カリ施肥レベルによるダイズの放射性セシウム吸収量の変化

Uptake of radioactive Cs by soybeans depending on the level of K application

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[Introduction]
After the Nuclear Power Plant accident, radioactive contamination of farmland caused contaminated crop production. It is known that radiocesium (radio Cs; Cs-134 + Cs-137) behaves similarly to potassium (K) in the environment; when the concentration of exchangeable K in soil is low, plants uptake radio Cs easily. Because soybeans (*Glycine max*) require substantial K, soybeans more easily absorb radio Cs from soil than other crops. Inhibition of absorption of radio Cs using K fertilization is required for safe crop production.
In this study, we investigated the time-dependent change of radio Cs concentration in soybeans, and the exchangeable K and radio Cs concentration when changing K fertilizer application rate. This information may be applied to develop an optimal method for inhibition of radio Cs absorption.
[Materials and Methods]
The study site is located in Fukushima Prefecture. Soybeans were seeded in June and harvested in October, 2015. Soil samples were collected before seeding and at five-leaf, full flowering, full seed, and full maturity stage from directly under the plants. Plant samples were also collected at each of these growth stages. Plant samples were separated into leaves, petiole, stems, pods, and beans and the growth amount, yield, and radio Cs concentration were measured for each part. The exchangeable K concentration, radio Cs concentration and exchangeable radio Cs concentration were also determined.
We conducted an exchangeable K level test and K sustained effect test. The basal fertilizer was N-P-K = 3-12-0 kg/10 a in all tests. In the exchangeable K level test, five levels of exchangeable K were set: no K fertilizer (3 years) and 15, 30, 50, and 70 mg K_2O/100 g. The K fertilizer was applied at seeding. Non-planted plots dressed with the same levels of K fertilizer were also established. We also investigated the sustained effect of K, in which the concentration of exchangeable K was set to 70 mg after harvesting in 2014, and no K fertilizer was applied to the same sections in 2015. All tests were conducted in triplicate.
[Results and Discussions]
The average concentration of radio Cs in soil was 3,391 ±240 Bq/kg at harvest.
In the Exchangeable K level test, there was no major difference in bean yield between exchangeable K levels. The grain radio Cs concentration and transfer factor from soil to beans (TF) decreased for applications greater than 30 mg K_2O (relative to no K fertilizer and 15 mg K_2O). The highest exchangeable radio Cs in soil was found before seeding in all treatments. For all treatments, the exchangeable radio Cs content throughout the year was lower when exchangeable K levels were higher. The no K fertilization, 15 and 30 mg K_2O plots had higher exchangeable radio Cs content than non-planted plots. This suggests that when soil K_2O content is below 30 mg, soybean planting increases exchangeable radio Cs in soil.
Because there was sustained K effect of 2013 and 2014, planted plots had different soil K contents before seeding. However, the exchangeable K concentration was similar in all non-planted plots, and at levels over 30 mg K_2O/100 g, it increased after fertilization to five-leaf. Exchangeable K at

harvest was comparable between K levels regardless of planting status. Thus, the no K fertilization and 15 mg K_2O/100 g have higher radio Cs concentrations and TF because of a lack of exchangeable K and an increasing exchangeable radio Cs.
The concentration of grain radio Cs in the K sustained effect test was lower than in the no K fertilization plots. This suggests that the exchangeable K concentration before seeding was higher, presumably because sufficient K content had been ensured. But the soil K_2O content decreased with time-dependent, so there is a risk that radio Cs concentration of grain will increase next cultivation.

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