Interception and Storage of Deposited Radionuclides in Crops

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Introduction

- Release of radionuclides from accidents, can result in deposition onto agricultural food crops.
- Main harmful radionuclides → radiocaesium (Cs), iodine (I) and radiostrontium (Sr).
- Level of interception is dependent on; (1) morphology, (2) angle of leaves, (3) plant biomass, and (4) external water storage capacity.
- Redistribution to edible plant parts depends on uptake.
- Information is essential for the risk assessment of food chain.
Flow

1. Deposition
2. Interception
3. Uptake
4. Distribution
5. Transfer

Rain & Snow

Diagram showing the process of flow from deposition to transfer.
Deposition

- Two main types of deposition: *dry deposition* and *wet deposition*.

- In dry deposition, particles directly deposited onto surfaces.

- In wet deposition, particles are smaller and are "washed" out from the air by e.g. rain.
Interception

- Complicated process → negatively charged leaves: weaker retention of specific ions, such as monovalent ions, than for i.e. divalent ions.

- Related to plant morphology e.g. area of the leaves, angle of leaves, the biomass, external water holding water capacity of plants.

- Level of interception can be described by different fractions e.g. interception fraction and mass interception fraction.

- Interception decreases as the amount of rainfall increases.
Uptake

- Uptake of radionuclides differs depending on: growth stage → well-developed stage, a majority are taken up.

- Radionuclides cannot easily enter the surface of leaves.

- However, surface contains cracks and defects where the entrance can take place.
Illustration with permission from Koranda & Robison (1978)
Distribution

- Radionuclide entrance depends on: plant species, precipitation, temperature, light, pH, carrier of the radionuclides, and valence of the radionuclides.

- Radionuclides are actively transported by the plant vessels and by exchange mechanisms between phloem and xylem.
- Growth of plants, the activity of radionuclides will be diluted or lost.

- Contamination of plants close to the harvest uptake will be higher.

- Redistribution of radionuclides can vary by a factor of 100 during the growing season.

- Depending on the development of the plant.
Transfer

- Transfer of radionuclides from environment to foodstuffs is controlled by the rate of direct uptake and root uptake.

- Estimation of radionuclide transfer is important when making decisions for agricultural countermeasures to reduce the content in foodstuffs.