PHYSICAL AND QUALITY INDICATORS OF SOILS FROM PODU ILOAIEI AGRICULTURAL AREA

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Key words: Podu Iloaiei, soil texture, soil structure, way of usage of lands, soil porosity, compaction degree, hydro-physical indicators of soil, excess soil moisture.

ABSTRACT:

Podu Iloaiei town is geographically situated in Inferior Jijia and Bahlui Plain, which is a sub-unit of Moldavian Plain. Geographical position, the specific relief of this area and the factors and pedogenesis processes had a great influence over the development of the soil cover. On soil classes , the Chernozems have the greatest extinction rate(78%), followed by protisols(11%), anthrosols(1%), gleysols (0,4%). 9,6% is represented by the complexes developed in areas affected by stabilized and semi-stabilized landslides.

To estimate the quality of this soil cover was necessary the characterization of some qualitative and quantitative indicators. If at the beginning there were used only the chemical indicators to evaluate the quality of soil, now a similar importance is given to the physical and biological indicators. In Podu Iloaiei area, the physical indicators used to evaluate the quality of soil cover are: the soil texture, structure, porosity, compaction degree, hydro-physical indicators of soil, excess of soil moisture. These indicators affect the way of lands use, too.

Podu Iloaiei is situated in the south of Moldovian Plain, in the meridional half of Inferior Jijia and Bahlui Plain. It is located in the Bahlui middle basin, at the confluence of Bahlui with Bahlueț (figure 1).

Geographical position and the factors of pedogenesis and pedogenesis processes influenced the development of the soil cover in this area.

In order to evaluate the quality of soil it was necessary the caracterization of some qualitative and quantitave indicators, which reflect the composition and the different composition of soil, various physical, chemical and biological characteristics and processes, which interacts in a frame or system in a continous dynamics.

The most important indicators in the evaluation of the quality of soil, in Podu Iloaiei area are: the soil texture, structure, porosity, the compaction degree, hydro-physical indicators of soil and the excess of soil moisture.

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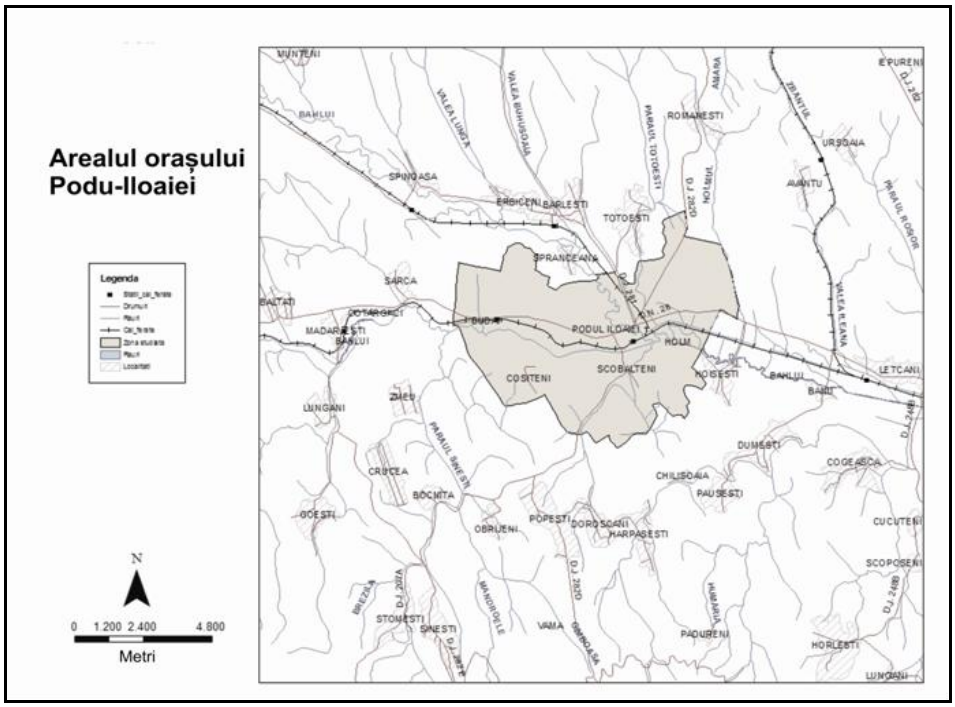

Fig. 1. Geographical position of Podu Iloaiei town.

