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RESEARCH ON THE INFLUENCE OF IRRIGATION ON THE MAIN FEATURES OF THE TYPICAL CHERNOZEM FROM BAILESTI PLAIN

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Abstract

In order to study how the long term irrigation influences the typical chernozem from Bailesti Plain as regard the morphological, physico-mechanical and chemical features there was, in the same time, studied a typical chernozem that was cropped rainfed. There was established that the main morphological features do not differ from the rainfed treatment, while the physico-chemical ones have significantly changed. The bulk density has increased over the entire soil profile; the total and the aeration porosity have decreased due to compaction determined by irrigation, the hydro physical indicators have recorded higher values and the humus content has decreased, especially within the shallow horizons. The total nitrogen content with the irrigated soil has decreased and the reaction has modified recording an increasing on the entire soil profile as a result of high accumulation of limestone from the irrigation water.

INTRODUCTION

Irrigation is one of the most important measures of the cropping systems with a high impact upon physical and chemical features. In this respect, the irrigated surfaces from our country raise a series of problems, especially in plain zones where the soils have a short profile with an enriched salt substrate and seldom, with shallow watertable or low mineralized, aspects that determine a negative evolution of these soils, the recovery of fertility of these soils being very costly, the prevention of the negative influence being a necessity of high importance for the irrigation terrains.

MATERIAL AND METHODS

There were accomplished comparative researches on a typical chernozem that was cropped and irrigated a long period of time (over 25 years) as well as with a typical cropped, rainfed chernozem, both situated near Bailesti, next one another that evolved in similar conditions. The typical chernozem was formed on loess deposits with the watertable at 4 m deep, very good permeability, rich in humus, silty texture, alkaline reaction.

The irrigation water comes from Danube and it has no high salinisation degree, so it is not harmfull for the soil (under 200 mg/l).

RESULTS AND DISCUSSION

The researches that have been carried out on the field as well as in laboratory in order to know the evolution of the soil profile of the typical irrigated chernozem over the rainfed one taken as control have emphasized modifications of the main features.

In this manner, the irrigated soil morphological features do not show essential changes. However, there are recorded at the base of the Ap horizon of discontinue compacted zone a more degraded structure over the rainfed one. Also, there is recorded a tendency of lifting of the salts toward the soil surface and humus taking along on a deeper zone.

The physical properties of the irrigated soil have suffered more evident changes. The bulk density have recorded an increasing on the soil profile as a result of the irrigation water recording the 1.48 g/cm^3 under the 25 cm depth that is the usual depth of plowing (table 1a; b). This tendency of plowpan formation was noticed over the entire irrigated chenozem zone from Bailesti Plain.

Table 1a

The main physical features of the typical, rainfed chernozem from Bailesti Plain

Horizon	Size fractions %				Bulk dens. (g/cm^3)	D (g/cm^3)	Tp (%)	Ap (%)	Hygr. Coeff (%)	ME (%)
	Thick sand 2-0.2	Fine sand 0.2-0.02	Silt 0.002-0.0002	Clay < 0.0002						
Ap 0-25 cm	8.5	42.1	22.4	27.0	1.33	2.64	50	22	6.2	21.2
Am 25-60 cm	8.4	40.9	23.2	27.5	1.43	2.64	46	15	6.3	21.7
AC 60-90 cm	7.1	41.4	24.4	27.1	1.40	2.66	48	18	5.9	21.5
C < 90 cm	7.9	43.2	22.8	26.1	1.37	2.70	50	22	4.9	20.1

The soil compaction determined by the irrigation has conducted to the decreasing of the total and aeration porosity on the irrigated soil. Thus, the total porosity has decreased with the irrigated soil by 1-2% over the rainfed one and the aeration porosity is lower by 1-3%.

The granulometric analysis does not show evident changes. Among the two studied soils, the thick fractions of both soil profiles can not be put as a result of irrigation. The higher clay quantities from the inferior soil horizons are determined by the action of irrigation water that takes along the fine fractions on the depth of the soil profile.

As regard the hydro physical properties they have recorded light changes by irrigation applying. The hygroscopicity coefficient and the moisture equivalent have higher values with the irrigated soil into the horizons where the clay content is higher, too.

