**Vermiculite application to inhibit radiocesium uptake by paddy rice**

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In order to ensure the distribution of safe agricultural and livestock products, measures to reduce radiocesium at field level, product testing for radiocesium, shipment restrictions and other measures have been combined after the accident at TEPCO's Fukushima Daiichi Nuclear Power Station. Regarding radiocesium reduction measures, radiocesium (Cs-134 and Cs-137) is absorbed via a part of potassium transport system by plant roots. Low phytoavailable potassium content in the agricultural soil decreases antagonism to radiocesium in the absorption phase and promotes the absorption of radiocesium. Therefore, the application of additional potassium to rice, soybean, buckwheat, and grass fields has been used to suppress the absorption of radiocesium in Fukushima and a few surrounding prefectures. On the other hand, the application of additional potassium supplementation is expensive in terms of labor and other costs, and in the situation that there have been no cases of brown rice produced in Fukushima Prefecture, Japan exceeding the standard value (100 Bq kg-1) since 2015, the application of potassium supplementation is being discontinued in rice cultivation. Potassium chloride is mainly used for potassium supplementation, but there have been concerns that the phytoavailable potassium content in the soil increased by potassium chloride is short-lived. In a field survey conducted by the authors, it was found that the exchangeable potassium content (extracted by 1M ammonium acetate solution) decreased over time after the potassium supplementation was discontinued, and that the activity concentration of radiocesium in brown rice increased in the third year after the potassium supplementation was discontinued. In this study, vermiculite, which is expected to be effective in maintaining exchangeable potassium content for a relatively long period of time due to its slow potassium release, was applied to paddy fields to verify the sustainability of the effect.

The field examination was conducted in farmers’ four paddy fields located in the Fukushima Prefecture. Three treatments were established in each paddy field. Potassium was applied by potassium chloride with the rate of 2.7 g m-2 in 2023 and 4.2 g m-2 in 2024 in the control plot. Additional potassium (9.9 g m-2, potassium chloride) and vermiculite (1 kg m-2, powder generated during horticultural vermiculite production) was applied in the second and third treatments, respectively, in 2023. The same rate of potassium as the control plot was also applied in the second and third treatments in both years. The vermiculite contained 47.2 g kg-1 of total potassium and 1.6 g kg-1 of exchangeable potassium. Nitrogen and phosphorus were applied at the rate of farmers' practice.

Activity concentrations of Cs-137 in brown rice was lowest in the vermiculite-applied plot followed by the additional potassium-applied plot then control plot in 2023. It was lowest in the vermiculite-applied plot and was similar in the additional potassium-applied plot and control plot in 2024. Exchangeable potassium content in soil sampled at harvest was highest in the vermiculite-applied plot and was similar in the additional potassium-applied plot and control plot in 2023. It was highest in the additional potassium-applied plot followed by the vermiculite-applied plot and then control plot in 2024. The results suggested that the inhibition effect had longer-lived in the vermiculite-applied plot than in the additional potassium chloride applied plot.