OPERATION OF THE DRĂGOIEŞTI-BERCHIŞEŞTI DRAINAGE NETWORK IN SUCEAVA COUNTY

COMPORTAREA ÎN EXPLOATARE A REȚELEI DE DESECARE DIN SISTEMUL DRĂGOIEȘTI-BERCHIȘEȘTI, JUDEȚUL SUCEAVA

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Abstract. *Agricultural land and especially arable land output has been increased throughout the years by means of parching, damming-regularization, underground drainage and soil erosion prevention works, as well as by other types of works performed on them. In order to introduce in the normal agricultural circuit and to use the whole fertility potential of the land with excessive humidity in the Drăgoieşti-Berchişeşti area, there was performed, between 1978 and 1980, a parching-draining system with an area of 1790 ha, of which 553 ha comprised underground drainage works. A proper excessive water removal from the parched land can be achieved, in principle, by a well-kept channel network, with the preservation of the channel geometric and hydraulic components, as well as with the maintenance of all the related water engineering facilities. However, after 1990, when the land became private property and an inadequate legislation on parched-drained land was passed, the changes undergone by the parching network building parameters were influenced by the way in which the land was used and by human interventions.*

Key words: moisture excess, drying system, erosion, soil clogging, geometrical and hydraulic elements of the drying network.

Rezumat. *Valorificarea capacității de producție a terenurilor agricole şi, în mod special, a suprafețelor de teren arabil, s-a realizat în decursul timpului prin amenajarea acestora cu lucrări de desecare, de îndiguire-regularizare, de drenaj subteran, de combatere a eroziunii solului şi altele. Pentru introducerea în circuitul normal al producției agricole şi valorificarea întregului potențial de fertilitate a terenurilor cu exces de umiditate din zona Drăgoieşti-Berchişeşti, s-a amenajat în perioada 1978-1980 un sistem de desecare-drenaj cu suprafața de 1790 ha, din care 553 ha cu lucrări de drenaj subteran. Obținerea unor rezultate corespunzătoare în evacuarea apelor excedentare de pe terenul desecat se asigură, de principiu, printr-o rețea de canale bine întreținută, prin care să se realizeze conservarea elementelor geometrice şi hidraulice ale canalelor, precum şi a construcțiilor hidrotehnice aferente. Începând cu anul 1990, în condițiile proprietății private asupra pământului şi a unei legislații neadecvate pentru suprafețele amenajate cu lucrări de desecare-drenaj, modificarea parametrilor constructivi ai rețelei de desecare este influențată de modul de exploatare a suprafețelor deservite şi de intervenția omului.*

Cuvinte cheie: exces de umiditate, sistem de desecare, eroziune, colmatare, elemente geometrice și hidraulice ale rețelei de desecare

INTRODUCTION

Among the main limitative factors of the farm production, which are found according to local soil and climatic conditions, there are moisture excess, floods, reduced soil permeability and soil compaction, erosion, slides etc.

The natural conditions of the Drăgoieşti-Berchişeşti area favour the appearance and maintenance of the moisture excess in soil and at soil surface. The moisture excess, which resulted from rainfall or ground waters and from the floods of the hydrographical network was found under different forms and intensities, both on horizontal and slope fields.

In order to improve the air and water regime from soil, the Drăgoieşti-Berchişeşti drying-drainage system was set up during 1978-1980. It has an area of 1790 ha, of which 553 ha have subsoil drainage works.

After setting up the hydro ameliorative projects, a special importance must be paid to the way of their exploitation and behaviour in time, having also in view the new conditions created after the passage to the private property on land.

MATERIALS AND METHODS

The Drăgoieşti-Berchişeşti drying-drainage system belongs to the Moldova watershed and is found on its left bank, on the territory of Drăgoieşti, Berchişeşti and Cornu Luncii communes.

