Finishing time and weights of grass-fed beef animals

NCR-SARE Project #FNC12-860

Description of the four farms in the "Finishing time and weights of grass-fed beef animals" NCR-SARE Project #FNC12-860.

Grass Meadows Farm
Pine City, MN
Jake and Lindsay Grass have a joint operation with relatives located farther north in Iron, MN. Calves are born at the Iron location, a 210-acre farm. Beef steers are intensively rotationally grazed for their finishing on 70 acres at the Pine City location. Pastures include cool-season grass and legume species: red and white clover, alfalfa, birdsfoot trefoil, tall fescue, orchardgrass, timothy. Two paddocks are in warm-season annuals; sorghum-sudangrass or grazing corn. Winter feed is produced on about 120 acres of rented land. Winter feed protocol includes three separate streams of feed types offered to cattle. Finished beef cattle are sold to Thousand Hills Cattle Company.

Bill & Bonnie McMillin
Kellogg, MN
During the course of this project Bill had a cow/calf herd of 30 and grass-fed beef finishing operation. All cattle are rotationally grazed in summer on 40 acres of cool-season grasses and legumes. Bill uses his former dairy infrastructure to produce alfalfa hay and haylage for his winter feed on about 35 acres. Cows get a combination hay and haylage ration with lower-quality hay, and steers get a similar ration with higher-quality hay. Finished beef animals are sold to Hidden Stream Farm, a regional distributor of grass-fed beef, pastured pork and chicken and organic produce.

Jane Jewett
Palisade, MN
Jane has a cow/calf herd of 12 and finishes animals on 71 acres of rotationally grazed pastures. Pastures include birdsfoot trefoil, quackgrass, timothy, red and alsike clovers, orchardgrass, tall fescue, reed canarygrass, and Canadian bluejoint. Hay is purchased from her brother, who uses about 50 acres of rented land to produce it. Cows have continual access to bales in bale rings in the winter. Nearly all of her beef is direct-marketed through the Grand Rapids Farmers' Market or by sales of quarters and halves.

Edgar Brown
Willow River, MN
Edgar has a cow/calf herd of 19 and finishes animals on 60 acres of rotationally grazed pastures. Pastures are cool-season grasses, alfalfa and clover. He makes hay on about 100 acres rented from neighboring farms. Cows have free access to bales without bale rings in winter, and sort for their preferred fraction of the hay. Some of Edgar's beef is direct-marketed locally, and the remaining animals are sold to Thousand Hills Cattle Company.

Average forage quality and calculated price per ton based on relative feed value (RFV) for the four farms: $/ton = (RFV*1.18)-3.66

Farm	Type of forage	RFV‡	Price/ton‡
Grass Meadows			
	AVERAGE	105	$ 120.24
McMillin	Alfalfa hay	162	$ 187.50
	Other hay	133	$ 153.28
	Haylage	120	$ 137.94
	AVERAGE	138	$ 159.18
Jewett	Mixed grass hay	108	$ 123.78
Brown	Mixed grass hay	90	$ 102.54

Ł Results from sampling of stored forage done in March and April 2013

‡ Calculated from Hay Auction reports at Sauk Centre, MN on Nov. 6 and Nov. 20, 2014. http://www.midamericanauctioninc.com/hay-sale-results

Days on feed were assumed to be one entire winter feeding season for the cow in the cow/calf phase of steer production.

Averages by farm for length of winter feeding season and total days on hay or other forage for finished steers

Farm	Days of winter feeding season	Total days on hay for finished steers
Grass Meadows	204	381
McMillin	204	227
Jewett	202	206
Brown	221	348

For steers, days on feed were obtained from averages of the farm's reported birth dates, reported slaughter dates for steers in the study, and the farm's winter feeding season.

2014 cropland and pasture cash rents for Minnesota counties where the four farms are located.

