

Tall fescue cultivars response to salinity as influenced by inoculation with non-livestock-toxic endophyte AR584

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Introduction

- Tall fescue, *Festuca arundinacea* Schreb., is a perennial C₃ forage and turf grass species widely used in most temperate regions of the world.
- An important plant-microbe symbiosis occurs between tall fescue and the asexual *Epichloë* fungal endophyte which can provide tolerance to biotic and abiotic stress to the host, although in some *Epichloë* strains can cause toxicity to grazing livestock due to the production of ergot alkaloids
- Although endophyte-free fescue cultivars are commonly selected to avoid toxicity in grazing animals, using seeds inoculated with non-livestock-toxic endophytes provide an alternative management strategy.

Objective

- An experiment was carried out in a germination chamber with the objective of comparing the salinity tolerance in cultivars of tall fescue endophyte-free seeds and seeds inoculated with non-toxic fungal endophyte AR584 (Grasslanz Technology Limited, Palmerston North, New Zealand) during germination.

Materials and methods

- A randomized complete block design with three replicates in time with factorial arrangement was used.
- The experimental factors were: 1) cultivars of tall fescue, six levels: Malma, Taita and Royal Q200, endophyte-free (E-) and inoculated (E+) with the non-toxic fungal endophyte AR584; and 2) saline condition, three levels: 0 (control), 120 and 200 mM NaCl.
- Seeds were placed in rolls of paper soaked in the appropriate saline solution and the following variables associated with germination were evaluated by International Seed Testing Association (ISTA) rules: germination energy (seed vigour), germination power, coleoptile and radicle length, fresh weight and dry weight of seedlings (Figure 1).
- Then the rolls were incubated in a germination chamber at constant 25°C and 8:16 light:dark photoperiod, for 14 days.
- The effects of the experimental factors and their possible interactions on the response variables considered were analysed using ANOVA.

Results

- Detrimental effects were observed for germination power and seedling fresh weight ($P < 0.001$) under 200 mM NaCl (Figure 2A-B).
- Non-toxic endophyte reduced germination energy by 40% (Figure 2C) and germination power by 37% (Figure 2D) in cv Royal ($P < 0.001$) and decreased both radicle (Figure 2E) and coleoptile length (Figure 2F) by 15% in cvs Malma and Royal.
- No differences were found in radicle length among cultivars under 120 mM NaCl (Figure 2E). However, non-toxic endophyte increased coleoptile length (Figure 2F) in cv Malma in 120 mM NaCl by 10%.
- Endophyte reduced radicle length by 25% (Figure 2E) and coleoptile length (Figure 2F) by 40% under 200 mM NaCl in cvs Taita and Royal.
- Malma presented the lowest seedling dry weight regardless of its infection level ($P < 0.05$, Figure 2G).



Figure 1. Tall fescue seedlings at the end of the experiment to measure radicle and coleoptile length, in control treatment (A) and in 200 mM NaCl (B).

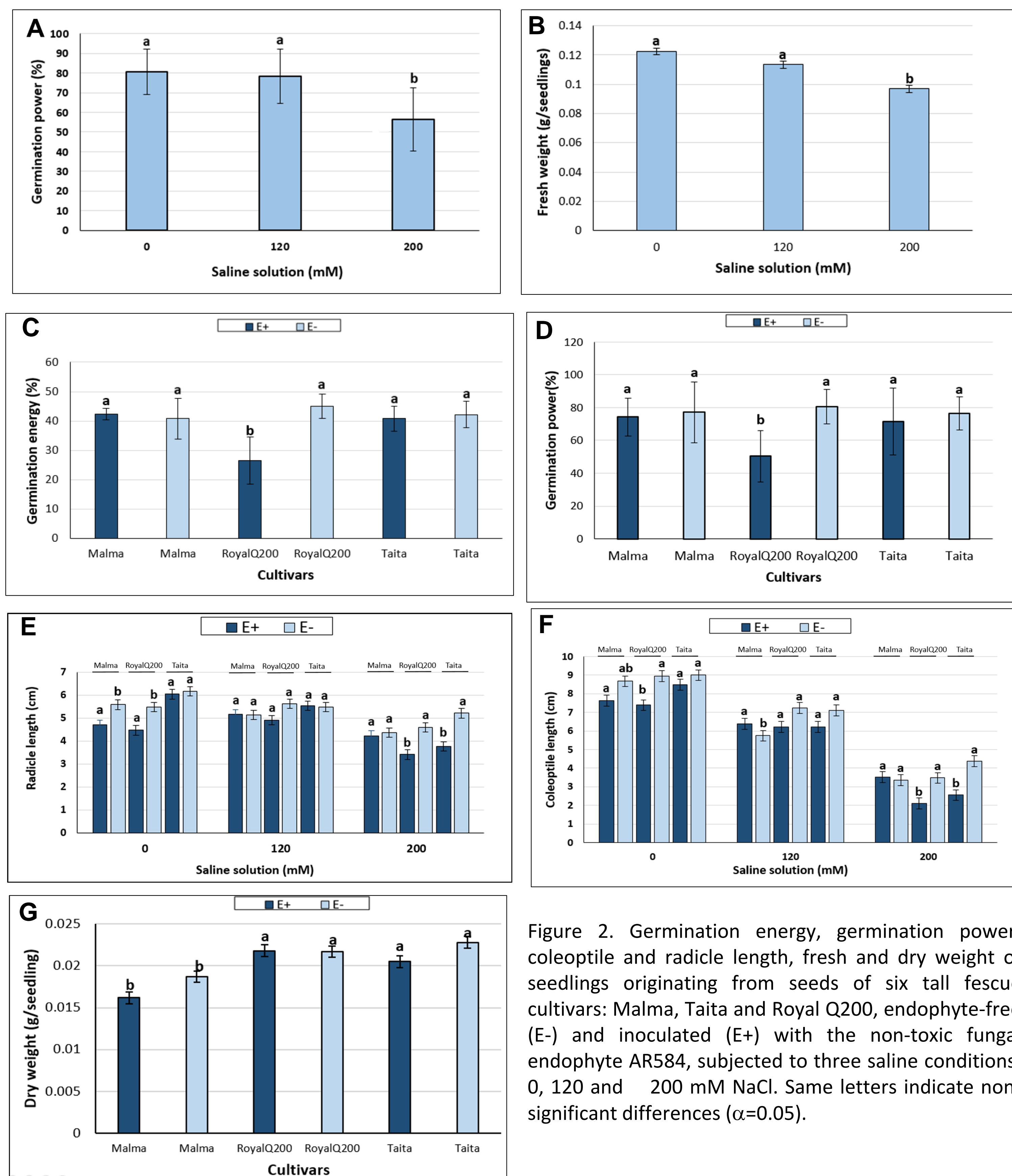


Figure 2. Germination energy, germination power, coleoptile and radicle length, fresh and dry weight of seedlings originating from seeds of six tall fescue cultivars: Malma, Taita and Royal Q200, endophyte-free (E-) and inoculated (E+) with the non-toxic fungal endophyte AR584, subjected to three saline conditions: 0, 120 and 200 mM NaCl. Same letters indicate non-significant differences ($\alpha = 0.05$).

Conclusion

- These results would indicate the existence of great variability in salinity tolerance among tall fescue cultivars evaluated and that the presence of the endophyte would generate an additional cost in the host genotype at germination stage.

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