EXCESS WATER REMOVAL OF BAIA AGRICULTURAL DRAINS EXPERIMENTAL FIELD, SUCEAVA COUNTY, AFTER 34 YEARS OF OPERATION

ELIMINAREA EXCESULUI DE APĂ DIN CÂMPUL EXPERIMENTAL DE DRENAJE AGRICOLE BAIA, JUDEȚUL SUCEAVA, DUPĂ 34 ANI DE FUNCȚIONARE

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Abstract. *The exploitation of the production capacity of the agricultural fields and mainly of the arable areas was performed over the time by their improvement with drainage, banking-regulation, underground drainage, soil erosion control and other types of works. According to the data supplied by A.N.I.F., in Suceava County, there is a surface of 44,904 ha with drainage works, of which 27,455 ha with drain works. The results of the research carried out within the pedoclimatic conditions of the drainage area of Moldova River showed that within 48 hours from the rainfall, in the case of the absorbing drain lines disposed at a distance of 15 m, the higher water content of the soil was obtained on the draining ditch, the content increasing once with the depth, thanks to the water inflow created towards the drain filter and to the permeability of the filter layer at 34 years of operation. At the absorbing drains disposed at a distance of 20 m, the higher value was obtained at the mid-distance between the drains. In both cases, the lowest average water content of the soil was recorded in the checkpoint located at 2 m from the absorbing drain lines. Modeling the field in ridge bands at the drains located at a distance of 20 m leads to a better removal of the excess water; the values of the average water content of the soil decrease from the drain line towards the mid-distance between them.*

Key words: moisture excess, drying-draining system, modeling in strips with ridges, soil water content

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. În județul Suceava, după datele A.N.I.F., există o suprafață de 44.904 ha cu lucrări de desecare, din care 27.455 ha cu lucrări de drenaj. Rezultatele cercetărilor efectuate în condițiile pedoclimatice din bazinul hidrografic al râului Moldova au arătat că la 48 ore de la înregistrarea precipitațiilor, în cazul liniilor de drenuri absorbante distanțate la 15 m, cel mai mare conținut de apă al solului s-a obținut pe tranşeea de drenaj, acesta crescând odată cu adâncimea, datorită afluxului de apă creat spre filtrul drenului şi a reducerii permeabilității stratului filtrant în 34 ani de funcționare. La drenurile absorbante distanțate la 20 m valoarea cea mai mare s-a obținut la mijlocul distanței dintre drenuri. În*

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ambele cazuri cel mai mic conținut mediu de apă al solului s-a înregistrat în punctul de control situat la 2 m față de liniile de drenuri absorbante. Prin modelarea terenului în benzi cu coame la drenurile distanțate la 20 m se realizează o mai bună eliminare a excesului de apă, valorile conținutului mediu de apă al solului descrescând de pe linia de dren spre mijlocul distanței dintre acestea.

Cuvinte cheie: exces de umiditate, sistem de desecare-drenaj, modelare în benzi cu coame, conținut de apă al solului

INTRODUCTION

The soil quality is less or more affected by one or more restrictions and namely: drought, periodic humidity excess, erosion, landslides etc. Their harmful influences are reflected in the damaging the soil characteristics and functions, in their bio-productive capacity, respectively in affecting the agricultural product quality and food safety with consequences on human life quality (Moca et al., 2000). These restrictions are determined either by natural factors or by agricultural and industrial anthropic actions that can synergically act in a negative way (Radu, 2009).

MATERIAL AND METHOD

Given the pedoclimatic conditions of the moist zone of the Suceava county, respectively, in the meadow and the river basin of the Moldova river, the area has been equipped with experimental shallow drainage field patches, as the major solution for fighting the temporary excess of moisture derived from rainfall, locally associated with various improving agro-pedoclimatic works.

The hydrotechnic layout of the experimental drainage field of Baia stretches across 3.00 hectares divided in plots, in two repetitions of three versions each, in which the following issues were emphasized: the distance between the lines of drainage (12, 15, and 20 meters), the average pipe laying depth (0.80 and 1.00 meter), the nature and the diameter of drainage pipes, the nature and the thickness of filtering materials.