Table 1b

The main physical features of the typical, irrigated chernozem from Bailesti Plain

Horizon	Size fractions %				Bulk dens. (g/cm^3)	D (g/cm^3)	Tp (%)	Ap (%)	Hygr. Coeff (%)	ME (%)
	Thick sand 2-0.2	Fine sand 0.2-0.02	Silt 0.002-0.0002	Clay < 0.0002						
Ap 0-25 cm	8.3	43.2	21.8	26.7	1.35	2.65	49	21	6.1	21.6
Am 25-55 cm	8.2	40.9	22.3	28.6	1.48	2.65	44	12	6.5	22.4
AC 55-80 cm	6.4	42.5	23.8	27.3	1.41	2.68	48	18	5.9	21.2
C < 80 cm	7.0	44.6	21.9	26.5	1.40	2.70	48	19	5.1	20.7

Table 2a

The main chemical features of the typical, rainfed chernozem from Bailesti Plain

Horizon (cm)	Humus (%)	Total N (%)	P_2O_5 (mg/100 g soil)	K_2O (mg/100 g soil)	$CaCO_3$ (%)	pH (H_2O)	T (me/100 g soil)	V (%)
Ap 0-25 cm	4.42	0.210	22.0	28.8	0.9	8.1	34.71	100
Am 25-60 cm	3.96	0.189	9.1	13.4	2.7	8.1	33.13	100
AC 60-90 cm	2.96	0.140	5.0	9.6	8.2	8.2	33.46	100
C<90 cm	1.28	0.096	2.5	8.2	18.9	8.3	28.90	100

The chemical features record changes with the irrigated soil, as well (table 2b). Thus, the humus content is lower with the typical, irrigated chernozem, especially within the shallow layer. The total nitrogen has recorded changes in the same way as the organic matter with the rainfed soil as a result of different oxide-reduction conditions within the first 35 cm, there was accumulated a higher nitrogen quantity over the irrigated soil (table 2a).

Table 2b

The main chemical features of the typical, irrigated chernozem from Bailesti Plain

Horizon (cm)	Humus (%)	Total N (%)	P_2O_5 (mg/100 g soil)	K_2O (mg/100 g soil)	$CaCO_3$ (%)	pH (H_2O)	T (me/100 g soil)	V (%)
Ap 0-25 cm	3.60	0.185	16.6	18.0	4.2	8.3	36.95	100
Am 25-60 cm	3.52	0.175	15.8	15.4	4.3	8.3	36.96	100
AC 60-90 cm	2.16	0.119	8.2	12.0	12.6	8.4	36.59	100
C<90 cm	1.76	0.106	5.5	9.6	17.8	8.5	31.33	100

Due to the irrigation water that contains lime, there was accumulated a higher lime quantity, especially within the shallow layer. Thus, within the Ap horizon the lime quantity has increased from 0.9% within the rainfed soil to 4.2% with the irrigated soil (table 2b).

The exchangeable capacity of ions records a slight increase within the first 100 cm with the irrigated chernozem over the rainfed one.

The higher lime accumulation on the soil profile has determined a change of its reaction, too. Thus, with the typical, irrigated chernozem there was determined an increase of the pH value on the entire soil profile, with more evident differentiations within the first horizons.

CONCLUSIONS

1. By irrigation and unsuitable cropping measures for a long time period the typical chernozem from Bailesti Plain has recorded some changes. Thus, the irrigated soil was more compacted, its structure was a little damaged, especially within the shallow layer as well as a decrease of the porosity.
2. The irrigation has determined a decrease of the organic matter quantity, an increase of the lime content and a change toward alkaline sector of the soil reaction.
3. The changes under the influence of irrigation have not determined the accentuated improvement of the soil properties maintaining a good environment for plant development.
4. Through observations that were made in the irrigation system Calafat – Bailesti there was noticed a raising of the watertable level in lower sites, in some places, the water reaching the soil surface. This phenomenon can

determine the secondary salinisation or soil waterlogging and radical lose of the soil fertility.

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