INFLUENCE OF THE PARCHING-DRAINING NETWORKS, PERFORMED IN THE PĂLTINOASA-DRĂGUŞENI AREA OF SUCEAVA COUNTY, ON THE GROUND WATER

INFLUENȚA AMENAJĂRILOR DE DESECARE-DRENAJ EXECUTATE ÎN SECTORUL PĂLTINOASA-DRĂGUŞENI, JUDEȚUL SUCEAVA, ASUPRA REGIMULUI APEI FREATICE

RADU O.
University of Agricultural Sciences and Veterinary Medicine Iasi, Romania

Abstract. *The parching-draining works were performed to remove any excessive humidity on the land surface and in the upper soil layers due to precipitations, ground water and the water coming from the more elevated neighboring areas. In the land where the ground water is not deep (0.5-2.0 m) and with a great level variation amplitude, the ground water is the main source of water that continuously or almost continuously maintains and excessive humidity if the soil. The high level of the ground water, together with water mounting to the surface due to the capillary phenomenon, cause a significant soil moistening, claying, swamping, especially in the wet climate areas. Water mounting through capillary tubes depends on soil structure and texture. The parching-draining works carried out in the Păltinoasa-Drăguşeni area influenced the ground water level by descending it, which means that large areas that used to be employed for grazing and as hayfields, were subsequently improved and became arable fields. The study of the free level ground waters emphasize the draining role of the main drains intercepting the ground water on both sides of a neighboring area of 350-1000 m, as well as the local effect of the secondary channel network.*

Key words: moisture excess, drying-drainage system, soil clogging, ground water level, hydrogeological drilling

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 terenurilor cu nivelul freatic situat la mică adâncime (0,5-2,0 m) şi cu amplitudine mare de variație a nivelurilor, apa freatică este principala sursă de apă care întreține permanent, sau aproape permanent, excesul de umiditate din sol. Nivelul ridicat al apei freatice, la care se adaugă şi ascensiunea apei prin capilaritate, provoacă umectarea puternică a solului, gleizarea, înmlăştinirea, mai ales în zonele cu climat umed. Ascensiunea apei prin tuburile capilare depinde de structura şi textura solului. Lucrările de desecare-drenaj executate în sectorul Păltinoasa-Drăguşeni au influențat nivelul apei freatice, în sensul coborârii acestuia, iar mari suprafețe care înainte erau cu folosința obligatorie păşuni şi fânețe, au fost trecute la folosințe superioare şi, în special, la arabil. Studiul apelor freatice cu nivel liber evidențiază rolul drenant al colectorilor principali care interceptează pânza freatică pe o zonă limitrofă de 350-1000m, de o parte şi de alta a acestora, precum şi efectul local al rețelei de canale secundare.*

Cuvinte cheie: exces de umiditate, sistem de desecare-drenaj, colmatare, nivel freatic, foraje hidrogeologice

INTRODUCTION

The knowledge of the nature of water that creates moisture excess is very important for choosing the efficient measures of soil improvement.

According to Mărăcineanu Fl et al. (2002), the percentage of sources, which result in water excess on the territory of Romania is the following: 31% rainfall, 26% floods, ground waters and rainfall, 16% ground waters, 15% ground waters and rainfall ,8% ground waters and rainfall on saline and alkaline soils and 4% coast springs.

Ground waters are influenced by the presence of some high levels (0.6 – 1.0 m), as well as by their low speed circulation. The low depths of ground waters favour the development of gleyfication processes that determine the appearance of a heavy permeable layer at a depth of 40-60 cm and some salinization or alkalinisation processes, when the ground water is mineralized and has a slow flow and the consumption through evapotranspiration exceeds the volume of rainfall.

MATERIALS AND METHODS

In the studied area, ground waters are found in quaternary deposits, made of gravels and stones of fine and coarse sand, at which dusty sands are added in the terrace area. These are also found in meadows and on terraces, according to the field configuration. The direction of groundwater flow is NW-SE, assessing the supply from higher sides to the Moldova Valley. The value of groundwater flow slope is almost 4.0 ‰, while on the terraces from Baia area, because of the supply from high areas, the values are higher, being comprised between 2.0 % ÷ 8.0 ‰. In the area of Băişeşti and Dumbrava localities, there is drainage of ground waters towards the Brădățelul Valley, on the other side of the water separating the Moldova Valley from the Şomuzul Mare Basin. Brădățelul, which course is situated 40-50 m down from the course of the Moldova Valley, reached with its springs the lower terraces of Moldova, from Băişeşti to Dumbrava. The hydrostatic levels are generally free only in the terrace area, isolated by a weakly increasing character, due to dusty-clayey formations.

