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INFLUENCE OF SOIL CONDITIONS ON MAIZE CROP AT TWO AGRARY SOCIETIES LOCATED IN BRAILA AND BUZAU COUNTIES

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Abstract

The scientific paper shows the differences of yield level at maize crop inside two agrary farms, at similar crop technology application. The differences are explained by the soil influence, respectively vertic chernozem at the first farm and typical chernozem at the second one. The analysis of maize crop during vegetation, as well as the level of yield at both farms (in t/h) revealed that low water permeability, the field water capacity and withered coefficient have been the restrictive elements for vertic chernozem. So, despite quite similar technology, the maize yield was 9.5 t/ha on chernozem soil at one farm and 8 t/ha on vertic chernozem at the second farm, which represents almost 16% difference between the two agrary units. Results reveal that, at similar crop technology, the soil is the one element which can make a significant difference.

INTRODUCTION

The present work-paper has as objective the analysis of the soil influence on maize crop, in its position as active layer for plants. The study is based on the results obtained at two agrary societies from Braila and Buzau counties, in 2008 agrarian year.

MATERIAL AND METHODS

The study took place at two agrary units, respectively SC Agroterra SRL located in Viziru area - Braila county and SC Agrisan SRL, located in the area of Buzau town. The fields at SC Agroterra SRL are represented by chernozems, while at SC Agrisan SRL the soil is vertic chernozem (figure 1). For soil type establishing, Soil Map of Romania has been consulted, 1: 1 000 000 scale, elaborated by Romanian Research Institute for Pedology and Agrochemistry and, in parallel, soil samples were prevailed from the fields of the two agrary societies, in order to determine a few of the soil indicators, necessary in underlining the influence of soil type.

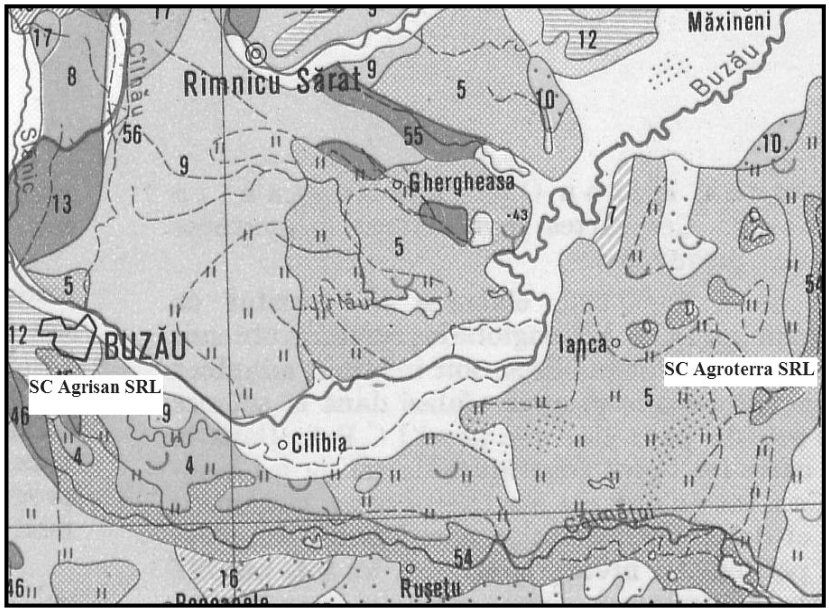

Fig. 1. Soil type at the two agrary units - chernozem at SC Agroterra SRL (5) and vertic chernozem at SC Agrisan SRL (12) (extras from Soil Map of Romania, 1: 1 000 000 scale, ICPA Bucharest)

Regarding cultivation technology at maize crop, it is to mention that the technological elements have been very similar, as follows:

- previous crop: winter wheat at SC Agroterra SRL and two row winter barley at SC Agrisan SRL
- fertilization: NPK 20-20-20 (200 kg/ha) and 100 kg/ha ammonium azotate at both agrary units
- maize hybrid: Thermo, produced by Syngenta company
- sowing time: April, the 18th at SC Agroterra SRL and April 22nd at SC Agrisan SRL
- herbicides: preemergence Guardian 2 l/ha and postemergence Mistral 1 l/ha and Calisto 0.3 l/ha, at both farms
- irrigation in both cases
- crop harvesting humidity: 12% at both farms.

