GEORGIA DAIRY CONFERENCE

2024

Two

PROCEEDING

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Dairy Economics –
Factors affecting profitability

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Georgia Dairy Conference 2024
January 15-17, 2024
Marriott Savannah Riverfront
Savannah, GA

A few important economic concepts…

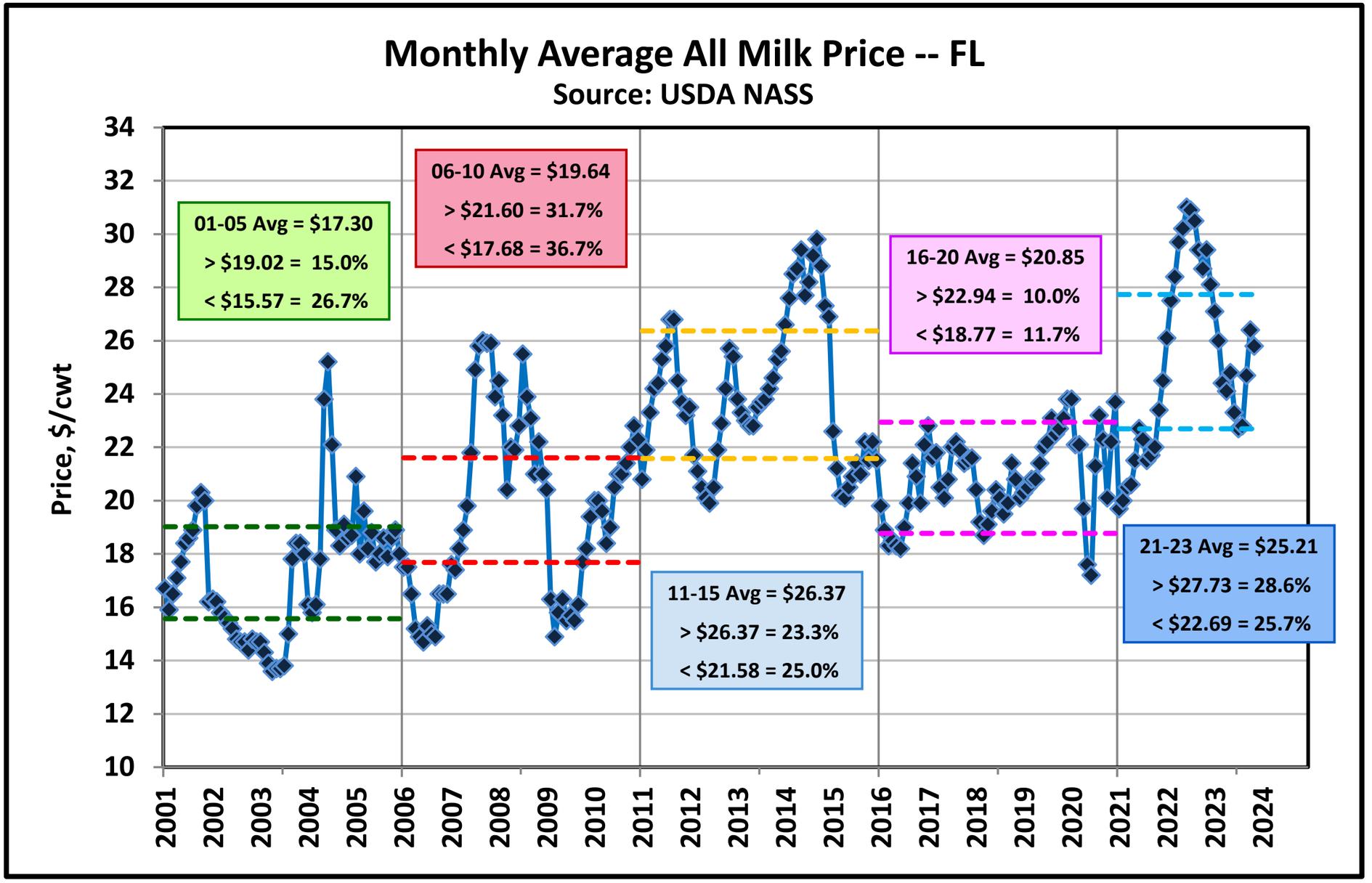
- Variable vs. fixed costs

  (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)

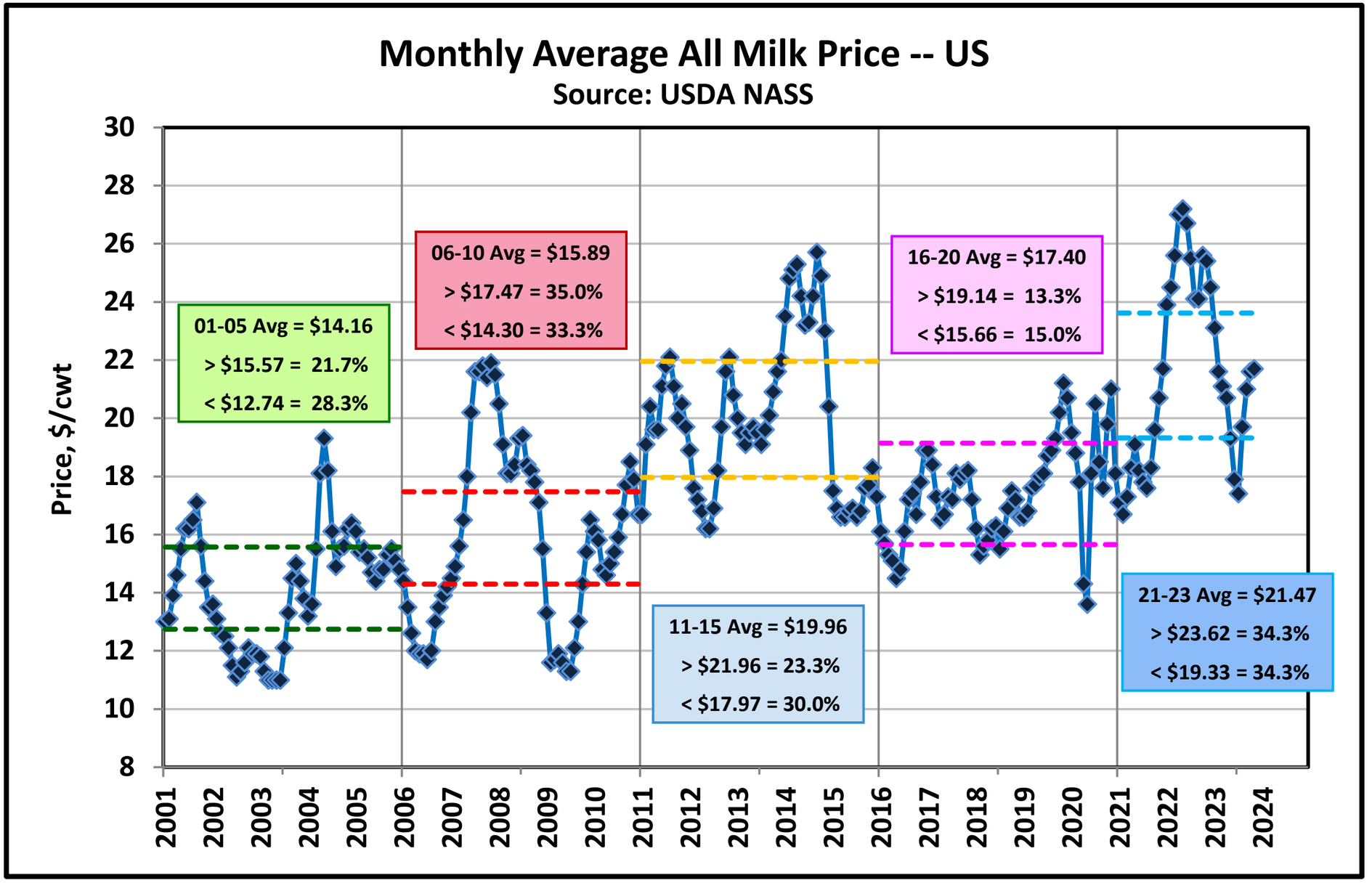
  (on average, in the long run, in competitive industries)
- Marginal revenue > marginal cost

  (decision rule for profit maximization)
- Partial budget vs. whole-farm analysis
- Time value of money

Monthly Average All Milk Prices – FL

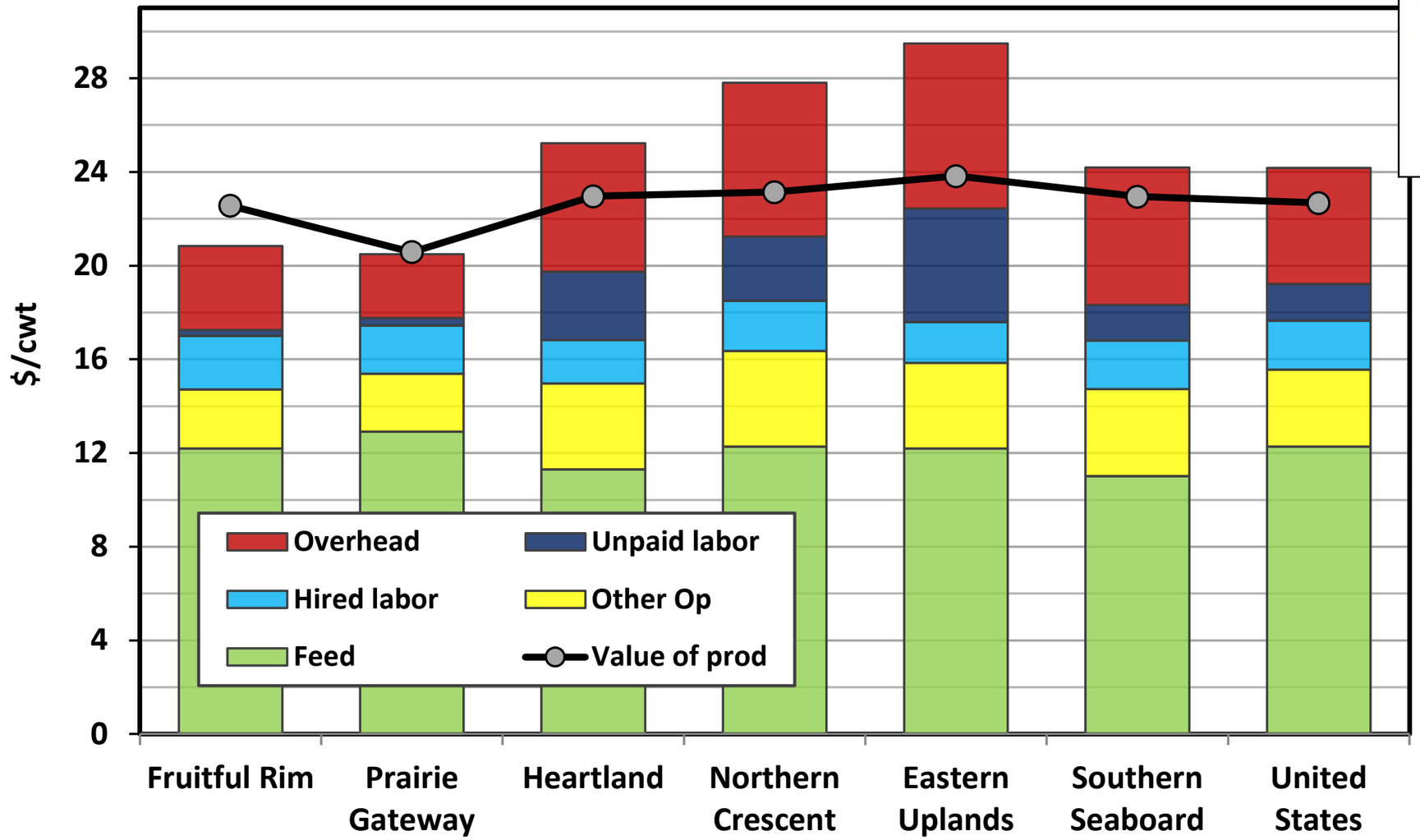


Monthly Average All Milk Prices – US

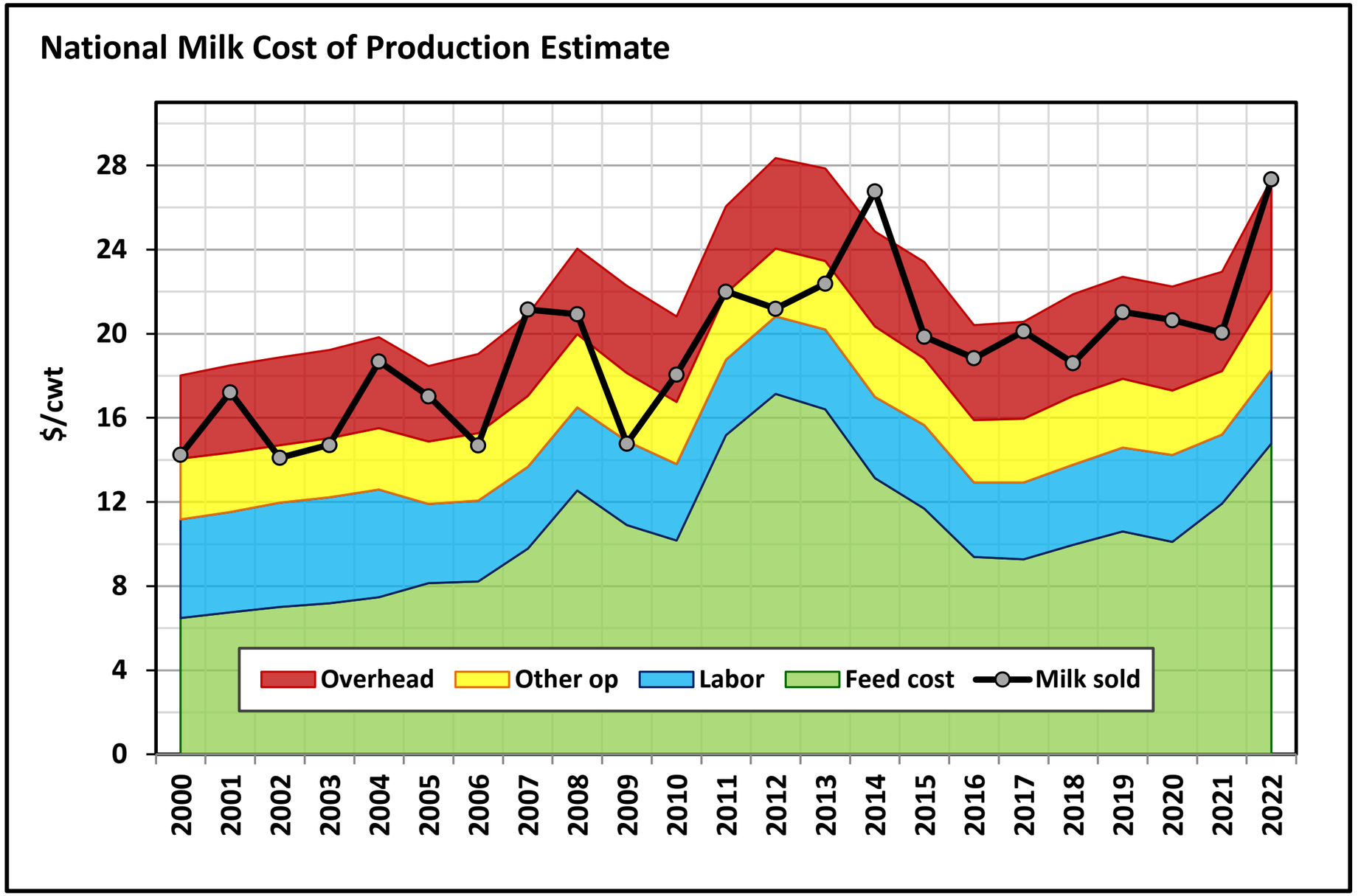


US price basically follows the same pattern as FL price except it is $3.50 to $4.00 lower.

Value of Production and Costs by Region, 2020-2022



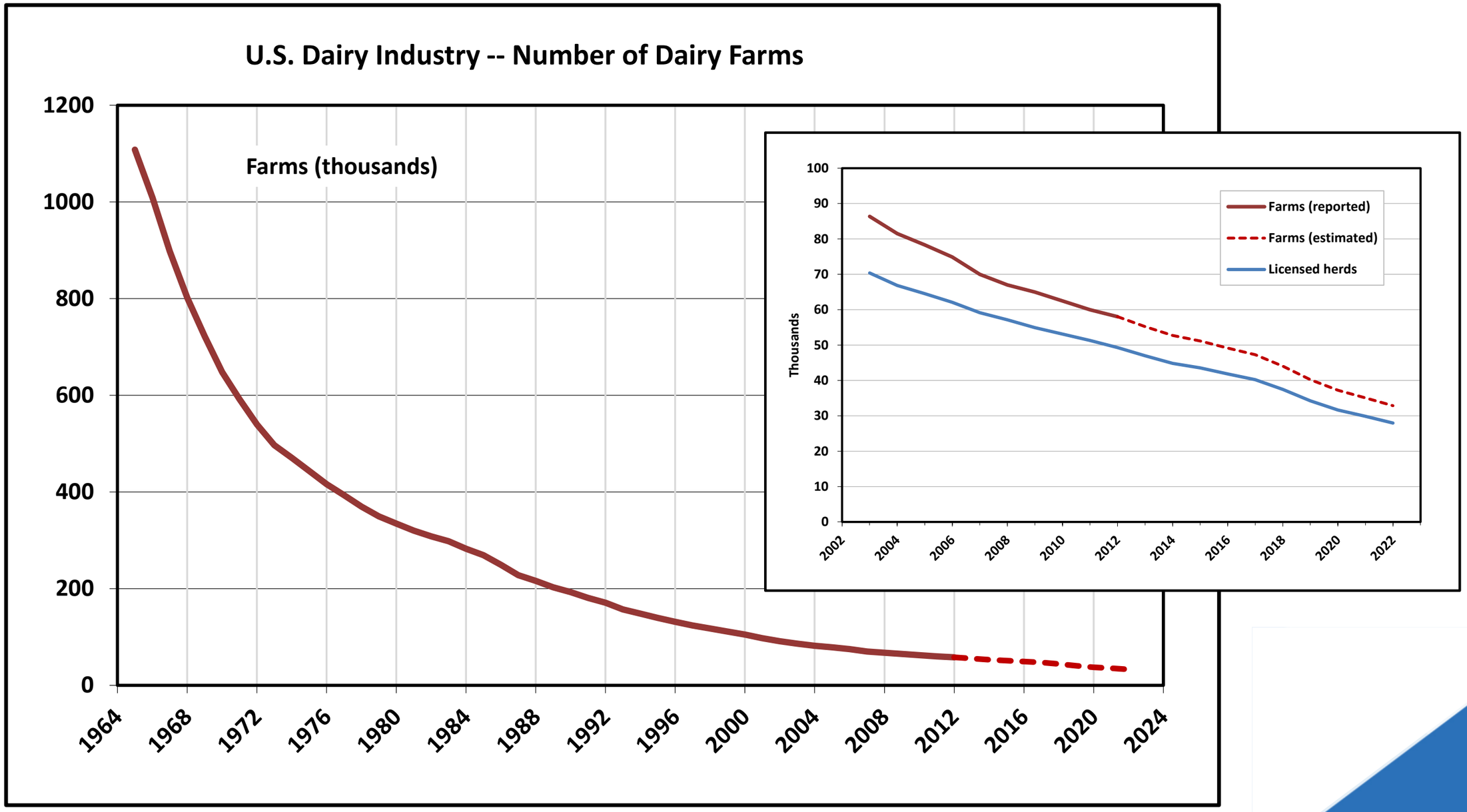
Source: USDA ERS Recent Costs and Returns: Milk (https://www.ers.usda.gov/data-products/commodity-costs-and-returns/commodity-costs-and-returns/). Accessed 06 Dec 2023.



