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Root phenotypic plasticity in response to P deficiency in two tall fescue cultivars

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Introduction Low soil P availability has been recognized as a key factor limiting pasture production in many soils. Changes in the partitioning of C between shoot and root (Mollier & Pellerin, 1999) or root length per unit of root biomass are particularly important to provide a greater root-soil contact to improve uptake of P (Gahoonia & Nielsen, 2004). The objective of this work was to analyze the genotypic variability of two tall fescue cultivars of different origin in response to P deficiency.

Materials and methods Two cultivars of tall fescue (*Festuca arundinacea* Schreb.), El Palenque Plus (EP, temperate) and Fraydo (F, Mediterranean), were cultivated under three P levels (0, 10 and 100 mg P added per kg mixture 1:1 w/w of soil (4.5 ppm P and 4.9% OM) and river sand, P1, P2 and P3, respectively) during 63 days in 12 PVC containers per cultivar per P level, arranged in three blocks in a glasshouse. Four harvests were performed (33, 42, 54 and 63 days after seeding). Shoot and root dry matter, shoot and root P content and total root length were measured. Statistical analyses were carried out using SAS (SAS Inst., Cary, NC, USA). Means were separated using LSD ($P < 5\%$) and slopes compared using dummy variables.

Results and discussion EP produced more root in relation to shoot (significantly steeper slope) than F under all of P treatments (Figure 1). Conversely to F, EP was capable of producing longer roots per unit of root biomass in response to P deficiency (Figure 2). However, specific root length was not significantly different between cultivars for P1 and P2. Phosphorus utilization efficiency (total plant biomass at the last harvest divided by tissue P concentration) was higher in P2 than in the other treatments and was similar between cultivars (Data not shown).

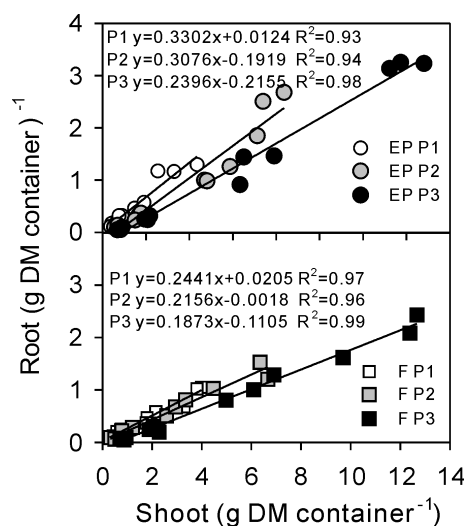


Figure 1 Root DM vs. shoot DM in two tall fescue cultivars subjected to three P treatments.

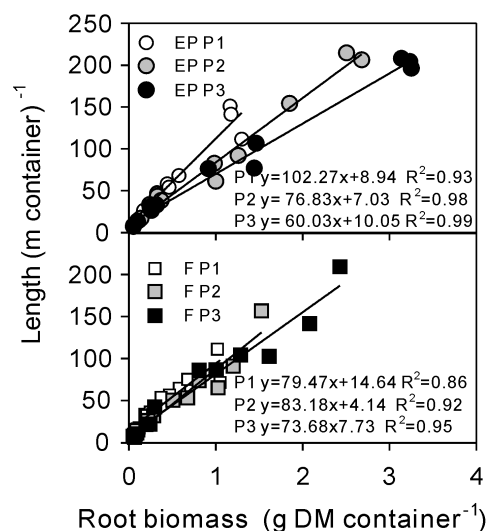


Figure 2 Root length vs. root biomass in two tall fescue cultivars subjected to three P treatments.

Conclusions EP tended to show a higher phenotypic plasticity in response to P deficiency: a higher biomass allocation to root system and an increased proportion of fine roots. However, no significant differences were found under the most limiting P availability between cultivars. Phosphorus utilization efficiency was increased under moderate P deficiency (P2) only.

References

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