Farm	County	Cropland cash rent/acre ł	Pasture Cash Rent/Acre‡
Grass Meadows	Pine	$ 38.50	$10
McMillin	Wabasha	$222.00	$35
Jewett	Aitkin	$32.50	$10
Brown	Carlton (northern Pine)	$31.00	$10

Ł From Cropland Rental Rates for Minnesota Counties. September 2014. Gary Hachfeld, William Lazarus, Dale Nordquist and Rann Loppnow. University of Minnesota Extension. http://www.cffm.umn.edu/publications/pubs/farmmgttopics/rentalrates.pdf

‡ There was very little information available about pasture rents in these areas. In Pine and Aitkin counties, the $10/acre represents a typical hay stumpage rate for hayfields, so probably overestimates the rental cost of pastures. For Wabasha county, the $35/acre for pasture is an estimate based on rents seen by graziers in southwest Wisconsin (Vance Haugen, UWEX St. Croix County, personal communication).

Brown farm: Cost of production and net income per steer and per acre

Average RFV of hay	90
Price/ton	$102.54
Average days on pasture/year	144
Average days on hay/year	221
Winter feed for 1400-lb. cow (3% of body wt./day) = ((1400 lbs.*0.03)*221 days)/2000 lbs./ton	4.64 tons
First winter feed for 643-lb. steer (average of fall wt. and spring pre-pasture wt.) at 3% of body wt./day = ((643 lbs. * 0.03)*221 days)/2000 lbs./ton	2.13 tons
Second winter feed for 1135-lb. steer (average live wt. at slaughter) at 3% of body wt./day = ((1135 lbs. * 0.03)*127 days)/2000 lbs./ton	2.16 tons
Total cost of winter feed = (4.64 tons + 2.13 tons + 2.16 tons)*$102.54	$ 915.68
Pasture opportunity cost = (60 acres * $10/acre)/19 cow-calf-steer groups	$ 31.58
Total feeding costs per steer produced	$ 947.26
Income per steer based on average carcass weight = 617 lbs. @ $322.50/cwt	$ 1,989.83
Net per steer	$ 1,042.57
Net per pastured acre devoted to cattle = ($1,042.57 * 19 head)/60 acres	$330.15
Net per pastured + harvested acre devoted to cattle = ($1,042.57 * 19 head)/160 acres	$123.80

Grass Meadows farm: Cost of production and net income per steer and per acre

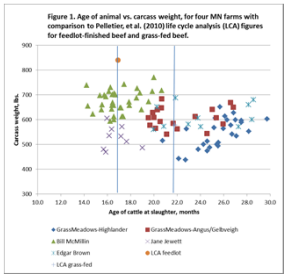
Average RFV of hay	105
Price/ton	$ 120.24
Average days on pasture/year	161
Average days on hay/year	204
Winter feed for 1400-lb. cow (3% of body wt./day) = ((1400 lbs.*0.03)* 204 days)/2000 lbs./ton	4.28 tons
First winter feed for 536-lb. steer (average of fall weaning wt. and spring pre-pasture wt.) at 3% of body wt./day = ((536 lbs. * 0.03)*204 days)/2000 lbs./ton	1.64 tons
Second winter feed for 1,129-lb. steer (average live wt. at slaughter) at 3% of body wt./day = ((1,129 lbs. * 0.03)*177 days)/2000 lbs./ton	3.00 tons
Total cost of winter feed = (4.28 tons + 1.64 tons + 3.00 tons)*$120.24	$ 1,072.54
Cropland opportunity cost = (120 acres * 538.50/ac)/120 cow-calf-steer groups	$ 38.50
Pasture opportunity cost = (280 acres * $10/ac)/120 cow-calf-steer groups	$ 23.33
Total feeding costs per steer produced	$ 1,134.37
Income per steer based on average carcass weight = 571 lbs. @ $322.50/cwt	$ 1,841.48
Net per steer	$ 707.11
Net per pastured acre devoted to cattle =($707.11 * 120 head)/280 acres	$ 303.05
Net per pastured + harvested acre devoted to cattle =($707.11 * 120 head)/400 acres	$ 212.13

