts concentration in the soil under the action of natural washings in the cold period in terms of highly efficient artificial drainage

We can observed in time a decrease of TCSS under action of the drainage with high efficiency in both options, the bigger efficiency being in the scarified terrain.

Version II: Determination of salt balance, in optimum artificial drainage conditions, for the application of irrigation standard of 1800 m^3/ha. We considered that irrigation water used from the Prut River has the average value of fixed residue of 0.6 g/l;

Tab. 8 - Saline balance for artificial drainage conditions and natural washing for pre-terrace area inside Albita-Falciu enclosure (30%) – non-scarified terrain

Year	Excess humidity in the cold period (mm)	Washing percentage	Salts input from groundwater layer		Initial concentration (mg/100g soil)	Final concentration (mg/100g soil)
			(mg/100g soil)	t/ha.year		
1995			5,95	0,387	734	666,148
1996	39.54	10.05477	5.72	0.372	666.148	612.7653
1997	34.05	8.872308	6.25	0.407	612.7653	552.4143
1998	43.32	10.86892	11.2	0.731	552.4143	511.497
1999	36.66	9.434462	19.2	1.25	511.497	515.6078
2000	14.85	2.95	22.3	1.45	515.6078	525.7498
2001	11.79	2.358	8.4	0.54	525.7498	530.2698
2002	3.69	0.738	10.1	0.66	530.2698	492.9114
2003	34.41	8.949846	8.2	0.53	492.9114	485.1904
2004	15.69	3.23	0.74	0.05	485.1904	447.3033
2005	29.82	7.961231	2.27	0.15	447.3033	415.2052
2006	28.53	7.683385	2.5	0.17	415.2052	411.6266
2007	7.32	1.464	8.13	0.53	411.6266	419.7566

Tab. 9 - Salt balance under artificial drainage and optimal irrigation for the pre-terrace area inside Falciu Albita enclosure (70%) – scarified terrain

Year	Excess humidity in the cold period (mm)	Washing percentage	Salts input from groundwater layer		Salts input from irrigation water	Initial concentration (mg/100g soil)	Concentration change (mg/100g soil)
			(mg/100g soil)	t/ha.year	(mg/100g soil)		
1995			5.95	0.387	16	734	593.42478
1996	92.26	22.1424	5.72	0.372	16	593.4	501.99055
1997	79.45	19.068	6.25	0.407	16	502	402.46166
1998	101.08	24.2592	11.2	0.731	16	402.5	347.03789
1999	85.54	20.5296	19.2	1.25	16	347	350.99914
2000	34.65	9.001538	22.3	1.45	16	351	363.10164
2001	27.51	7.463692	8.4	0.54	16	363.1	381.24903
2002	8.61	1.722	10.1	0.66	16	381.2	333.88387
2003	80.29	19.2696	8.2	0.53	16	333.9	326.61968
2004	36.61	9.423692	0.74	0.05	16	326.6	288.81681
2005	69.58	16.6992	2.27	0.15	16	288.8	260.94312
2006	66.57	15.9768	2.5	0.17	16	260.9	269.80562
2007	17.08	3.693333	8.13	0.53	16	269.8	293.93562

Tab. 10 - Salt balance under artificial drainage and optimal irrigation for the pre-terrace area inside Falciu Albita enclosure (30%) – non-scarified terrain

Year	Excess humidity in the cold period (mm)	Washing percenta-ge	Salts input from groundwater layer		Salts input from irrigation water	Initial concentration (mg/100g soil)	Concentration change (mg/100g soil)
			(mg/100g soil)	t/ha. year	(mg/100g soil)		
1995			5.95	0.387	16	734	682.148
1996	39.54	10.05477	5.72	0.372	16	682.148	643.3457
1997	34.05	8.872308	6.25	0.407	16	643.3457	595.671
1998	43.32	10.86892	11.2	0.731	16	595.671	566.6726
1999	36.66	9.434462	19.2	1.25	16	566.6726	585.1558
2000	14.85	2.95	22.3	1.45	16	585.1558	609.6578
2001	11.79	2.358	8.4	0.54	16	609.6578	629.5585
2002	3.69	0.738	10.1	0.66	16	629.5585	599.314
2003	34.41	8.949846	8.2	0.53	16	599.314	604.1562
2004	15.69	3.23	0.74	0.05	16	604.1562	572.7979
2005	29.82	7.961231	2.27	0.15	16	572.7979	547.0576
2006	28.53	7.683385	2.5	0.17	16	547.0576	557.5487
2007	7.32	1.464	8.13	0.53	16	557.5487	581.6787

