

# *Dairy Economics – Factors affecting profitability*

Kevin Dhuyvetter, PhD  
Technical Consultant, Elanco

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**Marriott Savannah Riverfront**  
**Savannah, GA**

**Elanco**

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# A few important economic concepts...

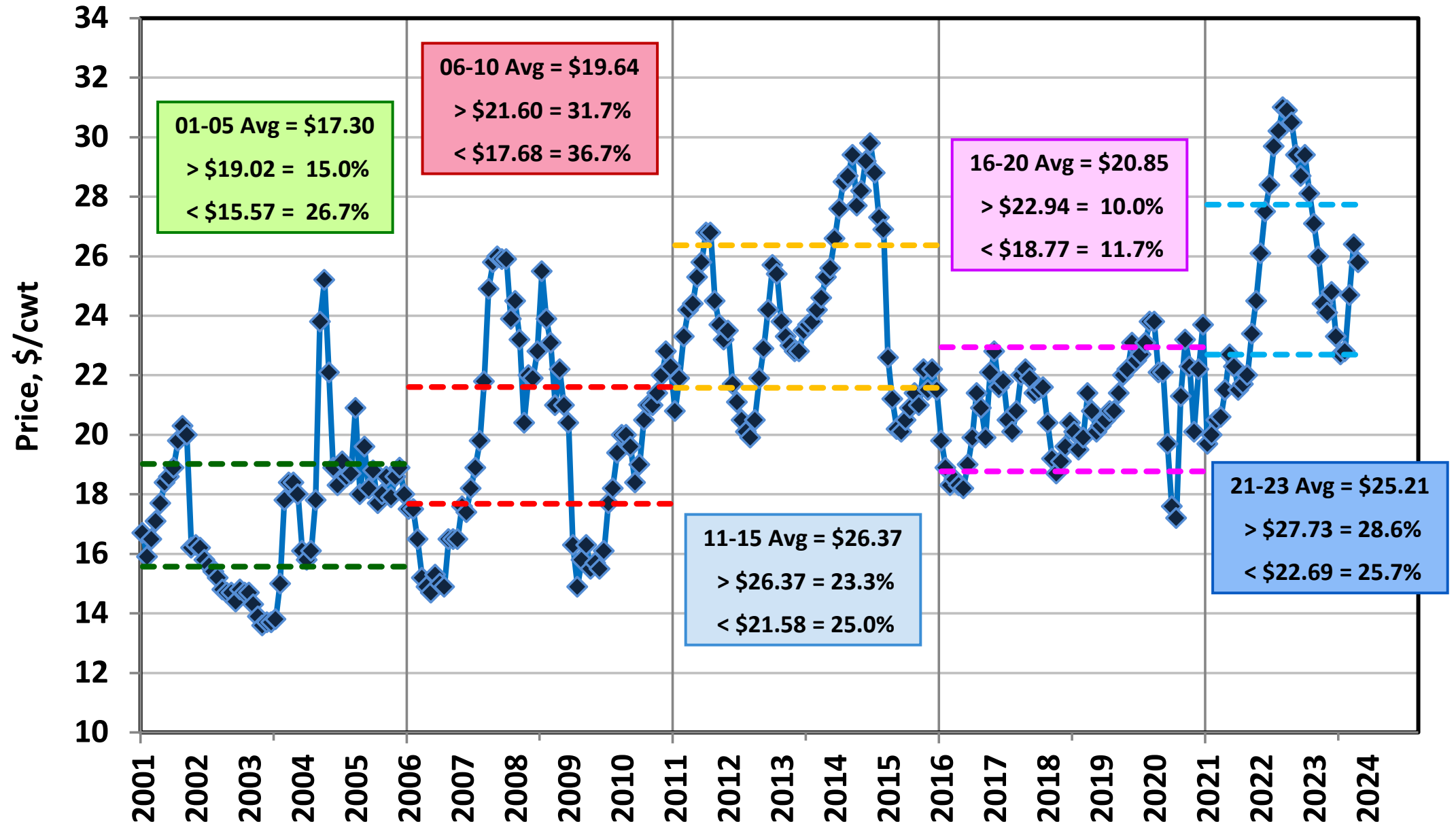
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- Variable vs. fixed costs  
(economies of size (scale) is related to fixed cost)
- Short run vs. long run
- Cash vs. economic costs (P&I pmt vs depreciation)
- Price = cost (implies profit = \$0)  
(on average, in the long run, in competitive industries)
- Marginal revenue > marginal cost  
(decision rule for profit maximization)
- Partial budget vs. whole-farm analysis
- Time value of money

# Monthly Average All Milk Prices – FL

## Monthly Average All Milk Price -- FL

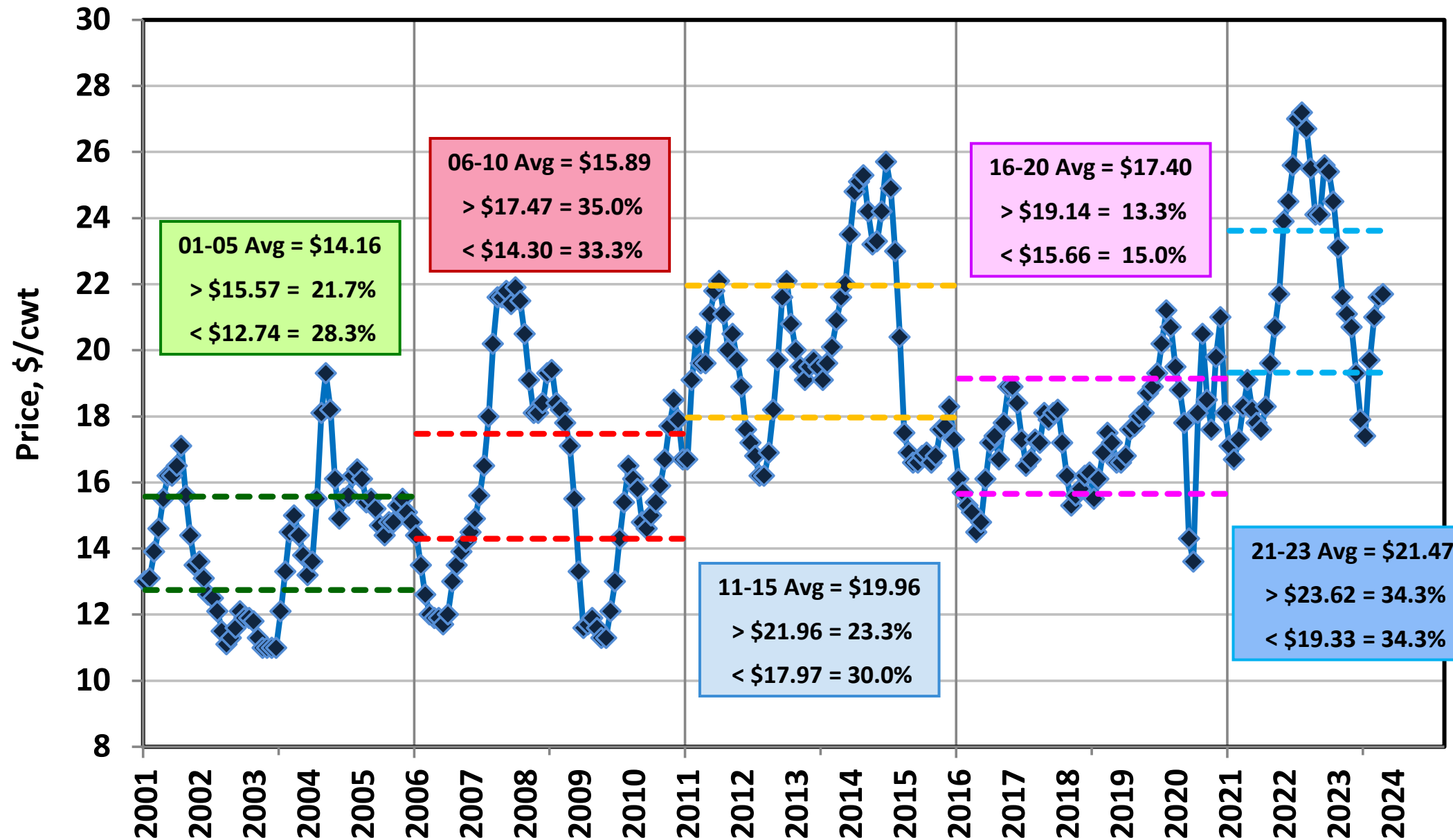
Source: USDA NASS



# Monthly Average All Milk Prices – US

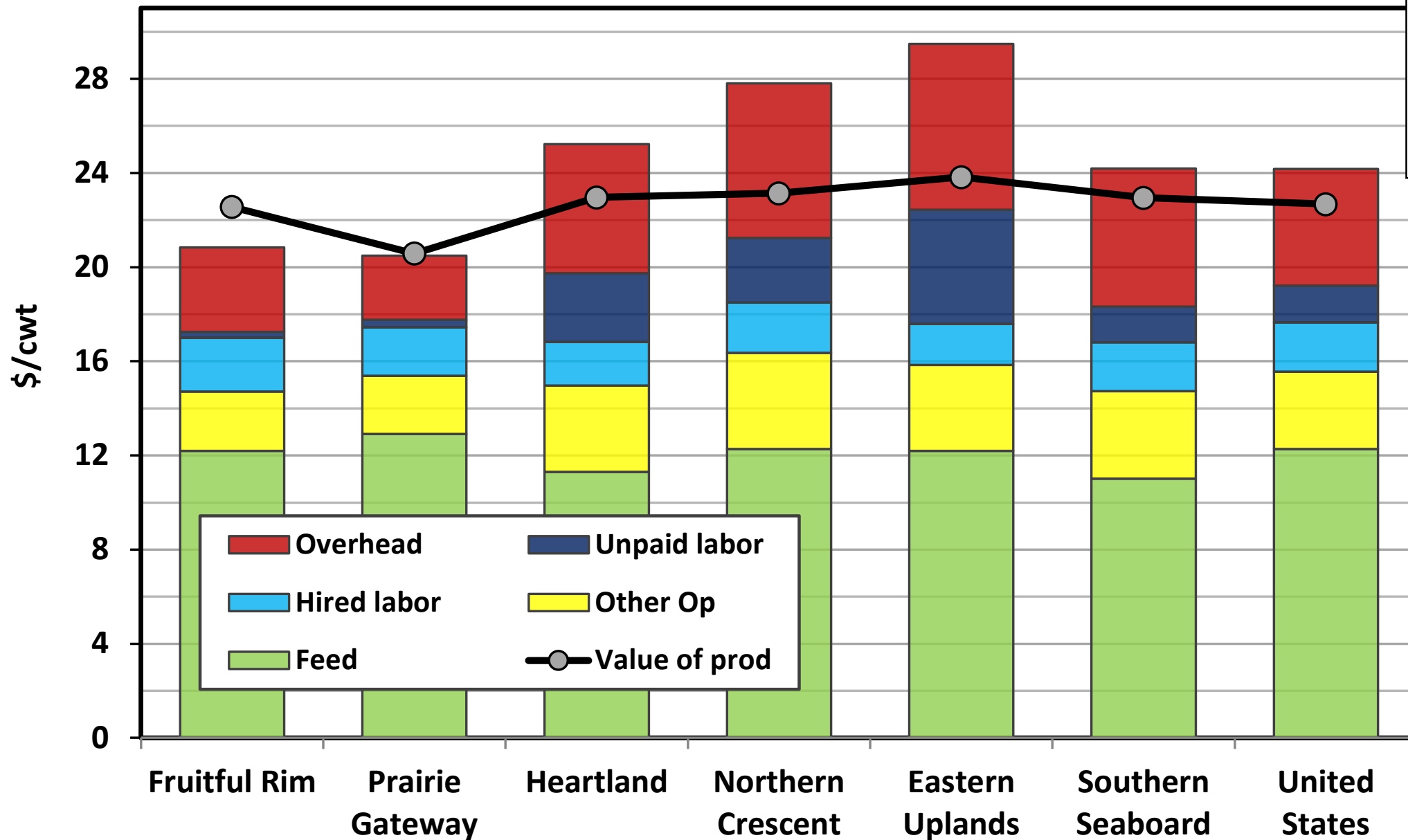
## Monthly Average All Milk Price -- US

Source: USDA NASS



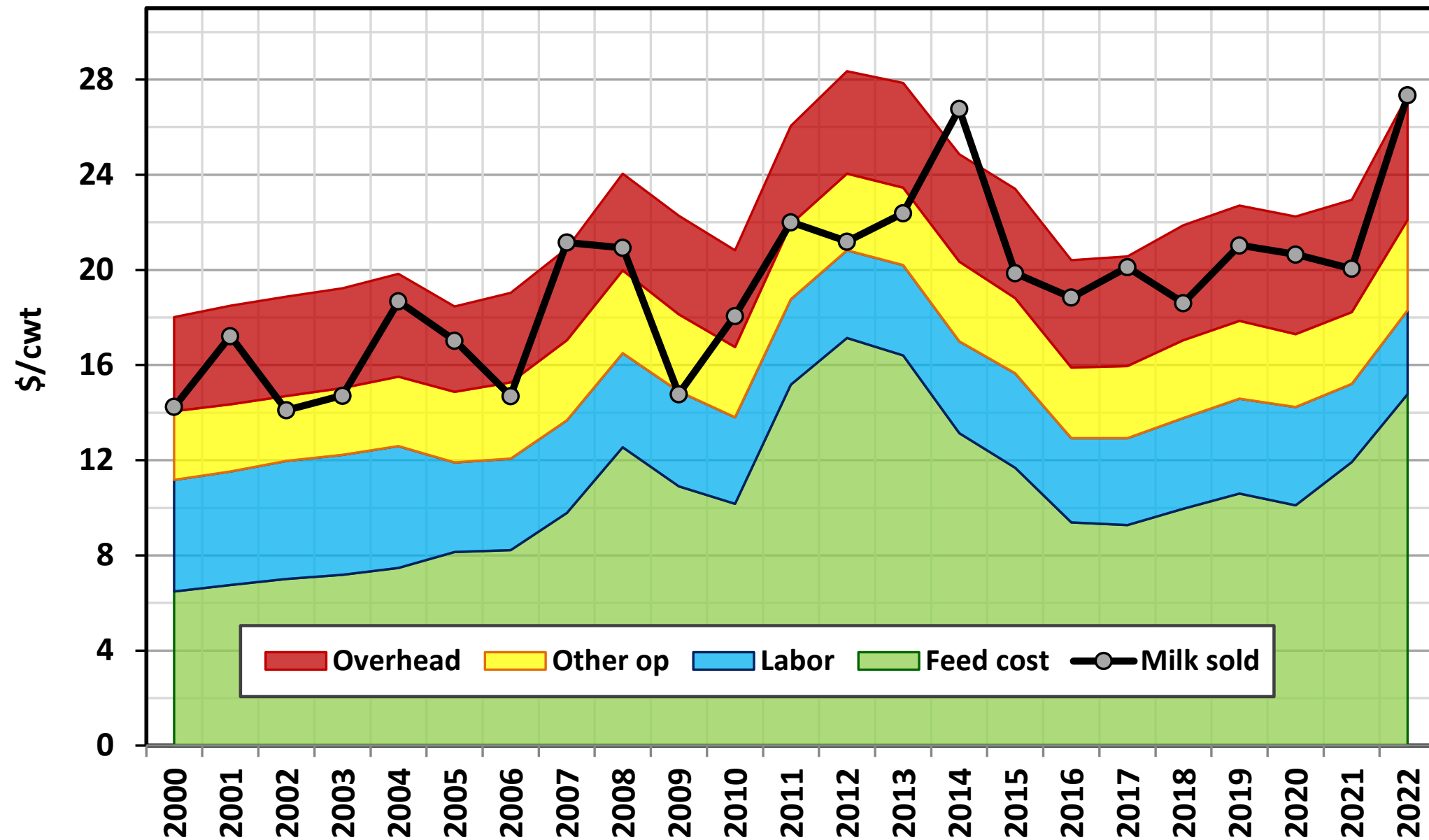
US price basically follows the same pattern as FL price except it is \$3.50 to \$4.00 lower.

## Value of Production and Costs by Region, 2020-2022



Source: USDA ERS Recent Costs and Returns: Milk (<https://www.ers.usda.gov/data-products/commodity-costs-and-returns/commodity-costs-and-returns/>). Accessed 06 Dec 2023.

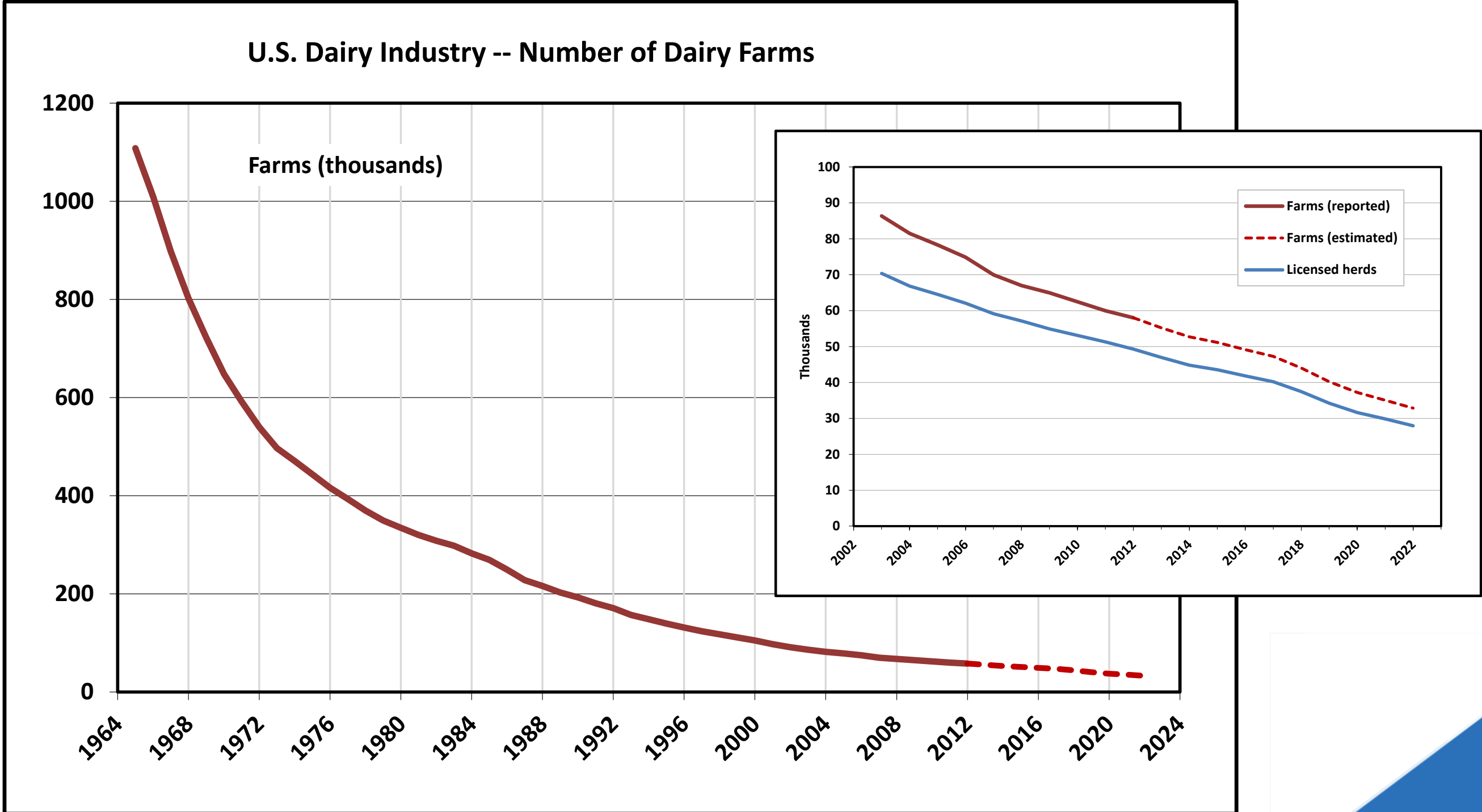
## National Milk Cost of Production Estimate



Milk price seldom covers total economic costs

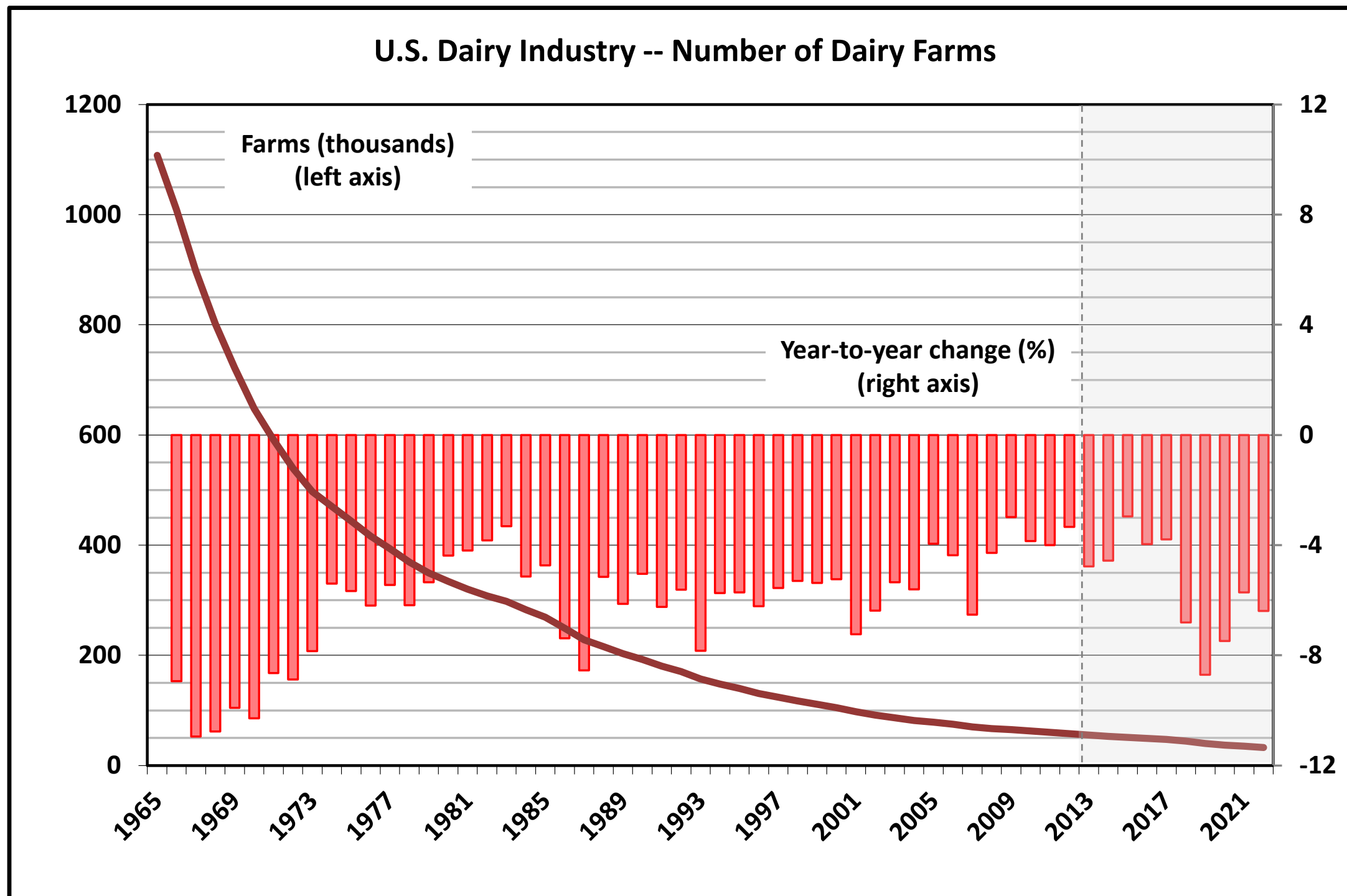
Source: USDA ERS Recent Costs and Returns: Milk (<https://www.ers.usda.gov/data-products/commodity-costs-and-returns/commodity-costs-and-returns/>). Accessed 06 Dec 2023.

