

[Workshop 1] Development of Phyto-Technology for Decreasing Heavy Metal in Food

## **Xylem and Phloem Transport of Cd, Zn, and Fe into the Grains of Rice Plants (*Oryza sativa* L.) Grown in a Continuously Flooded Cd-Contaminated Soil**

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To explore the functions of xylem and phloem-transported cadmium (Cd) in the accumulation of Cd into the grains in rice plants (*Oryza sativa* L.) under continuously flooded conditions, the concentrations of Cd in xylem and phloem saps and different tissues were determined and compared with those of zinc (Zn) and iron (Fe), using the semi-dwarf rice plants (cv. Kantou) grown on a Cd-contaminated soil. The concentrations of Cd, Fe and Zn in the tissues were examined at four growth (8th-leaf, 10th-leaf, early grain-filling, mature) stages. The phloem saps at the early 2 stages were collected from the laser-cut stylets of brownhoppers sucked on the mature leaf sheathes and those at early grain-filling were collected from the uppermost internodes. The xylem saps were collected from the cut stems.

Although the Cd content of the soil was 4-fold as much as the average in Japan, the Cd concentrations in the phloem sap collected at early grain-filling were very low and the Cd concentrations in the de-husked grain were also low, since the xylem vessels were disconnected to the grains. Zn and Fe concentrations in the xylem and phloem saps were not much reduced by continuous flooding. Cd may be transported to the grain via the phloem after xylem-to-phloem transport from the Cd storage in the roots and stems. Fe was accumulated to all tissues including grains via xylem and Fe in the vegetative tissues may be partly transported to the grains probably via phloem. Zn in the phloem saps was higher than in the xylem saps. Zn in the grains may be actively transported via phloem after mobilization in other tissues, resulting in the highest concentrations among three metals.

Thus, continuous flooding may reduce tremendously the Cd concentration in the phloem saps and consequently in the grains, while this reduction was not accompanied by Zn and Fe: the grain Zn and Fe contents were maintained, whereas grain Cd content was greatly reduced in continuously flooded soils.