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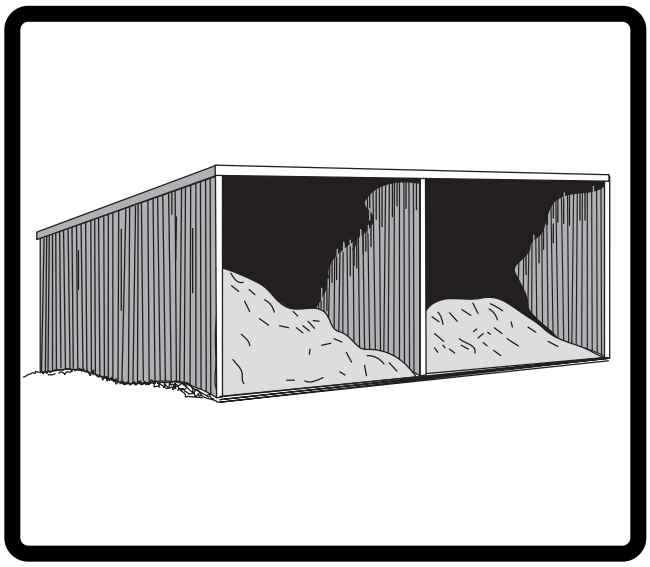
Using Commodity Feeds In Dairy Rations



Using Commodity Feeds In Dairy Rations

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Introduction

Feeding commodity feeds to dairy cows is not a new concept. Feed companies have used commodity feeds in rations as a source of nutrients for years. However, the use of commodity feeds in home-mixed rations may be new to many dairy producers. Commodity feeds include traditional feeds as well as by-products from a variety of sources, including grain processing and manufacturing of human foods. Many factors should be considered before beginning a commodity feeding program, even if the program only includes one commodity.

The primary reason producers use commodity feeds is to reduce feed cost. Feed accounts for 50 to 60 percent of the total cost of producing milk, so anything that reduces feed cost and improves the bottom line is worth considering. Some commodity feeds provide nutrients in a specific form, such as undegradable protein (UIP) or highly digestible fiber, that may be needed to optimize nutrient balance in a ration. Other high-fiber commodity feeds may be used to extend forage supplies during a drought or when animal numbers are increased without any increase in forage production.

There are disadvantages of commodity feeds that producers should consider as well. A commodity feeding program requires additional time for purchasing and arranging delivery and for formulating and mixing rations. Specialized storage and feeding facilities needed for certain commodity feeds may require construction of additional buildings or equipment purchases, both of which will require additional investments. If a commodity feed is only available for a short time or in insufficient amounts, it is questionable whether changing the current feeding program would be justifiable. These factors must be taken into consideration before beginning a commodity feeding program.

Factors to be considered

Economics

One of the main factors producers should consider is the cost of the nutrients provided by the commodity feed. The value of the nutrients in a specific commodity feed can best be determined by using a least-costration formulation computer program that will calculate the economic value of the feed based on feeds currently available and nutrient requirements for the level of milk production. For this analysis, the actual nutrient concentrations of all feeds should be used rather than “book” values.

Another approach to evaluating the economics of a feed is to calculate the pounds of corn and soybean meal needed to provide the same amount of energy and protein as provided by the feed in question. For additional information on this approach, producers

should refer to “The Value of Different Feedstuffs” (DFS-11). All costs should be considered when considering a commodity feed. A sample worksheet for computing the total cost of a commodity is presented in Table 1. For example, a producer is considering a commodity feed that can be purchased for $125 per ton delivered to the farm. If 23 tons are delivered, then the initial cost is $2,875. Interest costs equal $71.88 assuming an interest rate of 10 percent and that the load will be fed in three months. If shrinkage and storage losses are maintained at 7 percent, an additional $201.25 is added to the cost. Extra time for handling the commodity feed can easily add another $50 to the cost. These additional costs increase the total cost of the load of feed to $3,198.13 or $139.05 per ton. If all costs are not considered initially, the economic savings a producer hopes for may not materialize.

Storage

Storage facilities must not be overlooked. Certain commodity feeds such as dried distillers grains can be stored in grain bins; however, other commodities require specialized storage facilities such as a commodity shed or a pit (for wet feeds). Some producers have modified existing facilities without problems, but an engineer should be consulted to avoid problems that can occur due to the density of the feeds placed into these structures. Without proper storage facilities, spoilage and shrinkage losses will be higher. Spoilage and shrinkage losses range from 5 to 9 percent for dry commodity feeds, and from 15 to 25 percent for wet commodity feeds.

