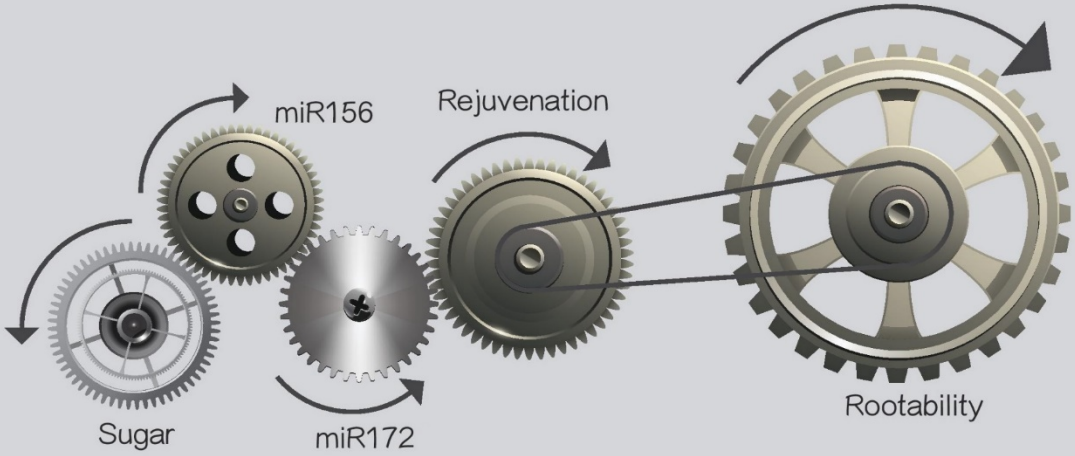
The decisive effect of the status of the donor plant on rooting



Importance of Adventitious root (AR) formation

- AR formation is an obligatory step in vegetative propagation.
- 70% of the propagation system depends on rooting of cuttings.
- Estimated loss due to poor rooting is €0.9B per year in the Netherlands.
- AR formation is highly interesting from the scientific point of view.

Importance of Adventitious root (AR) formation

- Despite much research, no general applicable rooting treatments have been developed.
- Adaptation of the rooting treatment is the common way to improve AR formation.
- An alternative way is adaptation of the donor plant including rejuvenation, etiolation and flooding.

Outlines

- Donor plant effects
  - Phase change from juvenile to adult
  - Etiolation
  - Flooding
- Role of endogenous sugar during rooting treatment

Donor plant preparation

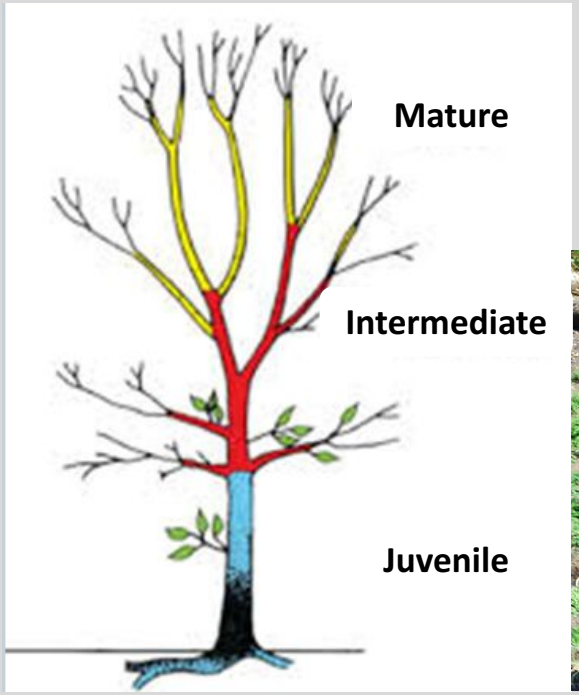
- **Arabidopsis**
  Hypocotyl : 12 days old
  Flower stem: 4-6 weeks

- **Apple**
  Subculturing 4-6 weeks.

