

## A Quick Guide to Understanding Forage Test Results

by Patrick Hoffman and Randy Shaver

### Introduction

Laboratory testing of forages for nutrient content and digestion characteristics is an important management step in the process of formulating dairy rations. In recent years, there have been numerous changes in forage analysis by commercial testing laboratories. These changes are sometimes difficult to understand and minor philosophical differences still exist within different dairy regions across the United States. As a result modern forage test reports sometimes yield as many questions as answers. For example, many laboratories are now testing forages for NDF digestibility, but dairy producers or nutritionists may not be familiar with normal averages or ranges in NDF digestibility for forages grown in their area. For the most part, however, concentrations of key nutrients within forages such as protein, energy, fiber, calcium, etc. remain the basis for defining the quality of one forage over another. Additional forage tests, such as NDF digestibility, lignin, starch etc, that are now done routinely in commercial testing labs help to better define the quality of forages.

To aid the understanding of the new forage testing schemes we have attempted to categorize forage tests according to their basic uses in dairy nutrition programming. Also summarized are test results for common forages of the North Central Region.

### Understanding Forage Tests - A Quick Guide

Presented in Table 1 (updated 12-06) is a simple scheme to aid dairy producers and nutritional consultants with understanding forage tests by defining forage nutrients into specific functional use categories. These categories are defined according to nutrients commonly used to: 1) predict dry matter intake, 2) estimate energy values, 3) direct use in ration formulation, 4) nutritional diagnostics, 5) supplementation strategies, 6) quality indexing, and 7) agronomic performance trials.

**Pat Hoffman** – Extension Dairy Scientist  
Marshfield Agricultural Research Station  
University of Wisconsin  
[pchoffma@facstaff.wisc.edu](mailto:pchoffma@facstaff.wisc.edu)

**Randy Shaver** - Extension Dairy Scientist  
University of Wisconsin – Madison  
[rdshaver@facstaff.wisc.edu](mailto:rdshaver@facstaff.wisc.edu)

In addition to defining forage test parameters by functional use categories, dairy producers and nutrition consultants often request some guidelines as to what typical values are and what desired values should be. Using database information from Upper Midwest forage testing laboratories, we have attempted to define common ranges for forage test results and provide a general idea of desired ranges for milking and dry cows. Dairy producers and nutritionists from dairy production areas with different forage sources and (or) growing conditions may want to ask their regional forage testing laboratories to construct a similar quick guide.

### References

Adapted from: Hoffman, P., and R. Shaver. 2004. Sorting through forage test results. *Hoards Dairyman*. Vol 1149, No. 16:590.

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**Table 1. Utility of various forage tests, test result ranges from Upper Midwest testing labs, desired forage test results for milking and dry cows.**