Table 1. Calculating the true cost of a commodity feed.

Price delivered to the farm	_____ tons @ $_____/ton	$ _____
Interest	_____% for _____months	_____
Shrinkage and spoilage losses[1]	_____%	_____
Extra handling cost[2]	_____hours @ $_____hour	_____
Total cost		_____
Divide total cost by _____tons		
Total cost per ton		_____

[1]Shrinkage and spoilage losses normally range from 5 to 9% for dry commodity feeds and 15 to 25% for wet commodity feeds.

[2]If an additional 5 minutes are required at each feeding and cows are fed twice daily, an additional 70 minutes labor will be required each week.

Feeding System

Another factor to consider is the type of feeding system present on the farm. Many commodities are not suitable for use in feeding systems designed to dispense feeds in the parlor or through computer feeders. For example, wet feeds such as corn gluten feed or brewers grains, or bulky feeds such as cottonseed or cottonseed hulls, are not feasible in these systems. Ideally, a mixer with scales is available for weighing each feed used in the ration. Scales help producers mix rations containing the desired nutrient concentrations and reduce overfeeding individual feeds. Guessing the amount mixed into a ration results in rations with nutrient imbalances which do not support the desired level of milk production.

Value

In most situations, producers must take a tractor-trailer load of a commodity feed if they are to realize full economic savings. Unless the commodity feed can be used in a reasonable period of time, interest costs are higher. Longer storage times can also result in higher spoilage and shrinkage losses. Both of these factors reduce the amount of savings.

Once producers have determined that a specific commodity can be economically used in their feeding program, they should check with several brokers to secure the best price. A few phone calls can save several hundred dollars over a year.

Nutrient Analysis and Variation

Another factor to recognize when using commodity feeds is the normal variation in nutrient concentrations. Table 2 provides an example of the normal variation that can be expected in several commodity feeds frequently used by dairy producers. For example, the average percent crude protein in corn gluten feed is 23.3 percent (DM basis); however, the standard deviation is 1.4 percent CP. This means that the percent crude protein in different loads of corn gluten feed could usually be expected to fall between 21.9 and 24.7 percent. Similar variations occur in other nutrients. This variation is due to differences in raw materials and processing methods used by manufacturers. Producers do not always have the luxury of purchasing a commodity feed from the same source each time, so they should ask the broker for information about the typical nutrient analysis.

Like other feeds, commodity feeds should be sampled on a regular basis and analyzed by a certified laboratory. Actual nutrient concentrations should always be used to formulate rations rather than average book values. Book values do not always reflect the actual nutrient content and may cause an excess or deficiency of a nutrient needed for supporting milk production or growth. A record of the nutrient analysis should be maintained so the variation associated with the commodity feed can be determined. Table 3 provides the typical nutrient concentrations for many of the commodity feeds used by dairy producers.

Risk and Additional Responsibilities

Several risks and additional responsibilities are associated with commodity feeding programs which dairy producers should be aware of. As discussed previously, additional

time is required for checking prices, managing commodity feed supplies and feeding (if the current feeding system is not set up for using commodity feeds). If a producer does not have sufficient time to devote to these tasks, then it may not be desirable to add commodities into the program.

A large amount of money will be invested in inventory, which may interfere with cash flow. The extent of investment depends on the number of commodities used in the feeding program and the time required to completely feed a load of each commodity.

The producer assumes more responsibility for balancing rations to support the desired level of milk production as commodity feeds comprise a greater proportion of the ration. Mistakes can reduce milk production and can, in certain situations, endanger the animal's health.

The producer also assumes the responsibility for quality control that feed companies normally provide, including screening for any contaminants or poor quality feeds.Commodity feeds can be contaminated by a number of products. For example, aflatoxin and other mycotoxins are a potential risk in certain commodity feedstuffs, such as peanut meal and cottonseed. Cotton products may contain gossypol that can be toxic if too much is fed. Residues from herbicides, pesticides, etc. must be avoided due to the potential animal health problems and contamination of milk. Fortunately, most commodity feeds from the production of human foods have already been checked for these residues.

Table 2. Typical nutrient variation on commodity feeds (Dry matter basis).

