Induction of freeze tolerance in roots of leafy spurge

L. D. METZGER and E. R. MANSAGER

The authors work at the USDA-ARS Biosciences Research Lab., Fargo, ND 58105-5674

Leafy spurge (Euphorbia esula) is an aggressive weed that infests large areas of rangeland in North America. Its resistance to control measures lies in part, in the ability to rapidly produce large numbers of shoots from adventitious ‘root’ buds located on the roots following damage or injury to the aerial portions of the plant. Understanding the mechanisms that enable the root systems of leafy spurge to survive the harsh winters of the Northern Great Plains may lead to the development of new and more effective methods of control. A bioassay that measures the tolerance of root systems to freezing temperatures was developed. Greenhouse or growth chamber grown plants were highly intolerant to temperatures slightly lower than freezing. After one week at -2 to -5º C the root tissue was necrotic and none of the root buds were able to produce new shoots when subsequently placed at warmer (24º C) temperatures. However, subjecting intact plants to low, non-freezing temperatures (6-8º C) prior to freezing increased the survival of roots and root buds; a 4 week low temperature pretreatment resulted in about the same ability to produce new shoots from root buds as non-frozen control plants. The induction of freeze tolerance in roots was correlated with a decline in starch levels and an increase in soluble carbohydrates (mostly sucrose).