1. Soil Texture

Soil texture is the first indicator used to evaluate the quality of soil in Podu Iloaiei area, influencing the water and other substances retention and transport.

It represents a morphological characteristic of soil determined by its granulometric composition. The soil's texture is responsible for a series of characteristics such as: apparent density, porosity, air-fluid system and temperature control. In this order, the texture from A horizon is very important.

As we can observe in the figure 2, the textural classes in this area are soft and medium, grafted on leossoidal deposits from this region and on the bassarabian Cryptomactra clays. These leossoidal deposits led to the formation of large quernoziom areas with favorable physical and chemical caracteristics.

In the area of Bahlui field the texture of soil is clay-clayey. The thickness of the river deposits from Bahlui and Bahluieț is 8-10 m. The river deposits are formed by an inferior, sandy with sand and gravel lens horizon and a superior horizon with soft,clayey deposits. These deposits represent the parental material for gleysols and fluvisols.

The medium textures are characterized by the balanced contents of every granulometric fraction. The physical properties of these are favorable having qualities such as: full available water retention, moderated capillary rise,

favorable water condition through total permeability and porosity which fits in middle and large parameters, middle values of apparent density and total porosity.

The chemical properties include: high cationic exchange capacity, mold in middle and large quantities, active microbiological processes, slow dynamics of nutrients, which confers stability of the reserves of these plant vital substances (Rusu C. 1998).

In the studied area, these are spread like scattered areas in Bahlui terrace areas, interfluves, sculptural tabelands from the south slopes of Bahlui Valley.

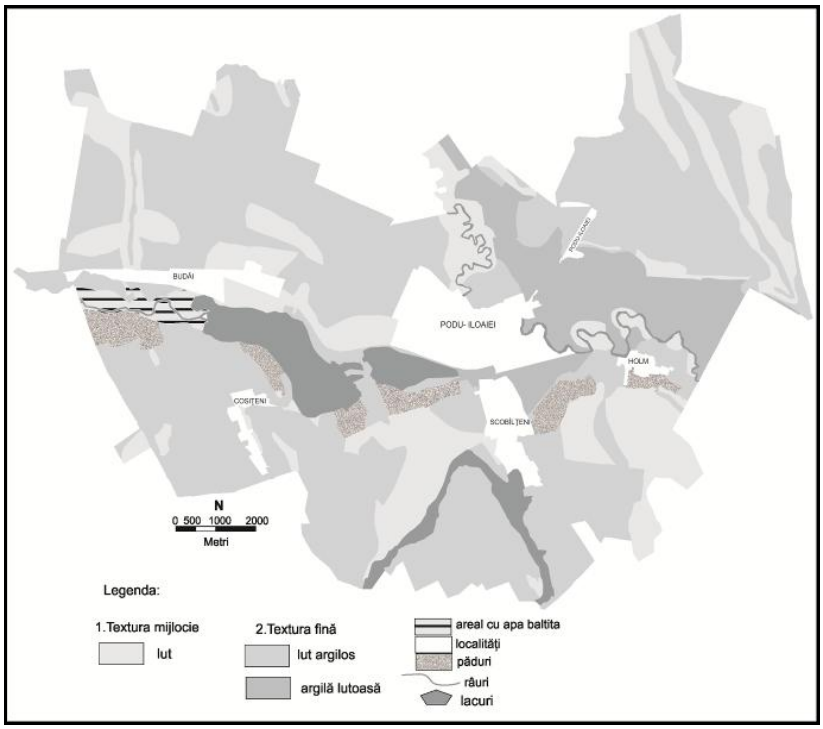

Fig. 2. The map of soil texture in A horizon (remaking after data from O.S.P.A Iași).

