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Alternative Feeds for Beef Cattle

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Supplemental feed can be a major cost incurred to maintain beef cattle. Corn, grain sorghum or milo, cottonseed meal and soybean meal were traditionally used to provide supplemental energy (TDN, total digestible nutrients) and protein (CP) needed by cattle consuming forage diets. Cattle producers today, however, rely on an abundance of alternative or byproduct (co-product) feeds to supplement their cattle. These feeds will be described as alternative feeds throughout this publication.

Alternative feeds may provide nutrients needed by cattle at a lower cost than traditional feeds. In fact, many of the locally sourced cattle supplements today are simple commodity blends of 3 to 5 feeds. The price of these feeds is usually based on the price of corn and a protein meal (such as soybean meal), supply and demand and how far the feed will be trucked from its origin to its destination. Several factors should be considered before deciding if and which alternative feed(s) to use in cattle diets. Factors discussed relative to alternative feeds include the following:

- Supplementation Basics
- Composition (nutrient density)
- Mineral Supplementation
- Description
- Availability and Storage
- Feeding and Limitations

Supplementation Basics

Energy

Total digestible nutrients make up the majority of cattle diets. The exact TDN value of a diet is difficult to obtain because (1) TDN content of purchased feed is not displayed on feed labels, (2) TDN content derived from a forage or feed analysis is usually estimated from a prediction equation, (3) TDN values for many feeds change as the amount in the diet changes, especially when forage is replaced with alternative feeds, and (4) variation within the nutrient composition of a feedstuff, as well as how the feedstuff was stored and processed, can affect its TDN. Cattle producers can do little about most of the factors mentioned. However, cattle producers have the opportunity to have ingredients tested for nutrient composition, which can be used to make diet adjustments.

Changes in TDN concentration of a feedstuff associated with partially replacing one type of dietary ingredient with another are referred to as associative effects and can be positive or negative. Corn grain, for example, contains high levels of starch and TDN (Table 1). When corn is used as a supplement, high levels of starch and sugar are rapidly digested in the rumen, resulting in the rumen environment becoming more acidic. When high-starch supplements are fed to cattle consuming a forage-based

diet, lower forage intake and digestibility can result once the starchy feed being used reaches a critical level. The impact of this negative associative effect is relative to the amount of grain fed, amount of rumen degradable protein, and the type and quantity of forage.

Adding grain (corn, grain sorghum or wheat) to the diet of cattle beyond a threshold of about 0.5 percent of body weight may be counterproductive if the goal is to maximize forage intake and digestibility. In these situations, it is often desirable to choose a supplement with a low level of starch that provides TDN in the form of highly digestible fiber, such as soybean hulls, corn gluten feed, wheat middlings or distillers grains (Table 1). A higher percentage of the TDN in these feeds is in the form of fiber, which is the same form as in the forage. Therefore, negative associative effects are not nearly as dramatic as those seen with starch-based supplements. However, using higher-starch feeds may be a viable option when they are competitively priced with the alternative feeds and when forage substitution is desirable. Although forage intake and digestibility are reduced by feeding high-starch feeds at greater than 0.5 percent body weight, total dietary energy intake can be greater, thus improving cattle performance.

The fiber in byproduct feeds is not equally digestible and can be influenced by other nutrients such as fat. For example, gin trash and soybean hull analyses report similar levels of neutral detergent fiber, however, soybean hulls contain 39% more TDN than gin trash. Gin trash has a greater fat content than soybean hulls, and gin trash fat level varies due to the amount of cottonseed that ends up in gin trash. However, gin trash has 6 times the amount of lignin (an undigestible plant fiber component) than soybean hulls which greatly affects digestibility. Gin trash can also be quite high in inorganic matter content. Greater inorganic material reduces the overall amount of available energy as well. The difference in fiber components and inorganic matter make soybean hulls a better feed for increasing energy intake compared to gin trash.