# Number of dairies has been declining for long time...



Source: USDA NASS Quick Stats Tool (<http://www.nass.usda.gov/Quick Stats/>). 2013-22 Estimated. Accessed 6 Dec 2023.

# Number of dairies has been declining for long time...



Year-to-year change from 1964-2012 averaged -6.1%. (1964-2022 = -6.0%)

Source: USDA NASS Quick Stats Tool (<http://www.nass.usda.gov/Quick Stats/>). 2013-22 Estimated. Accessed 6 Dec 2023.



## *Examples of historical dairy returns*

# Historical returns to dairy operations

## 2022 Data - Kansas Enterprise Summary

## Kansas Farm Management Association Annual ProfitLink Summary DAIRY COWS

	2017 - 2021					2022				
Number of Farms	11					8				
Number of Cows	189					221				
Pounds of Milk / Cow	23,195.55					25,527.43				
MIK Receipts / Cow	4,101.26					6,513.50				
Gross Income / Cow	4,790.60					7,195.19				
Feed Cost / Cow	2,595.26					3,995.36				
Non-Feed Cost / Cow	2,752.43					3,445.69				
Gross Income / CWT Milk	20.65					28.19				
MIK Price / CWT MIK	17.66					25.52				
Feed Cost / CWT MIK	11.20					15.66				
	Head	Weight	Total \$	\$/CWT MILK	\$/Cow	Head	Weight	Total \$	\$/CWT MILK	\$/Cow
<b>INCOME</b>										
Calves Sold	66	35,808	39,079.14			75	36,936	44,795.04		
Breed Stk Sold	50	66,181	36,910.90			61	64,651	55,649.01		
Ending Inventory	394	386,447	415,244.61			409	409,640	518,481.66		
Gross Sales	533	502,238	\$493,234.65			625	611,429	\$621,925.92		
Calves Purch						0	20	50.00		
Breed Stk Purch	6	5,054	4,792.30			8	10,709	12,939.36		
Beginning Inventory	392	391,165	412,025.94			461	460,971	504,739.51		
Gross Purchases	398	396,249	\$416,818.24			489	491,700	\$517,729.19		
<b>Net Sale Gain</b>	<b>135</b>	<b>105,988</b>	<b>\$76,416.61</b>	<b>\$1.74</b>	<b>\$404.14</b>	<b>136</b>	<b>119,729</b>	<b>\$104,196.73</b>	<b>\$1.65</b>	<b>\$472.28</b>
Milk Sales			775,486.18					1,437,040.05		
Patronage Refunds			5,149.12					6,466.27		
Government Payments			45,260.30					35,932.37		
Miscellaneous Income			3,536.65					4,183.29		
Livestock Futures			-21.04							
<b>Total Other Income</b>			<b>\$829,413.21</b>	<b>18.91</b>	<b>4,366.46</b>			<b>\$1,483,241.98</b>	<b>26.34</b>	<b>6,722.91</b>
<b>GROSS INCOME</b>			<b>\$905,829.82</b>	<b>\$20.65</b>	<b>\$4,790.60</b>			<b>\$1,587,438.71</b>	<b>\$28.19</b>	<b>\$7,195.19</b>
<b>EXPENSE</b>										
Labor Hired			61,163.29	1.65	429.35			127,477.12	2.26	577.00
General Machinery Repairs			43,900.57	1.00	232.60			76,369.66	1.39	355.22
Interest Paid			17,125.71	0.39	90.57			14,432.64	0.26	65.42
Gas, Fuel, Oil			20,120.77	0.46	106.41			43,262.67	0.77	196.09
Auto Expense			107.13	0.00	0.57			410.24	0.01	1.86
Fees, Publications, Travel			4,629.09	0.11	24.46			5,972.06	0.16	40.67
Personal Property Tax			1,329.95	0.03	7.03			1,555.06	0.03	7.05
General Farm Insurance			11,469.92	0.26	60.66			19,956.97	0.35	90.19
Utilities			22,966.71	0.52	121.56			31,323.03	0.56	141.97
Indirect Expenses			\$202,935.73	4.63	1,073.25			\$325,701.71	5.78	1,476.27
Feed			487,036.09	11.10	2,675.77			875,505.99	15.55	3,966.30
Pasture			4,256.15	0.10	22.51			6,631.88	0.12	30.00
Dairy Expense			60,512.08	1.52	351.76			82,120.96	1.46	372.25
Machine Hire - Lease			6,680.14	0.15	35.33			5,325.59	0.09	24.14
Vet Medicine/Drugs			30,730.60	0.70	162.52			41,644.52	0.74	186.76
Misc Livestock Expense			20,400.61	0.47	107.89			35,112.16	0.62	159.15
Cash Building Rent			65.61	0.00	0.35			125.00	0.00	0.57
Direct Expenses			\$615,683.68	14.04	3,256.13			\$1,046,472.40	18.58	4,743.22
<b>Total Variable Costs</b>			<b>\$816,619.41</b>	<b>16.66</b>	<b>4,329.36</b>			<b>\$1,372,174.12</b>	<b>24.36</b>	<b>6,219.49</b>
Return Above Variable Costs			\$87,210.41	\$1.99	\$401.22			\$215,264.60	\$3.82	\$975.70
Depreciation			46,025.36	1.09	253.99			75,676.74	1.34	343.01
Real Estate Tax			1,662.54	0.04	9.96			4,265.50	0.08	19.33
Unpaid Operator Labor			96,325.59	2.20	509.43			114,031.20	2.02	516.66
Interest Charge *			46,864.41	1.07	247.95			76,195.00	1.35	345.36
<b>Total Fixed Costs</b>			<b>\$193,117.92</b>	<b>4.40</b>	<b>1,021.33</b>			<b>\$270,166.44</b>	<b>4.80</b>	<b>1,224.56</b>
<b>TOTAL EXPENSE</b>			<b>\$1,011,737.33</b>	<b>\$23.07</b>	<b>\$5,350.71</b>			<b>\$1,642,340.56</b>	<b>\$29.16</b>	<b>\$7,444.05</b>
<b>NET RETURN TO MANAGEMENT</b>			<b>(\$105,907.51)</b>	<b>(\$2.41)</b>	<b>(\$500.11)</b>			<b>(\$54,903.85)</b>	<b>(\$0.97)</b>	<b>(\$248.86)</b>
<b>NET RETURN TO LABOR-MANAGEMENT</b>			<b>\$71,661.37</b>	<b>\$1.63</b>	<b>\$378.67</b>			<b>\$186,604.47</b>	<b>\$3.31</b>	<b>\$845.80</b>
<b>FACTORS</b>										
Feed Cost			481,294.24	11.20	2,595.26			862,137.66	15.66	3,966.36
Non-Feed Cost			520,443.09	11.87	2,752.43			760,204.70	13.50	3,445.69

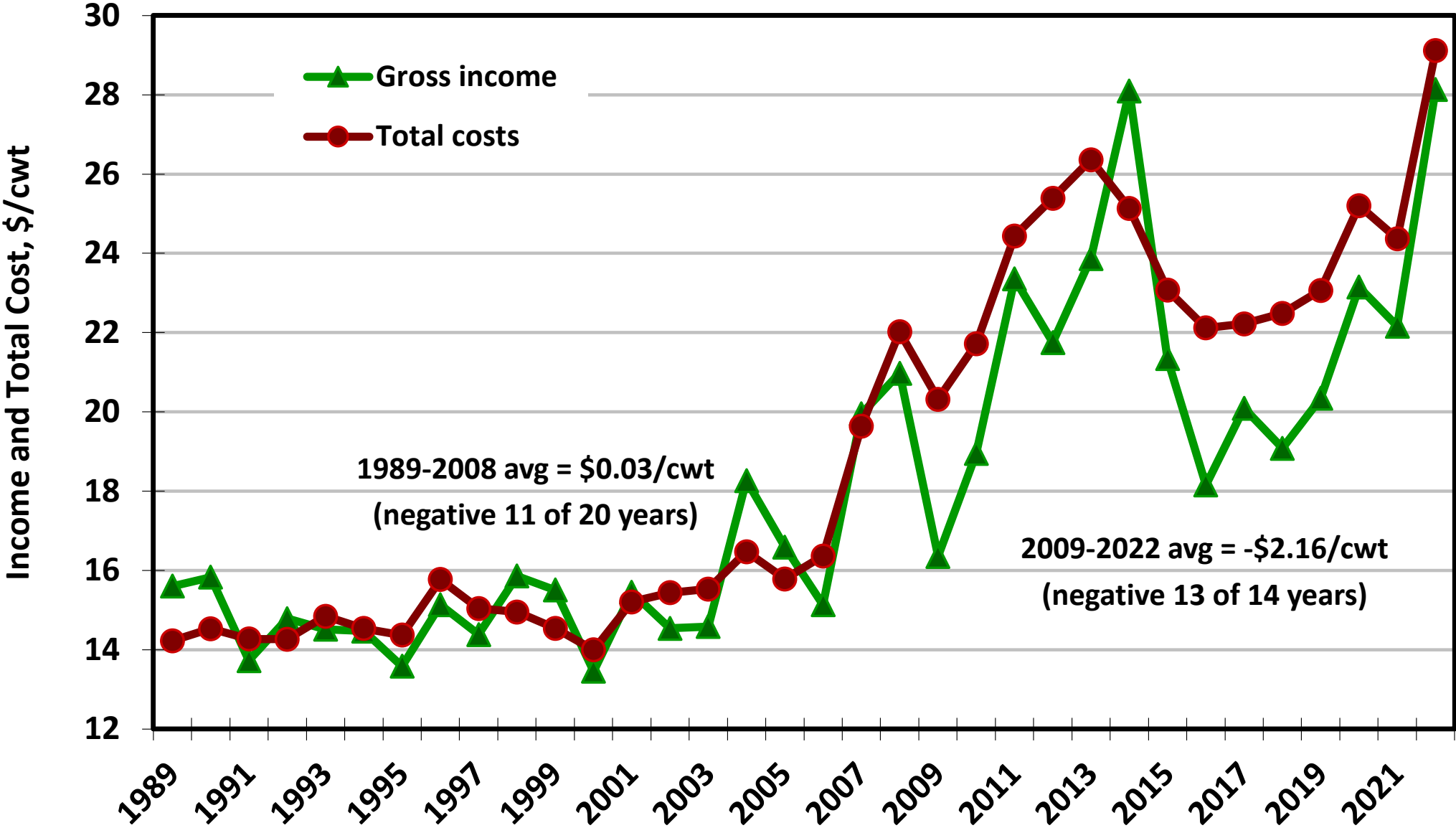
\* Interest charge represents computed interest on gross purchases, variable costs, machinery, and buildings minus cash interest paid

Annual Dairy Enterprise Reports covering the years 1989 to 2022.

Reports from 1995-2022 are available at <https://www.agmanager.info/kfma/kfma-enterprise-reports>

# Dairy Income and Cost of Production

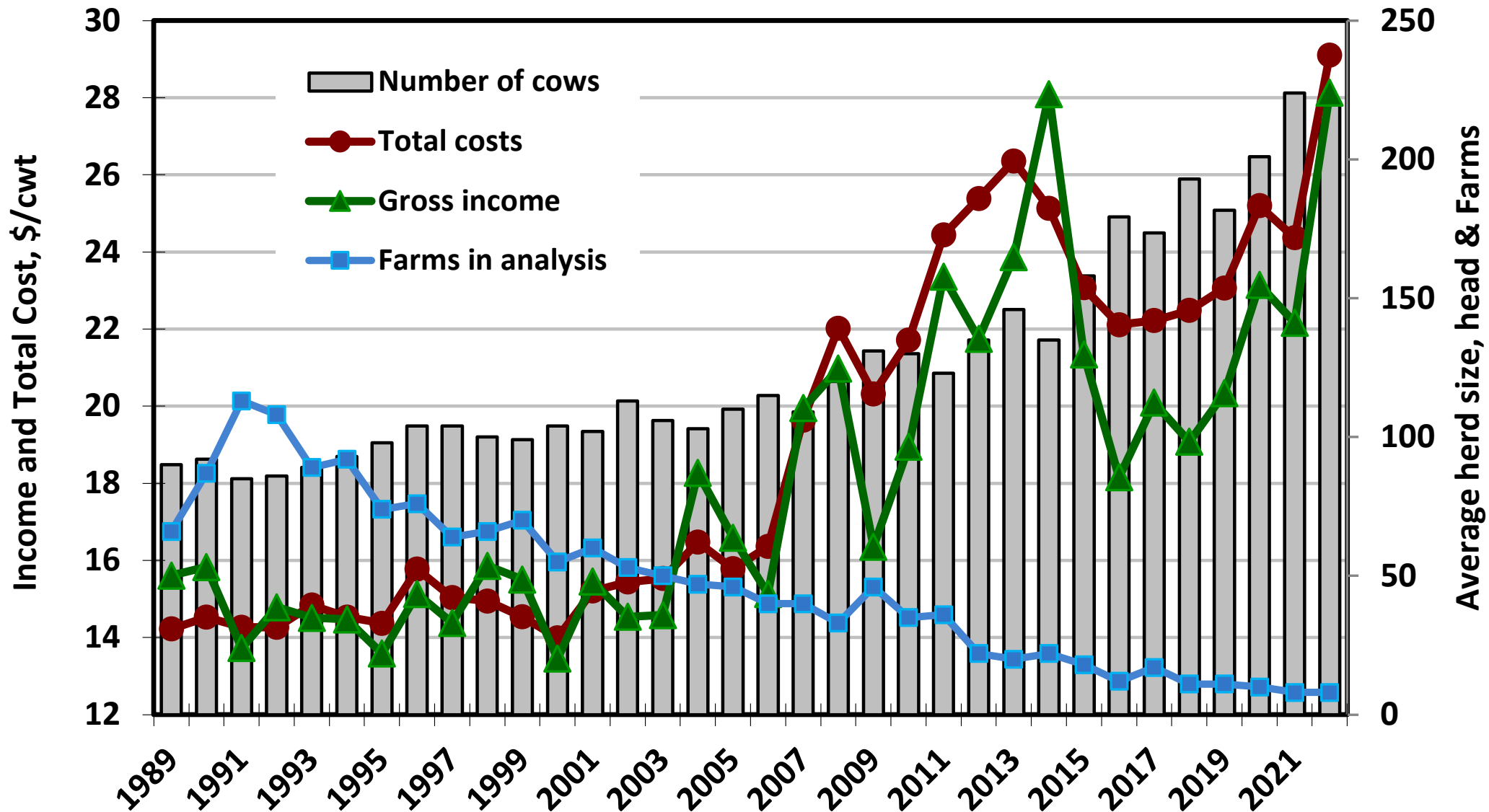
Source: KFMA Dairy Enterprise Report



Kansas Farm Management Association (KFMA) Enterprise Summaries for years 1995-2022 available at <http://agmanager.info/kfma>. Accessed 12-18-2023.

# Dairy Income and Cost of Production

Source: KFMA Dairy Enterprise Report



Kansas Farm Management Association (KFMA) Enterprise Summaries for years 1995-2022 available at <http://agmanager.info/kfma>. Accessed 12-18-2023.



# Historical returns to dairy operations

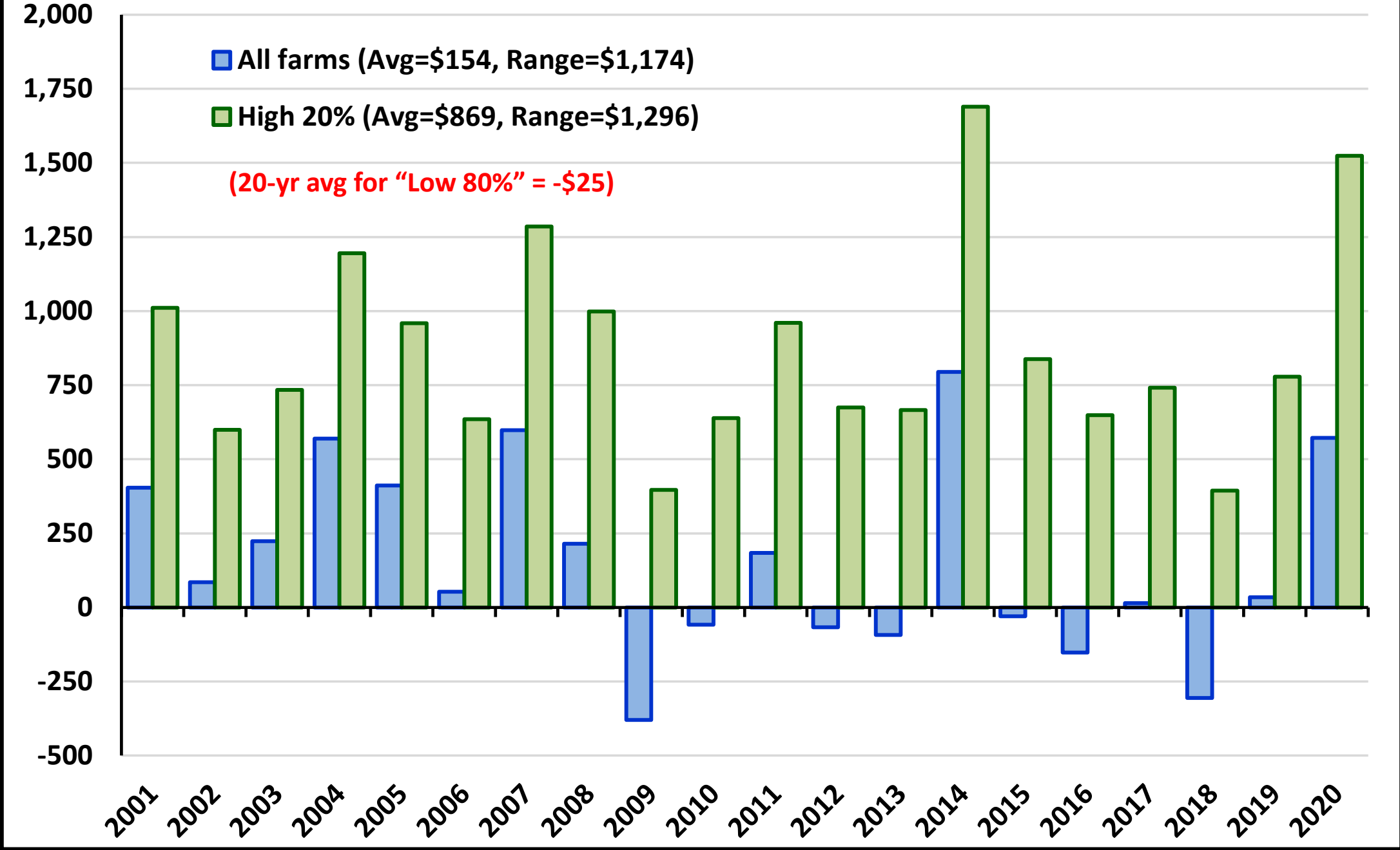
The screenshot shows a web browser window with the URL <https://finbin.umn.edu/LvBenchOpts/LvBenchIndex>. The page features the FINBIN logo and navigation links: Getting Started, About FINBIN, About the Data, and Contact. On the left, there are two sections of buttons: 'Generate a Summary Report' with 'WHOLE FARM', 'CROP', and 'LIVESTOCK' buttons; and 'Generate a Benchmark Report' with 'WHOLE FARM', 'CROP', and 'LIVESTOCK' buttons. Below these is a 'Compare Your Farm' section with a 'FINANCIAL RATIOS' button. The main content area is titled 'LIVESTOCK Benchmark Report' and contains the following fields:

- Livestock Enterprise: Dairy
- Livestock Unit: Cow
- Location: All States
- Group: Southwest Minnesota Farm Business Management Association, Mn State College & University South, Mn State College & University North, Mn State College & University Red River Valley, Wisconsin Technical College System
- Filters:
  - Year(s): 2020
  - Profitability Groups: All Levels
  - Profitability Measure: Net Return
  - Enterprise Size: (Cow): All Levels
  - Special Sort Items to Include: None Selected
  - Special Sort Items to Exclude: None Selected
  - Show All Expenses in Report:

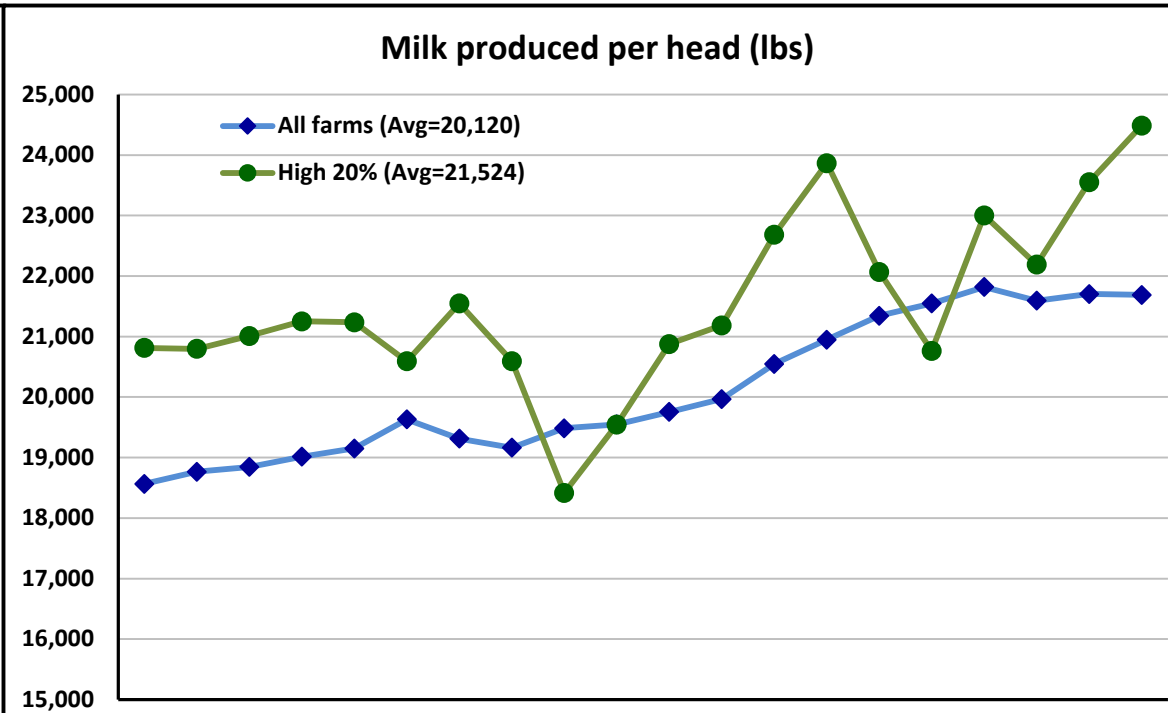
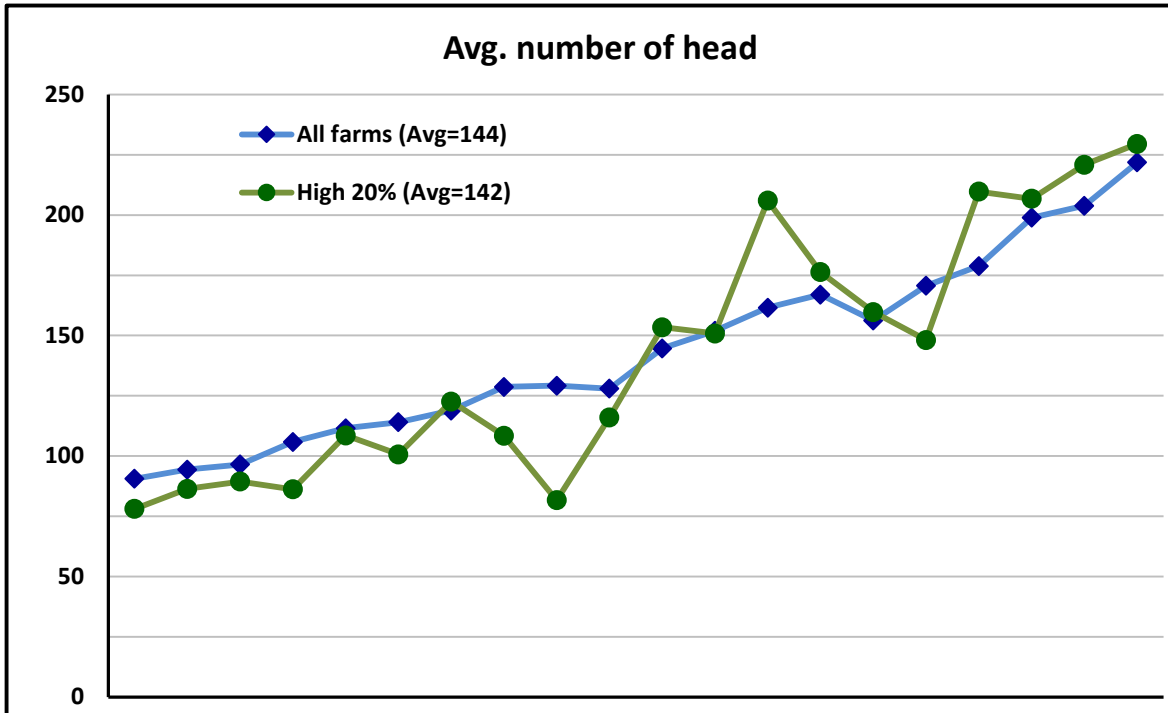
At the bottom of the form are 'Reset Form' and 'Generate Report' buttons.

Benchmark reports for Dairy from 1999-2020 by profitability group (MN and WI dairies).  
High 20% vs All (by year)

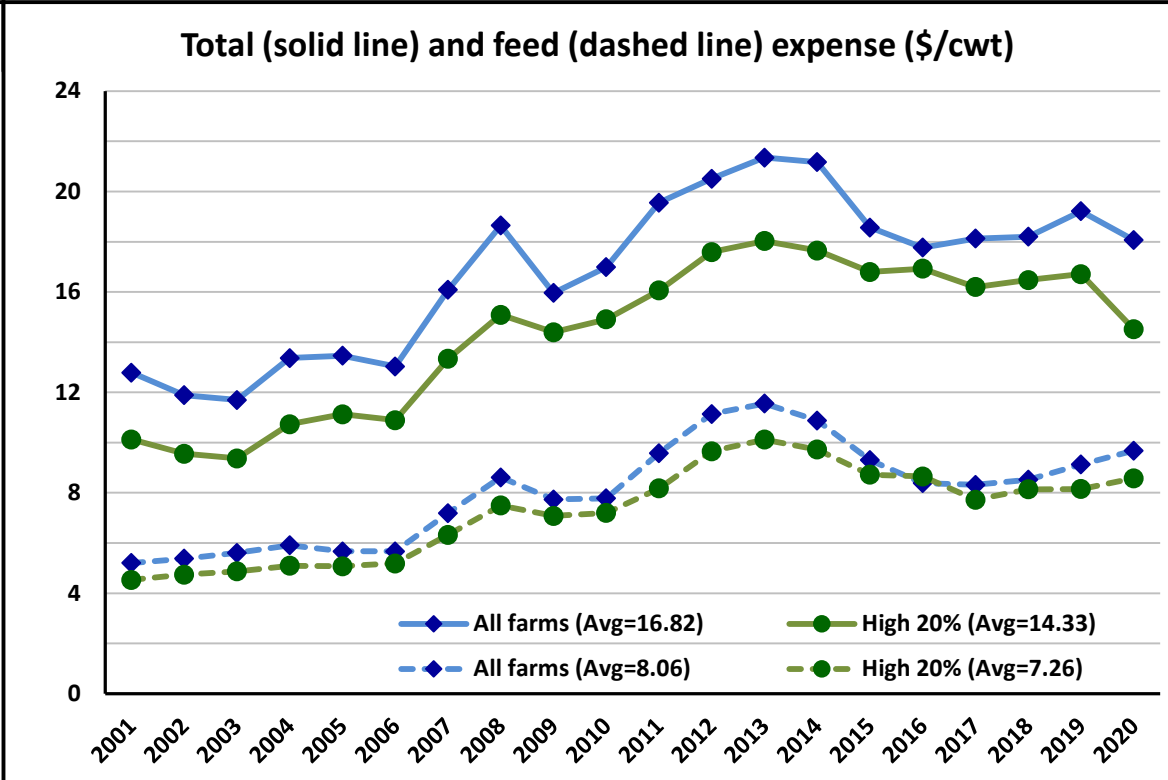
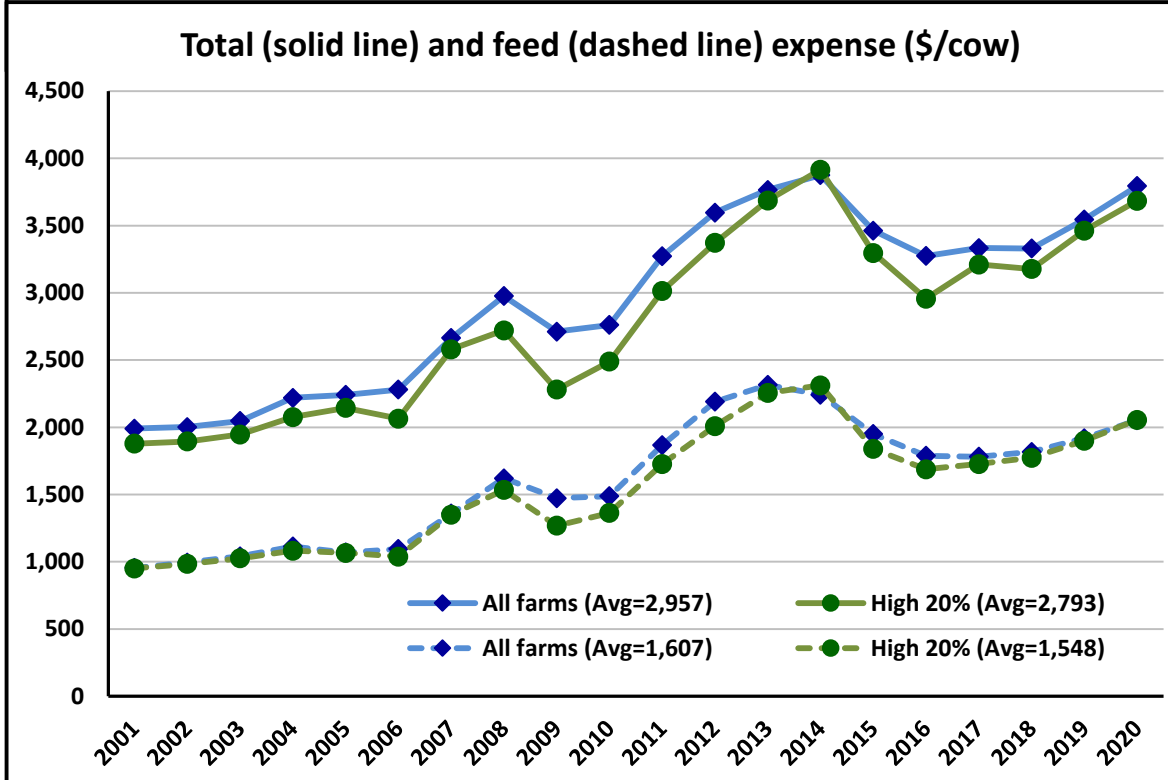
### Net return over labor & mgmt (\$/cow/yr)



Source: FINBIN Livestock Benchmark Report for Dairy (Cow); MN and WI Groups, Years 1999-2020, Various Profitability Groups. <https://finbin.umn.edu/LvBenchOpts/LvBenchIndex> accessed 12/23/21.



Dairies in Top 20% are similar size, considerably more productive and have lower costs per cow and per/cwt.



Source: FINBIN Livestock Benchmark Report for Dairy (Cow); MN and WI Groups, Years 1999-2020, Various Profitability Groups. <https://finbin.umn.edu/LvBenchOpts/LvBenchIndex> accessed 12/23/21.



# Historical returns to dairy operations

**Nietzke & Faupel, PC**  
Certified Public Accountants

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## Dairy Advantage Accounting and Benchmarks

*How does your dairy operation compare to the most profitable? What 2 or 3 things should you focus on to maximize the results of your hard work? Dairy Advantage Reports show the action plan.*

**WE LOVE COWS!** ... and we love helping dairy operations find the right things to work on to make their cows happier and more productive.


**Dairy Advantage Accounting Services** measure key performance areas of your dairy operation and compare each indicator to more than 50 other dairy operations with a combined total of more than 100,000 cows.

**QuickBooks Accounting Software** with our customized setup for dairy operations provides flexibility to do as little or as much accounting in house as desired. Training and help is a phone call away. Most dairy operations handle the day to day transactions, but prefer to have their accountants do the period end adjustments and create specialized accrual financial statements that show the "real story". These are numbers you can count on!

**Your Dairy Advantage Team works for you.** They gather the information needed and crunch the numbers. Monthly or quarterly services take care of tax and payroll filings, payroll services if needed, and financial statements. These are the core services that give you the Dairy Advantage.

**Dairy Averages Reports - turn into your action plans.** You'll compare your numbers to more than 100,000 cows from more than 50 operations. You'll understand what specific areas to focus on to build your operation. Comparative graphs and a milk 100 cwt schedule provide information you can count on to make strategy decisions. Compare your costs to others in the detailed cost analysis report. Our reports are concise, practical and useful.