According to geological, geo-morphological and hydrological conditions, four hydrological posts were set up in the Păltinoasa-Drăguşeni sector (Păltinoasa, Berchişeşti, Băişeşti and Baia posts), made of 26 drillings (fig. 1).

For pointing out the diminution and maintenance of ground waters at a low level after drying-drainage works were done, we have measured the ground water level at the Băişeşti Post, which is situated on both sides of the Moldova River, on the East side of the Băişeşti locality, in a concave-up arch profile. Drillings are perfect at depths of 10.0 ÷ 15.0 m (F_2, F_3, F_4 and F_5) and at 25.00 m (F_1, F_6, F_7 and F_8).

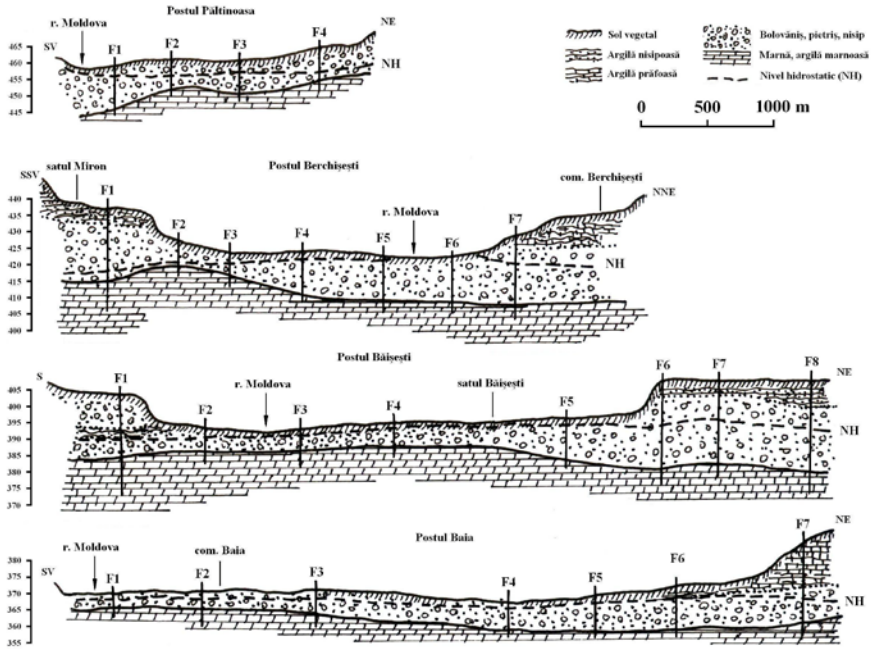

Fig. 1. Hydro-geological sections in the hydrographical basin of the Moldova River, Păltinoasa-Drăguşeni sector

RESULTS AND DISCUSSIONS

Along the valley of the Moldova River, from Păltinoasa to Baia, before the drying-drainage systems were set up, the first zone of the ground water level was found, having depths comprised between 0 and 5.0 m. Towards the terraces, both to North and South, there is the depth zone, comprised between 5 and 10 m, which develops as narrow strips along the effluents of the Moldova River. On the terraces of the Moldova River, on both banks, there is the area of the ground water level with depths from 10 to 20 m, occupying a greater and more continuous area on the left slope of the valley. In this area, NW from Baia, we found an area with the depth of the ground water level situated between 0 and 5.0 m, delimited at the outer side by a narrow uneven zone, with the depth of the ground water level situated between 5 and 10 m. Greater than 20 m depths of the ground water are found under the shape of three discontinuous patches in the region of Mălini, Valea Seacă and Dumbrava terraces.

Analyzing the levels of ground waters measured by hydro-geological drillings (Table 1), we found that the highest levels were reached during June-September, while the lowest ground water levels were recorded in the cold

months, especially during January-March, when the river was exclusively supplied with ground waters.

We also noticed a time lapse between the period of rainfall record and the increase in ground water levels in drillings. Thus, in 2006, the highest quantities of monthly rainfall of 162.3 mm/m^2 and 132.2 mm/m^2 were recorded in June and August, while the highest levels of the ground water levels were recorded after 20-30 days, according to drill setting up, in July and September.