Protein

Crude protein values for alternative feeds are included in Table 1. To maximize forage intake and digestion, protein requirements of cattle must be met. Protein supplements should be evaluated based on the digestive characteristics of the protein provided. A digestive characteristic of dietary protein is that it can be classified as either rumen degradable protein (commonly abbreviated as RDP) or rumen undegradable protein (commonly abbreviated as RUP). In previous years, RUP was called bypass protein or undegradable intake protein (UIP).

Table 1. Nutrient Concentration of Feed Ingredients

Feed	Dry matter (%)	Crude protein (%)	Degradable protein (% of CP)	Total digestible nutrients (%)	Neutral detergent fiber (%)	Fat (%)	Ash (%)	Calcium (%)	Phosphorus (%)	Ca/P	Sulfur (%)
Brewers grains (wet)	24	29	36	74	49	9.8	4.5	0.34	0.69	0.5	0.32
Corn gluten feed	89	24	63	80	36	4.3	7.5	0.08	1.07	0.1	0.50
Cotton gin trash	92	12	38	46	61	5.1	13.9	1.47	0.25	5.9	0.37
Cottonseed	92	24	48	93	56	18.3	4.3	0.17	0.60	0.3	0.24
Cottonseed hulls	92	8	29	42	80	4.2	4.2	0.31	0.19	1.6	0.11
Distillers grains (dried)	89	31	32	89	34	11.6	6.2	0.08	0.89	0.1	0.65
Grain screenings	90	13	50	76	30	6.2	5.8	0.38	0.40	1.0	0.17
Hominy	89	10	35	87	16	7.3	2.8	0.05	0.54	0.1	0.12
Rice bran (full fat)	92	15	46	83	24	17.1	10.7	1.72	1.76	1.0	0.18
Soybean hulls	91	13	46	63	64	2.7	5.1	0.61	0.16	3.8	0.12
Wheat middlings	91	18	63	73	37	4.4	5.4	0.13	1.06	0.1	0.20

Values reported by Dairy One Feed Composition Library, Nutritional Requirements of Beef Cattle 8th Revised Ed., and values reported in University of Arkansas Feed Test reports

Rumen degradable protein requirements must be met to maximize intake and digestibility. If the diet is deficient in protein, a supplement high in RDP must be provided before TDN or RUP supplements are considered. By-product sources with high RDP values include soybean hulls, rice bran, corn gluten feed, wheat middlings and whole cottonseed. When RDP is adequate, supplementation of RUP may enhance the performance of growing calves. An alternative feed high in RUP is distillers grains.

Many producers will purchase ingredients by the truckload and mix supplements and diets on the farm. Storage space, ingredient turnover rate and feed price may all dictate type and quantity of ingredients and affect how protein feeding decisions are made. If a feed is high in RUP, this does not necessarily mean that RDP needs will not be met. Cattle are capable of cycling excess nitrogen from protein metabolism to the rumen, which can be used by the rumen microbes. Because many alternative feeds are moderate to high in CP, a diet that contains a high percentage of alternative feeds may have sufficient nitrogen recycling to the rumen for adequate diet digestion.

Minerals

Beef cattle should be provided adequate levels of minerals year-round. When feeding some of the alternative feeds shown in Table 1, special attention should be given to the calcium-to-phosphorus ratio of the diet. All of the alternative feeds shown, except soybean hulls and cottonseed hulls, are relatively high in phosphorus. Although those feeds usually provide an inexpensive source of phosphorus, care must be taken to maintain a calcium:phosphorus ratio of at least 1 part of calcium to each part of phosphorus. Depending on the level of supplement fed, several of these feeds may need to be supplemented with a calcium source. Many of these feeds are also good sources of potassium, magnesium, sulfur and some trace minerals. Therefore, a lower cost mineral supplement can often be used because of the minerals provided in these alternative feeds. Commercially available mineral supplements that are 20 to 24 percent calcium and 0 to 4 percent phosphorus can often correct the calcium:phosphorus imbalance plus provide supplemental trace minerals and vitamins. Some alternative feeds can be excessive in minerals, and this too must be considered to avoid nutrition-related disorders (see FSA3071, Nutritional Disorders in Beef Cattle). Excessive amounts of distillers grains and corn gluten feed can lead to diets that exceed maximum tolerable level for sulfur. Mineral content can also be influenced by regional differences and how the feedstuff was processed, so values in Table 1 may not be an accurate representative of the feed in the bin or shed.