**Let's talk** about what your dairy operation needs to make those cows happier and producing more milk!

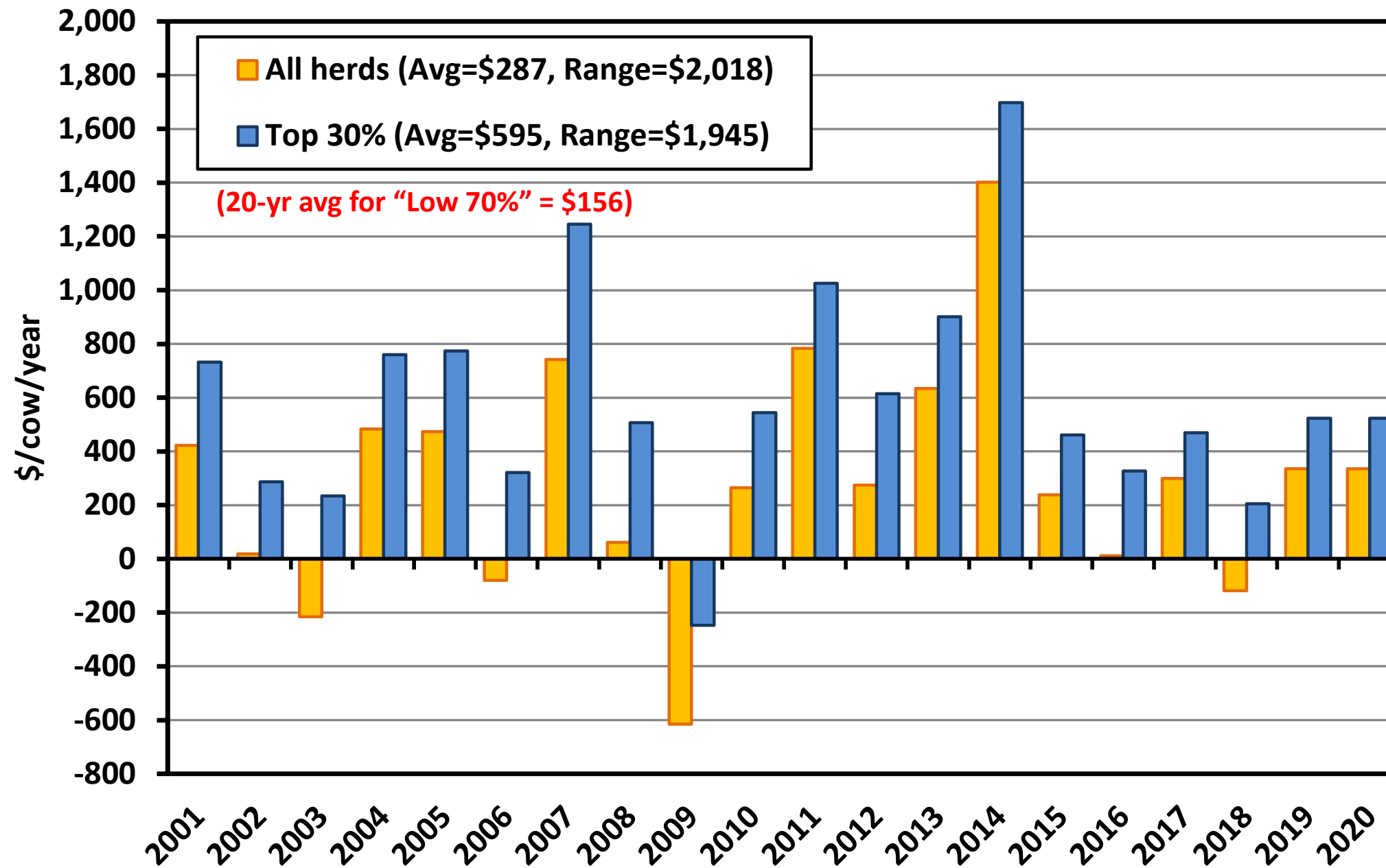


Annual reports covering  
years 2001-2020

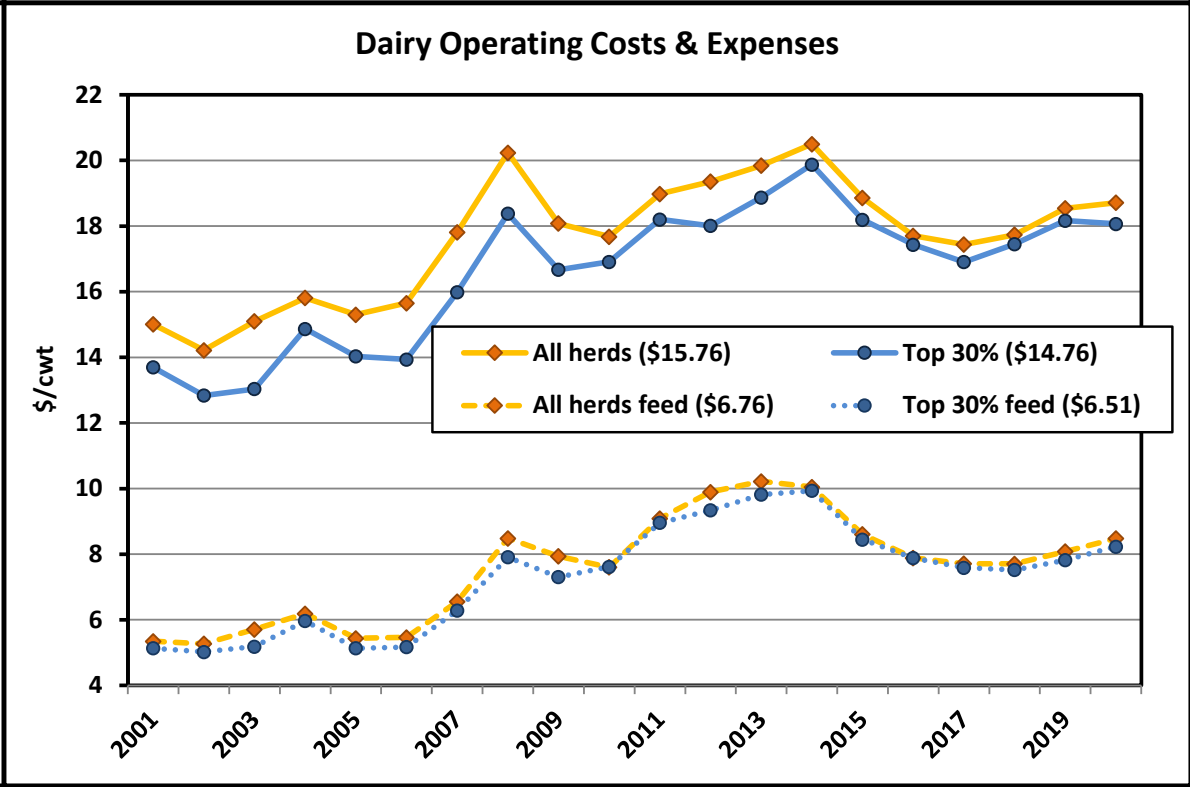
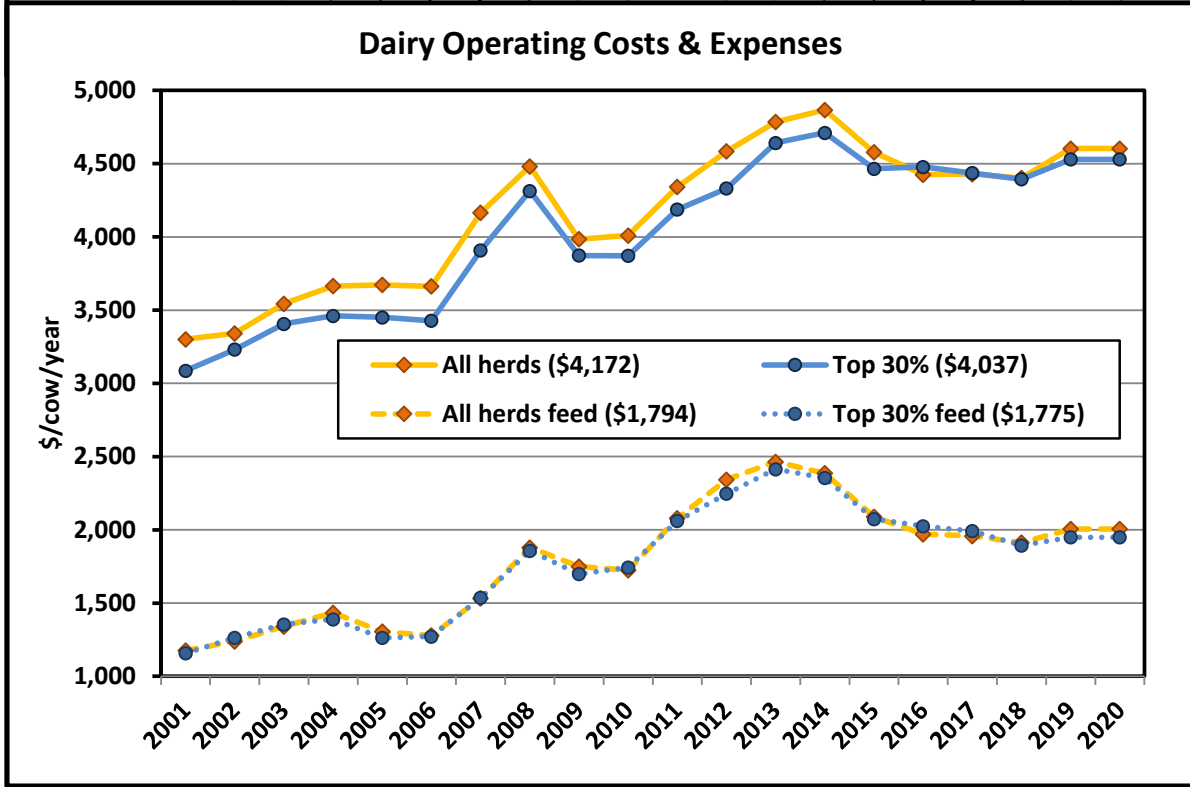
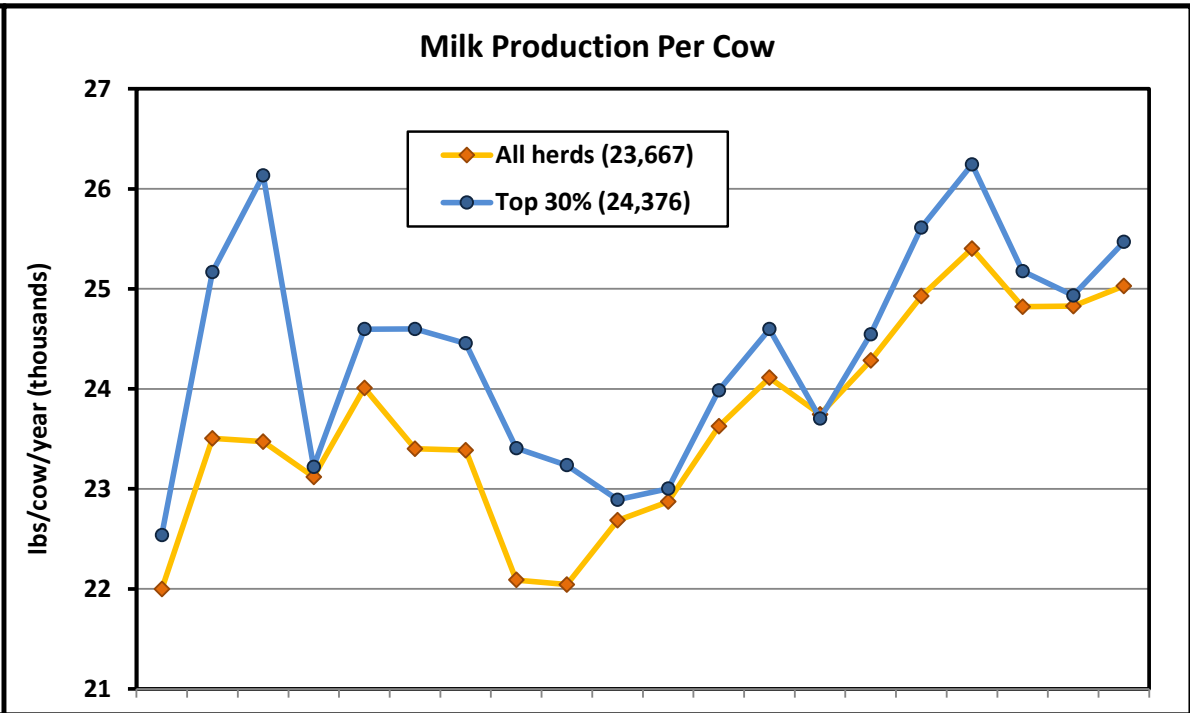
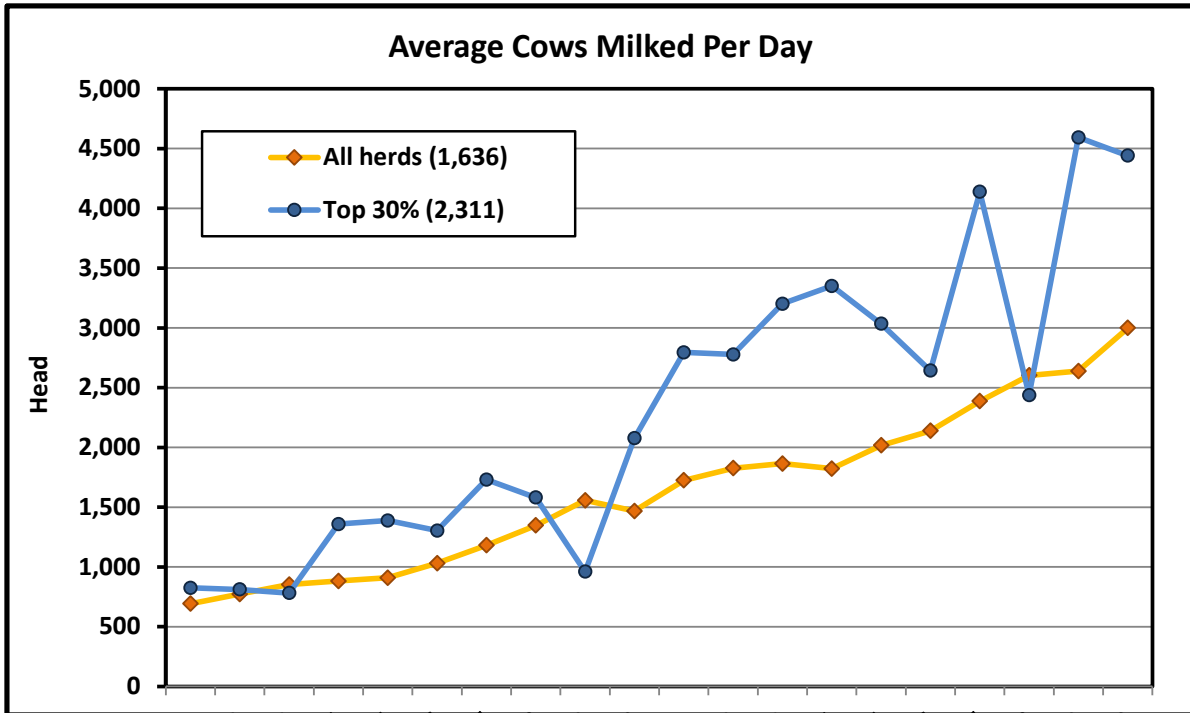
Top 30% vs Average  
(by year)



## Dairy Net Income



Source: Nietzke & Faupel, P.C.



Dairies in Top 30% are larger, more productive and generally have lower costs per cow and per cwt.

# Profitability drivers

TABLE 1		Difference from overall average by profitability group		
		High 40% profit minus overall avg <sup>a</sup>	Middle 20% profit minus overall avg <sup>a</sup>	Low 40% profit minus overall avg <sup>a</sup>
<b>Difference from overall average, AgFA Database<sup>b</sup></b>				
Price	[ +1.12 ]	0.64	-0.32	-0.48
Cost per cow per year	[ -20 ]	31	-159	51
Production, lbs/cow/year	[ +3,863 ]	1,881	209	-1,982
Cost of production per cwt	[ -3.29 ]	-1.35	-1.17	1.94
<b>Difference from overall average, FINBIN Database<sup>c</sup></b>				
Price	[ +0.33 ]	0.16	-0.02	-0.17
Cost per cow per year	[ +410 ]	151	136	-259
Production, lbs/cow/year	[ +3,195 ]	1,363	566	-1,832
Cost of production per cwt	[ -1.50 ]	-0.69	0.02	0.81

UW

UM

Two data sets (UW and UM), two time periods (2014-2018 and 2018-2022), and two profit metrics (ROA and net return)

➔ High profit farms:

1. receive higher price
2. have *higher* cost/cow/year
3. are more productive
4. have significantly lower cost per cwt of milk

Profit-reducing differences highlighted in red.

<sup>a</sup> Overall average refers to the average of all farms in the database including the high-profit farms.

<sup>b</sup> University of Wisconsin's Center for Dairy Profitability's AgFA database of 178 farms for years 2014-2018, profit groups based on Return on Assets.

<sup>c</sup> University of Minnesota's Center for Farm Financial Management's FINBIN database of 140 farms for years 2018-2022, and profit groups based on net return.

Source: Kevin Bernhardt, "Back to school on costs of production" August 8, 2023

<https://www.agproud.com/articles/57791-back-to-school-on-costs-of-production>

# Profitability drivers – Purchased vs home-raised feeds

TABLE 1		A summary of 143 Pennsylvania dairy farms from 2016-2021				
		Profitability Group				
2016-101 (N=143)	Average	Low 20%	20%-40%	40%-60%	60%-80%	High 20%
Gross margin	\$4,976	\$4,733	\$4,530	\$4,971	\$5,233	\$5,521
Milk price	\$18.11	\$17.45	\$17.44	\$18.64	\$18.32	\$18.57
Feed cost/cwt	\$9.67	\$10.92	\$9.64	\$9.15	\$9.35	\$9.27
Milk-feed margin	\$8.44	\$6.53	\$7.80	\$9.49	\$8.97	\$8.30
COP with labor and management	\$19.22	\$21.46	\$20.04	\$19.52	\$17.87	\$16.33
Milk produced per cow	24,902	25,091	23,642	24,928	25,443	25,328
Milk-feed margin						
Purchased feed	\$1,535	\$1,650	\$1,273	\$1,551	\$1,619	\$1,526
% of total feed cost	63.7%	60.2%	55.9%	68.0%	68.1%	65.0%
Home-raised feed	\$874	\$1,089	\$1,006	\$730	\$759	\$821
% of total feed cost	36.3%	39.8%	44.1%	32.0%	31.9%	35.0%
Total feed cost	\$2,409	\$2,739	\$2,279	\$2,281	\$2,378	\$2,347
Feed (% of gross margin)	48.4%	57.9%	50.3%	45.9%	45.4%	42.5%

In this sample of dairies, operations with a **higher percent of home-raised feed were less profitable** compared to those that purchased a higher percentage of their total feed.

Rather than whether feed was home-raised or purchased, what likely is more critical is how efficiently feed is converted to milk.

Farms sorted by net return

Source: FINBIN (2023) Center for Farm Financial Management: University of Minnesota. Retrieved from <http://finbin.umn.edu> (originally created September 21, 2023)

Source: Cassie Yost and Tim Beck, "Purchased and home-raised feeds: Where are we losing the most profit for the dairy?" Dec 4, 2023 <https://www.agproud.com/articles/58632>

# Where does the dairy make its money?



## General statements based on the data



- Big differences in profit between top group and average (similar variability across groups)
- Lower costs through more efficient use of fixed resources (i.e., both more cows and milk/cow) (avg diff in \$/cow = -3.5% and avg diff in \$/cwt = -8.4%)
- Feed cost *per cow* is not necessarily a good indicator (avg difference in feed/cow = -1.5%, but avg difference in feed/cwt = -5.8%)
- Herd replacement costs or cull rate is not a very good indicator of profitability



# There is a lot of variation in the cost of raising heifers

August 2020 E.B 2020-08

## Dairy Replacement Program: Cost & Analysis Summer 2019

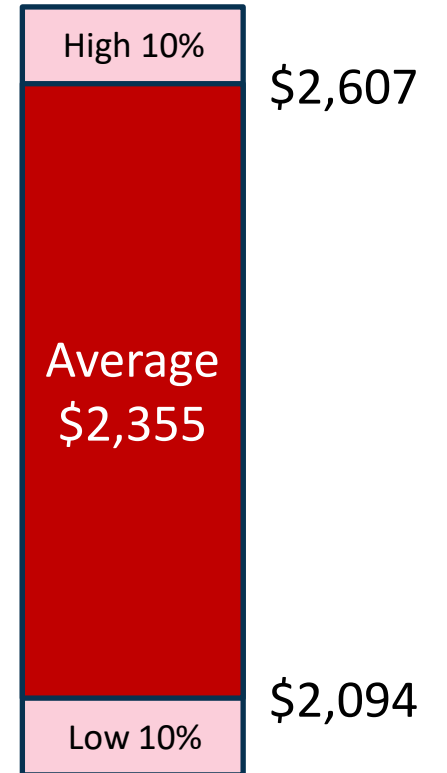
**Jason Karszes**  
**Lauren Hill**

PRO-DAIRY  
Charles H. Dyson School of Applied Economics & Management  
Department of Animal Science  
College of Agricultural & Life Sciences  
Cornell University

**Table 1. TOTAL COSTS TO RAISE HEIFERS**

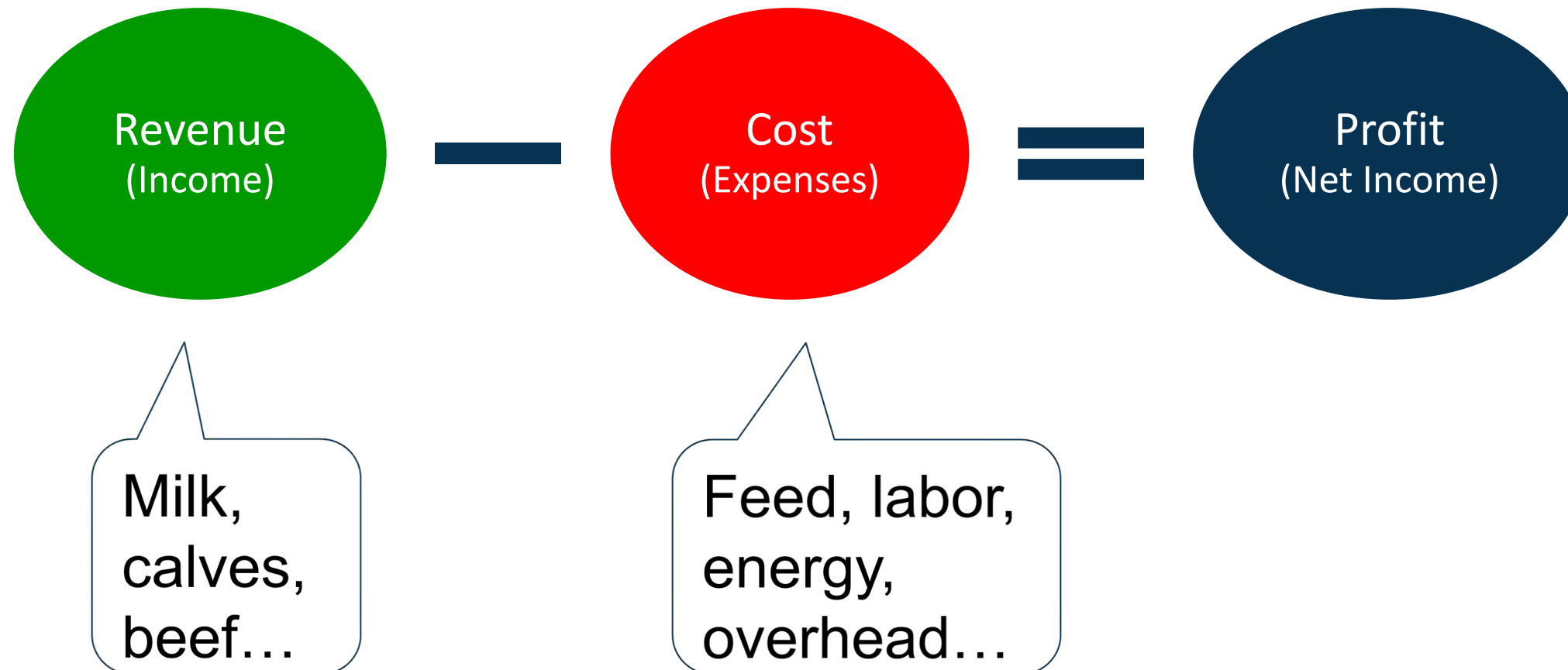
(26 Northeast Dairy Farms, Summer 2019)

Total Cost per Animal Completing	Average	Percent of Total	80 <sup>th</sup> Percentile Range (middle 80% of farms)		Range
Feed Total	\$1,088	46.2%	\$846	\$1,314	\$468
Labor	311	13.2%	233	421	188
Bedding	94	4.0%	51	144	93
Health	50	2.1%	29	64	35
Breeding	45	1.9%	33	59	26
Maternity pen	18	0.8%	11	26	15
Trucking	1	0.1%	0	0	0
Insurance	4	0.2%	0	6	6
Machinery (own & op)	77	3.2%	42	111	69
Building (own & op)	162	6.9%	98	228	130
Manure storage (own & op)	6	0.3%	0	13	13
Manure spreading	62	2.6%	28	90	62
Custom boarding	146	6.2%	0	354	354
Professional services and fees	18	0.8%	0	30	30
Non-performance expenses	122	5.2%	76	155	79
Interest on daily investment	152	6.4%	137	165	28
<b>Total</b>	<b>\$2,355</b>		<b>\$2,094</b>	<b>\$2,607</b>	<b>\$513</b>
Number of heifers	969		203	1,395	1,192
Age, months	22.5		21.8	23.3	1.5
Calving weight, pounds	1,340		1,262	1,417	155
Average daily gain	1.87		1.73	1.99	0.26
All heifers per labor hour	36.0		21.7	51.1	29.4
Pre-weaned heifers/labor hour	11.4		7.3	13.9	6.6
Post-weaned heifers/labor hour	56.9		30.3	78.2	47.9
Total investment in animal	\$2,505		\$2,244	\$2,757	\$513
% Non-completion rate	14.8		9.9	22.1	12.2
Cost per worker	\$50,797		\$42,208	\$57,139	\$14,931



# Profit (simplified)

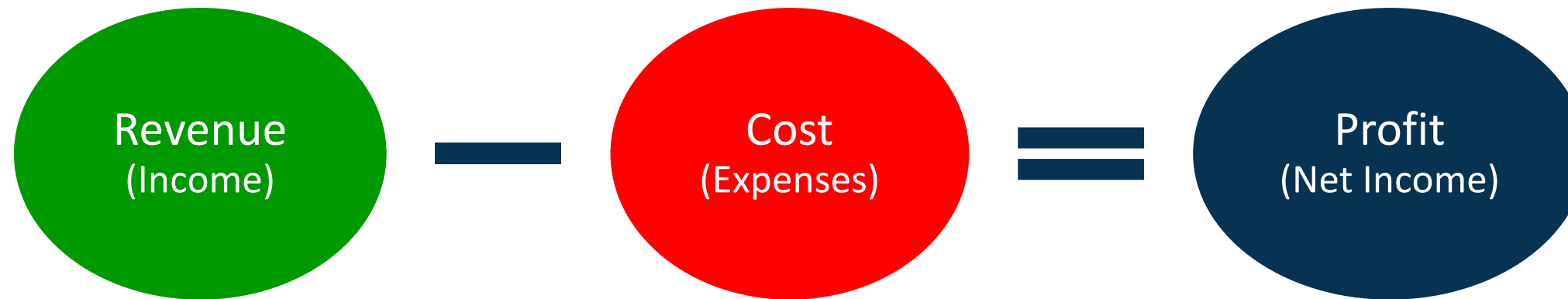
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We typically assume that the goal of the operation is profit maximization.

# Profit (simplified)

---



If we want to increase profit, how is that accomplished?

- 1) Increase revenue (↑) and/or decrease cost (↓)
- 2) Increase revenue (↑↑) by more than cost increase (↑)
- 3) Decrease revenue (↓) by less than cost decrease (↓↓)

These changes (increases or decreases) are referred to as “marginal” or “incremental” changes.