In order to determine the momentary water component of the soil, samples of soil were collected using a tubular probe, in 10 cm layers, down to 0.8 m and to 1.00 m respectively. The samples were probed 48 hours after the soil received 32 mm of rainwater, the control points being situated upon the drainage trench at 2.00 m distance from the latter and half-distance between the absorbing drains.

RESULTS AND DISCUSSIONS

Analyzing the water content in the soil, determined at 48 hours after receiving 32 mm of rainfall, one notices that, in the case of those drains placed 15.00 m apart, the water content within the soil increases half-way between drains down to the 30-40 cm depth and decreases afterwards due to a less permeable layer (fig. 1, 2, 3, 4).

Upon the drainage trench, the water content within the soil decreases, in general, consistent with the depth, due to the created water inflow to the drain's filter and the reduction in the permeability of the filtering layer in 34 years of operation.

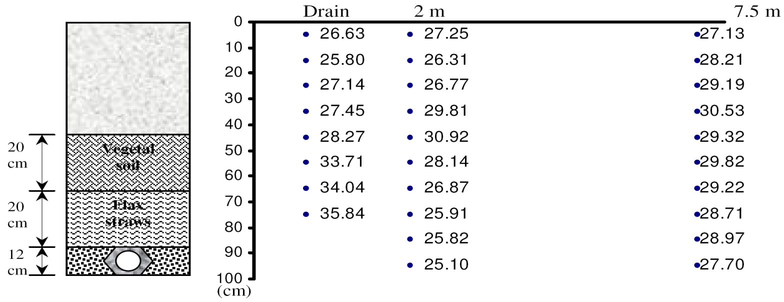

Fig. 1 - The soil water content in relation to depth, measured on drain D_5

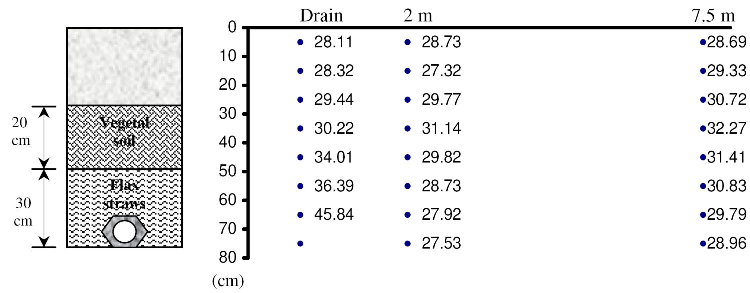

Fig. 2 - The soil water content in relation to depth, measured on drain D_{13}

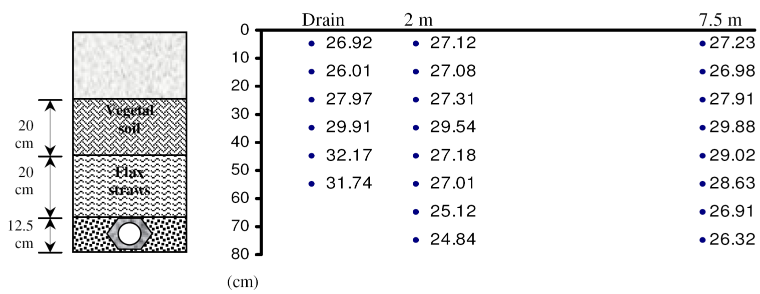

Fig. 3 - The soil water content in relation to depth, measured on drain D_{14}

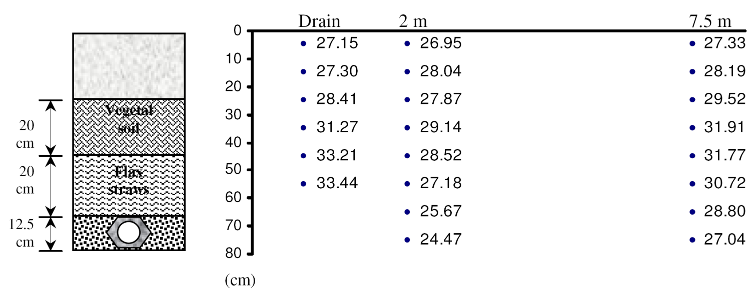

Fig. 4 - The soil water content in relation to depth, measured on drain D_{15}

In the case of the D_3 absorbing drain, having a distance between drainage lines of 20.00 m, a pipe laying depth of 1.00 m, and the surface serviced modeled in strips with ridges, the values of water content at the control points set 2.00 m apart and at half-distance between drains (10.00 m) increased down to 40-50 cm depth due to the contribution of the earth-like materials of which the strips with ridges are made (fig. 5).