Nutrient Variability and Feed Analysis

Nutrient variability must be considered with any alternative feed source. For example, Dairy One Feed Composition Library reports corn gluten feed protein average is 23.6% but the normal range is 17.5 to 29.7% CP, and the normal range for fat in rice bran is 11.4 to 22.9%. Feeds that are byproducts of grain and oilseed processing need to be analyzed for nutrient content. Ideally, the feed analysis is conducted using wet chemistry procedures. Many labs use a summative equation to estimate TDN. To estimate TDN, the analysis needs to include protein, acid and neutral detergent fiber, nitrogen content of detergent fiber residues, fat, ash, and lignin. Some labs also offer in vitro digestion analysis to estimate digestibility by incubating the feed in rumen fluid. Visit with a nutritionist or testing lab about what options are best for the feed being analyzed. One method to manage around feed variability is not relying on single ingredient supplementation, especially with growing cattle.

Brewers Grains

Description – Brewers grains are spent grains (barley alone or a mixture of barley and other cereal grain or grain products) from the brewing of beer. In the past, brewers grains were mostly sourced from large brewing facilities. Today, local micro-breweries are popular and also serve as a source for brewers grains, but at a much smaller scale.

Availability and Storage – Brewers grains are usually wet (75 to 80% water content) and have a density of 55 to 60 lb/ft^3. Transportation cost must be considered when deciding to purchase wet products. Wet brewers grains will have a short storage life unless it is ensiled. During summer months, a load of brewers grains should be fed within a week from receiving to minimize spoilage.

Feeding and Limitations – Because of the higher protein content of brewers grains compared to other feedstuffs, they are typically higher priced; therefore,

these feeds are usually preferred when both protein and energy supplementation are needed.

CAUTION – For an accurate comparison of the cost of wet grains vs. dry grains, the cost of wet grains should be adjusted to the same moisture level as dry grains. Most of the feeds in Table 1 contain about 90 percent dry matter, except wet brewers grains. For example, if wet brewers grains (at 26 percent dry matter) were $55 per ton, the cost adjusted to 90 percent dry matter is $190 per ton.

a. Cost of high moisture grain: _____ (example $55/ton)
b. Target moisture: 0.9
c. Moisture content of grain:_____ (example 26%)
d. Adjust cost = A × [0.9÷(C÷100)] (example 55 × [0.9 ÷ (26 ÷ 100)] = 190.38 $/ton)

Corn Gluten Feed

Description – Corn gluten feed is a byproduct of the wet milling industry that produces high fructose corn syrup.

Availability and Storage – Corn gluten feed is available in both dry (88 to 92 percent dry matter) and wet (55 to 70 percent dry matter) forms and the density can range from 26 to 33 lb/ft^3. The dry product is usually marketed as pellets. Pellets are either dark and hard or lighter in color but with more broken pellets and fines. Pellets flow well and are easy to store and feed.

Feeding and Limitations – The moderate protein content (Table 1) and highly digestible fiber often make corn gluten feed an economical protein and TDN supplement for cattle. Generally, corn gluten feed should not make up more than 50 percent of the dry matter intake. Even at 50 percent, the TDN value will be less than when it is fed at lower levels. Corn gluten feed can be quite variable from load to load. The pelletizing process can sometimes cause the product to have a burnt odor; therefore, corn gluten feed pellets may not be palatable, especially with receiving rations or creep feeds. Researchers have studied growth performance of calves with free-choice access to corn gluten feed. Feed conversions were reported to be very poor with free-choice access; therefore, avoid feeding corn gluten feed pellets as a sole free-choice supplement. There is also concern with corn gluten pellets that are really dark due to excessive heating during processing or storage. These have been referred to as burnt or charred. Heating can bind protein to fiber which causes a reduction in protein degradability. While feedstuff analysis can measure protein bound to fiber, other negative impacts from heating such as reductions in acceptability will not show up on a lab analysis report.

