Evaluating Progress in Alfalfa Forage Quality Improvement

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RATIONALE & OBJECTIVES

- Many varieties are marketed as having high forage quality but their forage quality relative to those of newly released reduced lignin varieties has not been compared.

Objectives:

To evaluate the forage quality and yield of alfalfa varieties including those being marketed as high quality and those marketed as reduced lignin over a range of maturities.

STUDY DESCRIPTION

Plot Layout:

Replicated small plots.

Locations:

St. Paul, MN, and Ithaca, NY.

Treatments:

- 24 alfalfa varieties, 8 reduced lignin (RL) varieties, 11 marketed as high quality (HQ) without the RL trait, and 5 control (CON) non-selected varieties.
- 5-6 sequential sampling dates resulting in forage of increasing maturity within spring and summer harvests.

Analysis:

- Forage quality was measured by hand-harvesting forage from three random 0.3m² areas in each plot to determine crude protein (CP), neutral detergent fiber (NDF), neutral detergent fiber digestibility (NDFD) and acid detergent lignin (ADL). Alfalfa plant maturity was determined.
- Yield was measured when alfalfa reached the bud-early flowering stage, with four harvests during the year at each location.

RESULTS

- Varieties developed for reduced lignin content had consistently lower lignin and higher NDFD than control varieties and other varieties marketed as high quality (**Table 1**).
- Control varieties and those marketed as high quality did not differ in lignin concentration and NDF digestibility. Differences among all varieties in forage CP and NDF were not consistent over St. Paul and Ithaca.
- For all varieties, forage lignin increased with alfalfa maturity from vegetative to flowering while NDFD decreased; however, the RL alfalfas maintained greater forage NDFD than other varieties over a range of maturities (**Figure 1**).
- Alfalfa forage yield was similar for all alfalfa varieties. Average yield in New York of 4.4 tons/acre was lower than for Minnesota (average yield of 6.7 ton/acre).

Table 1. Average alfalfa forage NDFD and lignin concentration for CON, HQ, and RL varieties for three harvests in New York and Minnesota in 2017 and 2018. Values are averaged for forage harvested from vegetative to early flowering harvest stages.

Nutritive Value	Group	New York		
		Summer, 2017	Spring, 2018	Summer, 2018
NDFD, %	CON	40.3[a,y]	39.0[a,b,y]	38.0[b,y]
	HQ	40.5[a,y]	39.1[b,y]	37.2[c,y]
	RL	42.5[a,x]	42.0[a,x]	39.7[b,x]
Lignin, %	CON	6.0[a,x]	6.0[a,x]	4.1[b,x]
	HQ	5.9[a,x]	6.0[a,x]	4.3[b,x]
	RL	5.4[a,y]	5.2[a,y]	3.7[b,y]
Nutritive Value	Group	Minnesota		
		Summer, 2017	Spring, 2018	Summer, 2018
NDFD, %	CON	55.1[a,y]	42.5[b,y]	42.8[b,y]
	HQ	55.4[a,y]	43.7[b,y]	42.6[b,y]
	RL	57.1[a,x]	46.2[b,x]	45.1[a,y]
Lignin, %	CON	5.7[c,x]	6.4[b,x]	6.9[a,y]
	HQ	5.5[c,x]	6.3[b,x]	6.7[b,y]
	RL	4.9[c,y]	5.4[b,y]	5.9[b,y]

Figure 1. Change in alfalfa variety forage lignin and NDFD content when alfalfa was harvested at several maturity stages in spring of the year following seeding.

Spring - Minnesota
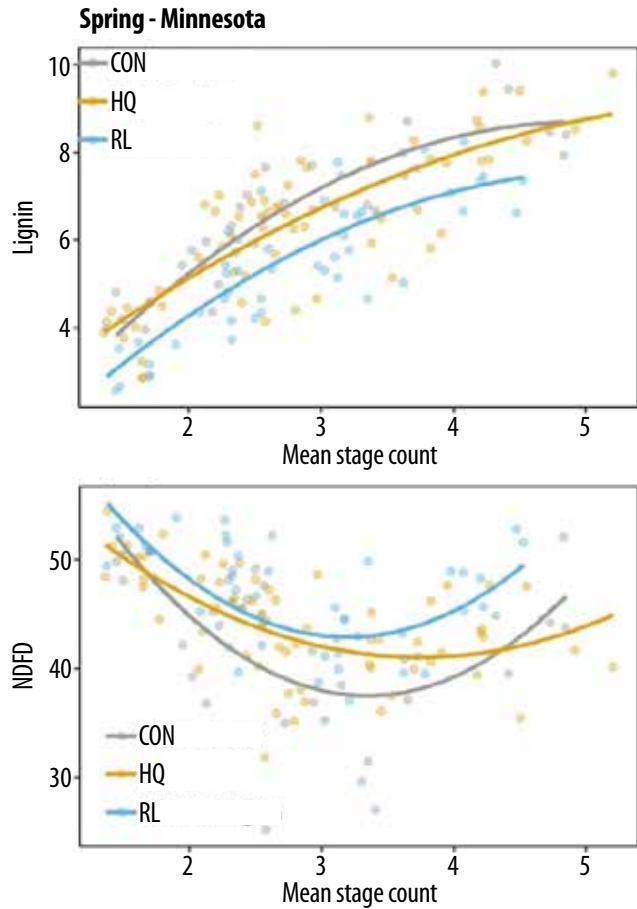
2 = late vegetative, 3 = early bud, 4 =late bud, 5 = early flower

CONCLUSIONS

- Alfalfa varieties vary in forage quality but primarily due to the reduced lignin trait.
- Differences among varieties in crude protein and neutral detergent fiber content are inconsistent.
- The relative differences in digestibility among entries were relatively consistent for bud to early flower maturities when farmers typically harvest alfalfa.
- Alfalfa varieties with varying forage quality had similar yields when harvested four times at bud to early flower.

U.S. Alfalfa Farmer Research Initiative