CONVERSION OF ARABLE LAND INTO ABANDONED INCREASE STABILITY OF SOIL ORGANIC MATTER

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The thermal and microbiological stability of soil organic matter (SOM) of arable and abandoned soils formed on Luvic Phaeozems in the subtaiga zone of Western Siberia were assessed during the study. Over a 30-year period of the arable land conversion to the abandoned, soil carbon stocks to a depth of 100 cm increased by 36%, ¾ of which were stored in the topsoil (0-30 cm). The thermally labile pool (49–51%) dominated in the structure of the accumulated SOM, while the total proportion of the stable and overstable pools of the accumulated SOM was 19% and 29% in the topsoil (0-30 cm) and the subsoil (30–100 cm), respectively. The activation energy of the SOM thermal oxidation, calculated from the data of differential scanning calorimetry and thermogravimetric analysis of the soils, was 62 kJ mol^{-1} for the thermally labile SOM pool, 149 kJ mol^{-1} for the stable pool, 214 kJ mol^{-1} for the overstable pool and 306 kJ mol^{-1} for the super stable pool. The activation energy of SOM thermal oxidation, quantified as the activation energy of individual pools and their contribution to the SOM structure, increased by 2 kJ mol^{-1} during conversion of the arable soil to the abandoned (from 121 kJ mol^{-1} to 123 kJ mol^{-1}). Basal respiration per unit of soil organic carbon increased 2.4 times in the top 5-cm depth of the abandoned soil compared to the arable, and decreased by 14% in the subsoil below 30 cm marking an increasing resistance of SOM to microbial decomposition in the deeper soil. The exponential relationship between thermal stability of SOM and microbial respiration was established for both the arable and the abandoned soils. This shows that the thermal analysis approach can be a useful tool for estimating the resistance of SOM to microbial decomposition.

Key words: soil organic matter, carbon sequestration, thermal stability, activation energy.