THE MAIN AGRICULTURAL LAND DEVELOPMENT AND IMPROVEMENT WORKS NECESSARY TO BE IMPLEMENTED ON THE LUGOJ HILLS AREA

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Abstract. The qualitative reclamation of the agricultural land can be achieved using two types of actions: land improvement works and agro-pedoameliorative works. The main remedial actions necessary for the Lugoj Hills agricultural land are: the flood control, the surface and the deep drainage, the irrigations, the erosion control works, the deep loosening and the ameliorative fertilization. The paper aims to map the precise location where these works must be implemented and to represent the percentage of the agricultural land targeted by them.

Keywords: land improvement, agro-pedoameliorative works, agricultural land, to map, Lugoj Hills

1. INTRODUCTION

The optimum use of land for agricultural activities or different other purposes is, mostly, restricted by one or more of the negative acting features of soil and/or environment. For these ones, in the specialized literature, the terms of limiting or restrictive factors are used. When their influence reaches a very high intensity, they can determine even the exclusion of an agricultural culture from a certain territory. In this case, they transform itself in eliminatory or exclusive factors. Florea (1997) affirms that the limitations should not be confused with land degradation which is strictly caused by the human action.

There are two categories of limitations differentiated according to the possibility of intervening or not on their action for reducing them partially or completely. So, we can remark the existence of the absolute or incorrigible limiting factors, like for example air temperature, high slope, reduced available edaphic volume, land covering with rocks or stones and so on, and corrigible limiting factors, like water excess, soil salinization etc. which can be improved by different technological actions (Florea, 2003).

Karlen et al. (1997) mention that the land has a specific ability to optimally function at the boundary between the natural ecosystem and the artificially created one by the agricultural technological systems.

By applying the development and/or improvement works, some negative land features, from the agricultural point of view, are corrected or removed which requires the reduction or elimination of the penalties introduced by the restrictive factors. Following this operation, the land must be reclassified in relation to the way in which the remedial measures modify their current quality estate.
The remedial actions applied on the agricultural land are divided in land improvement works and land agro-pedoameliorative works and they are chosen according to the nature and intensity of the limiting factors, as well as to the available financial and technical resources and to the intended purpose.

Bold et al. (1984) demonstrate that the application of correct technology soil tillage, of segetal vegetation and pests control, of use of plants varieties and hybrids with superior biological qualities, of adequate and balanced doses of fertilizers and amendments determine growing crops per hectare. The authors illustrate this statement by the wheat and corn production realized in Romania on the best fields, but under different technological conditions. So, in the 50s of the past century, the wheat production was about 3-3.5 t/ha, and the corn production about 4.5-5 t/ha. In the 80s, in the same climatic and soil conditions, but with far superior varieties and hybrids and an improved technology, the production increased to 6-7 t/ha for wheat and 8-9 t/ha for corn.

2. MATERIALS AND METHODS

The Lugoj Hills are a part of the Western Hills of Romania, the Banat Hills sector, being situated in the eastern end of the Timiş County and having a surface of 61,903 ha out of which almost three quarters (74 %) representing agricultural land with a total surface of 45,828 ha (tab. 1).

<table>
<thead>
<tr>
<th>Land use</th>
<th>Surface (ha)</th>
<th>Percents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agricultural land</td>
<td>45,828</td>
<td>74.00</td>
</tr>
<tr>
<td>Built-up areas</td>
<td>2,710</td>
<td>4.37</td>
</tr>
<tr>
<td>Forest</td>
<td>13,043</td>
<td>21.07</td>
</tr>
<tr>
<td>Surduc Lake</td>
<td>322</td>
<td>0.56</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>61,903</strong></td>
<td><strong>100.00</strong></td>
</tr>
</tbody>
</table>

The working methodology consisted in studying the materials executed over time by experts of Timişoara Soil Science and Agrochemistry Service, processing different cartographical materials (pedological, topographical, geomorphological, geological) and interpreting of the analytical data on identified limiting factors. The obtained results have been validated also by some field activities.

The results had as support the Banat soils map, on scale 1:100,000, made by Gh. Ianoş in 1994 and published four years later (Ianoş and Puşcă, 1998), from which the soil units corresponding to the Lugoj Hills area have been extracted. The names of the soils have been adapted to the new Romanian Soil Taxonomy System-SRTS 2012 (Florea and Munteanu, 2012). The ecologically homogeneous territories (TEO – in Romanian) have been established for the soil units of the researched area. The TEOs features have been introduced into a digital database created in ArcGIS 10.0 software and the measures for
protection, preservation and restoration of the fertility of the Lugoj Hills agricultural land have been proposed based on them.

