Terms & Definitions

DAIRYLAND Laboratories, Inc.

This list of definitions is meant to define each of the items on a typical Dairyland Laboratories feed analysis report in a basic way. (Last updated 10/2026)

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.

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.

CP – Crude protein. An estimate of the total protein content of a feed, calculated by multiplying the nitrogen content by 6.25.

Total amino acids – The sum of the amino acids measured in a sample. This provides a more direct measurement of protein building blocks than crude protein, which is calculated from total nitrogen and can include non-protein nitrogen compounds such as ammonia. Total amino acids may be used as an input in ration balancing programs that account for individual amino acids.

ADF – Acid Detergent Fiber. This fiber 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 Fiber measured with amylase and sodium sulfite 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 sulfite 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.

aNDFom (w/Na2SO3) – aNDFom is the same as aNDF, with the exception that 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 fiber in these feeds. “om” is the designation for organic matter basis.

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

Terms & Definitions

DAIRYLAND Laboratories, Inc.

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

Protein Sol. (SCP) – 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.

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.

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

Total Fatty Acids (TFA) – The 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.

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.

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.

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.

Total sugars – The sum of all the sugars in the sample. This is a more accurate method than ESC or WSC and will eventually be integrated into most ration balancing programs.

Fructans – Fructans are water-soluble carbohydrates made up of chains of fructose molecules. They are a storage carbohydrate found primarily in grasses and are included in the WSC fraction. Fructans have been estimated as the difference between WSC and ESC, but they can now be measured directly using high-performance ion chromatography (HPIC).

Terms & Definitions

DAIRYLAND Laboratories, Inc.

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.

Propionic Acid – Produced by microbial fermentation during ensiling. Higher levels may occur with certain silage inoculants.

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.

Fiber Digestibility

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

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 analyzed and the ration program the data will be used in.

Starch Digestibility

IVSD7 – In vitro starch digestibility after 7h incubation in buffered ruminal fluid 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. kds can be derived from IVSD7 for most ration formulation programs. These rates are reasonable for well processed corn silage and fine ground corn. However, since samples are ground through a 4-mm screen prior to analysis, kds should be discounted for poorly processed samples.

Terms & Definitions

DAIRYLAND Laboratories, Inc.

Protein degradability/digestibility

RUP – Ruminally undegradable protein. An estimate of the portion of protein that escapes degradation in the rumen. RUP is measured using a method developed by Dr. Debbie Ross at Cornell University. This analysis is intended primarily for commodity feeds such as soybean meal and is not recommended for forages or total mixed rations (TMR).

UCP – Undigestible crude protein. The portion of crude protein that remains undigested following gastric and intestinal digestion after the RUP stage. UCP was developed by Dr. Debbie Ross and is used as an input in ration-balancing programs that utilize the CNCPS model.

Calculations

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.

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

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

RDP NRC 2001 – Rumen degradable protein. An estimate of the portion of a feed's protein that is degraded in the rumen and available to rumen microbes. It is calculated using crude protein, ND-ICP, AD-ICP, protein solubility, and ammonia-CP.

TDN – Total digestible nutrients. An estimate of the total digestible nutrient content of a feed. TDN is an older measure of feed energy that is being replaced by newer energy calculations that better account for differences in nutrient composition and digestibility.

Nel 3x – Net energy for lactation at 3 x maintenance. An estimate of the energy available to a lactating dairy cow from a feed when the animal is consuming approximately three times its maintenance energy requirement.

Neg – Net energy for gain. An estimate of the energy available from a feed for body weight gain after the animal's maintenance energy requirements have been met.

Nem – Net energy for maintenance. An estimate of the energy available from a feed to meet the animal's maintenance energy requirements, such as basic metabolism and maintaining body tissues.

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, fiber, fat, and ash.

Terms & Definitions

DAIRYLAND Laboratories, Inc.

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

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.

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.

MLK24-Nel3x – These energy calculations were developed by the University of Wisconsin and are a modification of the NASEM calculations that include adjustments for NDFD and IVSD of corn silage.

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

Milk per ton MLK24 – This index of feed energy is derived from the Nel3x values of Milk 2024.

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

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 fiber digestibility.

NDF kd rate (MIR_P1) – The rate of digestion of aNDFom in a sample calculated from multiple NDFD time points using the Mertens Innovation and Research (MIR) approach developed by Dr. David Mertens. P1 indicates a one-digestible-pool model with an assumed indigestible pool.

Starch kd rate (MIR_P1T1) – The rate of starch digestion in a sample calculated from a single timepoint (IVSD7h) using the Mertens Innovation and Research (MIR) method developed by Dr. David Mertens. P1T1 indicates a single, one-timepoint model. Because the rate is calculated from IVSD7h, it is 100% correlated with IVSD7h.