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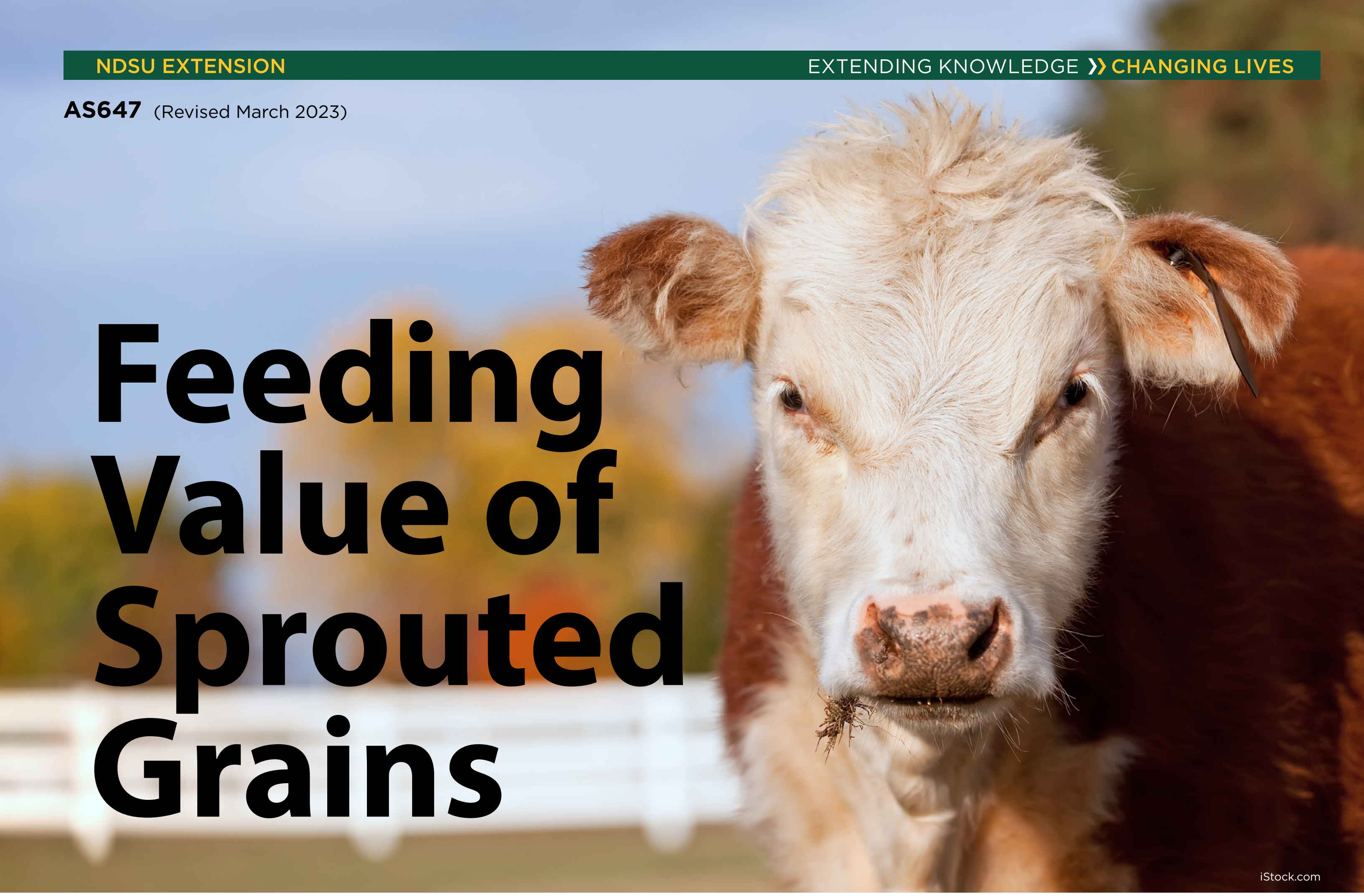

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Feeding Value of Sprouted Grains

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Adverse weather conditions can cause problems in harvesting grain promptly.