Milk price seldom covers total *economic* costs

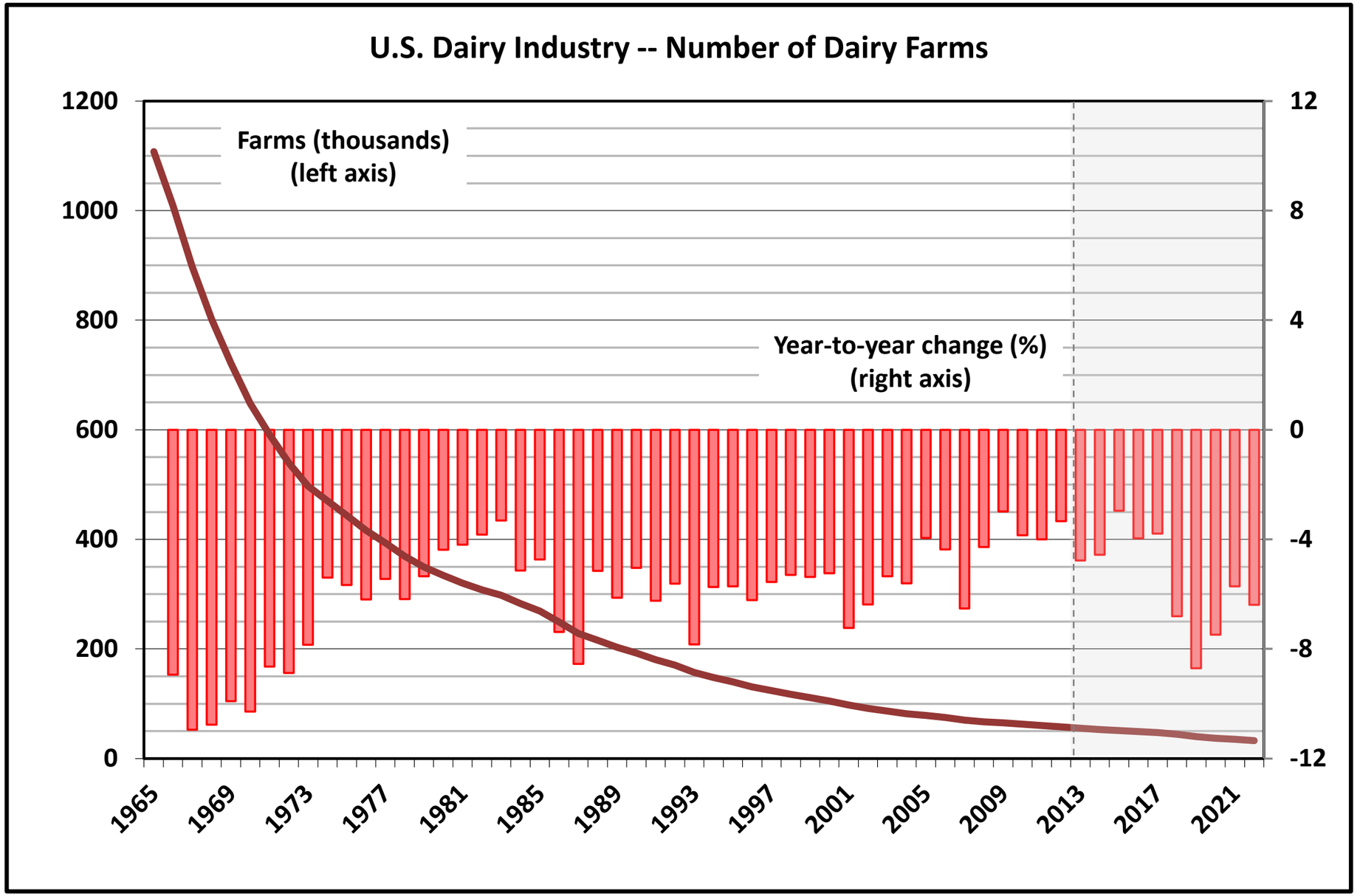
Source: USDA ERS Recent Costs and Returns: Milk (https://www.ers.usda.gov/data-products/commodity-costs-and-returns/commodity-costs-and-returns/). Accessed 06 Dec 2023.

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…



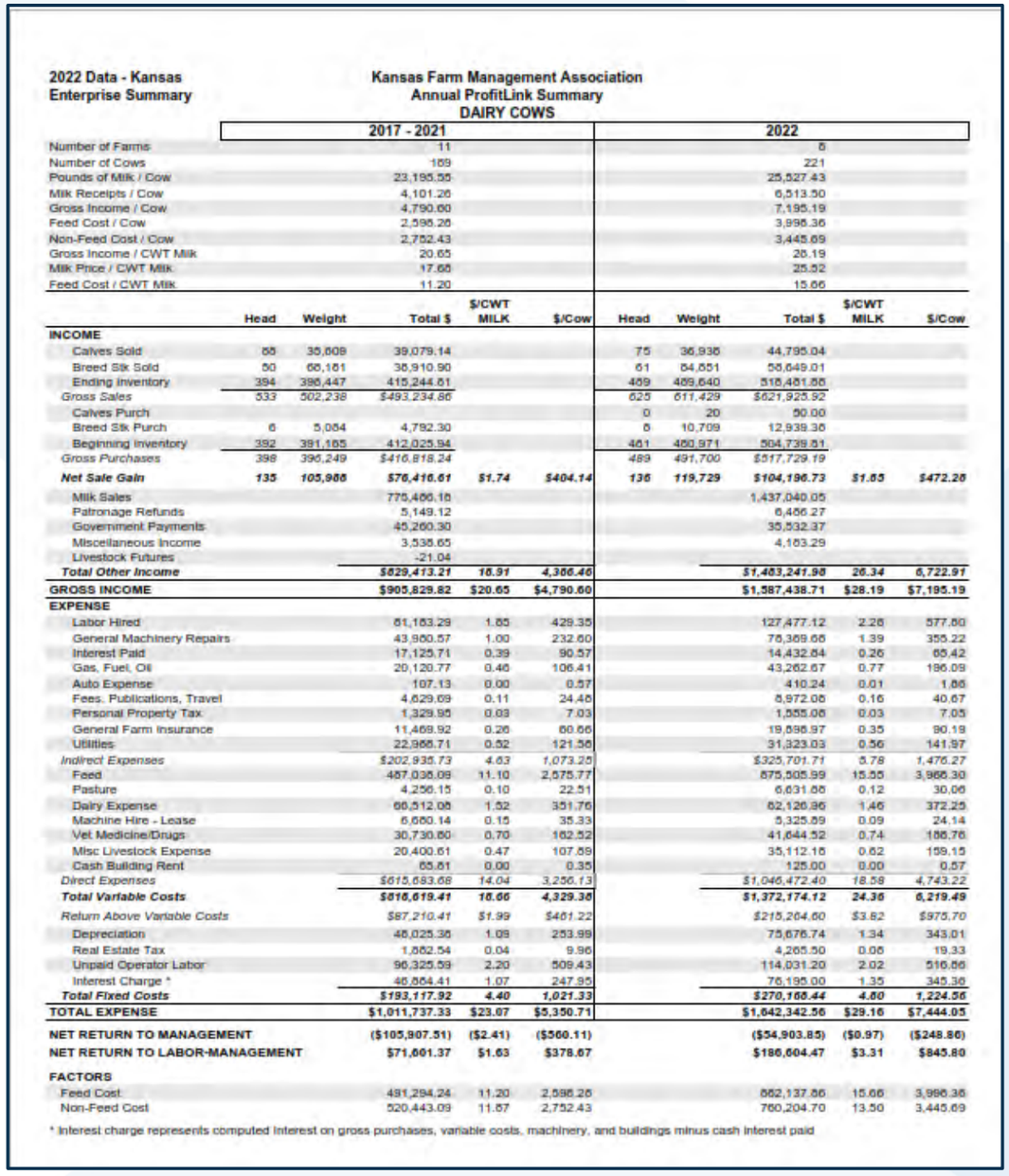
Year-to-year change from 1964-2012 averaged -6.1%. (1964-2022 = -6.0%)

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

Economic concepts with actual data

Examples of historical dairy returns

Historical returns to dairy operations



2022 Data - Kansas Enterprise Summary

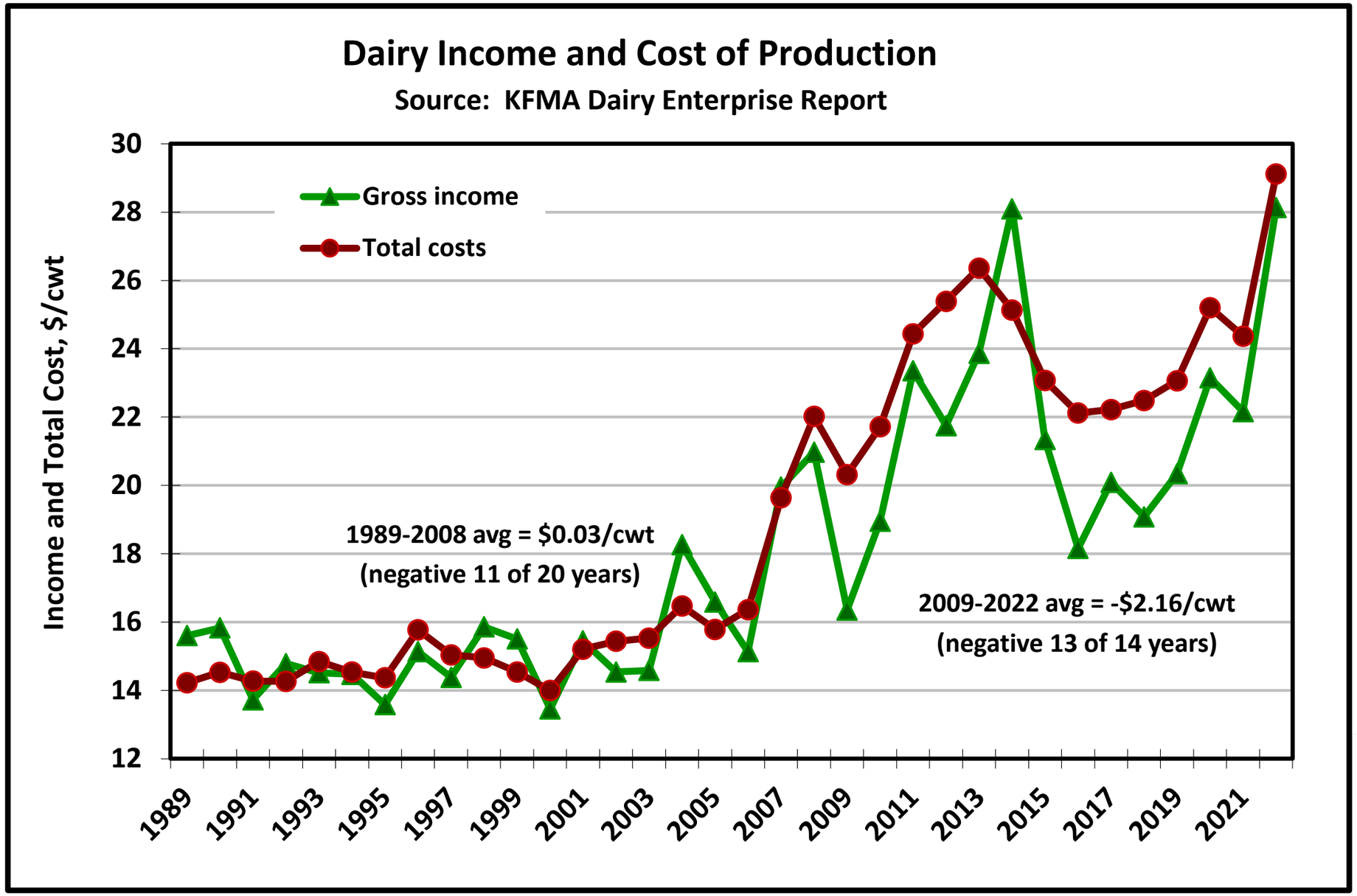
Kansas Farm Management Association
Annual ProfitLink Summary
DAIRY COWS

	2017 - 2021					2022				
Number of Farms			11					6		
Number of Cows			169					221		
Pounds of Milk / Cow			23,195.55					25,527.43		
Milk Receipts / Cow			4,101.26					6,513.50		
Gross Income / Cow			4,790.60					7,195.19		
Feed Cost / Cow			2,586.26					3,996.36		
Non-Feed Cost / Cow			2,752.43					3,445.69		
Gross Income / CWT Milk			20.65					28.19		
Milk Price / CWT Milk			17.66					25.52		
Feed Cost / CWT Milk			11.20					15.66		
	Head	Weight	Total $	$/CWT MILK	$/Cow	Head	Weight	Total $	$/CWT MILK	$/Cow
INCOME										
Calves Sold	68	35,609	39,079.14			75	36,936	44,795.04		
Breed Stk Sold	50	66,161	36,910.90			61	84,651	56,649.01		
Ending Inventory	394	396,447	415,244.61			469	489,640	516,481.86		
Gross Sales	533	502,238	*$493,234.86*			625	611,429	*$621,925.92*		
Calves Purch						0	20	90.00		
Breed Stk Purch	6	5,054	4,792.30			8	10,709	12,939.36		
Beginning Inventory	392	391,185	412,025.94			461	460,971	504,738.51		
Gross Purchases	398	396,249	*$416,818.24*			469	491,700	*$517,729.19*		
Net Sale Gain	***135***	***105,988***	***$76,416.61***	***$1.74***	***$404.14***	***136***	***119,729***	***$104,196.73***	***$1.65***	***$472.26***
Milk Sales			775,466.16					1,437,040.05		
Patronage Refunds			5,149.12					6,456.27		
Government Payments			45,260.30					35,532.37		
Miscellaneous Income			3,536.65					4,163.29		
Livestock Futures			-21.04							
Total Other Income			***$829,413.21***	***$0.91***	***$4,386.46***			***$1,483,241.98***	***$6.34***	***$6,722.91***
GROSS INCOME			**$905,829.82**	**$20.65**	**$4,790.60**			**$1,387,438.71**	**$28.19**	**$7,195.19**
EXPENSE										
Labor Hired			61,163.29	1.35	429.35			127,477.12	2.26	577.50
General Machinery Repairs			43,960.57	1.00	232.60			76,369.66	1.39	355.22
Interest Paid			17,125.71	0.39	90.57			14,432.84	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			4,629.69	0.11	24.48			8,972.06	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			19,596.97	0.35	90.18
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	2,575.77			875,505.99	15.55	3,966.30
Pasture			4,256.15	0.10	22.51			6,631.86	0.12	30.06
Dairy Expense			66,512.06	1.52	351.76			82,126.86	1.46	372.25
Machine Hire - Lease			6,660.14	0.15	35.33			5,325.89	0.09	24.14
Vet Medicine/Drugs			30,730.60	0.70	162.52			41,644.52	0.74	188.76
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*
Total Variable Costs			***$818,619.41***	***18.66***	***4,329.38***			***$1,372,174.12***	***24.36***	***6,219.49***
Return Above Variable Costs			*$87,210.41*	*$1.99*	*$461.22*			*$215,264.60*	*$3.82*	*$975.70*
Depreciation			46,025.36	1.05	243.39			75,676.74	1.34	343.01
Real Estate Tax			1,882.54	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 *			46,884.41	1.07	247.95			76,195.00	1.35	345.36
Total Fixed Costs			***$193,117.92***	***4.40***	***1,021.33***			***$270,168.44***	***4.80***	***1,224.56***
TOTAL EXPENSE			**$1,011,737.33**	**$23.07**	**$5,350.71**			**$1,642,342.56**	**$29.16**	**$7,444.05**
NET RETURN TO MANAGEMENT			**($105,907.51)**	**($2.41)**	**($560.11)**			**($54,903.85)**	**($0.97)**	**($248.86)**
NET RETURN TO LABOR-MANAGEMENT			**$71,601.37**	**$1.63**	**$378.67**			**$186,604.47**	**$3.31**	**$845.80**
FACTORS										
Feed Cost			491,294.24	11.20	2,586.26			882,137.86	15.66	3,996.36
Non-Feed Cost			520,443.09	11.87	2,752.43			760,204.70	13.50	3,445.69

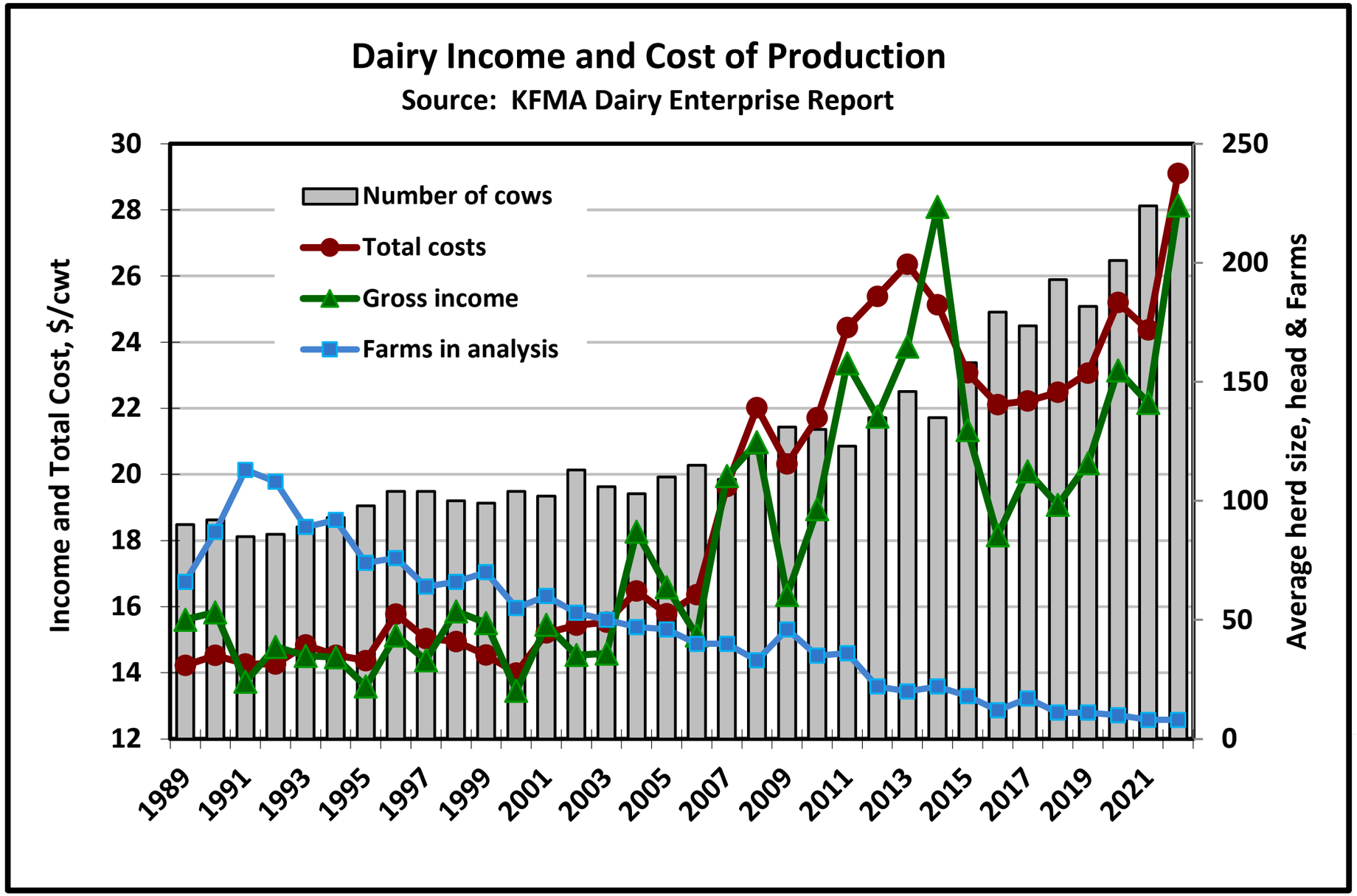
* Interest charge represents computed interest on gross purchases, variable costs, machinery, and buildings minus cash interest paid

