

1. Feed Test Terms & Definitions

This list of definitions is meant to define in a basic way each of the items on a Fodder Link feed test as powered by Dairyland Laboratories, Inc.

Moisture – Reflects the amount of water in a sample. This is measured by loss on drying by various methods depending on the feed type and analysis requested.

ME— Ryan Higgs calculation that utilises uNDF₂₄₀ and NDFD₃₀ to estimate fibre digestion.

$$ME \left(\frac{Mcal}{kgDM} \right) = (DE \times 1.01) - 0.45$$

***Mcal are converted to mega joules by multiplying by 4.184

$$DE \left(\frac{Mcal}{kg} \right) = \left(\left(\frac{TDNDF}{100} \right) \times 4.2 + \left(\frac{TDNFC}{100} \right) \times 4.2 + \left(\frac{TDCP}{100} \right) \times 5.6 + \left(\frac{FA}{100} \right) \times 9.4 \right) - 0.3$$

Potentially digestible NDF (pdNDF) = Total NDF – uNDF₂₄₀

NDF digested in the rumen = pdNDF × Rumen digestion

TD NDF = (pd NDF – NDF digested in the rumen) × 1.05

$TDNFC = (TD \text{ non - starch } NFC + TD \text{ starch})$

$$TDCP = CP \times e^{(-1.2 \times \left(\frac{ADICP}{CP} \right))}$$

If only EE is given, then FA are estimated as 1- EE. If 1- EE < 0 then FA are 0. If TFA is given, that is used (NRC, 2001).

Dry Matter – The inverse of Moisture. This represents the fraction of the sample that is not water and is measured by loss on drying by various methods depending on the feed type and analysis requested.

Crude Protein — A measure of protein content. In most animal feeds, Crude Protein is calculated as Nitrogen x 6.25 (the assumption is that proteins in typical animal feeds contain 16% nitrogen on average).

Sugar (WSC) – Water Soluble Carbohydrates is another method to estimate sugar in feed samples. Some ration formulation programs prefer WSC to ESC, because it includes some fructans that are missed in the ESC method.

ADF – Acid Detergent Fibre. This fibre fraction is generally defined as the portion of the sample consisting of cellulose and lignin. ADF is an important factor in the RFV calculation and early ration balancing programs used ADF to directly calculate energy values. Generally samples with lower amounts of ADF are considered higher quality.

aNDF (w/Na₂SO₃) – Neutral Detergent Fibre measured with amylase and sodium sulphite is generally defined as the portion of a sample consisting of hemicellulose, cellulose, and lignin. aNDF is a key nutritional component that is important to RFV, RFQ, and nearly all of the modern energy calculations. The additions of amylase and sodium sulphite are adaptations to correct for starch and protein contamination in the original NDF method. Generally samples with lower amounts of NDF are considered higher quality.

2. Feed Test Terms & Definitions

RFV – Relative Feed Value is an index of quality in hay, haylage, and small grain silages. It is calculated directly from ADF and NDF.

RFQ – Relative Forage Quality is an index similar to RFV, but includes measurements of protein, ash, and fibre digestibility.

aNDFom (w/Na₂SO₃) – aNDFom is the same as aNDF, with the exception that it has been corrected for ash contamination. Since silica is not soluble in neutral detergent, samples with soil contamination can have artificially high aNDF values. aNDFom is a better measure of fibre in these feeds. “om” is the designation for organic matter basis.

AD-ICP – Acid Detergent Insoluble Crude Protein is the amount of protein bound in the ADF fraction. This fraction is considered to be indigestible. High AD-ICP values are typically found in heat damaged samples.

ND-ICP_{ss} – Neutral Detergent Insoluble Crude Protein is the amount of protein bound in the NDF fraction. This fraction is partially digestible. ND-ICP_{ss} is important in some ration balancing models to define protein digestion parameters. “ss” indicates that sodium sulphite was included. For most programs, sodium sulphite needs to be included in the ND-ICP method if it was also included in the aNDF and aNDFom methods.

Protein Sol. – Protein Solubility is the amount of protein that is soluble in a buffer borate solution. Generally, samples with high protein solubility are thought to be more rapidly degraded in the rumen.

Lignin (Sulfuric Acid) – Lignin is considered to be indigestible, therefore high lignin values are associated with poor quality feed. Lignin is used to define fibre digestibility in many energy calculations but is rapidly being replaced by direct measurements of fibre digestibility like NDFD and uNDF.

Lignin % NDF – A calculated value that expresses lignin as a percentage of the NDF. This was one of the early ways of evaluating fibre digestibility.

NDFD 12, 24, 30, or 48 – NDF Digestibility is calculated from the relationship between aNDFom and uNDFom. Various ration balancing programs utilize any one of these time points or combinations of them. The time point that is appropriate will depend upon the program being utilized.

uNDFom 12, 24, 30, 48, 72, 96, 120 or 240 - uNDFom is the undigested aNDFom remaining after in vitro digestion at some time point. Early time points can describe the shape of a digestion curve, while longer time points measure the ultimate extent of digestion. Choices about the appropriate time points are dictated by the feed type being analysed and the ration program the data will be used in.