Cotton Gin Trash

Description – Gin trash is a product of cotton ginning and contains leaves, stems, burrs, immature seed, and other harvest contaminants. Gin trash can be quite variable in plant components and quality.

Availability and Storage – Gin trash is readily available in late fall and early winter. Supplies can become low by late winter during years that hay supplies are low. Similar to cottonseed hulls, gin trash is bulky. Gin trash is usually stored outside in piles, unprotected from the weather.

Feeding and Limitations – Gin trash is over-valued by cattle producers because the deceivingly good protein level (12% CP) overshadows the poor digestibility (46% TDN). Gin trash can be used as a substitute for forage, and cattle find gin trash palatable. However, gin trash must be balanced with other ingredients, high in TDN, to compensate its energy deficiency. Gin trash must also be used with caution because the crop chemical history is not known, and some chemicals advise not to feed gin trash to livestock. Anyone substituting gin trash in place of hay for mature cows should withhold gin trash from the diet for at least 14 days prior to marketing since cull cows may go directly to slaughter.

Cottonseed (whole)

Description – Whole cottonseed is a byproduct of cotton production. Most of the cottonseed used by the

beef industry has not been "delinted." Whole cottonseed can be fed to ruminants before or after the "lint" has been removed. Cottonseed is high in TDN and protein content (Table 1). Cottonseed should be clean, free of foreign debris, white to whitish-gray in color and contain no more than 14 percent moisture.

Availability and Storage – Cottonseed supplies are seasonal, and price tends to be lowest in the fall. Cottonseed is light (18 to 25 lb/cubic ft^3). It is usually hauled in dump trailers or trucks with a bottom conveyor, especially non-delinted seed which does not flow well in mechanical systems. Cottonseed is usually handled with front-end loaders or manually with a shovel. Storing cottonseed that is too wet may cause heating or molding, as evidenced in a dark or black seed. Heating results in damage to protein, making it unavailable, and may eventually cause spontaneous combustion.

Feeding and Limitations – Several factors make cottonseed an ideal supplement for cattle. It is a good source of protein, TDN and phosphorus – three nutrients likely to be deficient in many feeding situations. Cattle usually eat cottonseed after they have adapted to it. At first offering, whole seed may need to be mixed with other ingredients, but after adaptation, cattle usually consume it readily. Cottonseed can be fed whole. Cottonseed does not flow well in self-feeders. It is usually fed from a trough or in small piles on a well-drained surface. Because cottonseed is high in fat content and diets exceeding 6 percent fat (dry matter basis) can reduce forage digestibility, the quantity fed should be limited. In addition, gossypol, a potentially toxic compound found in cottonseed, limits its use. Gossypol is also found in cottonseed meal and cottonseed hulls. Fortunately, ruminant animals have the ability to detoxify gossypol, to some extent, during rumen fermentation. Maximum levels for feeding whole cottonseed generally should not exceed levels shown in Table 2. Although recommendations have been made for up to 10 percent whole cottonseed in the diet for developing young bulls, no recommendation is made here because research indicates potential reduced fertility in young, developing bulls and the relatively low potential cost savings versus risk when feeding whole cottonseed at the lower levels previously recommended.

