

Carbon Transfer and Accumulation in Farmlands

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Abstract

For considering probable long-term burden to the natural environment due to ^{14}C released from the spent nuclear fuel reprocessing plant in Rokkasho, Japan, during the period of its planned operation of 40 years, the most important target of concern is ^{14}C accumulation in the widespread forests around the plant. Although the total area of tillage, including paddy field, farm land and pasture, accounts for about 15% of the total area of Aomori prefecture, prevails in the Rokkasho area and pastures are widely spread over the local area exceeding 70 % of the total agricultural fields there. Therefore, the tillage, including farmlands, should be taken into account for modeling long-term transfer and accumulation of ^{14}C in the environment around the reprocessing plant. In this research program, the transfer and accumulation of carbon in the tillage have been experimentally studied using representative plants for photosynthetic carbon fixation such as carrot, Japanese radish, Timothy grass, and rice plant.

Developing a mathematical transfer and accumulation model of ^{14}C in farmlands requires investigation of carbon transfer from the atmosphere to plants through photosynthesis and carbon release by decomposition of organic matter in soil. To investigate the fixation of carbon by photosynthesis in farmland, temporal changes in plant biomass of four plants in actual fields, carrot and Japanese radish (crop fields), Timothy grass (pastures) and rice plant (paddy fields) were surveyed. The annual amount of litter was calculated to be 35 g-dry m^{-1} (Timothy), 310 g-dry m^{-1} (rice), 170 g-dry m^{-1} (carrot) and 59.6 g-dry m^{-1} (Japanese radish). In addition, a plant cultivation system using soil of actual farmlands was constructed for the experiment to measure carbon fluxes in the Closed Plant Experiment Facility (CPEF).

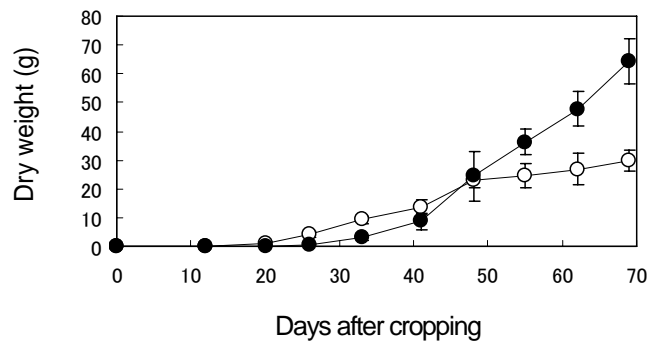


Fig. 1 Changes in dry weight of Japanese radish.
Open circle and closed circle denote shoot and root, respectively.



Fig. 2 Cultivation system using actual field soil (Timothy).



Fig. 3 Cultivation system using actual field soil (rice plant).