THE SITUATION OF LANDS ARRANGED WITH DRAINAGE WORKS FROM THE DRAGOIESTI-BERCHISESTI SYSTEM, SUCEAVA COUNTY

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Abstract

The surface and subsurface drainage systems carried out for eliminating the excessive moisture on agricultural lands were designed with respect to the exploitation of surfaces on the drainage sectors. When establishing and rebuilding the ownership right (1991 year), the orientation of the drainage lines and the drainage channels network was not considered. Thus, the terrain plots are located perpendicularly, parallel or at a sharp angle to the tile drains and / or drainage channels. This paper present aspects of removal of excess water from agricultural lands arranged with drainage works and exploited on parcels oriented along the level curves and perpendicular to them respectively. The different soil works performed on each individual plot has led, in time, to land shaping in ridges and furrows of variable widths, level differences and transverse slopes, depending on the width of the plots, on the manner in which they are used and on the machinery employed for the agricultural works conducted. The modelling of land in ridges and furrows causes an uneven removal of water excess from the soil surface. In the parcels oriented along the level curves, the modelling of the land causes the stagnation of water on trenches, prolongation of water excess, gradual passing from the category of arable use to hayfield and the installation of hygrophilous vegetation. The modelling of the land to parcels oriented perpendicularly to level curves the removal of water excess, which allows the performance of spring agricultural works in good conditions and in due course, ensuring the acquiring of high production.

Key words: water excess, drainage system, land shaping, ridges, furrows

The reasonable use, protection, improvement and preservation of soil have been a constant preoccupation lately, as the success of development depends on it (Răuţă C. *et al*, 1998).

Soil quality is more or less affected by one or more conditions, such as drought, periodic excess water, soil erosion, landslides etc (Hornbuckle J.W. *et al*, 2007; Burja C. *et al*, 2013).

Excessive dampness is one of the most significant restrictive factors concerning soil fertility, able to greatly or even totally reduce its productive capacity.

After implementation of drainage works (drainage channels, subsurface drainage, mole drainage, deep loosening, land modeling) diminishes the negative effects of moisture excess on the soil quality, improves soil aeration of the root system of the cultivated plants and hence the economic efficiency of farms is considerably rising (Schultz B. *et al*, 2007, Ritzema H. P. *et al*, 2008).

Worldwide, it is estimated that besides the 150 million hectares with drainage channels and underground drainage works, an additional 300 million hectares need to be set up in order to ensure optimum conditions for crop growing (Ritzema H. P. *et al*, 2006; Birendra K. C. *et al*, 2011).

After implementing hidroameliorative improvements, a special importance should be given to their use and how these are maintained over time, taking into account the new conditions created by the transition to private ownership of land.

MATERIAL AND METHOD

Out of all main limiting factors of agricultural production that manifest themselves depending on local pedoclimatic conditions, appear moisture, flooding, reduced soil permeability and compaction, erosion, landslides and others.

Drainage, embankment-regularization, underground drainage, soil erosion control, and more have been done in order to grow the production capacity of agricultural land, and, especially, of arable land, which is of 178.502 ha (20.8% agricultural land) in Suceava county (Moca V. *et al*, 2000).

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The excessive humidity, which occurs in the Moldova River basin and which is due to rain and/or ground water and to water system overflows, has manifested itself under various forms and at different intensities, on both horizontal and sloped land.

The natural conditions of the Baia piedmont plain support the occurrence and maintenance of excessive underground and surface humidity. The Moldova River meadow and 1.5 km-wide slip-shaped terraces, which are almost parallel with the Moldova River bed and which run north-west and south-east, with small 1-5% slopes, with flat areas and many small depressions, facilitate water stagnation.

In the wet climate of the Moldova River basin, the heavy precipitations fallen over 1-5 consecutive days and the low evapotranspiration rate make up the main excessive humidity cause in low permeability soils (Nitu T. *et al*, 1985)**.**

The precipitations fallen throughout the year exhibit an uneven distribution, with considerable amounts fallen in 24 hours or after long-lasting heavy rains, which cause surface overflows that carry along soil particles, thus enhancing bank erosion and hence clogging the channels (Radu O., 2009).

