Livestock Feed Analysis

How to Interpret the Results

Livestock are most productive when fed a ration that meets their nutritional needs. Laboratory analysis of feeds is the best indicator for predicting animal performance on a ration before it is fed. This publication has been developed to help livestock producers interpret feed analysis results, which can help them in planning rations. Livestock feed analyses provide producers with useful data that can help to:

- determine the nutrient content of a mixed feed or a particular ration component
- decrease feed costs through lower-cost rations and more efficient utilization
- evaluate forage production practices such as plant species selections, fertilizer schedules, and time of harvest (age of regrowth)
- set and monitor nutrient standards for local and imported feeds and feed by-products for marketing purposes

The results of the analysis can only be useful when the sample tested truly represents the lot of feed that the animals will eat. Poor sampling technique results in misleading feed analysis values, which may lead to increased feed costs, reduced animal performance, and economic loss. For further assistance in using livestock feed analysis results to maximum benefit, contact your local Cooperative Extension Service livestock agent.

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DM = Dry Matter
DM is the percentage of the feed that is not water (moisture). Fresh grass has higher moisture content and lower DM content compared to hay.

DM increases with plant age when harvested. The lower the DM, the more moisture is present, and the lower is the nutrient density in the fresh feed. A high, high moisture may decrease the keeping quality of a feed (through molding) unless it is made into slage.

Ash = total inorganic matter
A sh is a measure of the total mineral content of the feed, but it does not tell us how much of each mineral is present.

Ash is not digestible by animals. High ash content of feeds may dilute the amount of nutrients available to the animal. Bone content of feeds of animal origin can contribute to ash content. If a plant feed is high in ash content, it may be due to soil contamination during harvest of the plant material.

CP = Crude Protein
CP is an estimate of the level of protein in the feed, based on the amount of nitrogen present. Since some plant proteins (non-protein nitrogen) is in the form of true protein, it is termed "crude" protein. CP also does not give individual amino acid profiles.

CP content of plants peaks at about 4–6 weeks of age, then begins to decline quickly. Legumes such as alfalfa, clover, and kafir have higher CP values than other legumes. The protein quality of grasses declines more rapidly than that of legumes with plant age, and tropical forages decline more rapidly with plant age than temperate forages.

EE = Ether Extract
EE, also termed crude fat, is the amount of fat and fat-soluble components in a feed. In addition to fats and oils, it includes plant pigments (chlorophylls, xanthophylls, carotene) and fat-soluble vitamins (A, D, E, K), but it does not tell us how much of each vitamin or fatty acid is present.

EE is usually higher in meat and fish by-products and whole seeds. If a feed is high in fat, it may be susceptible to rancidity, which causes off-flavors, low palatability, and potential toxic effects. Usually an antioxidant such as Vitamin E is added to prevent a feed from becoming rancid.

CF = Crude Fiber
CF is the insoluble carbohydrate remaining in the feed analysis procedure. The sample is boiled in weak acid and alkali.

Crude fiber is the poorly digested component of a feed. It is made up of plant structural carbohydrates such as cellulose and hemicellulose, and lignin. Adding fat and fat-soluble components (chlorophyll, xanthophylls, carotene) and fat-soluble vitamins (A, D, E, K) improve palatability. Fat is also helpful in lubricating and maintaining feed mixing equipment.

NDF = Neutral Detergent Fiber
The NDF value is the percent of total fiber in the feed. NDF is the plant cell wall components: cellulose, hemicellulose, lignin, silica, insoluble CP, and ash. A analysis for NDF, along with ADF, cellulose, and lignin, is replacing the older, more variable crude fiber analysis.

NDF content increases as plants mature. Although feeds from animal tissue (fish meal, meat and bone meal, milk, etc.) do not contain fiber, they may contain small amounts of NDF due to ash and other insoluble components. Because fat has 2.25 times more energy per unit of weight compared to carbohydrates, feeds with high fat content are more energy-dense and are added to diets to increase calories, provide essential fatty acids, and (in some cases) improve palatability. Fat is also helpful in lubricating and maintaining feed mixing equipment.

ADF = Acid Detergent Fiber
The ADF value is the percent of the least digestible part of cell walls: cellulose, lignin, silica, insoluble CP, and ash.

ADF content increases as the plant matures and is generally higher in legumes than grasses of the same age. For any given sample, ADF will be lower than NDF content and the difference between the two reflects the amount of hemicellulose present.

Cellulose is the principal constituent of plant cell walls.

Cellulose is digested well by ruminants, moderately by horses and rabbits, and poorly by swine and poultry.

ADF, or the least digestible portion of fiber, affects a feed's digestibility - the lower the ADF content, the higher the digestibility. It is used in calculating energy estimates, such as TDN (total digestible nutrients) or NE (net energy).

Lignin
Lignin is not true carbohydrate; it is a protective coating on the cellulose-hemicellulose structure of plant tissues, which apparently protects them from bacterial attack.

Lignin is found in straws, hulls, and over-mature hays. It is essentially indigestible by all livestock.

NFE = Nitrogen free extract
NFE is a calculated value: the original sample weight minus the sum of weights of water, other extract, crude protein, crude fiber, and ash.

NFE is made up primarily of readily available carbohydrates, such as sugars and starches, this fraction may also contain sulubilized hemi cellulose and lignin.

Lignin has no known nutritive value, except as a bulk factor. At high levels, it reduces digestibility of other nutrients in a ration.

The NFE fraction in grain can be readily utilized as a nutrient by nearly all livestock species, but in forages and roughage it is less available to the animal.