

## BY-PRODUCTS USED FOR FEEDING DAIRY CATTLE

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By-products that result from the processing of food for humans have been used for many years to feed cattle. Dairy cattle rations may be formulated from by-products and roughage feedstuffs that cannot be used for human consumption. There are a variety of materials used: wheat bran, corn gluten feed, soybean meal, cottonseed meal, peanut meal, citrus pulp, beet pulp, brewers grains, molasses, hominy feed, feather meal, blood meal, meat and bone meal, fish meal, fats, corn cobs, soybean hulls, peanut skins, sunflower meal, rice bran, cottonseed hulls and many others.

This bulletin discusses many of the by-products that may be used to formulate rations for dairy cattle. It includes their feeding values and restrictions in the diet. A nutrient composition table for many byproducts available in Georgia appears on page 11.

### **OIL SEED MEALS**

Cottonseed, peanut, soybean, sunflower and canola meals are high protein supplements and are generally available statewide. Peanut, canola and sunflower meal may not be readily available throughout the state, but may be obtained. Generally, soybean meal is the preferred source of natural protein. For lactating dairy cows, cottonseed, peanut and low crude fiber sunflower meal may be used to replace soybean meal. Sunflower meal that is high in crude fiber should be restricted to 20 to 25 percent of the grain mixture because of palatability. Canola meal is similar to sunflower meal in that it is high in crude fiber, which lowers the TDN value. Thus, the energy value relative to soybean meal is lower. Use caution when you feed cottonseed meal to high producing cows, especially when whole cottonseed is included in the ration. Recent research indicates that during hot weather, and at high levels of cottonseed meal feeding the gossypol detoxification mechanism of the rumen may become overloaded. This condition allows gossypol to escape breakdown in the rumen and enter the blood stream to create gossypol toxicity and possible sudden death. Therefore, for high producing cows, restrict cottonseed meal to 35 to 40 percent of the grain mix or a maximum of 10 pounds per cow per day. If whole cottonseed is being fed, this should be added to the cottonseed meal weight to determine that not more than 10 pounds per cow per day are being consumed. All of these high protein supplements are excellent sources of energy. They may be used for energy when consumed in excess of the protein requirements.

### **WHOLE SOYBEANS AND COTTONSEED**

Both whole soybeans and cottonseed may be used in dairy rations. Restrict both to five to seven pounds per cow per day. They are excellent sources of energy and protein. Soybeans are approximately 38 percent crude protein, and cottonseed approximately 20 percent crude protein. Soybeans should be ground or cracked prior to feeding. Roasted soybeans also serve as a good source of rumen undegradable protein, but care should be exercised so that soybeans have not been overheated, thus rendering the protein unavailable to the cow. Excellent results have been obtained by feeding whole cottonseed without grinding or cracking. Do not grind or crack more than a three-day supply of soybeans or cottonseed during hot weather. The oil will become rancid if exposed to air too long. Whole cottonseed must be stored so that it does not pick up moisture during storage. Cottonseed must be maintained at less than 13 percent moisture to prevent mold growth. Whole cottonseed stored at moisture contents above 13 percent may grow *Aspergillus Flavus*, which is the mold that produces aflatoxin. Samples of moldy cottonseed have been found to contain 1000 to 3000 ppb of aflatoxin. Aflatoxin is extremely toxic to cattle.

### **HIGH FIBER BY-PRODUCTS**

**SOYBEAN HULLS** are an excellent source of energy and digestible crude fiber. The high digestibility of the fiber and the physical form of the hulls render soybean hulls of limited value as roughage. They may contain 11 to 15 percent crude protein and are a good source of magnesium.

**SUNFLOWER HULLS** are not readily available in Georgia. They are low in crude protein (3.5 percent) and TDN (62 percent) and high in crude fiber (50 percent). Hulls derived from oilseed processing are higher in protein and fat than those obtained from confectionery varieties. Sunflower hulls may be fed up to 30 percent of the total ration and are considered a good roughage replacer. Use caution when sunflower hulls are used at levels above 30 percent because of possible impaction or constipation. Don't feed sunflower hulls as the only source of roughage. Some long hay, silage or green chop should be included to prevent cows from going off feed.

