

# Reducing Usage of N Fertilizer For Optimizing Forage Yield of Bromegrass-Alfalfa Mixtures

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## Background

- Bromegrass is a common forage crop in the Parklands of Alberta and other Prairie Provinces.
- Because most soils are deficient in plant-available N, application of N fertilizer is essential for high yields and improved quality of grass forage.
- Fertilizer N is one of the major input costs for hay production.
- Grasses, when grown in mixtures with legumes, can benefit from the N fixed by legumes.
- This may improve yield and quality of forage, and should result in lower fertilizer N requirements to the forage stand.
- However, the amount of fertilizer N needed for optimum forage and protein yield depends on the percentage of legume in a grass-legume mixture.

## Objectives

To determine:

- the influence on dry matter and protein yield of growing alfalfa in a mixture with bromegrass.
- the optimum N rates for various bromegrass-alfalfa mixtures.
- the effectiveness of alfalfa in mixtures with bromegrass in reducing requirements of fertilizer N for optimum forage and protein yield.

## Materials and Methods

Locations:

Eckville (Gray Luvisol Soil)  
Lacombe (Black Chernozem Soil)

Experimental Design:	5 (mixtures) x 5 (N rates) factorial in a randomized complete block with four replications
Mixtures:	Pure Bromegrass Brome:Alfalfa (2: 1) Brome:Alfalfa (1: 1) Brome:Alfalfa (1:2) Pure Alfalfa
N Rates:	0,50, 100, 150 and 200 kg N/ha
Data Recorded:	Dry matter yield (DMY) Crude protein in plant samples

## Summary and Conclusions

Without fertilizer N, dry matter yield (DMY) and protein yield (PY) were lowest in pure bromegrass stands.

The DMY and PY increased when alfalfa was grown in association with bromegrass. The relative increase was greater with PY than with DMY, most likely due to increase in the concentration of protein in hay.

In pure bromegrass stands, there was a marked increase in DMY and PY from N application up to the highest rate of 200 kg N/ha used in the study.

Forage and protein yields also increased with N application in mixed stands, but the magnitude of yield response to applied N was less than the pure grass stands.

The net returns above fertilizer costs were much greater from mixed stands than from bromegrass alone.

In pure bromegrass stands, the net returns increased with increasing N rate up to 200 kg N/ha. However, equivalent net returns were attained without fertilizer N in bromegrass-alfalfa mixtures of 2: 1 at Lacombe and 1: 1 at Eckville, and with only 50 kg N/ha in the 2: 1 mixture at Eckville.

The results indicate that the use of N fertilizer on mixed perennial forages can be reduced by 150 kg N or more per hectare without any detrimental effect on forage yields, forage quality and returns to producers.

In addition to savings on the cost of fertilizer N (i.e., \$0.70 per kg of N), the use of alfalfa in mixtures with bromegrass has the potential advantages of reducing the consumption of fossil fuel needed to manufacture N fertilizer (i.e., equivalent of 2.3 L of diesel fuel per kg of N), and improving N-supplying capacity and tilth of soil. This is better for the environment.

## Acknowledgments

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Figure 1.

