



Northern NY Agricultural Development Program 2018 Project Report

Maximizing Both Alfalfa and Grass Quality of Mixtures Grown as Dairy Forage

Project Leader:

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Cooperating Producers:

- Jefferson County: Lynn Murray, Champion, NY
- Lewis County: Dallen Farney, Lowville, NY
- Lewis County: Marc Laribee, Lowville, NY

Background:

Fiber digestibility declines over one percentage unit per day in spring growth, and spring harvest may account for up to half of the total forage yield used as forage for lactating cows. Although forage quality improvement was mostly ignored in the past by breeders, there are releases of new cultivars for both alfalfa and perennial grass that have the potential to greatly improve the quality of this forage mixture as a dairy forage crop.

Forage quality of both grass and alfalfa can be improved by variety selection. Three reduced-lignin alfalfa varieties are now available: two conventionally-developed (Hi-Gest 360, and KF 425HD) and another that was genetically modified (HarvXtra). There are also numerous other alfalfa varieties with higher quality claims. Many alfalfa seed companies are now licensed to sell varieties containing the HarvXtra genetically-modified reduced-lignin trait.

Persistence and yield of higher quality alfalfa varieties are currently unknown in Northern NY.

Additionally, several new grasses are being developed or have been recently released that all have potential for higher grass quality at the normal harvest time for alfalfa-grass mixtures. Not only are meadow fescues typically higher in fiber digestibility than other grasses, it now appears that there are significant differences in NDFD among meadow fescue varieties. There are many meadow fescue varieties across Europe that have not been evaluated for yield or quality in North America. For Northern New York growers working under cooler climate conditions, meadow fescue has the added advantage of being more winter hardy than tall fescue.

This Northern New York Agricultural Development Program-funded research in 2017-2018 evaluates several variety options for their potential to enhance alfalfa-grass production by Northern New York growers.

Methods:

On May 17, 2017, we planted a trial at Murcrest Farms in Jefferson County with three low-lignin alfalfas:

HarvXtra, Hi-Gest360, and KF425HD sown in mixture with seven grasses:
Bariane TF, Tetrax, Pradel and Preval MF, Dividend VL OG,
Chiefton reed canarygrass, and Sunset III timothy.

The trial was harvested four times in 2018. Samples were hand-separated into alfalfa and grass fractions at each harvest, with any weeds discarded. Harvesting required four individuals and multiple vehicles at the site, with refrigerated sample storage to preserve samples for separation and drying in Ithaca, NY. Up to eight individuals were available for the sample separations in Ithaca.

Alfalfa and grass were analyzed separately for crude protein (CP), neutral detergent fiber (NDF), invitro true digestibility (IVTD), neutral detergent fiber digestibility (NDFD), Acid Detergent Fiber (ADF), and lignin.

The two primary concerns with alfalfa-grass mixtures are:

- 1) achieving a 20-30% grass mixture, and
- 2) achieving the highest quality possible for the grass.

Three new experiments were established in 2018 to help answer these questions.

1) An alfalfa-grass seeding rate study was sown at the Murcrest Dairy on May 8, and on the Dallen Farney farm (Silvery Falls Farm) in Lewis County on May 26. HarvXtra alfalfa and Hi-Gest 360 alfalfa were sown in mixture with two meadow fescues, each at 5 different seeding rates in 6 field replicates. Tetrax meadow fescue was sown at ½, 1, 2, 3, and 4 lbs/acre, while Minto meadow fescue was seeded at the same number of pure live seeds per acre as Tetrax. Tetrax seed was over 50% larger in weight per seed than Minto.

2) Meadow fescue seed was collected from a number of European sources for evaluation in mixture with alfalfa. We planted Ameristand 427TQ alfalfa on the Marc Laribee farm (Graceway Farm) in Lowville on May 26, in mixture with 19 meadow fescue varieties and Bariane tall fescue. The average seeding rate for meadow fescue varieties was 2 lbs pure live seed/acre. There was a 2-fold range in weight per seed, but the same number of pure live seeds/acre were planted for all meadow fescue varieties.

