INFLUENCE OF THE CHANGES OF THE GEOMETRIC AND STRUCTURAL PARAMETERS OF THE DRYING NETWORK, ON THE REMOVAL OF EXCESSIVE WATER, IN THE ROTOPĂNEŞTI-RĂDĂŞENI-FÂNTÂNA MARE SYSTEM IN SUCEAVA COUNTY

INFLUENȚA MODIFICĂRII PARAMETRILOR GEOMETRICI ŞI CONSTRUCTIVI AI REȚELEI DE DESECARE ASUPRA ELIMINĂRII EXCESULUI DE APĂ, ÎN SISTEMUL ROTOPĂNEȘTI-RĂDĂŞENI-FÂNTÂNA MARE, JUDEȚUL SUCEAVA

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Abstract. *The drying-draining facilities were built to remove excessive water from the land surface and from the upper layers of the soil, that is precipitation water, subsoil water and surface flows from the higher neighboring areas. Given the wet climate conditions of the Rădăşeni-Fântâna Mare-Baia depression, and given the low water consumption through evaporation and perspiration, the heavy precipitations fallen during 1 to 5 days in a row are the main source of excessive humidity in the hardly permeable soils (*Nitu T. et al*, 1985). Precipitations are unevenly distributed throughout the year, as there are high amounts of water fallen in just 24 hours or after long rains, which leads to surface flows, soil particle carrying, higher bank erosion and implicitly channel clogging.*

Rezumat. *Amenajările de desecare-drenaj au fost executate pentru a elimina excesul de umiditate de la suprafața terenului şi din orizonturile superioare ale solului, provenit din precipitații, apa freatică şi din scurgerile de suprafață de pe zonele limitrofe mai înalte. În condițiile climatului umed din depresiunea Rădăşeni-Fântâna Mare-Baia, precipitațiile abundente căzute în 1-5 zile consecutive, în regimul unui consum redus prin evapotranspirație, constituie principala sursă a excesului de umiditate din solurile greu permeabile (*Nitu T. şi colab., 1985*).Regimul precipitațiilor prezintă o repartiție neuniformă în timpul anului, înregistrându-se cantități însemnate în 24 ore sau în urma ploilor de lungă durată, ceea ce determină apariția scurgerilor de suprafață, antrenarea particulelor de sol, intensificarea eroziunii de mal şi, implicit, colmatarea canalelor.*

MATERIAL AND METHOD

The Baia-Rădăşeni-Fântâna Mare drying-draining system is located on the left side of the Moldova river and includes its meadow and terraces, as well as its tributary streams Şomuzul Băii and Şomuzel. The surface of this system spreads on 5527 ha, of which 1806 ha with underground draining works, and has a longish shape along the Moldova river and an average width of about 5 km and a length of 15 km.

The natural climate conditions of the Baia piedmont plain favor the occurrence and maintenance of excessive humidity in the soil and on the surface. The meadow of the Moldova river and its terraces of the shape of strips and with a mean width of 1.5 km, almost parallel with the bed of the Moldova river, oriented on a North-West to South-East direction, with mild 1-5% slopes, plane areas and many small depressions, facilitate water stagnation.

The actual drying channel network includes main collecting channels, secondary collecting channels, sector collecting channels and belt channels.

When designing the main and secondary collecting channels, there was considered the best use of the existing small waterfalls, valleys, depressions and network. The mean depth of the channels is 1.8 m, depending on the depth of the sector or draining network that open in them.

The sector collecting channel network has a less regular shape, depending on the configuration of the land, and the channels are routed approximately parallel with the level lines, at variable distances and depths, depending on the drained and undrained areas. In the drained areas, the distance between the channels is 400 m and the mean depth is 1.50 m, depending on the draining depth, so that the discharge openings be located above the highest channel level, while in the undrained areas, these are located at 300-350 m from one another at a mean depth of 1.30 m.