Table 2. Whole Cottonseed Feeding Recommendations

	Percent of Animal Body Weight	Percent of Total Diet	Lb/Hd/Day
Mature Cows	0.5	20	5 to 7
Bulls (during the breeding season	0.33	15	5 to 7
Growing Cattle (over 8 weeks of age)	0.3	15	1.5 to 2.5

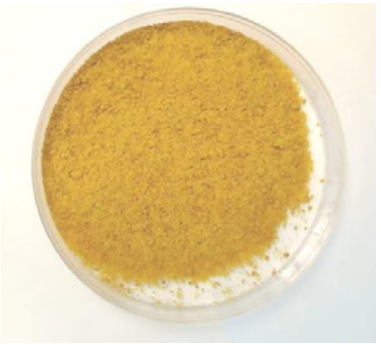
Cottonseed Hulls

Description – Cottonseed hulls are the outer covering of cottonseeds. They are low in TDN and calcium and very low in protein and phosphorus (Table 1).

Availability and Storage – Non-pelleted hulls have been used for many years as a substitute for roughage. They are bulky (12 lb/ft^3) and are difficult to transport and handle. Pelleted hulls are now available. In comparison to non-pelleted hulls, they are more digestible, require less transportation and storage space and are easier to handle.

Feeding and Limitations – Cottonseed hulls can be fed without further processing, but the use of pelleted hulls has increased in recent years because of ease of handling. In rations that contain high levels of TDN, pelleted hulls are not as effective as a roughage source for maintaining rumen health as non-pelleted hulls. Hulls are well liked by cattle, even when fed as the only roughage.

Distillers Grains



Description – Distillers grains are byproducts of the distilling industry. Since the mid-2000's, distillers grains volume has increased with the production of ethanol as an additive to automobile fuel. Distillers grains with solubles consist of distillers grains plus the solubles of fermentation. Distillers grains are identified by the type of grain from which they are made, for example, corn distillers dried grains. Distillers grains are a good source of RUP

for ruminants. They are rich in protein, TDN, minerals and vitamins (Table 1).

Availability and Storage – Distillers grains can be fresh (wet), dried, or partially dried (modified) and distillers grain pellets are also becoming more accessible. The dried product is the easiest to handle and store on-farm with a bulk density of 19 lb/ft^3). Transportation cost must be considered when deciding to purchase wet instead of dried products. The acidity of wet distillers grains helps prevent spoilage during storage.

Feeding and Limitations – Because of the higher protein content of distillers grains compared to other feedstuffs, they are typically higher priced; therefore, this feed is usually preferred when both protein and energy supplementation is needed. Distillers grains are palatable to cattle. Because of the sulfur content, distillers grains should not exceed 40 percent of the diet (dry matter basis), and lower levels may be required if there are other sources of dietary sulfur.

Grain screenings

Description – During the grain cleaning process, separated debris is marketed as grain screenings. Grain screenings can include stem pieces, weed seed, broken or poorly developed seed, grain dust, and husk pieces.

Availability and Storage – Grain screenings or grain dusts are usually stored in commodity sheds. Composition can vary greatly causing bulk density to range from 24 to 50 lb/ft^3.

Feeding and Limitations – Grain screenings can be a good source of protein and energy. The energy can be equal or lesser in value than the grain that was screened depending on feeding rate and composition of the screenings. Grain screenings that are not ground in a hammermill before feeding do pose risk of spreading weeds like pigweed.

Hominy

Description – Hominy is a byproduct of corn processing. It contains corn bran, corn germ and part of the starchy portion of either white or yellow corn kernels. Hominy is higher in protein, fat and fiber than corn grain (Table 1). The fat concentration can range from 5 to 12 percent, which will alter the TDN concentration.

Availability and Storage – Hominy is finely ground and can be stored, handled and fed similarly to ground corn. Bulk density of hominy is lighter than corn and ranges from 25 to 28 lb/ft^3. Producers have reported receiving loads of hominy that were near 15% moisture which is sufficient for mold growth during extending storage periods.

Feeding and Limitations – Hominy is often used in rations as a replacement for corn. For finishing cattle, the maximum levels that can be added to the ration may be influenced by the fat content. Supplies should be fed within a month after purchase, especially during warm weather, to avoid the stale smell.