Sugar (ESC) – Ethanol Soluble Carbohydrates is one way to measure sugar in feed samples. Most forages have elevated levels of sugar when they are freshly harvested, but much of this sugar is consumed during the fermentation of ensiled feeds.

Starch – A direct measurement of the starch content in a feedstuff. Starch is negatively correlated with NDF within a feed type. For example, corn silage that is high in starch will also be low in NDF.

3. Feed Test Terms & Definitions

Fat (EE) – Ether Extract fat is a crude measurement of fat in a sample.

Total Fatty Acids (TFA) – A sum of all the fatty acids in a sample. For most feeds, this is a more accurate measurement than Ether Extract and is the preferred fat method for most ration balancing programs.

16:0 Palmitic, 18:0 Stearic, 18:1 Oleic, 18:2 Linoleic, 18:3 Linolenic - The most common individual fatty acids in most feeds/forages.

Ash – A measurement of all the inorganic material in a sample including minerals and soil contamination. A certain amount of ash is normal in all samples, but elevated levels indicate soil contamination. Ash has zero energy value and has a negative impact on quality.

Calcium — Is a mineral that is necessary for life. It is vital to building strong bones, enabling blood to clot, and strong muscle contractions.

Phosphorus — Is needed to build strong bones. Also plays an important role in the health of kidneys, muscles, and blood vessels, as well as each cell in the body. Plays an integral role in energy metabolism.

Magnesium – Plays a major role in enzyme reactions, along with muscle & nerve function, regulating blood pressure, and supporting the immune system.

Potassium—Helps muscle function, including muscles that control heartbeat and breathing. It is considered an electrolyte, and is a cation (positive ion).

Sulphur – Appears in every living cell and is essential for the synthesis of certain amino acids.

IVSD7-o – In vitro starch digestibility at 7 hours can be used to detect differences in starch digestibility within and across feed types. For example, it will indicate changes in corn silage starch digestibility over time. Kd's can be derived from IVSD7-o for most ration formulation programs. These rates are reasonable for well processed corn silage and fine ground corn. However, since samples are ground to pass a 4mm screen prior to analysis, Kd's should be discounted for poorly processed samples.

Lactic Acid – Produced during the fermentation process of ensiled feeds, high levels of lactic acid are associated with high quality fermentations.

Acetic Acid – Produced during ensiling, elevated levels of acetic acid is an indication of poor fermentation in naturally fermented feeds. The exception to this is feeds inoculated with *L.Buchneri*, in which case elevated levels of acetic acid can still be considered high quality fermentations.

Butyric Acid – Only produced during poor fermentations, butyric acid is typically found in wet or rained on hay.

Ammonia – CP – Some ammonia is found in most ensiled feeds. In ensiled corn products, ammonia is highly correlated to starch digestibility.

Fibre Digestibility — All fibre digestibility analyses at Dairyland Laboratories are measured using methods derived from the Goering and Van Soest technique under the supervision of Dr. David Mertens.

1. Calculations

NFC – Non-Fibre Carbohydrates is a calculated value that represents the amount of sugar, starch, soluble fibre, and volatile fatty acids in a sample.

NSC—Non-Structural Carbohydrates is a calculation simply taking Sugar (WSC) and adding Starch.

Adjusted Crude Protein – This calculation adjusts the crude protein value if the AD-ICP value is above normal for a feed type.

ME—OARDC—Weiss summative energy equation.

ADF - TDN 1x, Neg, Nem, Nel – These are all ADF based measurements of energy. Used in early ration balancing programs these have generally been replaced by energy calculations that take into account variations in protein, fibre, fat, and ash.

OARDC – TDN 1x, Neg, Nem, Nel – These energy calculations were developed by the Ohio Agricultural Research and Development Centre and use a summative approach that accounts for variation in protein, fibre, fat, and ash.

MLK13 – TDN 1x, Neg, Nem, Nel - These energy calculations were developed by the University of Wisconsin and are a modification of the OARDC calculations that include adjustments for NDFD of hay, haylage, and small grain silage.

MLK06 – TDN 1x Neg, Nem, Nel – These energy calculations were developed by the University of Wisconsin and are a modification of the OARDC calculations that include adjustments for NDFD and moisture content of corn silage.

Milk per ton MLK06, MLK13 - This index of feed energy is derived from the TDN 1x values of Milk 2006.

Beef Per Ton - Developed by the Iowa Beef Centre, this index is derived from a TDN value that is calculated using protein, fibre, fat, ash, and fibre digestibility measurements.

Kd rate (Van Amburgh) – The rate of digestion of aNDFom in a sample calculated from a single NDFD time point and lignin.

Kd rate (MIR) – The rate of digestion of aNDFom in a sample calculated from multiple NDFD time points and uNDF240.

Lactic: Acetic ratio – The ratio of lactic to acetic acid is one indication of the quality of a fermentation. Generally, ratios above 2:1 represent quality fermentations. Lower ratios may be acceptable for feeds inoculated with *L.Buchneri*.