This class is found in Holm hill (located in the north of Bahlui Valley) too. It has a surface of 23% of the studied area.

The soft textures are the most popular in the studied area (77%). They are met on Miocene deposits, on newly deposits from terrace areas, interfluves, sculptural tabelands (lome-clay texture).In Bahlui, Bahluieț and Scobâlțeni fields the texture is clay-clayey. Under geomorphological aspect, the deposits and soils with soft textures are deep affected by landslides: Cosițeni Hill, Holm Hill, Spranceana Hill, due the drain slope and waterproofing of the sublayer. The use of water regime is differentiated, insignifiant rains not being optimum exploited and rainy periods forming an excess of soil moisture like in Bahlui field.

The physical properties are less favorable as they retain large quantities of unreachable water. They have a great capacity of contraction and blowing, small permeability, less favorable mechanical and thermal attributes . In the same time they have optimum chemical attributes: great cationic exchange capacity, high content of mold, increased wieght of microelements (Rusu, C, 1998).

2.The structure of soil

The structure of soil is one of the most important physical features, on which depends the fertility, on a hand, and other physical features: porosity and permeability, on the other hand. It is typological differentiated, varies on the profile depending on pedogenesis conditions and it is dependent by the way of land use and the agro-technique used.

Glomerulus and grainy structures are the most favorable structural types under the aspect of fertility and physical features whom it determines. These are specific to cambic chernozem, proxi and epicalcaric and to some alluvial soils and gleyic chernozem from Podu Iloaiei agricultural area.

The existence of these structure is due to the quite rich content in organic matter and to the connecting elements taken from parental material(leossoide deposits). Polyiedric structure occurs mainly at gleyosols.

The degradation of the structure of soil occurs from soil agricultural use, which in the case of Podu Iloaiei is prevalent.It can be determined by the excesive agricultural works or by innappropiate moisture, by the compaction due the heavy traffic on wet soil, natural compaction and crust formation under the action of rain drops or irrigations.

Degradation of soil strucure can also result from changes in soil chemistry, low humus content, unbalanced fertilization and irrigation with inadequate water.

After the deterioration of structure is forming the so-call structure with individual particles and the hardpan horizons.

A process of physical degradation is crust forming, which has negative implications, especially in emergence of crops with small seeds. To analize its formation it is used crust formation index, which shows the suscepitibility of its occurence. The crust forms on vulnerable soils to this degradation process and unprotected by vegetation, under the direct action of rain drops, especially those with high kinetic energy.

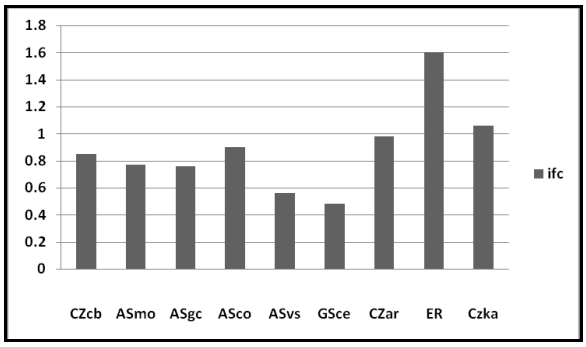

Fig. 3. The crust formation index for differnt types of soils in Podu Iloaiei area.

In figure 3 it can be observed that any type of soil from Podu Iloaiei area has higher values than 2, which demonstrates a good quality of the soil cover. A greater susceptability to the appearence of the crust has

the soils on eroded phase (1.6) followed by calcaro-calcic chernozem (1.06), which in this area is mostly silty textured. Haplic chernozems, which extends over the greater area of the territory has values of 0.85. Fluvisols have the largest index of crust formation (0.9), and occupy a small area in the region. The lower value of this index represents the mollic Gleysols, expanded on a small part of Bahlui field.