Rice Bran

Description – Byproducts from processing rice include rice hulls, rice bran, rice polishings and broken rice grains. When harvested from the field, rice is in the form of paddy (or "rough") rice – the kernel is fully enveloped by the rice hull. After being dried, the first stage in milling is removal of the hull, yielding brown rice. Next, the outer layer is removed from the brown rice kernel to yield white rice. The separated brown layer is designated rice bran. The composition of rice bran can be quite variable, due to the degree of milling and quantity of constituents. Rice bran is nutritious and supplies protein, energy and minerals (Table 1). Both full-fat rice bran (commonly referred to as 12-12-12 for 12 percent protein, fat and fiber) and defatted rice bran are sold for cattle feed.

Availability and Storage – A large quantity of rice bran is produced near rice producing states. Most rice bran on the market is full fat; however, there is some deoiled rice bran as well. The deoiled rice bran is lower in energy than full fat rice bran. The high fat content of full-fat rice bran makes it more susceptible to rancidity during warm weather, reducing its palatability. Rice bran has a fine particle size and a powdery texture, making handling and storage in bins difficult due to stacking and bridging. Blending with other concen-

trates, such as grain, improves flow characteristics. Traditionally, rice bran was used as a cattle supplement. In recent years, rice bran has seen increased use in deer and horse supplements, which has affected its price and availability. Rice bran is fairly light with a density range of 18 to 22 lb/ft^3.

Feeding and Limitations – Small particle size, starch and fat content all add to the risk of digestive upset and the potential for nutritional imbalances. In general, beef cattle diets should not exceed 6 percent fat on a dry matter basis. Therefore, full-fat rice bran should be limited to no more than one-third of the diet. Research in Arkansas found that full-fat rice bran was best utilized at less than 0.5 percent body weight. Defatted rice bran has a lower energy value than full-fat rice bran; however, the fiber digestibility of defatted rice bran is improved in the absence of fat. Due to their moderate energy content and moderate to moderately-high protein content, these feedstuffs make a good forage substitute when forage supply is limited. Research in Louisiana evaluated free-choice access to full-fat rice bran, and rice bran intake appeared to be self-limiting around 1 percent body weight, which may be due to fat intake. Rice bran is very high in phosphorus, so the addition of high levels of supplemental calcium may be needed to bring the calcium to phosphorus ratio to at least 1:1 when rice bran is used in rations. This may not always be the case as mills may be using limestone to remove the bran which increases calcium level. Most producers notice that cattle develop a loose stool, even at lower levels of rice bran supplementation.

Rice Millfeed

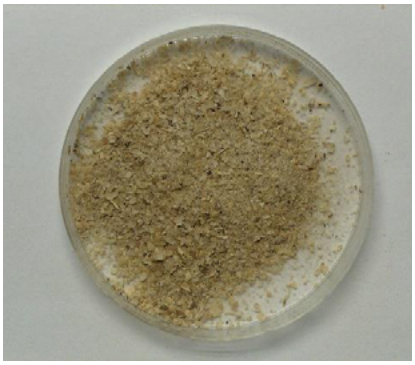
Description – Rice millfeed is a product of rice bran (full fat or defatted) and rice hulls. Nutrient composition will be affected by the proportion of rice hulls to rice bran in the blend. There is considerable difference in the nutritive value of rice bran and rice millfeed (Table 1). Rice bran is much higher in crude protein and TDN content and is more costly than rice millfeed.

Availability and Storage – As with rice bran, rice millfeed is readily available near rice producing areas. Handling characteristics are similar to rice bran, but rice millfeed has a longer storage life. Rice mill feed is powder like which can be problematic in windy areas.

Feeding and Limitations – Rice millfeed is better suited for formulating complete diets, as opposed to being used as a supplement, because of its low protein (7% CP) and energy (42% TDN) content. Rice millfeed is very palatable to cattle and could be used in combination with other feedstuffs during periods of drought as a forage substitute. Due to its small particle size, rice millfeed is not effective for maintaining a healthy rumen, so diets that include rice millfeed should also include a form of roughage, such as a hay, gin trash or cottonseed hulls, that will help maintain a healthy rumen. Research in Alabama showed rice millfeed can be utilized in combination with grain as an alternative to poultry litter with grain-based diets for growing cattle.

