



Soil-plant transfer of Cs-137 and Sr-90 in digestate amended agricultural soils- a lysimeter scale experiment

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Radiocesium and radiostrontium are among the most problematic soil contaminants following nuclear fallout due to their long half-lives and high fission yields. Their chemical resemblance to potassium, ammonium and calcium facilitates their plant uptake and thus enhances their chance to reach humans through the food-chain dramatically. The plant uptake of both radionuclides is affected by the type of soil, the amount of organic matter and the concentration of competitive ions.

In the present lysimeter scale experiment, soil-plant transfer of Cs-137 and Sr-90 was investigated in an agricultural silty soil amended with digestate, a residue from a biogas plant. The liquid fraction of the digestate, liquor, was used to have higher nutrient competition. Digestate application was done in accordance with the field practice with an application rate of 34 Mg/ha and mixing it in top 5 cm soil, yielding a final concentration of 38 g digestate/Kg soil. The top 5 cm soil of the non-amended reference soil was also submitted to the same mixing procedure to account for the physical disturbance of the top soil layer. Six months after the amendment of the soil, the soil contamination was done with water-soluble chloride salts of both radionuclides, resulting in a contamination density of 66 MBq/m² for Cs-137 and 18 MBq/m² for Sr-90 in separate experiments.

Our results show that digestate application led to a detectable difference in soil-plant transfer of the investigated radionuclides, effect was more pronounced for Cs-137. A clear difference was observed in plant uptake of different plants. Pest plants displayed higher uptake of both radionuclides compared to wheat. Furthermore, lower activity values were recorded in ears compared to stems for both radionuclides.