# BEHAVIOR OF UNDERGROUND DRAINAGE AFTER 30 YEARS OF FUNCTIONING, IN THE BAIA EXPERIMENTAL FIELD OF AGRICULTURAL DRAINAGES, SUCEAVA COUNTY

**Oprea RADU [1], Valeriu MOCA [1], Daniel BUCUR [1]**

[1] **University of Agricultural Sciences and Veterinary Medicine, Iaşi**

**Abstract**

The exploitation of the output of agricultural land, and of the surfaces of arable land in particular, occurred in time, via works of draining off, embankment-regulation, underground drainage, prevention of soil erosion and other works. In the Suceava county, according to the A.N.I.F. data, there is a surface of 44.904 ha with draining off works, of which 27.455 ha with drainage works. The network of draining off channels is 1875 km long, and the underground drainage network made up of suction and collection drains has a total length of 11.909 km. The findings of the research conducted in the pedo-climatic conditions of the water basin of the Moldova river showed that the modeling of the land in ridges, for the drains situated at a 20 m distance from one another, leads to the elimination of the humidity excess, similar to that for the drains situated at a 12 m distance. The use, as a filler material, of flax stems, irrespective of the thickness of the layer, is not recommended because of the reduction, in time, of permeability. However, their association with ballast ensures, even after 30 years of functioning, the best elimination of humidity excess. The average water content of the soil 1-2 days after rain has the smallest value in the vicinity of the drain lines, due to the water inflow created towards the drain filter and to the reduction of the permeability of the filler layer, in 30 years of functioning. 10-15 days after the last rain, the average water content decreases from the middle of the distance between the drains to the drain line.

**Key words**: excessive humidity, drying-drainage system, modelling in bands with crests

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. These restrictions are determined either by natural factors or by agricultural and industrial anthropic actions that can synergically act in a negative way.

The natural conditions of the Baia piedmont plains favor the emergence and maintenance of humidity excess in the soil and at its surface. In order to remove the water excess from the soil profile, in the hydrographic basin of Moldova river, Suceava County, it was worked out, depending on the nature and intensity of humidity excess, a underground draining network made up of absorbing drains and collecting drains with a total length of 1575.12 km. After carrying out the hydro-ameliorative arrangements, a peculiar importance should be offered to the way of their exploitation and behavior in time.

## MATERIAL AND METHOD

In the pedoclimatic conditions in the wet area of Suceava County, respectively in the meadow and hydrographic basin of Moldova river, underground drainage experimental fields were worked out of low depth as the main means of fighting the pluvial humidity excess of temporary character, locally associated also with various agricultural pedo-ameliorative works.

The pilot experimental field of Baia agricultural drains is located in the Rotopanesti-Radaseni-Fantana Mare drainage-desiccation System on a upper terrace platform on the left bank of Moldova river, located in the N-W part of Baia depression area. The field was worked out in 1978 by O.I.F.P.C.A. Suceava in cooperation with the Agronomical University of Iasi on a glossic psedo-gleic albic luvisol with usage in natural exploitation regime of pastures and grasslands with periodic excess of humidity from rainfalls.

The hydro-technical schedule of Baia drain experimental field (*fig. 1*) covers a surface area of 3.00 ha arranged after the subdivided parcel model within two repetitions with three variants each where the following were differentiated: the distance between drain lines (12; 15; 20 m), average depth of drain tube laying (0.80 and 1.00 m), nature and diameter of drain tubes, nature and thickness of filtering materials.