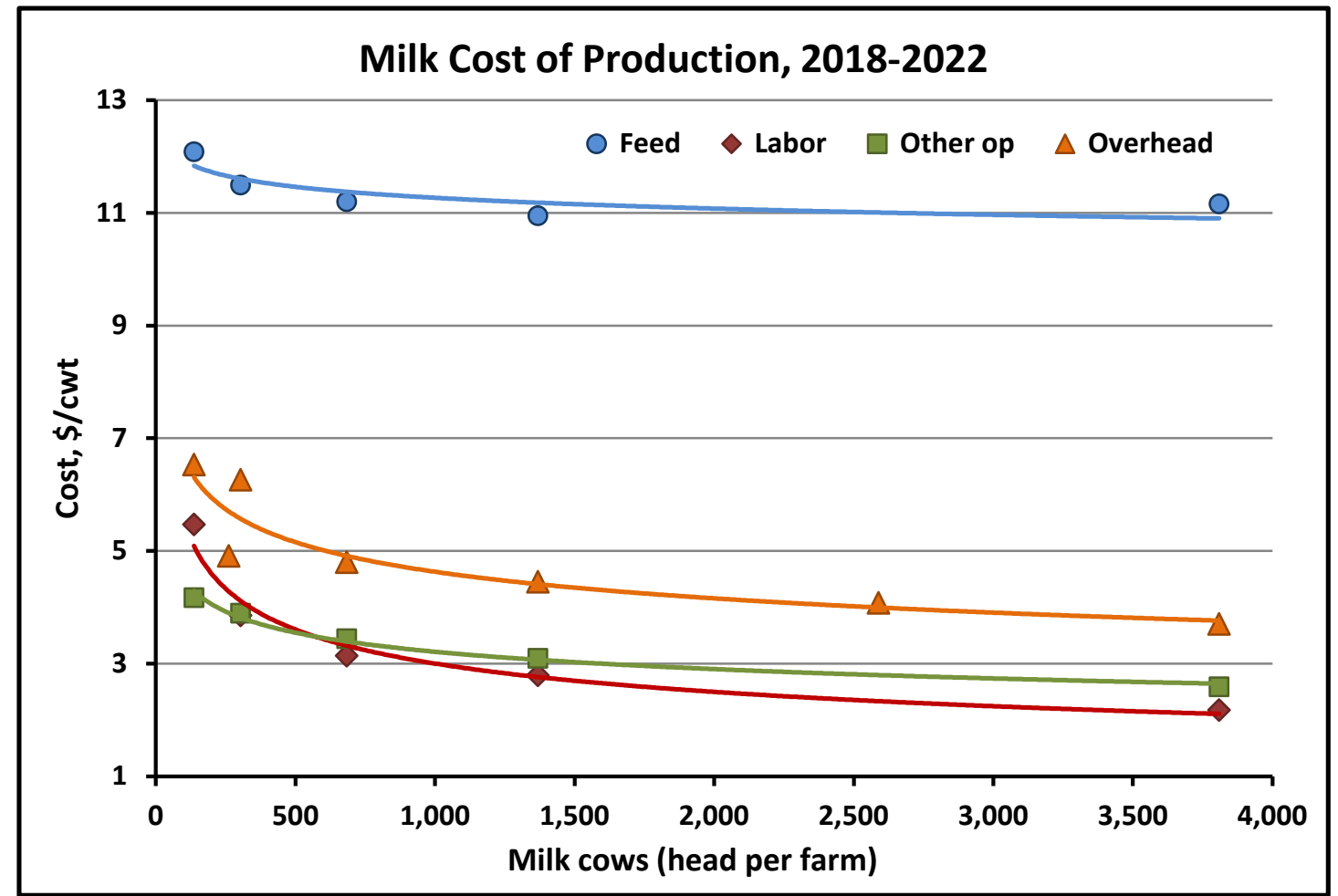
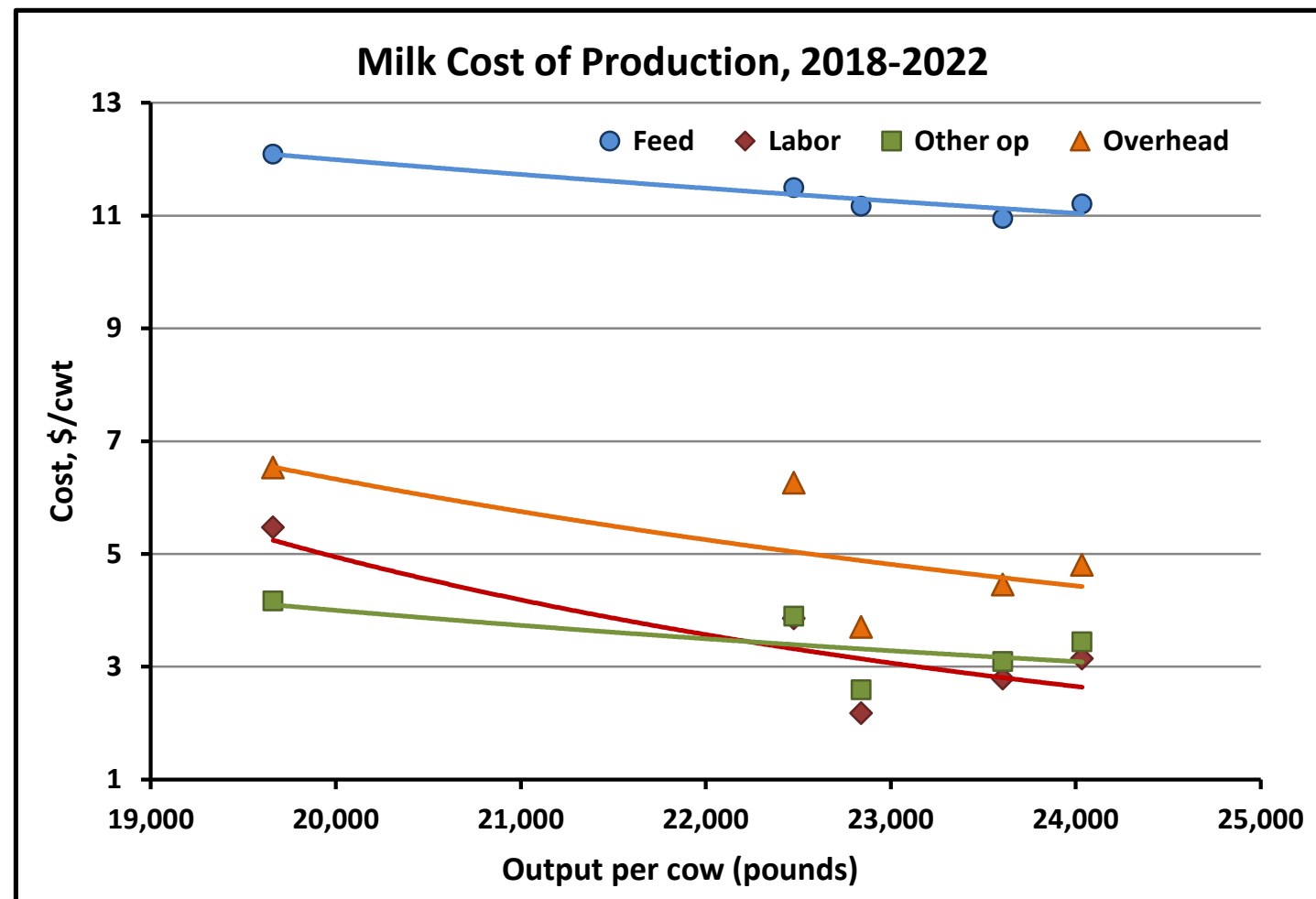


# Incremental (more) milk

---

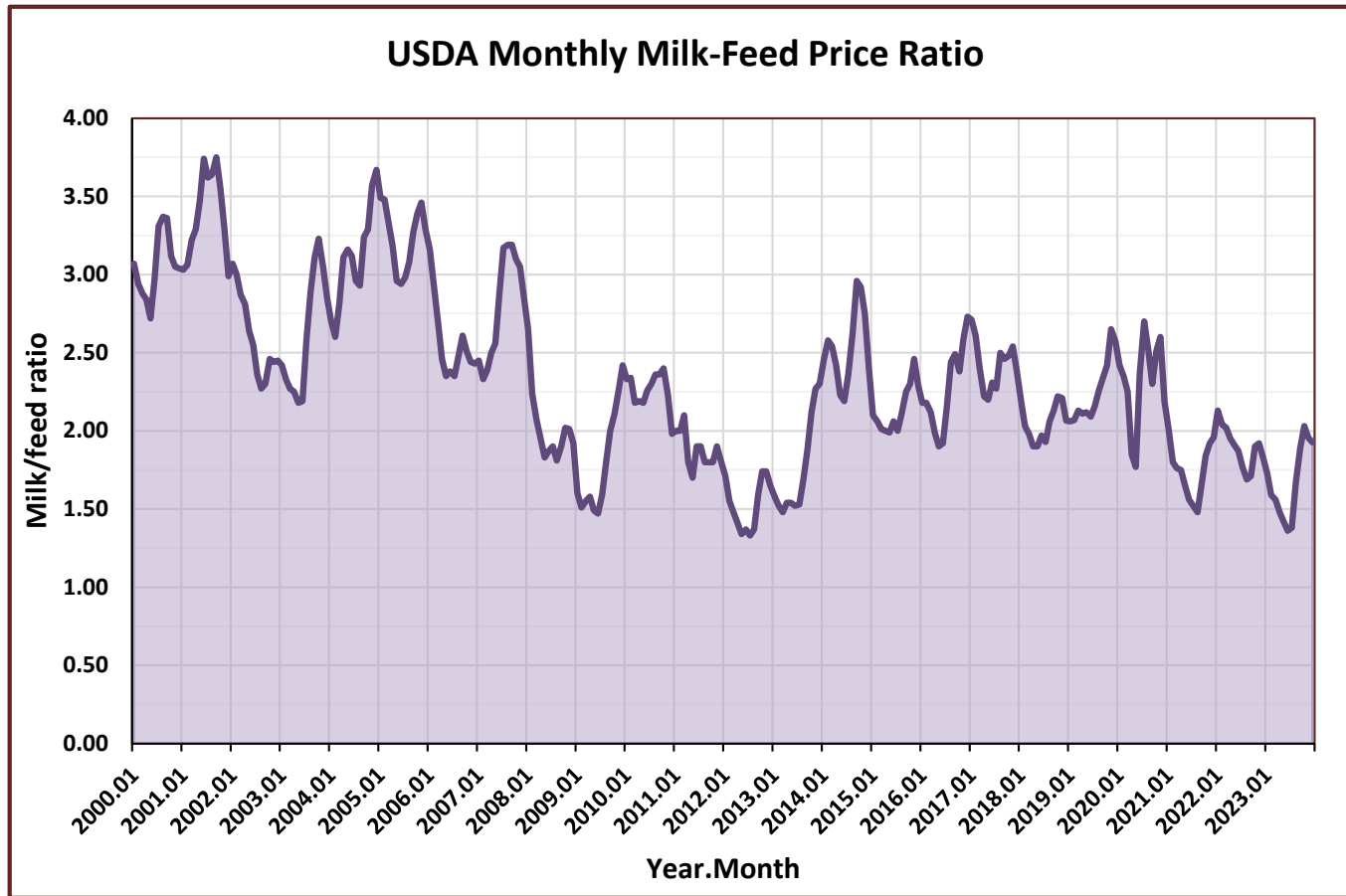
- Producing incremental (more) milk is typically a profitable decision for the individual dairy (not necessarily for the industry)
- Why?
  - Because in general, the value of the milk surpasses the incremental (marginal) cost
- How is this done?
  - 1) Adding cows
  - 2) Increasing the production from each existing cow
- Which is more beneficial?  
(answer varies depending upon dairy's constraints)

# Milk Cost of Production (\$/cwt), 2018-2020 – Excludes herds with < 100 cows

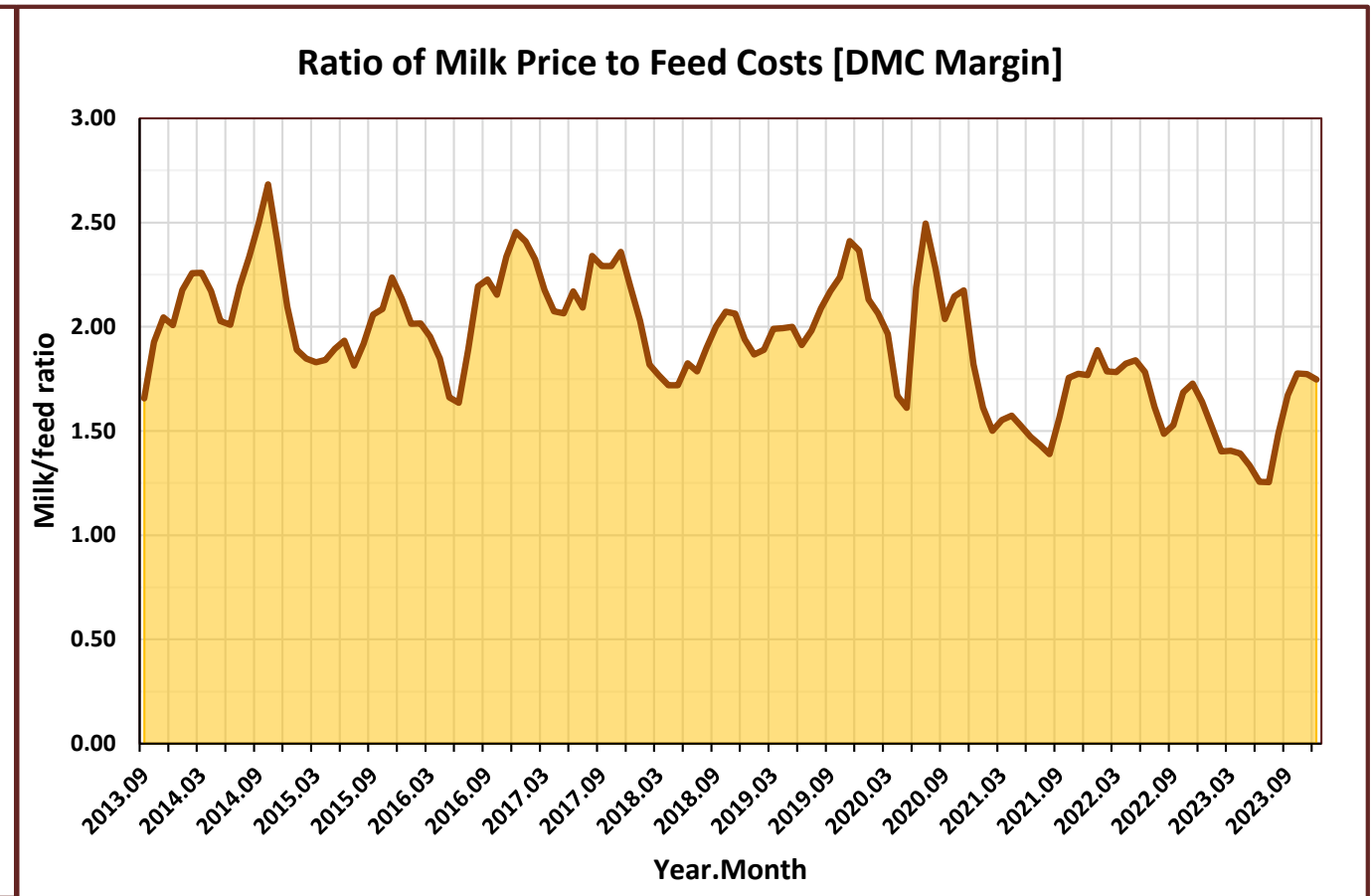


There is a strong negative relationship between costs of production with both output per cow and farm size – relationship is more linear with output per cow. Larger farms have advantage of spreading fixed costs over more cows and they generally have higher output per cow further diluting their costs of production.

# Milk-to-feed ratios (indicator of income over feed costs)



Source: USDA NASS Quick Stats  
<https://quickstats.nass.usda.gov/> Accessed 11 Dec 2023.



Source: USDA Farm Service Agency (FSA)  
<https://www.fsa.usda.gov/programs-and-services/Dairy-MPP/index>  
Accessed 11 Dec 2023.

As the milk|feed price ratio falls, the value of incremental milk declines

# What is the cost of marginal / incremental milk?

---

- Feed and water (additional energy/nutrients required)
- Hauling, marketing, promotion, etc.
- Other???
- Depends upon what is driving the increased production:
  - Improved adherence to protocols / procedures
  - 2X vs 3X
  - Technology
  - Heat abatement / cow comfort
  - New/improved facilities

# Evaluating the profitability of incremental milk

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- When evaluating the impact of incremental milk, it is important to consider the costs relevant to the decision (i.e., marginal revenue versus marginal cost)
- Partial budgets can be used to look at the economics of incremental milk... (as well as other things...)

## Partial budget...

<u>Intervention Benefits</u>		<u>Intervention Costs</u>	
Increased revenue	(1)	Decreased revenue	(3)
+ Decreased costs	(2)	+ Increased costs	(4)
<hr/>		<hr/>	
= Total benefit	(B)	= Total costs	(C)

**Total benefit (B) – Total cost (C) = Profitability of Intervention**

**Not all four factors will always be relevant.**

### Profitability can be expressed as:

1. Net return (\$) -- (farm, per head, per unit of production)
2. Breakeven level (production required)
3. Rate of return (ROI) (%)
4. Length of payback (years)

## Partial budget with sensitivity analysis around key assumption

# Economic Comparison of Alternative Feed Rations

						<u>Ration A</u>					<u>Ration B</u>				
Feed cost, \$/lb						\$0.140					\$0.145				
Maintenance, lbs/day						20					20				
Productive feed, milk/lb of feed						2.5					2.5				
Milk price						\$18.50					\$18.50				
Non-feed costs, \$/cow/day						\$8.00					\$8.00				

Milk production lbs/day	<u>Ration A</u>					<u>Ration B</u>				
	Feed cost		IOFC	Total cost	Profit	Feed cost		IOFC	Total cost	Profit
	(\$/day)	(\$/cwt)	(\$/day)	(\$/cwt)	(\$/day)	(\$/day)	(\$/cwt)	(\$/day)	(\$/cwt)	(\$/day)
84.0	\$7.50	\$8.93	\$8.04	\$18.46	\$0.04	\$7.77	\$9.25	\$7.77	\$18.78	-\$0.23
85.0	\$7.56	\$8.89	\$8.17	\$18.31	\$0.16	\$7.83	\$9.21	\$7.90	\$18.62	-\$0.11
86.0	\$7.62	\$8.86	\$8.29	\$18.16	\$0.29	\$7.89	\$9.17	\$8.02	\$18.47	\$0.02
87.0	\$7.67	\$8.82	\$8.42	\$18.01	\$0.42	\$7.95	\$9.13	\$8.15	\$18.33	\$0.15
88.0	\$7.73	\$8.78	\$8.55	\$17.87	\$0.55	<del>\$8.00</del>	<del>\$9.10</del>	<del>\$8.28</del>	<del>\$18.19</del>	<del>-\$0.28</del>
89.0	\$7.78	\$8.75	\$8.68	\$17.73	\$0.68	\$8.06	\$9.06	\$8.40	\$18.05	\$0.40
90.0	\$7.84	\$8.71	\$8.81	\$17.60	\$0.81	\$8.12	\$9.02	\$8.53	\$17.91	\$0.53
91.0	\$7.90	\$8.68	\$8.94	\$17.47	\$0.94	\$8.18	\$8.99	\$8.66	\$17.78	\$0.66
92.0	\$7.95	\$8.64	\$9.07	\$17.34	\$1.07	\$8.24	\$8.95	\$8.78	\$17.65	\$0.78
93.0	\$8.01	\$8.61	\$9.20	\$17.21	\$1.20	\$8.29	\$8.92	\$8.91	\$17.52	\$0.91
94.0	\$8.06	\$8.58	\$9.33	\$17.09	\$1.33	\$8.35	\$8.89	\$9.04	\$17.40	\$1.04

If the higher cost ration (Ration B) results in more milk, it might be more economical even though cost/day and feed cost/cwt of milk increase (and possibly even total cost/cwt).



# Income and costs – which are fixed vs variable?

	Incremental change in...	
	Cow number	Milk/cow
Daily milk production, lbs/day		
<b>INCOME</b>		
Milk sales		
Calf sales		
<b>EXPENSES</b>		
Feed (lactating and dry cows)		
Labor		
Supplies, drugs, and veterinary		
Breeding charge (semen, AI services, etc)		
Testing and trimming		
Utilities and water		
Fuel and oil		
Repairs		
Bedding, corral maintenance, etc.		
Equipment ownership <sup>2</sup>		
Building/facility ownership <sup>2</sup>		
Insurance and taxes		
Professional fees (legal, accounting, etc)		
Other		
Replacement cost		

These are the types of things that need to be identified to properly evaluate the economics of a management intervention/change.





# Income and costs – which are fixed vs variable?

	Incremental change in...	
	Cow number	Milk/cow
Daily milk production, lbs/day	<i>Depends</i>	<i>Varies</i>
<b>INCOME</b>		
Milk sales	<i>Depends</i>	<i>Varies</i>
Calf sales	<i>Varies</i>	<i>Fixed</i>
<b>EXPENSES</b>		
Feed (lactating and dry cows)	<i>Varies</i>	<i>Both</i>
Labor	<i>Depends</i>	<i>Varies</i>
Supplies, drugs, and veterinary	<i>Varies</i>	<i>Fixed</i>
Breeding charge (semen, AI services, etc)	<i>Varies</i>	<i>Fixed</i>
Testing and trimming	<i>Varies</i>	<i>Fixed</i>
Utilities and water	<i>Varies</i>	<i>Fixed</i>
Fuel and oil	<i>Fixed</i>	<i>Fixed</i>
Repairs	<i>Fixed</i>	<i>Fixed</i>
Bedding, corral maintenance, etc.	<i>Fixed</i>	<i>Depends</i>
Equipment ownership <sup>2</sup>	<i>Fixed</i>	<i>Fixed</i>
Building/facility ownership <sup>2</sup>	<i>Fixed</i>	<i>Fixed</i>
Insurance and taxes	<i>Fixed</i>	<i>Fixed</i>
Professional fees (legal, accounting, etc)	<i>Fixed</i>	<i>Fixed</i>
Other	<i>Depends</i>	<i>Depends</i>
Replacement cost	<i>Varies</i>	<i>Fixed</i>

There is not a set of answers that is correct in all situations, as what is variable versus fixed will depend upon each dairy's unique set of constraints and situation.

In other words, partial budgets can be quite simple to extremely complex...