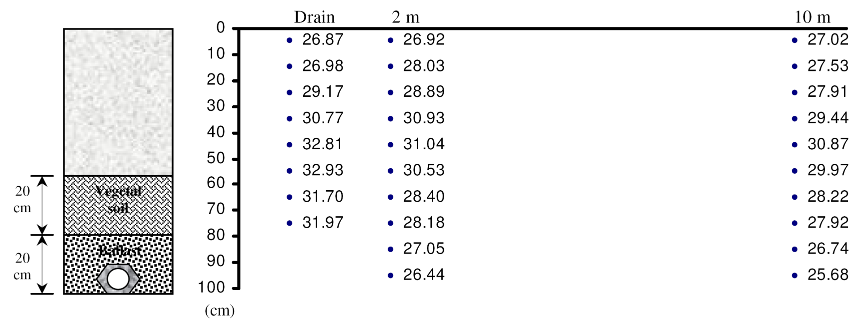

Fig. 5 - The soil water content in relation to depth, measured on drain D_3

In the case of the D_{12} absorbing drainage, set 20.00 m apart, yet with the serviced area not modeled in strips with ridges, the values of the momentary water content increase down to 30-40 cm in control points set 2.00 m apart and 10.00 from the drainage line respectively, and within the drainage trench they decrease in relation to depth (fig. 6)

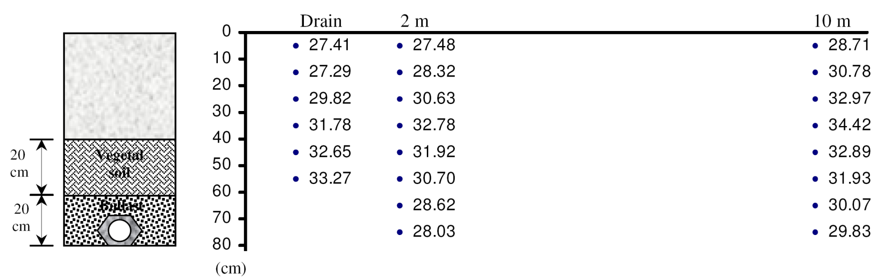

Fig. 6 - The soil water content in relation to depth, measured on drain D_{12}

The average water content within the soil upon the control points measured 48 hours following a 32 mm rainfall, in the case of drains spaced 15.00 m apart, is the lowest at the control point situated at 2.00 m from the drain line and highest on the drainage trench. That fact highlights the operating mode of drainage lines and the creation of water inflow towards the drain's filter during the time of operation (fig. 7)

At the D_3 absorbing drain, having a distance between drainage lines of 20.00 and modeled in strips with ridges, the mean values of the water content within the soil at control points decreases towards the mean distance between drains (fig. 8)

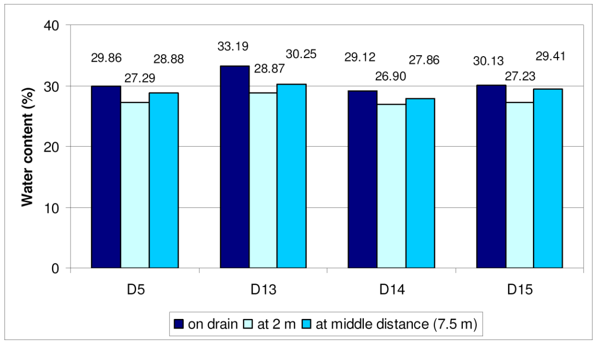

Fig. 7 - The mean content of water within the soil at control points, in the case of drains spaced 15.00 m apart

The lowest value measured half-distance between drains (10.00 m) is due to the water inflow created towards the drain's filter and due to water flowing towards the drainage lines, the drain making a better water interception within the first hours and days of water discharge.

