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Economic Costs and Labor Efficiencies Associated with Raising Dairy Herd Replacements on Wisconsin Dairy Farms and Custom Heifer Raising Operations

2013 Version 4 with 2015 Updates*

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**All tables updated for 2015 feed costs and calf value*

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INTRODUCTION

The cost of raising dairy replacement calves and heifers is the second largest cost on Wisconsin dairy farms in the production of milk. Calculating the costs associated with raising dairy calves and heifers is an essential part of dairy business management. To augment individual dairy calf and heifer cost of production analysis, the dairy industry also requires a set of benchmark costs whereby individual business costs and labor and management efficiencies can be compared. The objective of this project was to evaluate the economic costs and labor efficiencies associated with raising dairy herd replacements on Wisconsin dairy farms and custom calf and heifer raising operations.

METHODS

A computer model, Intuitive Cost of Production Analysis **(ICPA),** was written in 1997 and formally published in 2003 (MPS, 2003). A beta test of the ICPA model was conducted in 1999 and reported (Hoffman, et al., 1999) the costs of raising dairy herd replacements. In 2007 a second ICPA field test was completed and reported (Zwald, et. al., 2007). Due to inflation and changing economic dynamics in the dairy industry, the cost of raising dairy calves and heifers published by Zwald et. al., (2007) has become obsolete. As a result, a new ICPA field project was initiated in 2013 which evaluated the cost of production of dairy calf (n=30) and heifer (n=32) enterprises on commercial dairy and custom heifer raising operations in Wisconsin. Operations were divided into three operational categories (tie-stall dairy, free-stall dairy, and custom calf or heifer raisers) in an attempt to represent a broad spectrum of the Wisconsin calf and heifer industry. The operational categories were selected solely on the basis of how and if lactating cows were milked on the operation. The ICPA evaluation field input data were collected by 12-county based University of Wisconsin-Extension agriculture agents. Data were edited for practical errors and entered into the ICPA model by a single technician to ensure consistency in data entry. Calf and heifer enterprise summary statistics, including comparisons to the 1999 and 2007 ICPA data, were developed for the entire data set (36 operations total) and for each operational category. Tables 1-4 summarize the cost of raising dairy calves (birth to time moved to group housing) and tables 5-9 summarize the cost of raising dairy heifers (time moved to group housing to time freshened, or in the case of the custom heifer grower, returned to the dairy producer).

To avoid variation in calf and heifer raising cost calculations solely due to the price of some common inputs, prices were pre-assigned to some of those inputs. Feed costs and calf value were updated to reflect 2015 market prices. Pre-assigned costs used in the ICPA model to calculate variable and opportunity costs for calf and heifer rearing enterprises are listed on page 3. All other values used to calculate variable costs were operation-specific.

Key Assumptions Used in Costs Associated with Raising Calves and Heifers			
Item	**Unit**	**2013**	**2015**
Calf Enterprise[1]			
Calf Value	$/calf	150.00	400.00
Labor (paid and unpaid)	$/hour	13.00	13.00
Management (paid and unpaid)	$/hour	22.00	22.00
Interest Rate	%	4.50	4.50
Waste Milk	$/cwt.	5.00	5.00
Heifer Enterprise[2]			
Hay/Haylage, 100% Dry Matter (DM)	$/ton	200.00	150.00
Corn Silage, 100% DM	$/ton	140.00	100.00
Corn, 100% DM	$/ton	250.00	170.00
Soybean Meal, 100% DM	$/ton	375.00	350.00
Cow Waste, 100% DM	$/ton	150.00	100.00
Labor (paid and unpaid)	$/hour	13.00	13.00
Management (paid and unpaid)	$/hour	22.00	22.00
Interest Rate	%	4.50	4.50

[1]An animal raised from birth until the time she is moved to group housing.
[2]An animal raised from the time she is moved to group housing until she freshens, or in the case of the custom heifer grower, until she is returned to the producer.

Because of large variations in the age, design, and condition of buildings and equipment on survey operations, no single method of determining fixed costs adequately fits all situations. In an effort to standardize determination of fixed costs for facilities across operations, a replacement value for calf and heifer facilities was assigned using the following guidelines.

Valuation of Calf and Heifer Facilities (Replacement Value)		
Item	**Unit**	**Replacement Value**
Homemade Calf Hutch	$/hutch	200.00
Purchased Calf Hutch	$/hutch	400.00
Greenhouse Barn	$/square foot	10.00
Post-Frame Calf Barn	$/square foot	15.50
Bedded Pack Heifer Barn	$/square foot	18.50
Freestall Barn	$/square foot	20.00
Cattle Mound	$/square foot	0.10
Concrete Lot	$/square foot	3.00
Dirt Lot	$/square foot	0.10

Most survey operations used facilities and equipment that were partially depreciated and were thus considered to have a practical alternative use. The following is a description of how fixed costs of facilities were determined for these circumstances.

Determining Annual Fixed Costs for Facilities (most common situation)
Step 1: Facilities were inventoried on participating farms and were assigned a current replacement value using the cost estimates above minus a five percent salvage value.

Step 2: The present value of facilities was calculated, considering the replacement value, the age of the facilities and using a 30-year useful life straight-line depreciation. If facilities were more than 30 years of age, five percent of the replacement value was used as the present value.

Step 3: Annual fixed cost of facilities were established using 15 percent of the present value to account for the annual costs of depreciation, interest, repairs, taxes, and insurance. These values, expressed on a per animal basis, are used and expressed in the cost of production tables.

Determining Annual Fixed Costs for Equipment
Step 1: Calf and heifer equipment was inventoried on participating farms and the replacement value of all equipment was directly estimated by the owners. The estimated replacement value less ten percent salvage value became the replacement value.

Step 2: The present depreciated value of equipment was calculated considering the age of the equipment and using straight line depreciation with a useful life of 20 years for non-motorized equipment and ten years for motorized equipment. Ten percent of the estimated replacement value was used as the current value for non-motorized equipment older than 20 years and for motorized equipment older than ten years.

Step 3: Annual fixed cost of equipment was established using 15 percent of the present value to account for the annual costs of depreciation, interest, repairs, taxes, and insurance. These values expressed on a per animal basis are used and expressed in the cost of production tables.

