POTTASSIUM RELEASE FROM CLAYS BY BIOSIGNAL OF GRASS ROOT EXUDATES

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ABSTRACT
The objective of this study was to clarify that the root exudates of Italian ryegrass (*Lolium multiflorum* Lam.) expand the basal spacing of hydroxy potassium vermiculite (K-Vt) in the rhizosphere model with a clay-agar system, and to discuss that the action of the root exudates is regarded as a biosignal to release potassium ions from the interlayers of vermiculite clays.

KEYWORDS
expandable clay minerals,vermiculite, rhizosphere, potassium fixation, root exudates, grassland soil, Italian ryegrass (*Lolium multiflorum* Lam.), X-ray diffraction.

INTRODUCTION
Vermiculite is one of 2:1 type crystalline clay minerals and its basal spacing is 1.4nm (1nm=1/1,000,000mm) when it was saturated by magnesium or calcium ions. On the other hand, it has an ability to fix potassium or ammonium ions in the interlayer of unit lattices, with the basal spacing shrinking to 1.0nm.

The basal spacing of vermiculite increased from 1.0nm to 1.4nm after 3 years of reclamation in a grassland (Suzuki,1986,1990). It was supposed that the changes of the basal spacings were induced from the action of root exudates.

It was reported that the weathering of mica which is similar to vermiculite was accelerated by the action of the roots of ryegrass (Hisinger *et al*.1992).

The author investigated the changes of basal spacings of K-Vt incubated in the rhizosphere model with a clay-agar system (Kuchenbuch and Jungk, 1982; Hisinger *et al*, 1992) by X-ray diffraction analysis.

MATERIALS AND METHODS
K-Vt (less than 2 μ m e.s.d.) were prepared by successive deferration, removing hydroxy interlayered ions and K-saturation after collecting from vermiculitic soil by sedimentation after grinding. It was dispersed in an agar medium containing necessary elements for water culture except potassium. The special culture vessel device was modified from Hisinger *et al*. (1992). The agar was poured into a cylinder in the petri dish filled with water culture solution which contained the same components as the agar. The top of the agar in the cylinder was covered with a nylon net (pore size is 30μm) then pasturized seedlings of Italian ryegrass (*Lolium multiflorum* Lam.) were put on the nylon net. The set was incubated at 25/20C and 95%RH in a biophotochamber. After incubation, the agar in the cylinder was pushed out from the bottom by drilling press and it was cut 1mm thick. The cut agar sample was placed and air-dried on the slide glass and the basal spacings determined by X-ray diffraction (JEOL-60PM,Tokyo).

RESULTS AND DISCUSSION
It was observed that there was only 1.0nm peak in every depth of non-grass plot as control and its precise basal spacing was concentrated in 1.04~1.07nm. On the other hand, there was a 1.4nm peak in addition to 1.0nm peak in every depth of grass plot and their precise basal spacings were 1.07~1.11nm and they were somewhat larger than those of non-grass plots. The intensity of 1.4nm peak became larger closer to the grass roots and the ratio of 1.4 nm/1.0nm peaks increased from 0.55 in 20mm depth to 2.00 in 1mm depth.

It was supposed that the appearance of 1.4nm peaks of K-Vt in grass root plots resulted from the release of potassium which was fixed in the interlayer of K-Vt and that the action of release increased in accordance with decreasing of the distance from grass roots. The action of releasing potassium seemed the biosignal which was caused by the root exudates such as organic acids(citric acids etc.) from the grasses.

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