Morphologically, the system is situated on the meadows of the Moldova River and meadows of the lower rivulets Ratuş, Corlata, Rău, Stejăroaia and Bahna, on the lower and upper terrace of the Moldova River, the greatest height of 510.88 m being found in the North side of the area. The sector collecting drains were placed almost parallel to level curves, having the role to intercept surface waters, with the distance between them of approximate 250 m, depth of 1.20-1.60 m, bottom length of 0.40 m and slope coefficient m =1.00 – 1.25.

When setting up the network of tertiary, secondary and main channels we had in view the usage of watercourses, natural valleys and depression areas.

The main outlet canal is the channel of the Stejăroaia Rivulet, which was redimensioned on its entire length, the bottom width being of 1.40-2.00 m and the slope of 1:1.50, assuring a flow of 23.36 m^3/s. The channels were made with a trapezoid section, at sizes that ensure the transportation of the highest flows at 5%.

For estimating the changes in geometrical and hydraulic parameters of the drying network, topographical measures of accurate geometrical levelling were done by the method of radiation. The level observations were done with a Zeiss Ni-030-type mean precision levelling, the level differences being determined on two horizons of the level tool. Based on the obtained data, we have drawn transversal and longitudinal profiles of different order channels of the drying network and the result interpretation was done by comparing the obtained profiles to those designed and done at setting up of the projects.

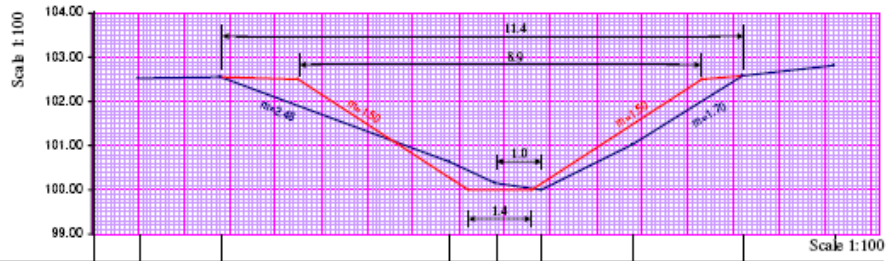
RESULTS AND DISCUSSIONS

The Stejăroaia main outlet channel of the Drăgoieşti-Berchişeşti drying-drainage system, which resulted by redimensioning the channel of the Stejăroaia Rivulet, had the following constructive elements on the studied section: mean

depth of channel 2.50 m, bottom width 1.40 m, slope coefficient 1.5 and light of channel 8.90 m.

As a result of measurements carried out 30 year after setting up the profile of this channel, in section I (fig. 1), we noticed an increase in the channel light of 2.50 m. This change is due to the bank erosion, especially on the left side of the channel (1.70 m), because the field area crossed by the Stejăroaia channel on this side has open channels, the surface runoff caused by abundant rainfalls amplifying the bank erosion.

The augmentation of the channel light by 0.80 m on the right side of the channel, where drainage works were set up, is caused by excess grazing during the entire year and by surface runoff that caused bank erosion. Bank erosion and clogging of the channel bottom determined an increase in the slope coefficient from 1.50 to 2.48 on the left side and, respectively, to 1.70 on the right side of the channel.



Point number		1	2	3	4	5	6	7	8
Land elevation (m)		102.514	102.564	100.644	100.147	100.000	101.039	102.581	102.817
Level differences (m)		+0.050	-1.920	-0.497	-0.147	+1.039	+1.542	+0.236	
Distances (m)	partial	1.8	5.0	1.0	1.0	2.0	2.4	2.0	
	total	0	1.8	6.8	7.8	8.8	10.8	13.2	15.2
Slope (%)		2.8	38.4	49.7	14.7	52.0	64.3	11.8	

Fig. 1 Transversal section (I) through the „Stejaroaia" main outlet channel

In section II (fig. 2), situated at 600 m upstream the first section, we did not find significant changes of the constructive elements, the neighbouring areas being used as arable lands and no grazing was on channel slopes.

In both sections, the slope depth was not changed, because of the consolidation of the channel bottom with quarry-run stone at different distances (100-300 m), while the alluvial deposits on the channel bottom are trained, transported and removed during floods by the permanent flows of the Stejăroaia Rivulet, which created a small bank through alluviums on some sections (fig. 2).