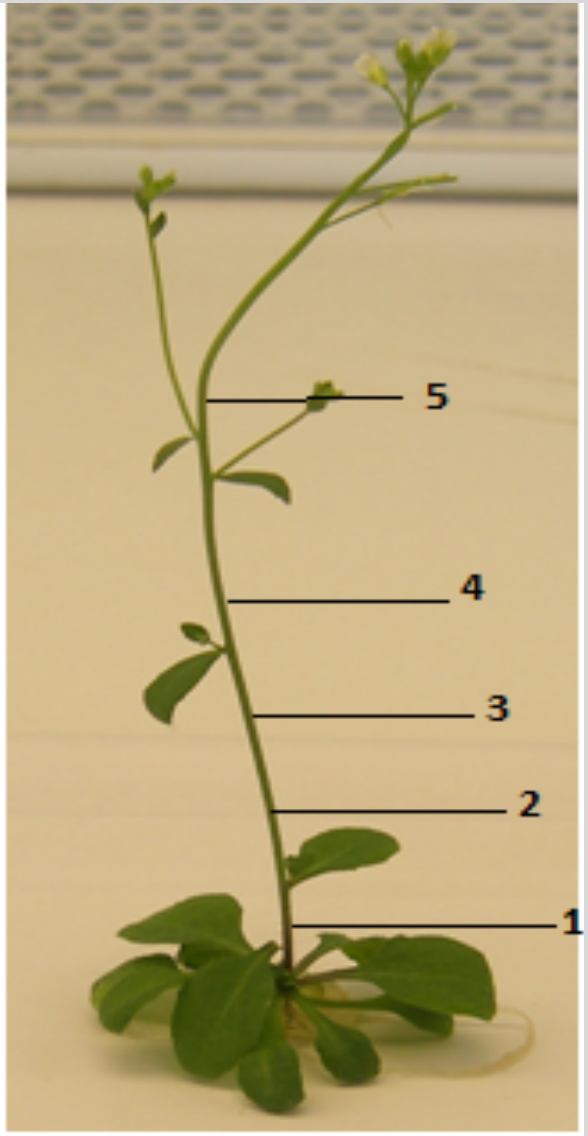
Rooting treatment

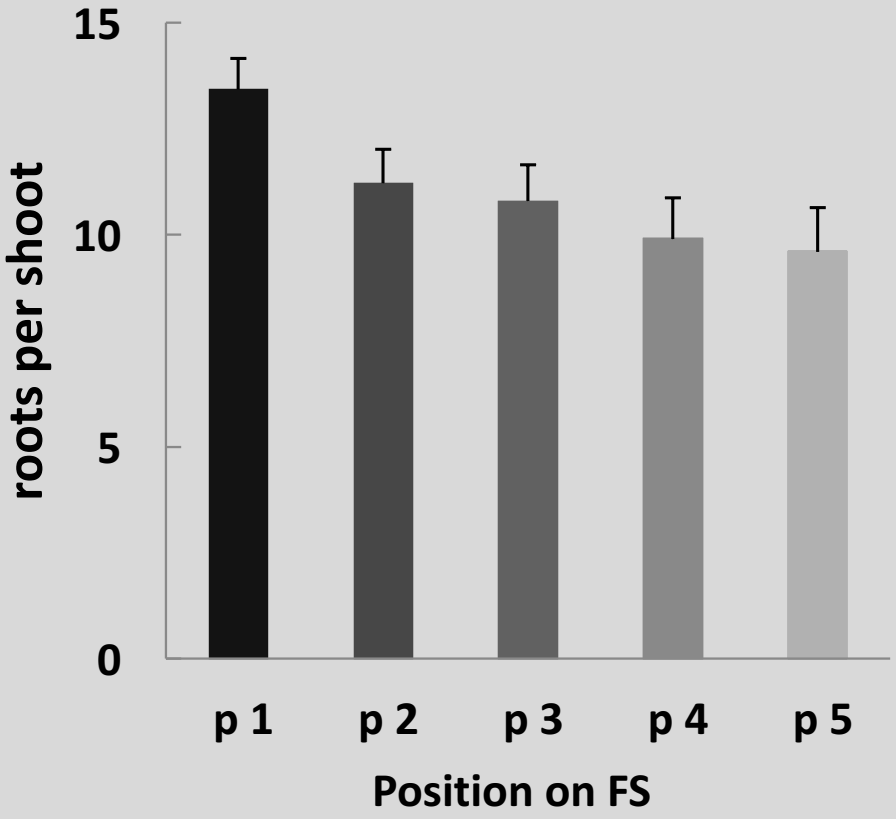
Phase change from juvenile to adult

- Plants go through 4 distinct developmental processes;
  1. Embryonic,
  2. juvenile vegetative,
  3. adult vegetative,
  4. adult reproductive
- Cone of Juvenility has been defined in adult trees.



Plant age negatively influences AR formation

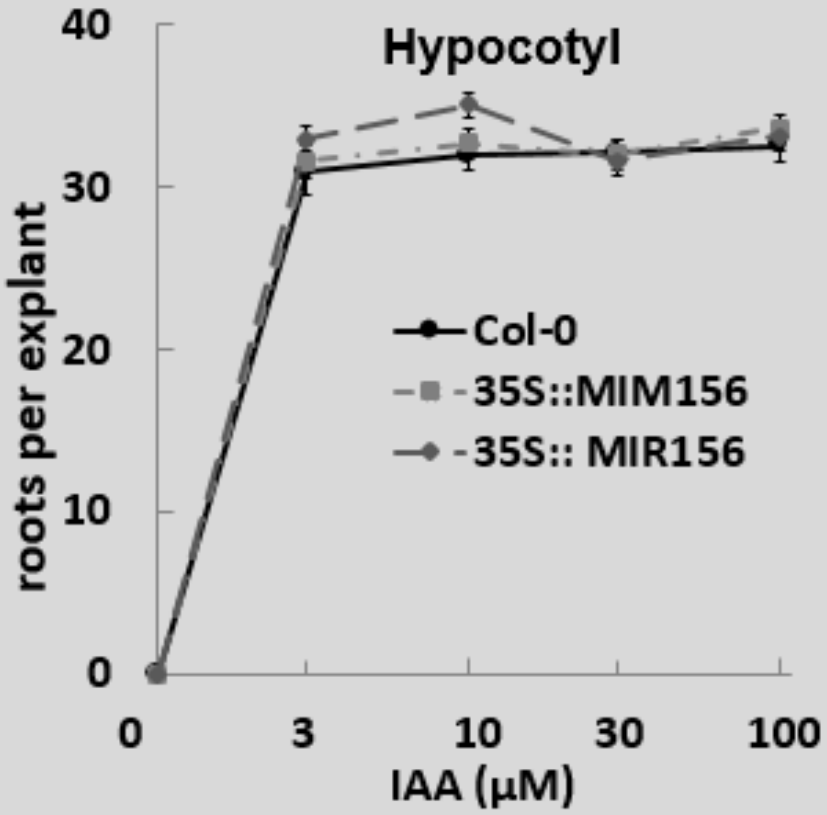


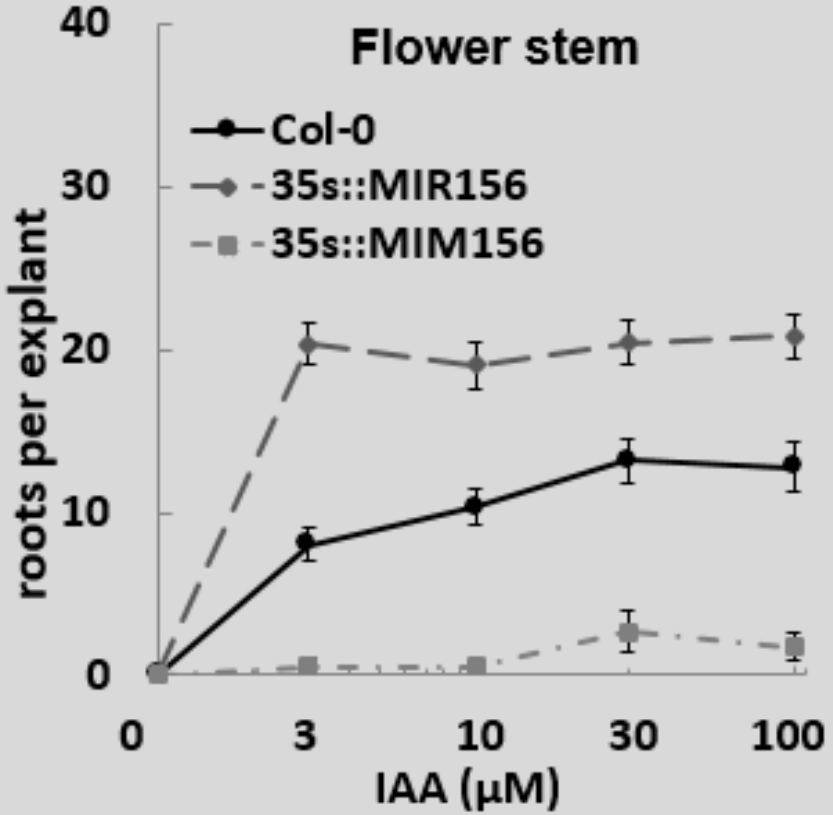


Transition to adult is controlled by miR156

- miR156 is highly expressed during Juvenile stage.
- Sugar promotes vegetative phase change by reducing the level of miR156.