RESULTS

Comparison of the Costs Associated With Raising Dairy Herd Replacements from 2007 to 2013

2015 Cost Updates
The cost of raising dairy replacements increased from 2007 to 2013, but comparisons should be interpreted with some caution. While the effort to estimate these costs was similar between both years, there are some important differences. First, the assigned opportunity cost of the calf was $500 in 2007, $150 in 2013, then due to increased dairy market values, calf value was adjusted to $400 for the 2015 revision. Secondly, the assigned labor and management rates were $12 and $20 per hour, respectively, in 2007 compared to $13 and $22 per hour, respectively, in 2013. These costs were changed to reflect the value of female dairy calves, and increases in labor and management costs.

The cost of forages, grains and protein supplements fed to dairy calves and heifers decreased from 2013 to 2015. The feed prices used in the 2013 ICPA model and 2015 update can be found in the Key Assumptions table on page 3. The costs associated with labor, management, and feed represent a large portion of the total cost increases in raising dairy heifers when considering cost differences between 2007 and 2013.

Comparing the Cost of Raising Dairy Herd Replacements by Commercial Dairy Producers vs. Custom Calf and Heifer Growers

The ICPA data will often show noticeable differences between dairy producers and custom calf-heifer growers in the costs required to raise dairy calves or heifers. The ICPA project is not designed to determine the reasons for these cost differences. It is reasonable and informative to describe some differences in management practices between dairy and custom calf-heifer operations that have been observed to yield differences in the cost of production. The following may aid readers in evaluating some of the reasons for these cost differences.

There are some notable differences in common management practices between custom calf-heifer growers and dairy producers in raising dairy calves and heifers. First, dairy operations rely mainly on lactating cattle for income. As a result, they tend to focus much of their management efforts on the lactating herd which may subsidize calf and heifer raising enterprises.

In contrast, custom calf-heifer growers raising dairy calves and heifers for their livelihood often do not have another like enterprise to subsidize their custom raising business. Thus the motivation of calf-heifer growers to maximize efficiency and minimize operation cost is inherent to the operation of such a business.

Second, as milk prices decrease or costs (feed, energy, etc.) increase, dairy operations offset some profit margin erosion by increased productivity from genetic progress. Custom calf-heifer growers typically do not benefit from genetic progress because genetic selection for milk production does not result in improved calf and or heifer feed efficiency. In fact, some research data would suggest genetic selection for improved milk production results in a negative effect on heifer feed efficiency. Consequently, as costs in general increase, custom calf-heifer growers have one less management option in coping with profit margin erosion. The three most obvious management options for custom calf-heifer growers to maintain profit margins are:

1. Reduce costs as much as possible by increasing labor efficiency, using less expensive feeds, etc.
2. Increase their size of operation and capture efficiencies due to size and scale.
3. Increase the price charged for raising replacements.

Reviewing data collected in this project, it appears custom calf-heifer growers have been effective in reducing some costs as compared to the dairy producers surveyed. Some management practices that may have helped custom calf –heifer growers reduce costs were noted by the authors:

1. In the field survey, almost all large custom calf raisers used pasteurized waste milk. They purchased waste milk from local farms with an estimated value of $5 per hundredweight instead of using conventional milk replacer. Liquid feeding costs for calves fed on custom calf operations are thus lower as compared to dairy producers.

2. Labor efficiencies were greater for custom calf and heifer growers than dairy operations.

3. Custom heifer growers used more unique feed ingredients as compared to dairy producers suggesting more management detail was paid to reduce feed cost.

4. Custom heifer growers do not typically raise dairy heifers to calving, thus total days on feed in this field survey are less for heifers raised on custom heifer rearing operations as compared to dairy producers.

5. The cost of semen and breeding services are sometimes paid by the owner of the heifer therefore, breeding costs may be artificially low on some custom heifer rearing operations as compared to producers.

Given the reasons listed above, it is logical calf and heifer cost of production differences should exist between custom calf-heifer growers and dairy operations. However, each business situation is different and readers of this report are encouraged to use the report to help them understand their own cost structure and make better informed calf and heifer management decisions.

HIGHLIGHT FINDINGS -2013 (2015 Update)

A complete review of dairy calf and heifer raising costs generated from the 2013 ICPA project would be exhaustive and will not be presented in this report. However, there are a number of highlight findings in 2013 that are especially noteworthy.

1. Price increases in the cost of milk replacer were offset by more producers feeding pasteurized waste milk. As a result, across all herds, the cost of liquid feed fed to dairy calves only increased 9.3 percent between 2007 and 2013.

2. Calf starter cost nearly tripled from 2007 to 2013.

3. Due to increases in labor and management efficiency, labor and management costs to raise dairy calves decreased.

4. Without considering the opportunity cost of the calf, the total cost to raise a dairy calf in 2013 was $364, while updated 2015 figures reflect an increase to $374. This increase was driven by increased interest and death loss costs.

5. As in the 1999 and 2007 ICPA surveys, custom calf growers had the lowest cost of raising dairy calves. Calf raising costs between tie-stall and free-stall operations were similar.

6. Feed costs to raise a dairy heifer increased 53% from 2007 to 2013. In the 2015 update, feed costs decreased 13%.

7. Bedding costs associated with raising a dairy heifer have nearly doubled since 2007, primarily due to the higher price of bedding.

8. Labor efficiencies to raise dairy calves have increased over the 1999-2013 survey periods, but labor efficiencies to raise dairy heifers have decreased across the same period.

9. Without considering the opportunity cost of the calf, the total cost to raise a dairy replacement from birth to calving on Wisconsin dairy and custom calf and heifer operations has increased approximately $600 from 2007 to 2013, primarily due to increased labor and feed costs. Between 2013 and 2015, total costs decreased $167 due primarily to lower feed costs.

10. On average the total costs to raise dairy replacements by custom heifer raisers are less than dairy operations. This is due in part because custom heifer raisers return heifers approximately four to six weeks prior to freshening, thus the last four to six weeks of costs are the responsibility of the producer, and are not reflected in this report.

