Two years observation results of radiocesium fate in some trees after the Fukushima Daiichi nuclear power plant accident

Keiko Tagami, Shigeo Uchida
Office of Biospheric Assessments for Waste Disposal, National Institute of Radiological Sciences

Abstract – To measure the decreasing trend of radiocesium in some trees after the Fukushima Daiichi nuclear power plant accident, a continuous sampling of tree tissues (leaves, branches and fruits) was carried out in Chiba, Japan for about two years. Radiocesium concentration in each tissue tends to decrease, however, since radiocesium can translocate in a tree, slight increase in new leaves in early spring was observed for some tree species. Because radiocesium mobility was low in soil, root uptake pathway would provide limited contribution to the total radiocesium amounts in trees; the radiocesium by foliar uptake after the accident still remains in trees.

Keywords – Cesium-137, translocation, foliar uptake, root uptake

I. INTRODUCTION

Radiocesium (^{134}Cs and ^{137}Cs) released from the Fukushima Daiichi nuclear power plant due to the reactor failures after the great earthquake and tsunami of March 11, 2011 is recognized as the only major contaminant in the terrestrial environment now. Decontamination of forests is the most difficult task because they occupy large areas in contaminated areas. Therefore, radiocesium deposited on forests will move in the forest ecosystems, and in the future, it will reach to an equilibrium condition as it was observed for the global fallout ^{137}Cs. Until that time, the concentration of radiocesium will decrease in trees due to plant grow and weathering. It is important to provide the information on the radiocesium behaviors in trees for the decision making process, and for the use of forest products.

In this study, therefore, concentrations of radiocesium in tree tissues, e.g., leaves, branches and fruits, were measured for about two years after the releases of radionuclides at NIRS Chiba.

II. MATERIALS AND METHODS

Six species of trees, i.e., three deciduous trees (*Someiyoshino* cherry, persimmon, and chestnut) and three evergreen trees (red robin, loquat and azalea) were selected, and tree tissues have been collected from late April 2011. The collected tissues were usually leaves and branches, and if the tree has fruits, then they were collected. The evergreen trees had leaves at the time of accident occurred, therefore, direct deposition effect was found for old green leaves: these results were not used in this study.

In April to June 2011, these samples were measured in raw, however, since the concentration in samples decreased rapidly, collected samples from July 2011 were dried at 80˚C for 3 days at least to concentrate. Each dried sample was mixed well and transferred into a plastic container to measure ^{137}Cs concentrations with a Ge detecting system (Seiko EG&G). Some of the branch samples were separated into barks, phloem, and xylem parts. For the case of fruit (persimmon, chestnut and loquat), whole or fruit flesh was measured.

III. RESULTS AND DISCUSSION

The radiocesium concentrations in leaf samples of all six plant species showed a decreasing trend. Figure 1 shows radiocesium concentration changes in leaves of the persimmon tree as an example. In 2012 and 2013 spring, when new shoot emerged, a slight concentration increase was observed for the deciduous trees, however, evergreen trees has different new shoot growing and defoliation seasons, the increase trend was not seen in spring.

Branch samples also decreased in radiocesium concentration with time. When branches were separated into three parts, radiocesium concentration was high in the following order: bark>phloem>xylem. Radiocesium behaves like potassium, which is essential elements, and thus the concentration in phloem is higher than in woody parts, however, higher concentration in barks may imply the radiocesium elimination from living part of trees.

Radiocesium concentrations in fruits decreased yearly. The concentrations in edible part of persimmon and loquat were smaller than that in leaves.

Acknowledgement: This study was partially supported by the Agency for Natural Resources and Energy, Ministry of Economy, Trade and Industry (METI), Japan.

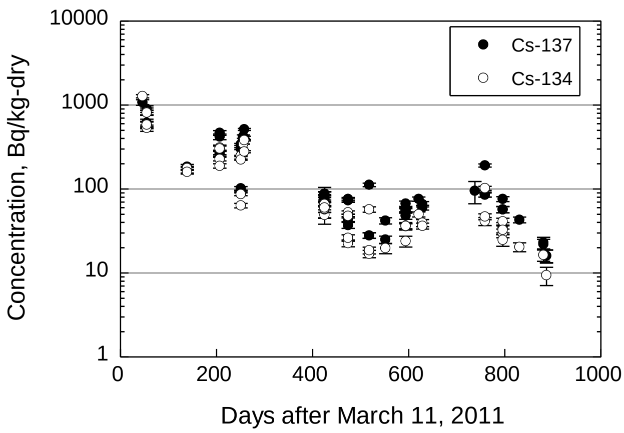

Figure 1. Radiocesium concentration change with time in the leaves of persimmon tree.