

# Timely Topics

## Forage Fiber Analysis- What Does it Mean?

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### ▪ **Fiber in Forages**

- The table below shows the average relationship between ADF and NDF from several thousand samples analyzed by Dairyland Laboratory in 2001.

Forage	NDF, % of DM	ADF, % of DM	Difference
Legume hay	42.3	32.5	9.8
Legume haylage	42.5	33.1	9.4
Grass hay	56.2	36.9	19.3
Corn silage	39.6	25.1	14.5

- Thumb rules:
  - Legumes = 10% difference between NDF and ADF
  - Pure Grasses = 20% difference between NDF and ADF
  - Corn Silage = 10 – 20% difference between NDF and ADF
- Correlation:

Within species (legumes, grasses and corn silage) ADF and NDF are highly correlated. Bill Weiss (2002) developed the following formulas to predict ADF from NDF:

- Legumes, ADF, % = (.825 x NDF, %) – 1.52
- Grasses, ADF, % = (.701 x NDF, %) – 6.85
- Mixed legumes and grasses, ADF,% = (.664 x NDF, %) + .082

### ▪ **Fiber Digestibility**

- The feeding value of forage is a function of the quantity and digestibility of NDF and NDF solubles (100 – NDF,%).
- NDF solubles are mostly starches, sugars, crude protein and fat that are considered to be 98% digestible. Thus, as NDF increases, NDF solubles decrease. Therefore, the total NDF content of forage is the major determinate of overall forage quality and digestibility. A forage with 40% NDF will be more digestible than a forage containing 60% NDF.

Weiss (2002) showed that in lactating cow diets where alfalfa was the only forage, a 3% change in alfalfa NDF content equaled 1 lb/day change in 4% fat milk ( lb 4% milk = 75- .34 x alfalfa NDF%)

- There are several reasons why NDF digestibility is important to know:
  1. Because NDF is such a large component of forages, the digestibility of NDF can significantly affect total digestibility of the forage.

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## *Fiber Digestibility Continued*

2. In the past, the lignin and ADF content of forage has been related to forage digestibility, but this did not explain all of the variation in digestibility of NDF or the total forage.
  3. The 2001 Dairy NRC energy calculations for forages and other feeds now uses NDF digestibility as a factor. Forage energy is no longer predicted from ADF or other single entity equations.
  4. Oba and Allen (1999) have shown a 1% increase in NDF digestibility increases DM intake 0.37lb/day and equates to a 0.55 lb/day increase in 4% fat milk.
- NDF digestibility can be measure in two ways; in situ or in vitro. In situ is where bags containing samples of the feed are placed in the rumen of a fistulated cow for various periods of time (normally 30 to 48 hours for forages). In vitro is a laboratory measure where rumen fluid collected from a fistulated cow is added to a flask containing a ground sample of the feed. The flask with the rumen fluid and sample is incubated at 102 ° F for 48 hours. The in vitro method is the one used in the 2001 Dairy NRC energy calculations. The in situ and in vitro values will not be the same with the in situ value generally being lower. Likewise, if incubation times are shorter than 48 hours, values will decrease.
  - Mike Allen (Michigan State University) reported the following formulas can be used to **estimate** in vitro NDF digestibility from lignin content:
    1. Legumes/grasses, NDF digestibility % =  $107.6 - (4.13 \times \text{lignin}\%)$
    2. Corn silage, NDF digestibility % =  $72.8 - (2.27 \times \text{lignin}\%)$
  - Wisconsin research shows in vitro NDF digestibility averages (ranges) of:
    1. Legumes/Grasses (hay or silage) - 53% (30 to 70%)
    2. Corn silage – 59% (40 to 75%)
- **Relative Feed Value (RFV) vs Relative Feed Quality (RFQ)**
- RFV and RFQ are indexes of legume and grass forage quality.
  - The concept of both RFV and RFQ is voluntary intake of available energy.
  - RFV is based on old equations using ADF to predict digestible DM (energy) and NDF to predict voluntary DM intake.
  - RFQ calculates DM intake from digestible NDF and then multiplies it by TDN calculated as described in the 2001 Dairy NRC, but using in vitro determined digestible NDF rather than calculating it.
  - The RFV and RFQ index scales are equal at about 134, but RFQ differentiates quality extremes more than RFV did. A 90 RFV equals 68 RFQ and a 188 RFV equals a 207 RFQ (Undersander, Univ. of Wisconsin).
  - The advantages of RFQ over RFV are:
    1. RFQ probably has more applicability over a wider range of legumes and grasses than RFV does because:
      - Intake is a function of NDF digestibility and not calculated from NDF
      - Other nutrient fractions in the forage (CP, NFC, Fat) are considered in the energy (TDN) rather than just estimating it (DDM) from ADF.
    2. RFQ can be translated into energy requirements whereas RFV had no corresponding animal requirement value.
      - $\text{RFQ} \times 0.0123 = \text{estimate of TDN intake (\% of BW)}$