

# Evaluation of Forage Yield and Quality of Low-Lignin Alfalfa in Monoculture and Binary Mixtures in the Dark Brown Soil Zone of Saskatchewan

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## Introduction

Lignin increases with advanced maturity in alfalfa. However, lignin is indigestible and reduces fiber digestibility in ruminants. Thus, reducing lignin content should increase fiber digestibility at any maturity stage.

## Objective

To compare low-lignin Hi-Gest® 360 alfalfa (Photo 1) to a conventional legume in both monoculture and binary mixtures.

## Materials and Methods

### Varieties

Alfalfa: *Medicago sativa* L. cvs. AC Grazeland (**Grazeland**) and Hi-Gest 360 (**Hi-Gest**)

Hybrid bromegrass (**HB**): cv. AC Success

### Growth Condition

In monoculture: **Grazeland** and **Hi-Gest**

In mixture (binary): **Graze+HB** and **HiGest+HB**

Soil zone: Dark Brown site in Saskatchewan

Irrigation: July 26, 27, and 29 July 2017, for 12, 24, and 24 mm, respectively

### Experimental Setup

Plot: 1.2 m × 6.2 m (7.44 m<sup>2</sup>) with 4 rows and 48 plots (Photo 2)

Design: plots in a randomized complete block design, four replicates with forages as treatments

### Agronomic Information

Seeding date: July 24, 2017

Seeding rate: 400/m<sup>2</sup> for alfalfa monoculture; 200/m<sup>2</sup> for alfalfa binary mixture; 167/m<sup>2</sup> for AC Success HB binary mixture

### Harvest

At 3 maturity stages (**stage**) of alfalfa over 2 years: 1 = 10% bloom; 2 = 40% bloom; and 3 = 100% bloom

Harvest dates: June 21, 25, and 29, 2018; July 8, 12, and 16, 2019



Photo 1. Low-Lignin Alfalfa Hi-Gest® 360. Credit D. Bagley.



Photo 2. Plot establishment. Credit B. Biligetu.

## Results and Discussion

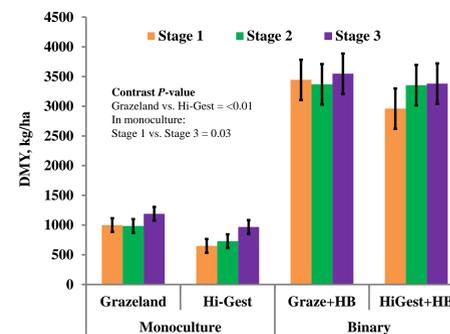


Fig. 1. Dry matter yield of the experimental site (Means ± SE; kg/ha).

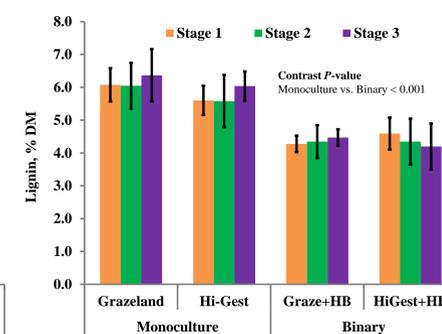


Fig. 2. Lignin content of forages (Means ± SE; %, DM basis).

- Forage × maturity stage interaction was not observed ( $P > 0.05$ ) for forage quantity and quality.
- In monoculture, Hi-Gest alfalfa had lower DMY (782 vs. 1058 kg/ha) compared to AC Grazeland; forages at maturity stage 3 had greater DMY (1058 vs. 783 kg) than those at maturity stage 1 (Fig. 1).
- The lignin content of Hi-Gest 360 was ~8% lower than AC Grazeland (5.7 vs. 6.2%) (Fig. 2).

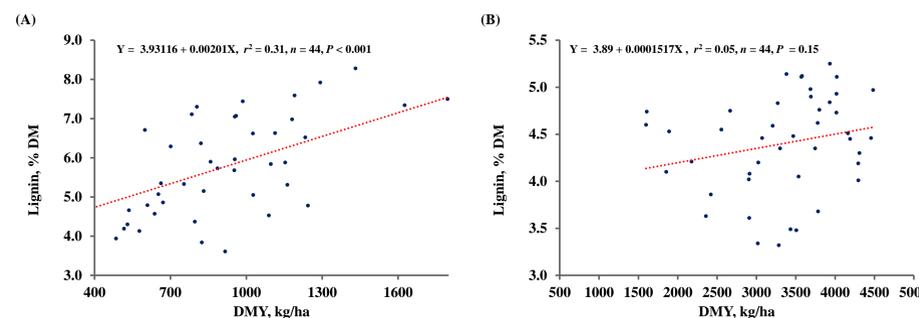


Fig. 3. Regression relationship between forage lignin (Y; %, DM) and DMY (X; kg/ha) in monoculture (A) and binary mixture (B).

