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 amendation), 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 anda 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, agrofitotehnical 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^{0}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

Treatment variants	Treatments										
	Drainage			Deep loosening	Ameliorative irrigation	Fertilization		Soil tillage		Mulching	Amendment
	high intense (20 m)	moderately intense (40 m)	no drainage			organic	chemical	with soil material inverting	without soil material inverting (paraplow)		
V_1	✓			✓	✓	✓	✓		✓		✓
V_2	✓			✓	✓		✓		✓		✓
V_3	✓			✓	✓		✓	✓			✓
V_4	✓				✓		✓		✓		✓
V_5	✓			✓			✓		✓		✓
V_6	✓			✓			✓		✓	✓	✓
V_7		✓		✓	✓		✓		✓		✓
V_8			✓	✓	✓		✓		✓		✓
V_{8a} (B)			✓				✓	✓			

V_1 - Drainage with 20 m between the drains + Deep loosening + Ameliorative irrigation + Organic fertilization + Chemical fertilization + Paraplow + Amendment;

V_2 - Drainage with 20 m between the drains + Deep loosening + Ameliorative irrigation + Chemical fertilization + Paraplow + Amendment;

V_3 - Drainage with 20 m between the drains + Deep loosening + Ameliorative irrigation + Chemical fertilization + Soil tillage with soil material inverting + Amendment;

V_4 - Drainage with 20 m between the drains + Ameliorative irrigation + Chemical fertilization + Paraplow + Amendment;

V_5 - Drainage with 20 m between the drains + Deep loosening + Chemical fertilization + Paraplow + Amendment;

V_6 - Drainage with 20 m between the drains + Deep loosening + Chemical fertilization + Paraplow + Mulching + Amendment;

V_7 - Drainage with 40 m between the drains + Deep loosening + Ameliorative irrigation + Chemical fertilization + Paraplow + Amendment;

V_8 - No drainage + Deep loosening + Ameliorative irrigation + Chemical fertilization + Paraplow + Amendment;

V_{8a} (Benchmark) - No drainage + Chemical fertilization + Soil tillage with soil material inverting + Amendment.

This paper presents the influence of deep loosening on the yields of the crops sown in the trial plot in the studied period (1998-1999, 1999-2000, 2002-2003, 2003-2004).

RESULTS AND DISCUSSIONS

The yield findings for the studied crops in the trial lot for the agricultural years 1998 – 1999, 1999 – 2000, 2002 – 2003, 2003 – 2004, both as absolute and

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*** $\mathbf{V_2}$ variant (Drainage with 20 m between the drains + ***Deep loosening*** + Ameliorative irrigation + Chemical fertilization + Paraplow + Amendment) were compared with $\mathbf{V_4}$ 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*).

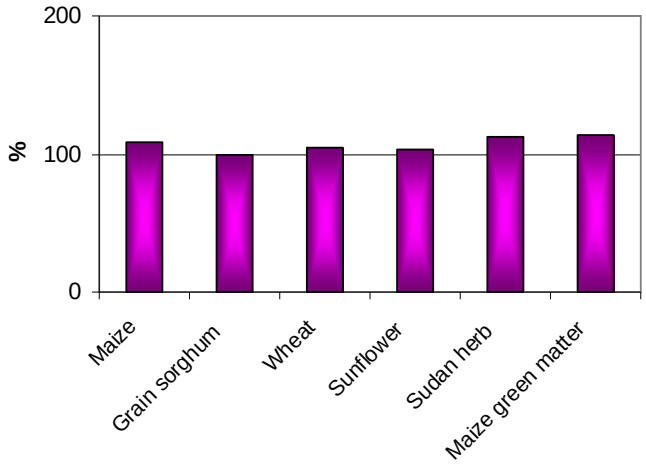

Figura 1 Variation of averaged relative yield (%) in crop due to deep loosening

Table 2

Influence of deep loosening application in trial plot Lacu Sarat, Braila

Influence of applied improvement	Agricultural year	Yield (kg/ha)								%			
		Compared treatment				Reference treatment							
Deep loosening (V2 – V4)	1998/1999	Maize	Sorghum	Sunflower	Sudan herb	Maize	Sorghum	Sunflower	Sudan herb	Maize	Sorghum	Sunflower	Sudan herb
		4884	3246	2535	500	4625	3233	2500	443	106	100	101	113
	1999/2000	Maize	Wheat	Sunflower	Maize green matter	Maize	Wheat	Sunflower	Maize green matter	Maize	Wheat	Sunflower	Maize green matter
		3748	4266	3285	28571	3390	4066	3185	24285	111	105	103	118
	2002/2003			Sunflower	Maize green matter			Sunflower	Maize green matter			Sunflower	Maize green matter
				1120	20100			1070	18000			105	112
	2003/2004			Sunflower	Maize green matter			Sunflower	Maize green matter			Sunflower	Maize green matter
				1125	20200			1080	18200			104	111

V_2 - Drainage with 20 m between the drains + Deep loosening + Ameliorative irrigation + Chemical fertilization + Paraplow + Amendment;
V_4 - 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.

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