2013
Calf Enterprise Analysis Summaries
Costs associated with raising dairy replacement animals from birth until moved to group housing
Tables 1-4

Table 1. The average cost plus the variance of cost to rear one calf on Wisconsin dairy and custom calf operations (n=30). [1]

Cost	Unit	Average	SD[3]	Operation[2] Low	Operation[2] High
Variable Cost					
Liquid Feed	$/calf	96.00	70.76	29.40	357.84
Calf Starter	$/calf	63.42	36.40	14.70	113.40
Forage	$/calf	5.31	10.74	0.00	42.00
Bedding	$/calf	8.63	12.62	40.56	20.22
Veterinary	$/calf	21.86	20.11	20.00	50.00
Death Loss	$/calf	16.42	12.19	50.65	4.17
Interest	$/calf	5.68	2.73	1.10	13.07
Paid Labor	$/calf	55.56	60.65	54.23	0.00
Paid Management	$/calf	4.88	6.58	0.33	0.00
Total Variable Cost	**$/calf**	**277.77**	**107.45**	**210.97**	**600.70**
Fixed Cost					
Calf Housing	$/calf	16.32	11.70	3.09	30.05
Calf Equipment	$/calf	6.87	16.93	0.61	1.70
Total Fixed Cost	**$/calf**	**23.20**	**23.63**	**3.70**	**31.75**
Total Allocated Cost (Variable Cost + Fixed Cost)	**$/calf**	**300.96**	**120.91**	**214.66**	**632.45**
Opportunity Cost of Unpaid Labor & Mgt	$/calf	73.86	90.41	0.00	275.42
Allocated Cost + Opportunity Cost of Unpaid Labor & Mgt	**$/calf**	**374.82**	**147.87**	**214.66**	**907.87**
Opportunity Cost of Calf	$/calf	400.00	N/A	400.00	400.00
Allocated Cost + Opportunity Cost of Unpaid Labor, Mgt, & Calf	**$/calf**	**774.82**	**147.87**	**614.66**	**1307.87**
Summary					
Feed Cost	$/calf	164.74	92.57	44.10	513.24
Other Variable Cost (Excluding Labor and Management)	$/calf	50.89	24.13	10.94	97.73
Labor/Mgt Cost (paid and unpaid)	$/calf	141.03	65.17	43.98	275.42
Total Fixed Cost	$/calf	18.60	11.78	2.46	48.70
Feed Cost	%	43.2	13.2	23.5	72.1
Other Variable Cost	%	14.9	8.6	3.8	40.9
Labor/Mgt Cost (paid and unpaid)	%	35.7	13.1	44.0	59.3
Total Fixed Cost	%	6.1	4.8	0.6	19.0
Labor/Mgt Required	days/year	633.6	2102.4	10989.0	62.6
Labor/Mgt Required	hrs/calf	10.0	5.0	4.2	19.3
Labor Efficiency	calves/hr	10.1	9.5	13.4	4.4
Labor Efficiency	calves/man/day	80.8	76.1	107.0	34.9
Weaning Age	weeks	7.6	1.4	7.0	12.0
Days on Feed	days	68.7	14.7	46.2	84.0

[1] In this analysis, a dairy replacement animal was considered to be a calf until moved into a group whereupon the dairy replacement animal was considered to be a heifer. Most of the other labels and terms in this table are explained in the glossary.

[2]Survey operations that had the lowest and highest allocated cost to rear calves.

[3]SD is the acronym for standard deviation. See glossary.

Table 2. Economic cost and labor required to rear one calf by operation type (n=30).[1]

Cost	Unit	Operation Type[2] Tie-stall	Free-stall	Calf grower
Number of Operations	n	12	13	5
Variable Cost				
Liquid Feed	$/calf	108.36	91.49	73.17
Calf Starter	$/calf	50.76	67.68	70.04
Forage	$/calf	11.19	1.67	0.00
Bedding	$/calf	8.54	3.51	20.89
Veterinary	$/calf	17.78	26.53	10.60
Death Loss	$/calf	14.95	19.14	12.85
Interest	$/calf	6.51	6.31	2.06
Paid Labor	$/calf	41.43	65.00	55.92
Paid Management	$/calf	2.96	4.96	6.35
Total Variable Cost	**$/calf**	**262.49**	**286.29**	**251.87**
Fixed Cost				
Calf Housing	$/calf	12.78	19.64	13.96
Calf Equipment	$/calf	1.52	12.22	1.83
Total Fixed Cost	**$/calf**	**14.29**	**31.86**	**15.79**
Total Allocated Cost (Variable Cost + Fixed Cost)	**$/calf**	**276.78**	**318.15**	**267.66**
Opportunity Cost of Unpaid Labor & Mgt	$/calf	110.19	71.40	0.72
Allocated Cost + Opportunity Cost of Unpaid Labor & Mgt	**$/calf**	**386.97**	**389.55**	**268.37**
Opportunity Cost of Calf	$/calf	400.00	400.00	400.00
Allocated Cost + Opportunity Cost of Unpaid Labor, Mgt, & Cal	**$/calf**	**786.97**	**789.55**	**668.37**
Summary				
Feed Cost	$/calf	170.31	160.84	143.21
Other Variable Cost (Excluding Labor and Management)	$/calf	47.78	55.49	46.39
Labor/Mgt Cost (paid and unpaid)	$/calf	154.58	141.36	62.98
Total Fixed Cost	$/calf	14.29	31.86	15.79
Feed Cost	%	43.16	40.00	51.78
Other Variable Cost	%	12.62	15.57	18.92
Labor/Mgt Cost (paid and unpaid)	%	40.23	36.31	23.21
Total Fixed Cost	%	3.99	8.12	6.09
Labor/Mgt Required	days/year	65.68	344.07	2388.29
Labor/Mgt Required	hrs/calf	11.23	10.58	4.62
Labor Efficiency	calves/hr	7.56	7.88	22.39
Labor Efficiency	calves\man\day	60.49	63.07	179.08
Weaning Age	weeks	8.21	7.65	6.70
Days on Feed	days	60.09	68.38	70.00

[1] In this analysis, a dairy replacement animal was considered to be a calf until moved into a group whereupon the dairy replacement animal was considered to be a heifer. Most of the other labels and terms in this table are explained in the glossary.

[2] The type of operation describes how lactating cows were managed on the operation. Calf and heifer grower operations did not manage lactating cows.

