

# The Influence of Yeast in a High Roughage Wintering Ration for Hereford Calves as Measured by Digestibility and Performance

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Among the many feed additives currently on the market are various types of yeast preparations. Results from experimental feeding of yeast are varied with some showing increased rates of gain, greater feed efficiency and improved digestibility, and others showing no significant advantages or even depression of these factors. Beeson and Perry (1952) reported that the addition of live-cell yeast suspensions to the ration gave an apparent, but not statistically significant, growth response in cattle. LeGendre et al. (1957) found that the addition of yeast to low quality and high quality roughage and fattening type rations depressed digestibility of ether extract in all rations with no apparent effect on other nutrients. Dyer (1960) and Burroughs and Cheng (1958) reported increased gains on steers and lambs, respectively, with the addition of yeast preparations. Artificial rumen studies conducted by Ruf et al. (1953) indicated that yeast had a stimulatory action on cellulose digestion. Probably the greatest improvement in animal performance has been when yeast was added to a roughage ration and generally to a low quality roughage ration.

Meadow hay of rather low quality is a major component of the wintering ration of beef cattle in eastern Oregon and throughout much of the western range area. The purpose of this trial was to determine the effect of adding yeast to a common wintering ration in this area on animal performance and digestibility of the various feed components.

## Experimental Procedure

The influence of purified brewer's yeast (Amber BYF)<sup>2</sup> on cellulose digestion was studied in the artificial rumen. The artificial rumen procedures were those described by Hubbert et al. (1958). Percent cellulose digestion was determined, with and without added yeast, on purified cellulose and on meadow hay.

The same yeast product was added to the wintering ration of weaned Hereford calves. Nine uniform Hereford calves were stratified by weight into three replications. One steer of each replication was randomly allotted to one of three treatments. Treatment 1 received

<sup>1</sup>Jointly operated by the Oregon Agricultural Experiment Station and the Crops Research Division, Agricultural Research Service, USDA.

<sup>2</sup>Product of, and furnished by, Amber Laboratories, Inc., of Milwaukee, Wisconsin. It is a dry, free flowing, water soluble fraction of autolyzed brewer's yeast.

meadow hay ad libitum, treatment 2 received meadow hay ad libitum and two pounds of barley per day, and treatment 3 received meadow hay ad libitum, 1.85 pounds of barley and 0.15 pounds of yeast. The steers were held in a common pen and tied to individual feed bunks from 7:00 a.m. to 3:00 p.m. daily. While the objective of the trial was to compare the influence of yeast on the common winter ration, which was full feed hay and about two pounds of barley, the hay alone treatment was used to give a means of indirectly calculating the digestibility of the barley components of the ration.

The ration was weighed in daily and refusals were weighed out weekly. The hay was chopped through a field chopper and three-fourths of the barley fed was dry rolled while the other one-fourth was ground. This was to provide a media for mixing the yeast. The dry matter, crude protein and cellulose content of the ingredients in the ration are presented in table 1. The grain portion of the ration was fed in a separate container so hay and grain refusals could be kept separate. However, there was very little grain refusal.

Table 1. Dry matter, crude protein, and cellulose content of the various ration components<sup>a</sup>

Ration component	Dry matter %	Crude protein %	Cellulose %
Meadow hay	86.9	8.8	32.5
Rolled barley	88.0	10.1	9.7
Ground barley	86.8	12.5	8.8
Brewer's yeast	81.7	58.5	3.7

<sup>a</sup>Dry matter basis

The steers were weighed every two weeks during the feeding trial. At the completion of the feeding trial, a digestion trial was conducted on all animals. Dry matter, crude protein, and cellulose digestibility was determined.

### Results and Discussion

The in vitro cellulose digestion was nearly doubled when yeast was added to the purified cellulose, while yeast added to the meadow hay samples increased the cellulose digestion by 10 percent. These data are presented in table 2.