3. RESULTS AND DISCUSSIONS

Soil fertility degradation flows rapidly in terms of some inadequate agricultural activities conditions or some improvement works without a proper scientific foundation. To these, it can be also added the low natural fertility due to an improper water and air circulation, to a low content of humus and nutrients, to a pronounced acidification or to ground etching through denudation processes (Mazăre, 2006 a).

The main land development and improvement works necessary to be realized on some terrain units of the agricultural area of the Lugoj Hills will be presented below. It must be mentioned that, in the figures that show the spatial distribution of the processes, there are found graphic charts presenting the percentage of the affected areas that require such curative actions of the total agricultural land.

3.1. Land improvement works

All the long term works executed in order to improve the features of an agricultural field belong to this category. They help to increase the land productivity, to protect their lands and cultures against the damages that can be caused by some natural elements and help to reduce the cost production (Vlăduţ and Popescu, 2000).

The land improvement actions, named also hydro-improvement actions, include the irrigation works, the regulation and damming of watercourses, the surface and deep drainage, the seepage, the erosion control works, the terracing sloping land and landslide areas etc. By applying these works, the natural production conditions are changed for a long period of time, creating new ones that promote the adaptation and productivity of plant organisms. Overall, the land improvement works fail to completely resolve the problems induced by the restrictive existing factors. They only create the necessary conditions for some future remedial actions as a base for the implementation of the agro-pedoameliorative works (Ianoş et al., 1997).

3.1.1. The flood control by the regularization and damming of watercourses

The purpose of these works is to protect the fields against the flood. So, the restrictions imposed by the ecopedologic indicator inundation are partially or completely removed.

The first regularization and damming works of the watercourses from the Lugoj Hills area were started more than 250 years ago. Even so, the entire territory is not yet fully protected against the flood. For example, in April 2005, large land areas, belonging to 15 settlements from the Lugoj Hills area, were flooded. The inundations were due to the freshets produced in the valleys of Bega, Timiş and Gladna rivers. Ianoş (2008) specify that the relief configuration determined the expansion of the waters damaging effect only on some well-defined sectors.
The surface appreciated as exposed to the rivers overflow and which needs to be protected by such improvements is of 7,324 hectares (fig. 1), meaning 15.98 % of the entire agricultural land of the researched relief unit.

![Fig. 1. The agricultural land of the Lugoj Hills requiring regularization and damming of watercourses.](image)

3.1.2. Seepage and surface drainage works

The surface drainage aims to eliminate the negative influence induced by the stagnation on the soil surface of the water coming from rainfall or other non-phreatic sources.

The elimination of the water excess from the soil surface determines also the improvement of the soil pseudogleyzation condition.

For the researched territory, the surface drainage could be done separately or together with the seepage works. 27,461 hectares (approx. 60 % of the Lugoj Hills agricultural land) require such works (fig. 2).
3.1.3. Seepage and deep drainage works

This kind of works is carried out to lower the high groundwater level. With the decrease of the groundwater depth, the soil gleyzation condition is improved also.

The deep drainage needs to be carried out for 31.68 % (14,520 ha) (fig. 3) of the researched agricultural land, most of them without drainage application.

Lowering the groundwater level below the critical limit has been realized on the most part of the land from the meadow area of the Bega and Gladna rivers affected by the groundwater humidity excess. Mazâre (2006 b) states that a part of these works no longer properly carry out their mission, the channels being clogged with dejections and mud or being invaded by vegetation.
3.1.4. Anti-erosion works

The execution of the preventing and combating soil erosion manifest itself by minimization of the penalties induced by the indicators land slope and landslides.

Anti-erosion actions non-associated with works for removing the humidity excess are required for protect the agricultural land located in the high slope area. These fields account for less than 10 % of the total agricultural land of the Lugoj Hills (9.25 % – 4,240 ha) (fig. 4). Beside this type of works, measures against gully and torrent processes need to be done on a surface of 1,490 ha (3.25 %) (fig. 5), and complex actions against landslides are required for 26.66 % of the agricultural land (12,217 ha) (fig. 6).
Fig. 4. The agricultural land of the Lugoj Hills requiring anti-erosion works non-associated with removing the humidity excess works.

