Wet Brewers' Grains for Beef Cattle[1]

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Wet brewers' grains (WBG) are the by-product of the beer-brewing industry. The WBG are the spent grains, most often barely, but some corn and/or rice may be included depending on the source of the grains. In a review, Westendorf and Wohlt (2002) summarized the nutrient content of WBG and determined that the protein, fiber, and energy concentration of WBG make them a suitable supplement in both ruminant and nonruminant diets. However, because of the protein concentration and high fiber concentration, WBG may be more beneficial in a ruminant diet to support rumen function and animal production.

Feed Characteristics

Wet brewers' grains have low dry matter content, are a reasonable protein source, and have a high content of total digestible nutrients (TDN) due to the digestibility of the available fiber (Table 1; Hersom 2006). This high concentration of fiber of WBG is because the starches and sugars are removed from the barley grain during the malting process leaving mainly the structural cell wall carbohydrates of cellulose and hemicellulose (Westendorf and Wohlt 2002). The energy value of WBG is approximately 71 to 75% TDN, compared to corn, which has a TDN value of 88%. This energy is mainly derived from the highly digestible fiber in WBG. The digestible fiber of WBG is an excellent compliment to forage-based diets that lack starch and readily fermentable fiber. Additionally, WBG contain 7 to 10% crude fat, which contributes to the total energy value of WBG.

Wet brewers' grains are a good source of protein with a crude protein content that ranges from 25 to 34% (Table 1). The protein is mainly located in the germ portion of the spent grain and is digested to a limited extent in the rumen and to a greater extent in the small intestine. The concentration of rumen degradable protein ranges from 28 to 43% with a mean of 35%, indicating that WBG are good sources of rumen undegradable or "bypass protein."

Wet brewers' grains are low in calcium and potassium, similar to other cereal grains. The calcium:phosphorus ratio is inverted compared to the National Research Council recommendation of 7:1 to 1:1. Therefore, more phosphorus is supplied relative to calcium from WBG. A well-balanced mineral supplement should be supplied when using WBG in cattle diets to avoid the negative effects of decreased growth performance experienced when this ratio is not properly balanced.

Considerations for Use

Wet brewers' grains contain a large concentration of water (mean = 74%), which requires some special consideration prior to its utilization as a feed resource for beef cattle producers. In order to correctly compare WBG to different feedstuffs, the comparison must be made on a dry matter basis. Because of the high water content of WBG, proper storage is typically an issue. Most WBG are stored either in an on-farm bunker silo or a plastic bag. Regardless of the storage method, WBG will have a finite feedout period, which will be shorter in the early fall and late spring when

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ambient temperatures are high, particularly in Florida. During the summer, the feedout period of WBG will be more limited. Spoilage of WBG can occur in as little as five to seven days after the bag or silo is opened, and this leads to increased mold growth, decreased moisture content, and decreased palatability. This can be costly for producers if their feeding rates fall below the rate of spoilage (Westendorf and Wohlt 2002).

Depending on distance from a brewery, the water content of WBG also can limit its availability and practicality to producers. The maximum economical distance for hauling WBG from a brewery is less than 200 miles; any greater distance increases the delivery cost above what a similar feedstuff could be priced in. For an accurate comparison of the costs and utilization of WBG, the cost of the wet grains should be adjusted to a similar moisture level as other dry feedstuffs. Many feedstuffs are approximately 90% dry matter, whereas WBG are 20 to 32% dry matter.

Additionally, the moisture content of a WBG can affect the level of intake in cattle, particularly when it is fed in combination with silage or fresh forages. Research indicates that for every 10% increase in dietary moisture content, dry matter intake decreases by 0.2 lb/100 lb of body weight (Schingoethe et al. 1988). This may be a response to gut fill and distention caused by the structural volume of plant water held within the cell wall (Balch and Campling 1962; Van Soest 1982). Also, because NDF has a slower rate of fermentation and degradation within the rumen, forages and feeds that contain higher levels of NDF can limit intake due to their greater filling effect (Allen 1996).

Variability exists in the nutrient composition of WBG just like every other by-product feedstuff. Table 1 indicates the normal range for each chemical component. The variation associated with the energy and protein content of WBG implies that representative samples from each bag or bunker should be analyzed by a reputable laboratory when formulating supplementation programs for cattle.

Feeding Guidelines

Due to the amount of water in WBG product, mature cows should be limited to 30 to 50 pounds per cow per day. This is equivalent to 7.8 to 13 pounds of dry matter intake per cow per day. Young cattle can utilize WBG equally effectively. Wet brewers' grains should be limited to 9 to 20 pounds per calf per day. This is equivalent to 2.3 to 5.2 pounds of dry matter intake per calf per day. Blending of WBG with other feedstuffs is an acceptable way to incorporate feedstuffs with other positive characteristics. Soybean hulls or other dry feedstuffs mix well with WBG and reduce the amount of water in the final mix. Because of the low calcium and potassium and high phosphorus contents, an adequate mineral supplement should be offered to growing cattle consuming WBG.

Since WBG are delivered in bulk, appropriate feed storage and handling systems need to be available. The physical form of WBG is a wet, loose, fibrous grain residue, and this necessitates the use of a front-end loader or similar equipment for handling, feed wagons for transport, and adequate feed bunk space for delivery. Wet brewers' grains can be a good feed-resource-based nutrient composition for beef cattle. Comparison of WBG with other feedstuffs should be made on the basis of price per unit of energy, protein or labor on a similar moisture or dry matter.

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Table 1. Typical nutrient composition of wet brewers' grains.

	Dairy One[1]		
Item	**Average[2]**	**Range**	**NRC[3]**
Dry matter, %	26.0	19.2–32.8	21.0
Crude protein, %	29.6	24.9–34.2	26.0
Rumen degradable protein, % of CP	35.5	28.3–42.7	40.9
Crude fiber, %	12.0	8.3–15.7	15.3
Neutral detergent fiber, %	48.3	42.0–54.7	42.0
Acid detergent fiber, %	23.5	20.1–27.0	23.0
Crude fat, %	9.1	7.6–10.7	10.8
TDN, %[4]	73.9	71.0–76.9	70.0
NEm, mcal/lb[5]	0.81	0.76–0.86	0.74
NEg, mcal/lb[6]	0.52	0.48–0.57	0.47
NE_L, mcal/lb[7]	0.81	0.77–0.85	0.74
Calcium, %	0.35	0.21–0.48	0.29
Phosphorus, %	0.68	0.56–0.79	0.70
Magnesium, %	0.23	0.18–0.27	0.27
Potassium, %	0.16	0.00–0.37	0.58
Sodium, %	0.03	0.00–0.10	0.15
Sulfur, %	0.33	0.26–0.39	0.34
Copper, ppm	9.5	2.3–16.7	11.3

[1] Dairy One Forage Laboratory accumulated data May 1, 2000 to April 30, 2009; accessed February 19, 2010.
[2] Dry matter (moisture free) basis.
[3] National Research Council 1996.
[4] Total digestible nutrients.
[5] Net energy for maintenance.
[6] Net energy for gain.
[7] Net energy for lactation.