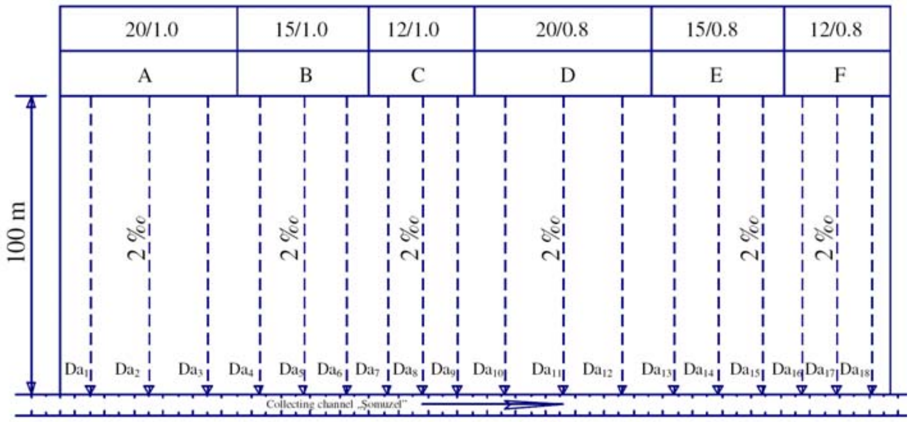


Figure 1 **Experimental field of Baia agricultural drains**

In order to determine the present water content in the soil, soil probes were sampled with a tubular probe on 10 cm thick steps till the depth of 0.80 m, respectively 1.00 m at various time intervals since rainfall recording. The control points were placed on the drainage trench at 2.00 m from it and at the middle distance between the tile drains.

## RESULTS AND DISCUSSIONS

Analyzing the average humidity values of the soil determined at 48 hours from the recording of 15 mm rainfall (*tab. 1*), differences of the water content are found out both on the control points and on the control section.

In case of the absorbing drains laid down at the same depth and distance between the drain lines ($Da_{13}$, $Da_{14}$, $Da_{15}$), the efficiency of various filtering materials was monitored (*fig. 2*).

At $Da_{13}$ drain with filtering material made of flax straws of 30 cm thickness, it was found out that, after 30 years of running, these are transformed in organic matter, facing a decrease in permeability around the draining tube and of the water inflow to the drain, recording the highest values of the water average content in soil on the drain trench (34.39%) and on the control section (30.47%).

Table 1

**Average water content on control points and section**

| Drain | Distance (m) | Depth (m) | oil average humidity (%) | | | Humidity average on control section (%) |
|---|---|---|---|---|---|---|
| | | | on drain | at 2 m | at middle distance | |
| $D_{13}$ | 15,00 | 0,80 | 34,39 | 27,87 | 29,16 | 30,47 |
| $D_{14}$ | 15,00 | 0,80 | 28,97 | 26,07 | 27,08 | 27,37 |
| $D_{15}$ | 15,00 | 0,80 | 30,08 | 25,39 | 27,62 | 27,70 |
| $D_3$ | 20,00 | 1,00 | 28,29 | 26,90 | 26,47 | 27,22 |
| $D_9$ | 12,00 | 1,00 | 28,30 | 25,79 | 26,58 | 26,89 |
| $D_{12}$ | 20,00 | 0,80 | 29,00 | 27,90 | 30,16 | 29,02 |