		CGF[1]		DDG		SH	
	UNITS	AVG	SD[2]	AVG	SD	AVG	SD
CP[3]	%	23.3	1.4	30.6	1.4	11.8	.2
ADIN	% of CP	9.0	.5	26.5	.8	7.4	.1
ADF	%	13.4	.7	15.3	1.0	52.8	1.2
NDF	%	51.9	2.3	33.0	1.5	72.5	.8
EE	%	6.6	1.9	7.4	.9	.8	.3
Ca	%	.09	.03	.01	.01	.65	.03
P	%	.89	.15	.69	.02	.08	.00
Mg	%	.45	.06	.25	.01	.26	.00
K	%	1.23	.18	.94	.07	.61	.05

[1]CGF = corn gluten feed; DDG = distillers dried grains; and SH = soybean hulls.

[2]SD = standard variation: A measure of the variation associated with the average concentration of each nutrient.

[2]CP = crude protein; ADIN = acid detergent insoluble protein; ADF = acid detergent fiber; NDF = neutral detergent fiber; EE = ether extract; Ca = calcium; P = phosphorus; Mg = magnesium; and K = potassium.

Source: Belyea et al. 1989. J. Dairy Sci. 72:23.

Table 3. Average nutrient concentrations of commodity feeds.

	DM	CP	UIP	EE	ADF	NDF	NE_l	Ash	NFC	Ca	P	Mg	K	Na
	%	%	%CP	%	%	%	Mcal/lb /lb	%	%	%	%	%	%	%
	DM Basis													
Oilseed														
Cottonseed, fuzzy	92	23.0	43	20.0	34	44	1.01	4.8	8.2	.21	.64	.46	1.00	.01
Cottonseed, delinted	90	25.0	43	23.8	26	37	1.01	4.5	9.7	.21	.64	.46	1.00	.01
Soybeans, raw	92	42.8	27	18.8	10	34	.96	5.5	.9	.27	.65	.29	1.82	.02
Soybeans, roasted	90	42.2	66	20.0	11	35	.99	5.5	.9	.28	.66	.23	1.89	.03
Energy Supplements														
Bakery waste	92	10.7	—	12.7	13	18	.94	4.4	54.2	.14	.26	.26	.53	1.24
Beet pulp	91	9.7	45	.6	33	54	.81	4.4	31.3	.69	.10	.27	.20	.21
Citrus pulp	91	6.7	20	3.7	22	23	.80	6.6	60.0	1.84	.12	.17	.79	.09
Hominy feed	90	11.5	65	7.7	13	55	.91	3.1	22.7	.05	.57	.26	.65	.09
Molasses	94	10.3	—	.9	—	—	.73	13.3	—	1.10	.15	.47	3.60	.20
Peanut skins	94	17.4	—	25.5	16	32	.67	3.0	22.1	.19	.20	—	—	—
Rice bran	91	14.1	—	15.1	18	33	.73	12.8	—	.08	1.70	1.04	1.92	.04
Soybean hulls	91	12.1	20	2.1	50	67	.80	5.1	13.7	.49	.21	—	1.27	.01
Tallow	99	0.0	—	99.5	—	—	2.65	.5	0.0	—	—	—	—	—
Wheat bran	89	16.6	21	4.4	15	51	.73	7.2	20.6	.16	1.31	.62	1.35	.07
Wheat middlings	89	18.4	21	4.9	10	37	.71	5.2	34.5	.13	.99	.40	1.13	.19
Medium-Protein Supplements														
Brewers Grains	92	25.4	49	6.5	24	46	.68	4.8	17.3	.33	.55	.16	.09	.23
Corn gluten feed	90	25.6	26	2.4	12	45	.87	7.5	19.5	.36	.82	.36	.64	.15
Distillers grains	94	23.0	54	9.8	17	43	.90	2.4	47.8	.11	.43	.07	.18	.10
Distillers grains w/solubles	92	25.0	47	10.3	18	44	.93	4.8	15.9	.15	.71	.08	.44	.57
High-Protein Supplements														
Blood meal	92	87.2	82	1.4	—	—	.68	5.8	—	.32	.26	.24	.10	.35
Corn gluten meal	90	67.2	55	2.4	5	14	.94	1.8	14.6	.16	.50	.06	.03	.10
Cottonseed meal	91	45.6	41	1.3	19	26	.79	7.0	20.1	.22	1.21	.55	1.39	.04
Feather meal	93	91.3	71	3.2	—	—	.73	3.8	—	.20	.70	.20	.30	.70
Fish meal	92	66.7	60	10.5	—	—	.76		—	5.65	3.16	.16	.76	.43
Meat and bone meal	93	54.1	49	10.4	—	—	.74		—	9.89	5.05	1.22	1.51	.78
Peanut meal	92	52.3	25	1.4	6	14	.80	6.3	74.0	.20	.61	.31	1.25	.23
Soybean meal, 48%	90	55.1	35	1.0	6	8	.91	6.5	29.4	.29	.70	.32	2.30	.03
Forage Extenders														
Cottonseed hulls	91	4.1	—	1.7	73	90	.45	2.8	1.4	.15	.09	.14	.87	.02
Peanut hulls	91	7.8	—	2.0	65	74	.19	4.2	12.0	.26	.07	.17	.95	.13
Rice hulls	92	3.3	—	.8	72	82	.08	20.6	0.0	.10	.08	.83	.08	.12

