Sprouted Barley For Dairy Cows:

Nutritional composition and digestibility

USDA Agricultural Research Service

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.

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

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

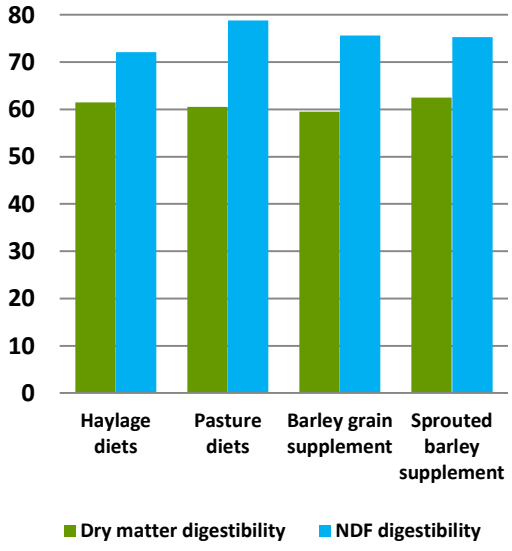

Figure 1. Pasture had greater fiber (NDF) digestibility than haylage. Supplementing with sprouted barley increased DM diet digestibility by 5%

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

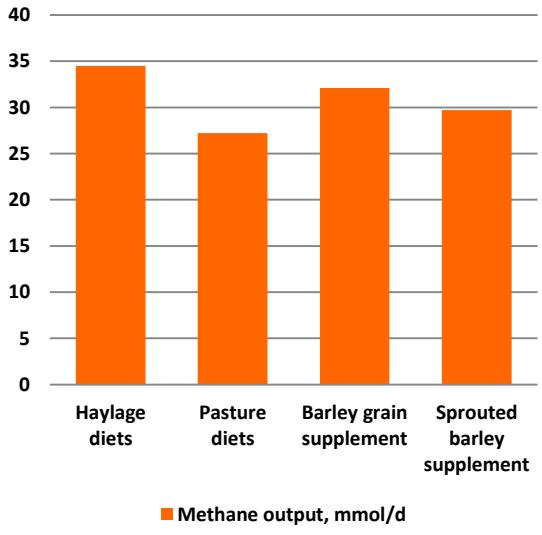

Figure 2. Haylage diets had a 27% greater methane output compared to pasture diets. Supplementing with sprouted barley did not affect methane output.

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

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