

Nutritive Quality of Straw & Feeding Recommendations

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Straw, or the material left after harvesting grain of cereal grain crops (typically wheat, oats, barley, or rye), is a common feed ingredient in dairy cattle rations for diluting ration energy (dry cows or pregnant heifers). It is also used for adding some fiber to extend forage inventories or to slow down the rate of digesta passage of diets with finely chopped forages or very high-quality forages. Dilution of the ration energy helps to control body weight and condition gain to avoid over-conditioning that can occur in older heifers or dry cows when fed a diet with a significant proportion of corn silage. The higher fiber diet also helps control feed intake and keeps the rumen full when feed intake drops around calving, which can prevent displaced abomasums in fresh cows. Straw is typically moderate in potassium (K) content while corn silage is typically low in K content, both of which help balance the dietary cation/anion difference (K, sodium, sulfur, chloride) in dry-cow diets. However, one should understand there is considerable variation in energy content and mineral content of straw due to growing conditions, species, and soil nutrient content. This variation can lead to undesirable outcomes when balancing diets closely for energy or minerals based on previous analysis, book-values, or using NIRS to estimate mineral content.

Work conducted by Tom Anderson and Pat Hoffman (former UW extension personnel) showed this variation for wheat, oat, and barley straw samples tested. In the factsheet “Nutrient Composition of Straw Used in Dairy Cattle Diets” (fyi.extension.wisc.edu/forage/nutrient-composition-of-straw-used-in-dairy-cattle-diets/), they found nutrient detergent fiber (NDF) content ranged 71-84% with an average of 78%. The fiber content had smaller variation compared with its digestibility. Digestibility of NDF ranged 20-57% digested after 48 hours *in vitro* with an average of 41%, which caused energy values to be variable. The energy content (total digestible nutrient, TDN) of the straws sampled ranged 24-54% (average of 39%), which dramatically impacts how much of the straw would need to be included to obtain the desired energy content of the diet. This variation in energy is likely due to growing condition (temperature and soil moisture), ash content, and the amount of grain remaining in straw after combining. Also, some species variation exists with oat straw samples having a higher average NDF digestibility and TDN. Oats are commonly used as a nurse crop for newly established alfalfa stands and may result in higher-quality straw if some alfalfa is harvested with it. In recent studies using straw in heifer rations at the Marshfield Ag Research Station, samples with 35-50% NDF digestibility and 35-47% TDN have been found using wheat straw. The mineral content can also be highly variable, especially K, with samples ranging 0.65-2.86%. Straw with high levels of K may limit its usability in dry-cow rations, but should not be an issue for use in heifer rations. Calcium (0.13-0.52% Ca), phosphorus (0.08-0.36% P), and magnesium (0.05-0.19% Mg) were also variable. Based on the variability that can be found in straw, it is suggested to conduct lab analysis to determine its nutrient content. Most labs now have robust NIRS calibrations for forages, but check with the lab prior to submitting a straw sample to ensure it has calibrations for straw. Since NIRS does not measure mineral content accurately, the use of wet chemistry analysis for minerals is needed.

Sorting can be an issue to manage with diets containing higher levels of straw (10-20% of diet for heifers; up to 30-40% of diet for dry cows). Straw chopping can help minimize sorting against the straw with a target length of <3"; a shorter chop length is more desirable. Use of water or molasses can help minimize sorting by helping bind feed particles together. A total mixed ration (TMR) with a moisture level of ~50% works well, with the ration possibly needing to be wetter to ensure animals consume the straw, especially with high levels found in dry-cow rations. Closely monitoring the number of animals and refusals remaining each day helps ensure animals consume entire rations. In our research with dairy heifers, we typically target ~2% daily refusal, which equates to few particles remaining in the feedbunk prior to that day's feeding. If significant refusals are left and are mainly straw, ensure the correct number of animals were fed, check the straw particle size, and then consider slowly reducing the amount fed over a few days.

Overall, straw can be a useful forage in dairy cattle rations but care must be taken, including checking its nutritive quality and utilizing good management practices. If additional purchases of straw are needed and straw prices are elevated, low-quality grass hay may be used as a substitute. Low-quality, mature grass hay can have similar nutrient composition as straw but with lower cost.