# Whole-farm budget looking at incremental changes...

Projected Budget (12-month) for Analyzing Dairy Herd Economics																				
Scenario =>		Base			% fixed	% chg	Increase milk/cow			Change from Base			% fixed	% chg	Increase cows			Change from Base		
Months for budget =>	12	Per Dairy	Per Cow <sup>1</sup>	Per Cwt	for dairy	per cow	Per Dairy	Per Cow <sup>1</sup>	Per Cwt	Per Dairy	Per Cow <sup>1</sup>	Per Cwt	for dairy	per cow	Per Dairy	Per Cow <sup>1</sup>	Per Cwt	Per Dairy	Per Cow <sup>1</sup>	Per Cwt
<b>PRODUCTION</b>																				
Number of lactating cows		1,200	87%	87%			1,200	87%	87%	0	0	0			1,300	87%	87%	100	0	0
Number of dry cows		180	13%	13%			180	13%	13%	0	0	0			195	13%	13%	15	0	0
Daily milk production, lbs/day		102,000	85.00	100			104,400	87.00	100	2,400	2.0	0.0			109,850	84.50	100	7,850	-0.5	0.0
Daily component production, lbs/day		7,038	5.87	6.90			7,204	6.00	6.90	166	0.1	0.0			7,580	5.83	6.90	542	0.0	0.0
<b>INCOME</b>																				
Quota milk sales		\$8,190,600	\$5,935	\$22.00			\$8,383,320	\$6,075	\$22.00	\$192,720	\$140	\$0.00			\$8,820,955	\$5,900	\$22.00	\$630,355	-\$35	\$0.00
Above quota milk sales		\$0	\$0	\$0.00			\$0	\$0	\$0.00	\$0	\$0	\$0.00			\$0	\$0	\$0.00	\$0	\$0	\$0.00
Calf sales		\$414,000	\$300	\$1.11			\$414,000	\$300	\$1.09	\$0	\$0	-\$0.03			\$448,500	\$300	\$1.12	\$34,500	\$0	\$0.01
<b>EXPENSES (for 12-month period)</b>																				
Feed (lactating and dry cows)		\$4,107,727	\$2,977	\$11.03	0%	0%	\$4,122,979	\$2,988	\$10.82	\$15,253	\$11	-\$0.21	0%	0%	\$4,434,136	\$2,966	\$11.06	\$326,410	-\$11	\$0.03
Labor		765,000	554	2.05	100%	0%	765,000	554	2.01	0	0	-0.05	90%	0%	771,375	516	1.92	6,375	-38	-0.13
Supplies, drugs, and veterinary		350,000	254	0.94	0%	0%	350,000	254	0.92	0	0	-0.02	0%	0%	379,167	254	0.95	29,167	0	0.01
Technology		0	0	0.00	0%	0%	0	0	0.00	0	0	0.00	0%	0%	0	0	0.00	0	0	0.00
Breeding charge (semen, AI services, etc)		50,000	36	0.13	0%	0%	50,000	36	0.13	0	0	0.00	0%	0%	54,167	36	0.14	4,167	0	0.00
Testing and trimming		24,000	17	0.06	0%	0%	24,000	17	0.06	0	0	0.00	0%	0%	26,000	17	0.06	2,000	0	0.00
Hauling and assessments	\$1.00	372,300	270	1.00	0%	0%	381,060	276	1.00	8,760	6	0.00	0%	0%	400,953	268	1.00	28,653	-2	0.00
Utilities and water		125,000	91	0.34	50%	2%	127,500	92	0.33	2,500	2	0.00	50%	0%	130,208	87	0.32	5,208	-3	-0.01
Custom hire		125,000	91	0.34	100%	0%	125,000	91	0.33	0	0	-0.01	80%	0%	127,083	85	0.32	2,083	-6	-0.02
Fuel and oil		150,000	109	0.40	100%	0%	150,000	109	0.39	0	0	-0.01	75%	0%	153,125	102	0.38	3,125	-6	-0.02
Repairs		250,000	181	0.67	100%	0%	250,000	181	0.66	0	0	-0.02	75%	0%	255,208	171	0.64	5,208	-10	-0.03
Bedding, corral maintenance, etc.		90,000	65	0.24	50%	3%	92,700	67	0.24	2,700	2	0.00	0%	0%	97,500	65	0.24	7,500	0	0.00
Equipment ownership <sup>2</sup>		220,000	159	0.59	100%	0%	220,000	159	0.58	0	0	-0.01	100%	0%	220,000	147	0.55	0	-12	-0.04
Building/facility ownership <sup>2</sup>		380,000	275	1.02	100%	0%	380,000	275	1.00	0	0	-0.02	100%	0%	380,000	254	0.95	0	-21	-0.07
Insurance and taxes		135,000	98	0.36	100%	0%	135,000	98	0.35	0	0	-0.01	100%	0%	135,000	90	0.34	0	-8	-0.03
Professional fees (legal, accounting, etc)		60,000	43	0.16	100%	0%	60,000	43	0.16	0	0	0.00	100%	0%	60,000	40	0.15	0	-3	-0.01
Marketing		80,000	58	0.21	100%	0%	80,000	58	0.21	0	0	0.00	100%	0%	80,000	54	0.20	0	-4	-0.02
Miscellaneous		20,000	14	0.05			20,000	14	0.05	0	0	0.00			20,000	13	0.05	0	-1	0.00
Interest		250,000	181	0.67			250,000	181	0.66	0	0	-0.02			250,000	167	0.62	0	-14	-0.05
Replacement cost		\$882,200	\$639	\$2.37	0%	0%	\$882,200	\$639	\$2.32	\$0	\$0	-\$0.05	0%	0%	\$955,716	\$639	\$2.38	\$73,517	\$0	\$0.01
<b>Total cost</b>		<b>\$8,436,226</b>	<b>\$6,113</b>	<b>\$22.66</b>			<b>\$8,465,439</b>	<b>\$6,134</b>	<b>\$22.22</b>	<b>\$29,213</b>	<b>\$21</b>	<b>-\$0.44</b>			<b>\$8,929,638</b>	<b>\$5,973</b>	<b>\$22.27</b>	<b>\$493,412</b>	<b>-\$140</b>	<b>-\$0.39</b>
<b>Net return</b>		<b>\$168,374</b>	<b>\$122</b>	<b>\$0.45</b>			<b>\$331,881</b>	<b>\$240</b>	<b>\$0.87</b>	<b>\$163,507</b>	<b>\$118</b>	<b>\$0.42</b>			<b>\$339,817</b>	<b>\$227</b>	<b>\$0.85</b>	<b>\$171,443</b>	<b>\$105</b>	<b>\$0.40</b>
<b>Breakeven base milk price, \$/cwt</b>		<b>\$21.55</b>	<b>(\$21.55 all prod)</b>				<b>\$21.13</b>	<b>(\$21.13 all prod)</b>		<b>-\$0.42</b>					<b>\$21.15</b>	<b>(\$21.15 all prod)</b>		<b>-\$0.40</b>		
<b>Breakeven milk production, lbs/day</b>		<b>82.5</b>					<b>82.1</b>			<b>-0.4</b>					<b>79.8</b>			<b>-2.7</b>		

<sup>1</sup> Per cow in herd (lactating + dry)

<sup>2</sup> Depreciation and interest, principal and interest, and rent/lease payments

Incremental milk is often profitable, but it does depend on what is fixed and what is variable (having a quota in effect can change things)

# *Pen move and ration change analysis*

*(another way of looking at incremental milk)*



# Background (email received by Elanco sales rep)

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XXXXXXXXXX,

I would like to look at what, if any, milk loss is associated with cows that move from a high cow ration diet to a maintenance cow ration diet.

Here is some of the relevant information that you will need:

Mature cow peak pens: 3, 13, 14, 15 Pen 2 is 1/2 heifers and 1/2 cows

Mature cow maintenance pens: 6, 12, Pen 5 is a DNB pen

1st Lact peak pens: 4, 17, 18

1st Lact maintenance pen 8

(this is a fairly new change and we probably shouldn't do the analysis on 1st lact animals)

Pen move analyses can be “messy” because of changes routinely being made at the dairy and the fact that move events are not always recorded with the best level of accuracy...

ID	LACT	FDAT	NMOVE	Event	DIM	Date	Remark	From	To	FromY	ToY	FtoT	FtoT DIM	From	To	DIM	Count	Cum count	Include		
1	1	11/22/2021	1	MOVE	12	12/4/2021	F001T017	1	17	0	0	0	.	2	1	5	1	0	2	2	0
1	1	11/22/2021	2	MOVE	26	12/18/2021	F017T002	17	2	0	0	0	.	3	1	6	1	30	1	3	0
														13	1	12	1	60	4	7	0
														14	1			90	10	17	0
														15	1			120	21	38	0
																		150	77	115	1
																		180	379	494	1
																		210	482	976	1
																		240	401	1377	1
																		270	251	1628	1
																		300	92	1720	1
3	1	7/9/2021	2	MOVE	204	1/29/2022	F002T008	2	8	0	0	0	.					330	66	1786	0
3	2	7/2/2022	1	MOVE	1	7/3/2022	F011T031	11	31	0	0	0	.					360	24	1810	0
3	2	7/2/2022	2	MOVE	227	2/14/2023	F031T006	31	6	0	1	0	.					390	13	1823	0
4	1	7/3/2021	1	MOVE	13	7/16/2021	F001T002	1	2	0	0	0	.					420	7	1830	0
4	1	7/3/2021	2	MOVE	204	1/23/2022	F004T008	4	8	0	0	0	.					450	1	1831	0
4	1	7/3/2021	3	MOVE	311	5/10/2022	F008T006	8	6	0	0	0	.					480	1	1832	0
4	2	8/6/2022	1	MOVE	21	8/27/2022	F011T002	11	2	0	0	0	.					510	0	1832	0
4	2	8/6/2022	2	MOVE	153	1/6/2023	F010T003	10	3	0	0	0	.								
4	2	8/6/2022	3	MOVE	227	3/21/2023	F002T012	2	12	1	1	1	227								
5	1	1/16/2022	1	MOVE	8	1/24/2022	F001T002	1	2	0	0	0	.								
5	1	1/16/2022	2	MOVE	287	10/30/2022	F002T004	2	4	0	0	0	.								

*Did I mention...  
pen move analyses can be "messy"*

Total of 22,922 MOVE events since 10/1/19 but only 1,832 match proper FROM and TO pens for mature cows (Lact>1). Those 1,832 moves range from 12-492 DIM (1,682 of observations are between 150 and 330 DIM). This 1,832 represents 1,737 unique cows (i.e., there are 95 cows with multiple FROM/TO moves).



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Comments Share

# EVENTS\SI09 ID LACT FDATE NMOVE FOR FDATE>10.01.2019

Clipboard Font Alignment Number Styles Cells Editing Analysis Sensitivity

A1

	AX	AY	AZ	BA	BB	BC	BD	BE	BF	BG	BH	BI	BJ	BK	BL	BM	BN	BO	BP	BQ	BR	BS	BT	BU	BV	BW
1	EVENTS\SI09 ID LACT FDATE NMOVE FOR FDATE>10.01.2019														Min lactation =>		2		Rules							
2															1. Deleted all moves that did not match at least one FROM or TO move											
3															2. Deleted all moves that were at DIM < 100 or > 300											
4	Average	2.26	4/21/2021	2.54		237.64	12/15/2021	#DIV/0!	9.37	8.72	0.40	0.52	0.34	1.78	3. Deleted cows with multiple moves in same lact between 100-300 DIM except first move											
5	Min	1	10/2/2019	1		101	1/12/2020	0	0	1	0	0	0	1												
6	Max	11	12/12/2022	9		300	3/28/2023	0	34	33	1	1	1	3												
7	Count	4,456	4,456	4,456		4,456	4,456	0	4,456	4,456	4,456	4,456	4,456	4,456												
8	Min date =>	10/1/2019								1,766	2,337	1,523	2,580													
9		10/4/2019								68.4%	90.6%	59.0%	100.0%													
10	ID	LACT	FDATE	NMOVE	Event	DIM	Date	Remark	From	To	FromY	ToY	FtoT	FtoT tot												
11	1	1	11/22/2021	5	MOVE	288	9/6/2022	F008T006	8	6	0	0	0	1												
12	2	1	8/2/2021	2	MOVE	152	1/1/2022	F002T008	2	8	0	0	0	1												
13	3	1	7/9/2021	2	MOVE	204	1/29/2022	F002T008	2	8	0	0	0	1												
14	3	2	7/2/2022	2	MOVE	227	2/14/2023	F031T006	31	6	0	1	0	1												
15	4	2	8/6/2022	3	MOVE	227	3/21/2023	F002T012	2	12	1	1	1	3												
16	5	1	1/16/2022	2	MOVE	287	10/30/2022	F002T004	2	4	0	0	0	1												
17	7	4	1/23/2020	1	MOVE	257	10/6/2020	F008T006	8	6	0	1	0	1												
18	8	1	6/19/2021	4	MOVE	289	4/4/2022	F008T006	8	6	0	0	0	1												
19	9	1	6/27/2021	3	MOVE	181	12/25/2021	F000T012	0	12	0	0	0	1												
20	9	2	7/10/2022	2	MOVE	205	1/31/2023	F002T006	2	6	1	1	1	3												
21	11	1	7/22/2021	2	MOVE	156	12/25/2021	F004T012	4	12	0	0	0	1												
22	11	2	7/3/2022	2	MOVE	162	12/12/2022	F034T006	34	6	0	1	0	1												
23	12	5	6/3/2021	3	MOVE	254	2/12/2022	F000T012	0	12	0	1	0	1												
24	12	6	6/30/2022	2	MOVE	129	11/6/2022	F003T005	3	5	1	1	1	3												
25	14	1	9/12/2021	2	MOVE	139	1/29/2022	F002T008	2	8	0	0	0	1												
26	14	2	9/4/2022	3	MOVE	177	2/28/2023	F014T012	14	12	1	1	1	3												
27	15	4	11/15/2019	3	MOVE	279	8/20/2020	F003T011	3	11	1	0	0	1												
28	15	5	10/25/2020	3	MOVE	249	7/1/2021	F015T012	15	12	1	1	1	3												
29	16	1	7/18/2021	4	MOVE	260	4/4/2022	F008T006	8	6	0	0	0	1												
30	16	2	7/15/2022	2	MOVE	167	12/29/2022	F011T005	11	5	0	1	0	1												
31	17	1	6/12/2021	3	MOVE	269	3/8/2022	F008T006	8	6	0	0	0	1												
32	17	2	6/10/2022	2	MOVE	177	12/4/2022	F013T014	13	14	1	0	0	1												
33	18	1	8/1/2021	3	MOVE	261	4/19/2022	F008T006	8	6	0	0	0	1												
34	18	2	7/27/2022	2	MOVE	102	11/6/2022	F003T005	3	5	1	1	1	3												
35	19	1	7/4/2021	2	MOVE	160	12/11/2021	F002T008	2	8	0	0	0	1												
36	19	2	6/30/2022	2	MOVE	215	1/31/2023	F002T006	2	6	1	1	1	3												

Ready Accessibility: Investigate

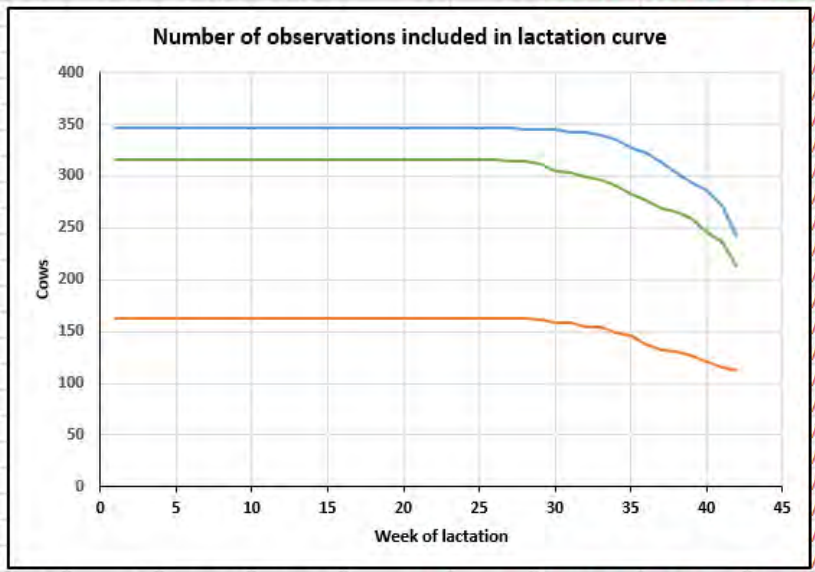
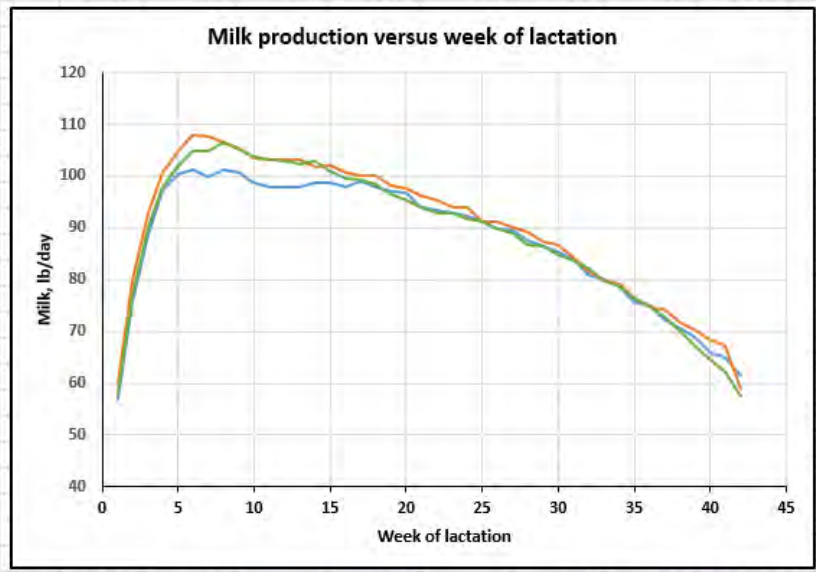
After several “Rules” for deleting MOVE events, a total of 2,580 potential moves remained for Lact>1 cows (4,456 including Lact=1 cows). Of these, 1,523 (59.0%) were correct for both FROM and TO pens. These are the moves that were used to match up with weekly milk data to compare “pre-move” and “post-move” milk for Lact>1 cows.



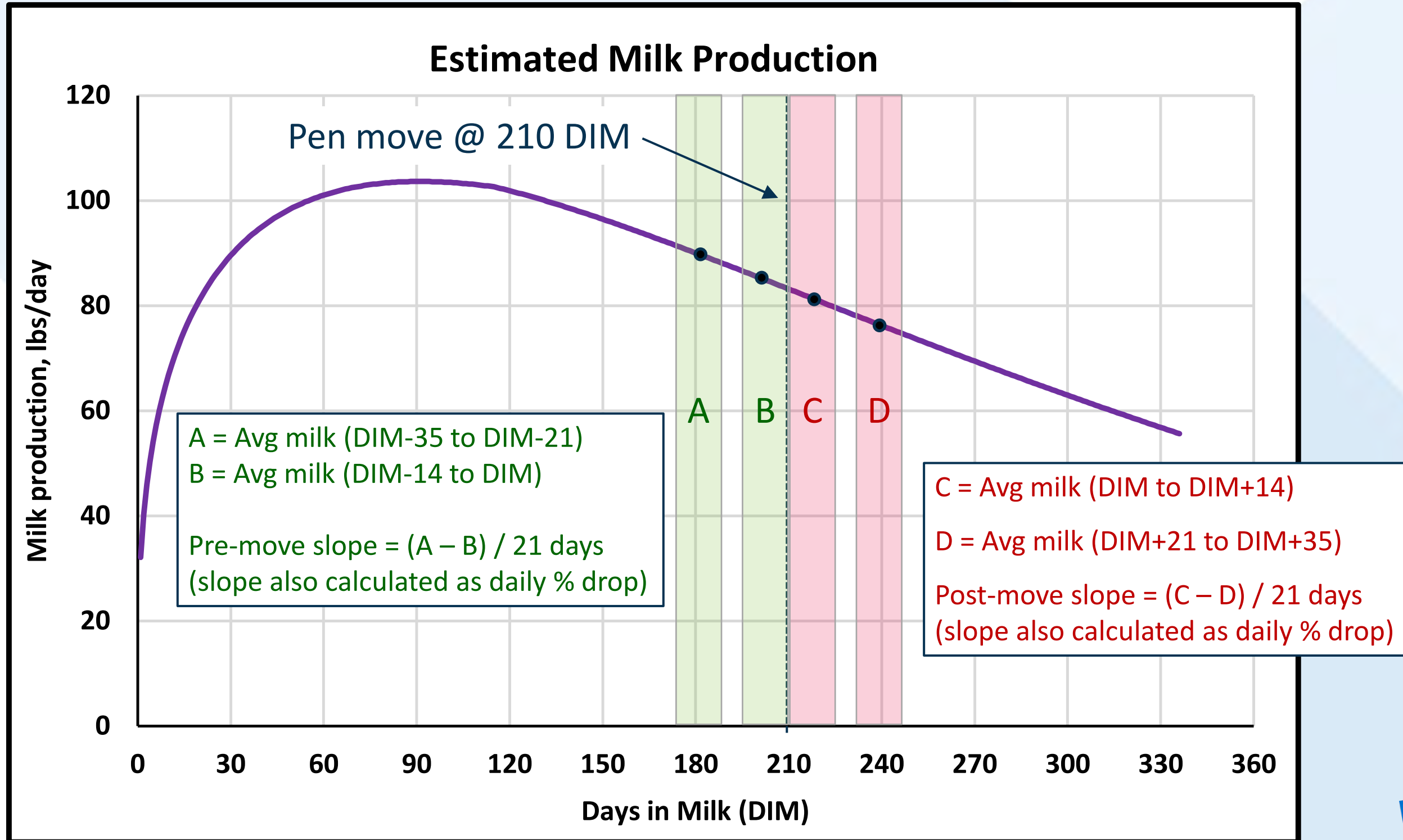


Weekly milk data are available for 6,045 lactations for cows with FDAT from 10/10/19 to 3/28/23. MOVE data exists for 2,435 of these lactations, but only 1,432 are for Lact>1 cows. The slope of each individual cow's lactation curve that met all constraints was examined for "pre-move" versus "post-move".