Source: National Research Council. 1989. Natl. Acad. Aci., Washington, DC.

Commodity Blends

Some dairy producers work with a feed company to have several commodities blended together using a fixed formula. This alternative to traditional commodity programs has several advantages for many dairy producers. The amount of inventory and capital invested in inventory is reduced. Less time is required for purchasing and mixing. This also reduces the amount of storage space required. Since a load of the blended commodity will be fed in a short period of time, feed is not as likely to become stale. Also, storage and shrinkage losses are reduced.

This approach works well for producers whose operations are not large enough to use large quantities of commodity feeds in a short time. Several commercial feed companies are providing this service, as well as individuals who specialize in this market. These companies shop around for the best buys on commodities and also have a quality control program. The producer is still responsible for balancing the rations, since the blends are made to the producer's specifications. Another advantage this approach has over traditional programs is that these companies can also purchase mineral-vitamin premixes in larger quantities and keep a fresher inventory than most individual dairy producers can.

Limits on Amounts Used

Questions often arise as to how much of a commodity feed should be included in a ration. Table 4 outlines some suggested limits for commodity feeds in dairy rations. There are several reasons for limiting the amount of a particular commodity feed in dairy rations. These include cost, palatability, moisture content of the total diet, protein balance, carbohydrate balance, fiber levels and fat concentrations.

Commodity feeds such as soybean meal, cottonseed meal and corn gluten meal are normally included in amounts needed to meet the protein requirements. Feeding more only increases feed cost without any benefit in production. Excessive amounts of degradable protein in rations may not maintain production levels in high-producing cows during early lactation. Commodity feeds such as blood meal, feather meal and meat and bone meal should be restricted due to poor palatability.

Similarly, the need for a balance of carbohydrates may limit the amount of high-fiber commodity feeds such as corn gluten feed, soybean hulls or wheat middlings. Fiber levels normally determine the upper limit of high-fiber feeds such as cottonseed hulls, peanut hulls or rice hulls. Rice hulls also have high concentrations of silicon, which will damage the digestive tract of the cow. Commodity feeds such as distillers grains, hominy feed and meat and bone meal have high concentrations of fat that could interfere with normal fiber digestion if excessive amounts are included in the diet.

Moisture levels in the total diet should not exceed 50 percent under normal circumstances. This limits the amount of wet commodity feeds such as brewers grains, corn gluten feed and distillers grains. This is especially true when large amounts of silages are fed.

Table 4. Suggested upper limits for commodity feeds in dairy rations.

