Impact of Automated Controlled Environment Agriculture (CEA) Wheatgrass on Holstein Beef Performance & Meat Quality

Nikole Ineck[1], Laun Hall[2], Brad Bateman[2], Scott Raban[1], Kara J. Thornton[3], and Brittany L. Graf[1]

[1]GrōResearch Center, Grōv Technologies, 487 E 1750 N, Vineyard, UT 84059; [2]Bateman Mosida Farm, 13650 West, Elberta, UT 84626; [3]Department of Animal, Dairy & Veterinary Sciences, Utah State University, 4800 Old Main Hill, Logan, UT 84322

Abstract

The GrōPod is an automated Controlled Environment Agriculture (CEA) technology that produces sprouted grain (wheatgrass) at commercial scale to deliver fresh Grōv High Density Nutrient (HDN) feed to cattle year-round. In this study, 80 Holstein beef animals were randomized into two groups and fed ad libitum either a high-energy (84% concentrate) grain-fed finishing ration (CTL) or a ration comprising up to 42% HDN wheatgrass. All animals were monitored for growth performance through the finishing phase, and 10 animals from each group were harvested for meat quality analysis. HDN-fed animals showed numerically higher (P = 0.13) average daily gain of 2.9 lbs v 2.8 lbs, and body weight after 126 d on feed compared to the CTL. Carcasses from the HDN-fed group tended (P = 0.06) to grade at a higher USDA quality grade (Choice) versus CTL (Choice minus). Meat samples from the HDN-fed group had a lower (P < 0.05) percent of trans and polyunsaturated fatty acids present in the sample. The HDN-fed group had a lower (P = 0.06) ratio of omega 6:omega 3 fatty acids. Preliminary data indicates Grōv HDN wheatgrass finishing ration may exhibit positive effects on feedlot performance and meat quality in Holstein beef cattle in comparison to a high-energy finishing ration.

A

B

C

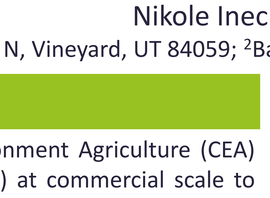

Figure 1. (A) GrōPod that produced HDN at the Bateman Mosida Farm during the beef trial; (B) HDN used in this trial, wheat sprouted for 7 days in the GrōPod ; (C) Trial animals.

Introduction

Numerous studies have shown that pasture grass-fed beef contains elevated levels of vitamin A, vitamin E, omega-3 fatty acids and conjugated linoleic acid (CLA) compared to grain-fed beef, contributing to an improved human health value [1-3]. However, typical grass-fed beef operations require a longer time for finishing in order to reach the same harvest weight as those finished on grains [4]. Little research has been conducted to evaluate the effects of a sprouted grain (wheatgrass)-based diet on beef production. The goal of this study was to compare the effect of a ration containing sprouted wheat produced in the GrōPod versus a traditional grain-based finishing ration on feedlot performance, blood urea nitrogen (BUN), carcass characteristics, and fatty acid content in the meat end product.

Methods and Materials

The study was conducted at Bateman Mosida Farm in Elberta, UT. Holstein steers and heifers were randomly allocated in two treatment groups:

1. Control (n=39) received a standard grain-fed feedlot finishing ration
2. HDN (n=40) received a ration of traditional feeds with an increasing concentration of HDN (**Figure 2**).

Cattle were weighed to evaluate body weight and average daily gain (ADG). Tail blood samples were collected at the start and the end of the trial. BUN was analyzed using the BUN Detection Kit (Eagle Bioscience). Ten animals in each treatment group were harvested when the group reached an average of 1350 lbs. Quality grades were collected by Haden Davis (USU), fatty acids were analyzed by Eurofins Scientific on 16-day aged steaks from the loin.

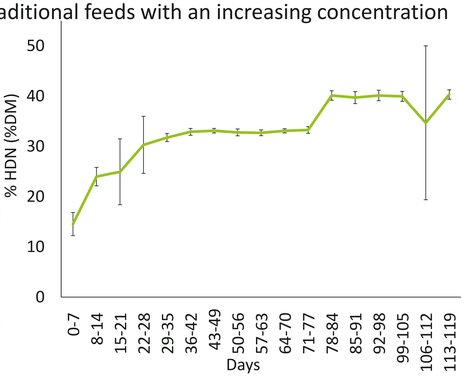

Figure 2. %HDN in the HDN ration during the trial on a dry matter basis.

