Lolium and **Festuca** genera exhibit **diverging responses** to severe **drought** stress

Strategies for improving forage productivity under future climates

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Background

- Grasslands cover 20.7% of Europe and are a source of feed for livestock
- But severe drought can reduce grassland yield by 46%, intensifying the need for drought tolerant forage grasses
- Two forage grasses used in grasslands are *Lolium perenne* (highly yielding, with excellent palatability but drought sensitive) and *Festuca arundinacea* (drought tolerant , high yielding but poor palatability)
- This project aims to uncover the basis of Festuca`s improved drought tolerance. With the view to exploit this in other grasses

Materials and Methods

- To investigate the differences between *lolium* and *festuca*, we measured growth response to long and short term drought stress; in four *lolium* and four *festuca* varieties (n = 336)
- The short-term experiments were made in a glass house, where leaf growth was tracked hourly, using an integrated system
- Whilst long-term responses were measured under a rain out shelter at Barenbrug, Mas-granier, France (Fig. 2)

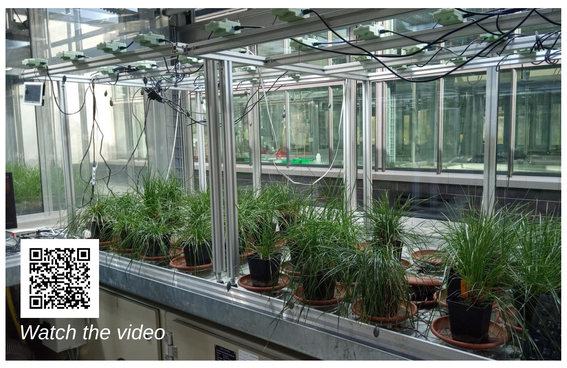

Figure 1: High throughput phenotyping platform used track the response of leaf elongation to drought stress

Figure 2: Forage grass (*Festuca arundinacea*) being tested for responses to drought under a rain-out shelther

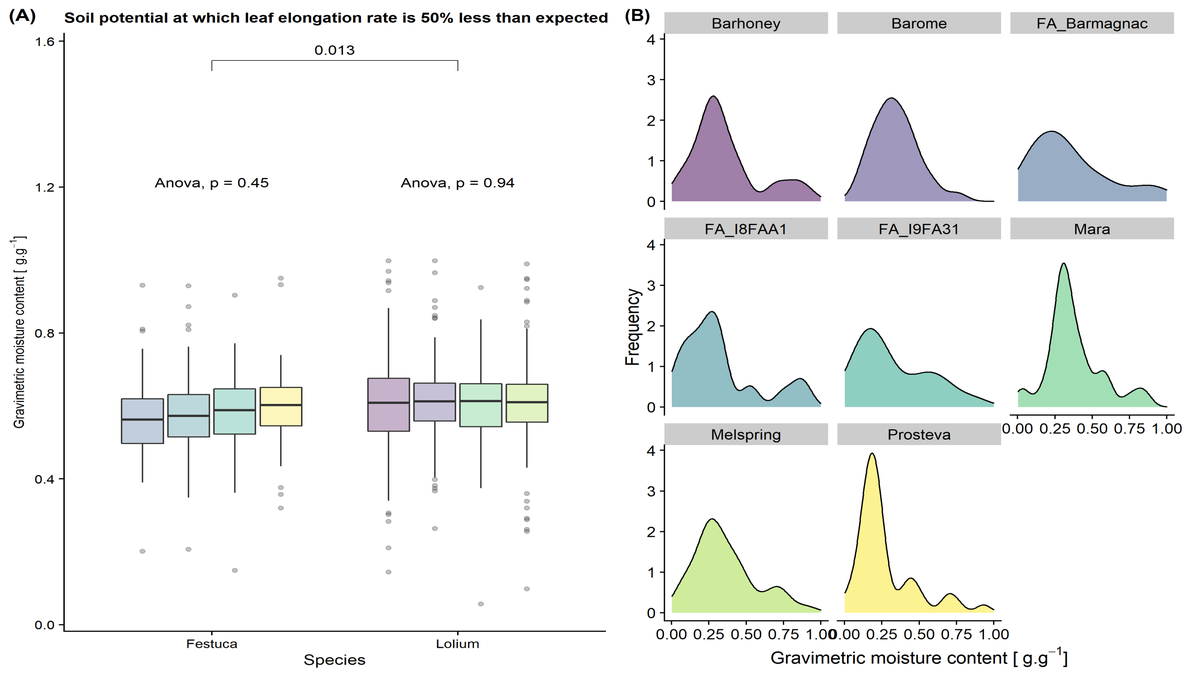

Figure 3: The significance (A) and (B) distribution of the trait, soil moisture content at which leaf growth reduced 50% less than expected, between varieties and within species

Results

- Rain-out shelter experiments showed higher biomass yields in *Festuca* than *Lolium* under drought stress
- Similar results were observed using the integrated system for tracking leaf growth where leaf elongation rate reduced at a significantly lower soil moisture content in *Festuca* than *Lolium* ($p < 0.05$) (Fig. 3)
- However, the temperature dependant growth rate was similar for both *Lolium* and *Festuca*

Conclusion

- *Lolium* is more sensitive to water stress than *festuca*, because it responds earlier to water deficit.
- The large phenotypic variation found suggests these traits can be exploited for breeding.
- This is the first step towards improving forage productivity under future climates

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