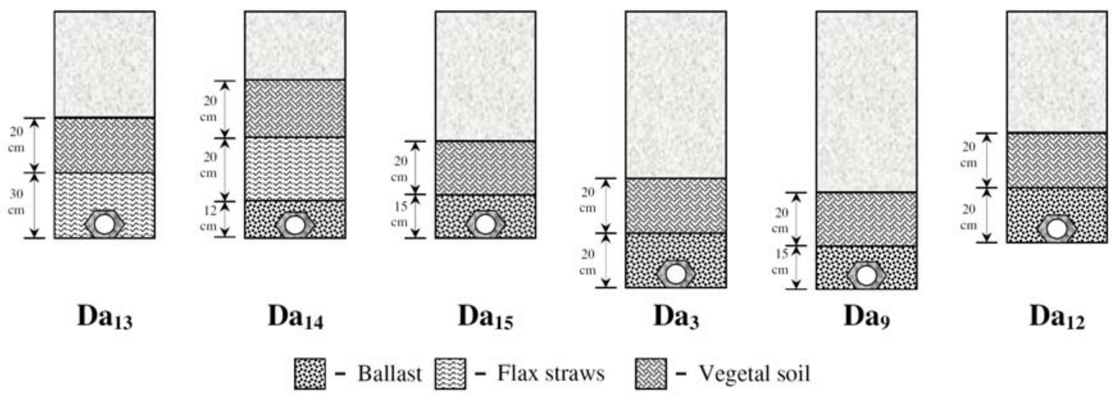


Figure 2 **Nature and thickness of filtering material**

The use of 12 cm thick ballast as filtering material as well as the use of flax straws in a 20 cm layer, in the case of $Da_{14}$ drain favored the humidity excess removal on the controlled surface of $Da_{14}$ drain, recording an average water content on the control section of 27.37%, a value lower than the one recorded on $Da_{15}$ drain (27.70%), where it was used only a 15 cm thick ballast.

Regarding the average water content in the control section points (on the drain at 2.00 m and at the middle distance between the drain lines), determined at 48 hours since the last rainfalls, we observe that the highest water content in the soil is recorded in the drain trench and the lowest water content is recorded at 2.00 m from the drain line (*fig. 3*).

The higher values of the average water content recorded on the drain trench are due to the water inflow created towards the drain line and due to the permeability decrease of the filtering layer during the 30 years of operation.

Analyzing the average humidity values on the control sections, it is also pointed out the influence of the distance between drains and the laying depth on removing the water excess. The lowest value of humidity on the control section (26.89%) was recorded on $Da_9$ drain with a distance between the drain lines of 12.00 m and a laying depth of 1.00 m, and the highest value (29.02%) was recorded on the $Da_{12}$ drain spaced at 20 m and laid down at 0.80 m. On the drains spaced at 15.00 m, intermediary values were recorded (27.37 and 27.70%) except $Da_{13}$ drain with a value of 30.47%, but this is due to the use of only flax straws as filtering material transformed, in time, in a thin layer of organic matter (3-5 cm).

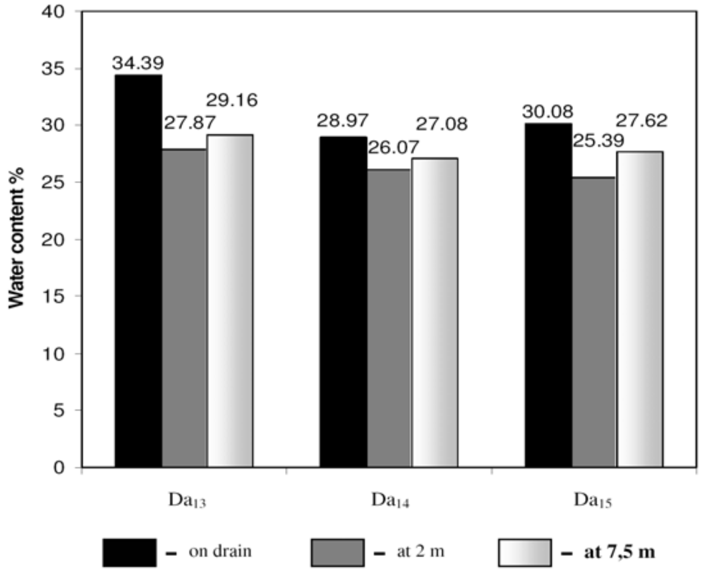


Figure 3 **Average water content on control points, at 48 hours from last rainfall**

By keeping the distance between drains at 20.00 m and by modeling the land in ridge strips ($Da_3$) a good removal of the water excess was carried out, recording a value of 27.22% relatively similar to the one of $Da_9$ drain with a distance of 12.00 m between the drain lines. The land modeling in ridge strips, in compliance with the absorbing drain network favors the removal of water excess due to directing the surface flows towards the drain lines, making up a better interception and removal of water in the first hours and days of humidity excess. The placement of absorbing drain lines at a distance of 12.00 m is not economically justified, recording slight differences of the average water content values compared to the ones spaced at 15.00 and respectively at 20.00 m. By increasing the distance between drains to 15.00 m and 20.00 m at the same time with the increase of the filtering material layer thickness, we may obtain a similar removal of water excess.

