Changes in photosynthetic and respiration responses during cold acclimation and deacclimation of annual bluegrass and creeping bentgrass

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Premature losses in freezing tolerance and winter injury of some cool-season turfgrasses can be a problem in northern climates. In order to reduce the economic losses and maintenance costs associated with premature deacclimation, a better understanding of the underlying factors that contribute to turfgrass freezing tolerance is needed. Therefore, the objectives of this study are were to: (1) compare the freezing tolerance of annual annual bluegrass (AB) and creeping bentgrass (CB); (2) understand the physiological and biochemical changes associated with cold acclimation and deacclimation. Plants were maintained in the green house for 3 months before moved to the growth chamber. A total of five treatments including: (1) non-acclimated at 20 °C; (2) cold acclimated at 2 °C ; (3) cold acclimated at -2 °C (4) deacclimated at 8 °C for 1 d; (5) deacclimation at 8 °C for 5 d were designed. At the end of each treatment, changes in freezing tolerance were determined based on lethal temperature resulting in 50% kill (LT50). In addition, carbon metabolic activities including photosynthesis, respiration, photochemical efficiency (Fv/Fm) and photochemical yield (Yield) were measured following each treatment. Overall, CB exhibited higher freezing tolerance (lower LT_{50}) following cold acclimation. Furthermore, CB deacclimated at a slower rate compared to AB, as demonstrated by a lower LT_{50} at 8 °C for 1 and 5 d. In addition, the photosynthesis, respiration, Fv/Fm and Yield of AB increased more rapidly during deacclimation, which suggested that the metabolic and physiological activities of AB are activated rapidly in response to temperature increases. This may explain why AB exhibits a more rapid loss of freezing tolerance compared to CB and enhanced susceptibility to winter injury.