THE EFFECT OF DEEP LOOSENING ON CROP PRODUCTION IN THE TRIAL PLOT
LACU SARAT, BRĂILA

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The results presented here were obtained within 1998-2004 period at the Lacu Sarat trial plot in natural conditions in the frame of the ameliorative field scheme and also the crops structure. The results are faced with the benchmark variant = 100, identified as the variant with the minimum ameliorative practices (only chemical fertilization, paraplaw tillage and amenderation), due to the lack of a real benchmark variant (without ameliorative interventions).

The aim of this paper is to emphasize the effect of the horizontal drainage, which is included into the ameliorative scheme of the Lacu Sarat trial plot, next to the deep loosening, ameliorative irrigation, ameliorative organic or/and mineral fertilization, plowing with or without soil material inverting, mulching, and amendment.

To help achieving the radical amelioration of the soil and a more efficient use of the land, alongside with the complex works for the amelioration of the saline and alkaline soils, during amelioration and exploitation itself, agrofitotechnical and agroameliorative measures should be applied.

Key words: deep loosening, treatment variants, yields

All over the world, and in our country too, deep loosening became an important agropedoameliorative measure, able to enforce the physical improvement of heavy and compacted soils, of those affected by alternately moisture excess and deficiency, and of other types of soils with limitations in yields capacity due to salinisation, alcalisation, pollution etc.

The soil deep loosening term includes all tillages which aim to increase lacunar space of the underlying layers of arable soil horizon, tillages not involving mixing, overturning or reversal of specific soil horizons.

Some contradictions and uncertainties have emerged and are maintained in terms of depth raising undergoing deep. Some researchers argue that deep loosening is the tillage to depths greater than 60 cm.

From the functional point of view, deep loosening causes a more rapid deployment and better ventilation, a shift in the chemical processes taking place in terms of compaction and sometimes excess moisture, developing a useful edaphic layer. Performed under optimal conditions, deep loosening is able to determine for
a period of 4-6 years, sometimes 7-8 years, a structural shift in position to eliminate the drawbacks caused by compaction and to ensure cost-effectiveness of this measure [2; 4].

The main characteristics of those tillages is that they are applied according to the specific conditions of the soil. Each ameliorative tillage belongs to a complex, aims to obtain amelioration of certain soil characteristics, so that, in the end the whole tillage set will lead to a consistent soil improvement in order to achieve favourable conditions for crops growth.

The aim of this paper is to emphasize the effect of the deep loosening, which is included in the ameliorative scheme of the Lacu Sarat trial plot, next to the horizontal drainage, ameliorative irrigation, ameliorative organic or/and mineral fertilization, plowing with or without soil material inverting, mulching, and amendment.

**MATERIAL AND METHOD**

In order to determine the influence of the different agropedoameliorative measures on the main field crop yields, the Lacu Sarat trial plot was set up in Braila county. This plot is sited in the Eastern Romanian Plain (Braila Plain), [5; 6] in a valley area which accumulates ground waters from the neighbouring higher areas, this phenomenon also being the cause of soil degradation processes by salinization and recurrent water excess. Surface deposits are made of loess and the texture varies from loamy-sandy to loamy-clayey. On the bottom of the valley, where the trial plot is sited, ground waters reach levels of less than 2 m and, in some parts, less than 1 m depth. Trial plot was located on slightly-moderately salinized a chernozem [7]. As far as climate is concerned, the trial plot is sited in the dry steppe [1], characterized by hot and dry summers, with a mean multiannual temperature of 10.9°C, precipitations of 452 mm annually, potential evapotranspiration of 705 mm and a climatic water deficit of 345 mm (Braila Weather Facility).

The natural conditions of the trial plot were the basis for the layout for several treatments (tab. 1):
- horizontal drainage;
- deep loosening;
- ameliorative irrigation;
- organic fertilization;
- chemical fertilization;
- soil tillage with soil material inverting;
- without soil material inverting (paraplow);
- mulching;
- amendment.