	Maximum % of DM	Maximum lb DM per day[1]
Oilseed		
Cottonseed, fuzzy	10 - 15	4.5 - 6.7
Cottonseed, delinted	10 - 15	4.5 - 6.7
Soybeans, raw	10	4.5
Soybeans, roasted	10 - 15	4.5 - 6.7
Energy Supplements		
Bakery waste	8 - 10	3.6 - 4.5
Beet pulp	20 - 30	9 - 13.5
Citrus pulp	20 - 40	9 - 18
Hominy feed	20 - 35	9 - 15.7
Molasses	3 - 5	1.3 - 2.2
Rice bran	10 - 15	4.5 - 6.7
Soybean hulls	15 - 25	6.7 - 11.2
Tallow	2 - 3	.9 - 1.3
Wheat bran	15 - 25	6.7 - 11.2
Wheat middlings	15 - 25	6.7 - 11.2
Medium-Protein Supplements		
Brewers grains	15 - 25	6.7 - 11.2
Corn gluten feed	20 - 40	9 - 18
Distillers grains	15 - 40	6.7 - 18
High-Protein Supplements		
Blood meal	3 - 4	1.3 - 1.8
Corn gluten meal	No Limit	No Limit
Cottonseed meal	No Limit	No Limit
Feather meal	3 - 4	1.3 - 1.8
Fish meal	3 - 4	1.3 - 1.8
Linseed meal	No Limit	No Limit
Meat and bone meal	3 - 8	1.3 - 3.6
Peanut meal	No Limit	No Limit
Soybean meal	No Limit	No Limit
Forage Extenders		
Cottonseed hulls	30 - 35	13.5 - 15.7
Peanut hulls	12 - 15	5.4 - 6.7
Rice hulls	10 - 15	4.5 - 6.7

[1]Amounts are based on an intake of 45 lb. dry matter per day and should be adjusted for actual dry matter content.

Whole Oilseed

Whole oilseed such as cottonseed and soybeans are good sources of energy, protein and fiber. They are typically included in the ration to increase the energy density of the diet, while maintaining acceptable fiber levels. These feeds contain approximately 20 percent ether extract (EE) or fat and should be limited based on the fat content of the ration. These feeds can be used to provide an additional 2 to 3 percent fat above that provided by the basal ingredients in the ration, with no more than 5 to 6 percent total fat in the DM. Amounts greater than this may interfere with fiber digestion and normal rumen function. If additional fat is needed, it should be provided by a ruminally inert or protected fat source.

Whole cottonseed may contain gossypol; therefore, no more than 10 pounds of cottonseed products (cottonseed meal plus whole cottonseed) should be included in rations for dairy cows. Cottonseed products should not be fed to very young calves as the rumen may not be functional and cannot detoxify gossypol in the diet. Soybeans may be fed raw or roasted and can be cracked. Roasting increases the amount of protein escaping rumen degradation. Roasted soybeans are especially effective when rations based on haylage are fed to high-producing cows during early lactation. Raw soybeans should not be included in rations containing urea as they contain an enzyme, urease, that breaks urea into ammonia. This decreases the palatability of the ration. Oilseed should not be ground, since this releases the oil directly into the rumen and may interfere with digestion.

Energy Supplements

Several commodity feeds can be substituted for grain to provide energy. Examples include bakery waste, hominy feed, molasses, rice bran, soybean hulls and wheat middlings. Some of these feeds have high concentrations of digestible fiber that the rumen microbes use for energy rather than starch. Other commodity feeds contain high concentrations of sugars, processed carbohydrates or fats. The amount included in the ration should be based on carbohydrate balance and fat concentrations. Saturated fats, such as tallow, are more suitable for dairy cows than unsaturated fats, such as vegetable oil.

High-fiber commodity feeds are useful in maintaining a balance of carbohydrate sources. One measure many nutritionists use to describe the form of carbohydrate in a diet is non-fibrous carbohydrates (NFC). The NFC fraction represents the starch, sugar and other soluble carbohydrates present in the feed. Corn contains approximately 75 percent NFC, much of which is starch. Rations should be formulated to contain 32 to 40 percent NFC since higher levels may cause a depression in milk fat percent and other metabolic problems such as laminitis that are associated with high starch intake.

Soybean hulls are generally restricted to less than 25 percent of the ration DM due to their fast passage rate through the small intestine. Beet pulp and citrus pulp are restricted more commonly due to total fiber levels and the need for minimal levels of NFC. Hominy feed also contains significant amounts of fat, which limits its use. Rice bran, wheat bran and wheat middlings are normally limited in rations due to poor palatability. Peanut skins contain tannin which may decrease protein digestibility.

Bakery waste is normally limited to no more than 10 to 15 percent of the ration DM

due to the high concentrations of fat. The amount of oilseed must be reduced in rations containing fat from these sources to keep fat concentrations from exceeding 5 to 6 percent of the total ration DM. Molasses is generally restricted to no more than 5 percent of the ration DM due to the possibility of digestive upsets which can occur with excessive amounts.

Tallow is considered to be more rumen-inert and may be used as a source of fat when the proper handling facilities are available. Blends of animal and vegetable fat should be limited to no more than 2 to 3 percent of the total ration DM. Vegetable oils contain high concentrations of unsaturated fatty acids that reduce fiber digestion in the rumen.