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



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



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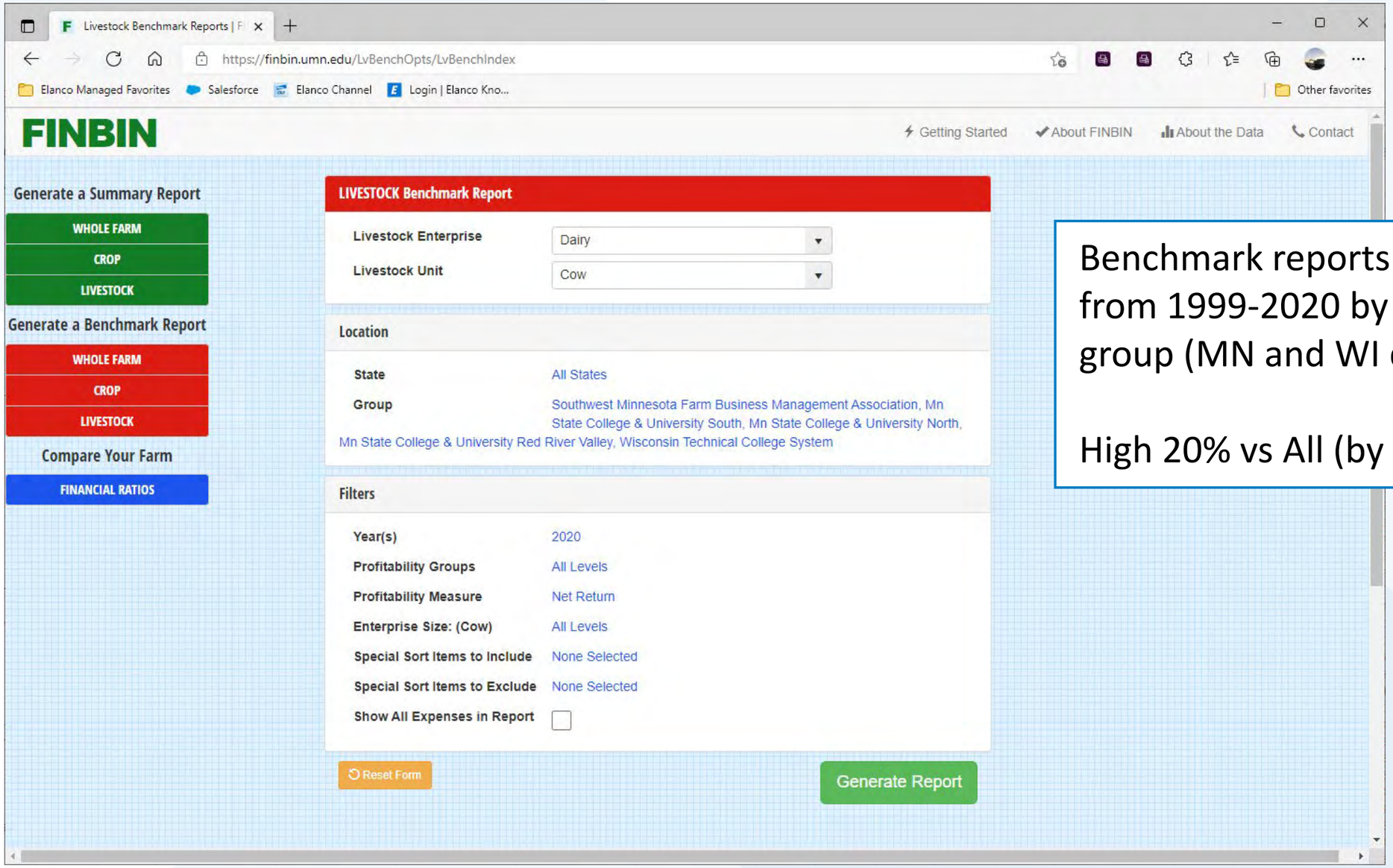
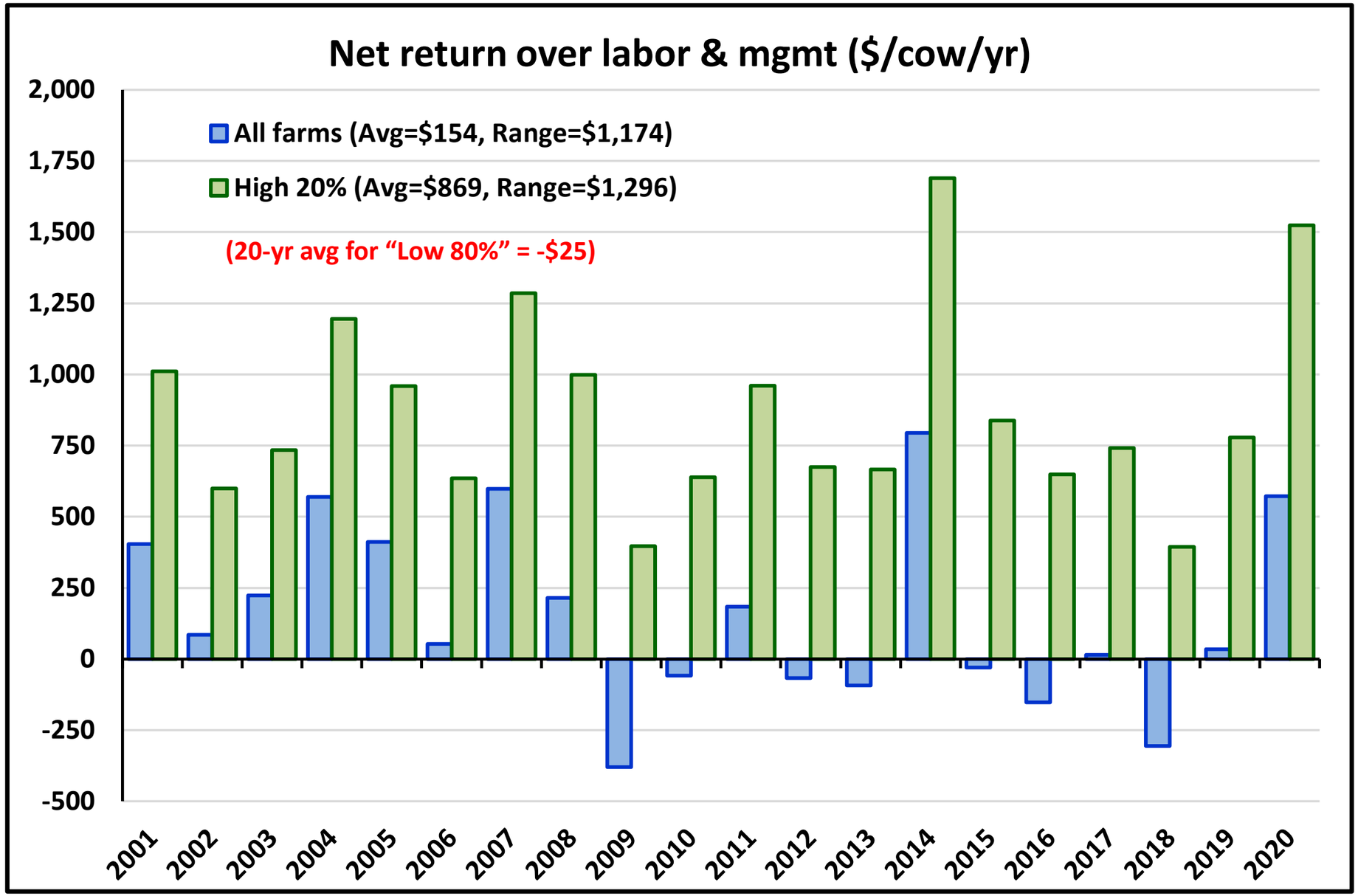
Historical returns to dairy operations



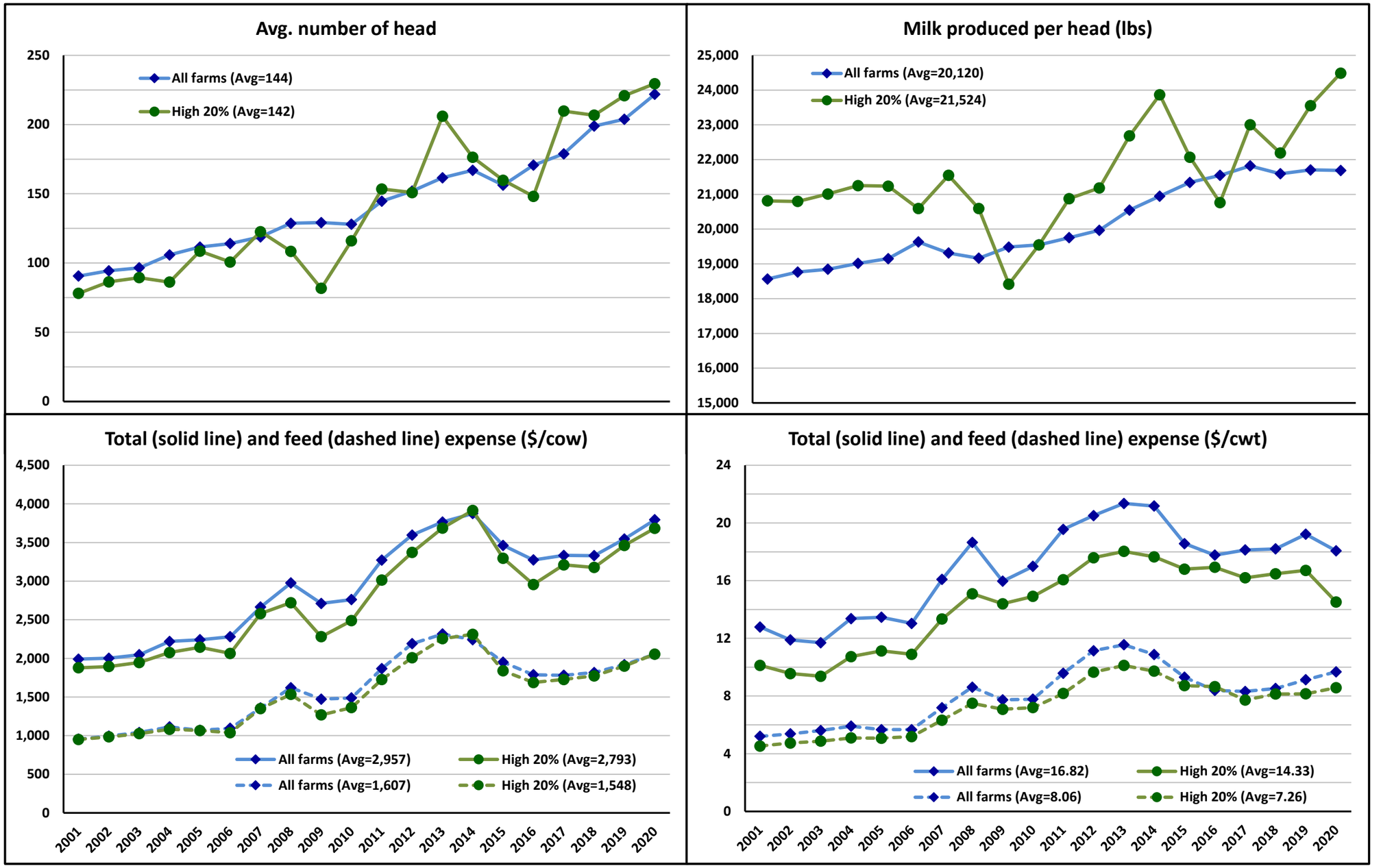
Benchmark reports for Dairy from 1999-2020 by profitability group (MN and WI dairies).

High 20% vs All (by year)

https://finbin.umn.edu/LvBenchOpts/LvBenchIndex



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.

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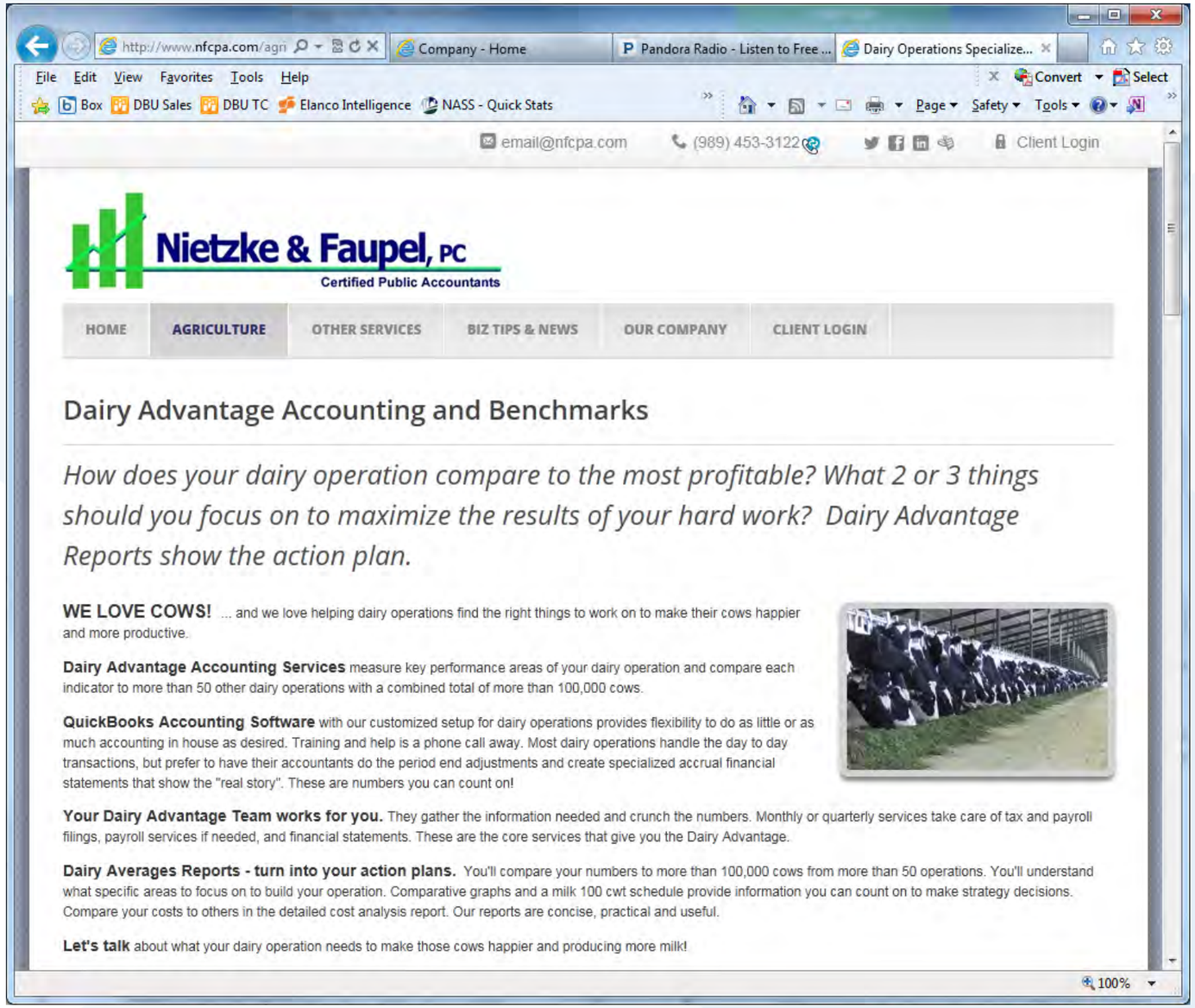
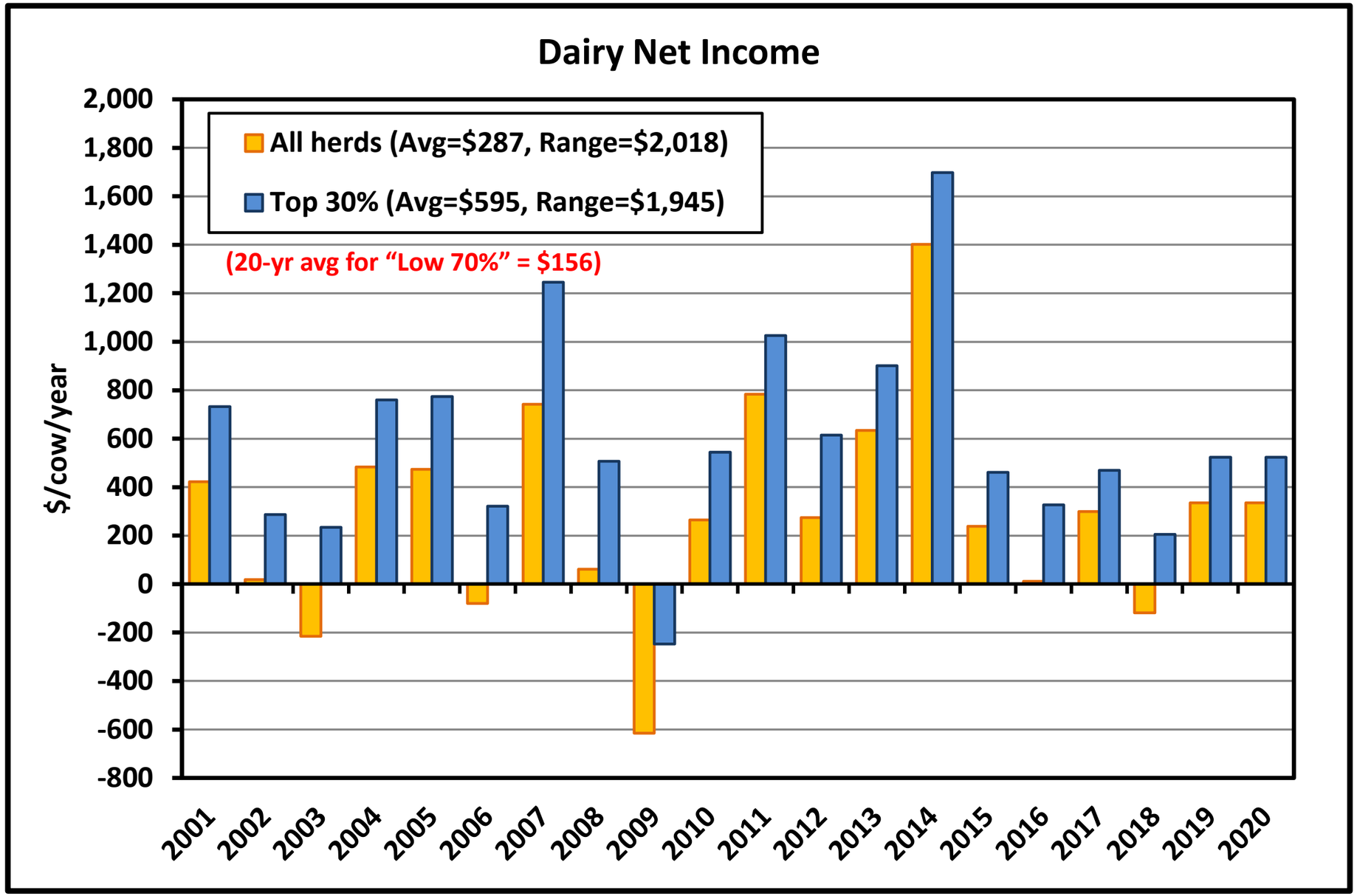


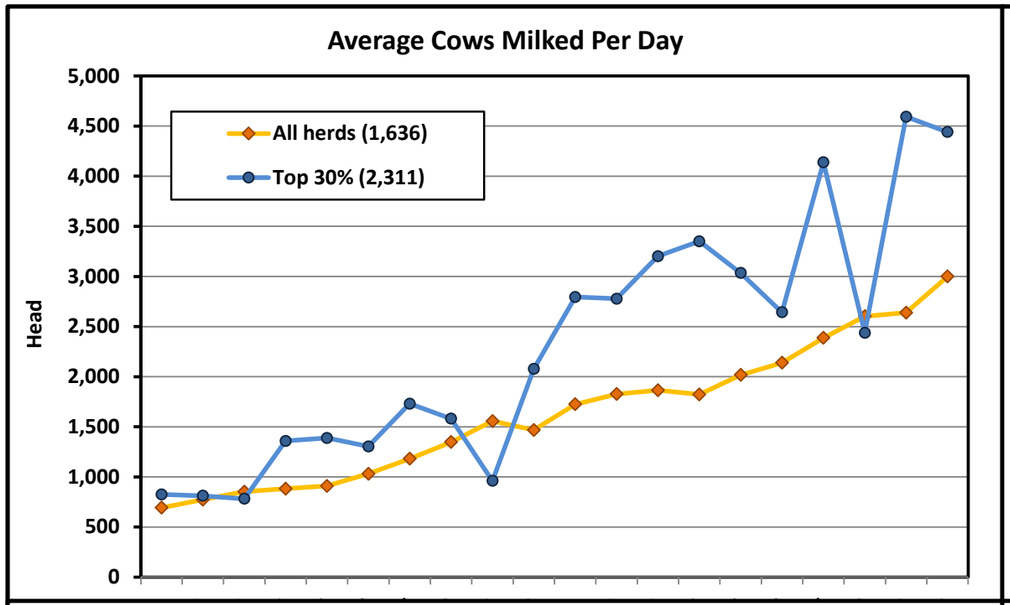
http://www.nfcpa.com/agriculture/dairy-advantage-accounting-and-benchmarks/