Weekly Milk Data -- FDAT 1/1/2019 - 4/8/2021															CDAT DIM		MoveDIM							LACT		FDAT				
1	<= First wk for lact curve	-0.144	0	140	3	89.7	86.6	0.147	-0.18%	81.0	73.5	0.219	-0.32%	2	10/01/19	03/05/19	01/24/21	276.6	380.6	56.0	22.1	05/20/22								
2	<= Last wk for lact curve	16.0%	500	260	3	346	346	346	346	346	346	346	346	2	09/30/22		346	342	319	342	333	307								
3	<= First wk for slope	-0.143	0	140	3	91.4	88.2	0.153	-0.16%	81.8	68.4	0.251	-0.36%	3	10/01/19	02/18/18	01/09/20	278.3	380.0	58.5	23.9	05/08/22								
4	<= Last wk for slope	13.7%	500	260	3	162	162	162	162	162	162	162	162	3	09/30/22		162	159	149	162	158	148								
5	First	14	Lact	Slope	66.4	0.4	229.4	0.7	80.8	77.3	0.17	-0.24%	73.8	73.5	0.18	-0.28%	Avg	2.2	04/10/22	02/16/19	01/22/21	255.3	224.2	33.3	13.6	05/04/22				
6	Second	21	L=1	-0.001	0	0	101	0	22	11	-2.52	-6.64%	1	1	-2.29	-18.20%	Min	1	10/10/19	05/20/10	05/02/13	0	0	0	0	06/04/21				
7	Third	35	L=2	-0.155	342	1	300	3	152	137	3.00	3.44%	135	120.5	3.19	6.82%	Max	11	03/28/23	05/01/22	03/28/23	389	614	166	149	02/20/23				
8	Change to move	0	L>2	-0.173	6045	6045	2435	6045	2434	2434	2434	2434	2335	1842	1842	1842	Count	6045	6045	6045	5987	6045	6045	6045	6045	3812				
9	All	-0.089	3812	2435	2435	2435	2434	2434	1661	697	2335	1842	1241	535	CountIF	6045	6045	6045	5987	5589	3576	3566	3402	3812						
10	Min =>	26	60	4											Pre-move		Post-move													
11	4040	Wks	Peak	Peak wk	Slope	CDAT DIM	MoveData	MoveDIM	MoveCnt	1st avg	2nd avg	slope, lb	slope, %	3rd avg	4th avg	slope, lb	slope, %	ID	LACT	FDAT	BDAT	L1DAT	PDCC	CINT	DDRY	DINCU	CDAT			
12	1	47	84	6	0.119	81	1	288	1	73	65	0.381	-0.006	62	39.5	1.071	-0.021	1	1	11/22/21	11/26/19	11/22/21	283	0	0	0	02/11/22			
13	0	20	98	9																										
14	1	44	83	30																										
15	1	36	116	5																										
16	1	44	70	22																										
17	1	38	97	7																										
18	1	51	81	37																										
19	1	34	99	15																										
20	1	63	124	47																										
21	1	62	107	36																										
22	0	9	112	6																										
23	1	48	76	30																										
24	1	38	109	8																										
25	1	47	85	24																										
26	1	38	122	15																										
27	0	3	44	1																										
28	1	42	80	19																										
29	0	25	105	9																										
30	1	49	140	6																										
31	1	39	123	7																										
32	0	8	72	7																										
33	1	44	108	12																										
34	1	30	122	9																										
35	1	44	115	24	-0.043	82	1	260	1	99.5	92	0.357	-0.004	82	82	0.000	0.000	16	1	07/18/21	09/23/19	07/18/21	274	0	0	0	10/08/21			
36	1	37	122	27	-0.176	0	1	167	1	108	106.5	0.071	-0.001	106	95.5	0.500	-0.005	16	2	07/15/22	09/23/19	07/18/21	280	362	59	24				



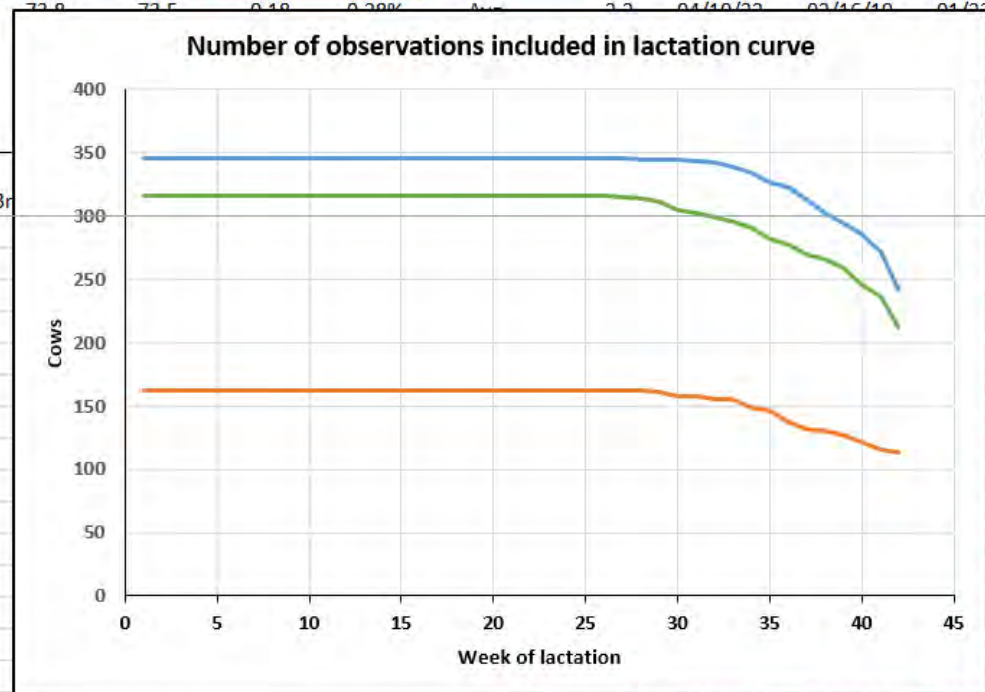
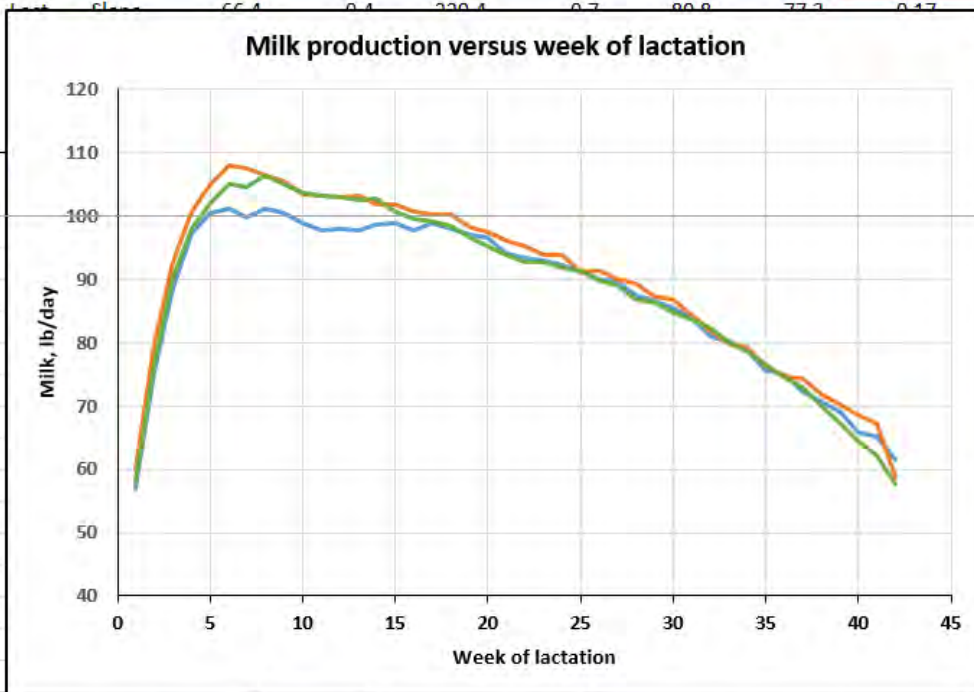
# Considering impact of pen move – comparison of slope(s) of lactation curve





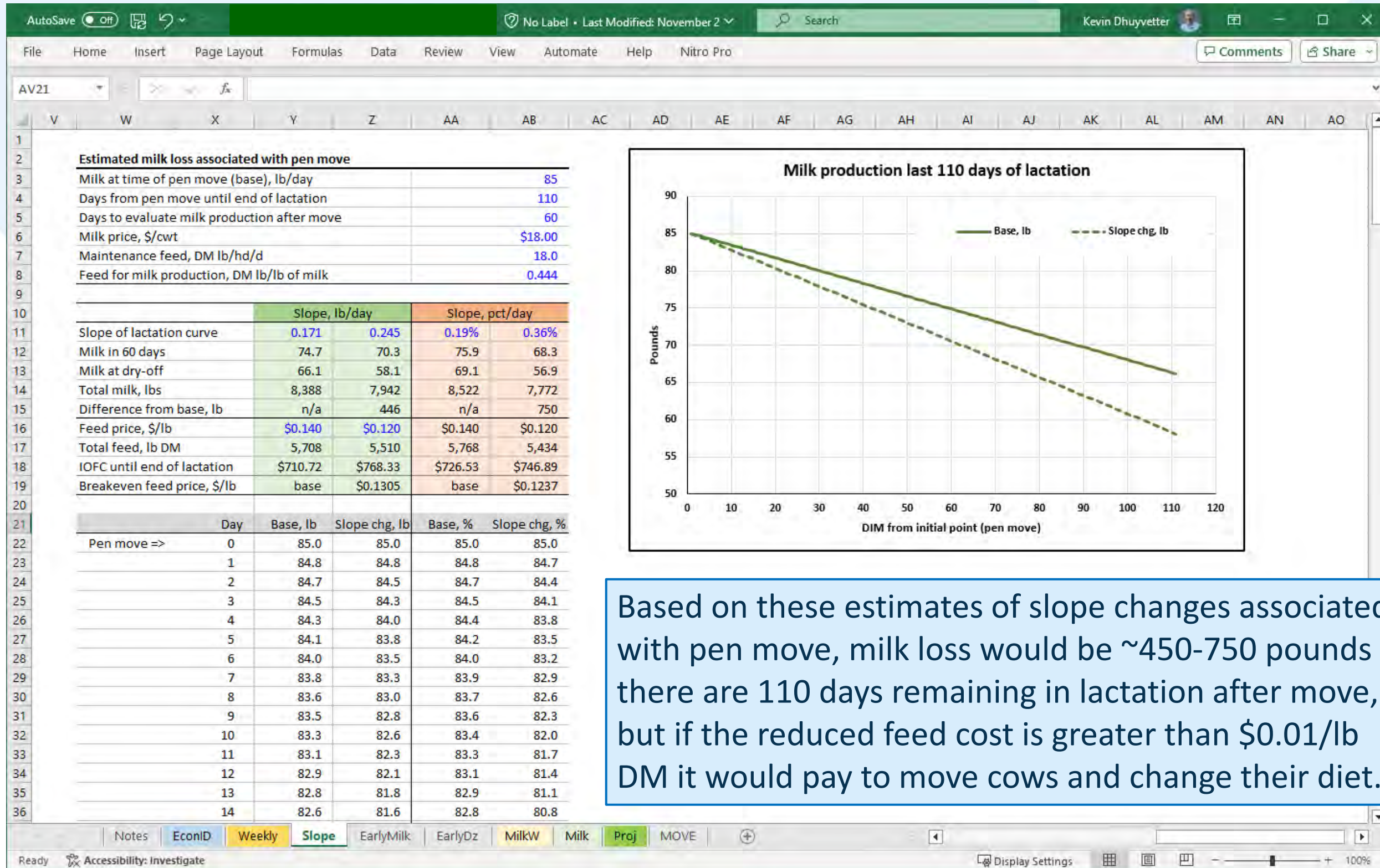
Average daily drop in milk is ~0.07 – 0.10 lb/day (0.15% – 0.20%) *greater* after the pen move than it was prior to the pen move [total of 824 cows in first week].

Weekly Milk Data -- FDAT 1/1/2019 - 4/8/2021		CDAT DIM	MoveDIM	Parity-wtd avg =>		Pre-move		Post-move		LACT	FDAT						
						0.171	-0.19%	0.245	-0.36%								
		-0.144	0	140	3	89.7	86.6	0.147	-0.18%	81.0	73.5	0.219	-0.32%	2	10/01/19	03/05/19	01/24/21
1	<= First wk for lact curve	16.0%	500	260	3	346	346	346	346	346	346	346	346	2	09/30/22	346	342
42	<= Last wk for lact curve	-0.143	0	140	3	91.4	88.2	0.153	-0.16%	81.8	68.4	0.251	-0.36%	3	10/01/19	02/18/18	01/09/20
20	<= First wk for slope	13.7%	500	260	3	162	162	162	162	162	162	162	162	3	09/30/22	162	159
30	<= Last wk for slope	-0.144	0	140	3	90.1	85.7	0.207	-0.22%	79.1	67.9	0.269	-0.42%	4	10/01/19	03/17/16	02/25/18
		16.1%	500	260	3	316	316	316	316	316	316	316	316	10	09/30/22	316	308





# Estimated milk loss with changing slope of lactation curve



Based on these estimates of slope changes associated with pen move, milk loss would be ~450-750 pounds if there are 110 days remaining in lactation after move, but if the reduced feed cost is greater than \$0.01/lb DM it would pay to move cows and change their diet.







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## Changes in milk production and estimated income over feed cost of group-housed dairy cows when moved between pens

Alex Bach<sup>1,2\*</sup>

<sup>1</sup>Marlex, 08173 Sant Cugat del Vallès, Spain

<sup>2</sup>ICREA, Institut de Recerca i Estudis Avançats, 08010 Barcelona, Spain

### Bach: MILK YIELD AND INCOME OVER FEED COST

**Table 3.** Predicted difference in average ( $\pm$  SE) milk yield, DMI, and income over feed cost (IOFC) for the first 21 d after cows moved from one pen to another relative to what they would be had cows not been moved

Pen change <sup>1</sup>	Milk yield, kg/head per day	DMI, kg/head per day	IOFC, €/head per day
Farm A			
High to medium	$-0.48 \pm 0.10^*$	$-0.02 \pm 0.02$	$0.22 \pm 0.02^*$
PMC to medium	$-0.08 \pm 0.11$	$-0.09 \pm 0.02$	$0.34 \pm 0.03^*$
Medium to low	$-2.1 \pm 0.10^*$	$-0.10 \pm 0.01^*$	$-0.37 \pm 0.01^*$
Farm B			
High to low	$-0.78 \pm 0.11^*$	$-0.03 \pm 0.10$	$0.39 \pm 0.04^*$
PMC to low	$-0.48 \pm 0.19^*$	$-0.15 \pm 0.06^*$	$0.75 \pm 0.06^*$
Farm C			
PMC to high	$-2.0 \pm 0.11^*$	$-0.22 \pm 0.04^*$	$-0.51 \pm 0.04^*$

<sup>1</sup>On farm A, cows were moved from a high-production pen to a medium-production pen; from a primiparous cow (PMC) pen to a medium-production pen, or from a medium-production pen to a low-production pen. On farm B, cows were moved from a high-production pen to a low-production pen or from a PMC pen to a low-production pen. On farm C, cows were moved from a PMC pen to a high-production pen.

\*Values differ from zero ( $P < 0.05$ ).

← Three herds with data for six different pen move scenarios. Looked at milk yield, DMI, and IOFC per head per day.





### Changes in milk production and estimated income over feed cost of group-housed dairy cows when moved between pens

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#### Bach: MILK YIELD AND INCOME OVER FEED COST

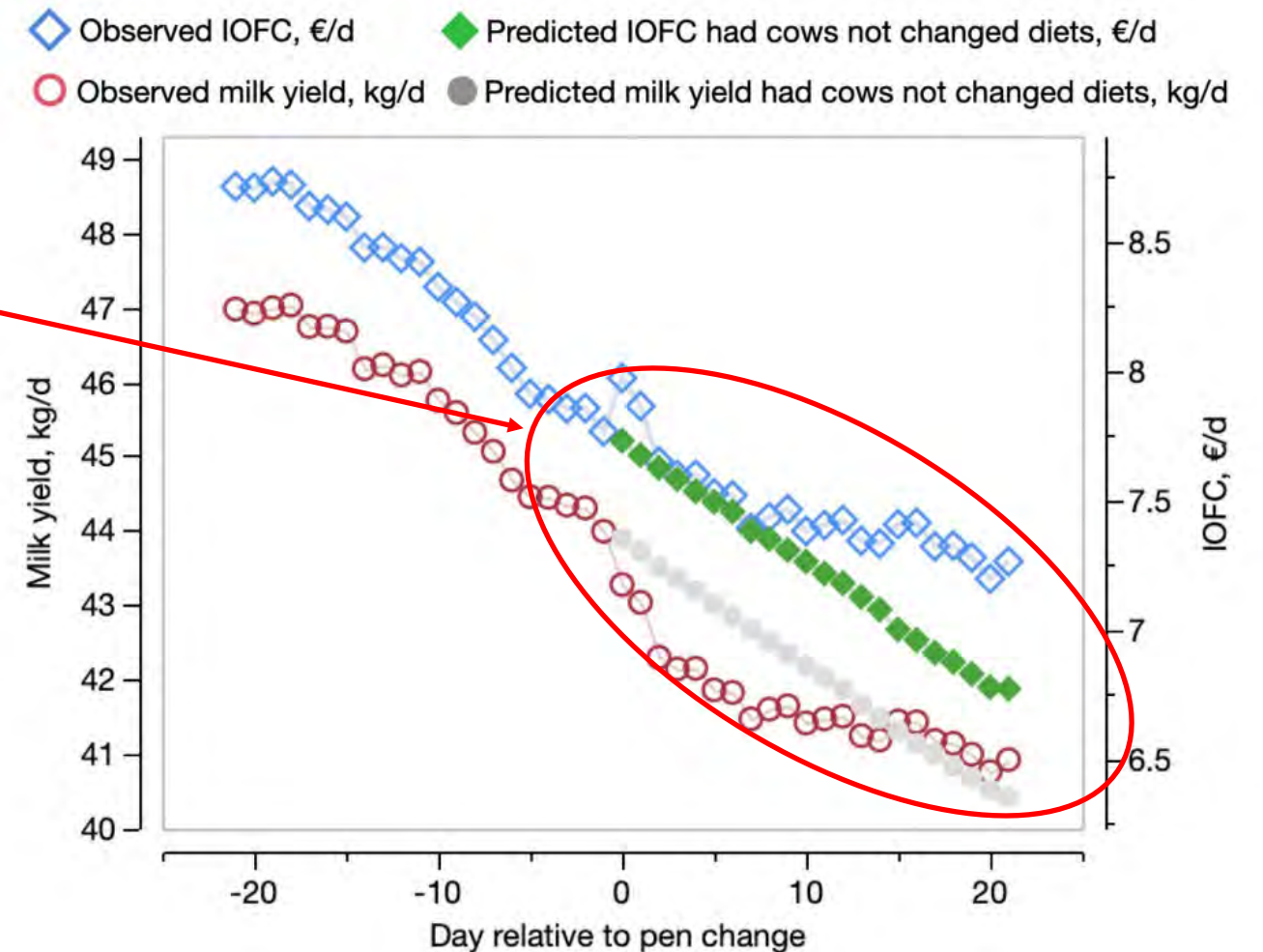
**Table 3.** Predicted difference in average (± SE) milk yield, DMI, and income over feed cost (IOFC) for the first 21 d after cows moved from one pen to another relative to what they would be had cows not been moved

Pen change <sup>1</sup>	Milk yield, kg/head per day	DMI, kg/head per day	IOFC, €/head per day
Farm A			
High to medium	-0.48 ± 0.10*	-0.02 ± 0.02	0.22 ± 0.02*
PMC to medium	-0.08 ± 0.11	-0.09 ± 0.02	0.34 ± 0.03*
Medium to low	-2.1 ± 0.10*	-0.10 ± 0.01*	-0.37 ± 0.01*
Farm B			
High to low	-0.78 ± 0.11*	-0.03 ± 0.10	0.39 ± 0.04*
PMC to low	-0.48 ± 0.19*	-0.15 ± 0.06*	0.75 ± 0.06*
Farm C			
PMC to high	-2.0 ± 0.11*	-0.22 ± 0.04*	-0.51 ± 0.04*

<sup>1</sup>On farm A, cows were moved from a high-production pen to a medium-production pen; from a primiparous cow (PMC) pen to a medium-production pen, or from a medium-production pen to a low-production pen. On farm B, cows were moved from a high-production pen to a low-production pen or from a PMC pen to a low-production pen. On farm C, cows were moved from a PMC pen to a high-production pen.

\*Values differ from zero ( $P < 0.05$ ).

