Research on Element-accumulating Capacity of Plants

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Abstract

Phytoremediation is a possible countermeasure against soil contamination with radionuclides. Identifying and establishing accumulators is the key to developing practical phytoremediation methods. This study aimed at selecting or developing accumulators usable for radionuclides that could potentially be released in Aomori Prefecture due to the location of a nuclear fuel reprocessing facility there. For that purpose, we focused on the following two approaches: to search for accumulators for Cs, Sr and I from crops and wild plants, and to employ a genetic approach to develop transgenic plants using genes controlling Cs resistance in *Arabidopsis* mutants.

The candidate accumulators, in FY 2008, *Amaranthus hypochondriacus*, *Helianthus annuus* and *Portulaca oleracea* were selected from crops based on their removal capacity of the target elements from soil. In FY 2009, they were cultivated in an experimental field with different planting densities to establish the optimal cultivation condition. The suitable planting density was determined for each candidate from the analysis of the plants harvested.

To search for candidate accumulators from wild plants, 44 species were cultivated in the same experimental field, and removal rate of Cs, Sr and I per unit land area were obtained from their elemental content and planting density. The selected candidate Cs accumulators were *Amaranthus retroflexus* and *Amaranthus caudatus*. *Persicaria lapathifolia* was also selected as the candidate accumulator of Sr and I. Those candidates will be examined further for establishing the optimal cultivation condition. The best accumulator for each element will then be selected based on the removal results.

We have already reported that the causative genes of CsR33 and CsR80, which are Cs-resistant mutant lines, were found as a chloroplast signal recognition particle subunit (*cpSRP54*) gene and a glutamyl-tRNA reductase (*HEMA1*) gene, respectively. In FY 2009 work, we found that the mutation sites of CsR33 and CsR80 were located near the p-loop domain in the *cpSRP54* gene and the t-RNA/NADP binding domain in the *HemA1* gene, respectively. Uptake capacity of Cs was also examined for the two lines with different Cs concentrations in cultivating medium. The Cs uptake capacity of CsR33 was similar to that of the wild type strain, while that of CsR80 was three times higher than the wild type strain.

We previously identified *AtCNGC17* as a gene of Cs transporter. We tried to overexpress *AtCNGC17* in CsR33 and CsR80 to produce Cs accumulator. In FY 2009, we produced the transgenic plants of CsR33 and CsR80 by the gene transfection method of *AtCNGC17*, and we will examine their Cs uptake capacity next.

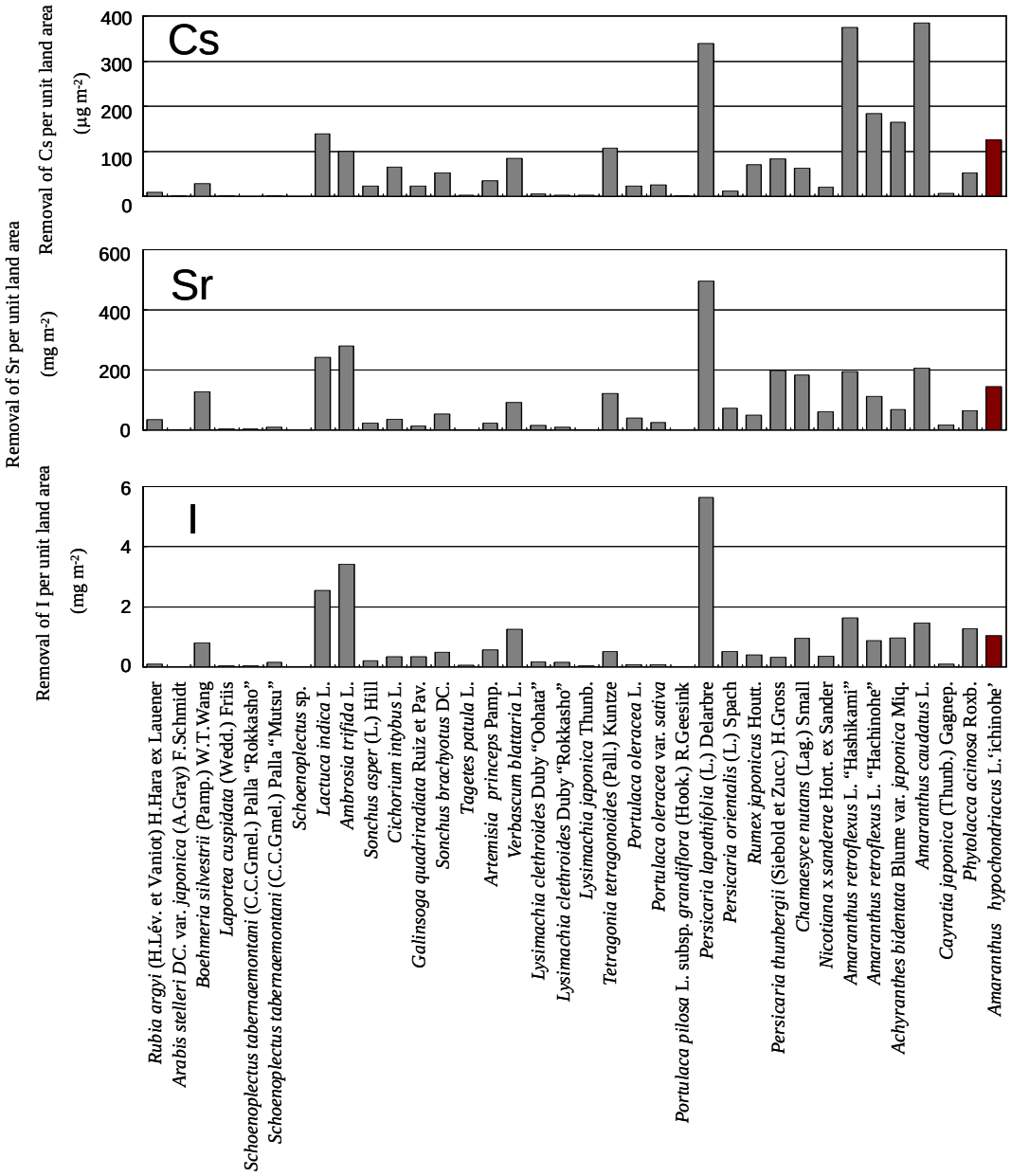

Fig. 1 Removal of Cs, Sr and I per unit land area in an experimental field