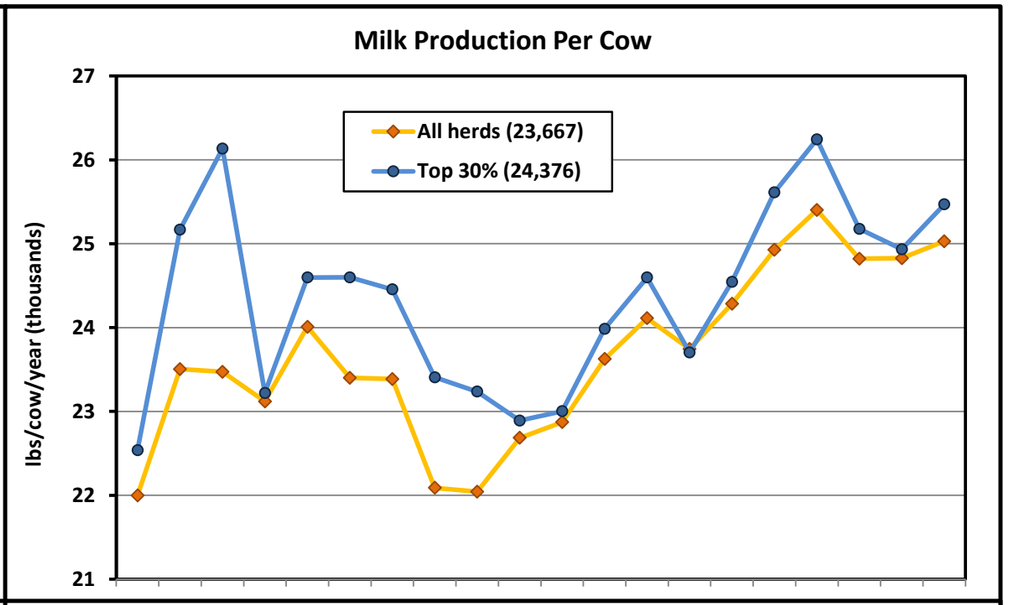
Annual reports covering years 2001-2020

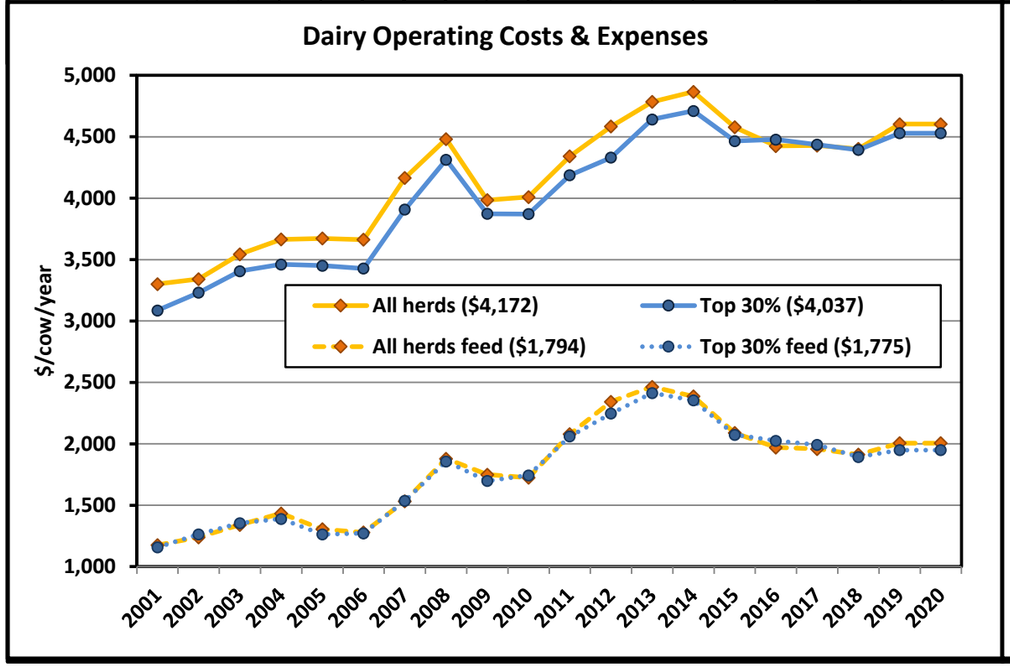
Top 30% vs Average (by year)

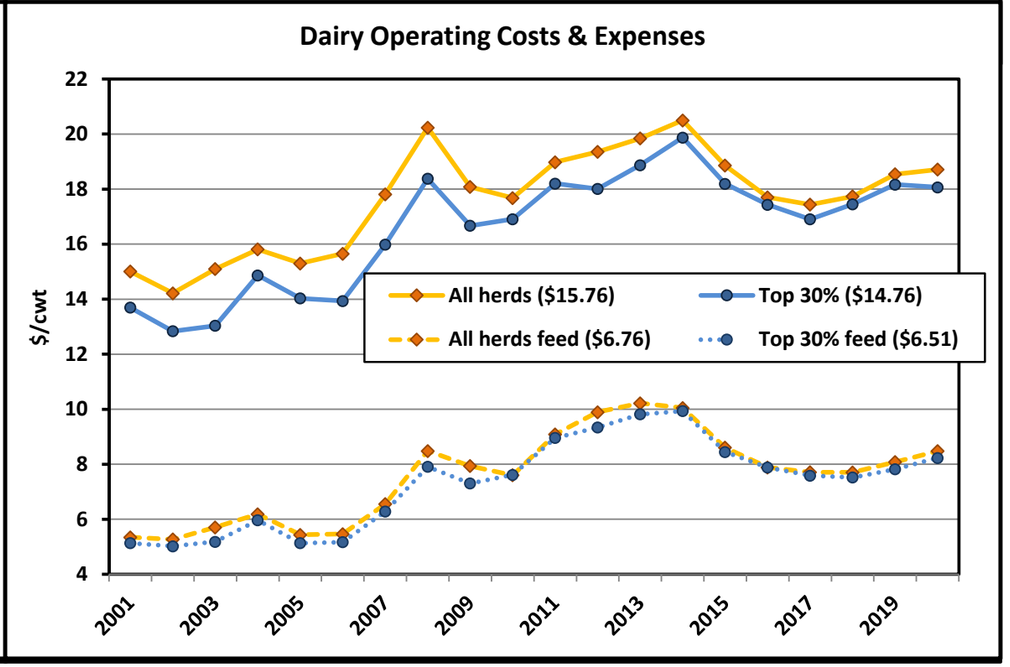


Source: Nietzke & Faupel, P.C.









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[a]	Middle 20% profit minus overall avg[a]	Low 40% profit minus overall avg[a]	
Difference from overall average, AgFA Database[b]					
Price	[+1.12]	0.64	-0.32	-0.48	UW
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	
Difference from overall average, FINBIN Database[c]					
Price	[+0.33]	0.16	-0.02	-0.17	UM
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	

Profit-reducing differences highlighted in red.

[a] Overall average refers to the average of all farrms in the database including the high-profit farms.

[b] 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.

[c] 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

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

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%

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

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.

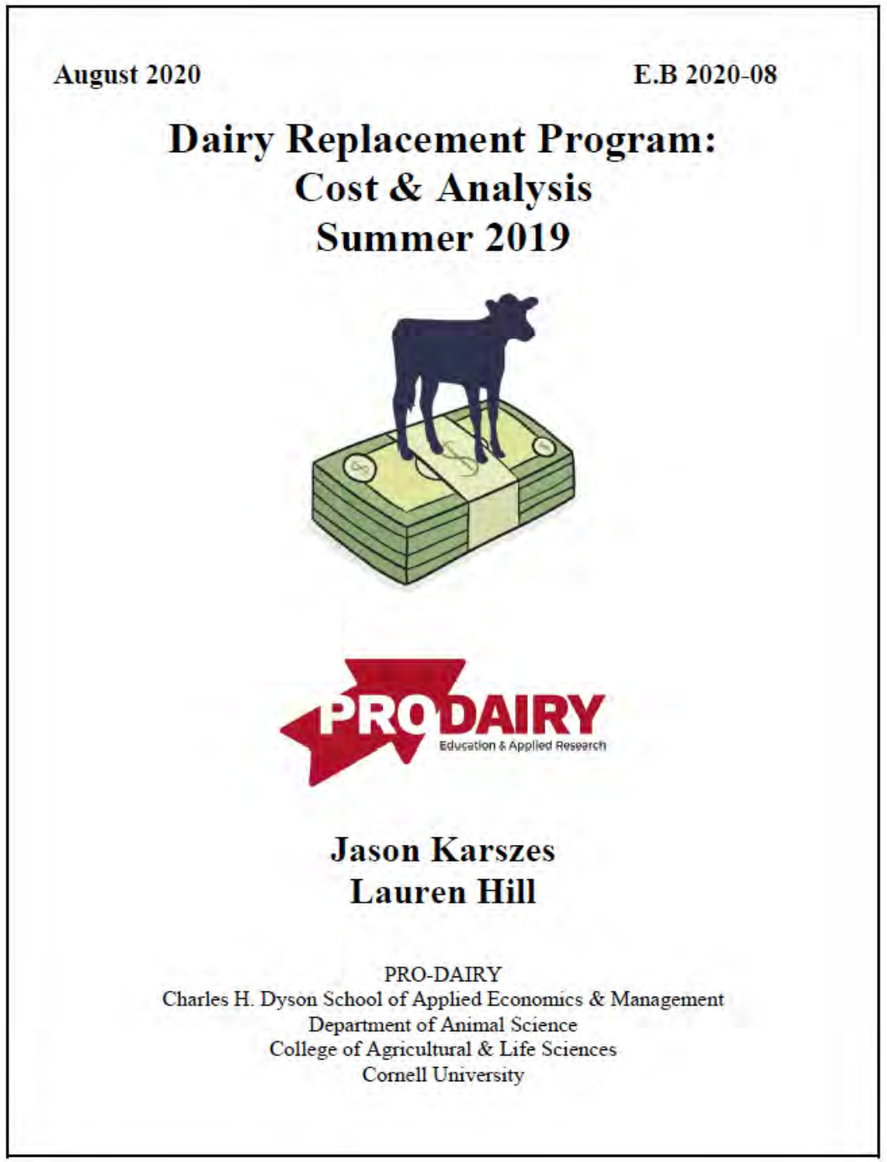
Rather than whether feed was home-raised or purchased, what likely is more critical is how efficiently feed is converted to milk.

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

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Department of Animal Science
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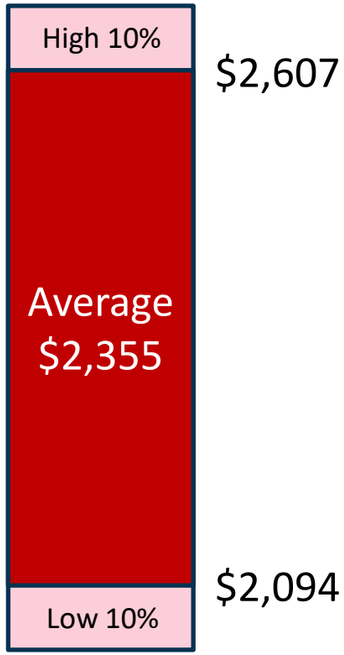
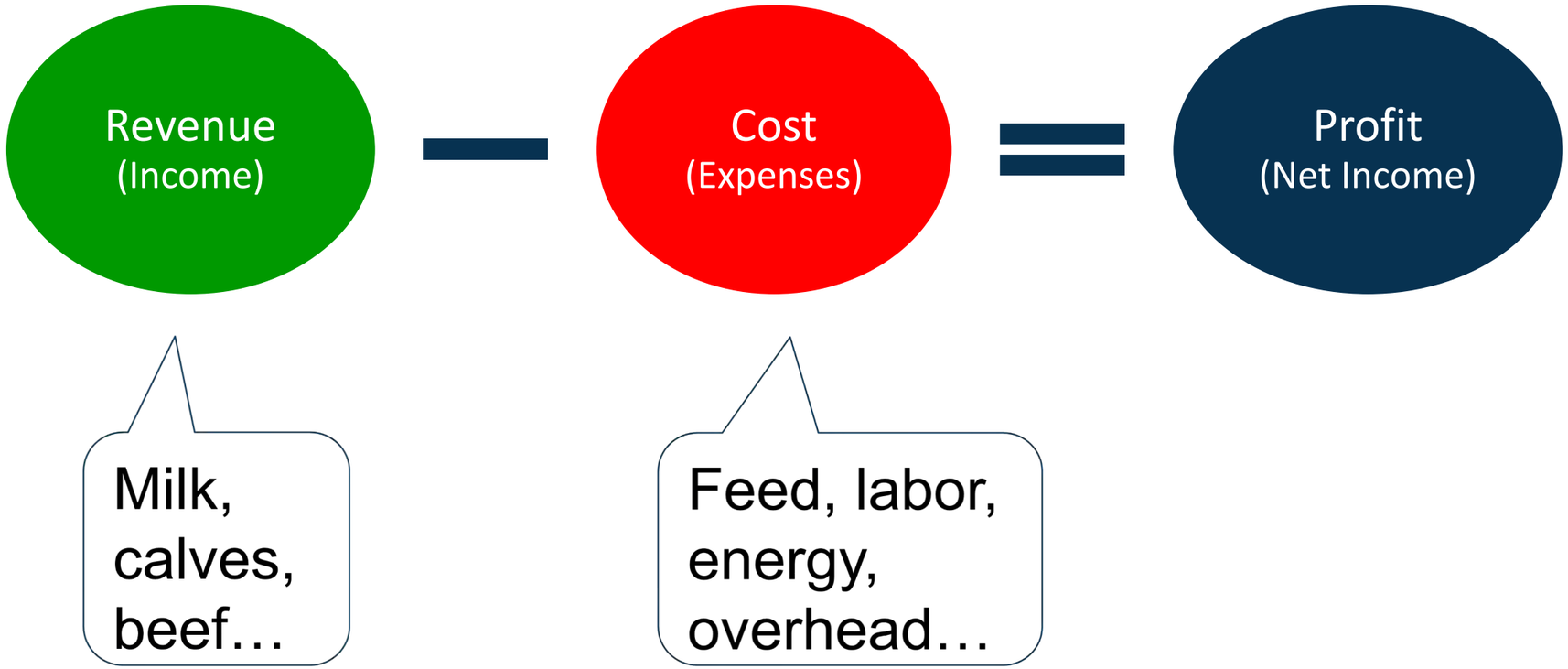
Table 1. TOTAL COSTS TO RAISE HEIFERS
(26 Northeast Dairy Farms, Summer 2019)

Total Cost per Animal Completing	Average	Percent of Total	80th 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
Total	**$2,355**		**$2,094**	**$2,607**	**$513**
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

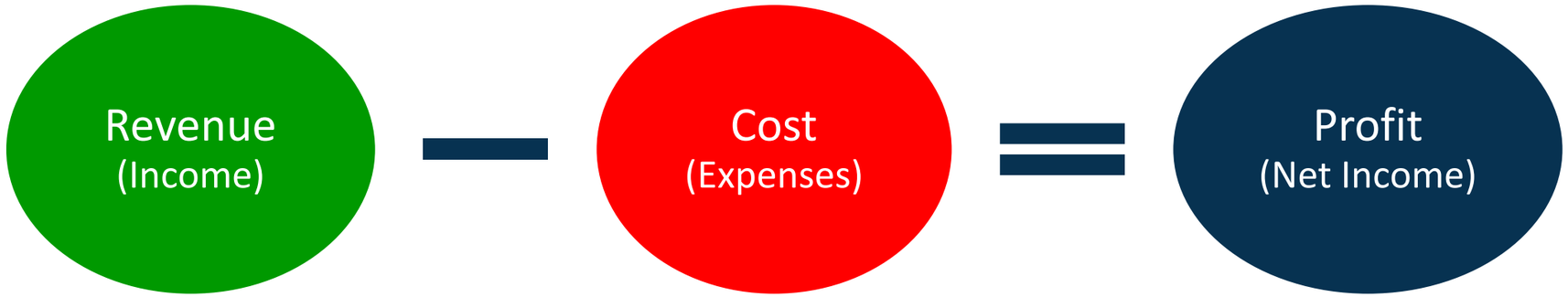


Profit (simplified)



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.

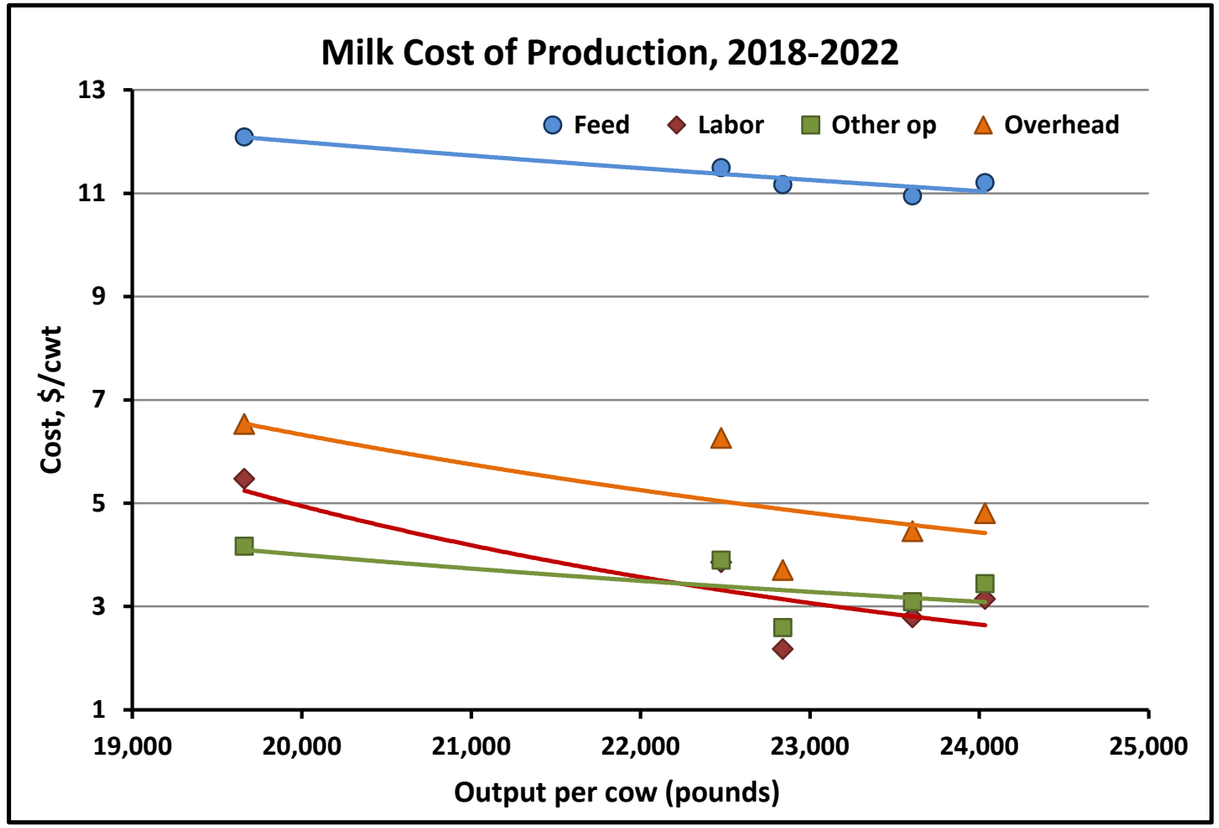
Incremental (more) milk

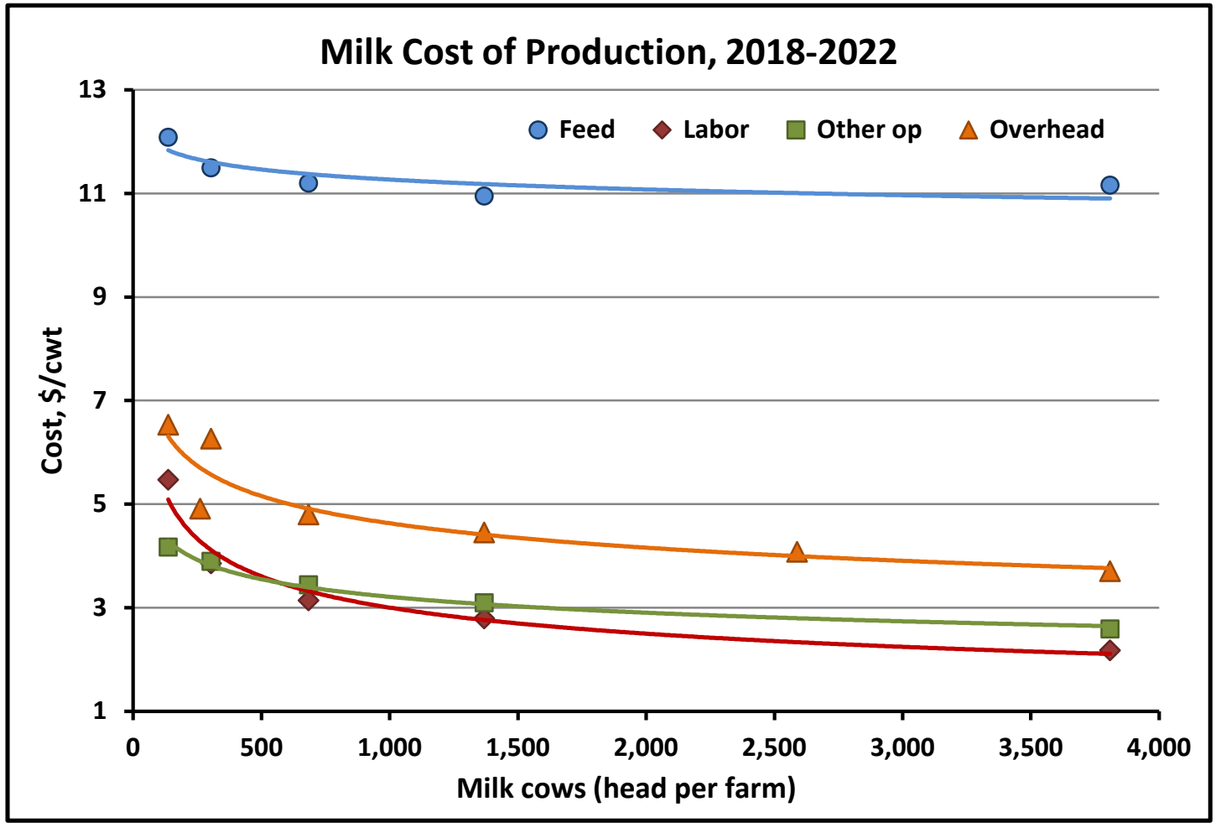
- Producing incremental (more) milk is typically a profitable decision for the individual dairy (not necessarily for the industry)
- Why?
  - Because in general, the value of the milk surpasses the incremental (marginal) cost
- How is this done?

