Construction of a Highly Business-Profitable Sewage Sludge Circulation System through Composting in Collaboration with Local Industries

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[Abstract]

Key Words: Sewage sludge, Newly developed sewage sludge compost, Tea cultivation, Regional biomass, Regional linking

The objective of this study is to mass-produce newly developed sewage sludge compost (NSSC) using regional biomass and to establish a highly profitable recycling process for tea cultivation. In sub-theme 1, a pilot-scale co-composting process (volume: 5 m^3) was conducted using sewage sludge (dewatered sludge) and plant biomass such as bamboo sawdust, rice bran, and shochu lees, and the process was optimized for the development of the mass production technology of NSSC. In sub-theme 2, we applied the NSSC mass-produced in sub-theme 1 to tea cultivation and evaluated the possibility of using NSSC as a substitute for commercially available organic fertilizers. In addition, we clarified the fertilizer cost reduction effect when using the NSSC for tea cultivation. In the pilot-scale co-composting test of the NSSC, the main components of mineral nitrogen, available phosphate, and soluble potassium were found to be comparable to the target values (N: P_2O_5: K_2O = 4.0%: 3.2%: 1.5%). The main components of the NSSC obtained in the mass production test were within the permissible margin of error (±20%) established by the Fertilizer Control Law, confirming the reproducibility through the co-composting process. Furthermore, by incorporating the results of composting temperature changes and microbiome analyses, the NSSC could be produced within 60 days, the target composting days. As a result of the germination and growth tests of the NSSC using komatsuna, the fresh weight index of the NSSC was significantly higher than that of the commercial sewage sludge compost, indicating its promoting effect on plant growth. In the tea cultivation test using the NSSC, the tea yields were equal to or better than those of the conventionally fertilized areas, indicating that the NSSC can be substituted for rapeseed cake (conventional organic fertilizer) as a fertilizer. The concentration of metals and heavy metals in the NSSC-fertilized soil did not change significantly during the tea cultivation tests, and the values were below the soil environmental standard. In the NSSC-fertilized area, the concentration of nitrogen leaching was lower than that in the conventionally fertilized areas; therefore, the NSSC was found to be an environmentally friendly fertilizer. Besides, the amount of heavy metals in the infiltrated water was similar to that in the conventional areas. This study showed that replacing all rapeseed cakes with the NSSC could reduce fertilizer costs by 36.6%.

[References]

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