Disaster Recovery

Livestock

Using frost-damaged soybeans in livestock rations

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 buy green soy oil, frost-damaged soybeans are of little use to the processing industry and often are docked at local elevators. However, frost-damaged soybeans can be marketed effectively through livestock.

Frost-damaged soybeans, green beans, and immature soybeans are all synonymous terms and will be denoted by frost-damaged soybeans 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. Soybean meal is a major supplemental protein source for most on-farm, mixed and commercially prepared feeds in the upper Midwest. Frost-damaged soybeans can be an economically attractive, supplemental protein source for beef cattle and sheep.

Research conducted at South Dakota State University using lambs showed that when raw frost-damaged soybeans 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 frost-damaged soybeans as the sole protein source in beef cattle and sheep diets, limit its level to less than 24 percent of diet dry matter intake. At these levels, the negative effects on nutrient use will be minimized.

Compared to soybean meal, raw soybeans (mature or frost-damaged soybeans) are lower in protein, 37 to 40 percent vs. 49 percent (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 per pound of protein must be equal to or lower than that of soybean meal.

Since the high oil content (18 percent) in raw frost-damaged soybeans 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 16 times higher. However, the negative effects of added dietary fat on feed digestibility can be greatly diminished by allowing mature or frost-damaged soybeans (raw or extruded) to provide no more than 3 percent added fat to the diet. This is accomplished by the 14 percent frost-damaged soybeans limited 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, new soybeans have little application in any swine rations except in gestation diets. However, when raw soybeans are heat-treated (extruded, roasted, and etc.), they have a feeding value similar to that of soybean meal.

Another recent study conducted at South Dakota determined the feeding value of frost-damaged soybeans for grow-finish swine. Basically, there was no difference in the feeding value of extruded frost-damaged soybeans or mature soybeans. Also, pigs fed extruded soybeans (either frost-damaged soybeans 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 percent improvement in feed efficiency.

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

Relative value of full-fat cooked soybeans for pigs

The protein or amino acids in whole soybeans are relative in value to what they would cost in soybean meal. The fat is relative in value to a similar amount of calories in corn. The accompanying table indicates the feeding value of whole cooked soybeans for pigs, compared to current prices of corn and 44 percent protein soybean meal. For example, if 44 percent soybean meal is $200 per ton and corn is $2.00 per bushel, the feeding value of whole soybeans is $5.95 per bushel. To compare this value with the market price of soybeans, it is necessary to deduct the cost of cooking them. If the processing cost is $1.00 per bushel, the comparable market price would be $4.95. Thus if the market price exceeds $4.95 it would be more economical to sell your soybeans and purchase soybean meal.

Summary

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

Due to the variability in composition, it is recommended to have the frost-damaged soybeans analyzed for material content before formulating rations.

Adapted from South Dakota State University Extension, Ex2014

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

		Mature Soybeans		Immature Soybeans	
Item	**Soybean Meal**	**Raw**	**Extruded**	**Raw**	**Extruded**
Crude Protein, %	49.8	38.7	37.4	39.8	40.7
Fat, %	.9	11.2	16.9	12.5	19.7

Table 2. Relative value of full-fat cooked soybeans for swine at various prices of corn and soybean meal[1,2]

44% SBM	Corn price, per bushel									
per ton	**$1.00**	**$1.25**	**$1.50**	**$1.75**	**$2.00**	**$2.25**	**$2.50**	**$2.75**	**$3.00**	**$3.25**
	Feeding value per bushel of cooked soybeans									
$120	$3.43	$3.60	$3.76	$3.93	$4.10	$4.26	$4.43	$4.59	$4.76	$4.93
$140	3.90	4.06	4.23	4.39	4.56	4.73	4.89	5.06	5.22	5.39
$160	4.36	4.53	4.69	4.86	5.02	5.19	5.36	5.52	5.69	5.85
$180	4.83	4.99	5.16	5.32	5.49	5.66	5.82	5.99	6.15	6.32
$200	5.29	5.46	5.62	5.79	5.95	6.12	6.29	6.45	6.62	6.78
$220	5.75	5.92	6.09	6.25	6.42	6.58	6.75	6.92	7.08	7.25
$240	6.22	6.38	6.55	6.72	6.88	7.05	7.21	7.38	7.55	7.71
$260	6.68	6.85	7.02	7.18	7.35	7.51	7.68	7.85	8.01	8.18
$280	7.15	7.31	7.48	7.65	7.81	7.98	8.14	8.31	8.48	8.64
$300	7.61	7.78	7.94	8.11	8.28	8.44	8.61	8.77	8.94	9.11
$320	8.08	8.24	8.41	8.57	8.74	8.91	9.07	9.24	9.40	9.57
$340	8.54	8.71	8.87	9.04	9.21	9.37	9.54	9.70	9.87	10.04
$360	9.01	9.17	9.34	9.50	9.67	9.84	10.00	10.17	10.33	10.50
$380	9.47	9.64	9.80	9.97	10.13	10.30	10.47	10.63	10.80	10.96
$400	9.93	10.10	10.27	10.43	10.60	10.76	10.93	11.10	11.26	11.43

[1]These relative values are based on the net energy, lysine and phosphorus contents of the feeds.
[2]These values represent the feeding value of one bushel of cooked, full-fat soybeans for growing pigs or the feeding value of one bushel of uncooked, full-fat beans for sows. For example, if 44 percent SBM is $200 per ton and corn is $2.00 per bushel, the feeding value of whole soybeans is $5.95 per bushel. To compare this value with the market price of soybeans, it is necessary to deduct the processing cost of cooking them. Subtract a processing cost of $0.50-$1.50 per bushel. If the result, $5.45 or $4.45, is less than the marketing price of soybeans, sell your soybeans and purchase soybean meal.

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