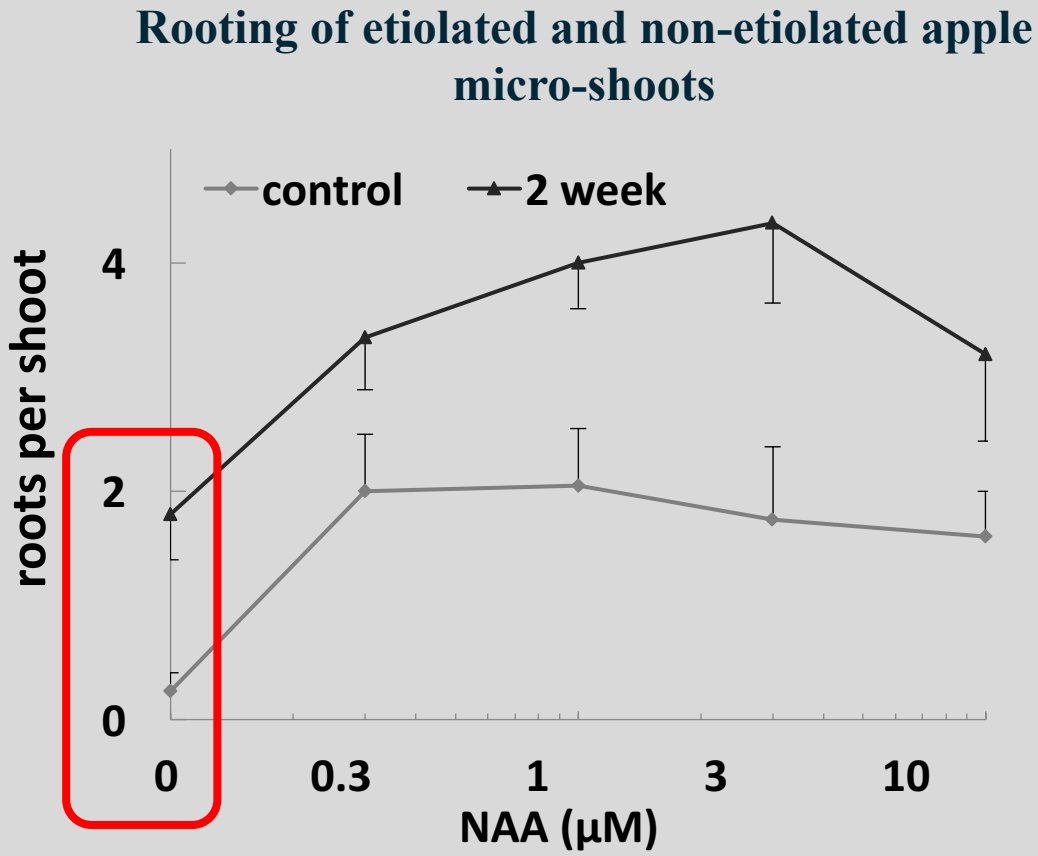
Maturation-related loss in rootability is related to the change in miR156 level



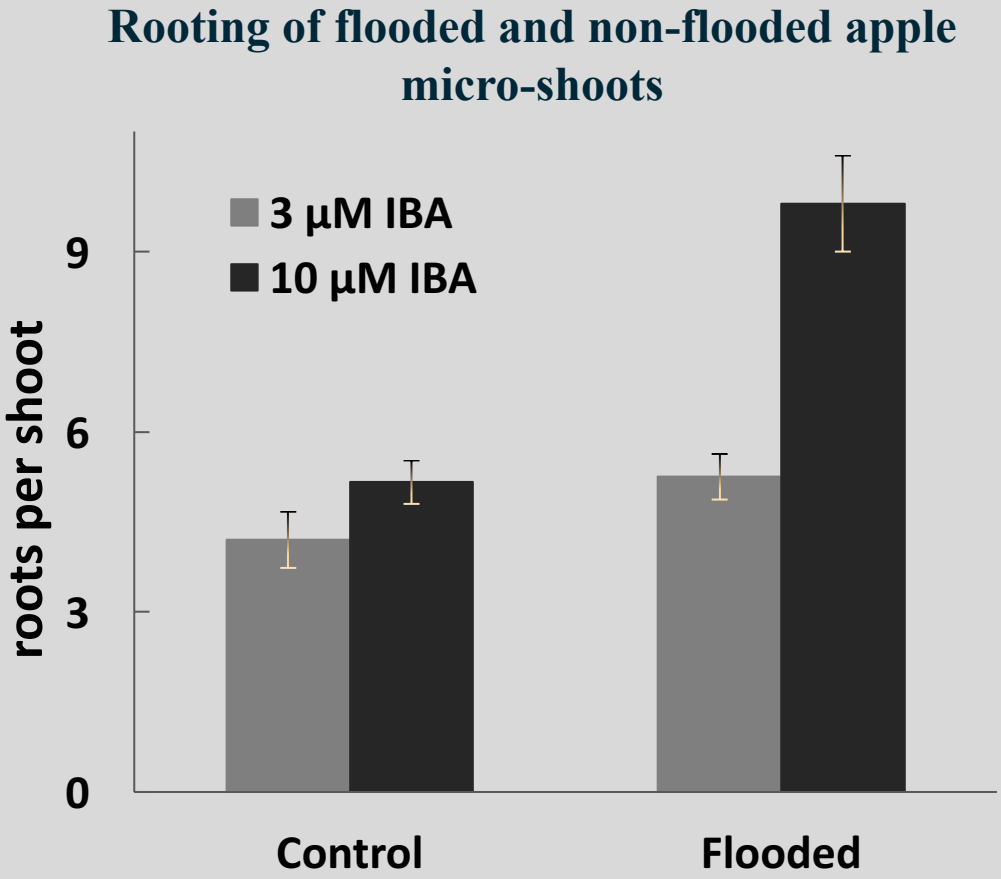


Donor plant pre-treatments

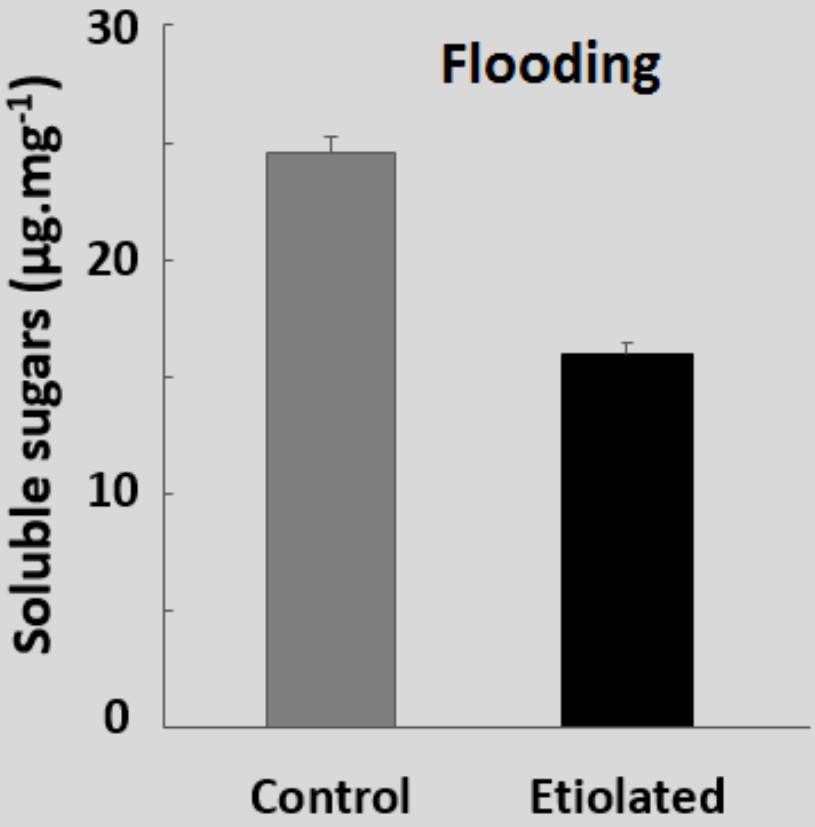
Etiolation of donor plants increase rootability of the cuttings