In this region, having wet weather conditions that delay the harvest is not unusual. These conditions can cause small grains to sprout in the swath or in the head, making them unsuitable for use in the milling, brewing and food industries. However, this sprouted grain can be fed to livestock.

Limited information on the feeding value of sprouted feed grains is available. Some dry matter is lost during the germination process as heat, CO_2 (carbon dioxide) and moisture are produced. Consequently, this has the potential to reduce the energy content of the grain.

However, based on the animal feeding trials that have been conducted with sprouted grains, the nutritive value of the grain does not appear to be reduced or depressed substantially. In some instances, sprouting may improve the feeding value of grain.

Substantial sprouting will involve some reduction in energy available per kernel, with slight to moderate sprouting showing smaller effects on the feeding value of grains.

NDSU EXTENSION

North Dakota State University, Fargo, North Dakota

Swine and Poultry Research

Historical research conducted with swine at NDSU indicates that sprouted durum and hard red spring wheat support better levels of performance, compared with barley-soybean meal control diets, when fed in swine-finishing rations **(Table 1)**.

Table 1. Evaluation of sprouted grain in swine-finishing rations.

	Barley Control	20% Sprouted Durum	40% Sprouted Durum	20% Sprouted HRSW	40% Sprouted HRSW
ADG (lbs./day)	1.65	1.98	1.72	1.68	1.65
Feed efficiency	3.99	3.47	3.56	3.55	4.07
Bushel weight, lb.[1]	–	58.6	56.7	57.4	56.0

1 Bushel weight of durum or hard red spring wheat used in the research.
NDSU data.

The average daily gain (ADG) of all treatments was equal or superior to the barley control ration. Feeding a 20 percent sprouted durum ration significantly increased average daily gains, compared with the other treatments. Feed efficiencies were similar for all treatments.

Additional work at NDSU utilizing sprouted durum fed to early maturing market-type turkeys indicated no differences in average daily feed consumption or feed efficiency among treatments. Treatments consisted of hard red spring wheat, sprouted durum replacing wheat and sprouted durum replacing corn.

Research conducted in Idaho with sprouted wheat indicated the following reduction in energy value for swine as compared with normal, nonsprouted wheat:

- 20 percent sprouted 92.5 percent of normal wheat
- 40 percent sprouted 87.2 percent of normal wheat
- 60 percent sprouted 85.6 percent of normal wheat

Wheat was used as 50 percent of a growing-finishing ration for hogs. The wheat was 60 percent sprouted when fed so that sprouted kernels represented 0, 10, 20 or 30 percent of the growing-finishing ration. Pig gains were not affected, but feed efficiencies were poorer for rations containing sprouted grains **(Table 2)**.

Table 2. Gains and feed conversions of weanling pigs fed normal or sprouted wheat.

Proportion of Sprouted Wheat	Sprouted Wheat in Ration	ADG (lbs./day)	Feed Efficiency	Relative Value of Sprouted Wheat Compared With Control
0%	0%	1.71	3.68	
20%	10%	1.65	3.83	92.5%
40%	20%	1.64	3.95	87.2%
60%	30%	1.72	3.99	85.6%

Idaho data.

Data collected in the early 1950s at NDSU indicated that sprouted barley gave similar performance as nonsprouted barley when included in pig diets. Research conducted in Alberta with sprouted or frosted barley indicated no differences in pig performance when these grains were fed.

Use of Sprouted Grains for Cattle and Sheep

The value of sprouted grains for ruminants is similar to that of nonsprouted feed grains. Very little, if any, reduction in feeding value is noted in the sprouted grains. Data from Idaho, Washington and Kansas indicate that the performance of cattle fed sprouted grains is similar to cattle fed normal grains.

Idaho researchers used nonsprouted and sprouted wheat at 60 percent of the ration, along with 38 percent roughage and 2 percent salt and minerals. The test weight of the sprouted wheat used in this study was 55.9 pounds per bushel, compared with 60.4 pounds for the nonsprouted wheat.