**COTTONSEED HULLS** are a poor source of protein and energy but may be used as a roughage replacer on a pound per pound basis. Research indicates that if no hay, silage or pasture is used, 15 to 18 pounds of cottonseed hulls must be fed to prevent rumen acidosis. Even at this level, the milk fat test may become depressed.

**PEANUT AND RICE HULLS** are worth even less than cottonseed hulls. They both are extremely low in energy and protein. Peanut and rice hulls are not good sources of roughage. They should not be used in lactating dairy cow rations unless no other source of roughage is available. Ground peanut hulls and rice hulls should be avoided.

**CORN COBS** are not generally available in Georgia; still, they may be used as a roughage replacer for hay and silage. They are low in crude protein and should probably be considered as zero crude protein. When replacing hay or silage, use the cobs on a pound per pound dry matter basis as a source of roughage. If they are to be the only source of roughage, a minimum of 15 pounds per cow or 30 percent of the total ration should be fed. They are about equal to cottonseed hulls on an energy basis.

**DRIED CITRUS PULP**, a by-product of the citrus processing industry, is frequently fed in dairy cattle rations. It consists of the peeling, pulp and culled whole fruit. It contains approximately 6.0 percent crude protein, 11 percent crude fiber and 70-75 percent TDN. It generally is restricted to 10 to 15 percent of the grain mix but may make up to 25 percent without serious palatability problems. Cows like it and it is consumed readily. However, when it is first introduced cows may not readily eat the new ration. Citrus pulp is a good source of digestible crude fiber. It is a good feed to use when energy and fiber are needed. Close attention should be paid to the calcium and phosphorus content of the total ration when citrus pulp is used because it contains approximately two percent calcium.

**MILLING BY-PRODUCTS** There are numerous milling by-products. Some of these are wheat bran, wheat mids, dried bakery products, hominy feed, corn gluten feed, corn gluten meal and rice bran.

**WHEAT BRAN** consists primarily of the seed coat and is used to provide bulk and a laxative effect. Restrict wheat bran to a maximum of 20 percent of the grain mix.

**WHEAT MIDS** consist of the fine particles of bran and germ and are a good source of energy and crude protein. Wheat mids should be restricted to 10 to 15 percent of the grain mix. They contain a lot of flour and become very gummy when eaten.

**WHEAT GRAIN**, though not a by-product, should be coarse ground or cracked. Since wheat grain becomes gummy when it's eaten, fine grinding should be avoided. It is approximately 12 percent crude protein and similar to corn in energy. Rations should be restricted to 400 to 500 pounds of wheat per ton. Wheat should be added gradually to diets because of its high density and peculiar fermentation that produces primarily lactic acid.

**DRIED BAKERY PRODUCTS** consists of stale bakery products and may be available in large amounts in many areas. Bakery products may be used to replace corn; but due to the high salt content, they should be restricted to 400 to 600 pounds per ton of grain mix. These products vary greatly in salt and fat content and often the fat source (animal or vegetable) is unknown.

**HOMINY FEED** is a corn by-product that results from the manufacture of grits, hominy and corn meal for human consumption. It is an excellent feed and may be used to replace corn in the ration pound for pound.

**RICE BRAN** is composed of the seed coat and germ, which are removed from rice during processing polished rice for human consumption. It may be used like wheat bran but only up to 15 percent of the grain mix.

**CORN GLUTEN FEED** consists of corn gluten and corn bran, with or without corn solubles. It is a good source of protein (approximately 25 percent). When and where cost is not prohibitive, corn gluten feed may be used in the grain mix without restriction.

**CORN GLUTEN MEAL** consists mainly of the corn gluten separated in the wet-milling process of starch manufacture. It is a heavy, concentrated feed and may or may not contain corn solubles. It is an excellent source of protein and energy for dairy cattle when properly balanced with other feeds.

**RICE BY-PRODUCTS** or "rice mill feed" include hulls, rice bran, rice polish and broken grains. They should contain approximately 60 percent rice hulls, and as the nutrient composition table indicates, are poor feed for dairy cattle. If rice by-products are used, restrict them to 10 percent of the grain mix.