The belt channels are located at 20-50 m from the foot of the slopes, at depths between 1.5-2.0 m, and their role is to protect the dried-drained surface by intercepting the flows from the upper neighboring areas.

The sizing of the upper channels was achieved on sections, depending on the slope and the flow collected in that sector. The flows carried by the channels were determined depending on the area they served and on the specific drying flow, which was set to be 2.17 l/s/ha for the drying network and 9.40 l/s/ha for the belt channels.

In order to determine the geometric and hydraulic parameters of the drying network, high-accuracy geometric levelling topographic measurements were performed by the radiation method and by traversing combined with the radiation method. The level-related observations were performed by a medium-accuracy Zeiss Ni-030 level and centimeter surveying rods, while the level differences were determined based on two horizons of the level device.

In order to emphasize the efficiency of excessive water removal, field observations were performed, following the precipitations fallen during 1-5 consecutive days, and after the sudden snow melting.

RESULTS AND DISCUSSIONS

During the studies performed, we noticed that the CC_1 belt channel of the Rotopăneşti-Rădăşeni-Fântâna Mare system filled up due to the slope flows after heavy rains of 48 to 72 hours, as well as after snow melting (photo 1).

After 27 years (1980-2007) of operation and especially in the last 17 years, the original section of the CC_1 channel was silted by about one meter, with a mean depth silting rate of 3.7 cm/year (figure 1).

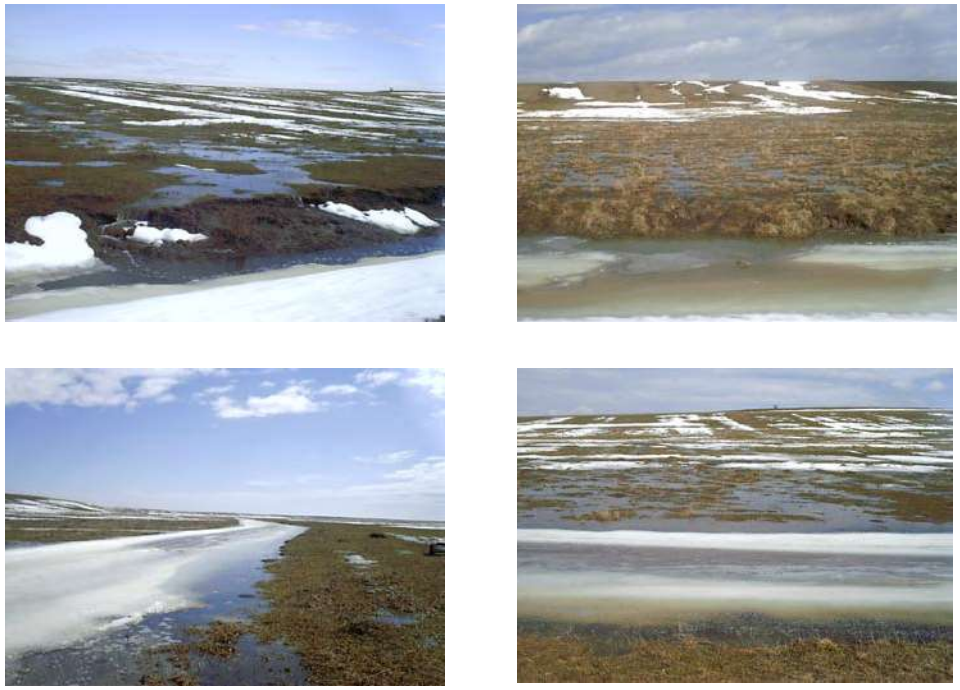
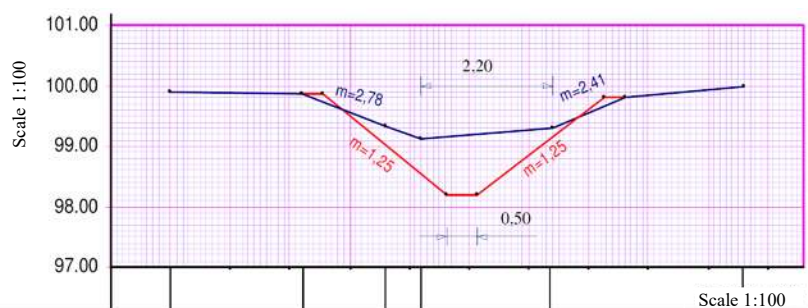