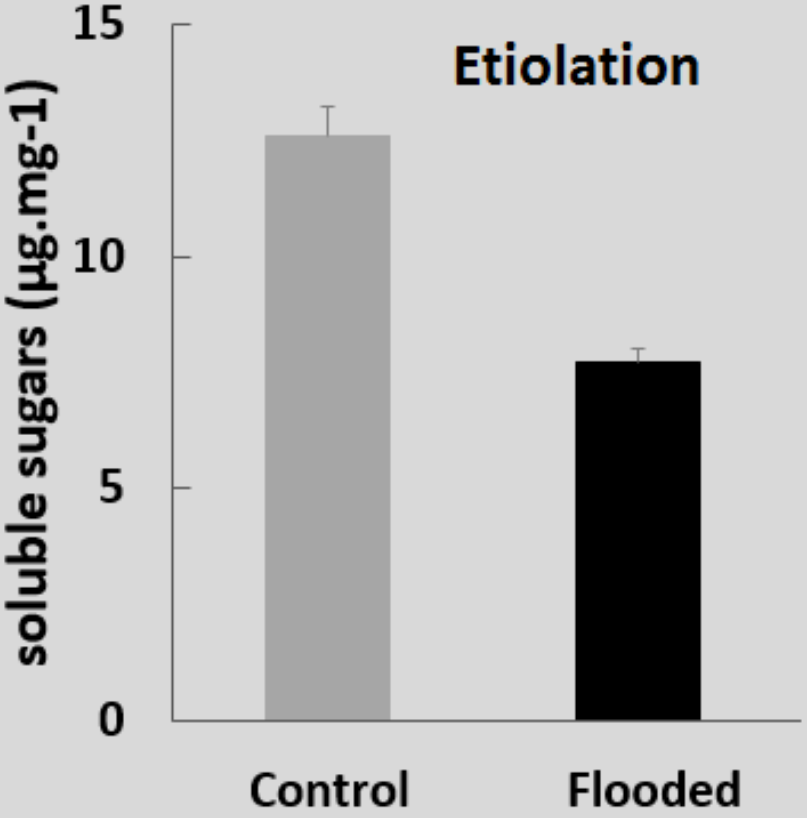


Flooding of donor plants increase rootability of the cuttings

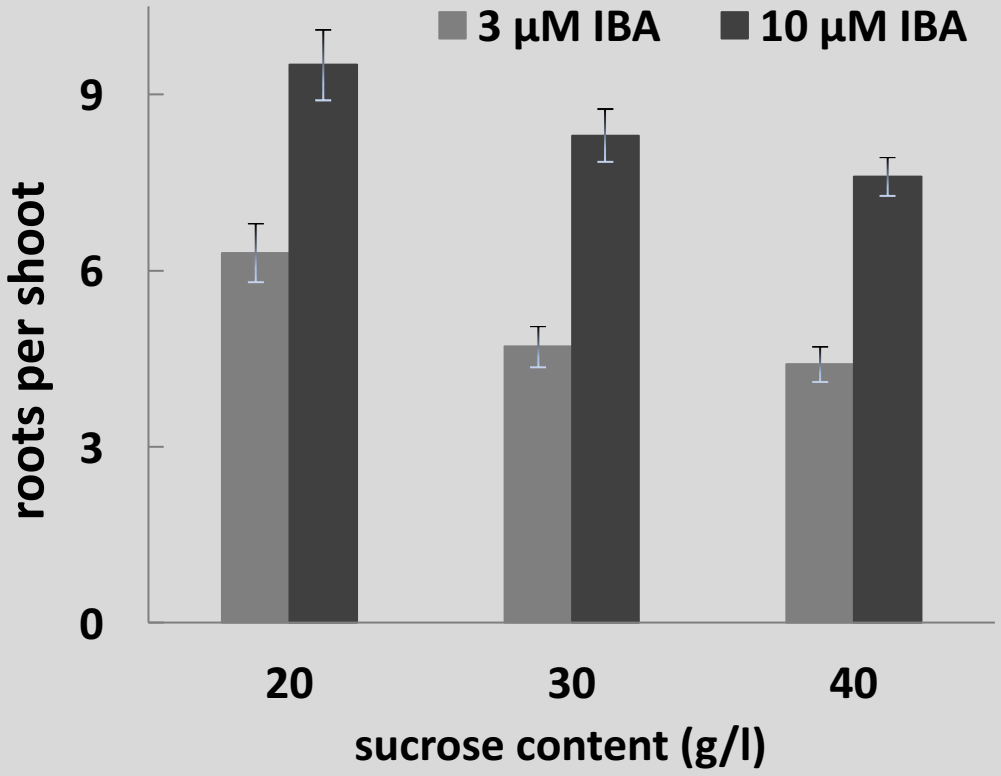


Both pre-treatments lower the level of endogenous sugar

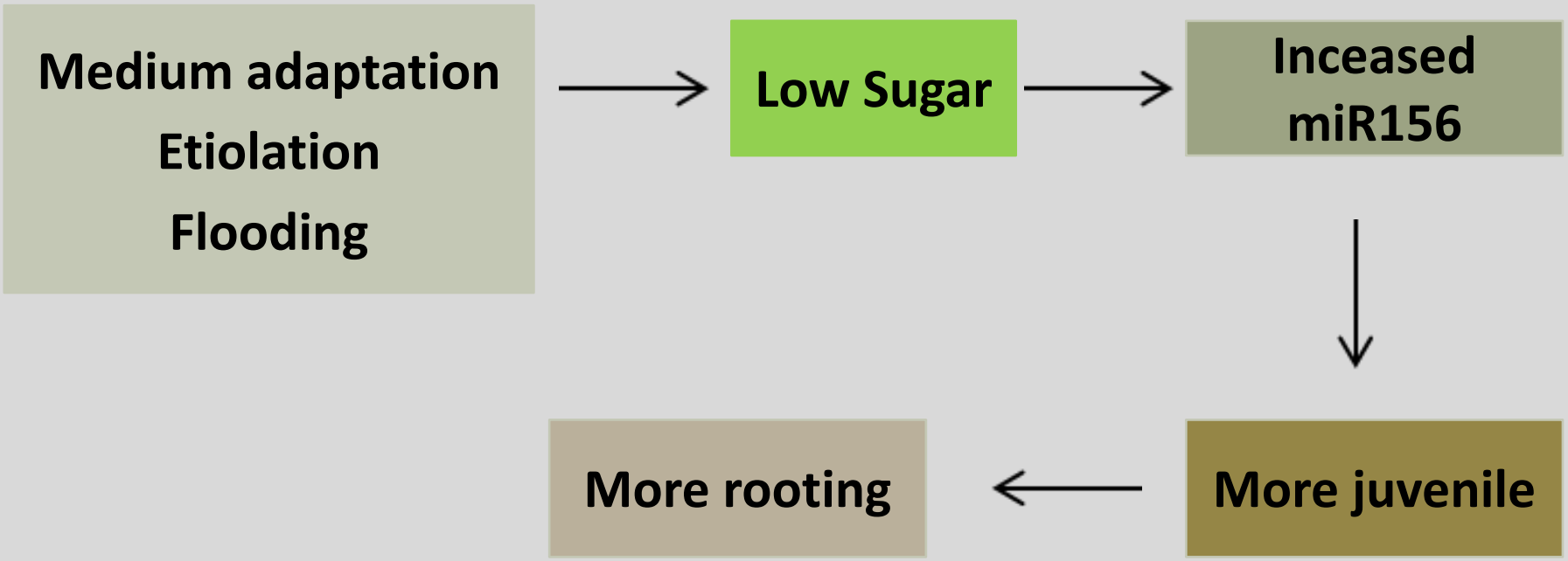