Table 3. Comparing the daily per calf rearing cost by operation type (n=30).[1]

		Operation Type[2]			
Cost	**Unit**	**Tie-stall**	**Free-stall**	**Calf grower**	**All Herds**
Number of Operations	n	12	13	5	30
Variable Cost					
Liquid Feed	$/calf/day	1.55	1.37	1.09	1.41
Calf Starter	$/calf/day	0.74	0.97	0.91	0.89
Forage	$/calf/day	0.15	0.02	0.00	0.07
Bedding	$/calf/day	0.13	0.05	0.35	0.14
Veterinary	$/calf/day	0.25	0.42	0.17	0.33
Death Loss	$/calf/day	0.22	0.30	0.19	0.25
Interest	$/calf/day	0.09	0.09	0.03	0.09
Paid Labor	$/calf/day	0.70	1.04	0.87	0.92
Paid Management	$/calf/day	0.04	0.08	0.08	0.07
Total Variable Cost	**$/calf/day**	**3.88**	**4.34**	**3.70**	**4.16**
Fixed Cost					
Calf Housing	$/calf/day	0.18	0.31	0.19	0.24
Calf Equipment	$/calf/day	0.02	0.19	0.02	0.11
Total Fixed Cost	**$/calf/day**	**0.21**	**0.50**	**0.21**	**0.35**
Total Allocated Cost (Variable Cost + Fixed Cost)	**$/calf/day**	**4.09**	**4.84**	**3.91**	**4.51**
Opportunity Cost of Unpaid Labor & Mgt	$/calf/day	1.55	0.95	0.01	1.00
Allocated Cost + Opportunity Cost of Unpaid Labor & Mgt[3]	**$/calf/day**	**5.63**	**5.79**	**3.92**	**5.51**

[1] In this analysis, a dairy replacement animal was considered to be a calf until moved into a group whereupon the dairy replacement animal was considered to be a heifer. Most of the other labels and terms in this table are explained in the

[2] The type of operation describes how lactating cows were managed on the operation. Calf and heifer grower operations did not manage lactating cows.

[3]The opportunity cost of the calf was omitted from this table because the purpose of this table is to compare the three

Table 4. Comparing the change in the per calf rearing cost between 1999, 2007, and 2015.[1,2]

Item	Unit	Cost/calf 1999	2007	2013	2015	% Change 2007 to 2015	% Change/yr[3] 2007 to 2015
Variable Cost							
Liquid Feed	$$/calf	35.51	87.84	96.00	96.00	9.3	1.2
Calf Starter	$$/calf	21.00	23.42	63.42	63.42	170.9	21.4
Forage	$$/calf	1.97	0.96	5.31	5.31	452.4	56.5
Bedding	$$/calf	5.57	6.80	8.63	8.63	26.9	3.4
Veterinary	$$/calf	8.43	17.26	21.86	21.86	26.6	3.3
Death Loss	$$/calf	4.54	14.66	7.02	16.42	12.0	1.5
Interest	$$/calf	3.40	10.25	3.94	5.68	-44.6	-5.6
Labor (Paid and Unpaid)[4]	$$/calf	60.38	138.54	122.33	122.33	-11.7	-1.5
Management (Paid and Unpaid)[4]	$$/calf	7.04	14.29	11.97	11.97	-16.2	-2.0
Total Variable Cost + Opportunity Cost of Unpaid Labor, Mgt[5]	$$/calf	147.84	314.02	340.49	351.62	12.0	1.5
Fixed Cost							
Calf Housing	$$/calf	11.23	10.00	16.32	16.32	63.2	7.9
Calf Equipment	$$/calf	1.19	2.05	6.87	6.87	235.2	29.4
Total Fixed Cost	$$/calf	12.42	12.05	23.20	23.20	92.5	11.6
Allocated Cost (Variable + Fixed) + Opportunity Cost of Unpaid Labor, Mgt[5]	$$/calf	160.26	326.07	363.69	374.82	15.0	1.9
Allocated Cost + Opportunity Cost of Unpaid Labor, Mgt, & Calf[6]	$$/calf	260.24	826.07	513.69	874.82	5.9	0.7
Summary							
Labor/Mgt Required	hrs/calf	9.2	12.3	10.0	10.0	-18.9	-2.4
Labor Efficiency	calves/hr	9.1	7.9	10.1	10.1	28.7	3.6
Labor Efficiency	calves/man/day	72.6	62.8	80.8	80.8	28.7	3.6
Weaning Age	weeks	7.4	7.0	7.6	7.6	8.1	1.0
Days on Feed	days	59.7	61.4	68.7	68.7	12.0	1.5

[1] In this analysis, a dairy replacement animal was considered to be a calf until moved into a group whereupon the dairy replacement animal was considered to be a heifer. Most of the other labels and terms in this table are explained in the glossary.

[2] This table is formatted differently from some of the other tables because it is a comparison of the 2007 and 2013 data with the less comprehensive 1999 data. Only data available for all years is shown.

[3]The percent change per year is the percent change divided by six years instead of using a discounted percent change per year.

[4]The cost of labor and management increased from 1999 to 2007 because the time per calf (but not per heifer) increased. The cost of labor and management increased even more because the labor and management assigned value increased substantially from 1999 and 2007. The cost of labor and management decreased from 2007 to 2013 because the time per calf decreased. Labor and management assigned value did increase slightly from 2007 to 2013, though this did not cause an overall increase in cost of labor and management.

[5]Unpaid labor and management were included as variable costs in the 1999 but not in the 2007 or 2013 tables other than in tables four and eight. Therefore, the numbers labeled as labor, management, total variable cost, and total allocated cost in tables four and eight are larger than their counterparts in table one and five by the amount of unpaid labor and management.

[6] The assigned opportunity cost of the calf increased $400 from 1999 to 2007 and decreased $350 from 2007 to 2013.

2013
Heifer Enterprise Analysis Summaries
Dairy replacement animals from the time they are moved to group housing to the time they freshen, or in the case of a custom grower, are returned to the dairy producer.
Tables 5-9

Table 5. The average cost plus the variance of cost to rear one heifer on Wisconsin dairy and custom heifer operations (n=32).[1]