**PEANUT SKINS** consist of skins from processed peanuts, broken nuts and nuts that may have been cooked and rejected for some reason at a plant that processes peanuts for human consumption. They may contain salt, some oil and possibly other material. They generally run about 16 to 18 percent crude protein and are a good source of energy. The protein should be discounted about 25 to 50 percent and other dietary protein may be bound up with the tannins present in the skins. Because of the nature of the products, skins should be limited to 10 to 15 percent of the mixed feed for dairy cows.

**BREWERS AND DISTILLERS BY-PRODUCTS** Because of the increase in consumption of beer and the construction of alcohol plants to produce fuel, there has been a rapid increase in the availability of wet brewers and distillers grains and products. Exercise caution when purchasing and feeding these products. Due to the variable water content, you may be purchasing a lot of water at a high price. Also, dry matter intake may be restricted because of too much water in the ration when wet by-products are fed in rations with silage. Unless feeding procedures are such that the wet grains may be effectively restricted to safe amounts, cows may not consume sufficient roughage. This situation creates low rumen pH and subsequent chronic or acute rumen acidosis. Restrict wet grains to 20 to 25 percent of the total grain dry matter intake or approximately 30 pounds of the wet material. Generally, brewer's grains will be a fairly consistent product because of the high standards required in the brewing of beer. Brewer's grains, either wet or dry, are a good source of protein and an average source of energy. Generally, calcium, phosphorus and potassium are low. Dried brewers grains are considered to be a good source of by-pass protein due to the heating effect on the protein during the drying process. Brewer's grains should be restricted to 20 to 25 percent of the grain mix. Distiller's grains (dried) usually are uniform in quality, due to the high standards imposed by the Distillers Industry for making whiskey. However, distiller's grains from ethanol (fuel alcohol) plants are not produced under the same strict standards as those produced in beverage alcohol plants and are subject to greater variability. Distiller's grains which have been subjected to excessive heating may have protein damage. There are two products: distillers dried grains and distillers dried grains with solubles. The grain source is usually corn or milo but may be rye, wheat or other grains. Distillers dried grains and grains with solubles consist of the residue after fermentation and contain six to 12 percent yeast cells and four to eight percent lactic acid. Either of

these products should be restricted to 25 to 30 percent of the grain mix. Note: These are grain products and not roughages. Wet distiller's products coming from locally operated alcohol plants may be extremely variable in water content as well as nutrient composition on a dry matter basis. Some may be less than 20 percent crude protein on a dry matter basis and others may be as high as 30 percent crude protein on a dry matter basis. Be sure to check with the distributor so that you may use the product correctly in the ration. Wet brewer's grains and wet distiller's by-products, because they are wet, must be fed rapidly, especially during hot weather. Generally, these products must be fed within three to four days during hot weather and will only keep five to seven days during winter. Take special care in storage and feeding of wet brewers and distillers by-products, or 20 to 30 percent of the material may be lost due to spoilage. Placing the wet material on a concrete slab, and covering with salt (20 pounds per ton) and plastic will delay spoilage. Again, feeding should be restricted to 25 to 30 pounds per cow per day. These are not roughage replacers and care should be taken to assure that cows get 15 pounds of roughage or roughage equivalent each day.

### **ANIMAL BY-PRODUCTS**

**HYDROLYZED POULTRY FEATHER MEAL** is a product that is not used extensively in dairy rations because of odor and palatability. Also, in spite of the fact that it is over 85 percent protein, the utilizable protein is thought to be approximately 10 percent lower. Feather meal protein is about 70 percent rumen undegradable, but has a poor balance of amino acids. It is a good sulfur source, however. It should be restricted for use in total mixed rations and to a maximum of 10 percent of the grain mix.

**BLOOD MEAL** is coagulated packing house blood which has been dried and ground into a meal. It is high in crude protein (80 percent#) and is a high quality amino acid source. However, method of processing can affect product quality. Blood meal can cause palatability problems and animals should be adapted to blood meal gradually. Blood meal has a high rumen undegradable (rumen bypass) protein content (80 percent+). Blood meal should be limited to one to two pounds per cow per day.

