EFFECT OF AMELIORATIVE WORKS ON YIELDS IN EXPERIMENTAL FIELD LACU SARAT, BRAILA COUNTY

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Abstract
The management of saline soils requires a combination of agricultural practices depending on the careful investigations of soil characteristics, water quality and local conditions including climate, crops, economical, social, political, and cultural conditions of the environment, as well as the existent farm systems.

The research was carried out in the eastern part of the Romanian Plain (Braila Plain), in a depressionary area, on a slightly-moderately salinized chernozem. Taking into account the natural conditions of the experimental field, an improvement scheme on an eight hectares area was established, with multiple variants of ameliorative treatment.

The results presented in this paper 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 presented here are faced with the benchmark variant = 100, identified as the variant with the minimum ameliorative practices, due to the lack of a real benchmark variant.

INTRODUCTION
In all countries, there are concerns for improving saline soils and those with risk of salinization, to increase agricultural production, to reduce content of soil soluble salts, therefore to increase the range of crops suitable for these lands, to obtain technical elements to improve breeding technologies, environmental protection and economic efficiency of improvement technologies, and to increase standards of living in areas with saline and alkaline soils.

In Romania, saline soils have been identified in 29 of the 41 counties. Total area of these soils is about 614,000 ha. Generally, saline soils are located on low lands, in depressionary areas, with low natural drainage, and, sometimes, on hilly regions (saline soils on slope). On irrigated soils, as a result of increased groundwater level, the risk of salinization occurs mainly in soils with shallow groundwater and in drought conditions.
MATERIAL AND METHODS

The Lacu Sărat micro-depressionary area is located in the eastern part of Romanian Plain (Braila Plain or Northern Baragan), (Posea, 1989) in a micro depressionary area („crov”), on a total area of about 300 ha which accumulates groundwaters from neighbouring higher areas, this phenomenon also being the cause of soil degradation processes by salinization and recurrent waterlogging. This micro-depressionary area is a representative area for micro-depressionary areas from Northern Baragan affected by salinization. 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 located, groundwater table reaches levels of less than 2 m and, in some parts, less than 1 m depth. Groundwaters are moderat and strong mineralized (mineral residue of 1 – 4.5 g/l) in peripheric areas and low–moderat mineralized (4.5 – 11 g/l) in central areas of micro-depressionary area. Trial plot was located on slightly-moderately salinized chernozem (SRTS, 2003). The trial plot is sited in the dry steppe (Bogdan, 1999), characterized by hot and dry summers, with an average 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 Station).

The natural conditions of the trial plot (with an area of 8 ha) were the basis to design the layout for several treatments, each of them composed from several ameliorative works, as follows: horizontal drainage, deep loosening, ameliorative irrigation, organic fertilization, chemical fertilization, soil tillage with soil material inverting, soil tillage without soil material inverting, mulching and amendment.

RESULTS AND DISCUSSION

The yield for the studied crops in the trial plot for the agricultural years 1998 – 1999, 1999 – 2000, 2002 – 2003, 2003 – 2004 are presented both as absolute and relative values compared to the benchmark treatment = 100, which in the trial context can be considered the V8a variant (No drainage + chemical fertilization + soil tillage with soil material inverting + amendment) which undergone the least improvements, an actual benchmark (with no improvement) treatment missing (Table 1).

The interpretation of yield data was performed to highlight the influence of a single improvement, by comparison the pairs of variants related in terms of works, but differing by a specific improvement work (the first of them being considered the comparison variant), (Figure 1) as follows:

- For the influence of organic fertilizers V1 variant were compared with V2 variant - Under organic fertilization, yield increases could be noticed for all crops and for all years as follows: 18 - 50% for maize, 2 - 5% for sunflower, 7 - 35% for
### Table 1

**Improvements applied to Lacu Sarat trial plot, Braila**

<table>
<thead>
<tr>
<th>Treatment variants</th>
<th>Drainage</th>
<th>Fertilization</th>
<th>Soil tillage</th>
<th>Mulching</th>
<th>Amendment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>high intense (20 m)</td>
<td>moderately intense (40 m)</td>
<td>no drainage</td>
<td>Deep loosening</td>
<td>Ameliorative irrigation</td>
</tr>
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<td>V&lt;sub&gt;1&lt;/sub&gt;</td>
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<tr>
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</tbody>
</table>

