



Sprouted Barley For Dairy Cows:



Nutritional composition and digestibility

Sprouting grains for livestock feed

- old technology with renewed interest
- continuous production of fresh, high-quality forage, all year.
- large increase in fresh weight with sprouting
- commercial sprouting systems are widely available for purchase

Unanswered questions

- loss of total dry matter may result in net loss of available nutrients?
- no data about feeding value of sprouted barley with high-quality pasture and conserved forages

Our objective was to evaluate the nutritional composition, digestibility, and methane output of sprouted barley grain incubated in a continuous culture fermentation system.



Left to right: barley grain, barley after 3 days of sprouting, barley after 7 days of sprouting, continuous culture fermentation unit with rumen fluid used to determine digestibility and methane output of diets.

How it was done

- Rumen fluid from a cannulated cow (top right) was introduced into continuous culture fermentation units, which are designed to mimic the rumen of a cow.
- Four experimental diets were fed in the continuous culture fermentation units. The digestibility and methane output of the diets were measured during this time.
- Barley grain was sprouted in climate controlled growth chambers (middle right) to be used as part of the experimental diets.
- The diets we looked at included pasture or haylage supplemented with either 7.5% sprouted barley (bottom right) or 6.7% barley grain, on a dry matter basis. Amounts of sprouted barley and barley grain were different so the net energy of each total diet was the same.



Chemical composition and yield characteristics

- Sprouting increased CP and fiber (NDF, ADF) concentrations, but decreased net energy concentration by 6%
- Fresh weight increased by 327% with sprouting, however the decrease in dry matter resulted in 17% dry matter yield loss
- The combined loss of dry matter yield and loss of net energy resulted in a 21% loss of total energy, when comparing 1 tray of barley grain and the resulting sprouted mat
- Sprouted barley had nutritional composition between barley grain and high-quality pasture

Chemical composition, fresh weight, and dry matter yield of barley grain and sprouted barley compared to composition of high-quality pasture

	Barley grain	Sprouted barley	% Change	Pasture
Nutrient				
CP, % DM	12.9	14.7	+ 14	25.5
NDF, % DM	14.4	30.5	+ 112	50.0
ADF, % DM	5.30	15.5	+ 193	31.6
Starch, % DM	58.1	27.7	- 52	1.10
NE _L , Mcal/lb DM	0.88	0.83	- 6	0.58
Ca, % DM	0.05	0.05	0	0.67
P, % DM	0.43	0.49	+ 14	0.51
Yield				
DM, %	95	18	- 81	-
Fresh weight, lbs	0.29	1.22	+ 327	-
Dry matter yield, lbs	0.27	0.23	- 17	-
Total NE _L for 1 tray, Mcal	0.24	0.19	- 21	-

DM = dry matter; CP = crude protein, NDF = neutral detergent fiber; ADF = acid detergent fiber; NE_L = net energy for lactation; Ca = calcium; P = phosphorus

Figure 1. Digestibility (%) of diets supplemented with barley grain or sprouted barley

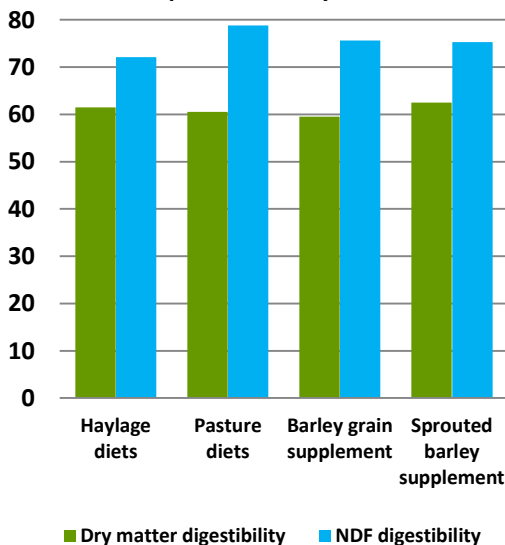


Figure 1. Pasture had greater fiber (NDF) digestibility than haylage. Supplementing with sprouted barley increased DM diet digestibility by 5%

Figure 2. Methane output from diets supplemented with barley grain or sprouted barley

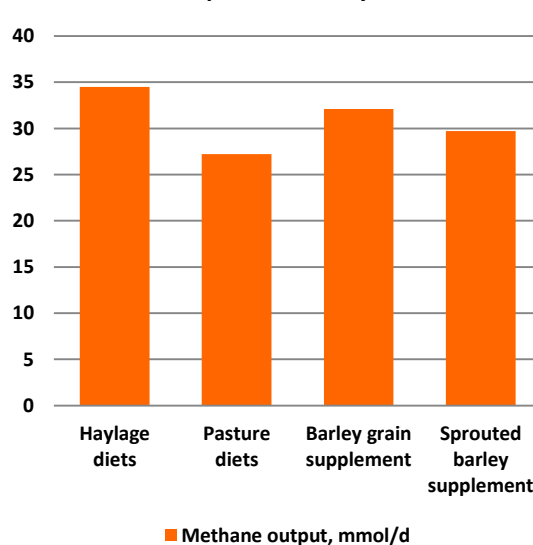


Figure 2. Haylage diets had a 27% greater methane output compared to pasture diets. Supplementing with sprouted barley did not affect methane output.

CONCLUSIONS

- Sprouting results in a rapid accumulation of fresh forage with low DM (< 20%)
- Sprouted barley provides a forage with nutritional value somewhere between that of barley grain and high-quality pasture
- The marginal increase in digestibility coupled with the DM yield loss could result in a net loss of digestible energy available to the animal, which could negatively impact performance and further increase feed costs

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination, write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410, or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.

For additional information contact: Dr. Kathy Soder at: Kathy.Soder@ars.usda.gov or (814) 865 3158