In order to harness the productive capacity of fields in the meadow and river terraces of Moldova, the Dragoiesti-Berchisesti surface and subsurface drainage system was set up between 1978-1980, with a surface of 1790 ha, out of which 553 ha have underground drainage works (*figure 1*).

The actual drainage channels network includes master collecting channels, secondary collecting channels, sector collecting channels and belt channels.

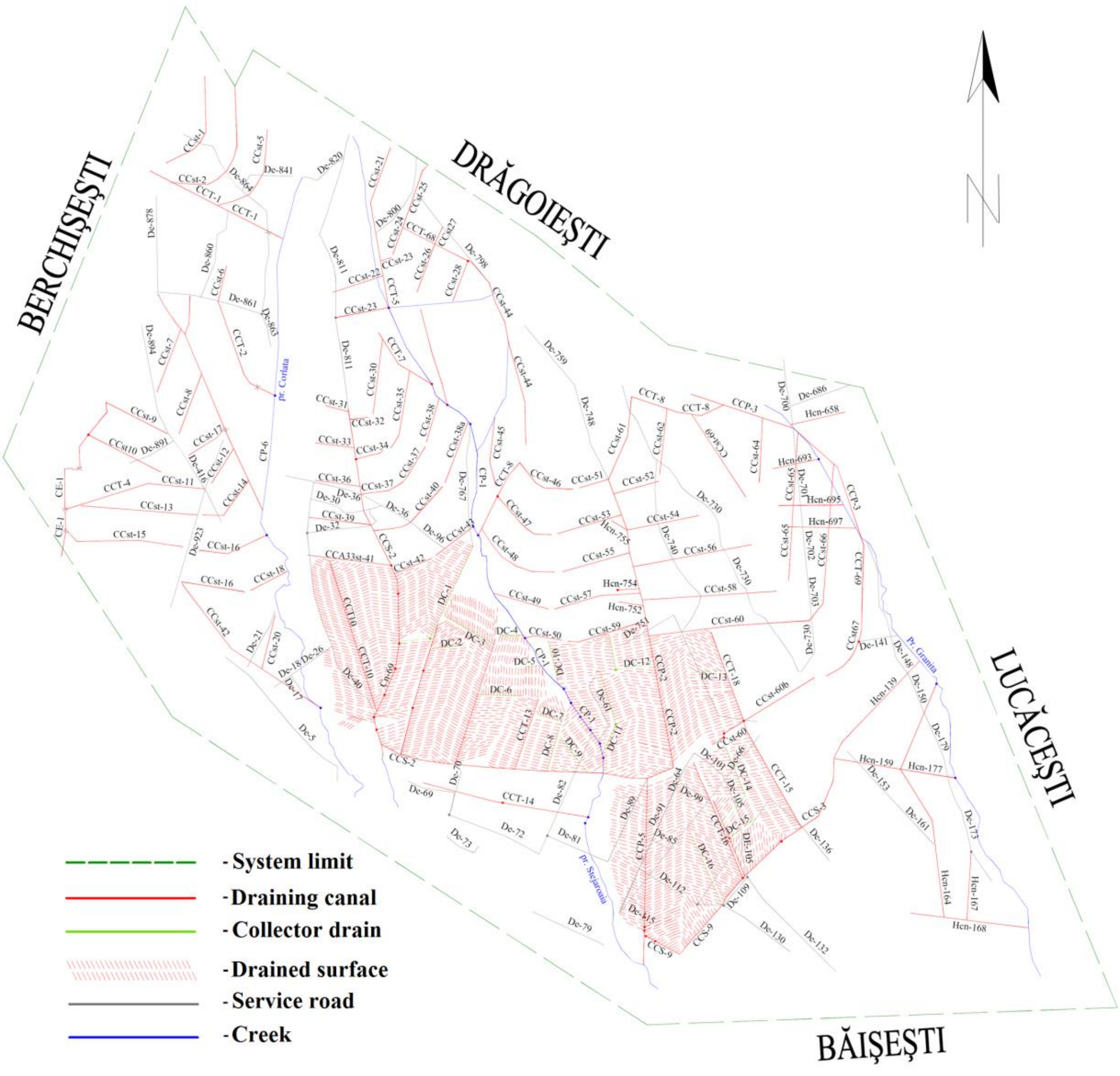


Figure 1 **Surface and subsurface drainage system from Dragoiesti-Berchisesti**

Morphologically, the system is located on the river meadow of Moldova and meadows of inland streams Ratus, Corlata, Rau, Stejaroaia and Bahna, on the upper and lower terrace of river Moldova, the highest altitude is of 510.88 m is situated in the northern part of the area.