The restoring of structure can be achieved through a complex of measures which include proper execution of work of soil moisture, application of crop rotations to ensure a positive balance of mold and promote microbiological activity of mezofauna.

3. The porosity

The texture and the structure of soil determine the porosity, a feature which has direct effect on water and air circulation. For the soils from agricultural area of Podu Iloaiei, the porosity is low in the lowlands of Bahlui, Bahluieț and Scobâlțeni and on the Valley Hoisești (figure 4). This class occupies 15% from the agricultural territory. In the most part of the territory of Podu Iloaiei, the edaphic cover has a medium porosity (85%).

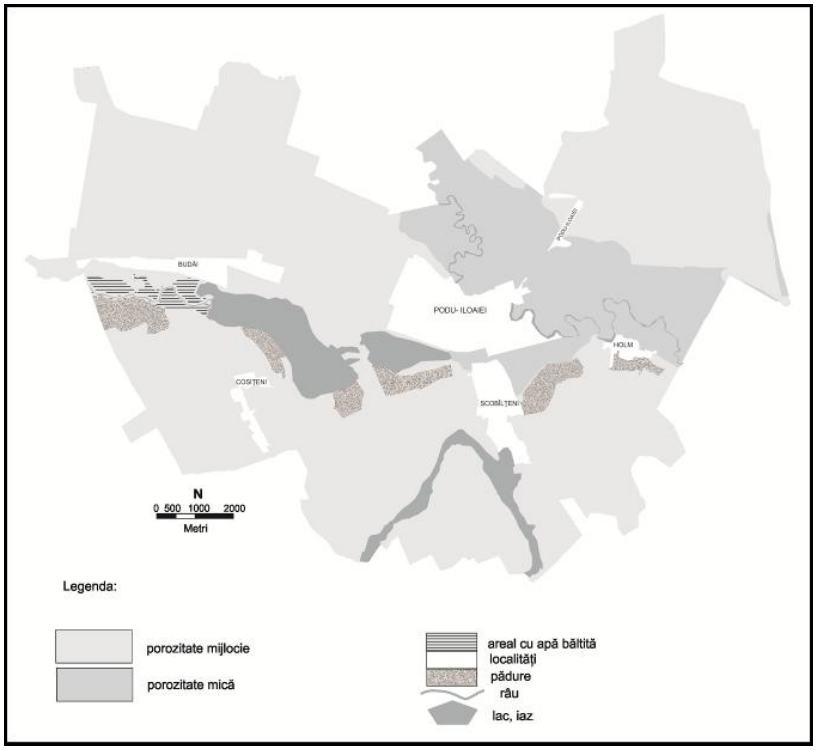

Fig. 4. The map of soils porosity (remaking after O.S.P.A Iași).

The porosity includes the soil spread on the terraces of Bahlui and Bahluieț, on interfluves, sculptural tableland, slopes with different degrees of inclination: Holm Hill, Sprânceana Hill, Răpăgău Hill, Scobâlțeni Hill, Holm Hill, Rața Hill. Chernozems with grainy and glomerular structure dominance in the area makes them have a higher volume of pores, allowing water and air circulation in the soil, which has a particular importance for its fertility.

4. The compaction degree

The compaction degree is a physical soil indicator which is directly utilized in agriculture practice in order to establish how should be applied the works of deep loosening.

The compaction degree rises when the apparent density gets higher and the porosity is lower.

Being directly dependent on clay content, the compaction degree is much higher for the soils with soft textures and anthropic compacted, which requires deep aeration works. The soils with medium texture do not raise special compaction problems.

