



# Western Beef Development Centre

Division of PAMI

## Alfalfa in Brown Soil Zone Crop Rotation

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### Introduction

Producers are interested in crop rotation sequences which utilize legumes that biologically fix nitrogen (N) to meet their own requirements because they do not require mineral fertilizer N, and because the residual N can be utilized by non-legume crops in the subsequent years. This residual N can significantly reduce N fertilizer requirements and save producers money. Alfalfa is used in rotations in other regions of North America for its high-quality forage and high forage production, but also to provide N to subsequent crops such as wheat and corn. In the Brown soil zone of southern Saskatchewan and Alberta, forage mixtures including alfalfa are frequently grown for long periods (10 years or longer) on soils considered marginal for annual crop production. However, short-rotation hay crops (three to four years) could provide crop producers with an alternative cash crop (hay) and provide N benefits to subsequent cereal crops.

### Trial Management

To test this idea, we took three experiments with three alfalfa cultivars mixed with three grass species that had been hayed for three years each, at the Semiarid Prairie Agricultural Research Centre (AAFC) in Swift Current Saskatchewan. The alfalfa varieties were Beaver, Nitro, and none, while the grasses were slender wheatgrass, intermediate wheatgrass, and Dahurian wildrye. Beaver alfalfa is a common persistent hay variety, while Nitro alfalfa is a non-dormant variety that persisted for only one to two years. All three grasses are considered as short-lived species (three years), but some research has reported longer persistence for intermediate wheatgrass. Each experiment had four replications.

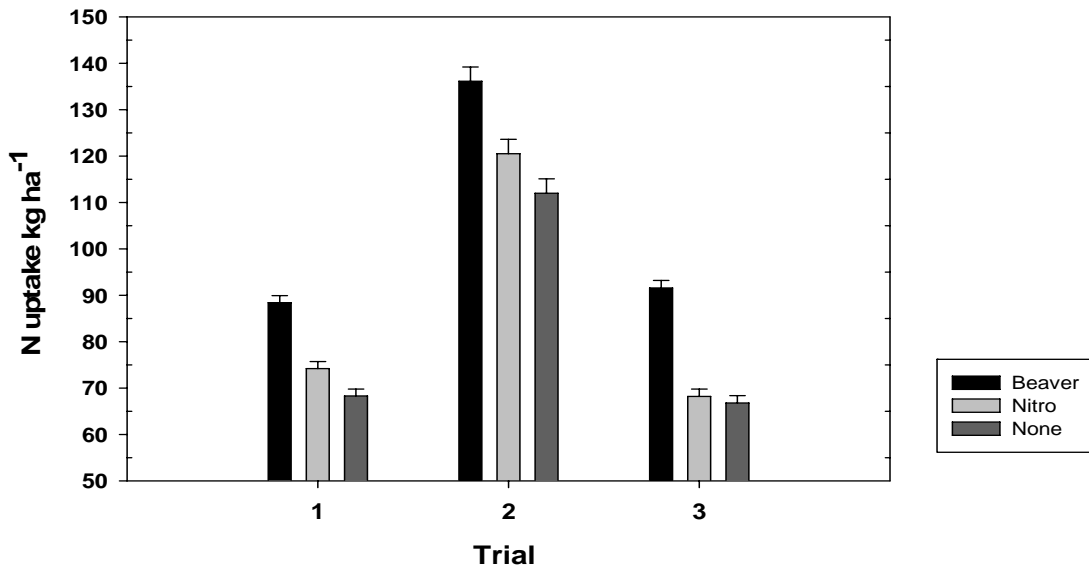
One experiment was terminated with glyphosphate herbicide in each year from 2003 to 2005. Barley was direct-seeded without prior tillage in late May or early June. No N fertilizer was applied at seeding. In the next year, a second barley crop was seeded with 55 kg N/ha applied at seeding as 46-0-0. We harvested biomass and grain yields of the barley crops from each original forage mixture plot and determined N concentration of both grain and straw/chaff. This allowed us to calculate the N uptake of the barley crop as affected by prior forage mixture.

### Results

The effect of alfalfa cultivar was greater than the effect of grass species. N uptake totalled over two years was significantly higher for barley following mixtures with Beaver alfalfa than Nitro, or no alfalfa, in all three trials (Figure 1). Nitro alfalfa had persisted for only two years in these trials, but produced some additional residual N in two of three trials. Note that there is soil residual N from the termination of grass only plots. If we use a balance approach and



deduct the N fertilizer applied in the second year of each trial, then the soil residual N was 40 – 90 kg N/ha following a Beaver alfalfa stand. At recent prices for N fertilizer, this would result in \$20 - \$50 per acre in savings for the barley crop production. Grain yield in the first year after forage termination was variable in our experiments because we applied no N fertilizer in that year. However, the difference among alfalfa treatments in barley grain yield was not as large as the differences in grain N concentration (data not shown). This observation would suggest that this rotation would generate more returns if we had used spring wheat as the test crop, where we could have captured some protein premiums in the Beaver alfalfa treatments.



**Figure 1.** Two-year total N uptake by barley

### Conclusion

Grain producers can use short-rotation alfalfa/grass hay crops in their annual crop rotations where they have local markets for cash crop hay, and capture N benefits for subsequent grain crops. Concern about stand termination can be addressed by timing the application of broad-spectrum herbicide to control the alfalfa. Dry soil conditions following alfalfa is a greater concern where the alfalfa stand is much older than three years, and where several tillage operations are needed to mechanically terminate the alfalfa stands.

### Acknowledgement

This research was conducted with the support of Agriculture and AgriFood Canada facilities, staff and equipment.