

# Glomus does not influence caesium uptake by *Medicago truncatula* at high external caesium supply

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## Caesium isotopes

- Radionuclides <sup>134</sup>Cs and <sup>137</sup>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.
- Natural concentrations of the stable isotope <sup>133</sup>Cs in soil are several orders of magnitude higher than concentrations of radioactive isotopes.

## 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).

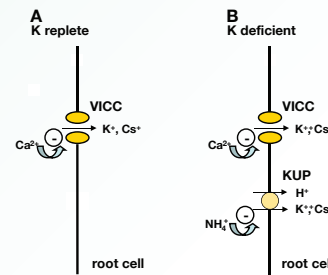


Figure 1: Caesium uptake across the plasma membrane of root cells under (A) K-replete and (B) K-deficient conditions. VICC (voltage-independent cation channels); KUP (high-affinity K/H symporters)

## Arbuscular mycorrhiza

Most vascular plants live in symbiosis with arbuscular mycorrhizal (AM) fungi. These can improve plant K nutrition and might therefore influence plant Cs uptake.

## 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

Experiment 1: 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 with or without the addition of 0.05 mM Cs and harvested after nine weeks. Concentrations of elements were measured using ICP-MS (PerkinElmerSCIEX, Massachusetts, USA). Mycorrhizal colonisation rate was 17.8% in roots of plants grown without Cs and 9.8% in roots of plants grown with Cs in the medium.

Experiment 2: *M. truncatula* was grown in association with *Glomus intraradices* in a sand:clay mixture. The plants were supplied with increasing amounts of <sup>132</sup>Cs and <sup>134</sup>Cs (Table 1) and harvested after ten weeks.

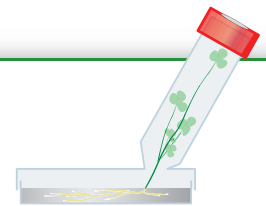


Figure 2: *In vitro* system for growing *M. truncatula*.

per pot	A	B	C	D	E
<sup>134</sup> Cs [Bq]	3125	6500	12500	25000	50000
<sup>133</sup> Cs [μg]	0.1	0.4	2	10	50

Table 1: Supply of <sup>132</sup>Cs and <sup>134</sup>Cs.

## Results

Mycorrhizal infection does not affect K concentrations in shoots or roots of *M. truncatula* plants (exp 1).

Blue bars represent non-mycorrhizal plants and red bars represent mycorrhizal plants. Mean K concentration [mg/g DW] ± SE

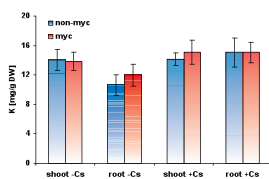


Figure 3

Mycorrhizal infection does not affect Cs concentrations in shoots or roots of *M. truncatula* plants (exp 1).

Blue bars represent non-mycorrhizal plants and red bars represent mycorrhizal plants. Mean Cs concentration [μg/g DW] ± SE

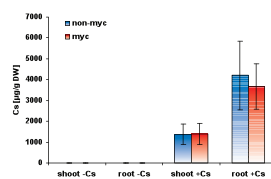


Figure 4

High external Cs concentrations interfere with mycorrhizal colonization (exp 2).

Richness of arbuscules in the root system of *M. truncatula* plants

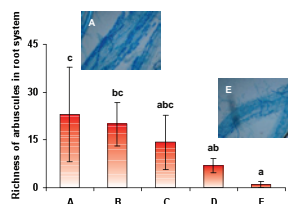


Figure 5

## Conclusions

- High external Cs concentrations interfere with the induction of AM symbiosis
- Under natural stable Cs concentrations AM fungi do not influence Cs uptake by plants

## Acknowledgements

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