The 19 meadow fescue varieties are: Tetrax, Liherold, Preval, Pradel, Barvital, Cosmonaut, Driftless, Hidden Valley, Tored, SW Revansch, Pardus, Barika, Barcrypto, Laura, SW Minto, Arni, Jogeva 47, Harlequin, and Hyperbola. Most of these varieties have not been evaluated in North America, and yield and quality in a northern NY environment are unknown. Many of these varieties were developed in colder, shorter season environments than those in Northern NY.

Results:

Yield

Above normal rainfall after seeding and for most of the growing season on the fertile Murcrest site in 2017 resulted in excessive grass growth that strongly competed with alfalfa during the seeding year. A relatively cold spring set back alfalfa in 2018, resulting in relatively mature grass harvested with pre-bud alfalfa in the spring. Alfalfa growth is primarily controlled by heat units or growing degree days, while grass development in the spring is primarily controlled by daylength. So grass headed at a normal time, while alfalfa development was significantly delayed. This combination resulted in very high grass percentages in all mixtures in the spring (Fig. 1). Yield did not differ over alfalfa varieties (Table 1).

Following spring harvest, however, the Murcrest site was droughty most of the rest of the season. While drought retards alfalfa growth, it has much more impact on grass growth. Drought shifted mixture composition from mostly grass to mostly alfalfa, with the exception of alfalfa-orchardgrass mixtures. Grass percentage (weighted average of 4 cuts) was very high for orchardgrass, resulting in the highest yield (Table 2). Others had a lower grass percentage over the season, but were an average of high grass percentage in spring growth and relatively low grass percentage in regrowths (Fig. 1). Both timothy and reed canarygrass had a very low grass percentage in mixtures in the 3rd and 4th cuts, with the lowest yield in alfalfa-timothy mixtures.

While the grass proportion in a mixture can impact yield and the CP content of grass, it does not significantly impact all other forage quality measurements for both alfalfa and grass.

Alfalfa Quality

HarvXtra alfalfa was 4.5 % higher than Hi-Gest 360 and 7.5% higher than KF425HD in fiber digestibility, averaged over the season (Table 1). For all of our alfalfa-grass studies across New York State (NYS), HarvXtra has averaged between 5 and 6% higher in NDFD than other alfalfas.

HarvXtra is always significantly lower in lignin than other alfalfa varieties, averaging 14% lower lignin across all our NY studies in past studies. HarvXtra averaged 13% lower lignin than Hi-Gest 360 and 18% lower lignin than KF425HD at Murcrest. Alfalfa was relatively immature at all harvests, as noted by the low average NDF values and high CP values averaged over the season (Table 1). Our harvests were taken at the same time that the entire field was harvested.

Grass Quality

Across all of our alfalfa-grass studies in NYS, meadow fescue averaged 17% lower lignin and about 10% higher NDFD than other grasses.

At Murcrest in 2018, Tetrax meadow fescue was consistently higher in fiber digestibility than other grasses (Fig. 2). At several sites in NY where the tetraploid Tetrax MF was compared to other meadow fescues, it was significantly higher in NDFD, as it was in this study. Tetrax also averaged 9% lower in lignin than the other two meadow fescue varieties in the trial.

Reed canarygrass and timothy sample separations from the 3rd and 4th cuts yielded insufficient grass for all analyses except CP (Table 2).

Grass NDFD averaged over 20 percentage units higher than alfalfa, even though alfalfa was relatively immature at all harvests, with higher than normal NDFD. Including

HarvXtra plus meadow fescue in mixtures can significantly increase annual income on dairy farms (Fig. 3) because of the higher NDFD.

2018 New Seedings

Both new seedings at Murcrest Dairy and Silvery Falls Farm were mowed off twice during the seeding year. Both had relatively stressful conditions for grass establishment, with dry, weedy conditions. We did not attempt to measure yield or quality at either of these sites in 2018, both should be adequately established for harvesting in 2019.

