Focus on Forage

Wisconsin TEAM Forage

Relative Forage Quality

by **Dan Undersander** and **John E. Moore**

Introduction

Relative Feed Value has been widely used to ranking forage for sale, inventorying and allocating forage lots to animal groups according to their quality needs, and determining when to harvest. With the introduction of the new approaches to determining animal requirements in National Research Council Nutrient Requirements for Dairy Cattle (2001), there is an opportunity to improve upon this quality index through use of newer analyses and equations.

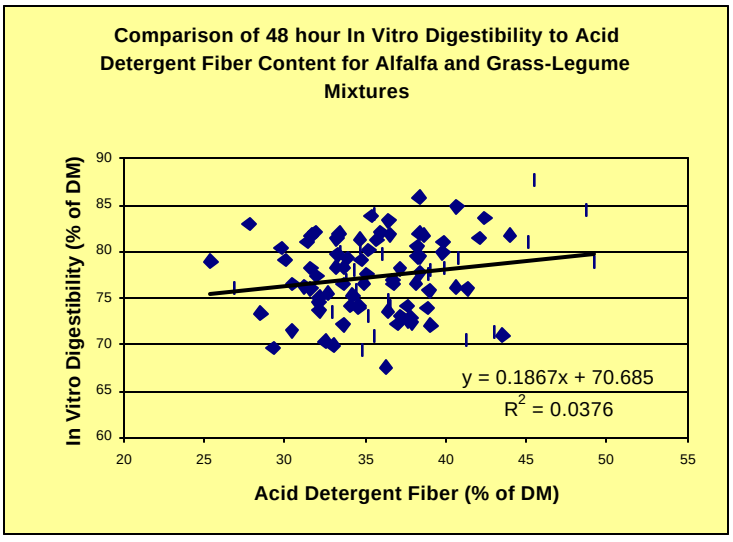
Background

Relative Feed Value was based on the concept of digestible dry matter intake relative to a standard forage according to the following:

RFV = (DMI, % of BW) * (DDM, % of DM) / 1.29

Where: DMI = dry matter intake
DDM = digestible dry matter

Dry matter intake was estimated from NDF and DDM from acid detergent fiber. The constant, 1.29, was chosen so that RFV = 100 for full bloom alfalfa. The constant was the expected digestible dry matter intake, as % of BW, for full-bloom alfalfa based on animal data.



The problem with this approach is that it assumes that acid detergent fiber (ADF) has a constant relationship to digestibility since digestibility is calculated from ADF. There is considerable variation in the digestibility of the dry matter relative to the ADF content as shown in the graph. The new NRC Nutrient Requirements of Dairy Animals Cattle recognizes this and recommends use of digestible fiber. Relative Forage Quality was developed to take advantage of the advance in technology.

How is RFQ calculated?

We propose to keep the same concept and format for Relative Forage Quality (RFQ) except that TDN will be used rather than DDM. Further, TDN and intake will be calculated using in vitro estimates of digestible fiber. Thus RFQ will be as follow:

RFQ = (DMI, % of BW) * (TDN, % of DM) / 1.23

Where the divisor, 1.23, is used to adjust the equation to have a mean and range similar to RFV. The following two equations are recommended depending on whether or not the primary forage is legume or grass:

1) For alfalfa, clovers, and legume/grass mixtures the equations will be:

A. Total digestible nutrients for alfalfa, clovers and legume/grass mixtures are calculated from the new NRC recommendations (NRC, 2001) using in vitro estimates of digestible NDF (not those calculated from lignin) as follows:

$$TDN_{legume} = (NFC*.98) + (CP*.93) + (FA*.97*2.25) + (NDFn * (NDFD/100) - 7$$

where: CP = crude protein (% of DM)
EE = ether extract (% of DM)
FA = fatty acids (% of DM) = ether extract - 1
NDF = neutral detergent fiber (% of DM)
NDFCP = neutral detergent fiber crude protein
NDFn = nitrogen free NDF = NDF – NDFCP, else estimated as NDFn = NDF*.93
NDFD = 48-hour in vitro NDF digestibility (% of NDF)
NFC = non fibrous carbohydrate (% of DM) = 100 – (NDFn + CP + EE + ash)

B. Dry matter intake calculations for alfalfa, clover and legume/grass mixtures will be:

DMI_{Legume} = 120/NDF + (NDFD – 45) * .374 / 1350 * 100 (Mertens, 1987 with NDFD adjustment proposed by Oba and Allen (1999). 45 is an average value for fiber digestibility of alfalfa and alfalfa/grass mixtures.)