Lower sugar content during multiplication increases AR formation

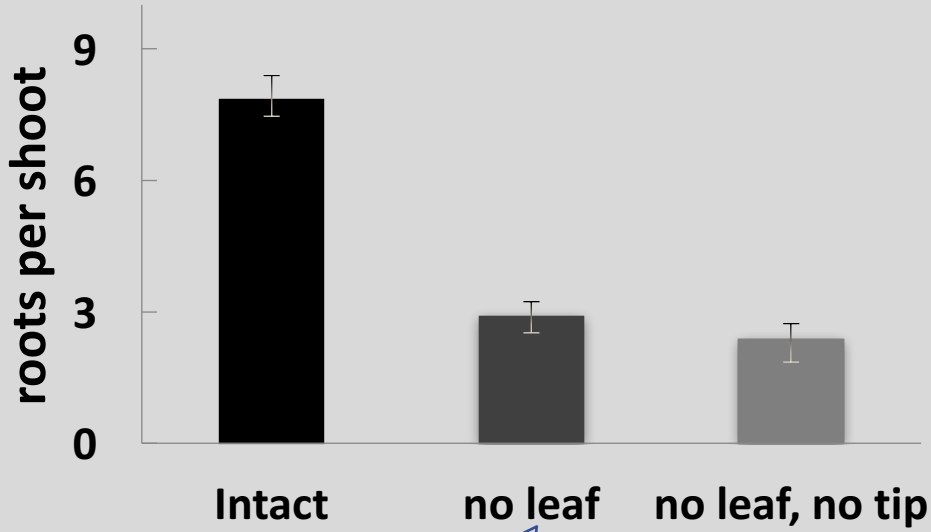


Model for mode of action of all three donor plant pre-treatments



Role of sugar during rooting treatment

Leaves play an important role during AR formation