During vegetation period, all maize surfaces have been monitorized at both farms, modification in plant growth have been observed comparatively and pictures have been taken, with main purpose of emphasizing the differencies which appear as a result of soil influence. Soil characterization coefficients are appreciated in according with The Methodology of Pedologic Studies Elaboration [1].

RESULTS AND DISCUSSION

The study has been made on two soil units, chernozem and vertic chernozem, which present a few notable differentiation in terms of soil characteristics, an aspect reflected in the plants development in their first stages of vegetation, as well as in the yield data. Thus, at SC Agrisan SRL, on vertic chernozem, a slowing of growth at maize plants during their first vegetation stages was discovered, due to a lower permeability of this kind of soil, as well as its more unfavourable features, compared to chernozem from SC Agroterra SRL. In table 1 a series of soil characterization data are shown, both for SC Agrisan SRL vertic chernozem, Buzau county and typical chernozem from SC Agroterra SRL, Braila county. As the table data show, there are differencies between the two soil types, regarding clay content, total porosity, permeability, whitered coefficient and field water capacity (table 1).

Table 1

Values of a few soil indicators at chernozem from SC Agroterra SRL and vertic chernozem from SC Agrisan SRL

Chernozem - SC Agroterra SRL (Braila county)								
Soil profile	**Mineral composition**			**B.D. (g/cm^3)**	**TP (%)**	**K (mm/h)**	**FWC (%)**	**WCf (%)**
	Sand (%)	**Loam (%)**	**Clay (%)**					
Ap	41.5	31	27.5	1.21	52	4.8	27.1	9.4
Am	41	33.4	25.6	1.17	56	2.70	25.6	10.2
A/Cca	41.6	32.6	25.8	1.19	55	2.63	24.4	10.6
Cca	43	32.4	24.6	1.22	53	1.46	22.7	9.7

Vertic chernozem – SC Agrisan SRL (Buzau county)								
Soil profile	**Mineral composition**			**B.D. (g/cm^3)**	**TP (%)**	**K (mm/h)**	**FWC (%)**	**WCf (%)**
	Sand (%)	**Loam (%)**	**Clay (%)**					
Apy	22.7	34.2	43.1	1.20	52.1	11.2	24.5	10.3
Amy	22.3	33.4	44.3	1.37	46.5	0.5	23.8	12.1
Bvy	24.5	30.7	44.8	1.43	43.4	0.4	22.4	14.3
Cca	28.3	29.5	42.2	1.50	43.1	0.3	22.1	13.8

So, at SC Agroterra SRL chernozem, the clay content in all four soil horizons is between 24.6 – 27.5% limits; that, along with sand and loam values generates a loamy texture. Instead, at vertic chernozem from SC Agrisan SRL, the clay content is increased in all soil horizons (values from 42.2 – 44.8%), generating a fine texture. This is also reflected in bulk density values, more increased at vertic chernozem, compared to chernozem from SC Agroterra SRL (BD is 1.22 g/cm^3 at chernozem and 1.5 g/cm^3 at vertic chernozem). More, total porosity (TP) has a decreasing tendence (52% minimum value at chernozem, respectively 43.1% minimum value at vertic chernozem), which means high and very high porosity in the first case and decreased porosity in the second case. Table data also show the diminution of water and air permeability at vertic chernozem: values between 0.3 – 0.5 mm/h in depth horizons (appreciated as very low), compared to supraunitary values of permeability at chernozem (in this case, permeability is appreciated as normal for all soil horizons). It is also to mention the increasing of whitered coefficient at vertic chernozem (WCf is between 10.3-14.3%), in comparison to its values on chernozem soil (9.4-10.6%).

The high values of bulk density, associated with lower permeability at vertic chernozem generated a more reduced starting in vegetation for plants at SC Agrisan SRL, in comparison with SC Agroterra SRL crop, as could be observed in the field (figure 2). This aspect, as well as the appearence of flat bog phenomenon three weeks after sowing time, leaded to 10% decreasing the crop density.

