Alternative Feeds for Beef Cattle

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Introduction

As a beef cattle nutritionist, two things have been drilled into to me from early on: 1) the cheapest way to feed the cow is to let her "harvest" her own feed by grazing, and 2) corn is the cheapest source of energy for fed cattle. However, fluctuations in corn and land prices in more recent years have raised questions regarding the truth in these old adages. The objectives of these proceeding are to explore the historic feeding strategies for cattle, discussing their benefits and limitations, and provide information on alternative feeds for beef cattle producers to take advantage of.

Forages

Although beef cattle producers and nutritionists have always relied on cow grazing to reduce input costs in their systems, many challenges are associated with this scenario. While the cows cheapest source of energy may be the one she harvests herself (i.e. grazed forages), the quantity and quality of those forages do not always match the cows requirements (Sollenberger and Chambliss, 1991). More often than not, calving seasons correspond more closely with poor forage quality and limited quantity. This is a major challenge to overcome because calving is also the time of the greatest energy and protein requirements of the dam (NRC, 2000). Therefore, while the cow is undergoing uterine involution, nursing a calf, and attempting to return to estrus and rebreed, she is often doing so with a limited supply of nutrients from pasture (Whittier et al., 1993). In addition, harvested forages may be fed to growing calves in confinement feeding systems (Murphy and Loerch, 1994). Feeding forages to growing cattle allows the deposition of lean gain, without the worries of over-fattening calves. However, there are challenges to feeding forages in confinement as they can be bulky, difficult to handle, and may have poorer quality. When harvested forages are used to supplement cattle requirements, they can be quite costly to an operation, depending on the source, year, and so on.

Corn

Cattle can be fed unprocessed, whole kernel corn to supplement their energy need; and, when corn was $2/bushel, this was a cheaper alternative to some harvested forages (Wright, 2005). Traditionally, corn grain is processed prior to inclusion in beef cattle diets, particularly in feeder cattle diets, to improve starch digestion, feed efficiency, and physical characteristics of the diet (Owens et al., 1997). However, the

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slower rate of fermentation of the whole kernel, may improve rumen synchrony when feeding corn in combination with a forage (i.e. as a supplement to grazing). Much of the rationale for corn processing then centers on traditions and perceptions. Ørskov (1986) reported that processed corn may be favored over feeding whole corn because of the visual appearance of whole kernels in the feces. i.e. more kernels are perceived to be in the feces of cattle fed whole kernel corn than those fed processed corn. However, researchers have quantified the excretion of whole kernels and found that less than 2% of the kernels consumed were present in the feces (Gorocica-Buenfil and Loerch, 2005). In feedlot settings, up to 80 or 90% of the ration DM would have been corn as recently as the late 90's. However, in the current U.S. bioenergy environment, there is a "newfound" reliance on corn grain to provide energy for fuel. This shift in emphasis on corn for fuel instead of feed has driven up the competition for corn grain and, thus, the cost.

Alternative Feeds

Due to the increasing costs associated with corn grain and harvested forages (and land!), beef cattle producers are turning to alternative feeds to meet cattle protein and energy requirements. The best alternative feeds for beef producers are those that are cheap and readily available. To remain economically viable, secondary products of other industries can, and should, be taken advantage of in beef cattle diets. These proceedings will focus on alternative feeds for beef cattle systems with added emphasis on products available throughout the Southeastern United States.

There are a large variety of alternative feeds in the United States. These feeds are sometime referred to as "millfeeds", as they are the products of processing materials, be they plant or animal, for human use. These feeds have also been termed by-products or co-products, and, as in this proceeding, alternative feeds. These terms may be used interchangeably. It is important to note that as grain processing is an ever-changing field, so are the alternative feeds from those processes. Thus, one critical component to using these alternative feeds effectively is obtaining a chemical analysis and knowing the nutrient composition of the material, in order to best meet the animal's requirements. Each scenario may have a different "optimum inclusion" of the products and this optimum is dependent on cost, availability, roughage inclusion, water source, and the production system. Because of the challenges associated with consistency of alternative feeds and the lack of peer-reviewed publications on the topic, more of the published information regarding alternative feeds are found in extension-type articles. Therefore, these articles have been included and cited in an attempt to make the proceedings complete.

