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The evaluation for soil carbon sequestration with rice straw treatments in paddy fields

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Abstract

Rice straw is very important to maintain fertility in agricultural soil with several aspects such as carbon and nitrogen cycles in Korea. Recently, concerning about climate change, carbon sequestration in agricultural land has become one of the most interesting and debating issues. Rice straw is most representative source of organic material produced in agricultural sectors. In order to evaluate changes of soil carbon treated by rice straw during cultivating rice in paddy field, we carried out to treat rice straw with 0, 0.5, 1, 1.5, and 2.0 ton ha⁻¹ at 50 x 50 x 20 cm blocks made of wood board, and analyze contents of fulvic acid and humic acid form, and total carbon periodically. The experiment was conducted in 2013-2016, and sampled with interval in a month. The organic material was applied to treatment blocks in 2 weeks ago in rice transplanting of each year. Total carbon in beginning time is low as 7.9 g kg⁻¹. The contents of total carbon with treatments of rice straw after experiment are recorded as 8.7, 11.2, 9.5, 10.5, and 10.9 g kg⁻¹ applied by 0, 0.5, 1, 1.5, and 2.0 ton ha⁻¹, respectively. When trend lines were calculated on changes of soil carbon in periods of experiments, The trend equations of soil carbon changes with treatments of 0, 0.5, 1, 1.5, and 2.0 ton ha⁻¹ were $Y=0.0015X+8.479$, $Y=0.073X+8.2577$, $Y=0.0503X+8.4477$, $Y=0.0822X+8.2103$, and $Y=0.082X+8.5736$. These trends suggested several results. When rice straw was applied in cultivating paddy fields, most carbon in rice straw would be decomposed regardless the amount of rice straw in soil. We calculated sequestration rate of applied rice straw as about 0.1% per year during rice cultivation in paddy fields. It means that if farmer want to increase 1% soil organic matter by using application of rice straw returned after cultivation, famer should apply rice straw continuously for ten years. The change of soil carbon as fulvic acid, humic acid, and humane is showed that only content of carbon as mumine is increased significantly while fulvic acid and humic acid were changed in range of 10 to 30% among total carbon in soil. In conclusion, to sequestrate soil carbon with rice straw, it is important for rice straw to apply continuously every year. The amount of rice straw applied is not much effected to increase soil organic matter.

Keywords: decomposition of rice straw, soil carbon, sequestration, fertility

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