Cost	Unit	Average	SD[3]	Operation[2] Low	Operation[2] High
Variable Cost					
Feed	$/heifer	909.52	426.90	405.12	1916.12
Bedding	$/heifer	92.50	157.45	5.40	534.81
Veterinary	$/heifer	51.01	86.40	2.83	263.87
Breeding	$/heifer	33.19	52.90	0.00	93.38
Electrical and Fuel	$/heifer	32.76	8.10	14.62	41.23
Interest	$/heifer	50.68	22.66	22.84	95.80
Death Loss	$/heifer	6.38	9.79	21.41	35.77
Paid Labor	$/heifer	178.13	287.28	87.49	1494.15
Paid Management	$/heifer	12.10	20.64	2.38	95.36
Total Variable Cost	**$/heifer**	**1366.26**	**630.57**	**562.09**	**4570.49**
Fixed Cost					
Manure Storage	$/heifer	20.34	22.09	1.55	69.33
Housing	$/heifer	154.83	187.41	11.08	434.83
Equipment	$/heifer	41.55	75.22	0.78	96.43
Total Fixed Cost	**$/heifer**	**216.72**	**225.80**	**13.41**	**600.60**
Total Allocated Cost (Variable Cost + Fixed Cost)	**$/heifer**	**1582.98**	**669.70**	**575.50**	**5171.09**
Opportunity Cost of Unpaid Labor & Mgt	$/heifer	147.31	128.22	13.62	400.55
Allocated Cost + Opportunity Cost of Unpaid Labor & Mgt (Heifer)	**$/heifer**	**1730.29**	**700.61**	**589.12**	**5571.65**
Combining the total cost of raising a dairy herd replacement from birth to freshening					
Allocated Cost + Opportunity Cost of Unpaid Labor & Mgt (Heifer)	**$/heifer**	**1730.29**	**700.61**	**589.12**	**5571.65**
Opportunity Cost of Calf + Calf Rearing Expense + calf unpd labor & mgt (from table one)	$/heifer	774.82	147.87	318.21	777.72
Allocated Cost + Opportunity Cost of Unpaid Labor & Mgt, +Calf Value + Calf Rearing Expense	**$/heifer**	**2505.11**	**879.64**	**907.33**	**6349.36**
Summary					
Feed Cost	$/heifer	909.52	426.90	405.12	1916.12
Other Variable Cost (Excluding Labor and Management)	$/heifer	272.62	140.76	98.61	731.64
Labor/Mgt Cost (paid and unpaid)	$/heifer	307.05	289.23	80.99	1538.31
Total Fixed Cost	$/heifer	216.72	190.63	20.27	857.88
Feed Cost	%	53.7	11.9	30.2	75.0
Other Variable Cost (Excluding Labor and Management)	%	15.8	6.6	6.5	32.5
Labor/Mgt Cost (paid and unpaid)	%	18.2	8.2	6.0	40.9
Total Fixed Cost	%	12.3	9.8	1.5	45.5
Labor/Mgt Required	days/year	465.1	696.9	372.1	1591.3
Labor/Mgt Required	hrs/heifer	12.8	12.2	62.0	2.2
Labor Efficiency	heifers/hr	46.6	35.2	5.9	163.4
Labor Efficiency	heifers/man/day	372.5	282.0	47.1	1307.5
Calving Age	months	23.4	1.7	20.0	30.0
Days on Feed	days	629.9	70.5	457.5	854.0

[1] In this analysis, a dairy replacement animal was considered to be a calf until moved into a group whereupon the dairy replacement animal was considered to be a heifer. Most of the other labels and terms in this table are explained in the glossary.
[2]Survey operations that had the lowest and highest allocated cost to rear heifers.
[3]SD is the acronym for standard deviation. See glossary.

Table 6. Economic cost and labor required to rear one heifer by operation type (n=32). [1]

Cost	Unit	Operation[2] Tie-stall	Free-stall	Heifer Grower
Number of Operations	n	12	13	7
Variable Cost				
Feed	$$/heifer	869.12	1021.98	773.25
Bedding	$$/heifer	96.13	113.55	60.94
Veterinary	$$/heifer	61.97	41.91	48.75
Breeding	$$/heifer	37.37	38.79	22.45
Electrical and Fuel	$$/heifer	32.15	35.21	29.40
Interest	$$/heifer	48.98	56.32	41.80
Death Loss	$$/heifer	4.37	10.93	4.23
Paid Labor	$$/heifer	157.84	188.43	193.79
Paid Management	$$/heifer	6.55	19.17	8.52
Total Variable Cost	**$$/heifer**	**1314.48**	**1526.28**	**1183.13**
Fixed Cost				
Manure Storage	$$/heifer	32.25	15.85	8.29
Housing	$$/heifer	149.27	162.70	150.10
Equipment	$$/heifer	77.51	23.59	13.55
Total Fixed Cost	**$$/heifer**	**259.03**	**202.13**	**171.94**
Total Allocated Cost (Variable Cost + Fixed Cost)	**$$/heifer**	**1573.50**	**1728.41**	**1355.06**
Opportunity Cost of Unpaid Labor & Mgt	$$/heifer	246.18	118.48	107.28
Allocated Cost + Opportunity Cost of Unpaid Labor & Mgt	**$$/heifer**	**1819.68**	**1846.90**	**1462.34**
Combining the total cost of raising a dairy herd replacement from birth to freshening				
Allocated Cost + Opportunity Cost of Unpaid Labor & Mgt	**$$/heifer**	**1819.68**	**1846.90**	**1462.34**
Opportunity Cost of Calf + Calf Rearing Expense	$$/heifer	786.97	789.55	668.37
Allocated Cost + Opportunity Cost of Unpaid Labor & Mgt, +Calf Value + Calf Rearing Expense	**$/heifer**	**2606.65**	**2636.44**	**2130.72**
Summary				
Feed Cost	$$/heifer	869.12	1021.98	773.25
Other Variable Cost (Excluding Labor and Management)	$$/heifer	271.86	236.91	200.06
Labor/Mgt Cost (paid and unpaid)	$$/heifer	411.00	326.08	232.97
Total Fixed Cost	$$/heifer	259.03	202.13	171.94
Feed Cost	%	48.8	55.9	58.2
Other Variable Cost	%	15.0	17.1	14.8
Labor/Mgt Cost (paid and unpaid)	%	21.8	15.7	16.5
Total Fixed Cost	%	14.5	11.3	10.5
Labor/Mgt Required	days/year	82.4	425.4	1195.0
Labor/Mgt Required	hrs/heifer	16.3	11.6	8.9
Labor Efficiency	heifers/hr	30.6	56.5	55.5
Labor Efficiency	heifers/man/day	244.5	452.2	443.9
Calving Age	months	23.5	23.9	22.2
Days on Feed	days	631.6	646.5	596.1

[1] In this analysis, a dairy replacement animal was considered to be a calf until moved into a group whereupon the dairy replacement animal was considered to be a heifer. Most of the other labels and terms in this table are explained in the glossary.

[2]Survey operations that had the lowest and highest allocated cost to rear heifers.