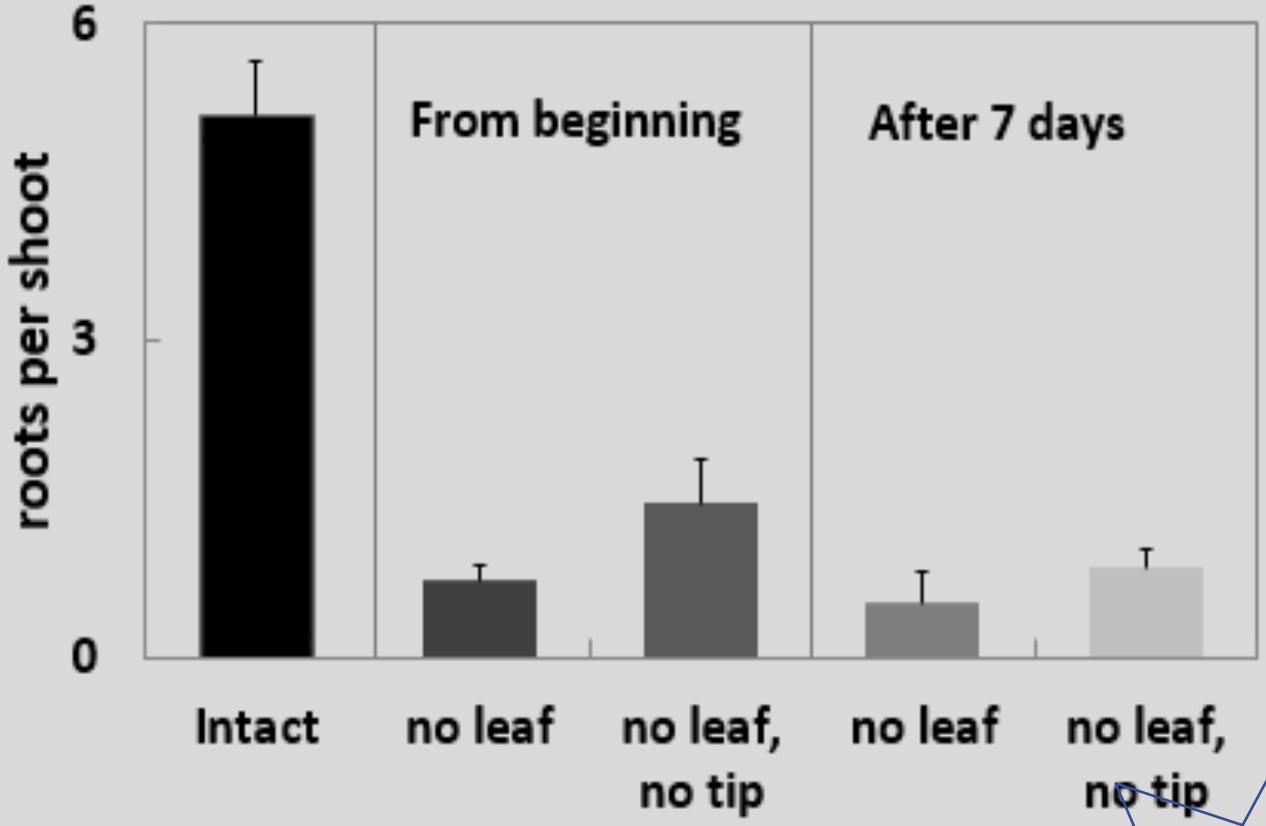


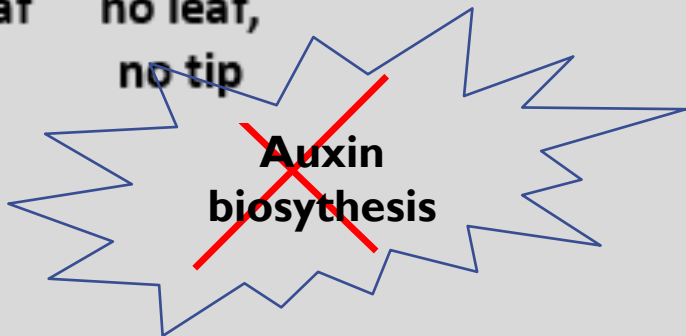
Phloem loading

Photosynthesis (PS)

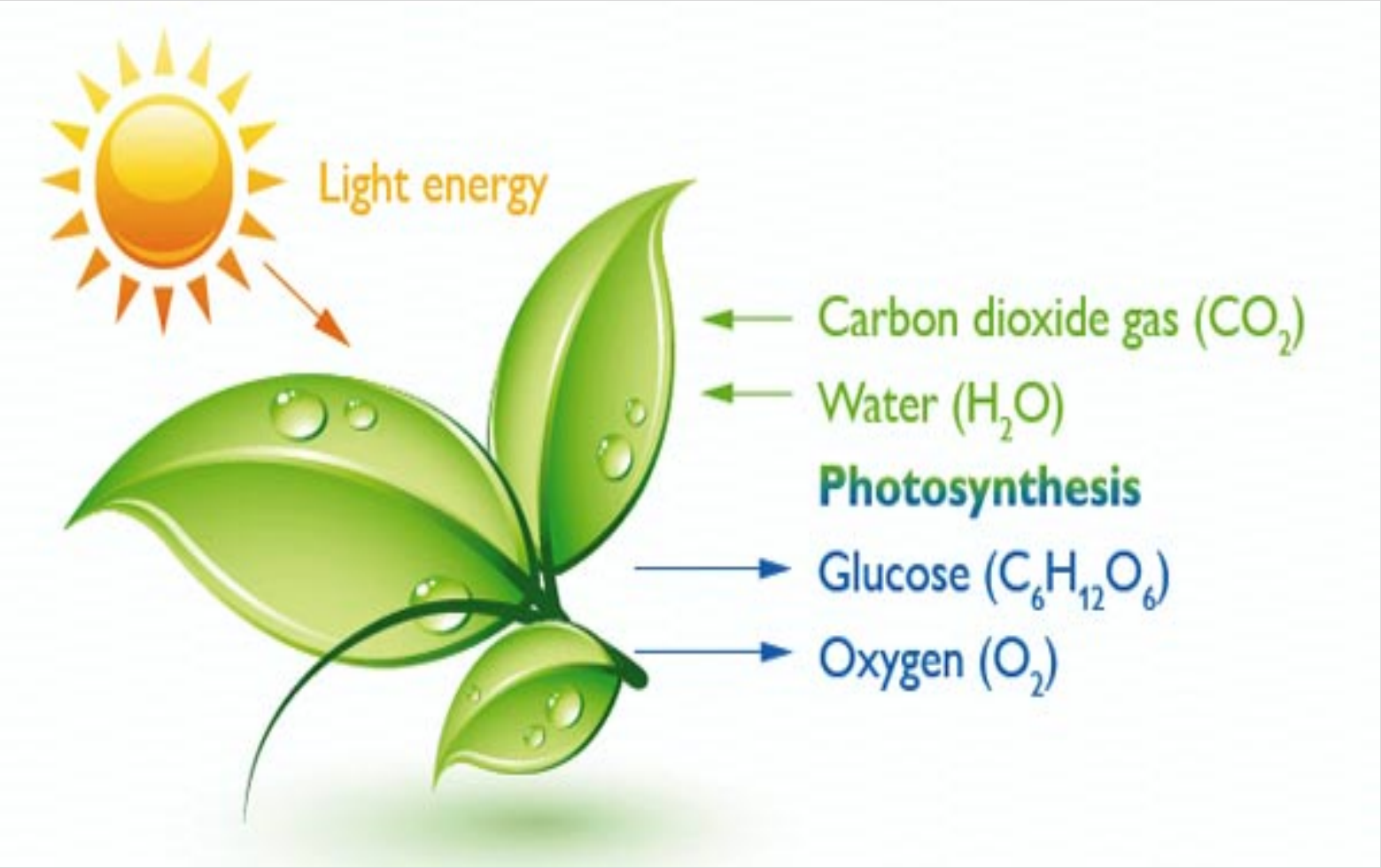
Auxin biosythesis

The effect of leaves on AR formation in not related to auxin biosynthesis.