The meadow fescue variety trial (seeded with alfalfa) at Graceway Farm had an excellent stand of alfalfa; it is not clear how much meadow fescue will be present in 2019. The early establishment period was dry and stressful. At the end of the 2018 season plots ranged from 0% visible grass to about 25% grass. Alfalfa growth was heavy and somewhat lodged. We have observed alfalfa-grass seedings in northern NY with plenty of grass in the first production year, but essentially no visible grass in the seeding year.

Many of the European meadow fescue varieties being evaluated were developed in harsher environments than Northern NY, so we assume that they will overwinter successfully, but relative competitiveness with alfalfa, and yield and quality of these varieties are as yet unknown.

Conclusions/Outcomes/Impacts:

Tetragyn meadow fescue continues to produce forage significantly higher in NDFD than other meadow fescue varieties, but will be compared to 18 other meadow fescue varieties in our 2019 study. The combination of reduced-lignin alfalfa with meadow fescue can result in a large increase in forage NDFD.

Crude protein content does not appear to be an issue with these alfalfa-grass mixtures, even the high grass percentage alfalfa-orchardgrass mixtures averaged around 20% CP.

In a 30% grass mixture, the addition of meadow fescue increases NDFD of the mixture by the same amount as adding HarvXtra to the mixture. The combination can increase forage NDFD enough to significantly increase milk income using balanced rations.

Outreach:

Alfalfa-grass research was reported at several meetings and conferences during 2018.

- Jan. 24 CCA Training for New England, Portsmouth, NH
- Oct. 5 World Dairy Expo, Madison, WI (J. Cherney invited presentation)
- Nov. 29 Field Crop Dealer Meeting, Syracuse, NY.

Next Steps:

Our results continue to show that meadow fescue has great potential in mixture with alfalfa, and the combination of meadow fescue and high quality alfalfa should lead to significantly improved forage quality.

Results in cooperation with other regions have shown that grass yield or quality is not consistent across environments, highlighting the importance of regionalized trials.

The main issue remains getting a consistent 20-30% grass mixture year-to-year. In 2019 we will evaluate meadow fescues at several seeding rates with alfalfa, and also will evaluate a large group of meadow fescue varieties, many of them not previously grown in North America.

Acknowledgments:

USDA-NIFA provided funding for evaluation of GMO reduced-lignin alfalfa in pure and mixed stands for a multi-state project (NY, MN, and KY). We have also received funding from the National Alfalfa & Forage Alliance (alfalfa seed checkoff funds) to evaluate forage quality of a wide range of alfalfa varieties in Ithaca. These funding sources plus Northern New York Agricultural Development Program grant funds are allowing us to focus specifically on improving alfalfa-grass production in NY.

Reports and/or articles in which results of this project have been published:

- Cherney, J.H., D.J.R. Cherney, and K.M. Paddock. Does high quality alfalfa pay in mixtures? What's Cropping Up? Vol. 28, No. 1, Jan. 2018.
- Cherney, J.H. and D.J.R. Cherney. Forage quality of spring growth. What's Cropping Up? Vol. 28, No. 2, Mar. 2018.

- Cherney J.H., and D.J. Cherney. Make more milk with alfalfa-grass mixtures. Aug. 2018. Hay & Forage Grower magazine.
- Cherney, D.J., S.R. Smith, C.C. Sheaffer, M.S. Wells, and J.H. Cherney Alfalfa-Grass results differ by region. Jan. 2019. Progressive Forage magazine.
- Cherney, J.H., R.L. Kallenbach, and V. Picasso Risso. 2019. Chapter 20. Forage Systems for Temperate Areas. In (K. Moore et al., ed.) Forages: The Science of Grassland Agriculture. 7th ed.

For More Information:

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Table 1. First production year, 2017, average of 4 harvests, alfalfa; Alfalfa-Grass Mix Quality Project, NNYADP, seeded in 2017.