Test	Common Abbreviations	Common Units Of Expression	Energy							Range--Upper Midwest Testing Labs <sup>1</sup>			Desired Content Within Range-Milking Cows	Desired Content Within Range-Dry Cows	
			DMI Prediction	Estimates, TDN, NEL	Ration Balancing	Nutritional Diagnostics	Supplement Strategies	Quality Indexing	Agronomic Trials	Legume-Grass Silages	Legume-Grass Hay	Corn Silage			
Crude Protein	CP	% of DM		x	x	x	x				9 - 25	13 - 25	5 - 10	Mid-Upper	Mid
Soluble Protein	Sol-CP	% of CP				x	x				21 - 77	35-47	21 - 45	Mid	Mid
Acid Detergent Fiber Crude Protein	ADF-CP, ADIN	% of CP, % of DM <sup>2</sup>		x		x					0.1 - 2.3	0.2 - 1.3	0.2 - 0.7	Lower	Lower
Neutral Detergent Fiber Crude Protein	NDF-CP	% of DM		x							1 - 9	2 - 5	0.5 - 2.3	Lower	Lower
Rumen Undegradable Protein	RUP	% of CP			x	x	x				16 - 39	13 - 45	na	Mid	Mid
Acid Detergent Fiber	ADF	% of DM		obsolete					obsolete		obsolete	obsolete	obsolete		
Neutral Detergent Fiber	NDF	% of DM	x	x	x	x	x				32 - 71	30 - 71	30 - 62	Lower	Mid
Neutral Detergent Fiber Digestibility	NDFD	% of NDF (30 or 48 h) <sup>3</sup>	x	x		x	x				33 - 79	36 - 75	44 - 72	Upper	Mid
Lignin	Lignin	% of DM		x							3 - 10	5 - 10	2 - 6	Lower	Lower
Lignin	Lignin	% of NDF		x							5 - 23	11 - 23	4 - 16	Lower	Lower
Fat	EE, Fat	% of DM		x	x	x	x				1 - 4	1 - 4	1 - 4	Mid	Mid
Non-fiber carbohydrate	NFC	% of DM		x	x	x	x				7 - 34	10 - 38	24 - 54	Mid-Upper	Mid
Starch	Starch	% of DM		x		x	x				d	d	7 - 38	Mid-Upper	Mid
Starch Digestibility (DSA)	DSA	% of Starch		x		x	x				d	d	83-98	Upper	Mid-Upper
Sugars	Sugars	% of DM				x	x				4-8	8-11	2-5	Mid-Upper	Mid-Upper
Ash	Ash	% of DM		x		x	x				6 - 16	7 - 16	3 - 14	Lower	Lower
Calcium	Ca	% of DM			x	x	x				0.3 - 1.6	0.5 - 1.7	0.1 - 0.4	Upper	Mid
Phosphorus	P	% of DM			x	x	x				0.16 - 0.53	0.08 - 0.40	0.15 - 0.23	Mid	Mid
Potassium	K	% of DM			x	x	x				1.1 - 3.8	0.7 - 3.7	0.7 - 1.7	Mid-Lower	Lower
Magnesium	Mg	% of DM			x	x	x				0.19 - 0.40	0.18 - 0.41	0.12 - 0.26	Upper	Upper
Sodium	Na	% of DM			x	x	x				0.01 - 0.14	0.01 - 0.12	0.05 - 0.09	Mid	Mid
Chlorine	Cl	% of DM			x	x	x				0.26 - 1.25	0.08 - 0.83	0.10 - 0.40	Mid	Upper
Sulfur	S	% of DM			x	x	x				0.13 - 0.38	0.10 - 0.39	0.05 - 0.20	Upper	Upper
Total Digestible Nutrients	TDN	% of DM			x		x				47 - 72	49 - 70	42 - 76	Upper	Mid
Net Energy <sub>Lactation, Maintenance, Gain</sub>	NE <sub>L</sub> , NE <sub>m</sub> , NE <sub>g</sub> <sup>4</sup>	Mcal/lb			x		x				0.47 - 0.75	0.49 - 0.72	0.72 - 0.78	Upper	Mid
Particle Size	MPL, % on screen	mm or cm, % on screen				x	x				na	na	na		
Relative Feed Value	RFV	unitless index							obsolete		obsolete	obsolete	obsolete		
Relative Forage Quality	RFQ	unitless index							x		63 - 230	69 - 237	na	Mid-Upper	Mid
Corn Silage Processing Score	KPS	% starch passing 4.75 mm screen				x					na	na	40 - 80	Mid-Upper	Mid
Fermentation Profile	pH, Lactate, acetate, etc.	pH or % of DM				x					na	na	na		
In Vitro True Dry Matter Digestibility	IV TDMD, IV DMD	% of DM								x	na	na	na		
Milk per ton	Milk/Ton	lbs/ton							x	x	1650 - 3801	1790 - 3437	2200 - 3600	Upper	Mid
Milk per acre	Milk/Acre	lbs/acre							x	x	na	na	na		

<sup>1</sup> d= devoid of the nutrient, na = not available for summary.

<sup>2</sup> Values are expressed as a percentage of DM

<sup>3</sup> Values are 48 h NDFD

<sup>4</sup> Values expressed are Net Energy Lactation at 3X maintenance