Table 1

Levels of the ground water at the Băişeşti Station, in 2006

Drilling / Month	F_1	F_4	F_5	F_6	F_8
	Ground water level (cm)				
I	1467	317	259	1341	1428
II	1461	320	266	1371	1443
III	1462	320	269	1374	1450
IV	1492	310	261	1354	1451
V	1547	298	252	1335	1456
VI	1530	301	234	1338	1436
VII	1510	273	210	1295	1401
VIII	1520	286	206	1387	1406
IX	1515	282	199	1383	1398
X	1523	294	215	1388	1400
XI	1510	285	216	1383	1394
XII	1479	292	246	1362	1428
MEAN	**1501**	**298**	**236**	**1359**	**1424**

** F_2 and F_3 drillings – taken by water and floods*

** F_7 drills – blocked*

Setting up drying-drainage works, rivulet calibration and redimensioning in this area, during 1978-1980, determined the decrease and the relatively constant maintenance of ground water level, low variations of the ground water level being recorded, compared to the uneven monthly spreading of rainfall.

In 2006, a normal year from the viewpoint of annual rainfall (689.80 mm), the ground water level recorded a diminution at all studied drillings, compared to the multiannual mean on 10 years (table 2).

Table 2

Annual and multiannual mean of the ground water level at the Băişeşti Station

Drilling	F_1	F_4	F_5	F_6	F_8
Mean ground water level, cm (2006)	1501	298	236	1359	1424
Mean multiannual ground water level , cm (1970-1980)	1350	243	205	1310	1380
Differences to the multiannual mean, cm	+151	+55	+31	+49	+44

The decrease of the ground water level in the Păltinoasa-Drăguşeni sector was greater in the areas where the drying-drainage network works under proper conditions and more reduced in the areas where the outlet and channel clogging was greater.

Analysing the ground water level from Băişeşti Post drillings, we found a depth increase by 150 cm at F_1 drilling, by 50 cm at F_4, F_6 and F_8 drillings, while at F_5 drilling, an increase of 30 cm was found, because the drying network of the area was partially out of function after 1991, by obstructing the drying channels and introducing them in the farming circuit (fig. 2).

Fig. 2. Drainage channels out of running

CONCLUSIONS

1. Setting up drying-drainage works, rivulet redimensioning and calibration in this area, during 1978-1980, determined the diminution and relatively constant maintenance of the ground water level, low variations of the ground water level being recorded, compared to the uneven monthly spreading of rainfall. The study of free level ground waters points out the draining role of main collectors that intercept the ground water on a surrounding area of 350-1000 m, on both sides, as well as the local effect of secondary channel network.

2. The diminution of ground water level in the Păltinoasa-Drăguşeni sector is higher in the areas where the drying-drainage network works under proper conditions and lower in the areas where the outlet and channel clogging is higher.

3. A time lag of 20-30 days was recorded between the period of rainfall records and the increase in ground water levels in drillings, according to the placement of drills.

4. The ground water level reaches the highest values during June-September, while the lowest values are recorded in the cold months, especially during January-March, when the river is supplied only with ground waters.

REFERENCES

1. **Amăriucăi M., 2000** - *Şesul Moldovei extracarpatice dintre Păltinoasa şi Roman*. Editura Corson, Iaşi.
2. **Mărăcineanu Fl., Constantin Elena, Nistreanu M., Semcu A., 2002** - *Considerații privind drenajul solurilor slab permeabile*. Lucrările Sesiunii Ştiințifice organizată cu prilejul împlinirii a 30 de ani de la înființarea Facultății de Îmbunătățiri Funciare şi Ingineria Mediului, CD, U.Ş.A.M.V. Bucureşti.
3. **Nitu T. şi colab., 1985** – *Influența lucrărilor de desecare-drenaj asupra apelor freatice şi suprafreatice din Câmpia piemontană Rădăşeni-Fântâna Mare-Baia, mijloc de creştere a producției agricole la hectar.* Primul Simpozion de Îmbunătățiri Funciare, Bucureşti.
4. **Radu O., 2007** - *Consecințe ale colmatării canalelor de desecare, în sistemul de desecare-drenaj Rotopăneşti-Rădăşeni-Fântâna Mare, județul Suceava*. Lucrări Ştiințifice, seria Agronomie, U.Ş.A.M.V. Iaşi, vol. 50. Editura ,,Ion Ionescu de la Brad" Iaşi.