The steers were on the feeding trial for 112 days. Those receiving hay alone lost weight during the first two week period but after that time all the animals made consistent gains except for the last two week period. The average daily accumulative gains for each treatment are presented in figure 1. The steers on hay alone gained at the average rate of 0.36 pounds per day throughout the trial while those receiving hay and barley, and hay, barley and yeast made gains of 0.73 and 0.81 pounds

per day, respectively. The addition of yeast did not significantly increase the rate of gain over those receiving hay and barley. However, the steers on hay alone made significantly lower gains than those receiving the hay and barley, and the hay, barley and yeast rations.

Table 2. Percent in vitro cellulose digestibility of purified cellulose and meadow hay with various amounts of brewer's yeast

Mgm yeast/25 ml nutrient medium	Cellulose digestion	
	Purified cellulose	Meadow hay
	%	%
0	30.0	41.0
30	49.8	42.3
60	53.9	45.9
120	56.8	43.7

Feed efficiency was not significantly increased by the addition of yeast to the diet. Those steers receiving hay and barley required 15.8 pounds of total feed per pound of gain while those receiving hay, barley and yeast required 14.8 pounds of total feed per pound of gain.

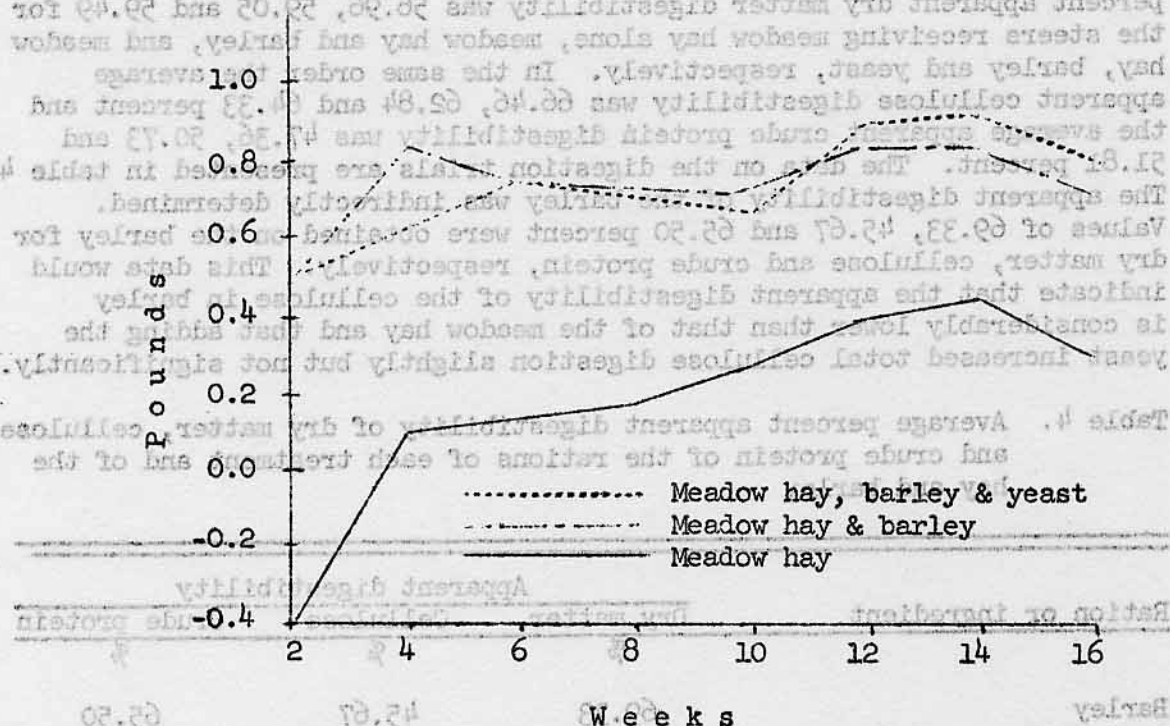


Figure 1. Average daily accumulated gain of steers in each treatment for two week intervals. Each point represents the average daily gain from beginning of the trial.



Hay consumption was not significantly affected by the yeast treatment. Both groups of steers receiving barley and hay made significantly greater gains than those receiving hay alone. The animals receiving hay alone required 28.3 pounds of feed per pound of gain. Table 3 shows the animal weights, average daily gain, and feed data for the trial.