  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

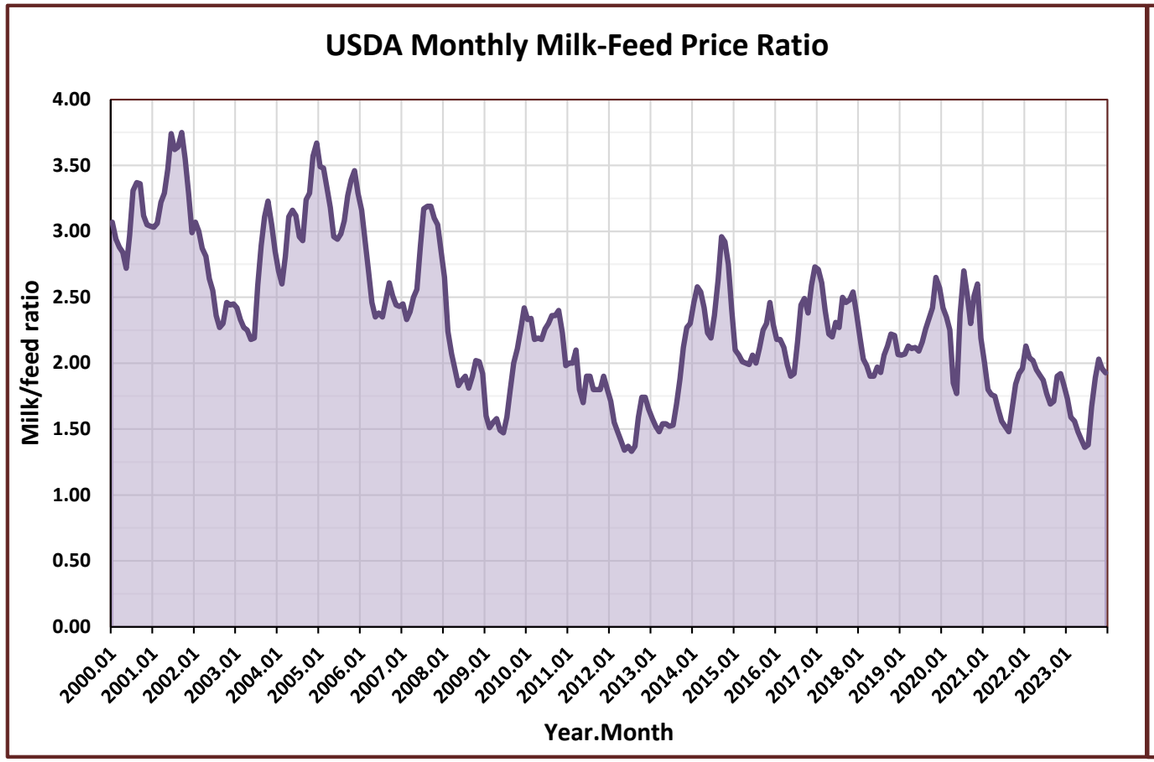




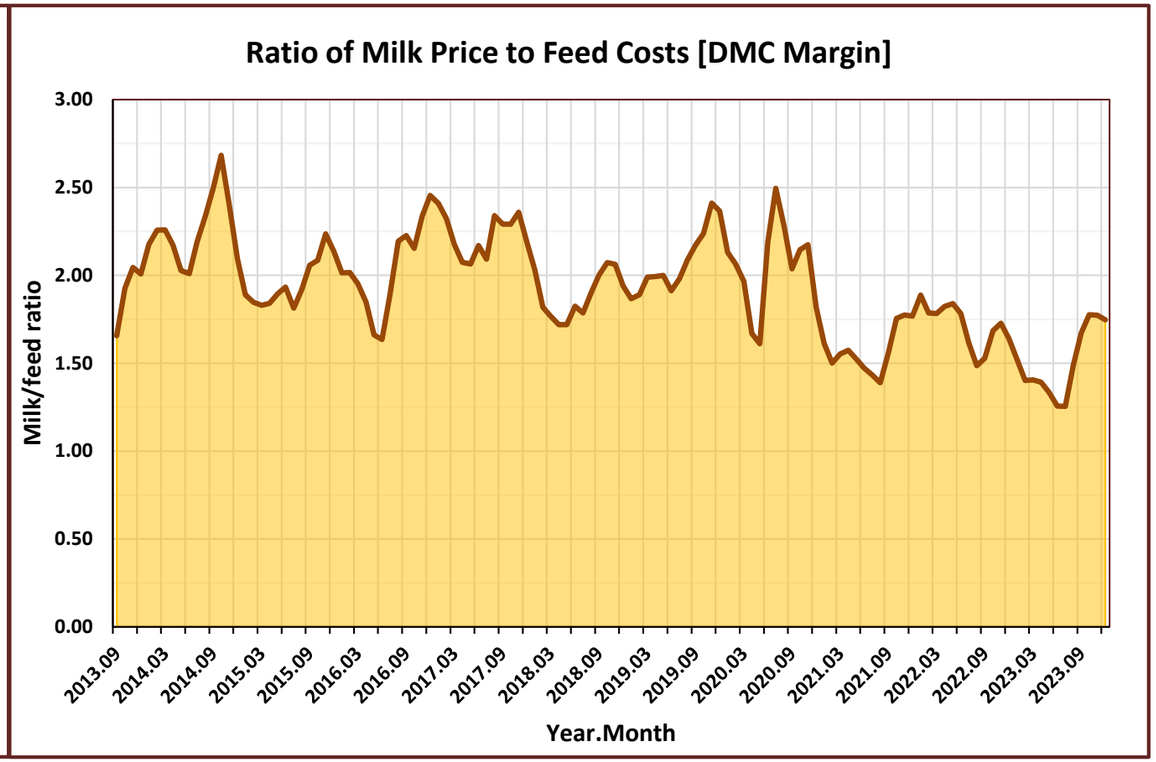
There is a strong negative relationship between costs of production with both output per cow and farm size – relationship is more linear with output per cow. Larger farms have advantage of spreading fixed costs over more cows and they generally have higher output per cow further diluting their costs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

Source: USDA ERS Cost-of-Production-Estimates-2016 and 2021 Base. Annual – Milk cost of production by size of operation. https://www.ers.usda.gov/data-products/milk-cost-of-production-estimates/ Accessed 5 Oct 2023.

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

- 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…

Intervention Benefits	
Increased revenue	(1)
+ Decreased costs	(2)
= Total benefit	(B)

Intervention Costs	
Decreased revenue	(3)
+ Increased costs	(4)
= 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

	Ration A	Ration B
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

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).

Milk	Ration A					Ration B				
production	Feed cost		IOFC	Total cost	Profit	Feed cost		IOFC	Total cost	Profit
lbs/day	($/day)	($/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	$8.00	$9.10	$8.28	$18.19	$0.28
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

Income and costs – which are fixed vs variable?

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

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[1]	Per Cwt	for dairy	per cow	Per Dairy	Per Cow[1]	Per Cwt	Per Dairy	Per Cow[1]	Per Cwt	for dairy	per cow	Per Dairy	Per Cow[1]	Per Cwt	Per Dairy	Per Cow[1]	Per Cwt
PRODUCTION																				
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
INCOME																				
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
EXPENSES (for 12-month period)																				
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%		381,060	276	1.00	8,760	6	0.00	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[2]		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[2]		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
Total cost		**$8,436,226**	**$6,113**	**$22.66**			**$8,465,439**	**$6,134**	**$22.22**	**$29,213**	**$21**	**-$0.44**			**$8,929,638**	**$5,973**	**$22.27**	**$493,412**	**-$140**	**-$0.39**
Net return		**$168,374**	**$122**	**$0.45**			**$331,881**	**$240**	**$0.87**	**$163,507**	**$118**	**$0.42**			**$339,817**	**$227**	**$0.85**	**$171,443**	**$105**	**$0.40**
Breakeven base milk price, $/cwt		**$21.55**	**($21.55 all prod)**				**$21.13**	**($21.13 all prod)**		**-$0.42**					**$21.15**	**($21.15 all prod)**		**-$0.40**		
Breakeven milk production, lbs/day		**82.5**					**82.1**			**-0.4**					**79.8**			**-2.7**		

[1] Per cow in herd (lactating + dry)

[2] 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)

XXXXXXXX,

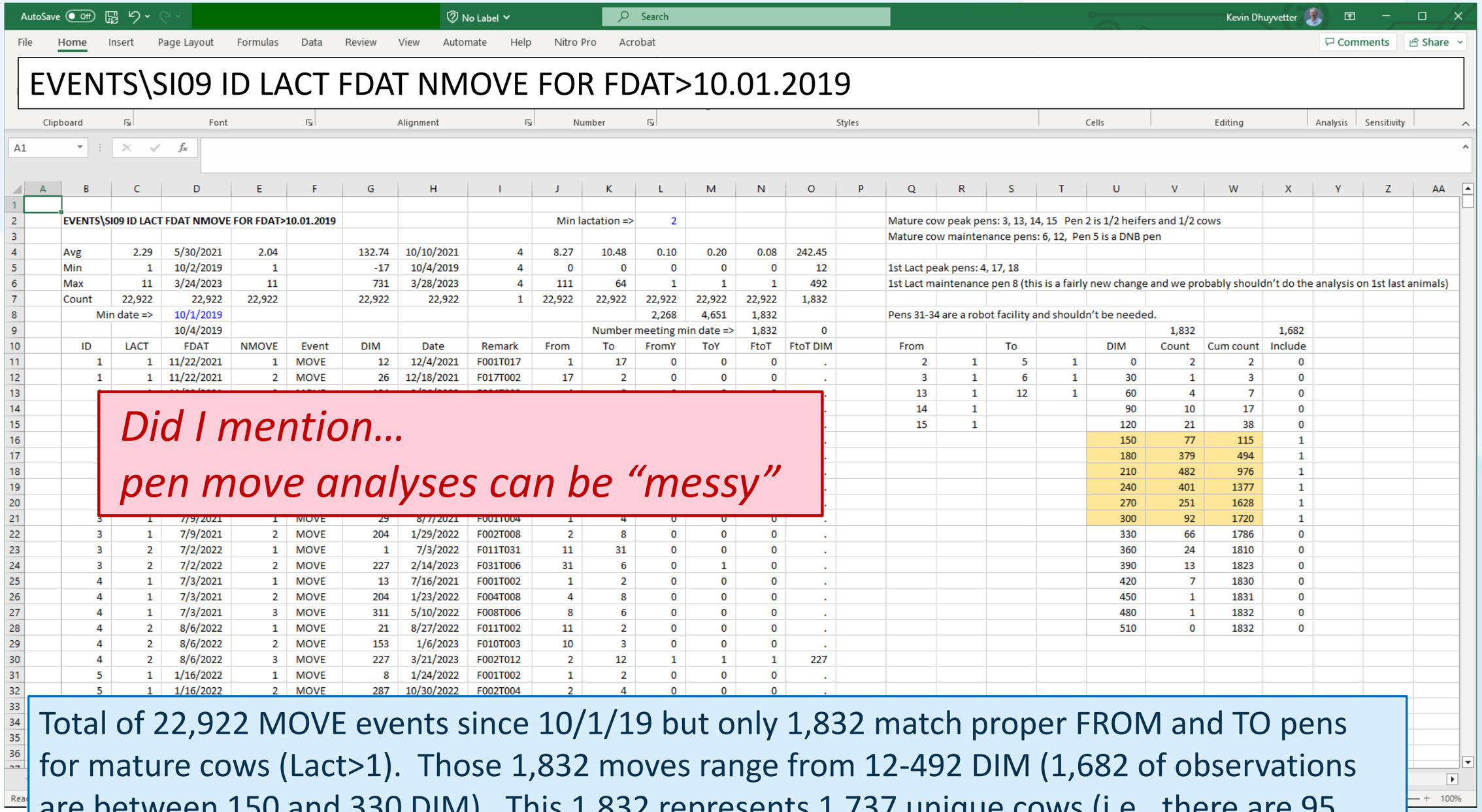
I would like to look at what, if any, milk loss is associated with cows that move from a high cow ration diet to a maintenance cow ration diet.

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…

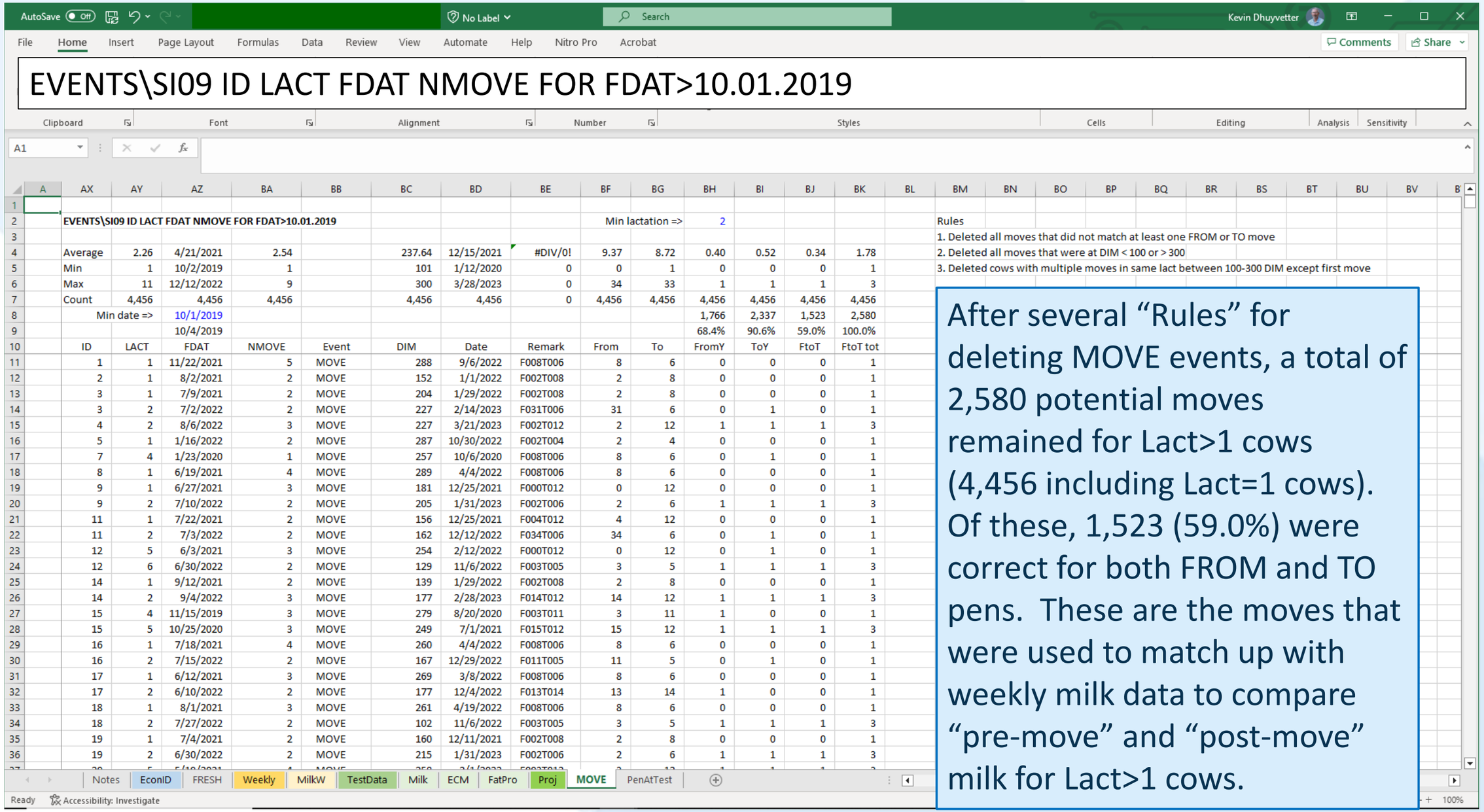


EVENTS\SI09 ID LACT FDAT NMOVE FOR FDAT>10.01.2019

	EVENTS\SI09 ID LACT FDAT NMOVE FOR FDAT>10.01.2019								Min lactation =>		2				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											
	Avg	2.29	5/30/2021	2.04		132.74	10/10/2021	4	8.27	10.48	0.10	0.20	0.08	242.45													
	Min	1	10/2/2019	1		-17	10/4/2019	4	0	0	0	0	0	12	1st Lact peak pens: 4, 17, 18												
	Max	11	3/24/2023	11		731	3/28/2023	4	111	64	1	1	1	492	1st Lact maintenance pen 8 (this is a fairly new change and we probably shouldn't do the analysis on 1st last animals)												
	Count	22,922	22,922	22,922		22,922	22,922	1	22,922	22,922	22,922	22,922	22,922	1,832													
	Min date =>		10/1/2019								2,268	4,651	1,832		Pens 31-34 are a robot facility and shouldn't be needed.												
			10/4/2019							Number meeting min date =>			1,832	0							1,832		1,682				
	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				
	3	1	7/9/2021	1	MOVE	29	8/7/2021	F001T004	1	4	0	0	0	.					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).



