

Soil-water contact angle of some soils of the Russian Plane

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INTRODUCTION

Soil wettability affects the aggregate water resistance, the movement of moisture and dissolved substances, preferential flows, etc. There are many factors affecting the soil's wettability (the content of organic matter (OM), soil's mineralogical composition, particle size distribution), so it can reflect changes in the soil, including results of human impact. The quantitative characteristic of soil wettability is a contact angle (CA), its measurement is a new and difficult problem because of the complexity, heterogeneity and polydispersity of the object of investigation. The aim of this work is to study soil-water CA of some soils of the Russian Plane.

MATERIALS AND METHODS

The objects of study were sod-podzolic (Umbric Albeluvisols Abruptic, Eutric Podzoluvisols), grey forest non-podzolised (Greyic Phaeozems Albic, Haplic Greyzem), typical Chernozems (Voronic Chernozems pachic, Haplic Chernozems) - profiles under the forest and the arable land, and the chestnut (Haplic Kastanozem Chromic, Haplic Kastanozem) soils. The CA's determination was performed by a Drop Shape Analyzer DSA100 by the static sessile drop method. For all samples was determined the content of total and organic carbon (OC and TC) by dry combustion in oxygen flow.

RESULTS AND DISCUSSION

There is CA increasing from 85,1° (5 cm) to 40-45° (deeper, than 45 cm) in the sod-podzolic soil; OC content is changed at the same depths from 1,44 to 0.22%. We can see the similar picture in profiles of chernozems. In the forest profile the highest OC content and CA value are achieved on the surface of profile (6,41% and 78,1°), and by 90 cm these values are 1.9% and 50.2°. In the chernozem under the arable land the OC content is almost two times less and the profile is more wettable (from 50° to 19° at 5 and 100 cm).

Corresponding with the OC content, the curve describing changes of CA in the profile of grey forest soil is S-shaped with peaks at 20 and 150 cm (81,3° and 70° respectively). The chestnut soil profile has the same distribution of the CA-values (47, 33, 42 and 20° at depths of 5, 25, 45 and 85 cm), although in this case the wettability increasing at 45 cm is related with the appearance of calcium carbonates (about 1.3%) at this depth.

CONCLUSIONS

A general trend of decreasing the OC-content down the profile, accompanied by increasing of surface's wettability was observed in all of the studied profiles.

In soils containing carbonates, graphs of the CA-change with the depth are repeating the graphs of the TC-content, so we can talk about hydrophobising role of calcium carbonate. Soils with the big differences in the OC-content in the upper horizon had in this part of the profile comparable CA-values, which suggests that the water repellency of the soil's solid phase is explained not only by a quantitative but by a qualitative composition of OM, as well as mineralogical composition of the solid phase.