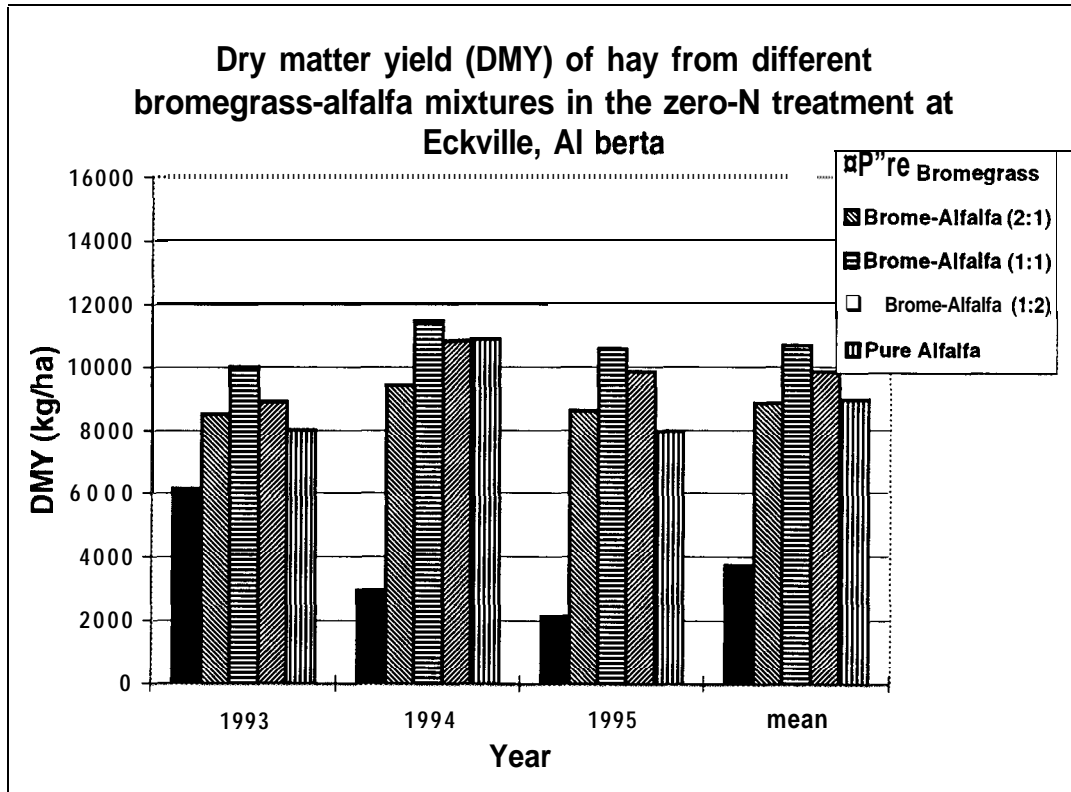


Figure 2.

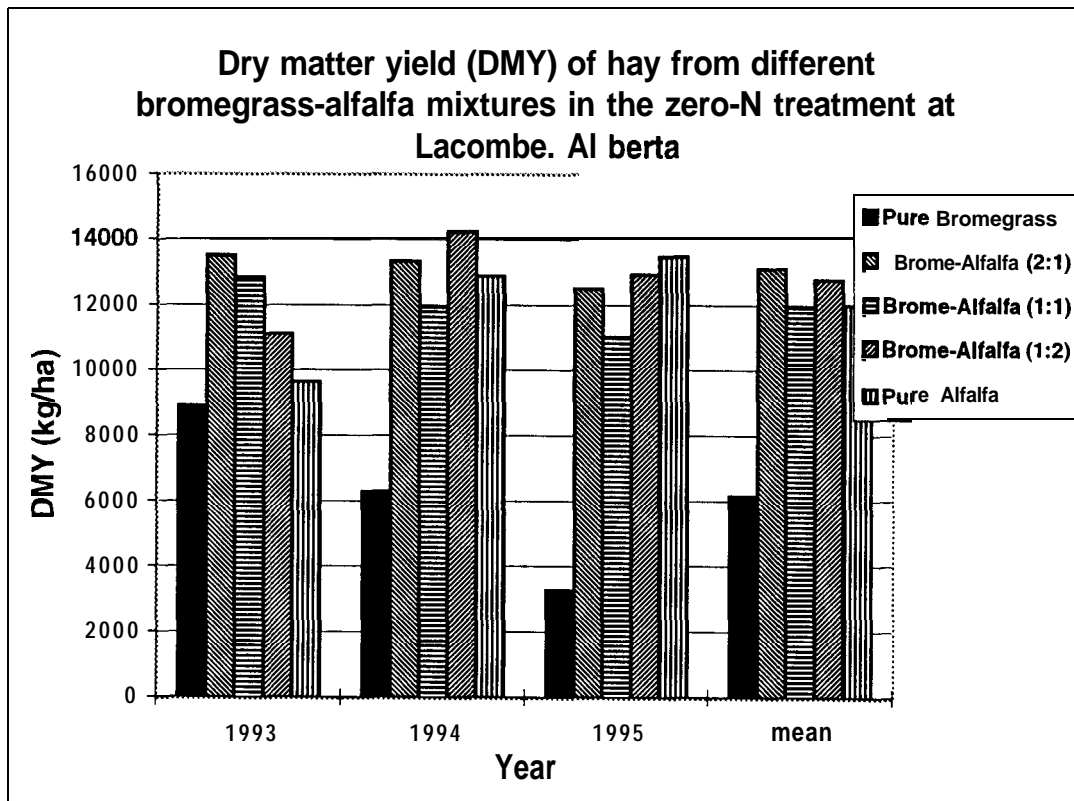


Figure 3.