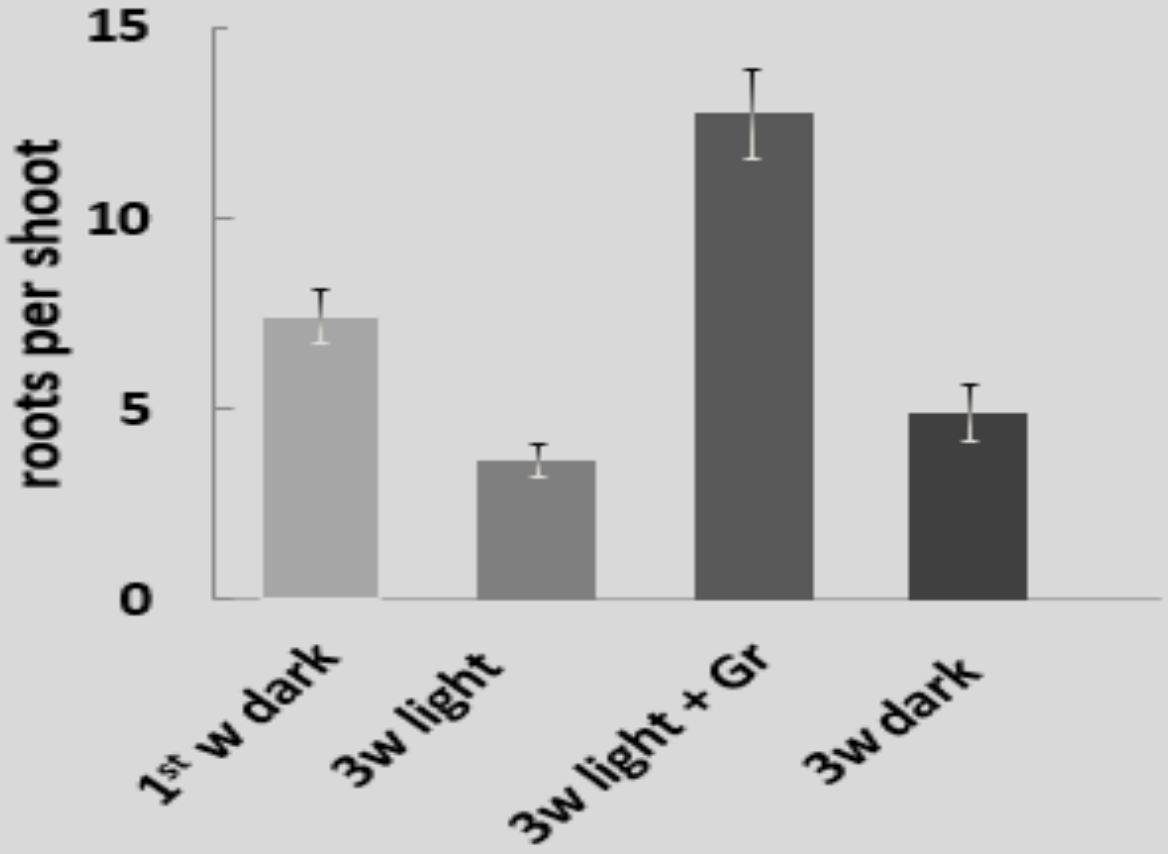


Is the importance of leaves because of photosynthesis (PS)?

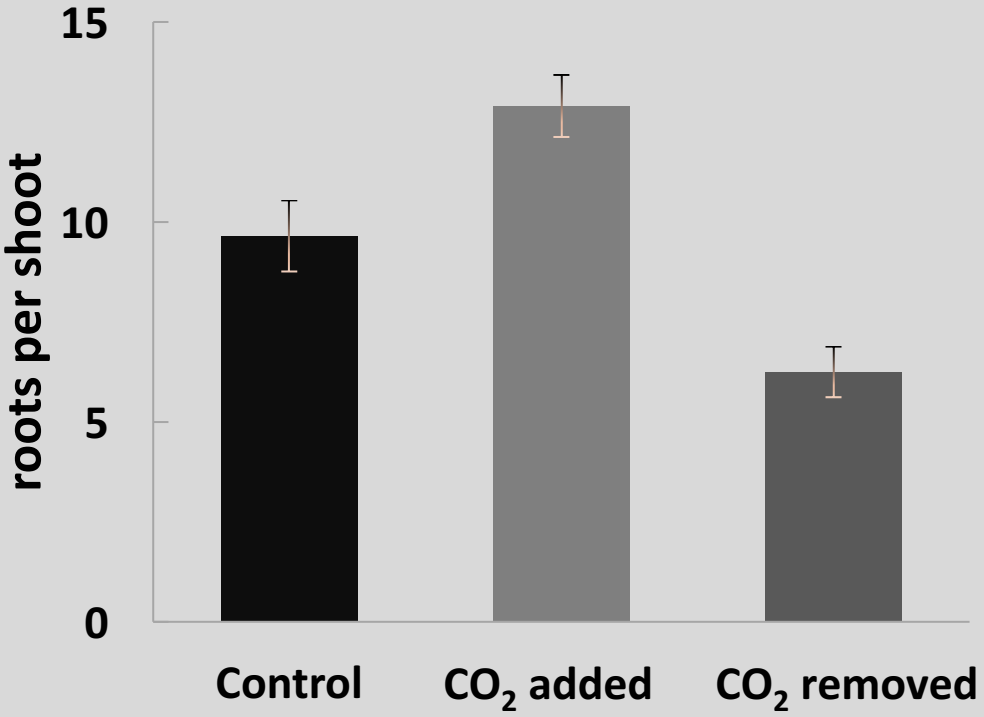


Light influences AR formation

Rooting of apple micro-shoots when different light periods are applied

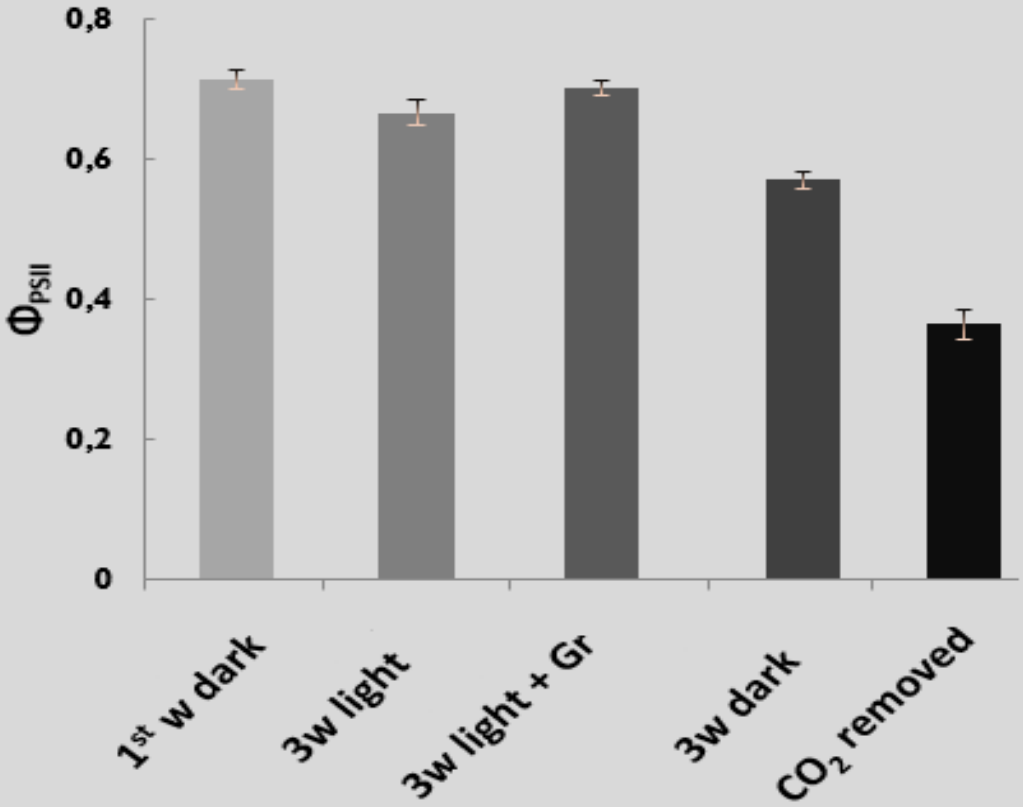


Alteration of CO_2 content of headspace affects AR formation.