Nutrient levels in the sprouted wheat were greater, compared with nonsprouted wheat, due to the concentration effect that occurs when starch is expended during the germination process **(Table 3)**.

No significant differences in cattle performance were detected when sprouted wheat was included in these diets **(Table 4)**.

Table 3. Effect of sprouting on nutrient characteristics of wheat.

	Nonsprouted	Sprouted
Bushel weight, lb.	60.4	55.9
CP, %	12.32	13.16
Fat,%	0.79	0.88
Crude fiber, %	3.22	3.57

Idaho data.

Table 4. Weight gain and efficiency of yearling steers fed normal or sprouted wheat.

Proportion of "Sprouted" Wheat	Sprouted Wheat Kernels in Ration	ADG (lbs./day)	Feed Efficiency
0%	0%	2.28	8.9
20%	12%	2.30	8.56
40%	24%	2.41	8.46
60%	36%	2.34	8.89

Idaho data.

Data collected at Washington State University indicates that sprouted wheat compared favorably with a barley-based finishing ration. Sound wheat (no sprouting), low-sprout wheat (9 percent sprouted kernels) and high-sprout wheat (58 percent sprouted kernels) were compared at 25 or 50 percent of the diet. No differences in ADG, feed to gain or carcass characteristics were detected **(Table 5)**.

Table 5. Effect of level of sprouted wheat on performance of feedlot cattle.

	ADG (lbs./day)	Feed Intake (lbs./day)	Feed Efficiency (lbs. feed/lb. gain)
Barley control	2.90	20.8	7.15
25% sound wheat	2.97	20.9	7.03
50% sound wheat	2.86	20.2	7.06
25% low-sprout wheat	2.81	19.7	6.96
50% low-sprout wheat	2.73	19.9	7.27
25% high-sprout wheat	2.99	20.9	6.99
50% high-sprout wheat	2.84	20.0	7.05

Washington State University, 1986.
Low-sprout wheat = 9% sprouted kernels.
High-sprout wheat = 58% sprouted kernels.

Additional research conducted at Washington State University indicated that sheep ate more high-sprout wheat, compared with sound wheat. The digestibility and energy content of the sprouted grain was slightly lower, compared with sound wheat.

Sprouted milo gave a slightly better performance (ADG; feed efficiency) than nonsprouted milo in research conducted in Kansas **(Table 6)**. The sprouted milo used in this trial had a test weight in excess of 60 pounds per bushel and 51 percent of the kernels were sprouted.

Table 6. Feedlot performance of steers fed sprouted milo.

	Sprouted	Nonsprouted
ADG (lbs./day)	2.72	2.51
Feed efficiency (lbs. feed/lb. gain)	8.93	9.18

Kansas State University, 1988.

The feeding value of sprouted and frosted barley was investigated in Alberta in 1987. Researchers found no difference in performance with frosted or sprouted grain, compared with normal barley with no sprouting or frost damage **(Table 7)**.

Research conducted in Montana with sprouted safflower indicated that the feed value was lower than feed barley. This may be expected because whole safflower has a relatively indigestible hull. At 10 percent of the ration, safflower had 92 percent the value of barley, but at 20 percent had only 70 percent the value of barley. Producers should limit the sprouted safflower content of the diet to 10 percent or less to maintain acceptable levels of performance.

Research conducted at NDSU with sprouted barley or durum indicates that feed intake, growth and feed conversion in growing steers is very similar to growing diets containing corn **(Table 8)**. Processing barley to a greater degree resulted in improved gain and feed efficiency, compared with coarsely processing the grain. With durum, rolling the grain resulted in improved performance, compared with feeding the grain whole.

In finishing diets, NDSU work indicated that steers fed diets based on sprouted barley had lower performance, compared with corn-based diets. Feeding whole sprouted barley or whole sprouted durum resulted in lower gains and poorer feed conversion efficiencies, compared with coarsely processed barley or durum, or rolled corn **(Table 9)**. These results indicate that processing the sprouted grain prior to feeding is necessary for optimal results.