**MEAT AND BONE MEAL** is the rendered product from animal tissues, including bone, which contains approximately 54 percent crude protein, of which about 50 percent is rumen undegradable. Because it contains bone, calcium and phosphorus content is high. Since chemical content of meat and bone meal can vary widely over time, caution should be used when formulating rations. Meat and bone meal should be limited to one to two pounds per cow per day.

**FISH MEAL** contains over 60 percent crude protein which is about 65 percent rumen undegradable. Fish meal has an excellent amino acid profile. However, considerable variability in rumen degradability may occur due to differing processing methods. Fish meal is high in both calcium and phosphorus. Because of smell and taste, acceptance of fish meal may be a problem, so cows should be adapted slowly. Limit to two pounds per cow daily.

**TALLOW** is 100 percent fat and supplies no nutrients beyond energy to the ration. Tallow has a very high energy density (177 percent TDN). When fat in the diet comes from natural sources that are not rumen protected (oilseeds, tallow), total fat should not exceed five to six percent of the total ration.

**RUMINALLY INERT FATS** are now available to dairymen. Because they are insoluble or undegraded in the rumen, they have little effect on rumen microorganisms, allowing dietary fat to exceed five to six percent of the diet if necessary to meet production requirements. Methods to make these specialty fats ruminally inert include hydrogenation of unsaturated fatty acids, encapsulating the fat in a matrix to protect it in the rumen, and chemically binding palm oil (vegetable fat) with calcium to form a rumen insoluble complex. These fats are energy dense and are fed up to one pound per cow daily. Because of their cost, they are usually used when dietary fat supplementation has reached the maximum level and additional energy is needed. A rule of thumb is for one third of dietary fat to come from natural diet sources, one third from rumen available sources (oilseeds, tallow) and one third from ruminally inert

sources.

**PROCESSED POULTRY LIVER** is available in some areas and may be used in rations for heifers and dry cows. Poultry litter is generally a good source of protein, but energy content is often low. Like some of the wet distiller's by-products, there may be considerable variation in nutrient composition. Be sure of your source and your supplier. Poultry litter is not recommended for lactating dairy cow rations. Restrict poultry litter in heifer and dry cow rations to 25 to 30 percent of the dry matter. It may contain 20 to 25 percent crude protein and 45 to 50 percent TDN. Be careful when using any poultry waste. It may contain antibiotics or other materials that may be harmful to cattle, or it may cause their milk or meat to be condemned due to chemical residues. Also, use caution to prevent the spread of disease.

**SCREENED MANURE SOLIDS AND CATTLE MANURE** may be used as sources of fiber and roughage in rations for heifers and steers. The nutritive value of the screened solids is considerably less than unwashed manure. Since manure and screened manure solids have not been approved for feeding to lactating dairy cattle in Georgia, the use of these materials should be restricted to replacement heifers. Satisfactory gains may be obtained when screened manure solids and/or manure is fed at levels not to exceed 30 percent of the ration dry matter. The screened manure solids are low in protein (seven percent) and high in crude fiber (41 percent). In order to achieve satisfactory intake, feed containing manure and screened manure solids must be mixed daily. Also, as with dried poultry waste, it may take one to two weeks for cattle to become accustomed to the odor and reach their peak in dry matter intake.

## **CONCLUSION**

Dairy cattle can effectively utilize many feedstuffs that are by-products of processing procedures used in the manufacture of food for humans. Many of these by-products have excellent nutritive value. Some do not. The dairy producer or feed formulator must always exercise caution when formulating rations. Essential nutrients must be available in adequate amounts to provide for growth, maintenance and the level of production desired. Certain by-products must be restricted due to palatability or because they are too low or deficient in a nutrient to allow usage at a higher rate.

Price and availability of the material should be high on the list of priorities to determine if a feed ingredient is used. Also, ease of handling, storing and feeding should be considered. By all means don't think you have to use an ingredient in your ration just because your neighbor does. Only use ingredients that are competitive in price and that provide essential nutrients needed in the diets you are formulating.

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