Corn Gluten Feed for Beef Cattle[1]

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Corn gluten feed (CGF) is a co-product from the wet-corn milling industry that manufactures starch, sweeteners, syrup, and oil from corn (Weigel et al). Corn gluten feed is readily available in the southeastern United States and its price has been favorable when compared to other feeds. Corn gluten feed is a good feed for beef cattle; however, producers should be aware of some potential problems with this feedstuff.

Utilizing Corn Gluten Feed

Corn gluten feed is mainly composed of corn bran and steep liquor, with the amount of steep liquor inclusion affecting the final color and nutritive quality. Corn gluten feed is available either in a dry or wet form. Dry CGF is the most common form available in the deep southeast, and can be purchased as a meal or pellets. Since the starch and oil are removed, CGF is relatively high in crude protein. Crude protein averages 23.5% (dry matter (DM) basis) but can range from 16% to 30% (Dairy One Laboratory).

The energy valve of CGF is good, almost as high as corn. The total digestible nutrients (TDN) value of CGF is about 75% to 83%, compared to whole corn grain, which has a TDN value of 88%. However, the form of energy in CGF is different from corn. Most of the energy in corn is from starch, whereas in CGF the energy comes from digestible fiber (bran fraction). Corn gluten feed is an excellent compliment to forag-based diets because it is a low starch, high fiber energy source. Additionally, CGF does contain some fat, which will increase the energy density of the diet. The composition of CGF is presented in Table 1.

Since CGF is a good source of both protein and energy, the relative economic value of this feed depends upon the relative price of corn and of a protein supplement such as soybean meal. The protein and energy provided by 100 lb of CGF (90% DM) is roughly equal to 75 lb of corn and 25 lb of soybean meal (48% CP). The CGF product is a good source of degradable intake protein. Approximately 50% of the crude protein of CGF is soluble, with 70%–75% of the protein being ruminally degradable.

Considerations for Use

A few cautions about feeding CGF. First, the sulfur (S) concentration of CGF is high relative to the animal's requirement. Sulfur dioxide is added during the wet milling process to aid in the extraction of starch. The added S ends up in the steep liquor, which is one of the components of CGF. The sulfur concentration in CGF averages around 0.5% (DM basis), with a range of 0.33% to 0.73%. The S requirement for beef cattle is 0.15% to 0.2% total dietary S. The upper safe limit is 0.4% total dietary S (NRC 2005). Feeding large amounts of CGF with a high S concentration can lead to S toxicity, resulting in reduced feed intake and possibly death. A specific disorder associated with excess S is polioencephalomalacia (PEM or commonly referred to as "brainers") (Niles et al. 2000). This disorder affects the nervous system, resulting in blindness, incoordination, and seizures (Gould 1998). Excess S in the diet can also increase

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the risk of a copper deficiency. Copper is an essential trace mineral important for growth, immunity, and other metabolic functions (NRC 2005). The potential risk of high S in the total diet could limit the amount of CGF that can be used in a feeding program.

Another caution is the high phosphorus (P) concentration. Phosphorus is an essential nutrient; however, the concentration in CGF (0.9% to 1.1%) far exceeds requirements (0.25% to 0.35%; DM basis). Dietary P excess has been associated with the formation of urinary calculi ("waterbelly") in cattle. The problem of excess P can be minimized by ensuring adequate intake of calcium (Ca). Excess P concentration along with a low Ca concentration would worsen the detrimental effect(s) of excess P. High P intake can also result in high P excretion by the animal, resulting in high P concentrations in the urine and manure.

Finally, be aware that the nutrient content of CGF is quite variable. As mentioned above, crude protein, the protein's degradability, and mineral content of CGF can vary widely. Thus, it would be desirable to have CGF analyzed, especially if large amounts are used. The color of CGF should be yellow to tan. Dark coloring along with a "burned" smell would indicate "scorching". Scorching can have a negative effect on nutritive value, particularly the protein availability and digestibility.

Feeding Guidelines

Because of the risk of high S intake, CGF should be limited to 50% or less of the total dry matter intake. For example, a 600 lb calf should receive no more than 6 lb per day, or a mature beef cow, 12 lb per day. It should be pointed out that many nutritionists recommend even lower limits (i.e., 0.5% of body weight per day, which in the above examples would be 3 lb and 6 lb per day). An effective practice is to blend CGF with another feed, such as soybean hulls. In fact, a 50:50 blend of CGF and soyhulls is a good feed for a backgrounding program. Because of the high P concentration in CGF, ensure an acceptable total dietary Ca:P by providing adequate supplemental Ca either as part of the mixed ration or included as a component of a free choice salt-mineral mix. The final consideration is that CGF, like corn itself, is low in the amino acid lysine. If dietary lysine concentration is a concern, amino acid evaluation and amino acid supplementation could be considered.

In all, CGF is a good feed for beef cattle. However, be aware of potential problems with the feed, especially when fed at a high level.

References and Further Reading

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EDIS Publications

Plant Protein By-product Feedstuffs for Dairy Cattle (http://edis.ifas.ufl.edu/DS075),

Florida Cow-Calf Management, 2nd Edition—Maintaining a Healthy Herd (http://edis.ifas.ufl.edu/AN120),

Total Protein Requirement of Beef Cattle II: Feeding By-product Feedstuffs (http://edis.ifas.ufl.edu/AN168), and

Average Nutrient Content and Bulk Price of Byproduct Feeds Commonly Available to Florida Cattle Producers (http://edis.ifas.ufl.edu/AN142).

Table 1. Typical nutrient composition of corn gluten feed, a co-product of corn wet milling process.[a]

	Dairy One[b]		
Item	**Average[a]**	**Range**	**NRC 2016[c]**
Dry matter, %	89.1	86.6–91.6	88.9
Crude protein, %	23.8	17.0–30.6	22.6
Crude fat, %	4.3	2.7–5.9	3.32
Crude fiber, %	8.6	5.7–11.5	-
NDF[d], %	36.3	30.3–42.4	35.1
ADF[e], %	11.7	8.9–14.5	11.2
TDN[f], %	73.3	70.6–76.0	80
NEg[g], mcal/lb	0.50	0.46–0.55	0.59
NEm[h], mcal/lb	0.78	0.74–0.83	0.88
Phosphorus, %	1.06	0.84–1.28	1.01
Potassium, %	1.45	1.09–1.82	1.41
Calcium, %	0.09	0.00–0.27	0.10
Magnesium, %	0.43	0.33–0.53	0.43
Sodium, %	0.26	0.03–0.50	0.30
Sulfur, %	0.51	0.25–0.76	0.58
Copper, ppm	6.30	0.0–17.3	6.30

[a] Dry matter (moisture free) basis.
[b] Dairy One Forage Laboratory accumulated data 5/1/2000–4/30/2016 accessed Aug. 30, 2017. (Please note that energy value given (TDN and NE) tend to be lower, about 10% lower, than from other labs).
[c] National Research Council.
[d] Neural detergent fiber.
[e] Acid detergent fiber.
[f] Total digestible nutrients.
[g] Net energy for gain.
[h] Net energy for maintenance.