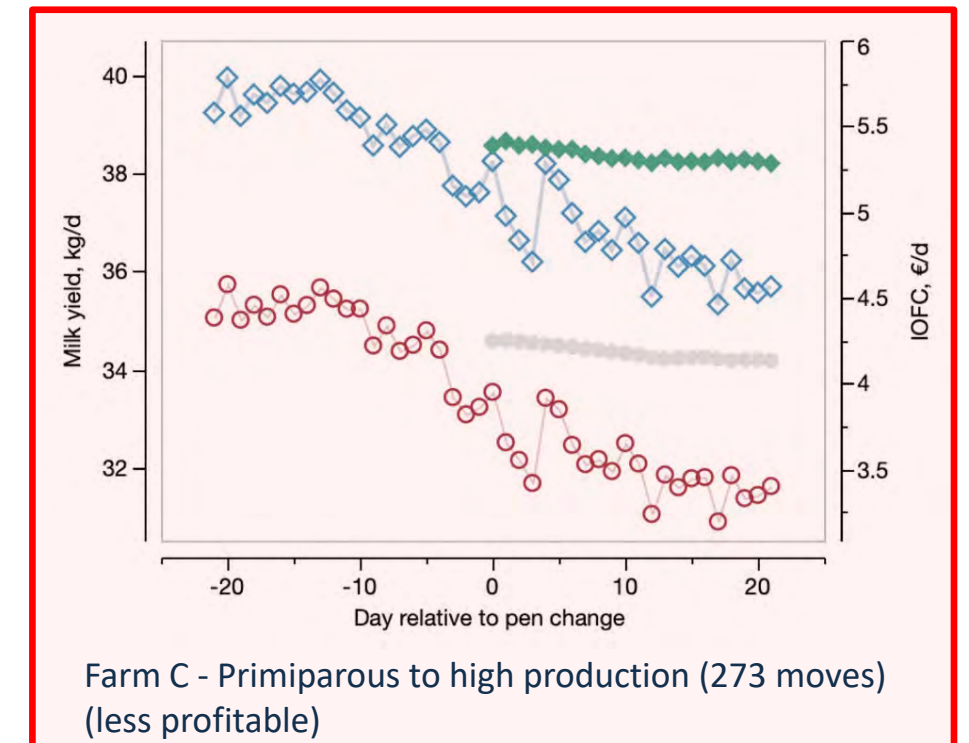
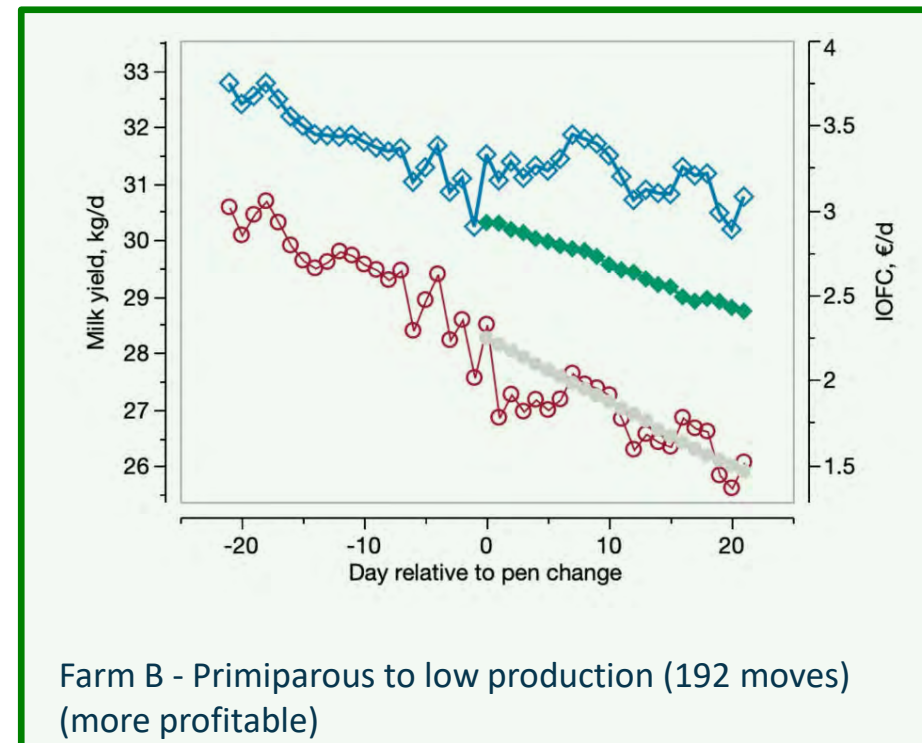
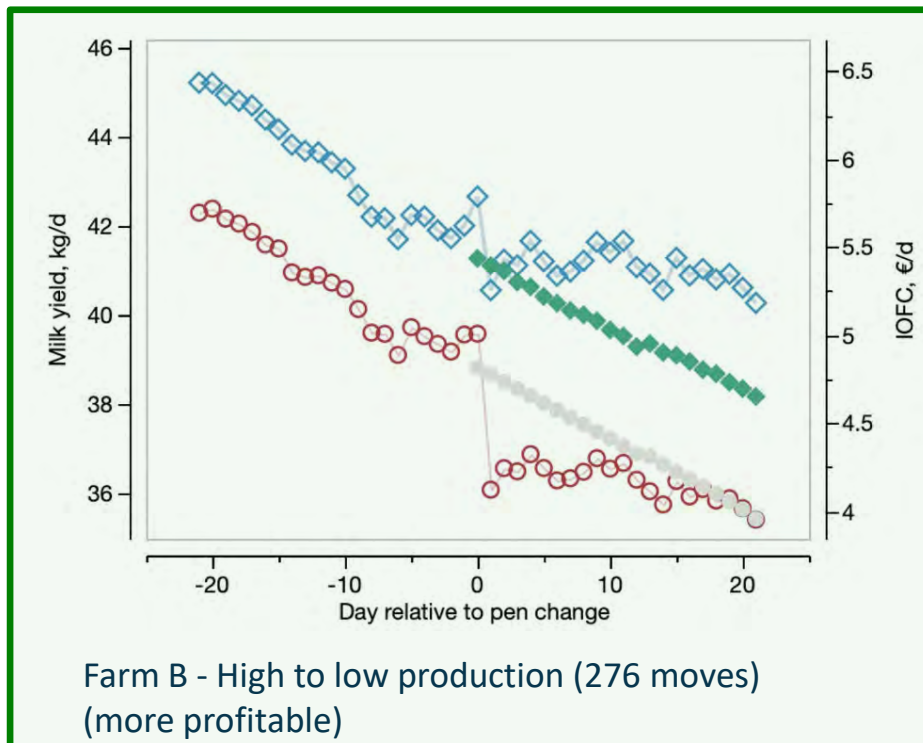
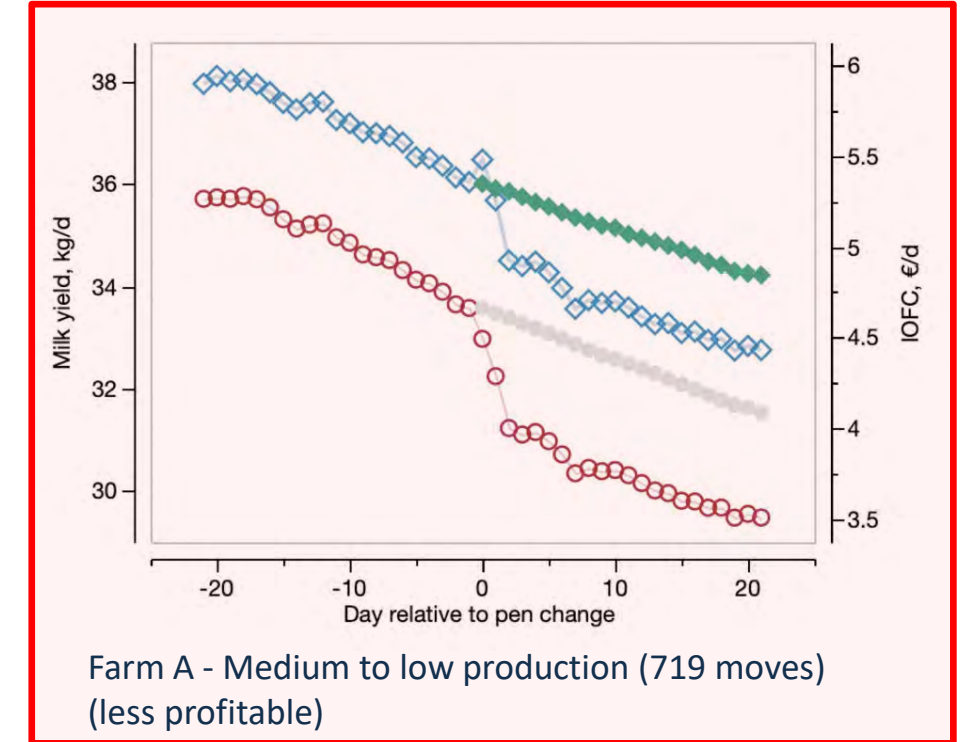
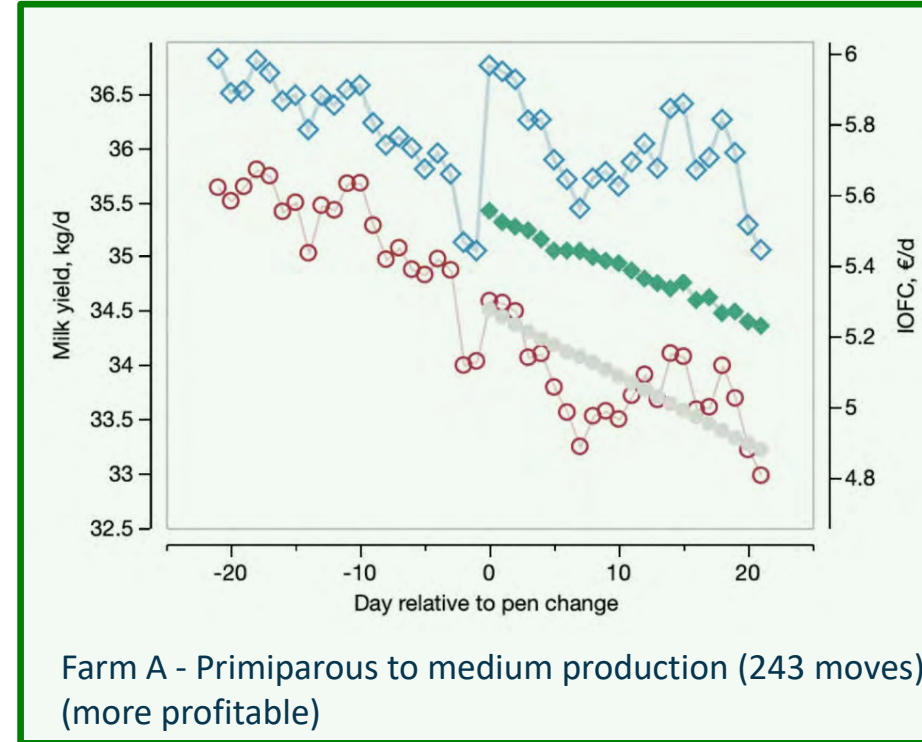
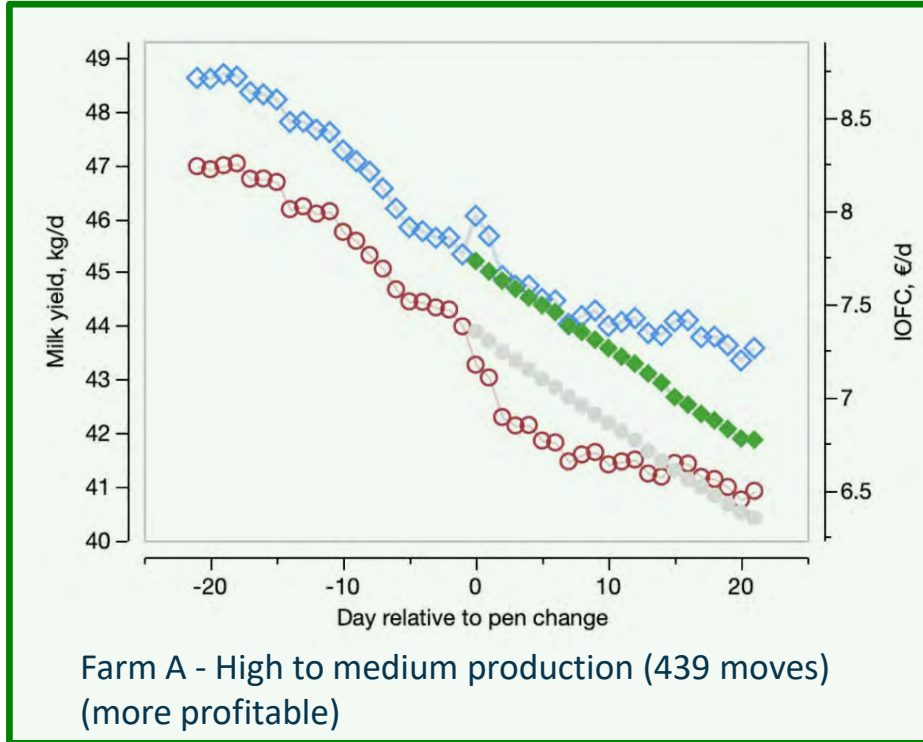
Milk is predicted to be higher without move/ration change, but IOFC was higher than it would have been without move.





◆ Observed IOFC, €/d     ◆ Predicted IOFC had cows not changed diets, €/d  
○ Observed milk yield, kg/d     ● Predicted milk yield had cows not changed diets, kg/d

Move was profitable (n=4)  
 Move was unprofitable (n=2)



# Pen moves / ration changes summary

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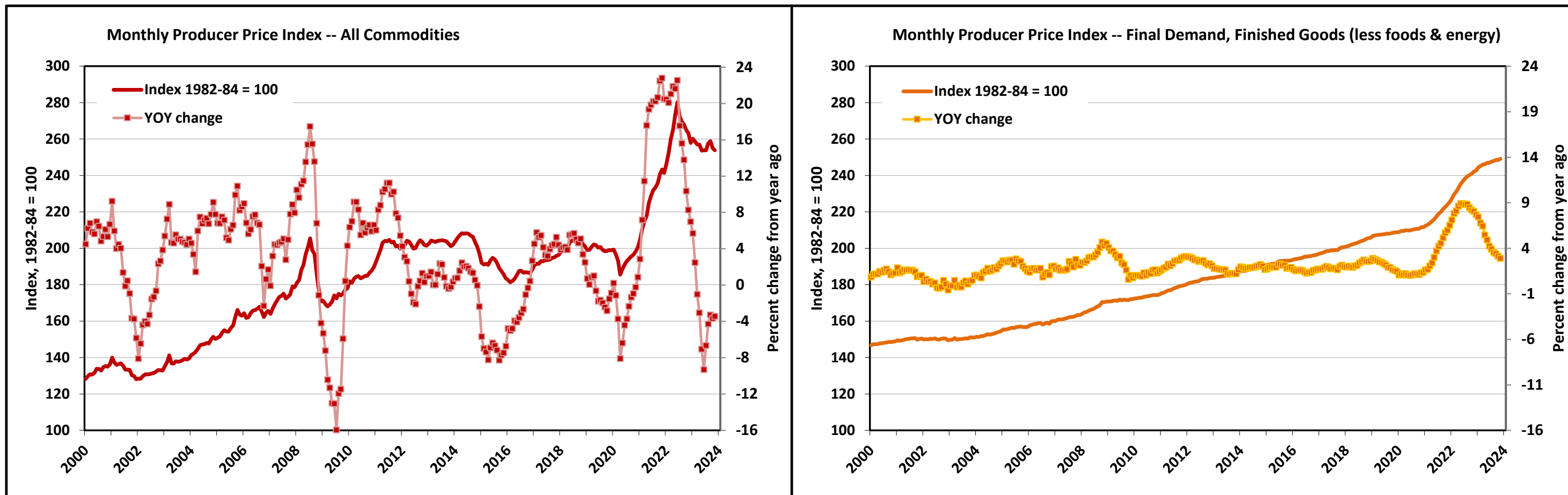
- Incremental milk is *often* profitable, but there will be times it is not economical (i.e., cost savings are greater than foregone income)
- Estimating the economics returns associated with pen moves and ration changes is challenging, but that is not a reason to ignore it
- Income over feed cost might be the primary metric examined, but there are other factors to consider that can be equally important
  - Body condition of cows and the impact this has for the next lactation or when cows are marketed
  - Ability to manage changes (people, equipment, facilities)



# *Inflation and interest rates*

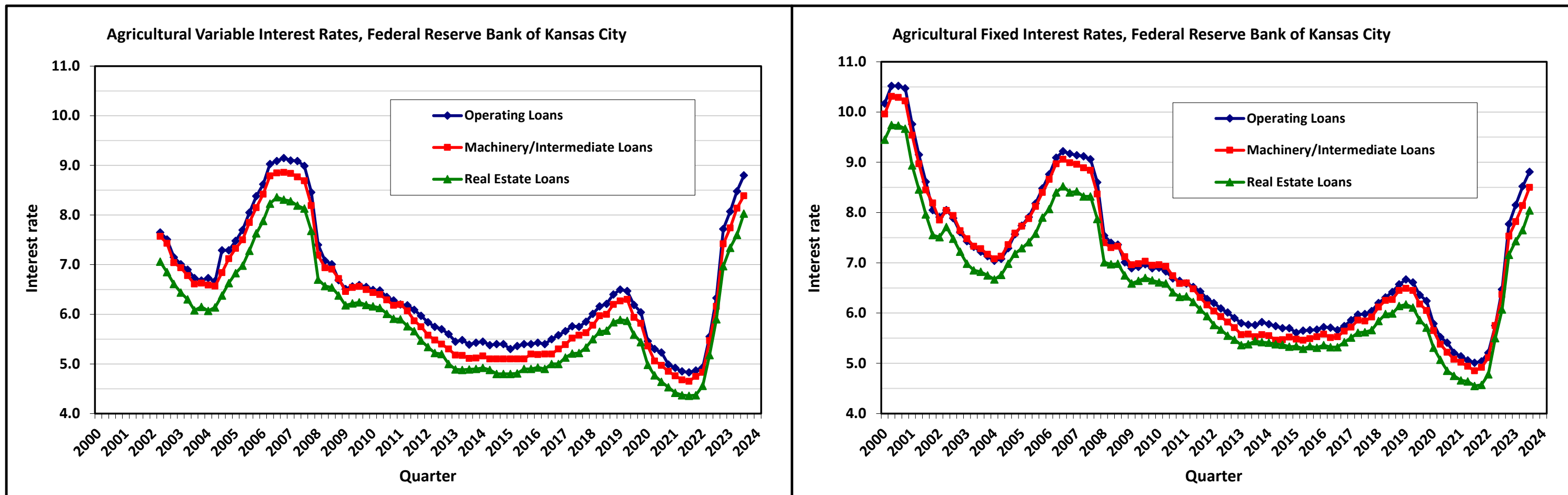


# Inflation – Producer price index



- Variation in PPI is significantly greater when foods and energy are not excluded
- Looking at percent change from previous year can be misleading – i.e., things look much better for 2023 but inflation was still going up (just that the previous year was very high)
- Comparing PPI in 2023 (Jan-Nov) to 2020 → +18-32%

# Interest rates on agricultural loans



- Interest rates in 2021 were the lowest they have been going back to 2000
- Fixed rates have averaged 0.25% (operating) to 0.81% (real estate) higher than variable rates
- Comparing rates in 2023 (Q1-Q3) to 2020 → +15-21% (+0.78-1.09 percentage points)

# Whole-farm budget looking at impact of inflation

Projected Budget for Analyzing Dairy Herd Economics							
Year =>	2023				2020		
	Per Dairy	Per Cow <sup>1</sup>	Per Cwt		Per Dairy	Per Cow <sup>1</sup>	Per Cwt
<b>PRODUCTION</b>							
Number of lactating cows	1,200	87%	87%	Percent change from 2020 to 2023	1,200	87%	87%
Number of dry cows	180	13%	13%		180	13%	13%
Daily milk production, lbs/day	102,000	85.00	100		102,000	85.00	100
Daily component production, lbs/day	7,038	5.87	6.90		7,038	5.87	6.90
<b>EXPENSES</b>							
				%			
Feed (lactating and dry cows)	\$4,107,727	\$2,977	\$11.03	30%	\$3,159,790	\$2,290	\$8.49
Labor	765,000	554	2.05	10%	695,455	504	1.87
Supplies, drugs, and veterinary	350,000	254	0.94	15%	304,348	221	0.82
Technology	0	0	0.00	15%	0	0	0.00
Breeding charge (semen, AI services, etc)	50,000	36	0.13	15%	43,478	32	0.12
Testing and trimming	24,000	17	0.06	15%	20,870	15	0.06
Hauling and assessments	372,300	270	1.00	15%	323,739	235	0.87
Utilities and water	125,000	91	0.34	15%	108,696	79	0.29
Custom hire	125,000	91	0.34	15%	108,696	79	0.29
Fuel and oil	150,000	109	0.40	20%	125,000	91	0.34
Repairs	250,000	181	0.67	15%	217,391	158	0.58
Bedding, corral maintenance, etc.	90,000	65	0.24	15%	78,261	57	0.21
Equipment ownership <sup>2</sup>	220,000	159	0.59	15%	191,304	139	0.51
Building/facility ownership <sup>2</sup>	380,000	275	1.02	15%	330,435	239	0.89
Insurance and taxes	135,000	98	0.36	15%	117,391	85	0.32
Professional fees (legal, accounting, etc)	60,000	43	0.16	15%	52,174	38	0.14
Marketing	80,000	58	0.21	15%	69,565	50	0.19
Miscellaneous	20,000	14	0.05	15%	17,391	13	0.05
Interest	250,000	181	0.67	20%	208,333	151	0.56
Replacement cost	\$882,200	\$639	\$2.37	10%	\$802,000	\$581	\$2.15
<b>Total cost</b>	<b>\$8,436,226</b>	<b>\$6,113</b>	<b>\$22.66</b>		<b>\$6,974,316</b>	<b>\$5,054</b>	<b>\$18.73</b>
<b>Breakeven base milk price, \$/cwt</b>	<b>\$21.55</b>	<b>(\$21.55 all prod)</b>			<b>\$17.62</b>	<b>(\$17.62 all prod)</b>	

<sup>1</sup> Per cow in herd (lactating + dry)

<sup>2</sup> Depreciation and interest, principal and interest, and rent/lease payments

Impact of inflation (and other changing economic conditions) increased individual costs 10-30% compared to where they were in 2020.

Cost of production in 2023 is ~\$4/cwt higher than it was in 2020 (increase of over \$1,000/cow). What will be the impacts of this on your operation(s) and the industry going forward?

# Summary

---

- There is a wide range of profitability across dairies  
(variability across dairies at a point in time > than average across time)
- Incremental milk is *often* profitable due to the dilution of fixed costs  
(i.e., marginal revenue > marginal costs)
- Strategies for minimizing fixed costs per unit of output are:
  - 1) increase cows through facilities (add cows)
  - 2) increase production per cow (add milk/cow)

Which is more profitable depends on an individual dairy's current situation and constraints

- Supply control/quotas impact the economics of incremental milk, but conclusions will depend on individual unique situations

# Summary

---

- Market variability (input and output prices) is high and likely will continue into the foreseeable future
- In commodity market, being low cost per unit of production is critical to business survival
- Inflation has increased cost of production significantly in the last several years
- Increased interest rates signal reduced leverage (all else equal)
- Are there things that might help offset some of these pressures? (e.g., beef x dairy, carbon markets, ???)



# Thank You



**Kevin Dhuyvetter, Ph.D.**

**(785) 410-3244**

**[kdhuyvetter@elanco.com](mailto:kdhuyvetter@elanco.com)**