Table 7. Comparing the daily per heifer rearing cost by operation type (n=32).[1]

		Operation[2]			
Cost	**Unit**	**Tie-stall**	**Free-stall**	**Heifer Grower**	**All Herds**
Number of Operations	n	12	13	7	32
Variable Cost					
Feed	$$/heifer/day	1.37	1.58	1.31	1.44
Bedding	$$/heifer/day	0.14	0.17	0.10	0.14
Veterinary	$$/heifer/day	0.10	0.07	0.08	0.08
Breeding[2]	$$/heifer/day	0.06	0.06	0.03	0.05
Electrical and Fuel	$$/heifer/day	0.05	0.06	0.05	0.05
Interest	$$/heifer/day	0.08	0.09	0.07	0.08
Death Loss	$$/heifer/day	0.01	0.01	0.01	0.01
Paid Labor	$$/heifer/day	0.25	0.29	0.33	0.28
Paid Management	$$/heifer/day	0.01	0.03	0.01	0.02
Total Variable Cost	**$$/heifer/day**	**2.07**	**2.35**	**1.98**	**2.16**
Fixed Cost					
Manure Storage	$$/heifer/day	0.05	0.02	0.01	0.03
Housing	$$/heifer/day	0.23	0.26	0.25	0.25
Equipment	$$/heifer/day	0.14	0.04	0.02	0.07
Total Fixed Cost	**$$/heifer/day**	**0.42**	**0.33**	**0.29**	**0.35**
Total Allocated Cost (Variable Cost + Fixed Cost)	**$$/heifer/day**	**2.49**	**2.67**	**2.27**	**2.52**
Opportunity Cost of Unpaid Labor & Mgt	$$/heifer/day	0.39	0.18	0.05	0.23
Allocated Cost + Opportunity Cost of Unpaid Labor & Mgt[34]	**$$/heifer/day**	**2.88**	**2.85**	**2.32**	**2.75**

[1] In this analysis, a dairy replacement animal was considered to be a calf until moved into a group whereupon the dairy replacement animal was considered to be a heifer. Most of the other labels and terms in this table are explained in the glossary.

[2] The type of operation describes how lactating cows were managed on the operation. Calf and heifer grower operations did not manage lactating cows.

[3]The opportunity cost of the calf was omitted from this table because the purpose of this table is to compare the three systems with each other in terms of daily cost per head. The typical custom grower in Wisconsin doesn't acquire ownership of the dairy herd replacement animals. The other two operations in the table typically retain ownership of the dairy herd replacement animals. Adding the opportunity cost of the calf to two systems and not to the third system would be distorting.

[4]All calf costs were omitted from this table to illustrate only heifer costs.

Table 8. Comparing the change in the per heifer rearing cost between 1999, 2007, and 2013. [12]

Item	Unit	Cost/heifer 1999	2007	2013	2015	% Change 2013 to 2015	% Change/yr[3] 2013 to 2015
Variable Cost							
Feed	$/heifer	647.15	683.66	1,077.78	909.52	-15.6	-7.8
Bedding	$/heifer	29.07	49.07	92.57	92.50	-0.1	0.0
Veterinary	$/heifer	37.66	32.68	50.96	51.01	0.1	0.0
Breeding	$/heifer	26.07	48.48	33.19	33.19	0.0	0.0
Electrical and Fuel	$/heifer	34.74	33.66	32.72	32.76	0.1	0.1
Interest	$/heifer	32.92	66.93	58.35	50.68	-13.1	-6.6
Death Loss	$/heifer	6.33	2.57	5.31	6.38	20.3	10.1
Labor (Paid and Unpaid)[4]	$/heifer	128.40	254.90	310.94	310.94	0.0	0.0
Management (Paid and Unpaid)[4]	$/heifer	15.96	27.53	26.59	26.59	0.0	0.0
Total Variable Cost + Opportunity Cost of Unpaid Labor & Mgt[5]	**$/heifer**	**958.30**	**1199.47**	**1688.41**	**1513.58**	**-10.4**	**-5.2**
Fixed Cost							
Manure Storage	$/heifer	22.44	19.72	20.34	20.34	0.0	0.0
Housing	$/heifer	93.09	129.32	154.83	154.83	0.0	0.0
Equipment	$/heifer	24.79	12.70	41.55	41.55	0.0	0.0
Total Fixed Cost	**$/heifer**	**140.32**	**161.73**	**216.72**	**216.7182**	**0.0**	**0.0**
Allocated Cost (Variable + Fixed) + Opportunity Cost of Unpaid Labor & Mgt[5]	**$/heifer**	**1099.12**	**1322.70**	**1905.13**	**1730.29**	**-9.2**	**-4.6**
Combining the total cost of raising a dairy herd replacement from birth to freshening							
Allocated Cost (Variable + Fixed)[5]	**$/heifer**	**1099.12**	**1322.70**	**1905.13**	**1730.29**	**-9.2**	**-4.6**
Calf Value + Calf Rearing Expense	**$/heifer**	**261.62**	**826.08**	**513.69**	**774.82**	**50.8**	**25.4**
Allocated Cost + Opportunity Cost of Unpaid Labor & Mgt, + Calf Value + Calf Rearing Expense	**$/heifer**	**1360.74**	**2148.78**	**2418.82**	**2505.11**	**3.6**	**1.8**
Summary							
Labor/Mgt Required	hrs/heifer	9.0	9.0	12.8	12.8	0.0	0.0
Labor Efficiency	heifers/hr	53.7	50.1	46.6	46.6	0.0	0.0
Labor Efficiency	heifers/man/day	429.0	401.6	372.5	372.5	0.0	0.0
Calving Age	months	24.6	23.9	23.4	23.4	0.0	0.0
Days on Feed	days	683.0	648.3	629.9	629.9	0.0	0.0

[1] In this analysis, a dairy replacement animal was considered to be a calf until moved into a group whereupon the dairy replacement animal was considered to be a heifer. Most of the other labels and terms in this table are explained in the glossary.

[2] This table is formatted differently from some of the other tables because it is a comparison of the 2007 and 2013 data with the less comprehensive 1999 data. Only data available for all years is shown.

[3] The percent change per year is the percent change divided by six years instead of using a discounted percent change per year.

