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Don Boggs
South Dakota State University

Kim Cassel
South Dakota State University

Jeff Held
South Dakota State University

Bob Thaler
South Dakota State University

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Utilizing Soyhulls in Livestock and Dairy Rations

by Don Boggs, Extension beef specialist, Kim Cassel, Extension dairy specialist, Jeff Held, Extension sheep specialist, and Bob Thaler, Extension swine specialist

Soyhulls are a co-product of soybean processing. The soyhull is the seedcoat of the soybean (not the pod) and makes up approximately 8% of the soybean.

When the soybeans are rolled or flaked, the soyhull pops loose from the meat of the seed. The soyhulls are very lightweight and once loose can easily be removed from the seed by air. The soyhulls are ground and blended back with the soybean meal to produce 44% meal, or they can be used as a feedstuff in various types of livestock and dry rations.

Composition

The National Research Council (NRC] Nutrient Requirements of Beef Cattle (7th ED., 1996) lists the composition of soyhulls on a dry matter basis as follows:

Total Digestible Nutrients	77.0%
NE maintenance	.84 Mcal/Ib
NE gain	.55 Mcal/Ib
Crude Protein	12.2%

The complete separation of the hulls from the meat of the soybean during processing is unlikely. The NRC values reflect the expected average nutrient composition of soyhulls removed during processing. Differences in processing efficiency lead to variation in nutrient composition. Analyzing each load of soyhulls for crude protein is strongly recommended to allow for cost effective ration balancing.

Soyhulls are approximately 90% dry matter. Soybean processors provide a guaranteed analysis for the soyhulls they sell. For example, the guaranteed analysis (as-fed basis) at South Dakota Soybean Processors, Volga, S.D., is as follows:

Crude Protein, min.	9.0%
Crude Fat, min.	0.5%
Crude Fiber, max.	38.0%

The guaranteed analysis represents the minimums or maximums for the various components, and as explained previously, it may not represent the actual composition of the soyhull product needed for ration balancing. The level of crude fiber in soyhulls is similar to that found in low-quality grass hay. However, since soyhulls contain very little lignin, the fiber in soyhulls is highly digestible compared to the fiber in most forages. Due to the unique characteristics of the fiber, the energy value for soyhulls is similar to feed grains when properly added to livestock and dairy rations.

Both pelleted and unpelleted soyhulls can be used in livestock and dairy rations. Pelleted soyhulls have a higher bulk density and are easier to store and transport. The pellets also are less susceptible to wind losses during transportation and feeding. The unpelleted hulls are typically 2 to 3% higher in dry matter and cheaper to purchase. Thus each producer will need to decide which physical form works best for their storage, feeding, and management conditions.

Soyhulls for Beef Cattle

Soyhulls are most effective as an energy supplement in forage based rations. Soyhulls are low in starch and thus do not create the negative associative effects in the rumen that often are created when low-quality forages are supplemented with feed grains. Because of the high ingestibility of the fiber in the soyhulls and the avoidance of any negative associative effects on the digestion of the forages, the net effect of supplementing low- to moderate quality forage rations with soyhulls is a total energy intake similar to supplementing with an equal amount of corn.

Numerous research studies have consistently shown that soyhulls can replace corn on a one-to-one basis in forage based growing diets for feeder cattle and replacement heifers. Nebraska researchers (NE Beef Cattle Rep., 1982) supplemented a stalklage, brome hay, and corn cob forage with either corn or soyhulls at 12.5, 25, or 50% of the ration. No significant differences were detected between the corn or soyhull supplements at any of the supplement levels. The soyhull-supplemented cattle did tend to have higher intake and slightly lower feed conversions (3-8%).

Soyhulls also have been used successfully as a supplement for calves grazing either cornstalks or grass pastures. Pasture supplementation with soyhulls appears most beneficial later in the grazing period when the grasses are coarser and quality has declined.

Finely ground soyhulls pass through the rumen quite rapidly. Adding soyhulls to rations that have a high rate of passage (i.e. high concentrate diets) reduces the time the soyhulls are in the rumen and thus reduces the energy derived from them. Therefore, using soyhulls either as the roughage or in place of corn in a finishing ration is not recommended since the soyhulls do not have good “roughage” properties and the rapid rate of passage significantly reduces their energy yield.

Soyhulls also make an excellent supplement for either gestating or lactating beef cows that need additional energy. Here again, soyhulls can be substituted for corn on a one-to-one basis when supplementing low- or moderate quality grass hay. When crude protein is low or marginal, supplementing with highly digestible fiber energy sources, such as soyhulls, may yield more energy from the total ration than supplementing with corn or another feed grain.

When hay supplies are short or prices are high, soyhulls can be used as a substitute for part of the cow's hay or silage needs. The question becomes, "How much can be fed on a daily basis?" While there is not a lot of research to address this question, up to 15 lb/day of soyhulls have been successfully fed to beef cows receiving limited amounts of hay. As a minimum, at least 8 - 10 lb/day of low- to moderate-quality hay should be fed with higher quantities of soyhulls to ensure proper rumen function and to slow the passage of the soyhulls through the rumen. When fed in this manner, a pound of soyhulls can replace 1.4 pounds of moderate-quality hay or 1.6 pounds of Tow-quality hay. Soyhulls do have a laxative effect, so expect cows receiving higher levels to develop a loose stool.