	HarvXtra	HiGest 360	KF 425HD
Jefferson County (Murcrest)			
Yield, tons/a	4.64 a	4.40 a	4.71 a
Grass, %	47.3 a	44.3 ab	39.7 b
NDF, %DM	31.6 b	31.8 b	33.6 a
ADF, %DM	26.1 b	26.6 b	28.1 a
Lignin, %DM	4.50 c	5.14 b	5.51 a
IVTD, %DM	85.7 a	84.9 b	83.4 c
NDFD, % NDF	55.7 a	53.3 b	51.8 b
CP, %DM	24.6 a	25.0 a	23.8 b

Means on the same line with the same letters are not different.
Quality means are a weighted (by yield) average of 4 cuts.

Table 2. First production year, 2017, average of 4 harvests, grass; Alfalfa-Grass Mix Quality Project, NNYADP, seeded in 2017.

	TF	RC	OG	Pradel	Preval	Tim	Tetrax
Jefferson County (Murcrest)							
Yield, tons/a	4.70 b	4.50 b	5.48 a	4.38 bc	4.39 bc	3.89 c	4.76 b
Grass, %	46.2 b	31.9 c	66.1 a	51.7 b	45.9 b	28.8 c	36.1 c
NDF, %DM	56.3 c	-*	60.8 a	58.0 b	58.1 b	-	53.6 d
ADF, %DM	31.8 c	-	36.4 a	33.5 b	33.4 b	-	31.9 c
Lignin, %DM	3.47 bc	-	4.57 a	3.76 b	3.81 b	-	3.36 c
IVTD, %DM	85.9 b	-	80.6 d	84.6 c	84.3 c	-	88.0 a
NDFD, % NDF	75.4 b	-	69.0 c	74.5 b	74.2 b	-	78.6 a
CP, %DM	21.9 ab	22.5 ab	18.6 c	21.3 ab	20.4 bc	23.2 a	22.1 ab

Means on the same line with the same letters are not different.

Quality means are a weighted (by yield) average of 4 cuts.

* Grass percentage in 3rd and/or 4th cut too small to provide enough sample to analyze.

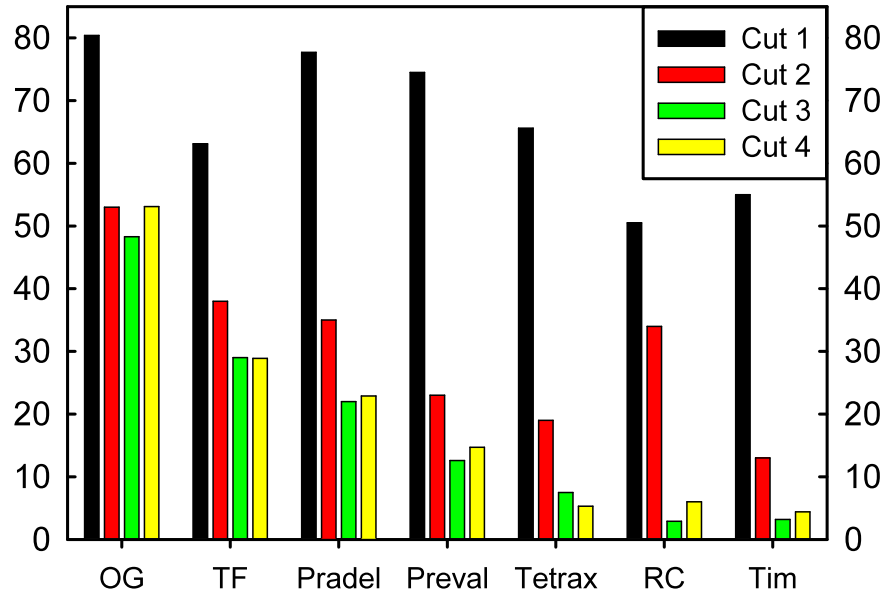


Fig. 1. Grass percentages over four harvests at Murcrest Dairy in 2018. OG=orchardgrass, TF=tall fescue, RC=reed canarygrass, Tim=timothy, others are meadow fescue varieties.