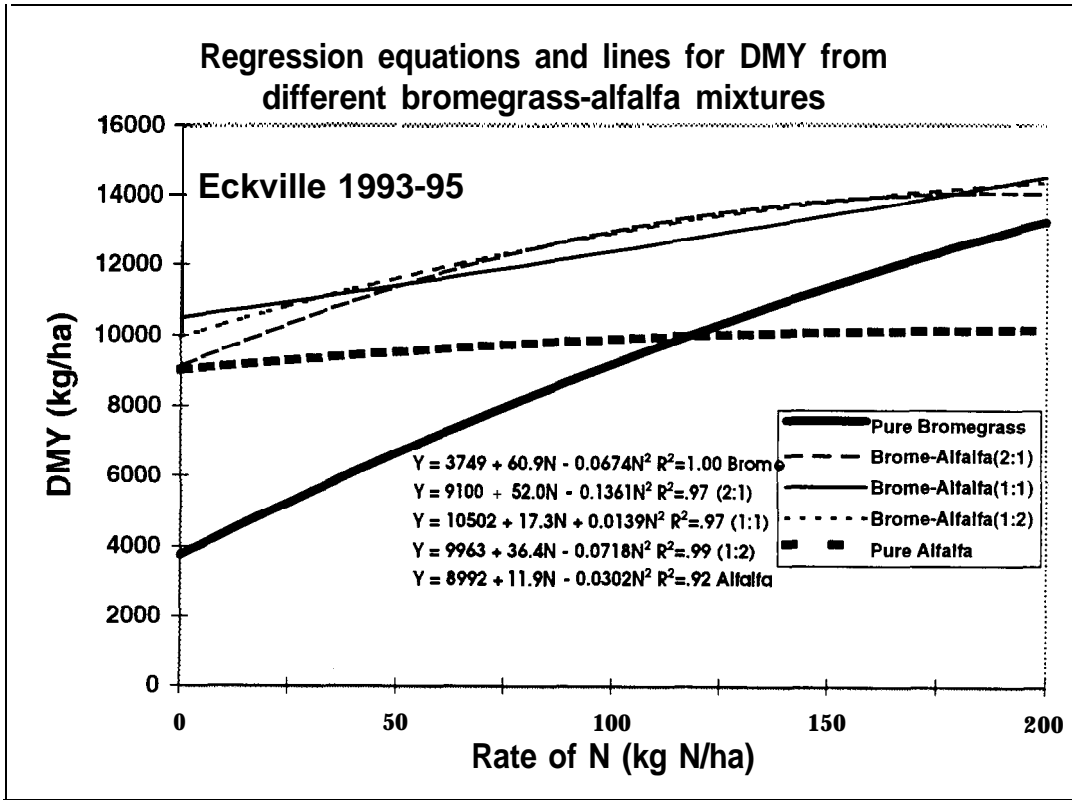


Figure 4.