Soybean Hulls

Description – Soybean hulls (seed coats) are a byproduct of soybean processing for soybean oil and soybean meal.



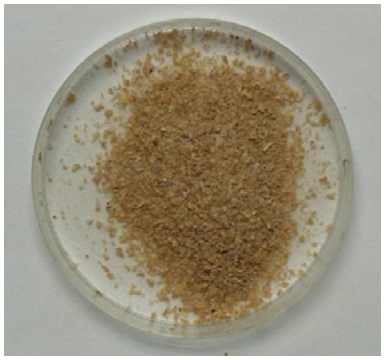
Availability and Storage – Currently, there is high demand for soybean hulls for feeding livestock species that can use highly-digestible, fibrous feeds. Soybean hulls have a very small particle size and are available in bulk meal form and pelletized form though the pelletized form can be more granular due to a high percentage of fines. The meal form of hulls has a density of 23 lb/ft^3. Soybean hulls may be stored in open-fronted sheds or grain bins. They auger slower than grain, but this is a convenient way to store them if equipment for loading and unloading the bins is available.

Feeding and Limitations – The TDN value of soybean hulls depends on the amount fed and the type of diet (concentrate versus forage or roughage). When fed to growing cattle as a supplement to forage diets at 0.5 percent of body weight or less, soybean hulls are equivalent to corn in TDN content. Therefore, growing diets should be formulated using the same value of 88 percent TDN (dry matter basis) for both soybean hulls and corn. When higher levels of soybean hulls are fed, TDN value is reduced. Soybean hulls fed alone have a high passage rate and a much lower digestibility than when the diet includes at least one-third long-stem forage to slow passage rate and increase ruminal retention time. Like other high-fiber byproducts, soybean hulls have a lower TDN value than corn grain when fed at a level greater than 20 percent of diet dry matter in high-concentrate diets. Research indicates that soybean hulls can be used to replace conventional grain sources

as supplements for cattle or as a creep feed. Soybean hulls are palatable to cattle. Sometimes, however, several days may be required to get cattle to consume desired amounts, especially when trying to start inexperienced, weaned calves on feed. Soybean hulls have been fed in free choice feeders to growing cattle producing gains of 2 pounds per day. Feeding free-choice soybean hulls may result in bloat (especially in the pelleted form). Soybean hulls are not a replacement for cottonseed hulls. Soybean hulls are highly digestible fiber, while cottonseed hulls are not. Cottonseed hulls are very effective at helping sustain a healthy rumen, while soybean hulls are not. Unlike a lot of other alternative feeds, soybean hulls are high in calcium and help improve the calcium to phosphorus ratio when used in combination with other alternative feeds.

Wheat Middlings

Description – Wheat middlings or "midds" are a product of the flour milling process. Wheat middlings and wheat mill run are often used interchangeably by the industry. Wheat midds cannot contain more than 9.5 percent crude fiber.



Availability and Storage – Wheat midds are marketed in either pelleted or meal form. The meal form has a lower bulk density (22 lb/ft^3) than pellets, resulting in some dust and logistical problems. Pelleted midds can be handled easily in conventional grain systems. Pelleting also improves palatability to cattle. Midds are moderately palatable to most cattle, but some animals may not readily consume them unless mixed with other feeds.

Feeding and Limitations – Generally, midds should not make up more than 50 percent of the total dry matter intake. Palatability may limit their use in some situations. When formulating rations with wheat midds, balancing calcium to phosphorus ratio is important as wheat middlings as 8 times more phosphorus than calcium. Wheat midds can also contribute substantial amounts of starch. The DairyOne Feed Composition Library indicates the normal range for starch content of wheat midds is 15 to 31%.

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