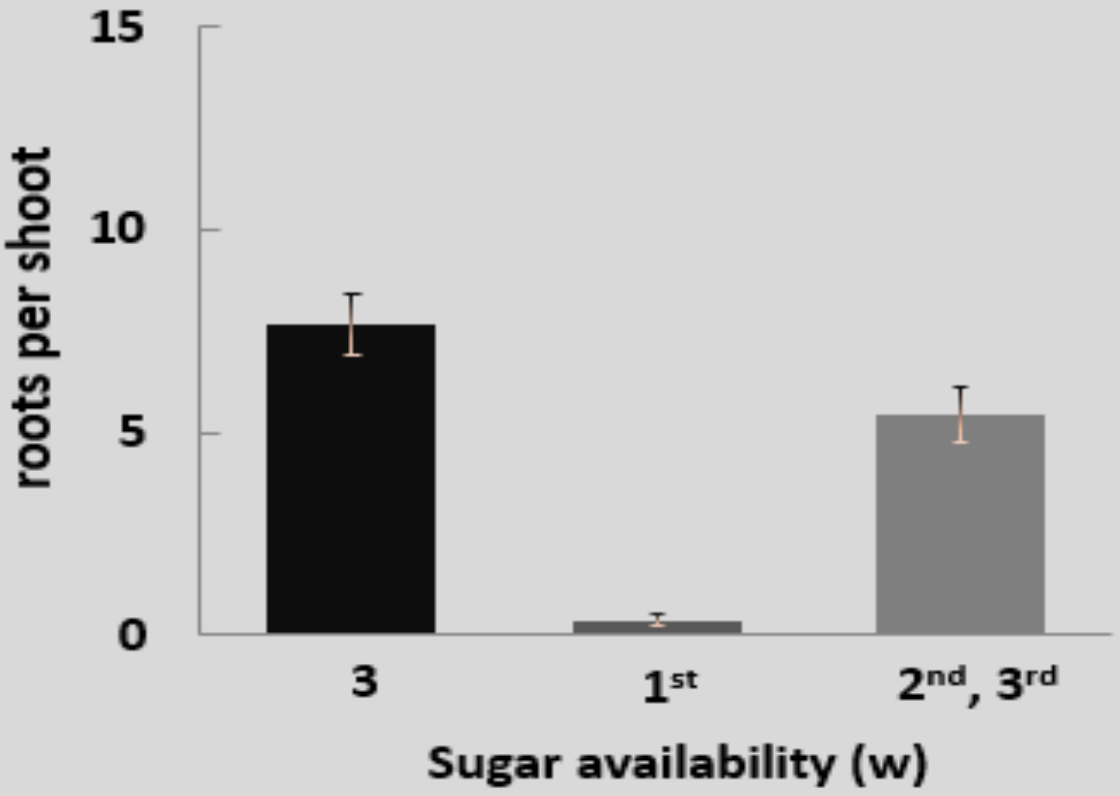
Dark and poor CO_2 conditions reduce efficiency of PSII

PSII efficiency upon dark and CO_2 treatments

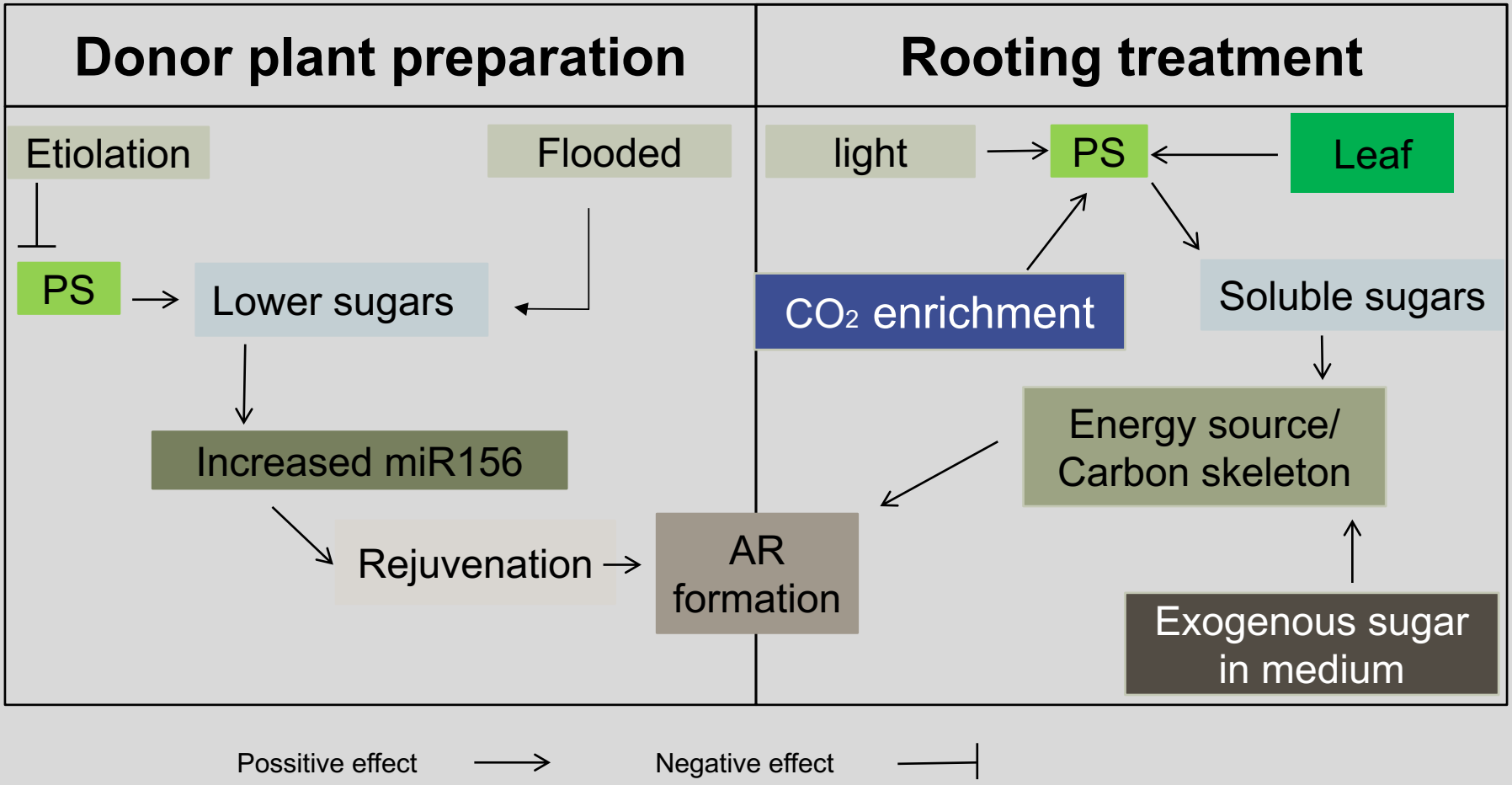


Sucrose, the product of PS, is important during rooting treatment.

Rooting of apple micro-shoots when sucrose was available during different stages of AR formation



A model for the influence of different factors on AR formation



Thank you for your attention