Jewett farm: Cost of production and net income per steer and per acre

Average RFV of hay	108
Price/ton	$123.78
Average days on pasture/year	163
Average days on hay/year	202
Winter feed for 1400-lb. cow (3% of body wt./day) = ((1400 lbs.*0.03)*202 days)/2000 lbs./ton	4.24 tons
First winter feed for 849-lb. steer (average of fall weaning wt. and spring pre-pasture wt.) at 3% of body wt./day = ((849 lbs. * 0.03)*202 days)/2000 lbs./ton	2.57 tons
Second winter feed for 1,038-lb. steer (average live wt. at slaughter) at 3% of body wt./day = ((1,038 lbs. * 0.03)*4 days)/2000 lbs./ton	0.06 tons
Total cost of winter feed = (4.24 tons + 2.57 tons + 0.06 tons)*$123.78	$ 850.37
Cropland opportunity cost = (31 acres * $32.50/acre)/12 cow-calf-steer groups	$ 83.96
Pastureland opportunity cost = (40 acres * $10/acre)/12 cow-calf-steer groups	$ 33.33
Total feeding costs per steer produced	$ 967.66
Income per steer based on average carcass weight = 528 lbs. @ $322.50/cwt	$1,702.80
Net per steer	$ 735.14
Net per pastured acre devoted to cattle = ($735.14 * 12 head)/71 acres	$ 124.25
Net per pastured + harvested acre devoted to cattle =($735.14*12 head)/121 acres	$ 72.91

McMillin farm: Cost of production and net income per steer and per acre

Average RFV of hay	138
Price/ton	$ 159.18
Average days on pasture/year	161
Average days on hay/year	204
Winter feed for 1400-lb. cow (3% of body wt./day) = ((1400 lbs.*0.03)* 204 days)/2000 lbs./ton	4.28 tons
First winter feed for 875-lb. steer (average of fall weaning wt. and spring pre-pasture wt.) at 3% of body wt./day = ((875 lbs. * 0.03)*204 days)/2000 lbs./ton	2.68 tons
Second winter feed for 1,204-lb. steer (average live wt. at slaughter) at 3% of body wt./day = ((1,204 lbs. * 0.03)*23 days)/2000 lbs./ton	0.42 tons
Supplemental summer feed when pastures ran low; about 50% of intake during July, 1400-lb. cows and 1000-lb. steers = ((1400 lbs. + 1000 lbs.)*0.015*30 days)/2000 lbs./ton	0.54 tons
Total cost of winter feed = (4.28 tons + 2.68 tons + 0.42 tons)*$159.18	$ 1,174.75
Total cost of summer feed =0.54 tons haylage @ RFV 120 * $137.94	$74.49
Cropland opportunity cost = (8 acres * $222/acre)/30 cow-calf-steer groups	$ 59.20
Pasture opportunity cost = (32 acres * $35/acre)/30 cow-calf-steer groups	$ 37.33
Total feeding costs per steer produced	$ 1,345.77
Income per steer based on average carcass weight = 675 lbs. @ $322.50/cwt	$ 2,176.88
Net per steer	$ 831.11
Net per pastured acre devoted to cattle =($831.11 * 30 head)/60 acres	$ 623.33
Net per pastured + harvested acre devoted to cattle =($831.11 * 30 head)/75 acres	$ 332.44



Figures used in the Pelletier et al. life cycle analysis for beef cattle finishing times and weights in three different finishing systems.ł

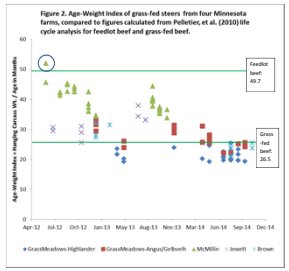
	Beef cattle finishing systems		
	Weaned to feedlot, hormone implants	Weaned to backgrounding on wheat pasture, followed by feedlot; hormone implants at feedlot	Weaned to pasture, finished on pasture & hay; no hormone implants
Age at weaning (months) ł	7	7	7
Time to finish after weaning (months)§	9.9	14.8	14.8
Finished weight (rounded)	1400 lbs.	1400 lbs.	1110 lbs.

ł Nathan Pelletier, Rich Pirog, and Rebecca Rasmussen. 2010. Comparative life cycle environmental impacts of three beef production strategies in the Upper Midwestern United States. Agricultural Systems. 103(6):380-389. http://www.sciencedirect.com/science/article/pii/S0308521X10000395

ł The Pelletier et al. study did not specify months of age at weaning, but all three systems assumed spring-born calves weaned in November. Seven months of age is a typical weaning age for calves in the Upper Midwest.