EVENTS\SI09 ID LACT FDAT NMOVE FOR FDAT>10.01.2019

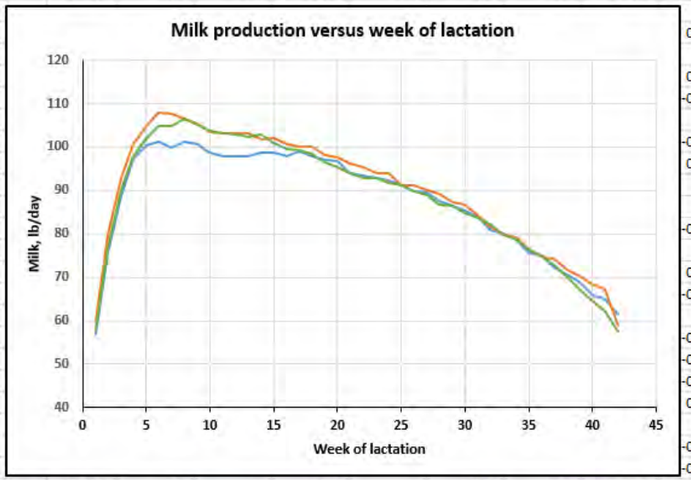
	AX	AY	AZ	BA	BB	BC	BD	BE	BF	BG	BH	BI	BJ	BK
2	EVENTS\SI09 ID LACT FDAT NMOVE FOR FDAT>10.01.2019								Min lactation =>		2			
4	Average	2.26	4/21/2021	2.54		237.64	12/15/2021	#DIV/0!	9.37	8.72	0.40	0.52	0.34	1.78
5	Min	1	10/2/2019	1		101	1/12/2020	0	0	1	0	0	0	1
6	Max	11	12/12/2022	9		300	3/28/2023	0	34	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	FDAT	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

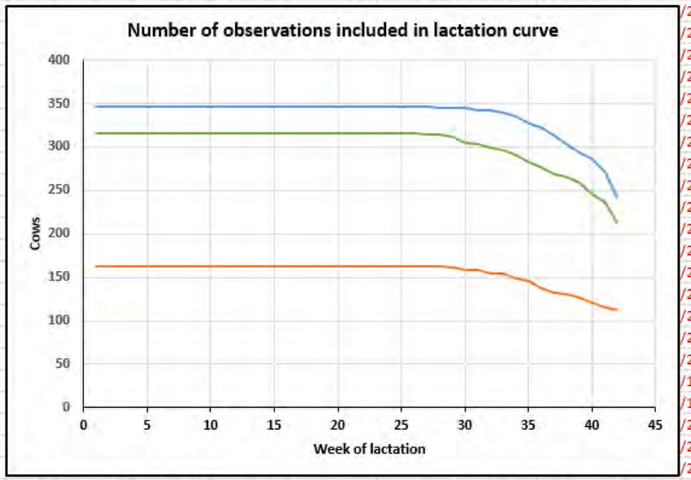
Rules

1. Deleted all moves that did not match at least one FROM or TO move
2. Deleted all moves that were at DIM < 100 or > 300
3. Deleted cows with multiple moves in same lact between 100-300 DIM except first move

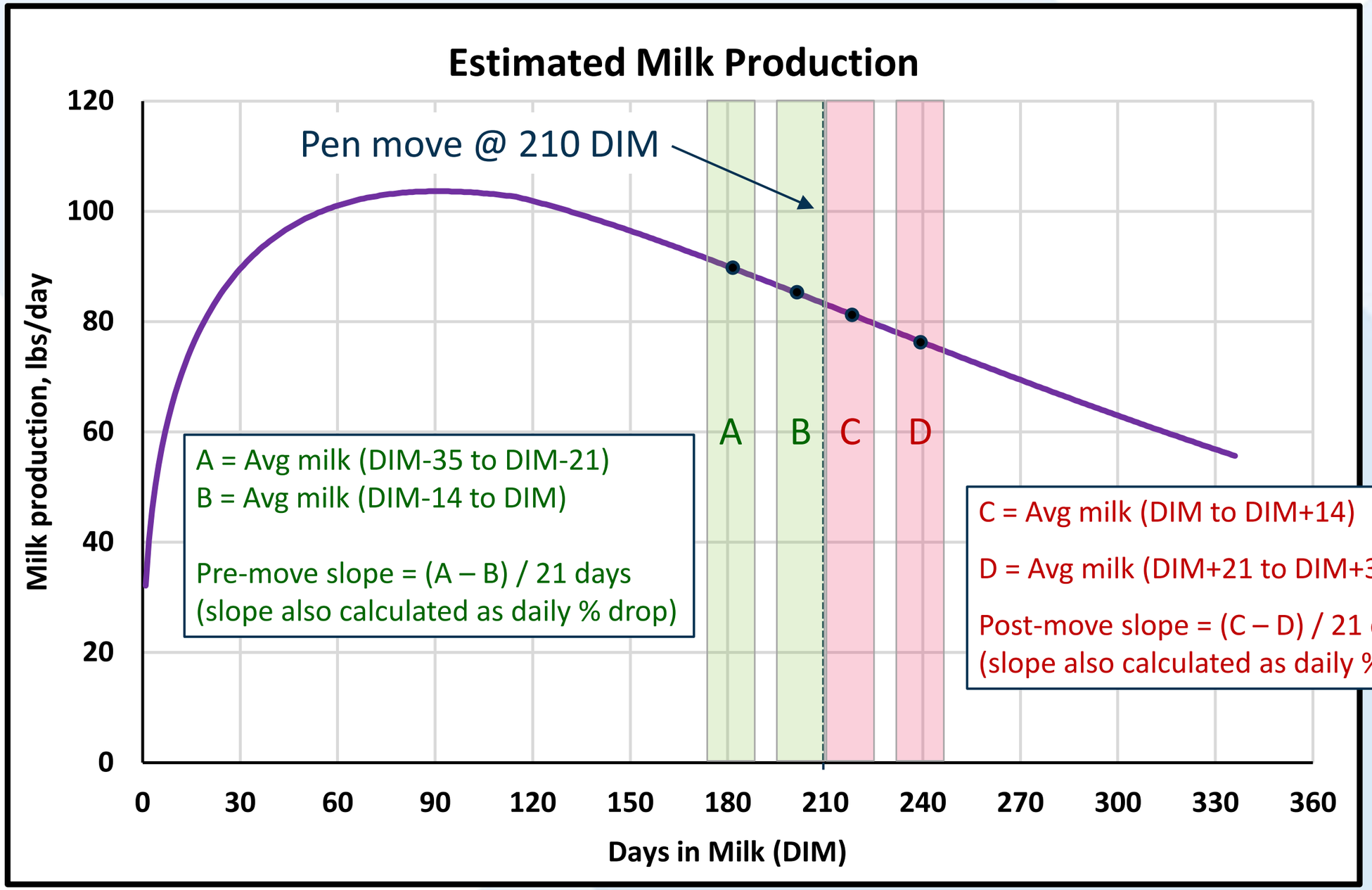
After several “Rules” for deleting MOVE events, a total of 2,580 potential moves remained for Lact>1 cows (4,456 including Lact=1 cows). Of these, 1,523 (59.0%) were correct for both FROM and TO pens. These are the moves that were used to match up with weekly milk data to compare “pre-move” and “post-move”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





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

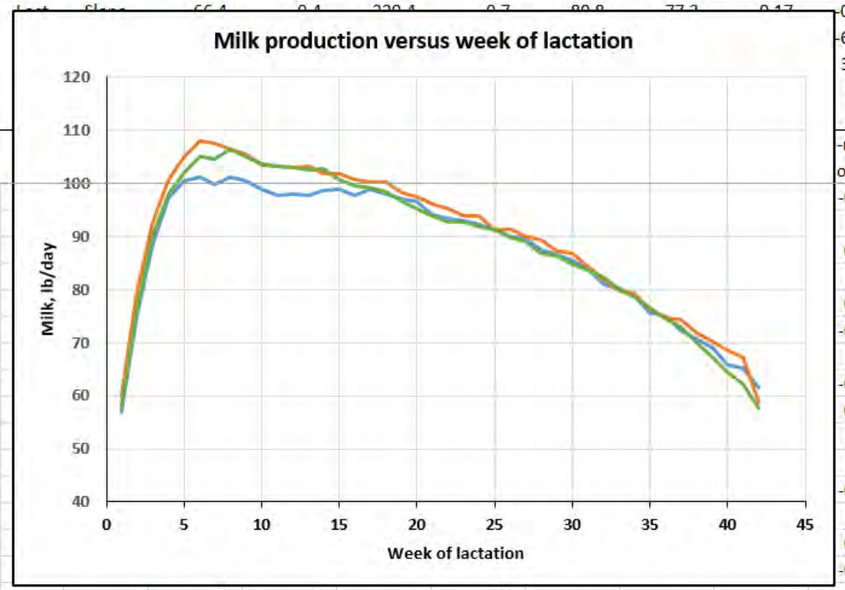


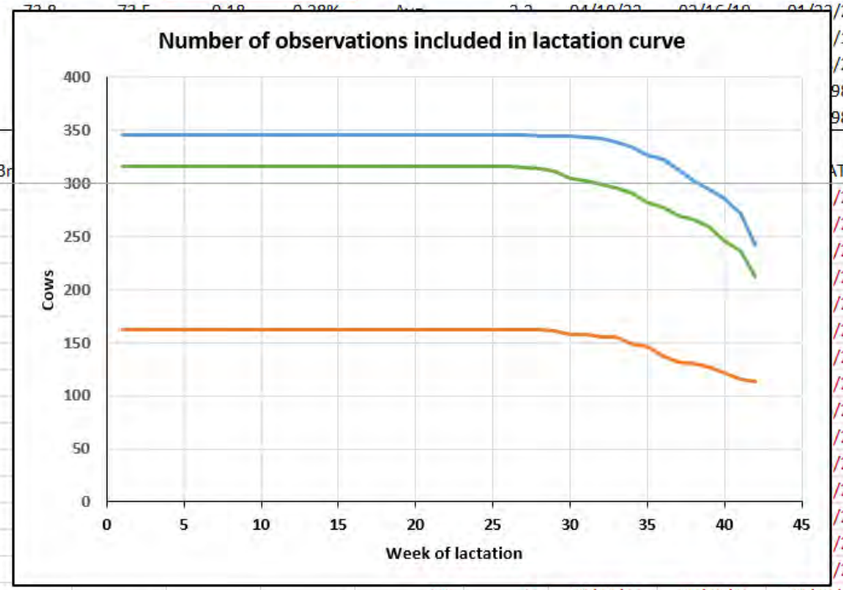
Average daily drop in milk is ~0.07 – 0.10 lb/day (0.15% – 0.20%) ***greater*** after the pen move than it was prior to the pen move [total of 824 cows in first week].

							Pre-move				Post-move						
INTBDPC(NC)						Parity-wtd avg =>	0.171	-0.19%			0.245	-0.36%		LACT	FDAT		
Weekly Milk Data -- FDAT 1/1/2019 - 4/8/2021	CDAT DIM	MoveDIM															
	-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

First	14
Second	21
Third	35
Change to move	0

Min =>	26	60	4
4040	Wks	Peak	Peak wk
1	47	84	6
0	20	98	9
1	44	83	30
1	36	116	5
1	44	70	22
1	38	97	7
1	51	81	37
1	34	99	15
1	63	124	47
1	62	107	36
0	9	112	6
1	48	76	30
1	38	109	8
1	47	85	24
1	38	122	15
0	3	44	1
1	42	80	19





Notes | EconID | FRESH | Weekly | Sheet1 | MilkW | TestData | Milk | ECM | FatPro | Proj | MOVE | PenAtTest

Ready | Accessibility: Investigate | Display Settings | 110%

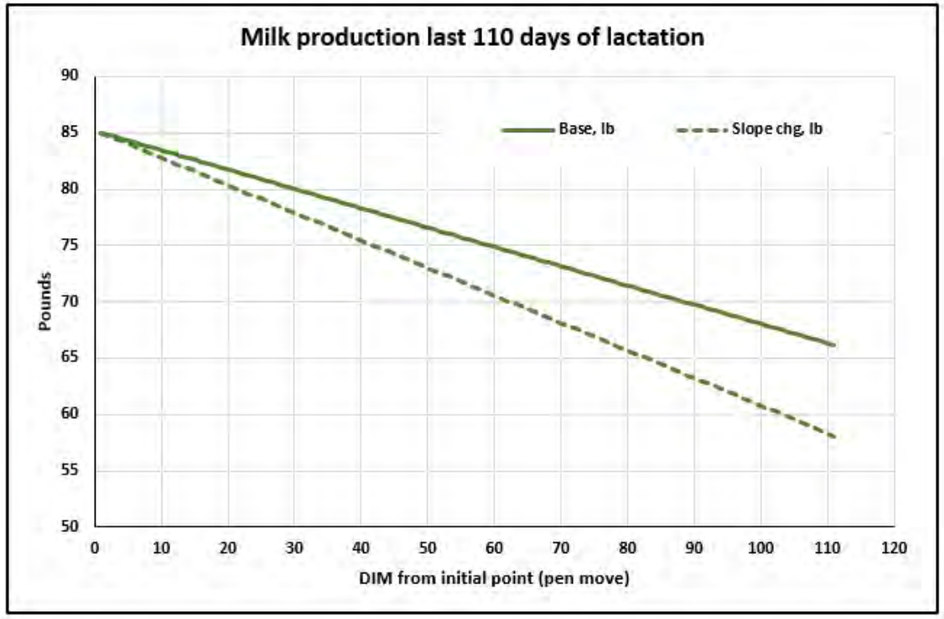
Estimated milk loss with changing slope of lactation curve

Estimated milk loss associated with pen move

Milk at time of pen move (base), lb/day	85
Days from pen move until end of lactation	110
Days to evaluate milk production after move	60
Milk price, $/cwt	$18.00
Maintenance feed, DM lb/hd/d	18.0
Feed for milk production, DM lb/lb of milk	0.444

	Slope, lb/day		Slope, pct/day	
Slope of lactation curve	0.171	0.245	0.19%	0.36%
Milk in 60 days	74.7	70.3	75.9	68.3
Milk at dry-off	66.1	58.1	69.1	56.9
Total milk, lbs	8,388	7,942	8,522	7,772
Difference from base, lb	n/a	446	n/a	750
Feed price, $/lb	$0.140	$0.120	$0.140	$0.120
Total feed, lb DM	5,708	5,510	5,768	5,434
IOFC until end of lactation	$710.72	$768.33	$726.53	$746.89
Breakeven feed price, $/lb	base	$0.1305	base	$0.1237

	Day	Base, lb	Slope chg, lb	Base, %	Slope chg, %
Pen move =>	0	85.0	85.0	85.0	85.0
	1	84.8	84.8	84.8	84.7
	2	84.7	84.5	84.7	84.4
	3	84.5	84.3	84.5	84.1
	4	84.3	84.0	84.4	83.8
	5	84.1	83.8	84.2	83.5
	6	84.0	83.5	84.0	83.2
	7	83.8	83.3	83.9	82.9
	8	83.6	83.0	83.7	82.6
	9	83.5	82.8	83.6	82.3
	10	83.3	82.6	83.4	82.0
	11	83.1	82.3	83.3	81.7
	12	82.9	82.1	83.1	81.4
	13	82.8	81.8	82.9	81.1
	14	82.6	81.6	82.8	80.8



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.

J. Dairy Sci. 106
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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[1,2*†]
[1]Marlex, 08173 Sant Cugat del Vallès, Spain
[2]ICREA, Institut de Recerca i Estudis Avançats, 08010 Barcelona, Spain

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[1]	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*

[1]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.

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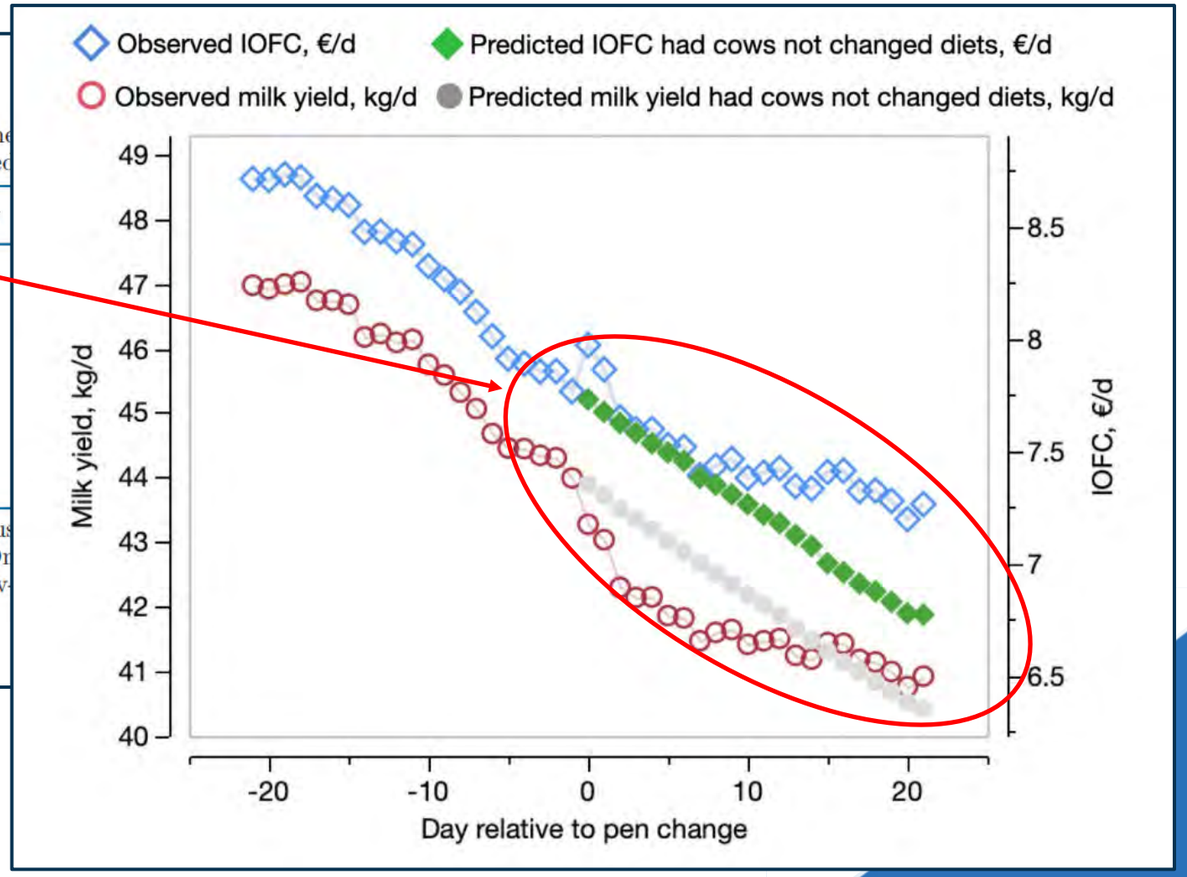
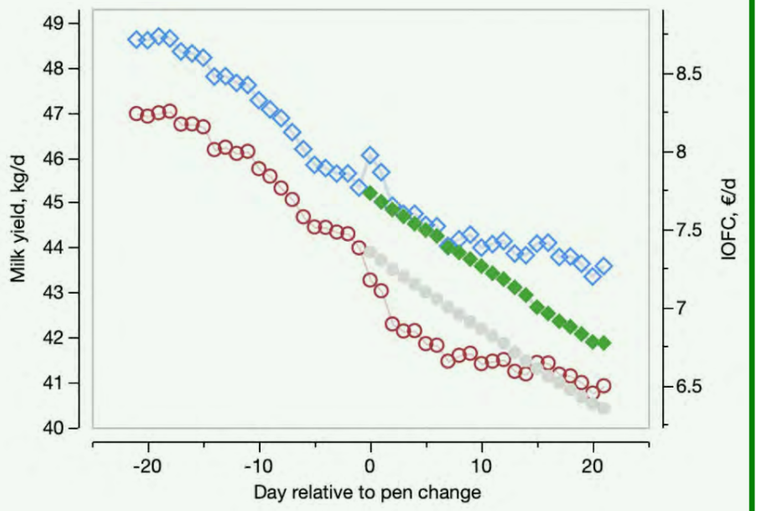
*Values differ from zero ($P < 0.05$).

