

# Physiological Responses of Continental (Summer-Active) and Mediterranean (Summer-Dormant) Tall Fescue to Cold Stress and Identification of Underlying QTL for Fall Growth and Winter Survival

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## ABSTRACT

We describe three experiments; the first two experiments were conducted in a greenhouse and with the use of cold chambers. The first experiment determined the effect of endophyte (*Neotyphodium ceonophialum*) presence under cold (4.5°C) and freezing (-3, -6, -9, and -12°C) conditions on two genotypes of Continental tall fescue [*Lolium arundinaceum* (Schreb.) S.J. Darbysh.], one Mediterranean tall fescue, and two *F. arundinacea* var. *atlantigena* St. Yves. The plants were assessed for growth, measured by leaf extension rate (LER), proline, fructan, and mono- and disaccharides concentrations at 25.0 and 4.5°C. Additionally, the survivability of these plants was assessed at -3, -6, -9, and -12°C. It was found that endophyte presence did not affect the LER or concentrations of proline and the mono- and disaccharides at 25.0 or 4.5°C. In the second experiment four Continental (PI 172423, PI 283297, PI 314684, and Kentucky-31) and three Mediterranean accessions (PI 200339, PI 610956, Flecha) were used to determine the growth quantified by LER, abscisic acid (ABA), proline, fructan, and mono- and disaccharides concentrations. Mediterranean accessions were different from Continental accessions for all parameters measured at 4.5°C. The final experiment included the development of a linkage map from a cross between a Mediterranean (103-2) x Continental (R43-64) cross, and identifying QTL relating to fall growth (FG), measured by LER, and winter survival (WS). This is the first reported linkage map of Mediterranean tall fescue as well as the use of DArTFest markers using array technology. Major QTL were found for FG and WS at each location across years. Based on all data in this study it appears these two types of tall fescue are unique species.