



Evaluation of alfalfa lines and populations for reduced dormancy, higher yield and winter hardiness across Canada

WINTER HARDY ALFALFA

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Background: Current varieties of winter hardy alfalfa enter into dormancy in late summer and early fall, meaning that growth ceases during that time. While they are grazing tolerant and winter hardy, after the first graze or cut, regrowth does not occur to an extent that permits a second cut or more flexible grazing systems. Higher yielding commercial varieties with faster regrowth often suffer during overwintering, making it difficult to keep a significant portion of alfalfa in the stand for a reasonable length of time.

Dormancy in alfalfa is related to the rate of decline in day light and temperature. This project will evaluate different populations of alfalfa across a number of geographic locations: Quebec City, Normandin, Swift Current and Lacombe, to find the plants that best combine superior winter hardiness and higher late season productivity to use in future breeding programs.

This project builds upon a related [Beef Industry Science Cluster project](#), which genotyped 18 alfalfa varieties and evaluated them for yield, fall dormancy, freezing

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Objectives: The objectives of this study were to:

1. Improve late season alfalfa productivity for grazing by selecting lines for enhanced fall growth (reduced fall dormancy) and winter hardiness.
2. Identify winter hardy alfalfa populations with variations in fall dormancy.
3. Compare the agronomic performance of short-season alfalfa (e.g. Yellowhead, Peace, Anik, Rangelander) in contrasting environments with differences in temperature and daylight hours.

What they did: Sixteen registered alfalfa varieties (Anik, Yellowhead, Heinrichs, Prowler, Rambler, Rangelander, Roamer, Caribou TF3, Beaver, Peace, Forerunner, Spredor 2) and six producer collected varieties (a Rhizoma type, MV Brand, an Anik-related type, ScL38304, Taproot Lundgard, Falcata Lundgard) representative of fall dormancy regions experienced in Canada were compared to checks with known dormancy ratings (6010, 6010 DTF2, AAC Nikon, AC Melodie, Vernal) for the agronomic testing. Also included were populations of Peace (Peace D1) and Yellowhead (Yellowhead D1) alfalfa that had undergone selection for reduced dormancy. Populations were established in a greenhouse in 2016 and then transplanted in single rows in Quebec City, Normandin, Swift Current, and

Lacombe. In 2017 and 2018, plant yield was measured twice during the growing season, plant height was measured in October, and individual plant mortality was determined in the spring.

A demonstration plot near Caroline, AB was established in 2013 with blocks of six pure-stand populations of alfalfa plants collected by producers in the Rocky Mountain House area that had a reputation for good winter survival. The seed originated from producers in central and northern Alberta. Each block was split in half, with both halves being cut and harvested as hay in July of each year, and then one half grazed intensively in September with the other half being left ungrazed.

What they learned: Selection for reduced dormancy in Yellowhead alfalfa was successful in developing a population (Yellowhead D1) that retained the same level of winter hardiness as the original population, but had higher fall regrowth at all locations (2986 kg/ha in 2017 and 5213 kg/ha in 2018 compared to 1703 kg/ha in 2017 and 3544 kg/ha in 2018). Selection within non-dormant populations improved winter hardiness for 6010 DTF2, and also improved winter hardiness and fall regrowth for Caribou FT3. Caribou FT3 performed similarly to Vernal in terms of fall dormancy (rating of 2), and had winter survival similar to Beaver (fall dormancy rating of 1.5). The regrowth of Caribou FT3 was best at Normandin and Lacombe, but averaged 3745 kg/ha in 2017 and 5276 kg/ha in 2018 over all locations. Generally speaking, regrowth forage quality for the more dormant types was greater than the less dormant types, largely because taller, less-dormant plants have more stem material. This slight quality decline may be offset by increases in yield.

As expected, the more dormant varieties experienced less winterkill two years after establishment; however, the Yellowhead D1 population that was selected for reduced fall dormancy outperformed all other varieties except the producer-collected Falcata Lungard in terms of average percentage of dead plants (3.5%) over all locations.

In the demonstration trial, a higher alfalfa content helped to drive forage regrowth. The less dormant Rhizoma, and more dormant Taproot Lundgard survived well, retaining 60% alfalfa in the stand after four years of graze/hay. MV Brand had good fall regrowth, but did not persist in the stand as well. Anik, Yellowhead and Falcata Lundgard did not compete well with grass, and tended to exit the stand fairly quickly through grass competition or winterkill.

What it means: There is potential to improve alfalfa regrowth through selection for reduced dormancy in normally dormant, winter hardy alfalfa populations, and also through selection of improved freezing tolerance in high yielding alfalfa populations normally grown in warmer locations. Some relatively unknown winter hardy populations that are in use by producers vary in dormancy and have good fall regrowth potential, thus may be useful as genetic sources for winter hardiness and regrowth in breeding programs.

A new [Beef Industry Science Cluster project](#) is going to further select Peace and Yellowhead varieties for reduced fall dormancy, freezing tolerance, and validate genetic markers for these traits. Additionally, they will be assessed for grazing tolerance.

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