The trial plot, with a surface of 8 ha, was divided in eight technological treatments, each treatment being composed of several treatments.
Table 1

Improvements applied to Lacu Sarat trial plot, Brăila

<table>
<thead>
<tr>
<th>Treatment variants</th>
<th>Drainage</th>
<th>Treatments</th>
<th>Fertilization</th>
<th>Soil tillage</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>high intense (20 m)</td>
<td>organic</td>
<td>chemical</td>
<td>with soil material inverting</td>
</tr>
<tr>
<td></td>
<td>moderately intense (40 m)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>no drainage</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>V₁</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>V₂</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>V₃</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>V₄</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>V₅</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>V₆</td>
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<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>V₇</td>
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<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>V₈</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>V₈a (B)</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

V₁ - Drainage with 20 m between the drains + Deep loosening + Ameliorative irrigation + Organic fertilization + Chemical fertilization + Paraplow + Amendment;

V₂ - Drainage with 20 m between the drains + Deep loosening + Ameliorative irrigation + Chemical fertilization + Paraplow + Amendment;

V₃ - Drainage with 20 m between the drains + Deep loosening + Ameliorative irrigation + Chemical fertilization + Soil tillage with soil material inverting + Amendment;

V₄ - Drainage with 20 m between the drains + Ameliorative irrigation + Chemical fertilization + Paraplow + Amendment;

V₅ - Drainage with 20 m between the drains + Deep loosening + Chemical fertilization + Paraplow + Amendment;

V₆ - Drainage with 20 m between the drains + Deep loosening + Chemical fertilization + Paraplow + Mulching + Amendment;

V₇ - Drainage with 40 m between the drains + Deep loosening + Ameliorative irrigation + Chemical fertilization + Paraplow + Amendment;

V₈ - No drainage + Deep loosening + Ameliorative irrigation + Chemical fertilization + Paraplow + Amendment;

V₈a (Benchmark) - No drainage + Chemical fertilization + Soil tillage with soil material inverting + Amendment.


RESULTS AND DISCUSSIONS

relative values compared to the benchmark treatment = 100, which in the trial context can be considered $V_{8a}$ (No drainage + chemical fertilization + soil tillage with soil material inverting + amendment) which undergone the least improvements, an actual benchmark (with no improvement) treatment missing.

Before the deep loosening tillage, as the land was unused for a long period of time, a vegetation clearing tillage has been done. After the deep loosening tillage, in order to break up the sod and to land leveling, a disc harrowing tillage has been applied, with the hard disk GDG 4.2 on two perpendicular directions. This work was done by car from loose MAS-60, at a depth of 60 cm and the distance between crossings being 1.5 m.

The interpretation of yield data was carried out in order to highlight the influence of a sole improvement (technological link), by comparing the pairs of treatments with similar technologies, but lacking an improvement (the reference point) considered comparison treatment [3], (tab. 2) as follows: - for deep loosening $V_2$ variant (Drainage with 20 m between the drains + Deep loosening + Ameliorative irrigation + Chemical fertilization + Paraplow + Amendment) were compared with $V_4$ varianta (Drainage with 20 m between the drains + Ameliorative irrigation + Chemical fertilization + Paraplow + Amendment).

The use of deep loosening tillage as ameliorative treatment leaded to small improved increases for maize, sorghum, and sunflower, between 0 to 11%, with the exception of Sudan herb and maize green matter, which obtained increases of 11 to 18% (fig. 1).

![Figura 1 Variation of averaged relative yield (%) in crop due to deep loosening](image-url)
### Influence of deep loosening application in trial plot Lacu Sarat, Braila

<table>
<thead>
<tr>
<th>Influence of applied improvement</th>
<th>Agricultural year</th>
<th>Yield (kg/ha) Compared treatment</th>
<th>%</th>
<th>Reference treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Maize, Sorghum, Sunflower, Sudan herb</td>
<td></td>
<td>Maize, Sorghum, Sunflower, Sudan herb</td>
</tr>
</tbody>
</table>

V₂ - Drainage with 20 m between the drains + Deep loosening + Ameliorative irrigation + Chemical fertilization + Paraplow + Amendment; V₄ - Drainage with 20 m between the drains + Ameliorative irrigation + Chemical fertilization + Paraplow + Amendment.
CONCLUSIONS

1. The use of deep loosening tillage in the complex of measures leaded to improved increases of crop yields.

2. In addition to issues directly related to crop production that is practiced on saline soils or under different stages of improvement, deep loosening tillage in the context of other ameliorative methods contributes essentially to enhance soil improvement.

3. The most important conclusion is that even soils of slightly-moderately salinized chernozem type can have yields close to the ones obtained on unsalinized soils if deep loosening and other ameliorative technologies are applied.

BIBLIOGRAPHY