[4] The cost of labor and management increased from 1999 to 2007 because the time per calf (but not per heifer) increased. The cost of labor and management increased mainly because the labor and management assigned value increased substantially from 1999 and 2007. The cost of labor and management increased from 2007 to 2013 because of an increase in hours per heifer (but not per calf) and also due to an increase in labor and management assigned value from 2007 to 2013.

[5] Unpaid labor and management were included as variable costs in the 1999 but not in the 2007 or 2013 tables other than in tables four and eight. Therefore, the numbers labeled as labor, management, total variable cost, and total allocated cost in tables four and eight are larger than their counterparts in table one and five by the amount of unpaid labor and management.

[6] The assigned opportunity cost of the calf increased $400 from 1999 to 2007 and decreased $350 from 2007 to 2013.

Table 9. The effect of body size and age on variable, fixed and total cost associated with rearing one heifer on Wisconsin dairy and custom heifer operations (n=32).[1234]

Weight (lbs)	Age (mo)	Variable Cost ($$/head/day)											Fixed Cost ($$/head/day)			Total Cost ($$/head/day)[45]
		Feed	Bedding	Vet & Med	Breeding	Electric & Fuel	Paid Labor	Unpaid Labor	Paid Mgt	Unpaid Mgt	Interest	Death	Equip	Buildings	Manure	
239	2.6	1.10	0.17	0.10	0.00	0.02	0.21	0.16	0.01	0.04	0.06	0.004	0.03	0.26	0.01	2.18
324	4.2	1.34	0.17	0.08	0.00	0.02	0.22	0.21	0.02	0.019	0.07	0.01	0.06	0.26	0.01	2.50
406	5.8	1.23	0.14	0.11	0.00	0.03	0.31	0.10	0.03	0.02	0.07	0.004	0.07	0.47	0.01	2.62
572	7.8	1.28	0.11	0.07	0.00	0.04	0.19	0.18	0.02	0.03	0.07	0.003	0.04	0.19	0.01	2.21
653	10.2	1.06	0.05	0.09	0.00	0.04	0.16	0.23	0.01	0.02	0.06	0.007	0.13	0.35	0.03	2.27
737	11.6	1.49	0.03	0.08	0.04	0.05	0.20	0.21	0.03	0.01	0.08	0.000	0.02	0.27	0.03	2.54
839	13.6	1.24	0.09	0.12	0.10	0.06	0.33	0.23	0.03	0.03	0.07	0.005	0.11	0.28	0.04	2.73
924	14.9	1.50	0.16	0.06	0.25	0.06	0.55	0.28	0.02	0.01	0.09	0.012	0.09	0.37	0.03	3.55
1059	18.0	1.57	0.10	0.05	0.04	0.07	0.17	0.22	0.03	0.01	0.08	0.011	0.07	0.35	0.06	2.84
1100	19.6	1.66	0.13	0.11	0.00	0.08	0.22	0.21	0.01	0.03	0.09	0.014	0.08	0.24	0.04	2.97
1171	22.1	2.02	0.21	0.06	0.00	0.08	0.10	0.15	0.00	0.02	0.11	0.007	0.08	0.30	0.08	3.36

[1] In this analysis, a dairy replacement animal was considered to be a calf until moved into a group whereupon the dairy replacement animal was considered to be a heifer. Most of the other labels and terms in this table are explained in the glossary.

[2]Unpaid labor and management are listed along side paid labor and management in the variable cost category in this table. In contrast, unpaid

[3]The costs in the row with the heifer weight and age is the daily cost of heifer of that size and age. For example, a 239 lbs, 2.6 month old heifer would have a total daily cost of $2.18. This is not the average daily cost from birth to 238 lbs and 2.5 months of age.

[4]What is called total cost in this table includes all costs but the opportunity cost of the calf.

[5]Producers with either the highest or lowest total cost ($$/head/day) in each age group were omitted from averages to provide continuity.

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Dairy Dreams	Casco, WI
David Schaefer	Menomonie, WI
Dic Wisco Farms	Dorchester, WI
Eckert Farms	Medford, WI
Horn Custom Heifer Raising	St. Cloud, WI
Halls Calf Ranch	Kewaunee, WI
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Herrmann Dairy Farm	Cato, WI
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Marsh Edge Dairy	Reedsville, WI
Misty Hollow Dairy	Athens, WI
Paul Kaczmarek	Green Bay, WI
Pfaff Way Farms	Alma Center, WI
Rosy Lane Holsteins	Watertown, WI
Smith Prairie Dairy	Oakfield, WI
Soaring Eagle Dairy	Newton, WI
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Teunissen Custom Heifers	Cedar Grove, WI
Todd Quarne	Blair, WI
Joel Kestell	St. Cloud, WI
Trinity Farms	Blair, WI
Troy Tenneson	Ettrick, WI
West Road Dairy	Ettrick, WI

GLOSSARY OF TERMS

Allocated Cost - All costs (variable + fixed cost), except the opportunity costs. Opportunity costs include cost of unpaid labor, management, and calf value.

Allocated Cost + Opportunity Cost of Unpaid Labor & Management - The sum of total allocated costs (variable cost + fixed cost) plus the opportunity cost of unpaid labor and management.

Allocated Cost + Opportunity Cost of Unpaid Labor & Management, and Calf - The sum of allocated cost (variable cost + fixed cost) plus the opportunity cost of unpaid labor and management, plus the calf value. This term is used in heifer cost estimates only when combining calf and heifer costs to avoid double accounting for the value of the calf.

Bedding – Bedding materials, such as sand, sawdust, straw, or corn stalks which are used to bed calves or replacement heifers. The cost of bedding for operations using mattresses without bedding was zero, but the mattress was reflected in the fixed cost of the operation.

Breeding - Semen cost associated with breeding heifers multiplied by the number of services per conception. Semen cost was estimated to be $15.00 per service when natural service sires were used. Breeding costs were assigned to the appropriate age and weight of the heifers when bred. Related breeding cost such as hormones, heat detection, and pregnancy checks were assigned as veterinary, or labor cost.

Calf - Youngstock on liquid feed prior to moving to group housing.

Calf Starter - Purchased calf starter or formulated grain mixes fed to calves.

Calving Age - The average age (in months) at first freshening.

Days on Feed (days) - The average number of days the calf or heifer was on feed. The number of days on feed is a separate value for calves and heifers.

Death Loss - For calves and heifers, the cost of death loss was estimated as the percent death loss multiplied by the calf value, plus expenses that accumulated to the age of death. Death loss percent estimates were collected separately for calves and heifers.

