学位論文内容の要旨

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学位論文題名

Strontium behavior from soil to plants

（土壌から植物へのストロンチウムの動態）

This thesis consists of 98 pages, 14 figures, and 10 tables with 1 reference paper.

Radioactive cesium (RCs) and radioactive strontium (RSr) with relatively long half-lives raise concerns about enduring environmental and human effects post-nuclear accidents. Past countermeasures were mainly carried out by expanding conventional agricultural practice for major contaminants, like potassium (K) for RCs and calcium (Ca) for RSr, respectively, which are known to be effective. However, there is a lack of information regarding how that countermeasure impacts the other elements. This study will lead to a new aspect to consider the effective countermeasures against agricultural land contamination by potential future nuclear accidents, recognizing the need for a comprehensive approach beyond a singular focus on major contaminants.

1. **Effect of potassium application on cesium and strontium uptake by soybean plants**

   In a field experiment at Fukushima, soybeans were tested to analyze element absorption and partition by K application. Results confirmed a significant decrease in Cs absorption with increased K application. The soil's exchangeable strontium (Sr) remained unaffected by K application, suggesting no impact on root absorption sites. Conversely, Sr redistribution within the plant decreased with higher K application.

2. **Effect of potassium application on cesium and strontium transport of Komatsuna plants grown in two different soil types**

   The pot experiments were conducted at a controlled greenhouse at Hokkaido University. The different K fertilizer levels were applied to Komatsuna grown in two different soil types. In the case of Komatsuna, the amount of Cs and Sr absorbed decreased with increasing K application. The concentration ratio (Cs or Sr concentration in plant was divided by soil exchangeable of Cs or Sr concentration)

for Cs and Sr were reduced, respectively, indicating that the effect of K on Sr absorption varied among crop species.

3. Co-application of potassium and calcium effect on cesium and strontium transport from soil to soybean plants

Co-applying K and Ca as a countermeasure for mixed deposition of RCs and RSr may prove effective. A greenhouse experiment at Hokkaido University involved soybean plants grown in K-deficiency soil subjected to five treatments (control as without K + Ca, Ca, K, K + Ca, and K + High Ca application). Results indicated that in addition to the decrease of Cs by increasing K application, increasing Ca application elevated soil exchangeable Ca concentration, reducing Sr absorption. This effect intensified with lower soil exchangeable K content, suggesting a discernible interaction between K and Ca in Sr absorption in soybeans.

In conclusion, increased K application as a countermeasure against Cs did not affect Sr absorption in soybeans but did decrease the translocation of Cs to the seeds and reduce Sr absorption in Komatsuna. However, with a higher K application, Sr redistribution within soybean plant decreased. In soybeans, the reduction of Sr uptake by increased Ca application and no effect on Cs uptake was observed. It has been found that applying counter cation for Cs can also alleviate Sr uptake and/or distribution and vice versa.