Medium Protein Supplements

The medium protein supplements contain moderate concentrations of protein and energy and include brewer's grains, corn gluten feed and distillers grains. These feeds are commonly available in wet or dry form. When using the dry form of these commodity feeds, greater amounts may be fed than the wet form due to total moisture content of the ration. Moisture in the total ration should not exceed 50 percent. This frequently limits the amount of wet commodity feeds that can be fed. Dry matter intake and milk production have been reported to decrease when the moisture level exceeds 50 percent, especially when large amounts of fermented feeds are used. However, recent research suggests that greater amounts of wet commodity feeds can be fed during the summer, even though the moisture level of the diet may exceed 50 percent. Wet commodity feeds should be used quickly and stored in a manner which reduces spoilage, especially during the summer. These feeds can also be used to extend or replace a portion of the forage. This is acceptable as long as fiber levels are maintained and the amount of UIP and NFC in the diet is balanced.

High-protein Supplements

The high-protein commodity feeds contain greater amounts of protein and lesser amounts of energy. Blood meal, feather meal, fish meal and meat and bone meal are not very palatable. These protein supplements have higher concentrations of undegradable protein which makes them useful during early lactation and for high-producing dairy cows. Other protein supplements are not limited in the ration except for meeting the protein requirements, since any excess increases ration cost. Due to the potential for toxicity, the amount of cottonseed meal may be restricted or not even used for very young ruminants if it contains gossypol. Peanut meal should be checked for aflatoxin as well, due to the potential for toxicity.

Forage Extenders

Several commodity feeds can be used to provide bulk in the ration when forage is limited. These commodity feeds provide very limited amounts of protein and energy. Cottonseed hulls have been used most commonly and have worked very well in built-in-

roughage type rations. Peanut hulls should be checked for aflatoxin prior to using them in rations. Rice hulls should be limited, due to the high amount of silicon they contain. Silicon is abrasive to the animal's intestinal tract if used in significant quantities.

Other Commodity Feeds

Several other "odd" commodity feeds are occasionally used by dairy producers. Some examples include: candy, cocoa byproduct, fruit pomace, fresh vegetables and vegetable residues. Before using these feeds, the producer (or nutritionist) must know the nutrient composition of these products to determine what limitations should be imposed. For example, most candies are predominantly sugar and should be treated like molasses. Some products may contain compounds that can make cows sick or kill them if overfed. For example, cocoa byproduct contain theobromine which is toxic when too much is fed, although small amounts (<2 percent of DM) may be acceptable. Additionally, some of these feeds may not be available for extended periods of time. When this is the case, the producers must decide if it is worth the trouble of changing their feeding program.

Summary

Commodity feeds can be used to provide economical sources of nutrients for dairy cows. Commodity feeds should be sampled and analyzed frequently to determine their nutrient content. Rations should be balanced using the actual nutrient concentrations of the commodity feeds, rather than table values, to assure that desired nutrient concentrations are provided. The amount of a commodity feed included in a ration should not exceed the recommended guidelines under most conditions. If the limits are exceeded, the producer must examine the nutrient profile of the ration carefully to insure that desired production levels can be achieved and animal health will be maintained. The moisture level of wet commodities and of the total ration should be monitored to insure that proper amounts of the commodity are added to the ration and that intake is maintained. Producers should store commodity feeds properly to reduce shrinkage and prevent molding and spoilage. Additional time and management are required if commodities are to be used; however, the benefits are generally considered worthwhile to most producers.

References

Belyea, R. L., B. J. Steevens, and A. P. Clupp. 1989. Variation in composition of byproduct feeds. J. Dairy Sci. 72:23.

National Research Council. 1989. Nutrient Requirements of Dairy Cattle. 6th rev. ed. Natl. Acad. Aci., Washington, DC.

For Additional Information on Specific Commodity Feeds, Refer to the Following Publications

Corn Gluten Feed, Dairy Info No. 43
Whole Cottonseed, Dairy Info No. 44
Brewers Grain, Dairy Info No. 45
Distillers Grains, Dairy Info No. 46
Whole Soybeans, Dairy Info No. 47
Wheat Middlings, Dairy Info No. 48
Soybean Hulls, Dairy Info No. 49
Hominy Feed, Dairy Info No. 50

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