After 1991, once with the passage into private property of the lands on which drying-drainage works were set up, the influence of human factor has increased on the change of the channel network parameters.

The sector collecting channel ($CCst_{48}$) of the Drăgoieşti-Berchişeşti drying-drainage system was designed to be used on a dried area of about 35.00 ha.

If, when it was set up in 1980, the channel had bottom width b = 0.40 m, mean depth H = 1.20 m and slope coefficient m = 1.00, after 30 years of work, it

became a discharge channel, the section of channel being clogged at a rate of 90 %.

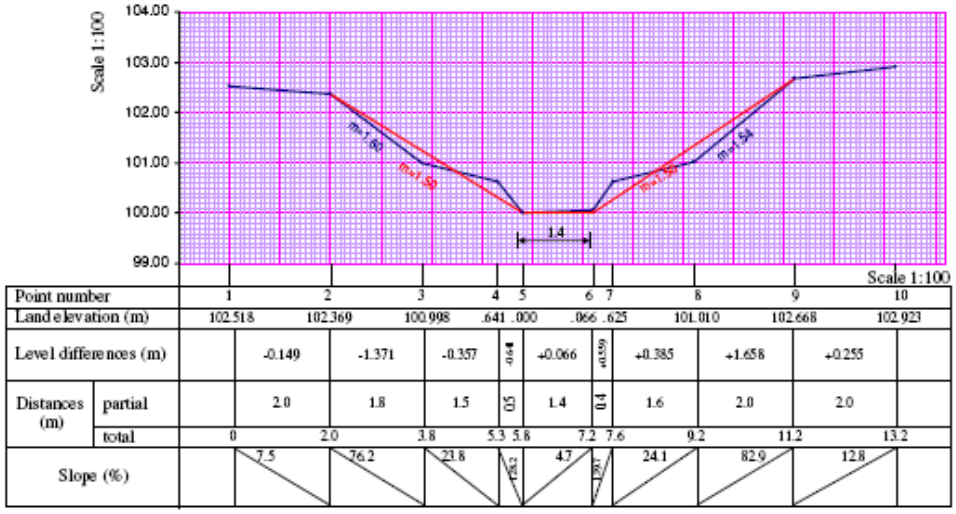


Fig. 2. Transversal section (II) through the „Stejaroaia" main outlet channel

In the transversal profile I (fig. 3), done at almost 200 m from the upstream end of channel, we noticed that by channel clogging, the section shape was changed from trapezoidal to triangular, the sector collecting channel becoming a discharge channel with depth of 0.30 m. The transversal section of this channel diminished by almost 86 %, from 1.92 m^2 at the beginning, until 0.27 m^2 , as it is today.

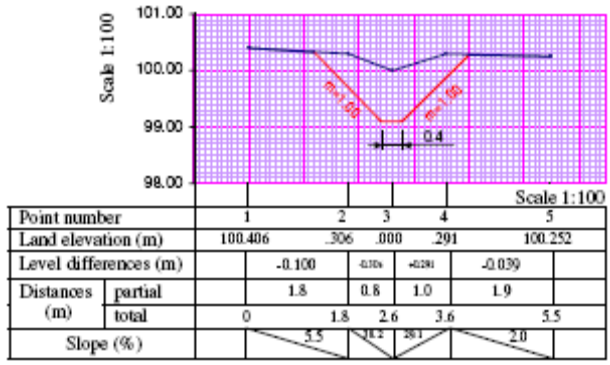


Fig. 3. Transversal section I through the $CCst_{48}$ sector-collecting channel

The transversal section clogging and the diminution of water transportation capacity were also noticed in the second profile (fig. 4), done at almost 400 m upstream the first one, where the ditch depth, resulted by clogging up, is of 0.10

m and the transversal section, of 0.05 m^2, the channel being clogged at a rate of 97 %.

