



Forage Quality

Relative Feed Value and Relative Forage Quality

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Forage quality is associated with nutrients, energy, protein, digestibility, fiber, minerals, vitamins and with animal production.

The available nutrients in a forage influences individual animal production, while the amount of forage produced affects production per acre. For the ones who work with animal production, the final quality test of forage is animal performance.

Several indices of forage quality have been developed over the history of forage quality evaluation research. Each index included both dry matter intake (DMI), of forage when fed as the sole source of energy and protein, and some measure of available energy, such as energy digestibility, digestible energy, digestible dry matter (DDM), or total digestible nutrients (TDN).

Relative Feed Value

The Relative Feed Value (RFV) index was developed by the Hay Marketing Task Force of the American Forage and Grassland Council

and give unacceptable estimates in many cases.

Forage and Grassland Council (Rohweder et al., 1987). The Relative Feed Value is an index representing forage quality and one of the systems used by forage testing laboratories, and ranks forages according to a calculation based on DMI (estimated from NDF) and digestible DM (estimated from ADF) of alfalfa at full bloom according to the following:

$$RFV = \frac{DMI, \%BW \times DDM, \%DM}{1.29 \times NDF, \%DM}$$

DMI, % of BW = 120 / NDF, % of DM
DDM, % of DM = 88.9 - .779 * ADF, % of DM

Dry matter intake is estimated from NDF and DDM from acid detergent fiber. The constant, 1.29 is the expected digestible dry matter intake, as % of BW, for full-bloom alfalfa with 41% ADF and 53% NDF, giving a predicted DDM intake of 1.29% of BW and a RFV of 100. Because the RFV was developed using alfalfa, the index is a valid comparison only when applied to temperate species.

The RFV Index has served the forage-livestock industries well. However, there is information suggesting that RFV has some limitations as an index of forage quality.

Current RFV equations often underestimate quality of higher quality grasses,

and give unacceptable estimates in many cases.

Table 1. Typical Crude Protein (CP), Acid Detergent Fiber (ADF), Neutral Detergent Fiber (NDF) and Relative Feed Values (RFV) for alfalfa hay at different maturities. (Redfearn & Zhang)

Stage of Maturity	%CP	%ADF	%NDF	RFV
Bud	25	28	38	164
Early Bloom	23	30	40	152
Mid Bloom	19	35	46	125
Full Bloom	16	41	53	100

Relative Forage Quality

The Relative Forage Quality (RFQ) index is a system that was developed to have the same mean and range as RFV. RFQ calculations are different from RFV calculations. The RFQ is based on the values of CP, ADF, fat, ash, and NDF.

The advantage of RFQ over RFV is that RFQ considers the digestible fiber, which becomes relevant when testing warm-season grasses that are high in fiber that is highly digestible. The values of RFQ can be applied to all forages (cool-season and warm-season or tropical), except for corn silage, making

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RFQ a much more versatile forage-quality index.

Table 2. Relative Forage Quality (RFQ) and the Nutritional Needs of Cattle (Adapted from Undersander, D. 2003)

Relative Forage Quality	Cattle Nutrients Requirements
140-160	Dairy, 1st trimester
125-150	Dairy, last 200 days Heifer, 3-12 months
115-130	Heifer, 12-18 months
100-120	Heifer, 18-24 months

How is RFQ Calculated?

RFQ uses the same concept and format for Relative Forage Value (RFV) except that for RFQ, TDN will be used rather than DDM. Thus RFQ will be as follows:

$$\text{RFQ} = (\text{DMI, \% of BW}) * (\text{TDN, \% of DM}) / 1.23$$

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:

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

$$\text{RFQ} = (\text{DM}_{\text{leg}}, \% \text{ of BW}) * (\text{TDN}_{\text{leg}}, \% \text{ of DM}) / 1.23$$

For warm and cool season grasses the

equations will be:

$$\text{RFQ} = (\text{DMI grass, \% of BW}) * (\text{TDN grass, \% of DM}) / 1.23$$

How Can RFQ Be Useful?

Relative Forage Quality should provide a better estimate than RFV of how the forages will perform when fed. RFQ can permit farmers to categorize and use hay lots by quality. For example, hay with a RFQ of 115-130 can be fed to maintain beef cow-calf pairs, hay with an RFQ of 125-150 is adequate for stocker cattle or young growing replacement heifers, and hay with an RFQ 140-160 can be used for lactation cows on the last 200 days, while hay with RFQ > 160 is suitable for dairy cattle in the first three months of lactation.



Final Considerations

- 1) The best single measure of forage quality is animal productivity.
- 2) A general rule-of-thumb to help remember forage quality analysis factors is “20-30-40”. High producing dairy cows need hay with at least 20% CP, less than 30% ADF, and less than 40% NDF.
- 3) Forage quality analyses are no better than the procedures used to ob-

tain the samples.

- 4) When forages are fed to animals in limited quantities, such as supplements for cow-calf herds and dry cows, the importance of RFV changes. Digestibility (estimated by ADF) and CP are the main quality factors to consider in these situations.

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