In the execution of tertiary, secondary and main channels, the watercourse ways, natural valleys and depressions were taken into account as much as possible.

Drainage channels were made with trapezoidal section, at a size which ensures the transport of maximum flows at 5%.

To emphasize the efficiency of drainage works, field observations, topographic measurements have been carried out and soil samples have been collected. Based on the topographic measurements, transversal and longitudinal profiles on individual parcels of field were drawn-up.

In order to determine the current water quantity of the soil, soil samples were collected on 10 cm thick stairs up to a depth of 0.60 m, both on the lines of ridges and gullies of the parallel, namely perpendicularly oriented field parcels towards the direction of level curves.

RESULTS AND DISCUSSIONS

Drainage facilities were executed in order to be exploited on the drainage areas and in order to prove their efficiency, a series of additional works were foreseen, aiming at accelerating water excess discharge: levelling, modelling, ditches and gullies facilities etc.

Since 1991, after turning lands into private property, these additional works for the acceleration of water excess interception and discharge, were no longer carried out and the arranged surfaces were exploited on individual parcels (*figure 2*).

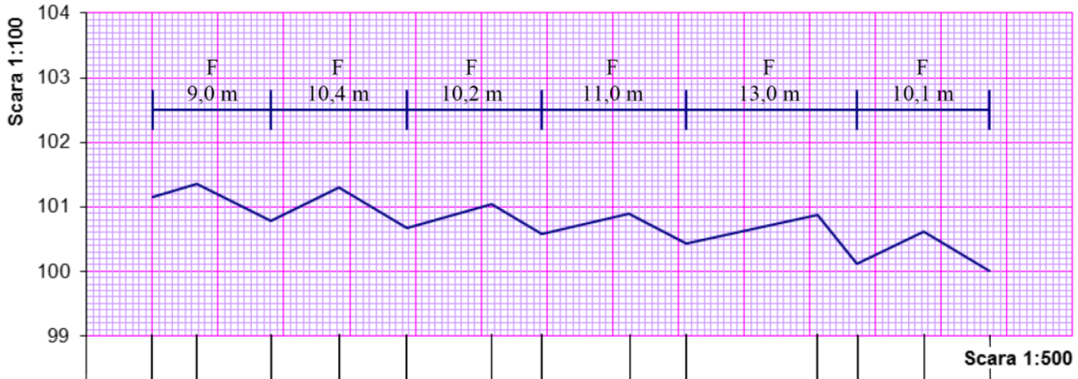
Figure 2 **Exploitation of fields arranged on individual parcels**

By carrying out individual soil tillage on field parcels, especially the basic work, namely moldboard ploughing, the field is modelled into ridge lanes, with variable widths, level differences and transversal slopes, according to parcel width, mode of use and equipment used to carry out agricultural works.

In figure 3, there are to be noticed variable values of modelling into ridge lanes, gully-ridge level differences are comprised between 0.198 m and 0.755 m and the transversal slope has values between 4.3% and 25.2%. In fact, the corresponding surface to this transversal profile has meadow use purposes and the different values of modelling technical elements were influenced by parcel width, equipment type, method used to carry out the ploughing and number of years during which it has been exploited as arable.

Within the studied drainage area, individual field parcels are oriented both along the level curves and perpendicularly to these. The parallel orientation of parcels with level curves and their modelling into ridge lanes, determined backwater on the gullies between parcels and water excess prolongation. Water excess prolongation, especially during springtime, the delaying and inappropriate execution of soil works, led to the gradual transition of the entire surface, which presents parallel parcels with level curves, to meadow class (*figure 4*).

Backwater has a long duration, due to surface drainage interception on perpendicularly oriented parcels to level curves (*figure 5*) and big gully-ridge level difference, with values reaching 0.519 m (*figure 3*).