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

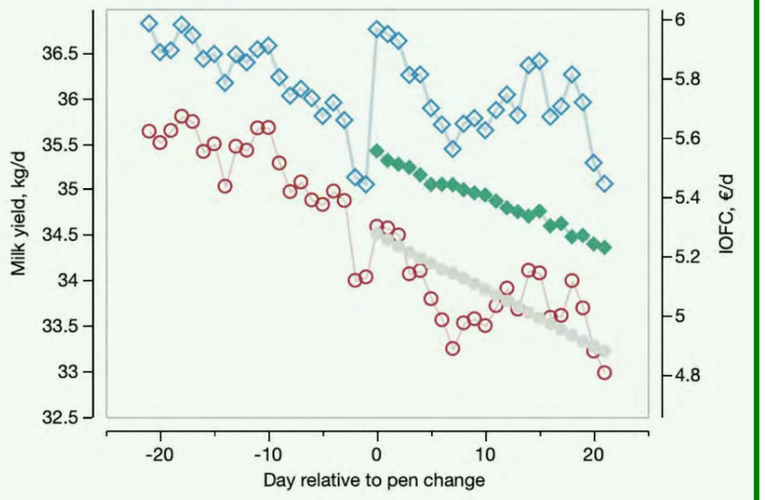


Observed IOFC, €/d
Predicted IOFC had cows not changed diets, €/d
Observed milk yield, kg/d
Predicted milk yield had cows not changed diets, kg/d

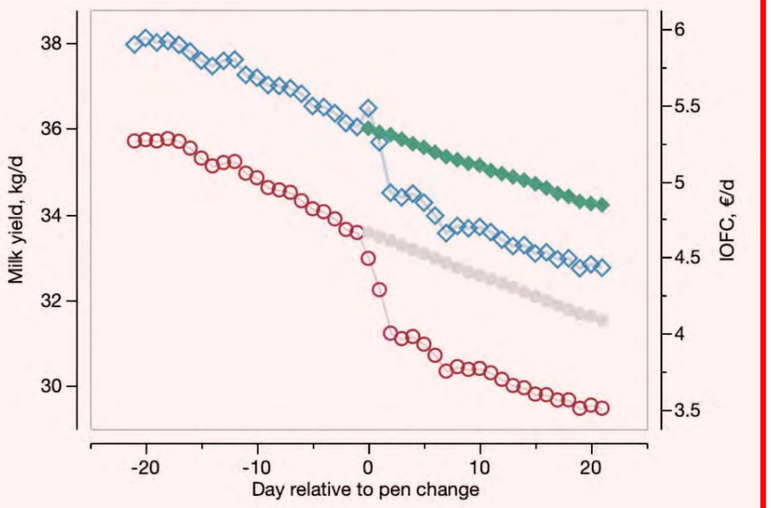
Move was profitable (n=4)
Move was unprofitable (n=2)



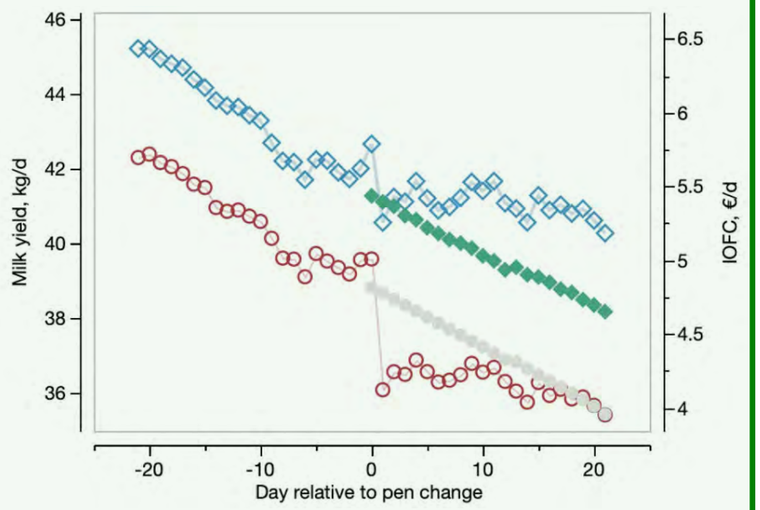
Farm A - High to medium production (439 moves) (more profitable)



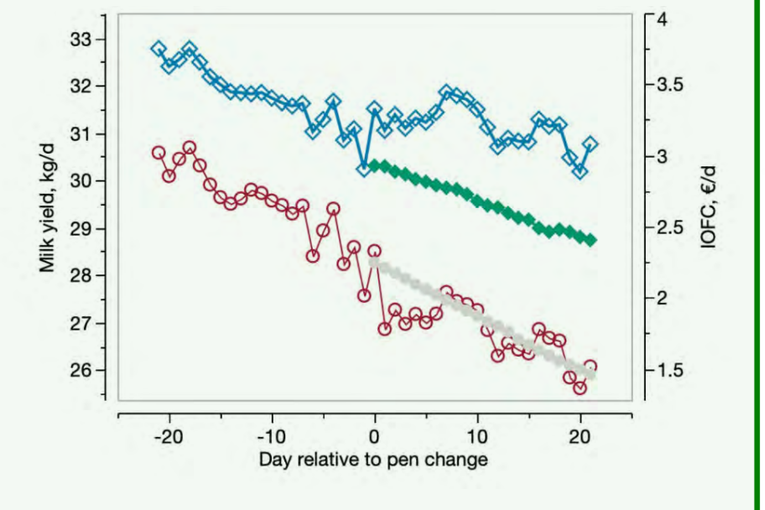
Farm A - Primiparous to medium production (243 moves) (more profitable)



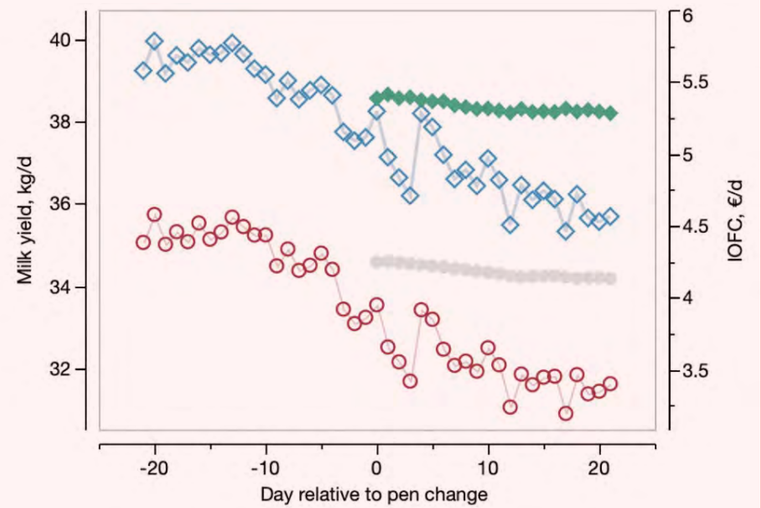
Farm A - Medium to low production (719 moves) (less profitable)



Farm B - High to low production (276 moves) (more profitable)



Farm B - Primiparous to low production (192 moves) (more profitable)



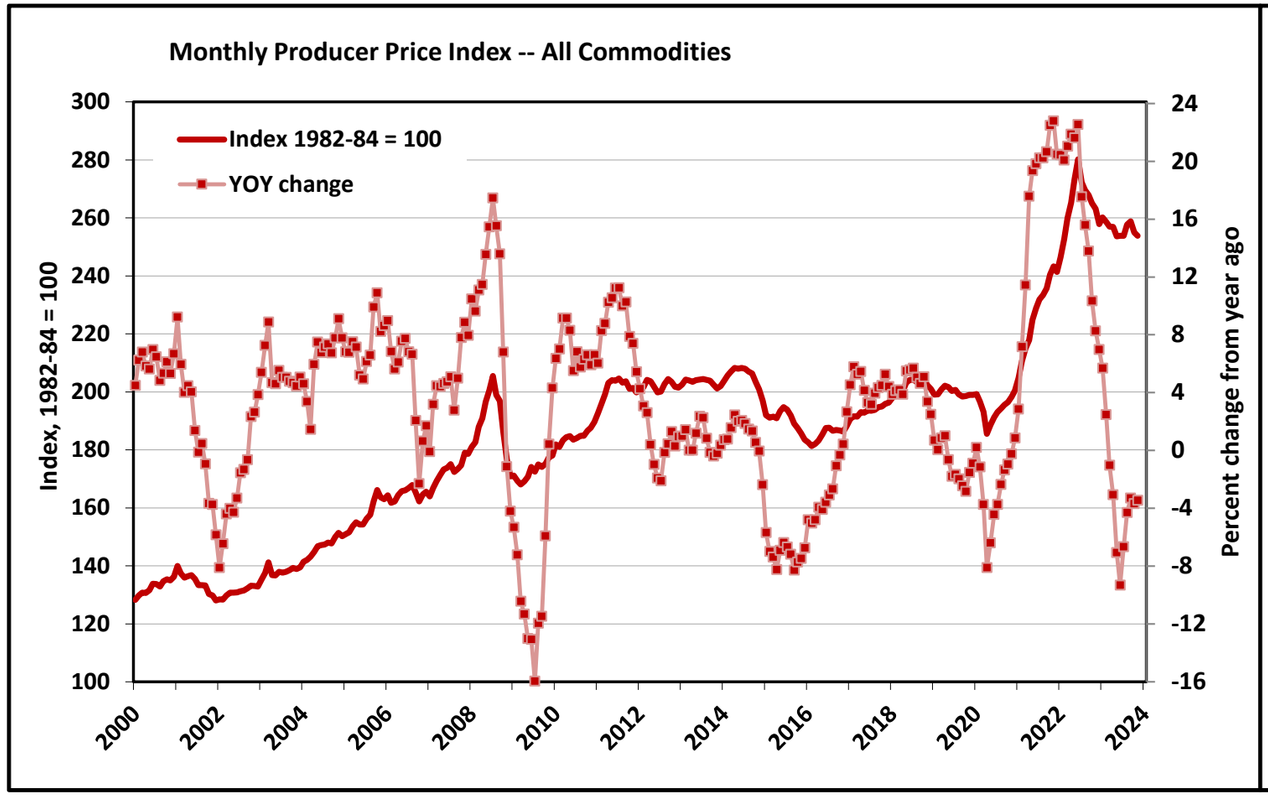
Farm C - Primiparous to high production (273 moves) (less profitable)

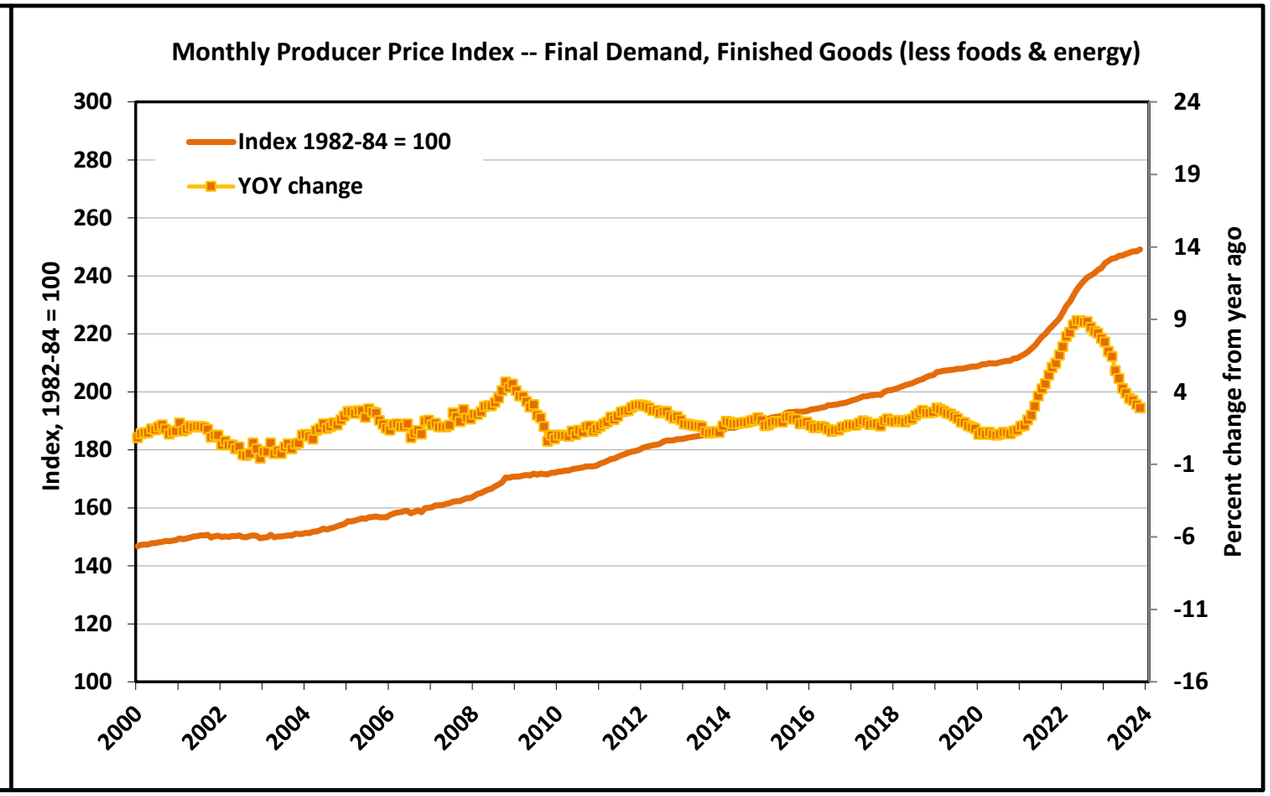
Pen moves / ration changes summary

- 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

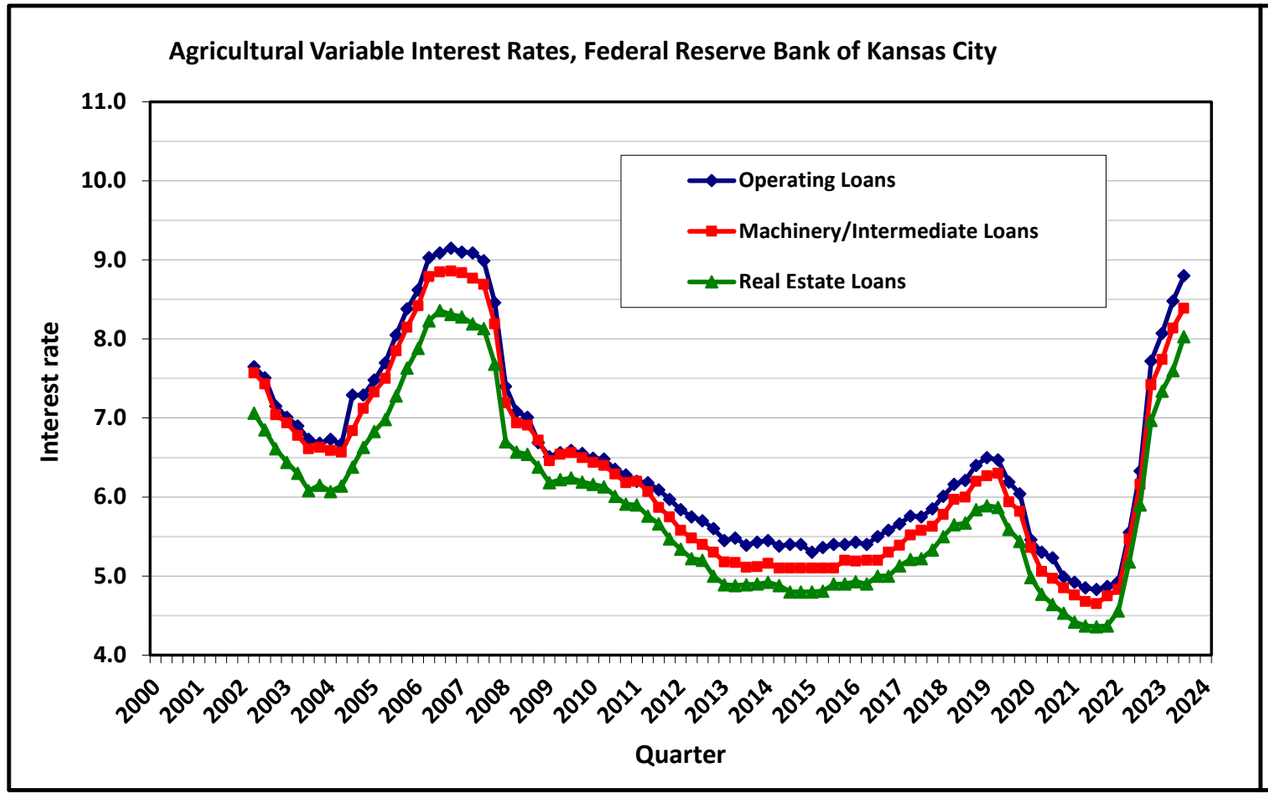


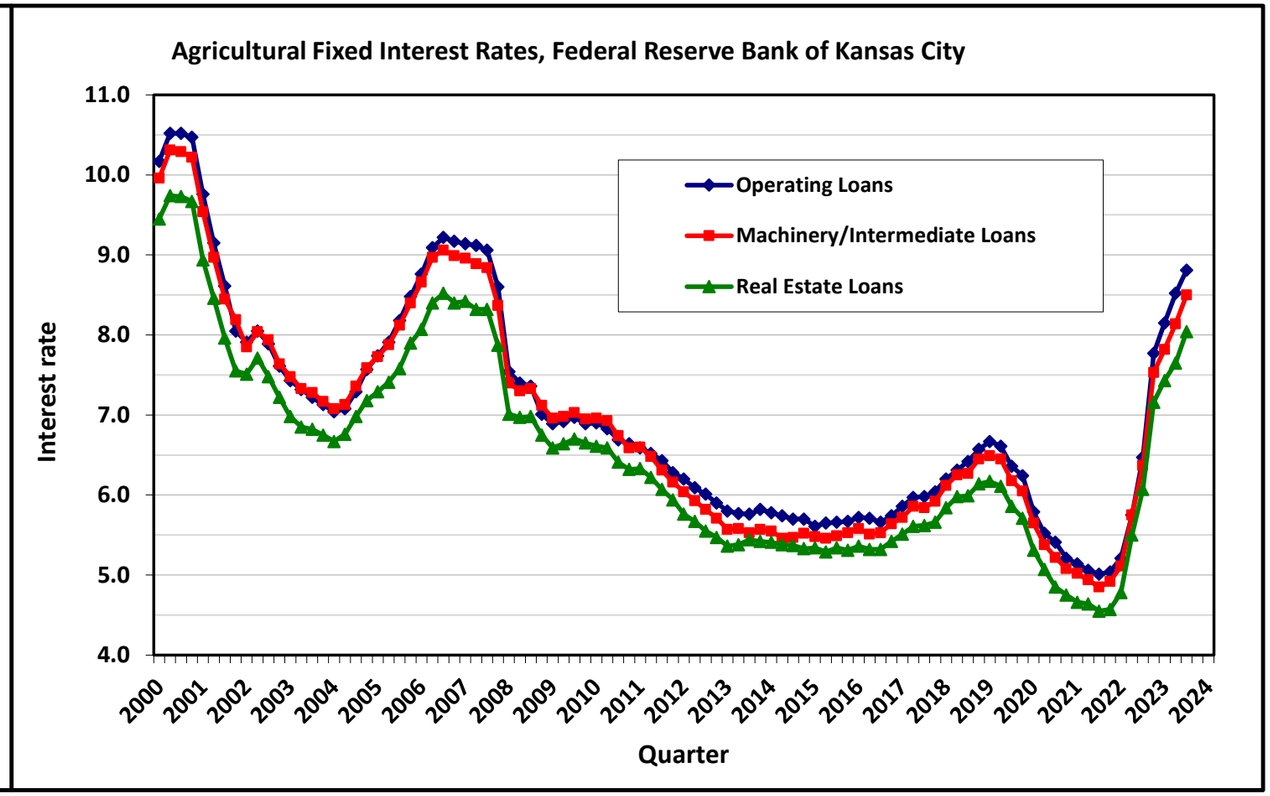


- Variation in PPI is significantly greater when foods and energy are not excluded
- Looking at percent change from previous year can be misleading – i.e., things look much better for 2023 but inflation was still going up (just that the previous year was very high)
- Comparing PPI in 2023 (Jan-Nov) to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

Source: Federal Reserve Economic Data (FRED) (http://research.stlouisfed.org/fred2/). PPIACO and WPSFD4131. Accessed 19 Dec 2023.

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)

Source: Federal Reserve Economic Data (FRED) (http://research.stlouisfed.org/fred2/). PPIACO and WPSFD4131. Accessed 19 Dec 2023.

Whole-farm budget looking at impact of inflation

Projected Budget for Analyzing Dairy Herd Economics							
Year =>	2023				2020		
	Per Dairy	Per Cow[1]	Per Cwt		Per Dairy	Per Cow[1]	Per Cwt
PRODUCTION							
Number of lactating cows	1,200	87%	87%	Percent	1,200	87%	87%
Number of dry cows	180	13%	13%	change	180	13%	13%
Daily milk production, lbs/day	102,000	85.00	100	from 2020	102,000	85.00	100
Daily component production, lbs/day	7,038	5.87	6.90	to 2023	7,038	5.87	6.90
EXPENSES				%			
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[2]	220,000	159	0.59	15%	191,304	139	0.51
Building/facility ownership[2]	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
Total cost	**$8,436,226**	**$6,113**	**$22.66**		**$6,974,316**	**$5,054**	**$18.73**
Breakeven base milk price, $/cwt	**$21.55**	**($21.55 all prod)**			**$17.62**	**($17.62 all prod)**	

[1] Per cow in herd (lactating + dry)

[2] 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

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"Surviving in a World Market."
Georgia Dairy Conference - Savannah, GA Jan 15th 24’

Ronald K. OBrien II
@rko2milk

'The best way to predict your future is to create it.'
-Abraham Lincoln

"It's safe to say U.S. dairy producers did not get the quota that they thought they were promised under USMCA."

