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Interpreting Corn Silage Analysis

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Corn silage test results are of little value unless they are understood and used. Results can be used to balance rations and to improve future crop management if the test has shown the present forage is of unsatisfactory quality.

Results of analysis are expressed on an "as received" and on a "100% dry matter (DM)" basis. As-received is sometimes referred to "as-fed" or "fresh." The as-received basis includes the water or moisture contained in the feed. Nutrients expressed on this basis represent the nutrient content of the feed when it was received at the lab.

Dry matter basis means all moisture has been removed. The nutrient concentration is that which is contained in the dry matter portion of the feed. Values reported on a dry matter basis are always larger than the as-received values. To convert from an as received to a dry matter basis, use the following formula:

$$\frac{\text{Nutrient (as received basis) x 100}}{\text{\% DM}} = \text{Nutrient (DM basis)}$$

For example, if a sample of corn silage (30% DM) contains 2.7% crude protein (CP) on an as-received basis, it contains 9.0% (CP) on a dry matter basis:

$$\frac{\text{2.7\% CP x 100}}{\text{30\% DM}} = \text{9\% CP}$$

Moisture/Dry Matter (DM)
Moisture is the amount of water in the feed. Percent moisture = 100 - % DM. Dry matter is the percentage of feed that is not water. Percent DM = 100 - % moisture. A sample of corn silage with 30% dry matter contains 70% water. Knowing moisture content of corn silage is critical

to balancing rations properly. Lower moisture contents are usually associated with more mature plants, which can significantly alter the digestibility and energy content of this forage. Adequate fermentation is also highly dependent on adequate moisture content, which for corn silage should be between 60 and 70%. If ensiled in an upright silo, 60-65% moisture is desirable to minimize seepage.

Crude Protein (CP)
Crude protein is termed "crude" because it is not a direct measurement of protein but is an estimation of total protein based on nitrogen in the feed (Nitrogen x 6.25 = crude protein). Crude protein includes true protein and non-protein nitrogen (NPN) such as urea nitrogen and ammonia nitrogen. The crude protein value provides no information about amino acid composition, intestinal digestibility of that protein, or the rumen degradability of that protein.

Acid Detergent Fiber (ADF)
ADF consists primarily of cellulose, lignin, and acid detergent fiber crude protein. It is closely related to indigestibility of forages and is the major factor in calculating energy content of feeds. The greater the ADF, the less digestible the feed and the less energy it will contain.

Neutral Detergent Fiber (NDF)
The total fiber content of a forage is contained in the NDF or cell walls. This fraction contains cellulose, hemicellulose, and lignin. NDF gives the best estimate of the total fiber content of a feed and is closely related to feed intake. As NDF values increase, total feed intake will decrease. It is generally assumed ruminants will eat a maximum total NDF of close to 1.2% of their body weight.

Grasses will contain more NDF than legumes at a comparable stage of maturity.

Digestible NDF 48 (dNDF 48)

The importance of measuring dNDF 48 has been recently recognized. Fiber digestibility differs between legumes and grasses harvested at a similar stage of maturity, and even for a same species when grown under different weather conditions. By digesting NDF more rapidly, ruminants can move more feed through their rumen faster, thus allowing for greater DMI and enhanced animal performance. Decreases in dNDF 48 are usually a reflection of higher lignin content in the NDF fraction. DNDF 48 is measured from an in vitro NDF digestion for 48 hours.

Lignin

Lignin is a polymer component of the plant cell walls that provides rigidity and structural support to plants. It cannot be digested by animal enzymes. It increases as plants mature, and is higher for a same plant species grown under warm weather conditions. The higher the lignin content of a forage, the lower the dNDF.

Crude Fat

Also known as ether extract (EE). This term comprises all substances that are soluble in ether (thus the term ether extract). Although it will mainly contain lipids, it will also include other fat-soluble substances such as chlorophyll and fat-soluble vitamins, and it is high in energy when the fraction represents primarily lipids.

Neutral Detergent Fiber Digestibility (NDFD)

NDFD is dNDF expressed as a percent of NDF. Therefore

$$NDFD = dNDF/NDF * 100$$

Ash (ASH)

Ash is the remaining residue after all organic matter present in a sample is completely incinerated, thus 100 – ASH = organic matter. It comprises all inorganic matter (or mineral matter) in the feed, as well as inorganic contaminants, such as soil or sand.

Minerals

Calcium (Ca), phosphorus (P), magnesium (Mg), and potassium (K) values are expressed as a percentage of each in the feed.

Total Digestible Nutrients (TDN)

TDN represents the sum of digestible crude protein, digestible carbohydrates, and digestible fat (fat is multiplied by 2.25 to compensate for its higher energy content).

Since feeds are utilized differently by different species, percent TDN in a feed is different for each species, and it is highly correlated with the energy content in feeds. TDN is estimated in many different ways. TDN in SDSU lab reports is estimated from the NEL value, which in turn is calculated from the ADF content of the silage. The equation for calculating TDN is:

$$TDN = 31.4 + (53.1 * NE_l)$$

Net Energy for Lactation (NE$_l$)

Net energy for lactation is the term used by the NRC (National Research Council) for assessing the energy requirements and feed values for lactating cows. It is usually expressed as megacalories per pound (Mcal/lb) or megacalories per kilogram (Mcal/kg). Corn silage NE$_l$ is calculated from ADF with the following equation.

$$NE_l = 1.044 - (0.0124 * ADF)$$

Net Energy for Maintenance (NE$_m$) and Net Energy for Gain (NE$_g$)

The net energy system used by NRC for beef cattle assigns both energy values to each feedstuff and similarly subdivides animal requirements for energy. Feed energy is used less efficiently for depositing new body tissue than for maintaining existing body tissue. NE$_m$ is the net energy value of feeds for maintenance. NE$_g$ is the net energy value of feeds for the deposition of body tissue, growth, or gain. Both NE$_m$ and NE$_g$ are needed to express the total energy needs of growing cattle. They are usually expressed as megacalories per pound (Mcal/lb) on SDSU lab reports and can also be expressed as megacalories per kilogram (Mcal/kg).

$$NE_m = -0.508 + (1.37 * ME) - (0.3042 * ME^2) + (0.051 * ME^3)$$
$$NE_g = -0.7484 + (1.42 * ME) - (0.3836 * ME^2) + (0.0593 * ME^3)$$

where ME (metabolizable energy) = 0.01642 * TDN.