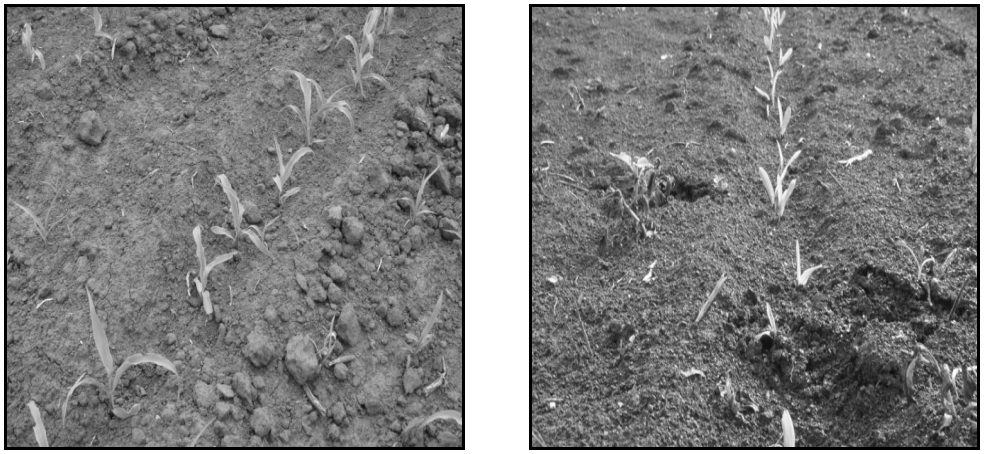

Fig. 2. Plant growth differencies in the first stage of vegetation SC Agroterra SRL (left) and SC Agrisan SRL (right)

Despite their reduced start, maize plants from SC Agrisan SRL had a normal growth during vegetation, except for some periods in July when, due to the lack of rainfalls and delay of irrigation, they deeply experienced the lack of water at soil level, which caused temporary wither of plants. It is also to mention that

vertisolage process and the cracks appearence in the soil surface (during warm season) generated temporary disturbance for maize plants on vertic chernozem from SC Agrisan SRL (as could be observed in figure 3).

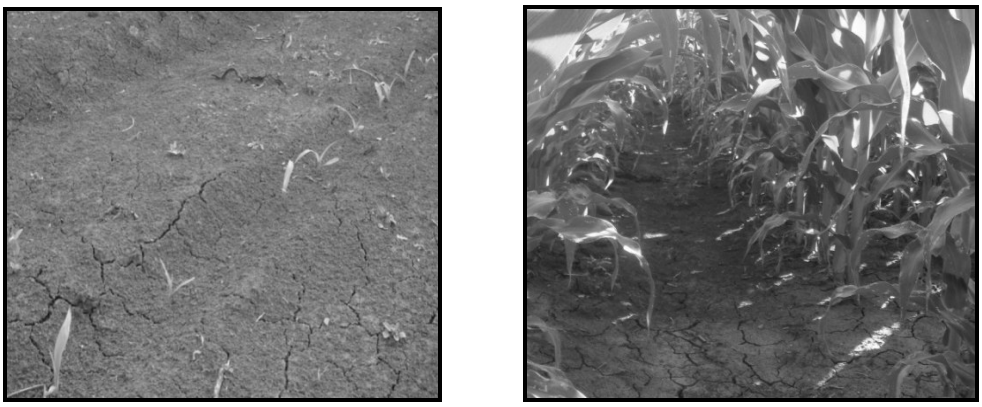

Fig. 3. Cracks in surface horizon at vertic chernozem in the area of Agrisan SRL (at different stages of plants vegetation)

All these differences between soils have been reflected in the maize yields, at the same technology application. The influence of soil has been observed at yield level registered at the two societies, in condition in which the crop technology has been almost the same. This way, at SC Agroterra SRL from Braila county, the maize yield (t/ha) has been 9.5 (grains), while at SC Agrisan SRL from Buzau county the maize yield was 8.5 t/ha (figure 4). It isn't a very significant difference; however, it is notable, if we think that soil is different only at subtype level (chernozem, in first case, vertic chernozem, in the second one). However, the results show how striking the influence of soil can be in some cases, especially when we deal with the same crop technology.

CONCLUSIONS

1. At two agrary societies, located in Braila and Buzau counties, the maize yields (t/ha) have been different at similar crop technology application.
2. The only element which created differencies regarding yields was the soil: chernozem at SC Agroterra SRL and vertic chernozem at SC Agrisan SRL.
3. The vertic features of chernozem from SC Agrisan SRL (increased bulk density, lower permeability, high clay content) generated differences at maize crop for the two farms.
4. The yield was 9.5 t/ha on chernozem soil and 8 t/ha on vertic chernozem, which represents almost 16% difference between the two agrary units.

5. Results reveal that, at similar crop technology, the soil is the one element which can make a significant difference.

Fig. 4. Maize yield (t/ha) at the two agrary units, on different soil subtype

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