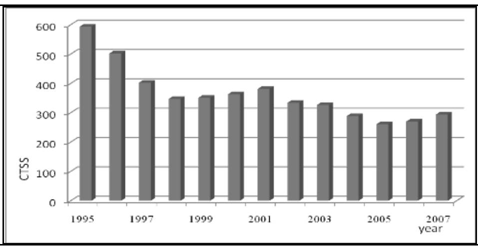

Fig. 7 - Changes in salt concentration in the soil under the irrigation action during artificial high efficiency drainage – scarified

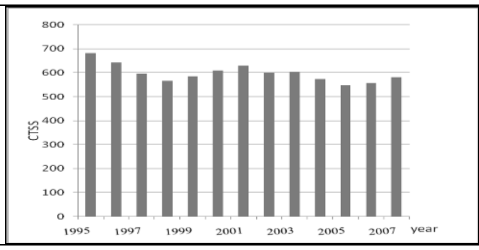

Fig. 8 - Changes in salt concentration in the soil under the irrigation action during artificial drainage – non-scarified terrain

Version III: Determination of salt balance, in optimum artificial drainage conditions, for the application of irrigation standard of 1800 m^3/ha and washing. Washing standard is 2000 m3/ha and was applied in 2000, 2001, 2002, 2004, 2007 (the water excess during the cold period was low), at the early vegetation season.

The results of the annual balance presented in the last column of each table shows that while a reduction of soil salinity is made, in the years when winter precipitation is low, salinity tends to maintain or even increase. In conclusion, for a background of efficient artificial drain, the moisture excess in the cold period allows salts washing and salinity reduction.

Thus, the soil that was originally in S3 salinization intensity class (moderate saline soil CTSS = 401-1050 mg/100 g), after 13 years is in class S1 (non-salinized, CTSS $\leq$ 170 mg/100 g soil). Natural washing efficiency diminishes when

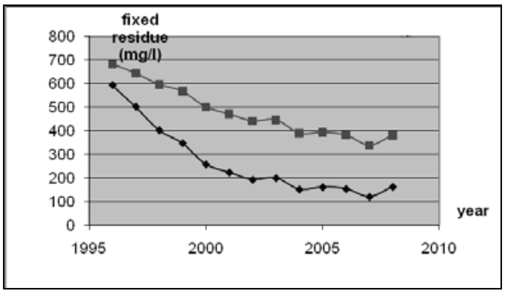

Fig. 9 - Fixed residue variation for irrigation (1800 m^3/ha) and washing (washing standard 2000 m^3/ha) in the years 1995 to 2007 (Tab. 11, 12)

Tab. 11 - Salt balance under artificial drainage, washing and irrigation for the pre-terrace area inside Falciu Albita enclosure (70%) – scarified terrain

Year	Excess humidity in the cold period (mm)	Washing percentage	Quantity of water for washing (mm)	Salts input from groundwater layer		Salts input from irrigation water	Initial concentration (mg/100g soil)	Concentration change (mg/100g soil)
				(mg/100g soil)	t/ha. year	(mg/100g soil)		
1995				5.95	0.387	16	734	593.4248
1996	92.26	22.1424		5.72	0.372	16	593.4248	501.9905
1997	79.45	19.068		6.25	0.407	16	501.9905	402.4617
1998	101.08	24.2592		11.2	0.731	16	402.4617	347.0379
1999	85.54	20.5296		19.2	1.25	16	347.0379	257.45
2000	34.65	35.958	140	22.3	1.45	34	257.45	223.382
2001	27.51	35.1012	140	8.4	0.54	34	223.382	192.4385
2002	8.61	32.8332	140	10.1	0.66	34	192.4385	199.4564
2003	80.29	19.2696		8.2	0.53	16	199.4564	151.4667
2004	36.61	36.1932	140	0.74	0.05	34	151.4667	160.913
2005	69.58	16.6992		2.27	0.15	16	160.913	153.4743
2006	66.57	15.9768		2.5	0.17	16	153.4743	120.0238
2007	17.08	33.8496	140	8.13	0.53	34	120.0238	162.1538

deep soil loosening works are not done at intervals of 2-3 years, especially in areas far from the drains. In this case there is a risk to maintain high salinity and in some years, when the precipitation in the cold period are low, to produce a re-increase of soil salinity. In this situation, if there is a succession of years with low precipitation, it will need to apply washing watering in several stages in the early irrigation season.

