Do arbuscular mycorrhizal fungi influence caesium uptake by *Medicago truncatula*?

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Radiocaesium contamination

- Radionuclides ^{134}Cs and ^{137}Cs:
  - Emission of harmful β and γ radiation
  - Rapid incorporation into biological systems
  - Long half-lives
- Sources of radiocaesium contamination are global fallout and accidental release from nuclear facilities.

Potassium transport proteins

Caesium (Cs) is chemically similar to potassium (K). Root uptake mechanisms cannot differentiate between these elements easily. Several K transporters can contribute to Cs uptake by roots. In K-replete plants Cs uptake is mediated by VICC, but in K-deficient plants Cs uptake is mediated by KUP (Fig. 1).

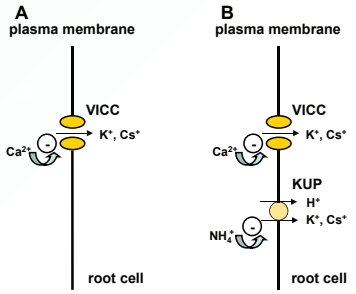


Figure 1: Caesium uptake across the plasma membrane of root cells under (A) K-replete and (B) K-deficient conditions. VICC (voltage-independent cation channels); KUP (high-affinity K/H symporters)

Hypothesis

If mycorrhizae improve plant K status, then Cs uptake by mycorrhizal roots would occur mainly through VICC and AM fungi would decrease the accumulation of Cs by reducing the abundance of KUP.

Material and Methods

An *in vitro* system was used to grow *Medicago truncatula* (Fig. 2) in association with *Glomus sp*. The plants were cultivated under K-deficient conditions on modified Hoagland's medium containing 1 mM K with or without the addition of 0.05 mM Cs. After nine weeks the plants were harvested, oven dried and acid digested in a microwave. Concentrations of elements were measured using ICP-MS (PerkinElmerSCIEX, Massachusetts, USA). Mycorrhizal colonisation rate was 22.5% in roots of plants grown without Cs and 5% in roots of plants grown with Cs in the medium.

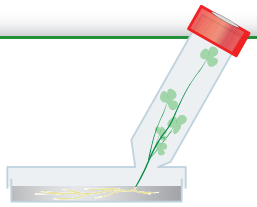


Figure 2: *In vitro* system for growing *M. truncatula*.

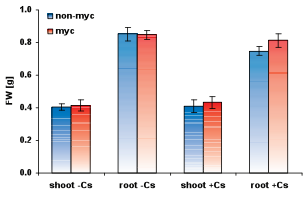
Results

Blue bars represent non-mycorrhizal plants and red bars represent mycorrhizal plants.

Fresh weight

Mycorrhizal infection does not affect fresh weight of *M. truncatula* plants.

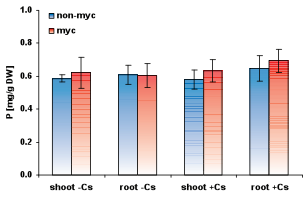
Fresh weight [g] ± SE



P concentrations

Mycorrhizal infection does not affect P concentrations in shoots or roots of *M. truncatula* plants.

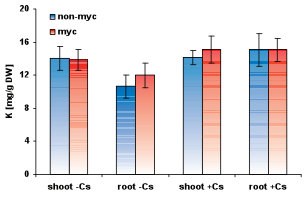
Mean P concentration [mg/g DW] ± SE



K concentrations

Mycorrhizal infection does not affect K concentrations in shoots or roots of *M. truncatula* plants.

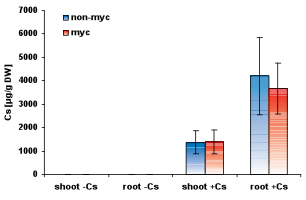
Mean K concentration [mg/g DW] ± SE



Cs concentrations

Mycorrhizal infection does not affect Cs concentrations in shoots or roots of *M. truncatula* plants.

Mean Cs concentration [µg/g DW] ± SE



Conclusions

In the *in vitro* system used here

- Mycorrhizal infection did not affect fresh weight of *M. truncatula* plants
- Mycorrhizal infection did not affect the accumulation of K, P or Cs

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