Where DMI is expressed as % of body weight (BW), NDF as % of DM and NDFD as % of NDF.

C.
RFQ = (DMI_{leg}, % of BW) * (TDN_{leg}, % of DM) / 1.23

2) For warm and cool season grasses the equations will be:

A. Total digestible nutrients for warm and cool season grasses are calculated as:

TDN_{grass} = (NFC*.98) + (CP*.87) + (FA*.97*2.25) + (NDFn*NDFDp/100) – 10 (Moore and Undersander, 2002)

Where terms are as defined previously and
NDFDp = 22.7 + .664*NDFD

B. Dry matter intake calculations for warm and cool season grasses will be:

DMI_{grass} = -2.318 + 0.442*CP -0.0100*CP2 - 0.0638*TDN + 0.000922*TDN2 + 0.180*ADF - 0.00196*ADF2 - 0.00529*CP*ADF (Moore and Kunkle, 1999).

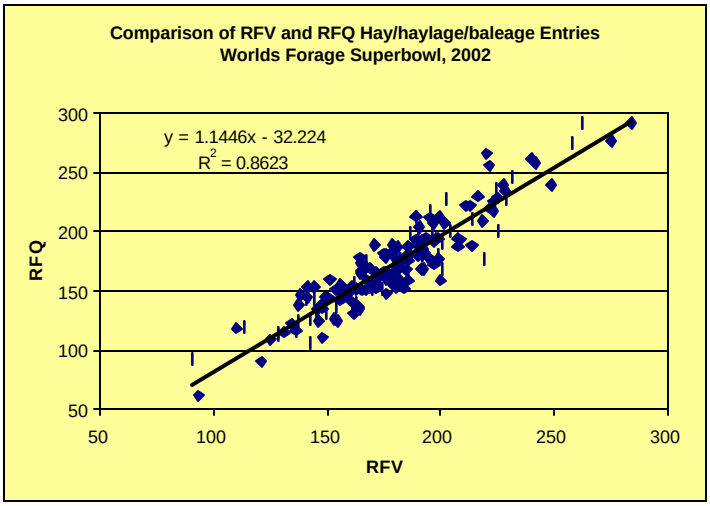
Where DMI is expressed as % of BW, and CP, ADF, and TDN are expressed as % of DM

C.
RFQ = (DMI_{grass}, % of BW) * (TDN_{grass}, % of DM) / 1.23

How does RFQ differ from RFV?

We designed RFQ, to have the same mean and range as RFV so that RFQ could be substituted for RFV without making economic and other management changes. The similarity is shown in the analysis of forage samples at the Worlds Forage Superbowl where the mean RFV was 179 and mean RFQ was 172. The graph below also shows that the range of values was similar. However, RFQ of individual samples varied by as much as 40 points higher or lower than RFV, and 22% of the samples varied by 20 points or more.

Dan Undersander, UWEX Forage Specialist, UW-Madison
djunders@facstaff.wisc.edu
John E. Moore, Professor Emeritus, University of Florida



When and how do I use RFQ?

Since RFQ includes digestible fiber, we believe that it is more representative of the way an animal would perform on a given forage. Therefore, whenever RFV and RFQ are different, RFQ is the better value to use. When RFQ is higher than RFV, the seller could have gotten more for the hay (or the buyer got a good deal) and, where RFQ is lower than RFV, the cows would not milk as expected on a ration balanced on ADF.

In general, RFQ is appropriate for use with all forages except corn silage because RFQ does not account for differences in starch availability. We believe that it more accurately reflects forage quality than previous measurements and should be used for determining when to harvest, allocating forages to animals, buying and selling hay based on forage quality, and contracting for harvest with a quality incentive.