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Using Frost-damaged Soybeans in Livestock Rations

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Soybeans are routinely grown in the upper Midwest as a cash crop. However, late planting coupled with an early freeze can result in frost-damaged or “green beans.” Even after processing, the resulting soybean meal and soy oil are still green due to high chlorophyll concentrations. Since the consumer is reluctant to purchase green soy oil, frost-damaged soybeans (FDS) are of little use to the processing industry and often are docked at local elevators. However, when done properly, FDS can be marketed effectively through livestock.

Frost-damaged soybeans, green beans, and immature soybeans are all synonymous terms and will be denoted by FDS in the rest of this article. Raw refers to non-heat treated soybeans.

Using Frost-Damaged, Raw Soybeans in Beef Cattle and Sheep Diets

Soybean products are used in ruminant diets to provide supplemental protein. Most on-farm mixed and commercially prepared feeds in the Upper Midwest use soybean meal as the major supplemental protein source. Frost-damaged soybeans can be an economically attractive supplemental protein source for beef cattle and sheep.

Research conducted at SDSU using lambs showed that when raw FDS were used in a corn silage-based diet, nitrogen utilization and fiber digestibility were reduced compared to the same diet using soybean meal. Based on this study, when using raw FDS as the sole protein source in beef cattle and sheep diets,

limit its level to less than 14% of diet dry matter intake. At these levels, the negative effects on nutrient utilization will be minimized.

Compared to soybean meal, raw soybeans (mature or FDS) are lower in protein, 37-40% vs 49% (Table 1). Therefore, to have a similar dietary protein level, it is necessary to add 20 to 25 percent more whole raw soybeans than soybean meal. For raw or extruded soybeans to have an economic advantage over soybean meal, their cost/lb of protein must be equal to or lower than that of soybean meal.

Since the high oil content (18%) in raw FDS and mature soybeans causes a decrease in diet digestibility, animal growth performance would be expected to be slightly lower compared to diets using soybean meal as the main protein source. Compared to soybean meal, the fat content of raw or extruded soybeans is 10 to 15 times higher. However, the negative effects of added dietary fat on feed digestibility can be greatly diminished by allowing mature or FDS (raw or extruded) to provide no more than 3% added fat to the diet. This is accomplished by the 14 % FDS limit mentioned previously.

Using Frost-Damaged, Soybeans in Swine Diets

Hogs traditionally have been used to market a variety of marginal feedstuffs. However, since they contain trypsin inhibitors, urease, and other anti-nutritional factors, raw soybeans have little application in any swine rations except in gestation diets. However, when raw soybeans are heat-treated (extruded, roast-

ed, etc.), they have a feeding value similar to that of soybean meal.

A recent study conducted at SDSU determined the feeding value of FDS for grow-finish swine. Basically, there was no difference in the feeding value of extruded FDS or mature soybeans. Also, pigs fed extruded soybeans (either FDS or mature) gained as fast as pigs fed a soybean meal based diet, and there was no difference in carcass quality. However, due to the higher fat content of extruded soybeans, those pigs fed extruded soybean diets exhibited a 7% improvement in feed efficiency.

Note that the extruded soybeans (FDS and mature) replaced soybean meal on a % protein basis, and not on a pound-for-pound basis. From this study, it was determined that extruded FDS have the same feeding value as mature extruded soybeans.

When calculating the economics of replacing soybean meal with extruded FDS in swine diets, consider all the associated costs and benefits, such as:

- Extrusion cost (approx. \$40/ton).
- Need more lbs of extruded soybeans to reach desired protein level.
- 8-10% improvement in F/G due to fat.

- Transportation costs.
- Lose 8% of product during extrusion.

In short, use extruded FDS in swine diets when the total diet cost is equal to or less than that when using soybean meal after all the associated are figured in. However, it is also an alternative way to add fat in nursery and lactation diets, but the economics still need to be calculated.

Summary

Frost-damaged soybeans can be utilized effectively in sheep, beef cattle, and swine diets. In beef and sheep diets, limit FDS to 14% of dry matter intake, but in swine diets, use extruded FDS to totally replace soybean meal. Remember, however, the main determinant in using FDS in any ration is cost of the complete diet.

Due to the variability in composition, it is recommended to have the FDS analyzed for nutrient content before formulating rations.

For more assistance in utilizing FDS in livestock rations, contact your county Extension agent or Extension livestock specialist.

Table 1. Chemical composition and economic value of soybean products.

Item ^a	Soybean Meal ^b	Mature Soybeans		Immature Soybeans	
		Raw ^c	Extruded ^d	Raw ^c	Extruded ^d
Crude Protein, %	49.8	38.7	37.4	39.8	40.7
Fat, %	.9	11.2	16.9	12.8	19.7
Cost/lb of crude protein, \$.20	.22	.29	.22	.27

^aDry matter basis.

^bSoybean meal @ \$200/ton.

^cSoybeans @ \$5.18/bu.

^dExtruding cost @ \$40/ton, 8% shrink, no transportation cost charged.

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