§ The Pelletier et al. study reported the time to finish as days. Days were converted to months with this formula: days/30.5 = months.

There are five clusters of points on the Figure 1 chart above, representing the McMillin, Jewett, and Brown farms; and within the Grass Meadows farm, their Angus/Gelbveih stock and their Scottish Highlander stock. Vertical lines for age of animals in the life cycle analysis (LCA) show that many of the grass-fed beef animals on the four farms were finishing earlier than the LCA figure of 21.8 months for grass-fed beef. Some of the grass-fed animals were finishing earlier than the LCA figure of 16.9 months for feedlot beef.



Estimate of Age-Weight index of the feedlot beef and grass-fed beef in the Pelletier, et al. study.

	Feedlot beef	Grass-fed beef
Age at slaughter (months)	16.9	21.8
Carcass weight (estimate)ł	860 lbs.	577 lbs.
Age-weight index	49.7	26.5

ł Assuming a carcass yield of 60% for feedlot beef and 52% for grass-fed beef

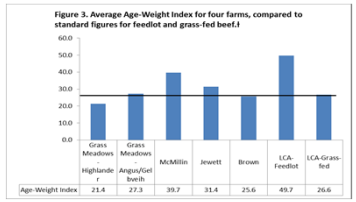
An Age-Weight index incorporates both the age of the animal and the weight of the carcass, and allows plotting of that number against some other factor.

Averages for age at time of slaughter, live weight, carcass weight, and carcass yield percentage for the four farms.

Farm	Age (months)	Live weight (lbs.)	Carcass weight (lbs.)	Carcass yield %
Grass Meadows – Highlander	25.5	1080	546	51
Grass meadows – Angus/Gelbveih	22.3	1198	608	51
McMillin	17.0	1204	675	56
Jewett	16.8	1038	528	51
Brown	24.1	1135	617	54

The Figure 2. chart above shows that one of Bill McMillin's grass-fed animals exceeded the performance of the feedlot beef when viewed as an age-weight index. That particular animal produced a 739-lb. carcass at 14.3 months of age.

All of Bill McMillin's steers, most of Jane Jewett's, about half of Edgar Brown's, and about half (10 of 19) of Grass Meadows's Angus-Gelbveih steers exceeded the assumed standard for grass-fed beef when viewed as an age-weight index.



Grass Meadows Farm's Scottish-Highlander cattle fell below the assumed standard for grass-fed beef. This is expected of the Scottish-Highlander breed, which typically takes 30 months to finish on grass and hay and returns a lighter carcass than mainline British breeds.

The difference between Scottish Highlander cattle and other cattle in this study highlights the issue of **confounding** of grass-fed beef production systems with beef breed. Calculations of the potential for grass-fed beef productivity that are based on results from heritage or small-stature breeds are not representative of the potential from modern genetics of British breeds.

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www.northcentralsare.org

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Comparative life cycle environmental impacts of three beef production strategies in the Upper Midwestern United States. 2010. Nathan Pelletier, Rich Pirog, and Rebecca Rasmussen. *Agricultural Systems* 103(6):380-389.

Jane Jewett would also like to acknowledge the contribution of Rich Pirog, co-author of the above paper and currently with the Center for Regional Food Systems at Michigan State University. Conversations with Mr. Pirog helped clarify the situation with availability of data on grass-fed beef production.

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Thoughts on the future of grass-fed beef research & development

* New life cycle, environmental impact, and economic analyses of grass-fed beef are needed that take into account:

1. Potential of high-productivity farms and ranches that are using modern genetics
2. Effects of heritage breeds and low-productivity pastures on the performance of grass-based beef production systems
3. Benefits of a perennial forage crop in reducing soil erosion and nutrient leakage from agricultural landscapes

- In order for grass-fed beef producers to make progress with their systems, there needs to be information available about the range of performance levels of grass-based production systems. Then producers will be able to see how their operation measures up to others, and can begin to make the changes necessary to improve. It would be useful to have a grass-fed beef data collection and reporting service.

- This project showed that there is potential for the animals in a grass-based system to approach the performance of animals in a feedlot system. There should be further applied research focused on maximizing the performance of grass-based beef production systems.