Effect of sludge amendment on soil organic carbon and glomalin related soil protein in reconstructed mine substrates during 9-year reclamation

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Abstract

A plant-complex substrate-microbe ecological restoration system was constructed in field and sludge was added to the reconstructed mine soils in order to speed up the reclamation process. The effect of sludge addition on plant growth, microbial activity, soil aggregate stability and aggregation-associated soil characteristics in 9-year chronosequences was monitored. The results showed that the height and the total biomass of ryegrass with sludge amendment increased with the reclamation time and eventually reached 1.5 times and 4.3 times respectively higher than the control (CK1) after 9 years. The sludge amendment enhanced the content of aggregate binding agents such as SOC and glomalin and the soil aggregate stability. The SOC, LFOC and HFOC in RMS were increased by 151.35%, 247.41% and 132.82% over the CK1, respectively. A similar trend was also observed for GRSP. Besides, the stable indexes of soil aggregates had been increasing until the seventh year. In short, the tested variables in reconstructed mine soils after 3-7 years were insignificantly different from them in the treatment without sludge amendment after 9 years (CK2). Furthermore, a significant positive correlation between GRSP and SOC was investigated in RMS, as well as GRSP and soil structure-related variables. Biological stimulation of SOC and GRSP to soil accelerated the recovery of soil structure and ecosystem function. Consequently, the plant-complex substrate-microbe ecological restoration system can be used as an effective technique in early mining soil reclamation.

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