Table 3. Average initial weight, final weight, daily gain, daily feed consumption, and feed required per pound of gain for each treatment

Treatment	Initial weight lb.	Final weight lb.	Daily gain lb.	Daily feed lb.	Feed/lb. gain lb.
Meadow hay	405	445	0.36	10.2	28.3
Meadow hay & barley	409	491	0.73	11.5	15.8
Meadow hay, barley & yeast	411	502	0.81	12.0	14.8

The digestion trial was conducted at the close of the feeding trial. The feces were collected using a harness and fecal bag over a seven-day collection period. Dry matter, cellulose, and crude protein digestibility was determined. The addition of yeast to the diet had no significant effect on the digestibility values obtained. The average percent apparent dry matter digestibility was 56.96, 59.05 and 59.49 for the steers receiving meadow hay alone, meadow hay and barley, and meadow hay, barley and yeast, respectively. In the same order the average apparent cellulose digestibility was 66.46, 62.84 and 64.33 percent and the average apparent crude protein digestibility was 47.36, 50.73 and 51.81 percent. The data on the digestion trials are presented in table 4. The apparent digestibility of the barley was indirectly determined. Values of 69.33, 45.67 and 65.50 percent were obtained on the barley for dry matter, cellulose and crude protein, respectively. This data would indicate that the apparent digestibility of the cellulose in barley is considerably lower than that of the meadow hay and that adding the yeast increased total cellulose digestion slightly but not significantly.

Table 4. Average percent apparent digestibility of dry matter, cellulose, and crude protein of the rations of each treatment and of the hay and barley

Ration or ingredient	Apparent digestibility		
	Dry matter %	Cellulose %	Crude protein %
Barley	69.33	45.67	65.50
Meadow hay	56.96	66.46	47.36
Meadow hay & barley	59.05	62.84	50.73
Meadow hay, barley & yeast	59.49	64.33	51.81

### Summary

The in vitro digestion of cellulose was almost doubled when yeast was added to purified cellulose and increased by 10 percent when yeast was added to meadow hay.

The addition of yeast to a hay and barley wintering ration increased gains of Hereford steer calves slightly, but not significantly, during a 112-day feeding trial.

The animals receiving hay and barley, and hay, barley and yeast made significantly higher gains with significantly greater feed efficiency than those receiving hay alone.

Feed efficiency or hay consumption was not significantly increased by the addition of yeast to the diet.

There were no significant differences in the apparent digestibility of dry matter, cellulose, or crude protein in rations with or without yeast. Cellulose digestibility was higher in the hay alone ration than in the hay and barley, or hay, barley and yeast rations. Yeast in the barley ration apparently increased the cellulose digestibility, but the increase was not of statistical significance.

### Literature Cited

- Beeson, W. M., and F. W. Perry. 1952. Balancing the nutritional deficiencies of roughages for beef steers. J. Animal Sci. 11:50.
- Burroughs, W., and E. W. Cheng. 1958. What about yeast in cattle feeds. Eastern Feed Merchant. January.
- Dyer, I. A. 1960. Feed additives for beef cattle. Sixth Annual Beef Cattle Day Report, Washington State College, Pullman, Washington.
- Hubbert, F., Jr., R. R. Wheeler, C. S. Cooper and W. A. Sawyer. 1958. The response of beef cattle to phosphorus fertilized and unfertilized flood meadow hay with in vitro observations on factors influencing rumen microorganism activity. Proc. West. Sec. Amer. Soc. Anim. Prod. 9:LXI-1.
- LeGendre, J. R., R. Totusek and W. D. Gallup. 1957. Effect of live-cell yeast on nitrogen retention and digestibility of rations by beef cattle. J. Animal Sci. 16:671.
- Ruf, E. W., W. H. Hale and Wise Burroughs. 1953. Observations upon an unidentified factor in feedstuffs stimulatory to cellulose digestion in the rumen and improved liveweight gains in lambs. J. Animal Sci. 12:731.