Estimating Forage Quality of 1st-Cut Alfalfa/Grass Mixtures: A NY-Farm-Based Tool

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The RFQ and RFV indices of standing 1st-cut alfalfa/grass mixtures can be estimated based on grass percentage, alfalfa height, and growing-degree-day (GDD) data. This assertion is based on data from 77 farm samples across 19 New York counties during 2004-2005, and 2012 Near-Infrared Reflectance Spectroscopy (NIRS)-Consortium equations. More specifically:

- **For RFV** (and NDF & ADF, equations in journal papers), equations incorporating the fraction of grass in the sample and the maximum alfalfa height produced satisfactory prediction results.
- **For RFQ** (and NDFD, equations in journal paper), equations incorporating the additional factor of GDD base 32˚F had the greatest predictive accuracy.

Before pursuing this new research-based concept in more detail, some important factors/limitations should be acknowledged:

1. ALL of the farm samples used to develop and test this concept were from New York; which has somewhat similar climate to the north central U.S., but is geographically different. North central U.S. farm samples would be needed to further develop and validate this approach for this region.
2. As with the PEAQ system, this tool is only a forage-quality estimator designed to provide information to aid the harvest-timing decision process. It by no means replaces the need for forage testing of the stored harvest.
3. Although equations using GDD appear promising for RFQ estimation, and are derived from two years of data collection, they should be used with caution. In contrast with equations based on plant height, prediction-equations including GDD do not perform as well in years other than for which they were calibrated. Thus, prediction errors can be inflated when an existing equation is used with new data.

The farm samples used to develop the RFQ and RFV estimation-equations included timothy, reed canarygrass, or orchardgrass at 10-90% in the mixtures (i.e., GFRAC from 0.1-0.9). Alfalfa MAXHT ranged from 12-40". Alfalfa NDF concentration ranged from 30-50%, and grass NDF from 40-60%; so the tool should not be expected to provide good information for very immature or very mature stands, or mixtures with different grass species.

Ranges for other parameters of the NY-farm samples used to develop these equations follow:

- Grass canopy average height: 10-49"
- Most-mature grass tillers: early-vegetative to flowering (i.e., anthesis)
- Most-mature alfalfa stems: mid-vegetative to late-bud
- GDD32: 545-1,685˚F
- Day of year in 2004-2005: May 7-June 9

In the following equations, GFRAC is the visually estimated (requires some practice) grass proportion in the mixture from 0.1-0.9, and MAXHT is the height of the tallest alfalfa stems in inches. The GDD32 variable is the accumulated growing-degree-days base of 32˚F, initiated when the average daily temperature exceeds 32˚F for 5 consecutive days.

$RFV = 312 - (97.1 \times GFRAC) - (4.40 \times MAXHT)$ [$r^2 = 0.74$]
$RFQ = 420 - (91.8 \times GFRAC) - (0.116 \times GDD32) - (3.03 \times MAXHT)$ [$r^2 = 0.83$]

A couple of examples using an actual set of NY-farm observations follow, to illustrate how to use these equations:

Example 1: RFV estimate based on GFRAC & MAXHT

- 72% orchardgrass, 22" maximum alfalfa height
- RFV = 312 – (97.1 x 0.72) – (4.40 x 22)
- RFV = 312 – 70 – 97
- RFV estimate = 145

Example 2: RFQ estimate for this same sample based on GFRAC, MAXHT, and GDD32

- 1085 GDD32
- RFQ = 420 – (91.8 x .72) – (0.116 x 1085) – (3.03 x 22)
- RFQ = 420 – 66 – 126 – 67
- RFQ estimate = 161

Data and experience from north central U.S. farms are needed to further develop and test this concept for this region. For now, growers might consider 'playing' with these FQ-estimation equations to add an additional tool to the harvest-timing-decision toolbox.

Footnote: A couple of additional estimation-equation options that performed reasonably well in NY follow. These equations could also be tested with personal farm observations.

- RFV = 354 – (110 x GFRAC) – (0.0737 x GDD32) – (2.76 x MAXHT) [r^2 = 0.84]
- RFQ = 353 – (72.1 x GFRAC) – (5.60 x MAXHT) [r^2 = 0.67]

Adapted from D. Parsons, P.R. Peterson, and J. H. Cherney; 2013. Estimation of nutritive value of spring alfalfa-grass mixtures using in-field measurements and growing degree data. Forage and Grazinglands. DOI 10.1094/FG-2012-0162-RS.