Electric and Fuel - Cost associated with electricity and fuel to operate the dairy replacement facilities and equipment. These costs were estimated as an energy cost factor multiplied by body weight and are estimates because electric and fuel charges could not be reasonably separated from other farm enterprises.

Feed Cost (%) - Feed cost expressed as a percent of total allocated cost plus unpaid labor and management.

Feed Cost ($/calf) - The sum of all feed costs for feeding a calf.

Feed Cost ($/heifer) - The sum of all feed costs for feeding a heifer not including the calf portion of feed costs**.**

Fixed Cost (%) - Total fixed cost as a percent of total allocated cost, plus unpaid labor and management.

Fixed Cost ($/calf) - See total fixed cost, not including heifer portion.

Fixed Cost ($/heifer) - See total fixed cost, not including calf portion.

Heifer - A weaned calf that is moved to group housing.

Interest - An interest cost (4.5 percent annual) was calculated for other variable costs for the duration of the calf or heifer raising period to estimate the value of capital throughout the raising period.

Labor Efficiency (calves per day) - The number of calves that can be handled (labor and management) by one person working an 8 hour day.

Labor Efficiency (heifers per day) - The number of heifers that can be handled (labor and management) by one person working an 8 hour day.

Labor Efficiency (calves per hour) - The number of calves that can be handled (labor and management) by one person in one hour.

Labor Efficiency (heifers per hour) - The number of heifers that can be handled (labor and management) by one person in one hour.

Labor & Management Cost (%) - Paid and unpaid labor and management expressed as a percent of total allocated costs, plus unpaid labor and management.

Labor & Management Cost ($/calf) - The total value of both paid and unpaid labor associated with raising a calf.

Labor & Management Cost ($/heifer) - The total value of both paid and unpaid labor associated with raising a heifer.

Labor & Management Required (days per heifer) - The number of days per year required to raise one heifer.

Labor & Management Required (hours per calf) - The number of hours required to raise one calf.

Liquid Feed - Whole milk, pasteurized waste milk, milk replacer or combinations used to feed calves. Waste milk had an assigned value of $5.00 per hundredweight.

Manure Storage – That portion of the total manure storage structure determined to be associated with the heifer enterprise.

Opportunity Cost of Calf - For operations raising their own calves, the estimated market price of the calf is considered an opportunity cost because there was the opportunity to sell the calf instead of raising it. In other words, in deciding to raise the calf, the owner gave up income from selling the calf--income that could later be used to offset costs of buying another calf. In the 1999 study, the assigned opportunity cost of a calf was $100 compared to $500 in 2007, $150 in 2013. A calf opportunity cost of $400 was assigned in 2015 because $400 per calf was a fairly typical sale price of female calves sold shortly after birth at the time of the survey. Be aware of this difference when interpreting tables 4 and 8. For operations raising bull calves, the day old sale price of a bull calf would be the opportunity cost. Operations raising purchased calves should use the actual purchase price. Custom raisers who do not acquire ownership of the calves should not include calf value or opportunity cost as a cost of raising calves or heifers. Finally, in estimating the total cost of raising heifers from birth to first calving, make sure the calf value is not included twice. An economically successful business should be able to pay for all costs including realistic opportunity costs.

Opportunity Cost of Unpaid Labor & Management - Considered an opportunity cost because this labor or management time has earning potential if used in a different way such as milking more cows or performing another job. If calf and heifer labor or management is not hired or partially hired, the unpaid portion of labor and management is considered an opportunity cost. The value of unpaid labor and management was calculated by multiplying the estimated unpaid labor hours by $13.00 and the estimated unpaid management hours by $22.00. If all calf and or heifer labor and management are hired, calf and heifer labor and management are a paid cost. In this analysis, paid labor and management costs are assumed to be variable costs. An economically successful business should be able to pay for all costs including realistic opportunity costs.

Other Variable Cost (%) - Total variable cost minus feed, labor and management costs expressed as a percent of total allocated cost plus unpaid labor and management.

Other Variable Cost ($/calf) - Total variable costs minus feed, labor and management costs for a calf.

Other Variable Cost ($/heifer) - Total variable costs minus feed, labor, and management costs for a heifer.

Paid Labor - The cost of paid labor as estimated for labor hours per calf and/or heifer multiplied by $13.00 per hour.

Paid Management - The cost of paid management as estimated for labor hours per calf and/or heifer multiplied by $22.00 per hour.

Standard Deviation - The most widely used measure of the spread in a data set [how much variation there is from the "average" (mean)]. A large standard deviation indicates that the data points are far from the "average" and a small standard deviation indicates that they are clustered closely around the mean.

For example, the data sets {49, 51} and {1, 99} each have a mean of 50. Their standard deviations are 1, and 49, respectively. The first set has a much smaller standard deviation than the other one because its values are all close to 50. In a loose sense, the standard deviation tells us how far from the average the data points tend to be.

Total Fixed Cost - The sum of facility and equipment fixed costs based on current un-depreciated values of assets to reflect a fairly common situation. For heifers, the fixed costs of manure storage and equipment prorated to its use by the heifer enterprise are also included in total fixed cost. See methods for more information about calculation methodology. In the short run, all costs are fixed and in the long run, all costs are variable. Consequently, in any analysis, judgment must be used to determine which costs are considered fixed and which variable. In this project we exercised that judgment, and handled depreciation, interest, repairs, taxes and insurance associated with structures and equipment as fixed, because that represents the most common time frame of most people interested in the project results. All other costs excluding opportunity (unpaid labor and management, calf value) costs were handled as variable costs.

Total Variable Cost - The sum of all variable costs. In the long run, all costs are variable. In the short run, all costs are fixed. Consequently, in any analysis, judgment must be used to determine which costs are considered fixed, and which variable. In this project we exercised that judgment, and handled depreciation, interest, repairs, taxes and insurance associated with structures and equipment as fixed, because that represents the most common time frame of most people interested in the project results. All other costs excluding opportunity (unpaid labor and management, calf value) costs were handled as variable costs.

Veterinary - Veterinary services, drugs, vaccinations, pregnancy checks, and other veterinary expenses associated with the cost of raising calves or heifers. Veterinary expenses were assigned to the age and weight classes of heifers in which they occurred.

Weaning Age (weeks) - The average age of a calf when they stop receiving liquid feed.

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