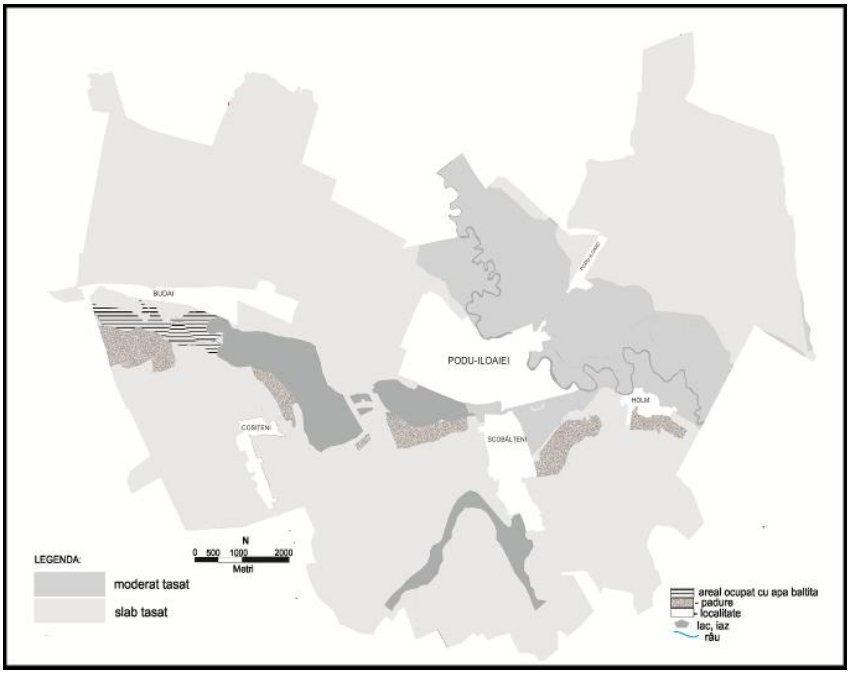

Fig. 5. The compaction degree in A horizon
(after data from OSPA Iași).

For the most part of Podu Iloaiei soils perimeter – 85% the compaction degree is low (figure 5), that which implies deep plowing and subsoiling in order

to increase the agriculturale quality of these soils. This is found in the areals where the porosity is middle: Bahlui and Bahluieț terraces, interfluves, structural plates, slopes with different degrees of tilt: Holm Hill, Sprânceana Hill, Răpăgău Hill, Scobâlțeni Hill, Rața Hill. This tendency of compaction of typical chernozems from the studied area may be a limiting factor for them. For Fluvisols and gleyic soils spread in Bahlui, Bahluieț and Scobâlțeni fields the compaction degree is medium (15%).

5. The hydro-physical coefficients of soil

To indicate the main changes in the mobility and accessibility of water for plants, the most important calculated indicators are: wilting coefficient, useful water capacity and field water capacity.

Wilting coefficient is the most important hydro-physical index. This represents the humidity in the moment in which the plants irreversible whiter from lack of water. The concept was introduced in pedology by Briggs and Schantz (1912) and then verified in our country through field and laboratory experiments by Motoc M(1962).

The wilting coefficient mainly depends on the granulometric composition of soil, varying in the same direction with the growth of clay and humus content. The wilting coefficient value is influenced by the intensity and type of salinization, too. These factors contribute to increase the soil water retention forces. On the saline soils, the wilt instals to higher humidity values compared to soils unaffected by these processes. In the studied area, on the soil types the highest values of this indicator is on the mollic gleyosol (23.5%) and fluvisols (20%), where the percentage of clay is higher. Chernozems records a wilting coefficient of about 13%, with a value a bit higher than of Happlic Chernozems.

On Podu Iloaiei territory the wilting coefficient has middle values (9-12%) and high values(13-16%) on soils situated on Bahlui terraces, interfluves, sculptural plates, on Bahlui Valley southern slopes and very high values(17-25%) on soils situated in lowland of Bahlui, Bahluieț and Scobâlțeni (figure 6).

The great and the greatest value of this coefficient in soil from Podu Iloaiei, makes them vulnerable in the case of a water deficit in soil, being met, especially on clay-clayey and clayey-clay materials. A shorter percentage is occupied by a middle value of wilting coefficient, especially met in chernozems with loamy texture. In Bahlui field, where occurs the weak and medium salinization, soil water retention forces are increased. Thus, in this case, the wilt may occur with higher values of humidity, compared to other unaffected soils by this pedogenesis process.