Research regarding the use of soyhulls as a creep feed is limited. University of Georgia researchers have noted high intakes of 1.5 to 2.0% of bodyweight when soyhulls are offered free choice in a creep feeder. At these intakes, the passage rate of the soyhulls is quite high and the efficiency of utilization is quite low. Researchers at the University of Illinois found no differences in gain or efficiency between soyhulls and corn as creep feeds with intakes either limited (2.2 lb/day) or free choice. In this study, creep feed was provided during late summer and the intakes, as percentage of body weight, were only .54% and 1.17% for the limit-fed and free-choice creep feeds. Reported creep-feed to added-gain ratios were 4.821 for the limit-fed and 7.121 for the free-choice creep feeds. Limit-feeding the creep feed increased the efficiency of utilization by 50%.

If soyhulls are used as a creep feed, limit the intake to no more than 1% of the bodyweight. This will force the calf to eat more of the lower-quality pasture forages that should slow the rate of passage and improve utilization of the soyhulls. Using soyhulls as a creep feed on lush pastures probably would not be efficient.

Soyhulls for Sheep

Research utilizing soyhulls in sheep rations is limited. Based on the physical and nutrient characteristics, this co-product should be an excellent feed for sheep. As with beef cattle, it should be expected to substitute pound for pound with corn when used as an energy supplement.

Soyhulls can be used in many sheep feeding management situations, yet they are most commonly used in gestation and lactation diets for ewes. Palatability in ewe diets has been reported to be excellent.

Soyhulls are classified as an energy feed, yet they can be safely substituted for a portion of the forage due to the unique physical characteristics of the fiber. Level of substitution will depend on cost effectiveness. Pricing all feeds on a cost per pound of TDN basis will help identify whether it fits into the diet and whether it should substitute for forage and/or grain. A least-cost, ration-balancing program can accurately determine the most cost-effective level of soyhulls in a ration.

In practice, producers have used soyhulls to replace a portion of the forage in gestation and lactation diets for ewes when forage intake is limited. Replacing up to 50% of the forage dry matter with soyhulls is recommended. Since soyhulls contain approximately 30% more energy per pound than most grass or legume forages, one pound of soyhulls would replace 1.4 pounds of forage.

When forage is limit-fed in a gestation ration, replacing up to 50% of the forage dry matter with soyhulls likely requires no additional protein source. However, substituting soyhulls for high-protein forage during lactation will

likely require additional protein supplementation. Producers must decide whether replacing forage for soyhulls plus a protein supplement actually reduces costs.

Analyses have shown that soyhulls contain about 17 parts per million (ppm) copper, which is slightly higher than what is typically found in feeds (8-12 ppm). Copper toxicity is considered a risk for sheep when total ration copper levels are above 25 ppm. Using soyhulls in ewe ration management as described would increase the copper level in the ration by about 2 ppm.

Soyhulls for Dairy Cattle

The National Research Council (NRC) Nutrient Requirements of Dairy Cattle (6th Ed., 1989) lists the composition of soyhulls (dry-matter basis) as follows:

Neutral detergent fiber	67.0%
Acid detergent fiber	50.0%
Lignin	2.0%
Total digestible nutrients	77%
NE lactation	.80 Mcal/lb
Crude protein	12.1%
Ether extract	2.1%

As with beef cattle, soyhulls are an excellent source of energy and some protein for dairy cattle. The fiber is highly digestible, though hulls are not a source of effective fiber. As long as effective fiber is adequate in a ration, hulls can be an important source of both energy and fiber in rations for high-producing, early-lactation cows. In other words, fiber levels can be met or maintained without grossly compromising energy in the ration.

The lack of effective fiber from soyhulls is an important consideration when formulating dairy rations. Hulls may comprise up to 20-25% of the ration total dry matter or 8-9 lb/cow/day. However, consider the level of effective fiber provided. Adequate, effective fiber is essential for maintaining rumen health and production performance.

Raw or non-heat treated soyhulls can create problems in rations with urea due to urease activity. However, since most hulls are heat-treated and the urease activity is inhibited, this generally is not a concern.

Soyhulls for Swine

Since pigs are monogastrics and have a different digestive system than cows and sheep, they are unable to utilize the energy from the fiber in soyhulls. Therefore, soyhulls are considered to be high in fiber and low in energy content for swine and are not routinely used in swine diets.

However, field demonstrations have indicated a potential use for them in gestation diets. During gestation, sows are limit-fed to keep energy intake at the proper level for optimum reproductive performance; this sometimes causes sows to be more aggressive. By replacing some of the corn in the diet with soyhulls, the bulk-density is decreased, and sows can eat more feed without altering total energy intake. This extra feed intake results in more gut-fill and the animal approaches satiety. Field observations indicate calmer sows with no adverse effects on reproductive performance when soyhulls are added.

Before changing sow diets, work with a nutritionist to make sure the proper replacement rates are being made to ensure optimum performance.

Summary

Soyhulls can be used efficiently in many types of livestock and dairy rations. Their unique fiber characteristics make them an excellent energy source for ruminants when they are fed with low- to moderate-quality forages.

However, soyhulls are a poor source of roughage (effective fiber) when included in higher-energy rations. When fed according to recommendations, soyhulls generally can be comparatively priced on a pound-for-pound basis with corn.

Due to differences in processing efficiency, the actual composition of soyhulls can vary from the guaranteed analysis. Therefore, analyze each load of soyhulls to allow for least-cost ration balancing.

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