Physiological and anatomical root traits conditioning drought tolerance in oats

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- The susceptible genotype has lower hydraulic conductivity.
- The tolerant genotype has higher hydraulic conductivity of:
  - **Total Root conductivity** → seems to be associated with an increase in the length of the thinner roots
  - **Root conductivity per total root length** → could be correlated with changes in root anatomy.

[Graphs and data tables showing root conductivity and root anatomy comparisons between susceptible and tolerant genotypes]
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RESULTS

This strategy allowed the tolerant genotype to maintain higher water potential reducing drought symptoms and promoting growth under water deficit conditions.

3.2 Materials and Methods

Under drought stress conditions plants reduce transpiration by closing stomata as a method to save water. However, stomata closure uncouples the electron flux for CO2 reduction and promote oxidative stress and a decrease in carbon fixation and plant growth. As an alternative to cope with drought, some plants species follow another strategy according to which, plants exhibit higher stomata control showing lower sensitivity to evaporative demand and soil moisture, and allowing larger fluctuations in leaf potential, maintaining photosynthesis and avoiding oxidative stress. However, such strategy expose plants to a higher risk of xylem embolism.

Materials and Methods

We studied the drought tolerance strategy of a drought resistant and a drought susceptible oat genotype over an imposed water deficit time course of 20 days. We used two oat cultivars, Flega and Patones characterized as susceptible and tolerant to drought, respectively. Sampling times were chosen to cover different levels of sRWC: still-sufficient water (60 daw, 55-60% sRWC), mild water deficit (9 daw, 40-45% sRWC), moderate water deficit (12 daw, 30-35% sRWC), high water deficit (15 daw, 20-25% sRWC), severe water deficit (16 daw, 15-20% sRWC).

Results

We observed that the susceptible genotype increased dramatically the abscisic acid reducing stomatal conductance. Despite this, leaf water potential decreased concomitantly due to a decrease in root hydraulic conductivity (total root conductivity and conductivity per root length) in this genotype that showed early drought symptoms.

By contrast, the resistance genotype, showed a mild and slow increase in abscisic acid that allowed maintaining transpiration longer. This was associated with an increase in root hydraulic conductivity together with an increase in total root length and in the length of the thinned roots.

In addition, root conductivity per root surface increased in the resistant genotype. In order to determine whether the increase in root conductivity per root surface was correlated with changes in root anatomy we carried out a histology study. Preliminary results show that root cortex keep thinner in resistant genotype compared with the susceptible.

Conclusion

This strategy might allow less resistance to water transport maintaining higher water potential, reducing drought symptoms and promoting growth under water deficit conditions.