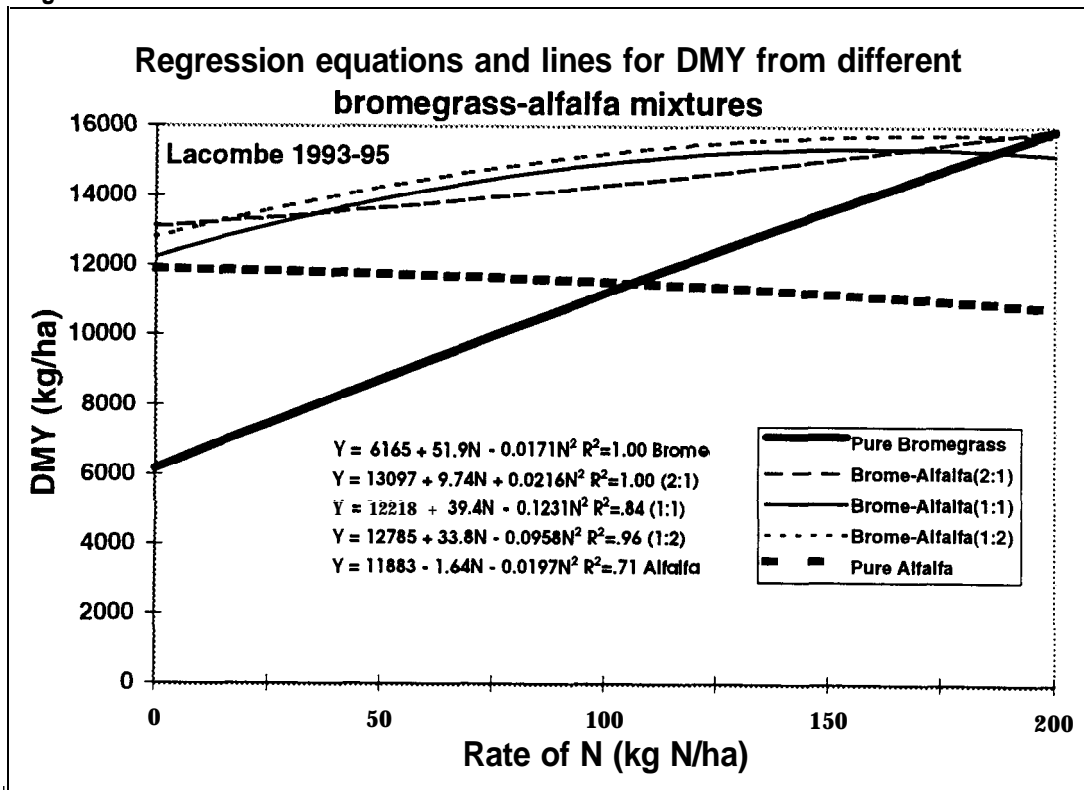


Figure 5.

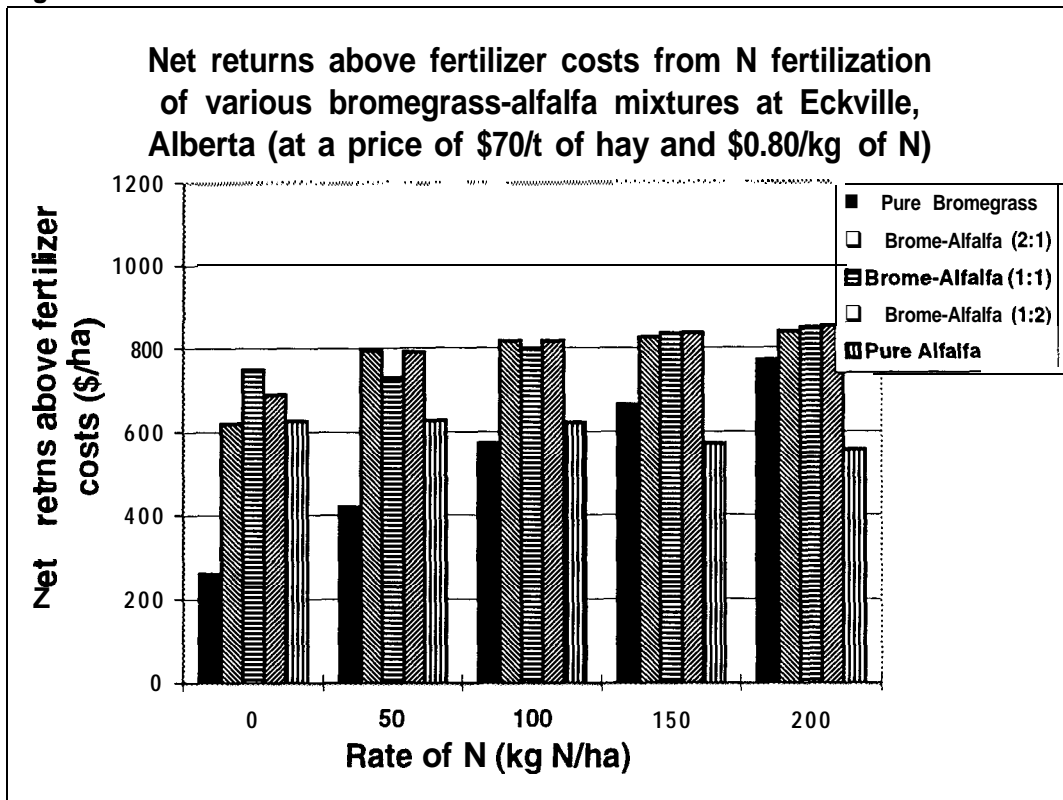


Figure 6.

