Reliability of Various Plant Constituents and Artificial Freezing Methods in Determining Winterhardiness of Alfalfa

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Changes in the content of certain constituents and in the permeability of cell membranes during hardening suggest that various methods may serve to differentiate hardy from less hardy varieties of alfalfa, Medicago sativa L. The purpose of this investigation was to test the reliability of several plant constituents and freezing methods that have been suggested in the literature and used as measures of winterhardiness.

LITERATURE REVIEW

Martin (15) concluded that freezing of wheat plants at controlled temperatures followed by a determination of the extent of killing was the most feasible laboratory method for measuring hardiness. Tysdal and Crandall (24) obtained high correlations between the survival of alfalfa in controlled freezing tests and their survival under field conditions. In contrast, Ausemus and Bamberg (2) obtained low correlation coefficients with winter wheat varieties between winter injury in the field and injury sustained by artificial freezing.

The electrical conductance method described by Dexter (6)—a measure of the degree of exosmosis of electrolytes from tissue after freezing—has been used by several investigators (4, 5, 8, 11, 19) to show a progressive development of hardiness throughout the autumn period in hardy and non-hardy varieties of legumes. Dexter (7) subjected unfrozen, hardened wheat leaves to mechanical pressure, simulating injury from ice pressure within the tissue, and correctly classified varieties in the order of their hardiness by measuring the conductivity of exosmosed electrolytes from the injured tissue. Wilner (28) has shown a close association between hardiness ratings of hardened tissue of apple varieties by electrical conductance and their relative capacity to survive winter conditions in the field in central Canada.

Steinmetz (23) compared hardy 'Grimm' alfalfa with the less hardy Kansas Common during the winter months

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