Distiller's grains with solubles. Among the most popular alternative feeds in the Midwestern United States are the co-products of corn processing. For example, distiller's grains with solubles (**DGS**) have been an important, low cost protein source for beef cattle producers for over 3 decades. Demand for DGS increased as the cost of corn reached up to $8/bu and they became an economically attractive source of energy. However, there are 3 major challenges when feeding large amounts of DGS. #1 Protein:

The “traditional” DGS diet may have contained approximately 25% DGS on a dry matter basis (**DMB**) and supplied approximately 14.3% crude protein (**CP**) on a DMB to the diet. When corn prices sky-rocketed though, it was not uncommon to see feedlot diets that included 50% DGS, increasing dietary protein to roughly 19% (DMB). That shift had some researchers questioning the long term ramifications of feeding so much excess protein, not only on the environment, but also on the animal. #2 Fat: Another challenge with using DGS as an energy source has been the fat content. Feeding fat in excess reduces fiber digestibility and cattle performance. Some DGS may contained as much as 10 to 12% fat (DMB). While fiber digestibility was not a major concern for feedlot owners, it had some cow producers turning to a lower fat alternative, like corn gluten feed (**CGF**). Fat content represents another avenue of income for ethanol companies, however, and many Midwestern plants now de-oil their DGS and sell a product containing as little as 3 to as much as 8% fat. #3 Sulfur: The 3rd major issue with feeding DGS has been sulfur content (Felix et al., 2011). Unfortunately, due to the use of sulfuric acid in the production of ethanol, this one may not be an easy fix. Some new investigations have looked at using phosphoric acid in place of sulfuric, but the efficiency of ethanol production using this technique has not been good enough for it to become an industry standard. That said, most plants will have a sulfur value on their DGS, but that value may vary within plants and between plants. The typical range of sulfur in DGS can be anywhere from 0.35 to 1.00% (DMB). The moral of this story is to test DGS and/or ask for the plants analysis of their DGS. Two important considerations with DGS are cost and availability. The cost of DGS follows the cost of corn. As corn price increases, price of DGS increases. In August of 2012, the drought in the Midwest had driven the cost of corn so high, that several ethanol plants were no longer running. Availability of DGS became a serious issue. Similarly, in the fall of 2015, demand for DGS was so great that it became, temporarily, more expensive than corn. Remember, the goal of alternative feeds should be to reduce input costs. In the Southeastern States, with less access to corn processing plants, reliance on DGS will likely not be the norm.

Other fibrous feeds can also be used with great success in cattle diets. These fibrous feeds include brewer’s grains, soybean hulls, cottonseed products, and citrus pulp. As these feeds are byproducts of their respective industries, as with any byproduct feed, the most important thing for a nutritionist to do is get a nutrient analysis of each new load.

Brewer’s grains. Brewers grains are the byproducts of brewing different grains, but predominately barley, for the beer industry. They are typically a regionally available feed that can be sourced relatively inexpensively. One of the reasons that brewers grains are growing in popularity with the beef industry is the increasing availability. From 2013 to 2014 alone the total number of breweries in the U.S. has grown by 18.6% (Brewers Association, 2014). Much of this growth has been realized in small operations, or “microbreweries and in regional craft breweries. In fact, in 2014, the growth of craft beer production rose 9.6% even while overall beer production fell 1.4% (Morris, 2014). For example, Florida’s craft brewing industry produces over a million barrels of beer annually (Brewers Association, 2014). Because of the unique nature of the beers these

breweries sell, nutritionists and producers wishing to capitalize on these byproducts should recognize the inherent variability from source to source *and* even within a source. The NRC (2000) states that brewer's grains contain 26 to 29% CP and 6 to 10% fat (DMB). However, reports of up to 12% fat, or greater, have been cited (Long et al., 2015). In many instances, the biggest challenges associated with sourcing brewers grains for cattle producers are the storage and handling of the product. Brewers grains will be cheapest when sourced wet and contain as much as 79% moisture in these circumstances (NRC, 2000). Handling and storing a product this wet, particularly in a warmer climate, presents challenges with runoff, spoilage, and equipment.

Soybean hulls. Another alternative feed to consider is soybean hulls. While whole soybeans have a number of antinutritional factors that can be discussed (such as phytoestrogens, goitrogens, etcetera), soybean hulls are heated and processed, thus, most of the antinutritional factors routinely attributed to soybeans are eliminated. However, caution should still be taken and soybean hulls should not be included at more than 30% of the diet as they have been known to cause bloat at these upper inclusions (Rankins, 2011). Because of the uniformity of the soybean industry, soybean hulls tend to be the most consistent of the alternative feeds and contain 12.2% CP (NRC, 2000).