Număr punct	1		2		3		4		5		6		7		8		9		10		11		12		13
Cota terenului (m)	101,161		101,359		100,788		101,307		100,676		101,042		100,571		100,887		100,437		100,870		100,115		100,613		100,000
Diferenţe de nivel (m)		+ 0,198		- 0,571		+ 0,519		- 0,631		+ 0,366		- 0,471		+ 0,316		- 0,450		+ 0,433		- 0,755		+ 0,498		- 0,613	
Distanţe (m) Parţiale		3,4		5,6		5,2		5,2		6,4		3,8		6,6		4,4		10,0		3,0		5,1		5,0	
Distanţe (m) Cumulate	0		3,4		9,0		14,2		19,4		25,8		29,6		36,2		40,6		50,6		53,6		58,7		63,7
Panta terenului (%)		5,8		10,2		10,0		12,1		5,7		12,4		4,8		10,2		4,3		25,2		9,8		12,3	
	1,82																								

Figure 3 **The cross section of oriented parcels to along the level curves**

Figure 4 **Backwater and agricultural works delaying**

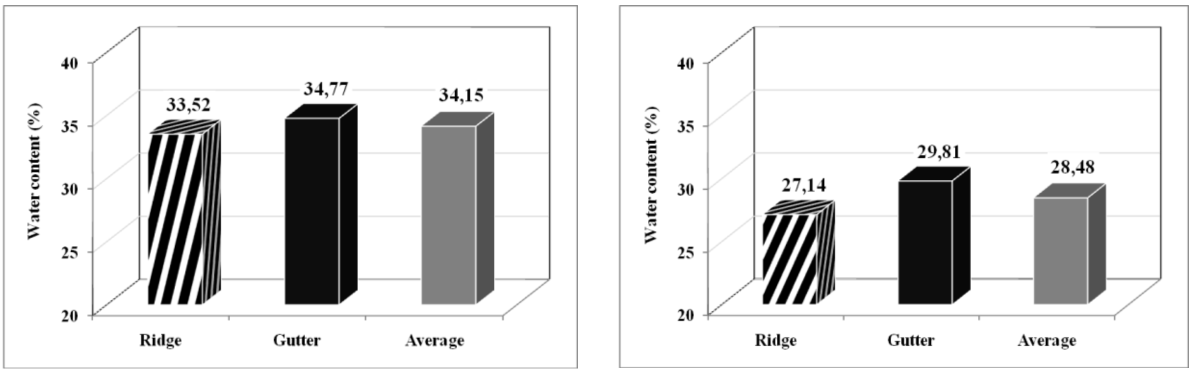
Figure 5 **Water drainage from perpendicularly oriented parcels to level curves**

Water excess prolongation, both during springtime, when snow melts, and during vegetation periods, as a consequence of heavy rainfalls for 1-5 consecutive days, led to the onset of hygrophilous vegetation and to obtaining low-quality fodder productions (*figure 6*).

Figure 6 **Backwater and the onset of hygrophilous vegetation on the arranged surface**

Modelling the field to parcels oriented on the greatest slope line (perpendicularly to level curves), contributes to the acceleration of excess water discharge, allows for soils work performance in good conditions, which ensures increased agricultural productions.

Inappropriate discharge of water excess from the parcels modelled into ridge lanes and parallel oriented with level curves, is also stressed out by the values of the current soil water quantity from figure 7. The increased soil water quantity from the ridge parcels parallel oriented with level curves, is due to the large backwater quantity on gullies for a long time and to the small width of the parcels.



a b

Figure 7 **Average water content of soil**
a - parcels oriented along the level curves
b - parcels oriented on the most sloping slope

CONCLUSIONS

Individual application of soil works on field parcels arranged with drainage works, determined field modelling into ridges with variable widths, level differences and transversal slopes, according to the mode of use, equipment and methods used in carrying out agricultural work.

Land shaping into ridge lanes, as a consequence of individual application of soil work, leads to an uneven discharge of water excess from the surfaces arranged with drainage works.

On arable surfaces arranged only with drainage works and individual parcels oriented along the level curves, modelling the fields into ridge lanes determined backwater and dampness excess prolongation, especially during springtime and heavy waterfalls, which led to a gradual transition of the parcels to an inferior category of meadow use.

In the case of parcels oriented towards the line of the biggest slope (perpendicularly to level curves), modelling the field into ridge lanes accelerated water excess discharge, which allowed for smooth and timely spring works, for the growth and normal development of plants.

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