In *figure 4* we find out that, at $Da_9$ and $Da_{12}$ drains as well, the lowest water content in the soil, at 48 hours since rainfall recording, was obtained in control points located at 2.00 m and the highest content was obtained on the drain trench. On the $Da_3$ drain, the average water content increases on the control points from the middle distance between drains towards the drain line due to directing the surface flow towards the drain line during abundant rainfalls.

The average water content values on the control points determined at 10 days from last rainfalls (*fig. 5*), their decrease is observed from the middle distance between drains towards the drain lines and the lowering of water content amplitude in the soil on the control section. The recording of the lowest values on the drain trench reflects the operation of the drain lines also after 30 years of running.

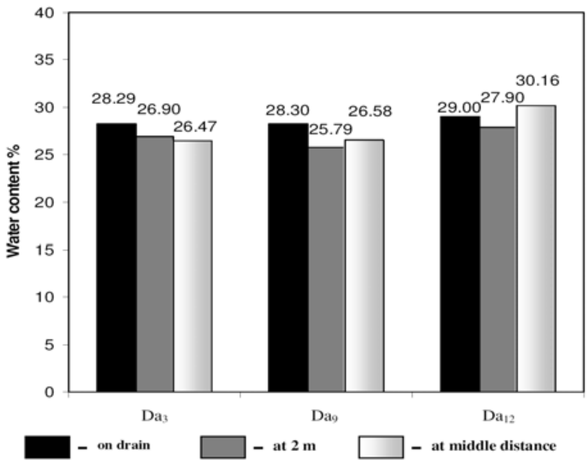


Figura 4 **Average water content on control points, at 48 hours from last rainfall**

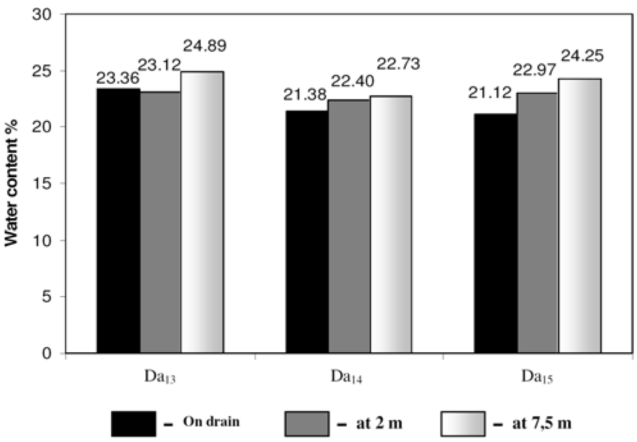


Figura 5 **Average water content on control points, at 10 days from last rainfall**

## CONCLUSIONS

The use of flax straws as a filtering material, irrespective of the layer thickness, is not recommended due to the permeability decrease by transformation in time in organic matter. The association in the case of filtering layer of flax straws with ballast provides also, after 30 years of operation, the best removal of humidity excess.

The placement of absorbing drain lines at 12.00 m is not economically justified. By increasing the distance between drains at 15.00 m and 20.00 m at the same time with the increase of filtering material layer thickness, a similar removal of water excess can be obtained.

The land modeling in ridge strips at the drains spaced at 20 m determines a water excess removal similar to the drains spaced at 12.00 m due to directing the surface flows towards drain lines, carrying out a better interception and removal of water in the first hours and days of humidity excess.

After 30 years of operation, the average water content in soil determined at 2 days since last rainfall recording has the lowest value near the drains (2.00 m) and the highest value on the drain trench due to the water inflow created towards the drain filter and due to the permeability decrease of the filtering layer during this period. At 10-15 days from the last rainfalls, the average water content decreases from middle distance between the drains towards the drain line.

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