Cottonseed byproducts. One of the more unique alternative feeds for the Southern States to capitalize on in particular are cottonseed byproducts. There are a number of cottonseed products to choose from as cattle feeds, including whole cottonseed, cottonseed hulls, cottonseed meal, and gin trash (Stewart, 2010). Whole cottonseed can come delinted or "fuzzy". Fuzzy cottonseed has been touted by some as a near perfect supplement for cattle (Blezinger, 1999) because it contains the meat and oil from the seed, as well as some additional fiber from the fuzzy lint that covers the seed. It typically contains 15 to 21% CP and 15 to 17% fat (DMB); however, its nutrient composition too can be affected by growing and harvest conditions, thus analysis is recommended. Because of the high fat concentration in whole cottonseed, their inclusion in the diet is often limited to 15% of the DM (Blezinger, 1999). Cottonseed hulls are simply the outer seed coat that is removed before the grain is processed for oil. Cottonseed hulls contain very little protein (approximately 4%; NRC, 2000) and are mostly fiber (90% NDF on a DMB; NRC, 2000). Therefore, they are more applicable in a situation where additional "filler", or fiber, is needed, such as a growing cattle diet or cows fed a mixed ration. Cottonseed meal is a popular source of protein for cattle feeders. At 36 to 41% protein, is a concentrated option for producers that do not have access to the Midwestern corn milling products. In addition, because its poor quality protein is not favored by swine and poultry nutritionists, cost tends to be favorable (Jurgens and Bregendahl, 2007). Finally, gin trash can be used as a cattle feed and is best recommended for cows in the last trimester, due to its poor digestibility and limited nutrient supply (Stewart, 2010). Gin trash is a feed that will provide an economic feed for cows without putting too much fat on them; however, it may not be palatable when first fed. Adaptation to gin trash is advisable then. Caution should be exercised when feeding cottonseed products, and largely centers around gossypol in the diet. Gossypol is a problem that nonruminant nutritionists are extremely familiar with. However, the

rumen microbes do degrade the majority of gossypol entering cattle. Still, gossypol poisoning may reduce fertility in breeding bulls, females seem more resistant to these effects, and it may reduce intake and gains in growing animals, if overfed (Poore and Rogers, 1998; Stewart, 2010).

Peanut byproducts. Similar to cottonseed, there are a variety of products available from peanut processing, including: hulls, skins, and meal. However, these products are less widely available and should be fed with some caution. For example, although peanut meal may contain as much as 45 to 55% CP (DMB), it is often lysine deficient. In addition, the protein that is present is often less digestible than other high protein supplemental feeds, likely due to the tannin concentration in peanuts. From a health standpoint, peanut products are prone to aflatoxin contamination (Kellems and Church, 2010). Aflatoxins can cause fertility issues, including abortions, and suppress growth. On top of the troubles with aflatoxin, associated with all peanut products, peanut hulls also have very little energy. Because of this, peanut hulls are generally only used when other alternative feeds with comparable fiber characteristics, like cottonseed hulls, are too expensive or unavailable (Blezinger, 2003).

Citrus byproducts. Citrus byproducts are unique to the Southeastern U.S. and CA. These byproducts can include citrus meal or citrus pulp, although citrus pulp is the more widely used product for cattle. Citrus pulp can be an excellent feed for cattle. The fiber fractions in citrus pulp are very digestible, making it a popular choice for growing animals. In fact, citrus pulp has been successfully fed to growing cattle at up to 50 to 60% of the diet (Kellems and Church, 2010). However, additional protein sources will need to be considered when feeding such great amounts to growing cattle and citrus pulp contains only 5 to 8% CP (DMB). In addition, citrus pulp is heavily used in the dairy industry due to its fiber concentration and palatability; thus, access for beef producers may be more limited (Jurgens and Bregendahl, 2007).

Conclusions

When feeding alternative feeds to cattle, they should always pencil in the operation. Myer and Hersom (2003) provide an excellent overview on determining the value of several alternative feeds relative to corn and cottonseed meal. The key for beef cattle producers and nutritionists alike will be to stay on top of new information. Most importantly, however, is to remember that byproducts are secondary to the plants processing the whole grains. Therefore, the composition of these byproducts should always be determined before decisions regarding which to use in the ration, and at what dietary inclusion they will be incorporated, are made. It is important to determine what works best in your production system. Cost should drive much of the decisions regarding “optimum” inclusion of alternatives feeds in beef rations. As is typical, these decisions will have to be made quickly to take advantage of opportunities as they arise and the need for rapid dissemination of new information on alternative feeds will be paramount.

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SESSION NOTES