- A strong positive correlation was detected between lignin content and forage yield ( $r^2 = 0.31$ ;  $n=44$ ;  $P < 0.001$ ) in alfalfa monoculture (Fig. 3A).
- Association between lignin content and forage yield ( $r^2 = 0.05$ ;  $n=44$ ;  $P < 0.15$ ) was not observed in binary system (Fig. 3B).
- The TDN yield of Hi-Gest, Grazeland, HiGest+HB, and Graze+HB were 540, 718, 1976, and 2100 kg/ha, respectively.
- The CP yield of Hi-Gest, Grazeland, HiGest+HB, and Graze+HB were 160, 210, 407, and 434 kg/ha, respectively.

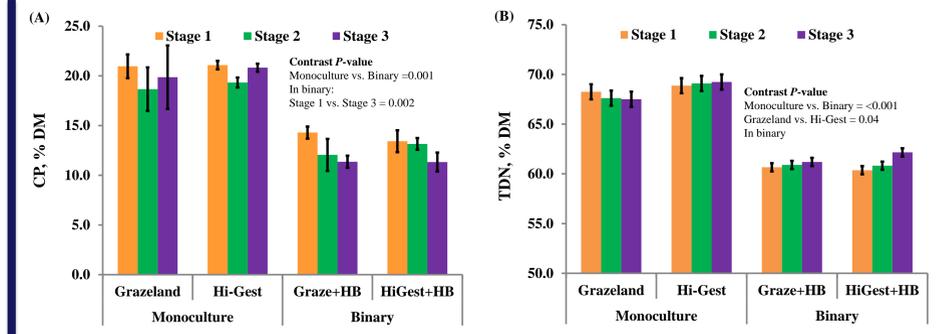


Fig. 4. Crude protein (A) and total digestible nutrients (B) of forages.

- Hi-Gest alfalfa had greater crude protein (CP, 19.1 vs. 17.9%) (Fig. 4A), total digestible nutrients (TDN; 68.7 vs. 66.5%) (Fig. 4B), relative feed value (186 vs. 164) and sugar (5.4 vs. 4.8 %).

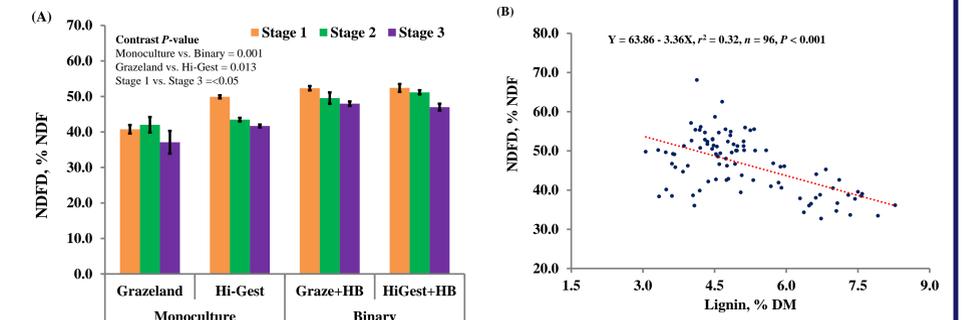


Fig. 5. Digestibility of NDF of forages.

- Hi-Gest alfalfa had higher ( $P < 0.05$ ) NDFD (40.7 vs. 37.6%) (Fig. 5).

- A strong negative correlation was detected between NDFD and forage lignin content (Fig. 6).

- No differences were observed between Graze+HB and HiGest+HB binary mixtures for DMY or quality profiles.

## Conclusions and Implications

Hi-Gest 360 alfalfa in monoculture yielded 25% lower than AC Grazeland, however, Hi-Gest monoculture had greater nutritive value than AC Grazeland, and similar yield and quality in binary mixture, suggesting Hi-Gest 360 alfalfa is a viable alternative legume for the Dark Brown soil zone of Saskatchewan. Hi-Gest alfalfa harvested at the stage 3 was very similar with AC Grazeland harvested at the stage 2 (commercial cut) suggesting that it may be possible to delay harvest to get higher CP with the same yield as from standard alfalfa varieties cut earlier.

## Acknowledgements

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