# Linking sugar transport and nitrogen remobilization and use efficiency in Arabidopsis

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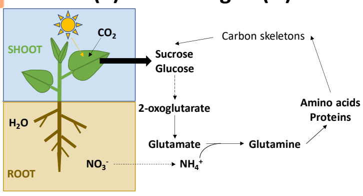
## Introduction

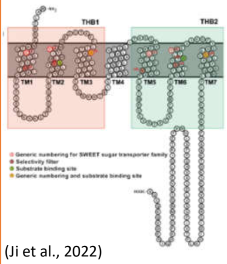
### Carbon (C) and Nitrogen (N) metabolisms are interconnected




- TCA cycle intermediates (e.g., 2-oxoglutarate) are required for ammonium assimilation
- Nitrogen is needed for Rubisco synthesis
- Amino acid metabolism is essential to generate C skeletons, energy and reductants

**But what about the connexion between sugar transport and N allocation and *vice versa*?**

### SWEET transporters are sugar facilitators

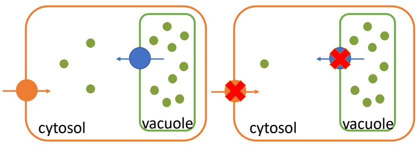


(Ji et al., 2022)

The SWEET proteins were discovered as sugar facilitators able to transport glucose, fructose and/or sucrose between cells (Chen et al., 2010). They are involved in plant development and plant response to abiotic and biotic stresses (for review see Xue et al., 2022).

### How perturbations of the intercellular and intracellular sugar transport affect plant growth and development?

Sugars availability in the cell is controlled by transporters activity at the plasma membrane and the tonoplast

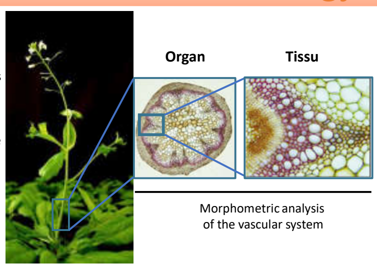



**SWEET11/SWEET12 and SWEET16 transport hexoses and sucrose at the plasma membrane or at the tonoplast and SWEET17 is a tonoplastic fructose-specific transporter**
**(Chen et al., 2010; Klemens et al., 2013; Chardon et al., 2013; Le Hir et al., 2015)**

## Methodology

**Plant**

- Growth parameters (stem height, diameter, DW)
- C and N percentage in rosette leaves, stem and seeds
- $^{15}N$ labeling experiment




- Reverse genetic approach with double and quadruple *sweet* mutant lines
- Multiscale approach from plant to cell level

## Conclusions

Intracellular sugar exchanges mediated by SWEET16 and SWEET17 specifically impact the vascular system development but not the N distribution

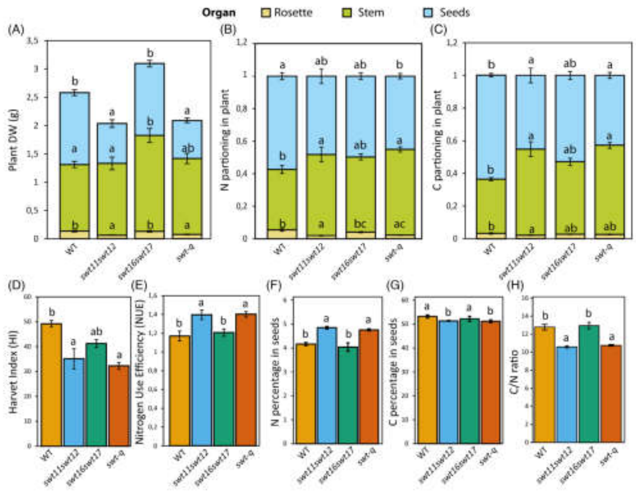
*swt11swt12* is impacted in vascular development and displays an improved NUE and nitrogen remobilization to the seeds.

Xylem defects in the stem constitute a bottleneck for the amino acids transfer to the seeds (increased amino acids content in stem)

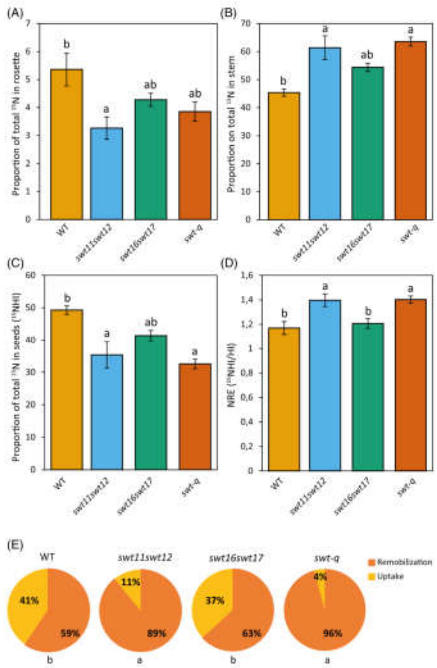
Finally, less C reached the seeds most probably because C is not loaded or remobilized properly in the phloem sap from the stem and accumulates as soluble sugars and starch.

## Main results

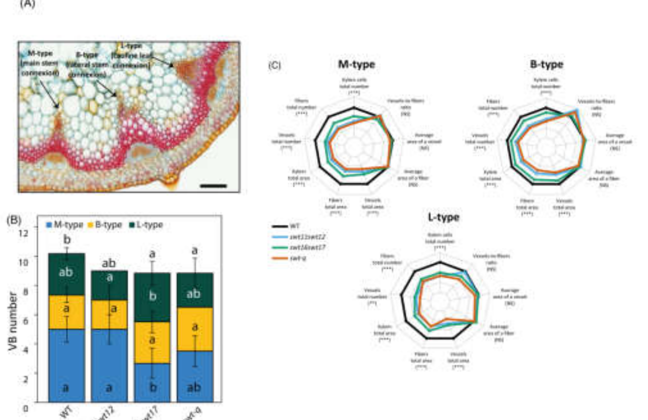
### SWEET genes modulate plant biomass, yield and NUE




### Nitrogen remobilization efficiency is partly dependent from *SWEET* genes




### Mutation in *SWEET* genes affects vascular bundle development




(Hoffmann et al., 2022)