Photo 1- CC_1 belt channel filling up



Point number		1		2	3	4	5	6	7
Land elevation (m)		99,902		99,854	99,333	99,134	99,307	99,804	100,000
Level differences (m)			-0,048	-0,521	-0,199	0,173	0,497	0,196	
Distances (m)	partial		2,2	1,4	0,6	2,2	1,2	2,0	
	total	0,0		2,2	3,6	4,2	6,4	7,6	9,6
Slope %			2,2	37,2	33,2	7,9	41,4	9,8	

Figure 1 – Cross section through the CC_1 belt channel

The analysis of the flowing section of the channel shows that it originally had a value of 4.41 m^2 and it has now reached 2.28 m^2, which means a decrease of the collecting and carrying capacity of about 50%. The one meter channel silting in this section is caused both by the higher reception surface and the water flowing from it, and by the smaller longitudinal slope of the channel as compared to the upstream section.

Due to the silting of the bottom of the channel with silts brought by the slope water flows and by the bank erosion they cause, and due to the presence downstream of a footbridge whose pipe section is silted (photo 2), the belt channel in no longer able to carry the water to the Şomuzel collecting channel, which means water spills and flooding of the neighboring areas (photo 3). Therefore, the CC_1 belt channel can no longer protect the dried-drained surface; on the contrary, it collects large amount of water on its right side, which are collected by the Şomuzel collecting channel, the latter having in this sector a route approximately parallel with the CC_1.

Photo 2- Channel section and silted footbridge

Photo 3 – Spills and flooding of the neighboring land

This water spills from the CC_1 belt channel, and also the heavy precipitations in the last 24 hours and/or in the last 1-5 consecutive days, result into a higher surface water flowing speed (photo 4), which accelerates the bank erosion phenomenon of the Şomuzel main collecting channel (photo 5) and also drags along sediments and soil particles that clog the bottom of the channel.

Photo 4 – Collection of the water spills from the ,,Şomuzel" channel

Photo 5 – Slope erosion and channel bottom silting

CONCLUSIONS

1. The bank erosion aggression and channel silting of the Rotopăneşţă-Rădăşeni-Fântâna Mare drying-draining system are influenced by the slope coefficient, by the grass grown on the slope and by the use of the land dried by the channel.

2. During study performace, we found a highly marked bank erosion and channel silting in the areas where the dried-drained land was used as grazing field. In these areas, there is little or no grass grown on the slopes, due to inadequate grazing and to the fact that the animals are allowed to cross the channels, which is harmful especially during excessive humidity seasons. The slopes of the channels in the areas used as arable land, have much grass grown on them, which, on the one hand, diminishes bank erosion and, on the other hand, in time, if this grass is not cut, it facilitates hygrophilic vegetation and bush growing, which disturbs water flowing and accelerates silting.

3. The degradation of a channel section may determine spills of the water collected by it, the flooding of the neighboring land, longer excessive humidity periods and hygrophilic vegetation growing.

4. Even the smallest deficiency in the operation of a component of the drying-draining systems should be fixed immediately, to prevent degradation acceleration in time, or their placing out of operation.

REFERENCES

1. Nitu T. et al, 1985 – *Influence of the drying-draining works on the subsoil and ground waters in the Rădăşeni-Fântâna Mare-Baia piedmont plane, means of agricultural production increase per hectar.* The First Land Development Symposium, Bucharest.