**Fig. 1. Variation of mean relative yield (%) for different crops, due to ameliorative works**

Sorghum and 2 - 79% for Sudan grass. It could be noticed that the highest yields were obtained in the agricultural year 1998 - 1999, an agriculturally favourable
year, with precipitations of 563 mm, compared to the multiannual average of 452 mm and an annual mean temperature of 11.1°C compared to the multiannual average of 10.9°C, another explanation being the fallowing of the meadow before setting up the trial plot (Cotet, 2009a).

- For deep loosening $V_2$ variant were compared with $V_4$ variant - 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 grass and maize green matter, which obtained increases of 11 to 18% (Cotet, 2009b).

- For ameliorative irrigation $V_2$ variant were compared with $V_5$ variant - Ameliorative irrigation resulted, in agricultural year 1998 – 1999, to lower yields for all crops, namely between 4 and 6% for maize, sorghum, and 13% for Sudan grass, unlike the next years, when an yield increase for all cultures have been obtained, between 3 – 26%. This is explained by the fact that the first year was a wet year, leading to a less favorable aerohydric regime (Cotet, 2008).

- For soil tillage with soil material inverting $V_3$ variant were compared with $V_2$ variant - The application of tillage with soil material inverting, as an improvement methods, in the first two years leaded to yield decreases quite large, between 10 and 30%, excepting sorghum and sunflower, where yields are similar to the compared variant. In the further years, the decrease of yields is still present, but at lower values of 3 to 5% (Cotet, 2009c).

- For mulching $V_6$ variant were compared with $V_5$ variant - Mulching with straw gave no production increases, instead they were lower by 1-5%, except agricultural year 1999 - 2000 when the yield decline was 2-28%. The smallest decrease recorded sunflower yield between 2 and 5% (Cotet, 2008).

- For moderate drainage $V_7$ variant were compared with $V_8$ variant - Moderate drainage ($D = 40 m$) lead to important yield enhancements, between 6 and 36% in all crops, the highest being recorded for sunflower, 15 - 36%.

- For intense drainage $V_2$ variant were compared with $V_8$ variant - Intense drainage ($D = 20 m$) determined significant yield enhancements, reaching 25 - 114%, the highest being for maize green matter and sunflower.

- For without drainage $V_8$ variant were compared with $V_2$ variant - Without drainage ($D = 0 m$), but with the application of different ameliorative measures, low yields were obtained, even 50% lower than the reference treatment, with decreases of 20 - 53% for all crops.

- When no ameliorative measures are applied $V_{8a}$ variant were compared with $V_8$ variant - The yield decrease is obvious, but 4 - 24% lower than the previous case (Cotet et al., 2009).
CONCLUSIONS

1. The application of manure together with the other improvements had favourable effects, especially in maize, sorghum, and Sudan grass. The application of manure in doses of 60 t/ha leads to the improvement of permeability and structuring degree, the reactivation of microbiological activity etc., with positive effects together with other agropedoameliorative measures.

2. The use of deep loosening tillage in the complex of measures leaded to low increases of crop yields, excepting the Sudan grass, with yield increases between 11 and 18%.

3. Application of ameliorative irrigation has led to slight ameliorative production increases between 3 - 26%.

4. The tillage with soil material inverting has low or nonconclusive effects due to medium texture and relatively good soil characteristics. Favourable effect, although relatively moderate, had also the tillage without soil material inverting (paraplaw). Soil tillage at shallow depth and without soil material inverting is recommended, and in order to reduce subplough layer compaction, annually changes of ploughing depth are recommended.

5. Soil mulching has inconclusive effects in experimental conditions, causing slight decreases of yields.

6. Drainage triggered significant yield increases, the value being double in the case of intense drainage (D = 20 m).

7. The lack of drainage strongly affects the development of crop plants, due to the unfavourable air-water regime related to the presence of groundwater close to the surface.

8. The most important conclusion is that even soils like slightly-moderately salinized chernozem could have yields closed to the ones obtained on unsalinized soils.

ACKNOWLEDGEMENTS

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REFERENCES