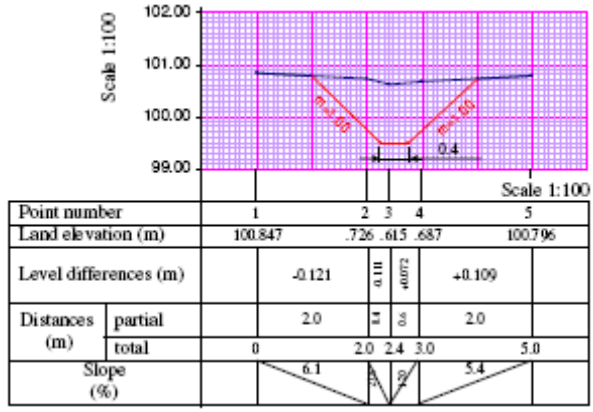


Fig. 4. Transversal section II (A-A'), through the $CCst_{48}$ sector-collecting channel

By applying the Law 18/1991, the land plots were placed perpendicular to this sector collecting channel and the beneficiaries of the Law considered that the property right over land allowed them to have rights on works, clogging the channel section in some portions, in order to facilitate the access to the individual land plots. These obstructions have favoured water stagnation on the channel bottom for a longer period and formation of hygrophilous and woody vegetation, accelerating the clogging process.

In the longitudinal profile of the $CCst_{48}$ channel (fig. 5), created upstream and downstream the second section, the determined values of the longitudinal slope were between 0.58 % and 1.62 %. This variation of the longitudinal slope is caused by the woody vegetation that stops the flow speed, favouring the alluvial sedimentation.

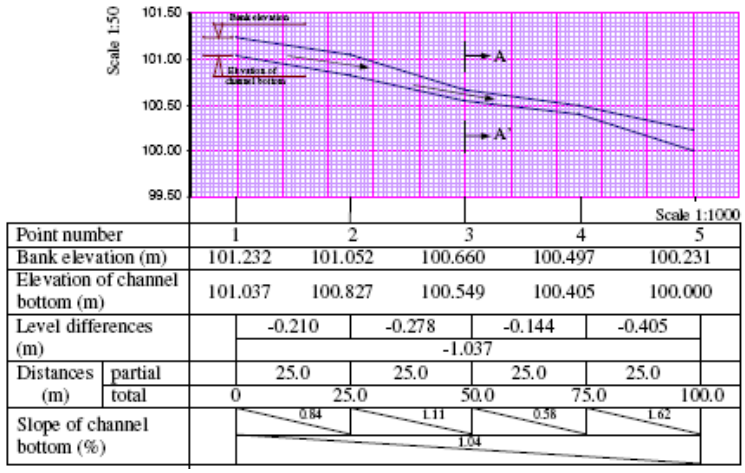


Fig. 5. Longitudinal section through the $CCst_{48}$ sector-collecting channel

Because of the relatively great longitudinal slope, during the abundant rainfall, a part of water reaches the Stejăroaia Channel, but the highest part stagnates in micro depressions for longer periods, favouring the formation of hygrophilous vegetation and the appearance of moisture excess on the areas crossed by the channel. Because of the lack of maintenance works, during the last 19 years, the $CCst_{48}$ sector collecting channel is no longer running and the entire area of 35.00 ha, which is afferent to the channel, has been used in the last years as hayfields.

CONCLUSIONS

1. The change in geometrical and hydraulic elements of the drying network was highly influenced by the usage category of the areas crossed by channels. On dried-drained areas used as grasslands, the bank erosion and clogging of drying channels is higher, being produced with almost a double mean annual rate (4-5 cm/year), compared to that of the channels crossing the areas used as arable lands and hayfields.

2. The lower channels have a higher rate clogged section, compared to the upper channels. The sector collecting channels on the areas on which drying works were set up, with a low depth (1.20-1.40 m), after 30 years of working and lack of maintenance works and, especially, in the last 19 years, became water discharge channels, and their section did not assure the transportation of collected flows.

3. The channel clogging and formation of hygrophilous vegetation resulted in changing the longitudinal slope, which had various values along the channels, sometimes making counter-slopes that favour water stagnation and sedimentation of alluviums, increasing the mean clogging rate and accelerating their out of use.

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