Field water capacity. It's a hydro-physical indicator defined as being the quantity of water that the soil can retain it for a long period of time, after being excessively moistened and then drained. This indicator signifies the upper limit of the accessible moisture gap of plants, as over this limit the water is not retain anymore for a long period. On the other hand, field water capacity represents the lower limit of the pore space, which is usually unoccupied by the liquid phase. There is an increase in field water capacity on soils with coarse and fine textures, compared to moderate values of the soils with medium textures. Thus, the greatest

values of this coefficient (31-40%) is recorded in Bahlui, Bahluieț and Scobâlțeni fields, where clay-loamy texture is predominant. Values of 21-25% of this coefficient are spread on the most part of this territory (terraces, interfluves, sculptural plates) where the texture is clay-loamy. On some slopes (Cosițeni Hill, Scobâlțeni Hill, Dudan Hill, Holm Hill, Henci Hill), the field water capacity is characterized by values of 26-30% (figure 7). On soil types, the Mollic Gleysols records the highest values(32,5%) and the Fluvisols (almost 29%), followed by Chernozems23%).

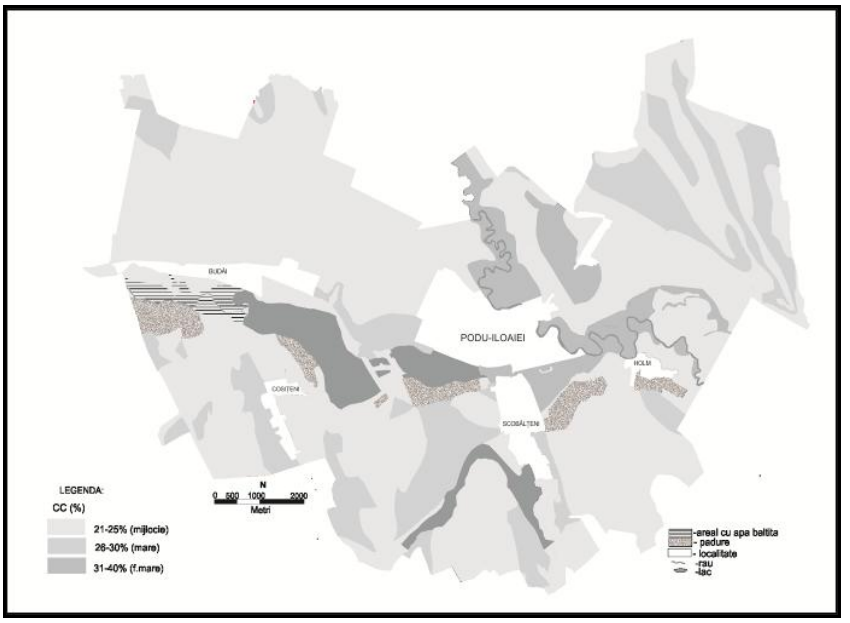

Fig. 6. The spatial distribution of the values of wilting coefficient (remaking after dates from OSPA Iași).

Useful water capacity represents the quantity of water that the soil can retain it and make it available for plants. This indicator is the main parameter of potential reserve of water and shows the share of total quantity of precipitations that can accumulate in the soil profile utilized for plants supplying. The maximum values of useful water capacity are characteristic to clayey and clayey-sandy soils(medium textures), dropping sharply in the domain of soft soils and heavy soils(coarse and fine textures).

On Podu Iloaiei territory the predominant values are those of 11-12%, that which indicates a medium useful water capacity of soils. In Bahlui, Bahluieț and Scobâlțeni field area the useful water capacity is low (8-10%) (fig.no.8).

On soils types, the highest values of this coefficient is recorded at Chernozems (10,7%), followed by Fluvisols (9,7%) and Mollic Gleysols (8,9%).