Tab.12 - Salt balance under artificial drainage, washing and irrigation for the pre-terrace area inside Falciu Albita enclosure (30%) – non-scarified terrain

Year	Excess humidity in the cold period (mm)	Washing percenta-ge	Quantity of water for washing (mm)	Salts input from groundwater layer		Salts input from irrigation water	Initial concentration (mg/100g soil)	Concentra-tion change (mg/100g soil)
				(mg/ 100gsoil)	t/ha. year	(mg/100g soil)		
1995				5.95	0.387	16	734	682.148
1996	39.54	10.05477		5.72	0.372	16	682.148	643.3457
1997	34.05	8.872308		6.25	0.407	16	643.3457	595.671
1998	43.32	10.86892		11.2	0.731	16	595.671	566.6726
1999	36.66	9.434462		19.2	1.25	16	566.6726	500.0756
2000	14.85	17.964	60	22.3	1.45	34	500.0756	470.2145
2001	11.79	17.2296	60	8.4	0.54	34	470.2145	440.7394
2002	3.69	15.2856	60	10.1	0.66	34	440.7394	445.3939
2003	34.41	8.949846		8.2	0.53	16	445.3939	388.6854
2004	15.69	18.1656	60	0.74	0.05	34	388.6854	392.4813
2005	29.82	7.961231		2.27	0.15	16	392.4813	380.5955
2006	28.53	7.683385		2.5	0.17	16	380.5955	337.6034
2007	7.32	16.1568	60	8.13	0.53	34	337.6034	379.7334

Conclusions

For sustainable use of dammed terrains, researches of the factors that occur in soil water-salt regime changes and application of engineering solutions to ensure optimal use conditions are needed.

Presented solutions to optimize drainage and draining network prevents appearance of excessive moisture. One of the factors which influence variation of soil salinity are precipitation and excess moisture in the cold season respectively. In some years when the precipitation in the cold are reduced, there is an increase in soil salinity.

The quantity of salt can be kept within limits by applying irrigation and washing procedures. Washing norms must be applied on several phase at the beginning of the irrigation season.

The presented solutions intend to maintain the favorable soil status in order to avoid the salinization and excess moisture phenomenon.

Acknowledgments. This paper was supported by the project PERFORM-ERA "Postdoctoral Performance for Integration in the European Research Area" (ID-57649), financed by the European Social Fund and the Romanian Government.

References:

A.B.A. Prut Barlad, (1980), *Hydro-geological study of the hydro-geological post Rîşeşti; dates;*

Agronomic Institute of Iasi, (1999) - Study the state of groundwater and soil salinization in Albita-Falciu area before and after Prut damming, for improvement purpose.

Atanasie Dumitru, (2008), *Studies and researches on the behavior and foundation of solutions for rehabilitation and modernization of land improvement works in hydro-improvement unit Albita Fălciu*, Ph.D. Thesis, Iasi.

Bagarello V., (2006), *Field and laboratory approaches for determining sodicity effects on saturated soil hydraulic conductivity*, Geoderma, 130: 1–13

Duncan R.A, Bethune M.G., Thayalakumaran T, E.W. Christen, T.A. McMahon, (2008), *Management of salt mobilisation in the irrigated landscape – A review of selected irrigation regions*, Journal of Hydrology 351: 238–252

Institute for Land Reclamation and Improvement Bucharest, 1975, *Project planning Albita Fălciu complex*, 1975.

Thayalakumaran T., Bethune M.G., McMahon T.A, (2007), *Achieving a salt balance—Should it be a management. objective?*, Agricultural water management, 9 2: 1–12

Tomita. Octavian, (1999), *Researches on the influence of improvement works inside dammed enclosure Albita Fălciu, on soils and groundwater*, PhD thesis;UPFLOW, Upward water movement from a shallow water table.

Vlad Lăcrămioara, (2009), *Contributions to the study of fluid and ecological regime changes in dammed floodplains,* PhD thesis.

Wissmeier L. and D.A. Barry, (2009), *Effect of mineral reactions on the hydraulic properties of unsaturated.*