Table 8. Effect of grain source and processing method on intake and performance in growing beef steers.

	Rolled Corn	Rolled, Sprouted Barley		Rolled, Sprouted Durum	
		Coarse	Fine	Coarse	Fine
Intake, lbs./day	20.9	20.7	20.9	21.4	20.8
ADG	2.95	3.08	3.32	3.08	3.32
Feed/gain	7.09	6.71	6.29	6.94	6.25

Table 9. Effect of grain source and processing method on intake and performance in finishing beef steers.

	Rolled Corn	Sprouted Barley		Sprouted Durum	
		Whole	Rolled	Whole	Rolled
Intake, lbs./day	24.7	25.85	26.29	25.54	23.98
ADG	3.91	2.84	3.34	3.39	3.70
Feed/gain	6.29	9.09	7.87	7.52	6.45

Table 7. Nutrient characteristics and feedlot performance of sprouted and frosted barleys.

	Sample					
Type of Damage	1 None	2 Sprouted	3 Sprouted	4 Frosted	5 Frosted	6 Frosted
% damaged kernels	0.1	18.7	6.9	75	>75	>75
Bushel weight, lb.	51	48	45	47	42	43
CP, %	12.1	13.3	11.0	11.4	11.7	12.3
	Steer Performance					
ADG, lb./day	2.71	2.84	2.68	2.79	2.62	2.97
Feed intake, lb./day	17.95	17.82	17.51	16.87	17.49	18.13
Feed efficiency (lbs. feed/lb. gain)	6.65	6.29	6.57	6.02	6.67	6.08

Hydroponics

Recently, some producers have shown interest in purposely sprouting cereal grains in hydroponic systems as a means of using the sprouts as a forage source in livestock rations. Research investigating the addition of sprouted grains as an additive in continuous culture systems has indicated that the sprouted grains were stimulatory to fermentation (Hafla et al., 2014). Anecdotal evidence and testimonials indicate improved livestock production parameters with the addition of sprouted grains to a variety of rations.

However, a review of literature conducted by Australian researchers (Sneath and McIntosh, 2003) indicated that the cost of hydroponic systems generally prohibits their application in large commercial systems. The cost, in part, stems from the relatively high labor requirement needed for large-scale application of the systems, as well as relatively high capitalization costs. Therefore, producers should evaluate the costs and benefits of these systems carefully prior to investing in them.

Other Management Considerations for Dealing With Sprouted Grain

Although molds and toxins were not reported to be a problem in any of the studies reviewed in this publication, the possibility exists that molds and toxins could develop in sprouted grain, especially if the grain is stored improperly.

The moisture level of sprouted grain should be tested before placing it in storage. If visible molds are present, a sample should be taken and sent to a laboratory for mycotoxin analysis prior to feeding. This is especially important if the moldy grain will be fed to gestating or lactating livestock.

Several options exist for storing sprouted grain that is too wet for normal storage channels, especially if the grain is intended to be fed to ruminants. Sprouted grain could be ensiled in a high-moisture state under anaerobic conditions. Bunker, trench or upright silos, along with commercial silage bags, could be used.

If the sprouted grain is intended to be used in rations for cattle or sheep, producers may choose to mix or layer sprouted grain into bunker or trench silos as a more traditional silage crop is being ensiled.

Recommendations

- **Depending on the degree of sprout damage, sprouted grains appear to have little reduction in feeding value.**
- **Grain should be processed similarly to nonsprouted grain.**
- **Check for the presence of molds. If you have any doubt about the presence of molds or toxins, have the feed screened by a qualified laboratory.**
- **Storage can be a problem with wetter grain. Producers who can utilize high-moisture grain should consider storage in a bunker, trench or upright silo. Plastic silage bags also are an option.**
- **Bushel weight may be used as a rough indicator of feeding value.**
- **Feeding recommendations (maximum levels, etc.) should follow recommendations you normally follow for each respective grain.**

This publication was authored by Greg Lardy, NDSU Animal Sciences Department, 2013.

For more information on this and other topics, see www.ag.ndsu.edu

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