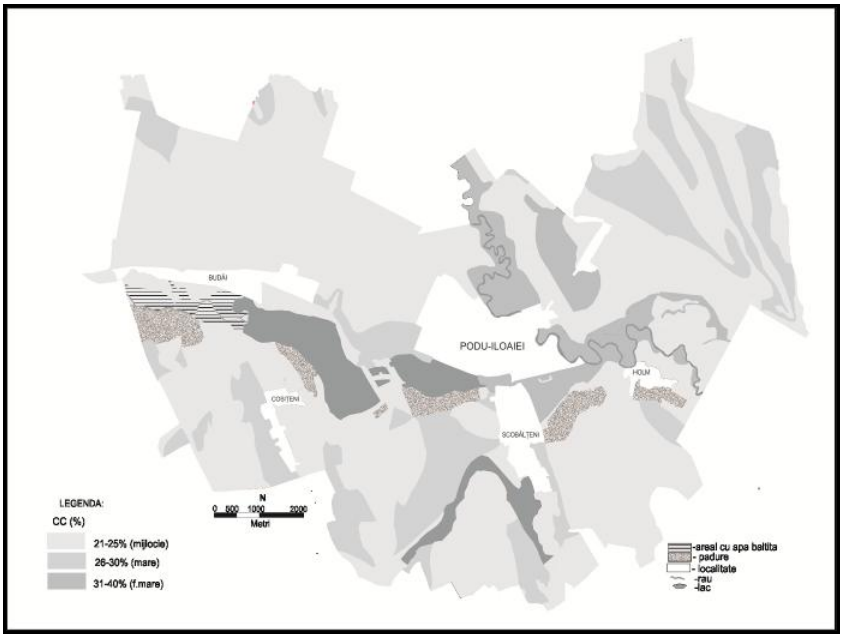

Fig. 7. The spatial distribution of the values of the field water capacity (remaking after dates from OSPA Iași).

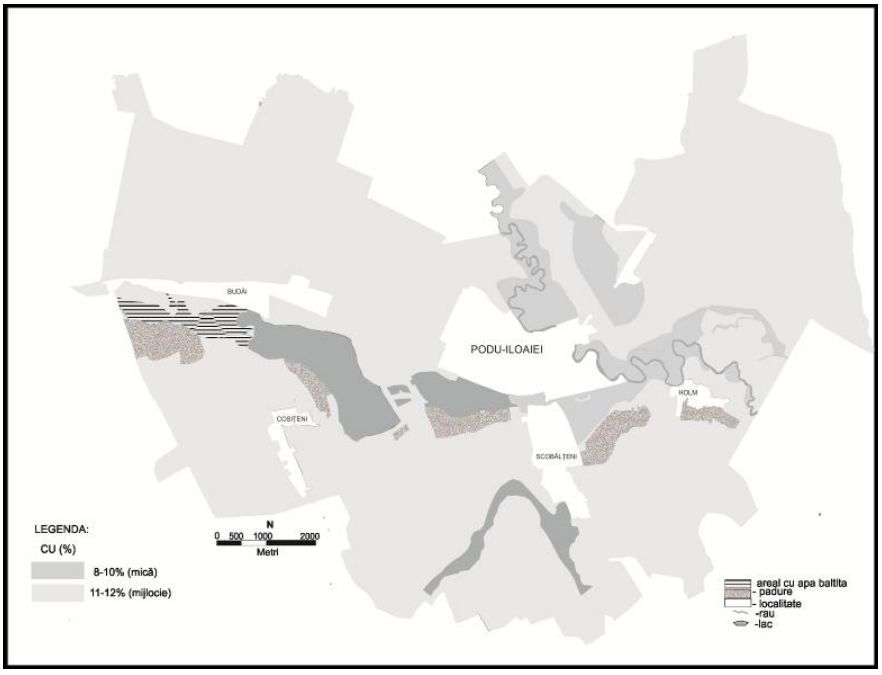

Fig. 8. The spatial distribution of the values of useful water capacity (remaking after dates from OSPA Iasi).