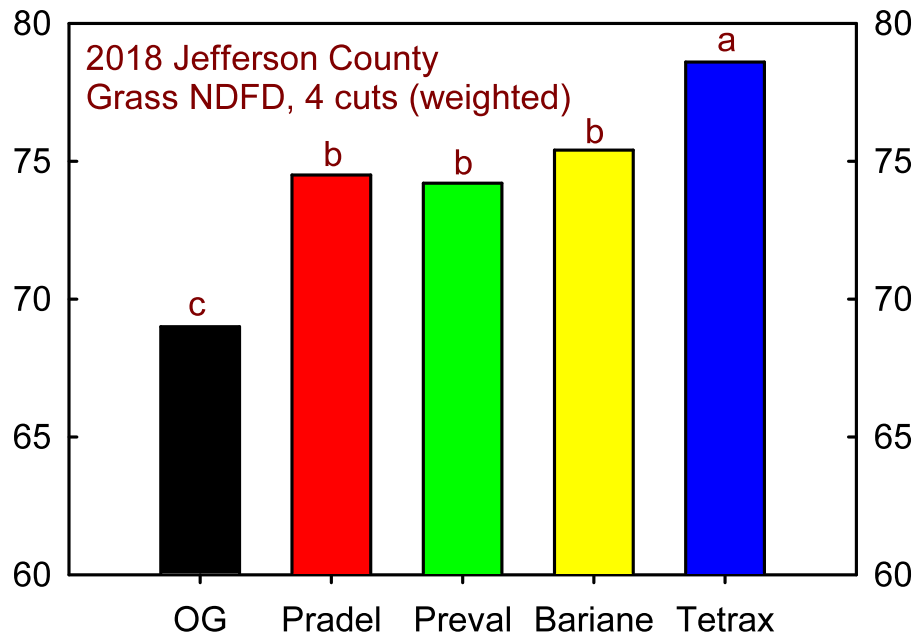


Fig. 2. Weighted average fiber digestibility (NDFD) over four harvests at Murcrest Dairy in 2018. OG=orchardgrass, Bariane tall fescue, and three meadow fescue varieties. Different letters above the bars indicate significant differences among entries.

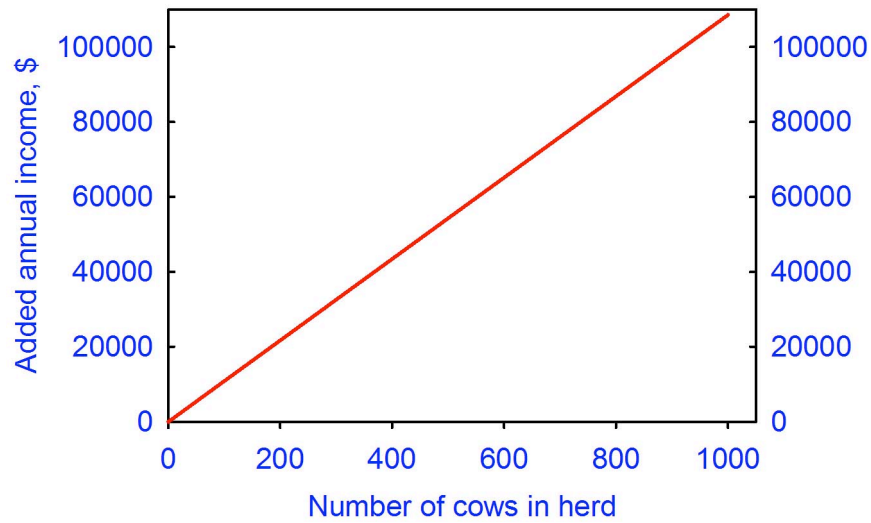


Fig. 3. Estimated added annual income by including both HarvXtra and meadow fescue replacing average varieties. This assumes a mixture of 30% grass, and a 3.5 percentage unit increase in forage NDFD with the improved varieties. The change to improved varieties is farm-size neutral.

Photos:



At left, 10% meadow fescue vs. 25% meadow fescue at right in the fall of 2018 at the Marc Larabee farm, Lewis County, Alfalfa-Grass Mix Quality Project, NNYADP.