Results: Growth

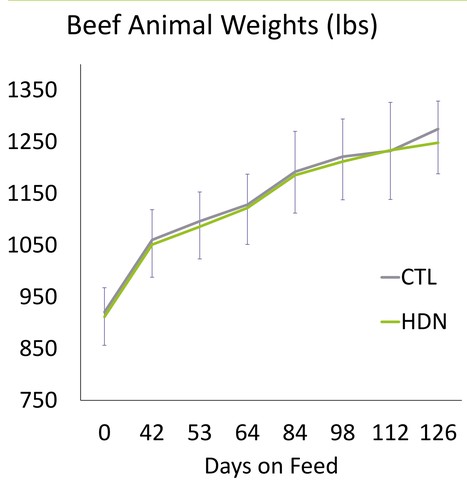

Table 1. Changes in growth and BUN concentration over 112 days. Data are mean SD (CTL n=39; HDN n=40).

Growth	HDN	CTL
Body Weight Increase	36%	34%
Total Pounds Gained	326	313
Average Daily Gain	2.9	2.8
SD	0.61	0.60
BUN Concentration		
Starting (µg/µl)	5.7	6.4
SD	2.9	2.9
Ending (µg/µl)	13.3	11.8
SD	2.8	4.3

Figure 3. Animals fed HDN gained weight similarly to CTL (P = 0.27, t-test). Data are the mean + SD for HDN (n=40), mean – SD for CTL (n=39). Prior to day 112 the heaviest two animals in the HDN group were harvested, which may have skewed weight data at the end of the trial.

Results: Meat Quality

Table 1. Carcass characteristics, meat quality, and fatty acids. Data are mean (n=10). Statistical analysis was t-test with unequal variances

	HDN		CTL		
Carcass Characteristics	**AVG**	**SD**	**AVG**	**SD**	**P Value**
Harvest Weight (lbs)	1403	33.3	1425	40.2	> 0.05
Dressing Percentage (%)	57.9	1.0	57.7	1.0	
Ribeye Area (in$^{2)}$	10.45	1.6	10.39	0.8	> 0.05
Back Fat (in)	0.39	0.1	0.38	0.2	> 0.05
Body wall (in)	1.85	0.2	1.75	0.3	> 0.05
Yield Grade	2.89	0.4	2.66	0.5	> 0.05
Quality Grade	Choice		Choice Minus		0.06
Fatty Acids (% of fresh sample					
Omega 6	0.44	0.15	0.65	0.08	0.002
Omega 6: omega 3 ratio	10.4 : 1	1.63	12.1 : 1	2.11	0.056
Trans	0.76	0.46	1.37	0.35	0.012
Polyunsaturated	0.47	0.16	0.68	0.8	0.002

Conclusions

- HDN fed group had a numerically higher average daily gain
- HDN fed group had a higher carcass quality grade (P = 0.06)
- Meat samples from the HDN-fed group had a significantly lower percent of trans and polyunsaturated fatty acids (P < 0.05)
- HDN-fed group had a lower and healthier ratio of omega 6:omega 3 fatty acids (P = 0.06).

Acknowledgements

The authors would like to acknowledge Bateman Farm Crew, Grōv Lab Techs, and Grōv Operations team for their assistance in making this project possible.

References

1. Daley, C.A., Abbott, A., Doyle, P., Nader, G., Larson, S., n.d. A Literature Review of the Value-Added Nutrients found in Grass-fed Beef Products 11.
2. Daley, C.A., Abbott, A., Doyle, P.S., Nader, G.A., Larson, S., 2010. A review of fatty acid profiles and antioxidant content in grass-fed and grain-fed beef. Nutr J 9, 10. https://doi.org/10.1186/1475-2891-9-10
3. McCluskey, J.J., Wahl, T.I., Li, Q., Wandschneider, P.R., 2005. U.S. Grass-Fed Beef: Marketing Health Benefits. Journal of Food Distribution Research. https://doi.org/10.22004/ag.econ.27758
4. Manning, L. 5 Tips for Finishing Cattle on Grass, 2019. Successful Farming. URL https://www.agriculture.com/livestock/cattle/to-capitalize-on-the-grass-fed-beef-craze-proper-finishing-is-key(accessed 4.24.20).