Fig. 5. The agricultural land of the Lugoj Hills requiring works against gully and torrent processes.
Main agricultural land development and improvement works in Lugojului Hills area

3.2. Agro-pedoameliorative works

This type of curative works aims also to positively change the production factors of the agricultural land and includes works that can be also assigned to the first category. But because of their cyclic nature and their reduced effect over time, they have been separately indicated (Bold et al., 1984). They usually complete the land improvement works without which they can not achieve their purpose.

These works are set out not only for the land covered by nonproductive or low productive soils, but for all areas which require such actions in order to obtain higher possible yields.

Ianoş et al. (1997) specify that the agro-pedoameliorative works can be grouped according to the required purpose in the next categories:

- own agro-pedoameliorative works – they include liming and plastering, the salts washing, the deep loosening, the subsoiling, the ameliorative fertilization, the fight against pollution;
- superficial drainage works – including the ditches and culverts for excess water drainage, grouped in systematic and unsystematic one, the mole-drainage, the ridge strips modeling, the obligatory agricultural machines working way in the direction of water flow;
- anti-erosion agro-technical works – grouping the plowing on the level curve, the anti-erosion system of crops in strips and the grass strips, the protective crop rotation, perennial grass crops.

Fig. 6: The agricultural land of the Lugoj Hills requiring works against landslides.
From all these, for the Lugoj Hills area, the most important works are the deep loosening and the ameliorative fertilization. These actions are specific to the soil and they determine the improvement of its chemical, physical and biological features, affecting the soil profile on depths often exceeding the arable layer (Ap). Their effect has an average duration of 3-7 years, but often even longer (Nitu, 1988, 1990).

3.2.1. Deep loosening works
The deep loosening works are made without turning on the furrows, at depths of up to 60-80 cm, and they are executed with the agricultural machine called scarificator. For this reason, they are also named soil scarifying works. They are designed to improve the soil porosity, having as effect the amelioration of soil compaction. These works must be repeated on regular time intervals.

Ianoș et al. (1997) specify that the fields needing deep loosening works are those covered by illuvial soils having a high compaction. The fields located on areas with slope higher than 10 %, those with landslides, the fields covered by vertisols and vertic soils and those covered by lithosols and lithic soils, the lands with the phreatic level less than 1.5 m from the surface, the ones located on depression landforms, and also the areas with high and very high soil porosity and permeability are excluded from this type of works. Considering this, it appears that the deep loosening is necessary to be carried out on a surface of 4,834 ha (fig. 7), meaning 10.55 % of the Lugoj Hills total agricultural land.

Fig. 7. The agricultural land of the Lugoj Hills requiring deep loosening works.
3.2.2. **The radical ameliorative fertilization works**

The radical ameliorative fertilization must be done on the fields which have suffered natural or anthropogenic fertility degradation processes, lacking humus or having very low humus reserves. These remedial actions contribute in this way to the improvement of the land quality by increasing the soil organic material.

For the agricultural land of the researched region, the radical ameliorative fertilization should be carried out on a surface of 2,670 hectares (5.83 %) (fig. 8).

![Map of the agricultural land of the Lugoj Hills area requiring radical ameliorative fertilization works.](image)

**Fig. 8. The agricultural land of the Lugoj Hills requiring radical ameliorative fertilization works.**

4. **CONCLUSIONS**

The anthropogenic intervention on the restrictive factors of the agricultural production could be done by the help of so called land quality enhancement works. There are two types of human remedial activities: those aiming the agricultural land development and those aiming the improvement of the agricultural land quality condition. Both types of works determine the decreasing of the restrictions imposed by different limiting factors or even their total removal.

In the context of some specific natural conditions and under the impact of the current agro-cultural works, the land from the Lugoj Hills area is affected by one or more restrictive factors due to the soil or environmental features.
The main curative actions necessary for the agricultural land of the Lugoj Hills are the following: flood control, surface drainage, deep drainage, land irrigations, erosion control works, deep loosening and ameliorative fertilization.

Identifying the areas targeted by the remedial actions and specifying their percentages of the total agricultural land of the Lugoj Hills are made in relation with the development and improvement works necessary to be realized. The spatial representation of the results offers a direct view, structured in an accessible style, easy to be observed and interpreted even by the non-experts.

REFERENCES


