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E. Charles Brummer
Iowa State University

Mindy Weishaar
Iowa State University

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Selecting Non-dormant Alfalfa for Winter Hardiness

Abstract
Alfalfa (*Medicago sativa* L.) adapted to the Midwestern United States typically becomes dormant in autumn to allow the plants to survive the stresses of winter. Plants that do not have a dormancy response are not winter hardy, but they produce more biomass during the late summer and autumn. Trying to get high autumn yield together with excellent winter hardiness has been a goal of alfalfa breeders for many years, but it is difficult to achieve. One possibility is to select for winter hardiness in non-dormant varieties. They may produce more yield in the autumn than currently available varieties. Also, because the non-dormant varieties are not related to varieties adapted to Iowa, they may be useful in the development of hybrid alfalfa. The objective of this study was to determine if selection within non-dormant cultivars for winter hardiness is possible.

Keywords
Agronomy

Disciplines
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Selecting Non-dormant Alfalfa for Winter Hardiness

E. Charles Brummer, associate professor
Mindy Weishaar, undergraduate student
Department of Agronomy

Introduction

Alfalfa (*Medicago sativa* L.) adapted to the Midwestern United States typically becomes dormant in autumn to allow the plants to survive the stresses of winter. Plants that do not have a dormancy response are not winter hardy, but they produce more biomass during the late summer and autumn. Trying to get high autumn yield together with excellent winter hardiness has been a goal of alfalfa breeders for many years, but it is difficult to achieve. One possibility is to select for winter hardiness in non-dormant varieties. They may produce more yield in the autumn than currently available varieties. Also, because the non-dormant varieties are not related to varieties adapted to Iowa, they may be useful in the development of hybrid alfalfa. The objective of this study was to determine if selection within non-dormant cultivars for winter hardiness is possible.

Materials and Methods

We made two cycles of selection for winter hardy plants starting with four non-dormant varieties. The selection was conducted by planting the varieties in the autumn at Ames and selecting the most vigorous plants the following spring. After crossing the surviving plants, we repeated the process a second time. For this study, we compared the selected populations (Cycle 2) with the original varieties (Cycle 0) to see if we had improved winter hardiness. The test was conducted at Ames and Nashua. Plots were seeded in August 1999 and plant height was measured in October to estimate the dormancy response because more dormant plants have shorter growth during autumn. We evaluated the plants for spring vigor, the opposite of winter injury, in April 2000.

Results and Discussion

The spring vigor data demonstrate that we were able to improve the winter hardiness of all four varieties using our selection methods (Table 1). The results in Nashua were less striking than those in Ames, perhaps because and the weather was drier and the plants had less time to grow. Unfortunately, we also decreased the plant growth in autumn of all four varieties. We are not surprised by this result, because plants need to reserve some of their energy to prepare for winter, rather than to continue growth.

We will continue to select to generate breeding populations for further research and variety development. One possibility is to use these populations to develop hybrid alfalfa. Otherwise, they can be used to select superior plants for use in improved varieties.

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Table 1. Spring vigor and autumn plant height for unselected non-dormant varieties (C0) and populations selected for two cycles for winter survival and spring vigor in Ames, IA. Data are presented for an experiment planted in 1999 at both Ames and Nashua.

	Spring Vigor					
	Ames			Nashua		
Variety	Cycle 0	Cycle 2	C0 vs. C2	Cycle 0	Cycle 2	C0 vs. C2
	----------Score[a]----------					
5939	2.9	5.0	*	2.9	4.0	*
CUF101	3.7	5.6	*	3.5	4.3	NS
GT 13 R Plus	3.4	5.6	*	3.8	4.5	NS
Magna 8	2.9	5.2	*	2.4	3.6	*
	Autumn Plant Height					
	Ames			Nashua		
Variety	Cycle 0	Cycle 2	C0 vs. C2	Cycle 0	Cycle 2	C0 vs. C2
	----------cm----------					
5939	16.8	12.0	*	6.2	4.4	*
CUF101	13.1	9.1	*	5.3	4.7	*
GT 13 R Plus	13.1	9.5	*	5.1	5.5	NS
Magna 8	18.0	11.9	*	5.3	3.7	*

[a]Score for spring vigor: 1 = dead to 9 = very vigorous.

*, NS = Indicate that C0 and C2 for a particular variety are significantly different from each other at the 5% probability level or are not significantly different, respectively.