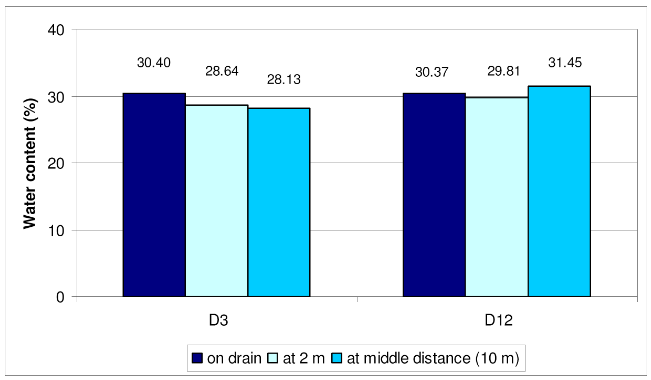

Fig. 8 - The mean content of water within the soil at control points, in the case of drains spaced 20.00 m apart

Orienting the surface water flow towards the drainage line, in the case of the D_3 drain is also revealed through the analysis of the mean water content at the control points placed upon the surface serviced by the un-modeled D_{12} drain, where the highest value is measured half-distance between drains.

Analyzing the mean values of the water content within the soil upon the studied drains control section (fig. 9), one may ascertain that the highest values are measured at the D_{13} and D_{12} drains (30.77% and 30.54%), and the lowest at the D_{14} drain (27.96%) spaced at 15.00 m and having the filtering layer made of gravel and flax stalks. The high value measured at the D_{13} drain is due to the reduction in the filtering layer permeability by its ongoing conversion into organic matter, the latter being initially made merely of flax stalks.

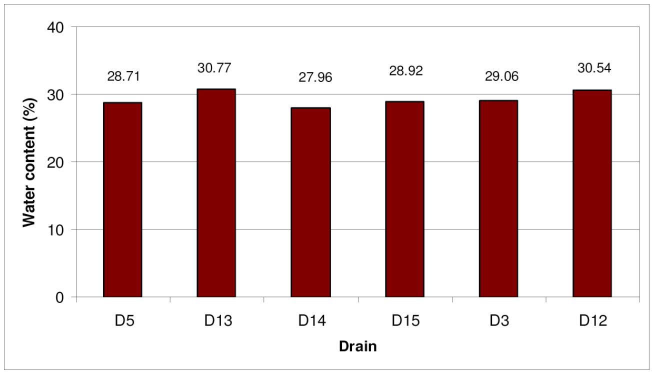

Fig. 9 - The soil mean water content within the controlled section

By modeling the terrain into strips with ridges at the D_3 drain, having a mean distance between drainage lines of 20.00 m, the water in excess is better driven out, the water content values being comparatively close to the ones measured at the 15.00 m apart spaced drains except for drain D_{13}.

CONCLUSIONS

1. In the case of 15.00 m apart spaced drains, at 48 hours from receiving 32.00 mm of rainfall, the lowest value of the mean water content is measured at the point of control spaced 2.00 m from the drainage line and the highest value upon the draining trench, due to the created water inflow to the drain's filter and due to the reduction in the filtering layer's permeability during the time of operation.

2. In the case of 20.00 m apart spaced drains, the highest value of the mean water content within the soil was measured at half-distance between drains and the lowest at the control point set at 2.00 m.

3. By modeling the terrain in strips with ridges, at the 20.00 m apart spaced drains, the water drainage process works better, the mean values of the soil water content decreasing towards the mid-distance between drains. The lowest value measured at mid-distance between drains (10.00 m) is due to the created water inflow to the drain's filter and due to causing the surface waters to flow towards the drainage lines, the drain making a better water interception within the first hours and days of water discharge.

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