6. Excess soil moisture

The amount of water existing in the soil influences both nutrient leaching due to the existence of CO_2, and their transport to plants roots through diffusion phenomenon. Excess moisture represents that soil moisture state which exceeds the field water capacity and tends to reach the total capacity of water. In this state not only the capillary pores from soil, but also the non capillary pores are practically filled with water, the lack of air and oxygen in the soil being felt. In what concerns the excess moisture (fig.no.9) in the interfluvial areas, plateau areas and on the terraces of Bahlui and Bahluieț, this is practically zero, the soil being excessively wet at most once every few years and for periods that do not overcome 3-5 days. In these conditions, the cultures do not suffer and there are not necessary prevention or control works of water excess. These areas are mainly occupied by Chernozems and have a share of 84,6%. In contrast, the field area of Bahlui , Bahluieț and Scobâlțeni where the soils that occur are Fluvisols and Gleysols

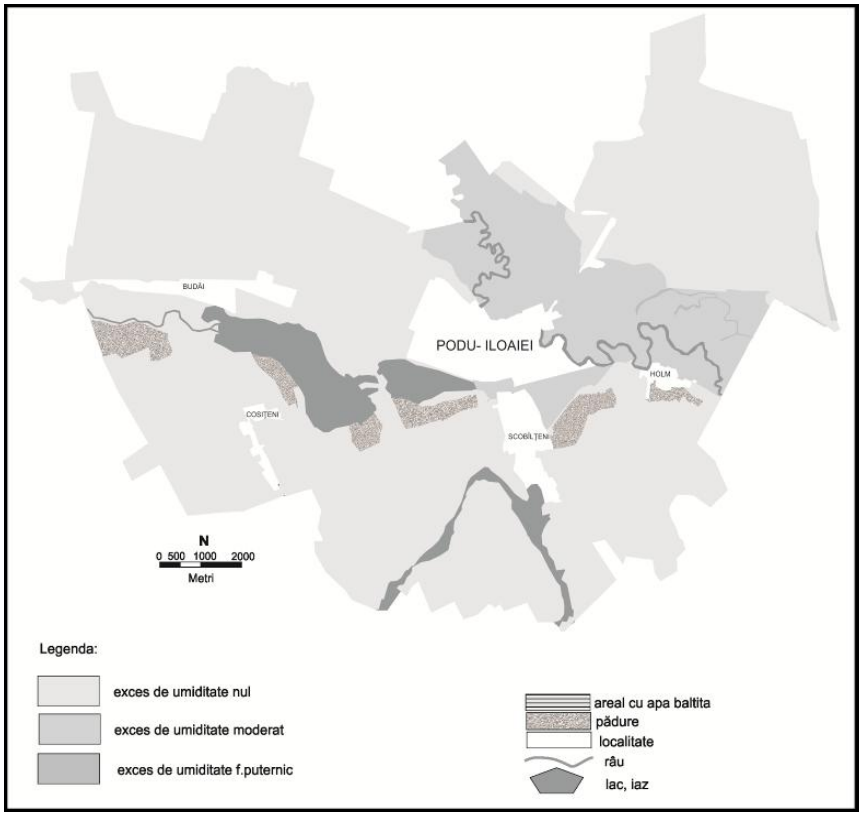

Fig. 9. The map of the excess of soil moisture
(remaking after dates from OSPA Iasi).

The excess soil moisture is moderate and occupies 15% of the agricultural territory. Thus the soil can be excessively wet in some years for periods of up 5-15 days. In these years the crops suffer and require extensive drainage works and improvements and control of water excess. In the case of Mollic Gleysols, the excess soil moisture is very high. The soil is excessively wet in the most years for periods that overcome 30-60 days. All crops heavily suffers and require extensive draining and drainage works, but also works of improvement and control of water excess. The area owned by this coefficient it's very small (0,4%).

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