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Possibilities of using different approaches to assessing the resistance of organic matter of fallow soils to mineralization

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Fallow lands, the area of which in Russia can be up to 40 million hectares, are considered both a very significant potential sink and a source (with a change in the land use system) of CO_2 in the soil-plant-atmosphere system. The return of fallow lands to agricultural circulation can lead to an abrupt emission of CO_2 into the Earth's atmosphere due to the mineralization of a significant part of the organic matter (OM) accumulated under fallow vegetation over the past decades. Forecasting the scale of CO_2 emissions from fallow soils when changing the land use system is an actual task, the solution of which should consider both the quantitative parameters of the accumulation of pollutants under fallows and their potential susceptibility to mineralization.

The purpose of the work is to study the effectiveness of various approaches to the assessment of stable and labile components of the pool of OM of fallow soils, in the aspect of assessing the susceptibility to microbial destruction. As the object of the study, a fallow site aged 15-20 years was used, on which 3 sites with low, medium and high reserves of OM were allocated. At each of the sites, 2 pits were laid, for layer-by-layer (after 5 cm) sampling from the old arable horizon. In the samples, the total content of OM and soluble OM in a mixture of $Na_4P_2O_7$+NaOH was determined. Also, the amount of OM oxidized 0.167 mol/l $K_2Cr_2O_7$ in 5 N H_2SO_4 solution (easily oxidized fraction of OM according to the Khan method [1]) was determined.

A significant differentiation of the old arable horizon was revealed both in terms of the total content of OM and in terms of the content of alkali-soluble and easily oxidized OM. At the same time, when calculating the carbon content of the alkali-soluble and easily oxidized parts of the OM as a percentage of the total organic carbon, the patterns of differentiation of the old arable horizon are different. The proportion of alkali-soluble carbon in the total pool of organic carbon in the old arable horizon increases, from 44.3% in the 0-5 cm layer to 53.0% in its lower part (deeper than 15 cm). According to the content of easily oxidized carbon, there is a decrease in its proportion in the total pool of organic carbon, from 56.0% in the 0-5 cm layer to 43.6% in its lower part. The difference in the patterns of differentiation of the old arable horizon in terms of the content of labile OM is associated with the fact that a part of detritus, insoluble in alkali, also enters the composition of easily oxidized OM.

It can be concluded that the use of the stepwise oxidation method to assess the potential susceptibility of OM of fallow soils to mineralization is a more informative indicator, since along with taking into account the labile part of OM, it allows objectively taking into account its detritus component, potentially susceptible to oxidative degradation.

Possibilities of using different approaches to assessing the resistance of organic matter of fallow soils to mineralization.

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