–NMPF

Projections, forecasts, expectations & assumptions

- "USDA projections include policies in place as of …"
- Trade tariffs policies in place are **"assumed"** to remain in effect…
- "EU outlook report should not be misinterpreted as a forecast. More precisely, these projections correspond to the average trends that agricultural markets are expected to follow if current policies and the macroeconomic environment remain unchanged over the projected period."

USDA
Projections **assume** USMCA policies will be enforced
Projections **assume** continuation of Mercosur policies in effect

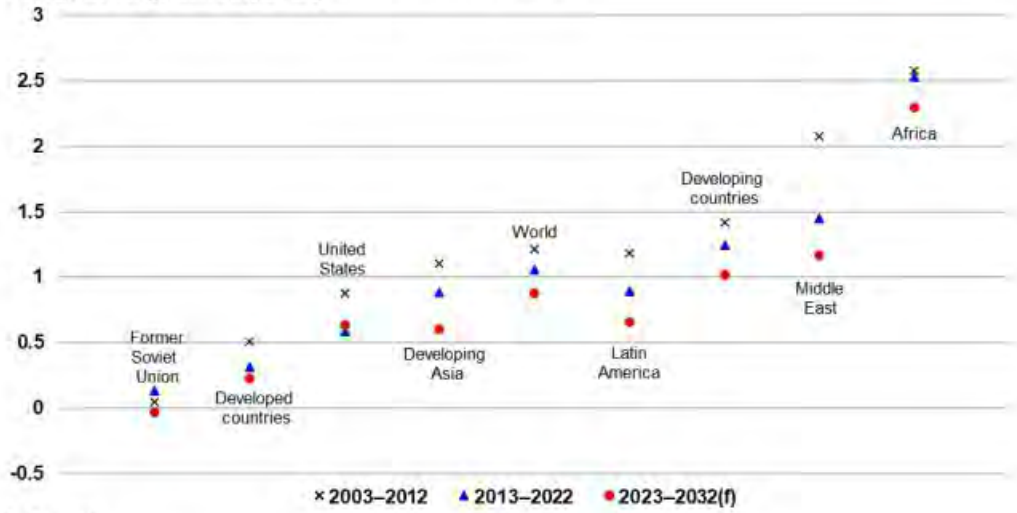
EU
Projections **assume** "The EU is expected to keep its export volumes stable despite decreasing milk production projections"

All based on macro assumptions deemed most plausible at the time of the analysis.

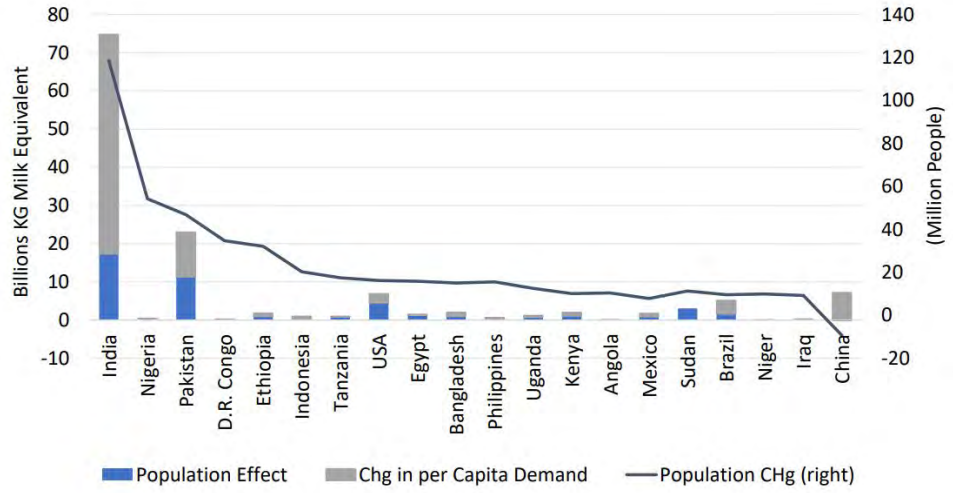
"The forecasts have been embarrassingly wrong, in the entire forecasting community," Torsten Slok at the asset manager Apollo Global Management, said in the Times story. "We are still trying to figure out how this new economy works."

Global Population- key risks

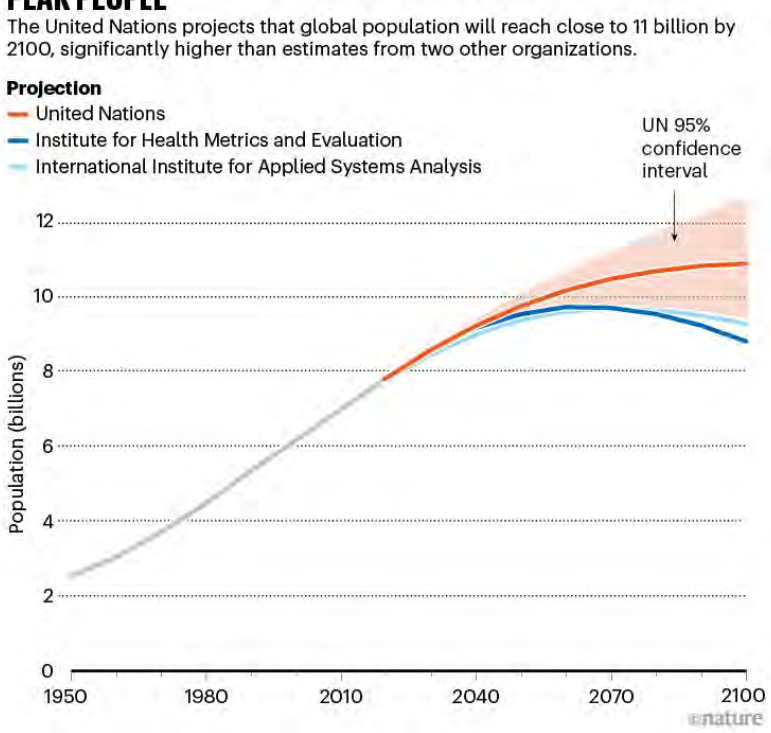
Figure 9. World population growth rates, 2002-32
Average annual growth rate (percent)



f = forecast
Note: Developing Asia is Asia less Japan.
Source: U.S. Department of Commerce, Bureau of the Census.



Source: UN Population Estimates, OECD, IFCN, RaboResearch, 2023



Global milk production forecasts

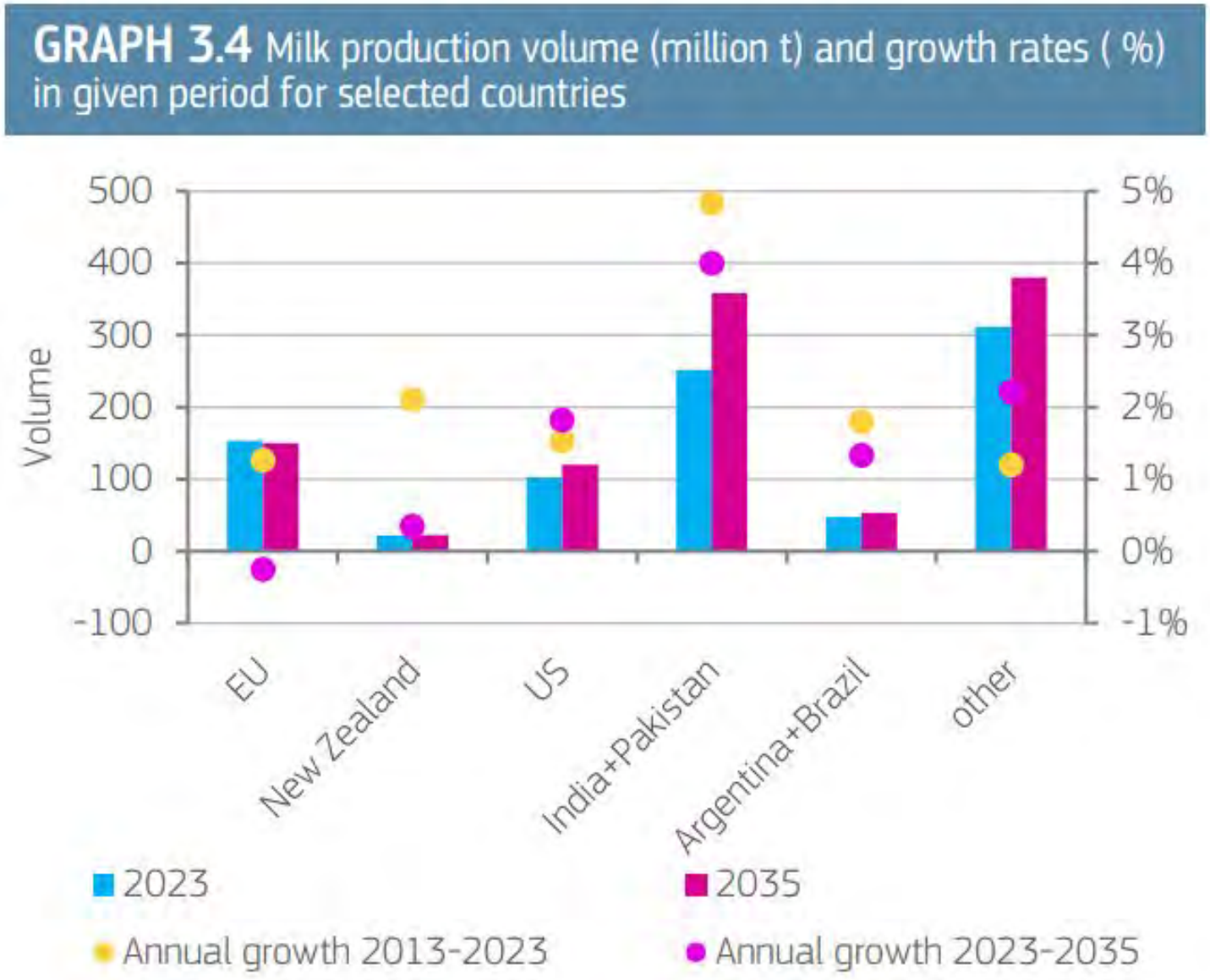
"Expectations for stricter EU and national environmental policies will likely force the EU dairy herd to shrink (-13 % by 2035 compared with the 2021-2023 average)."

EU milk production could decline by 0.2% per year on average between now and 2035

increase in NZ milk production will also likely slow down… growth in milk yields limited in grassland-based systems +increasing pressure from environmental policies

"EU forecast of 1% decrease in milk fat and an almost 2% decrease in non-fat solids by 2035"

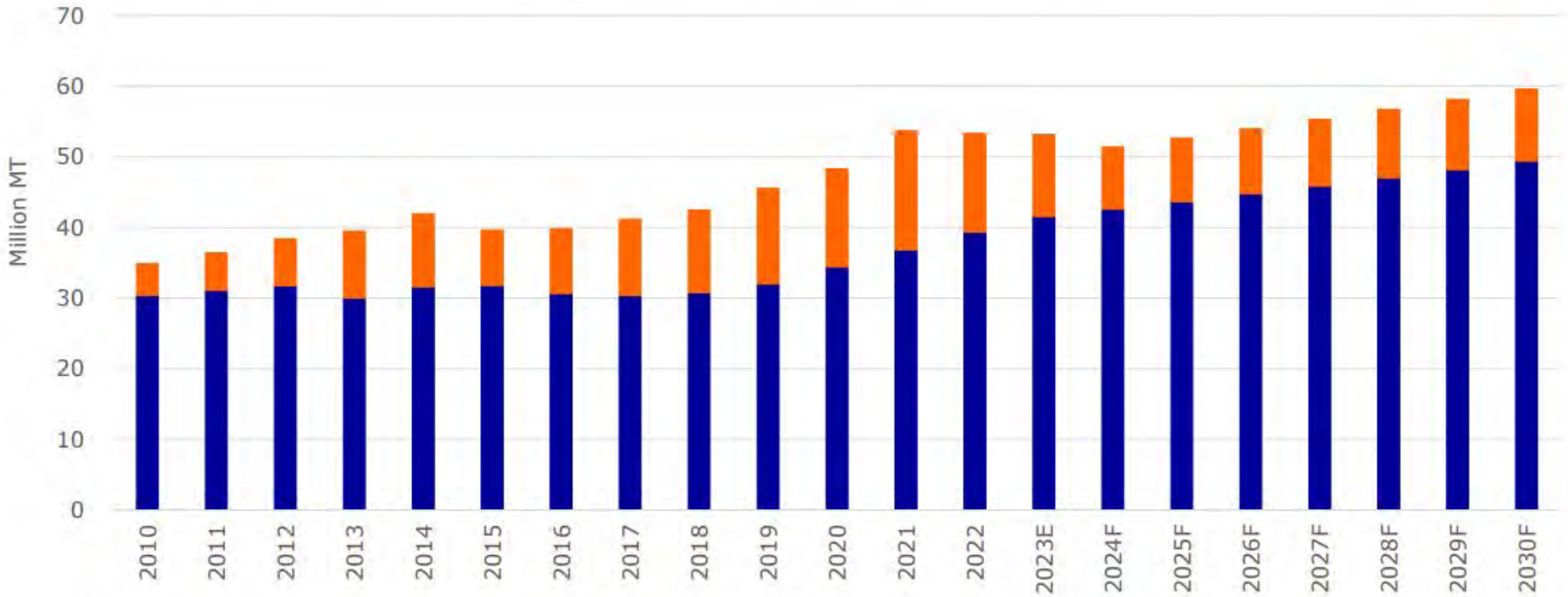
EU Ag Outlook 2023



Import markets increasing domestic production

Rising domestic Chinese production is tempering imports

- China added 10 million MT of production from 2017 to 2023



 Source: Rabobank 2023.

Global Trade 2030-2035

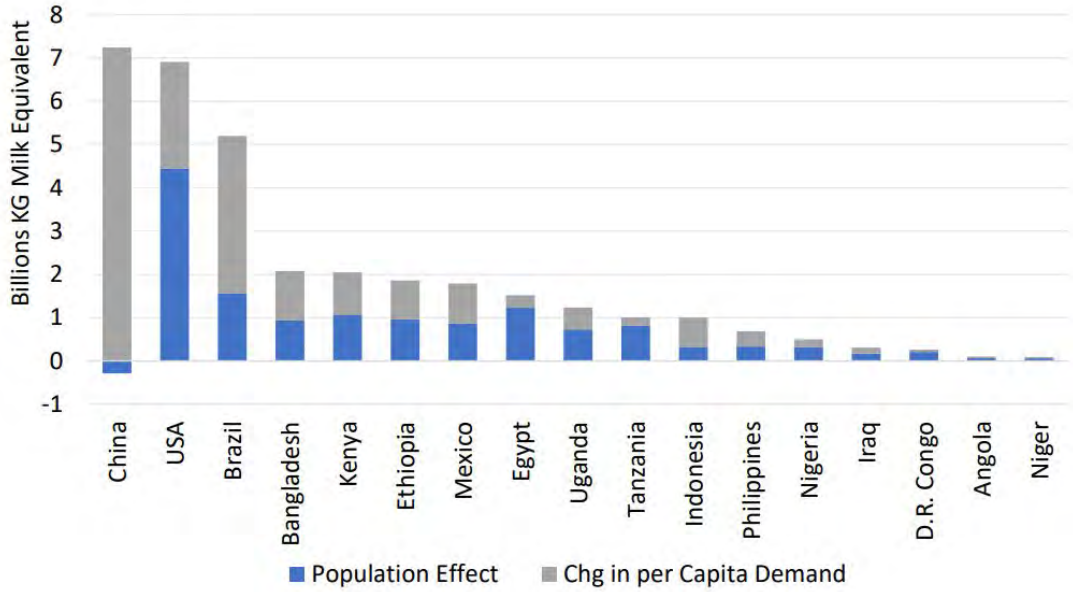
"growth in total global imports of dairy products is expected to slow down to roughly 2 % annual milk deficit growth between 2023 and 2035, compared with 4% in the past decade"

"EU is expected to keep its export volumes stable"

"increasing milk production in the main importer regions will slow down the strong import growth achieved in past, for both skimmed and whole milk powders"

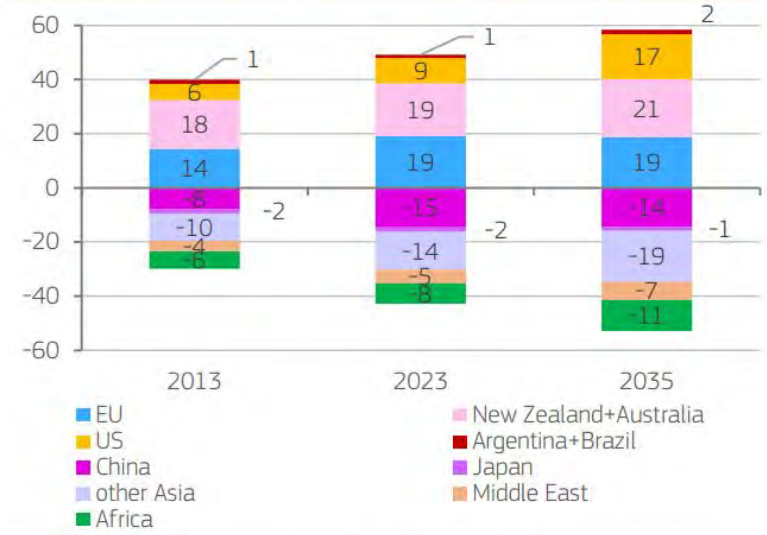
"New Zealand will likely be the most impacted by decreasing demand in China, potentially leading to some changes in their export portfolio"

EC: EU AG Outlook



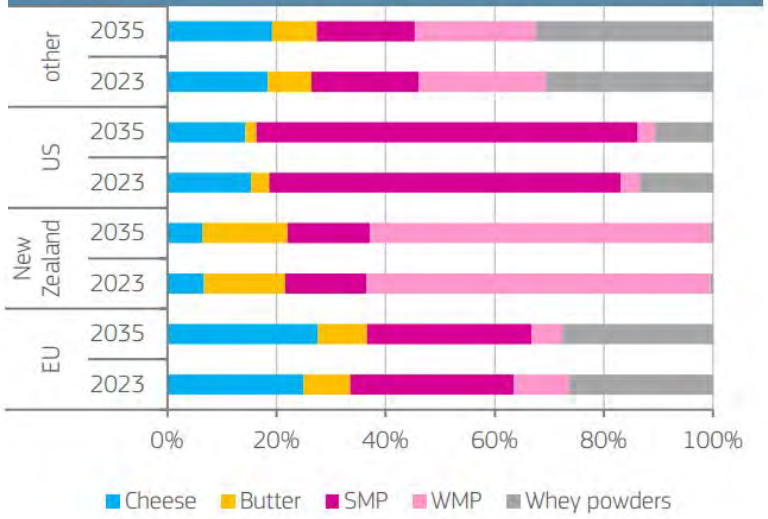
Note: Sudan is primarily an informal market.
Source: UN Population Estimates, OECD, IFCN, RaboResearch, 2023.

GRAPH 3.5 Milk surplus and deficit in selected countries and regions (million t of milk equivalent)



Note: surplus/deficit is calculated as domestic consumption- domestic production

GRAPH 3.6 Trade shares of main dairy exporters in selected dairy products

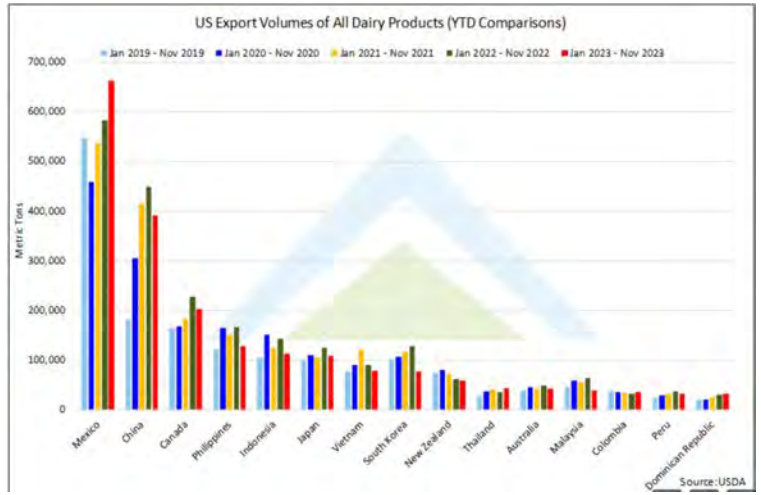


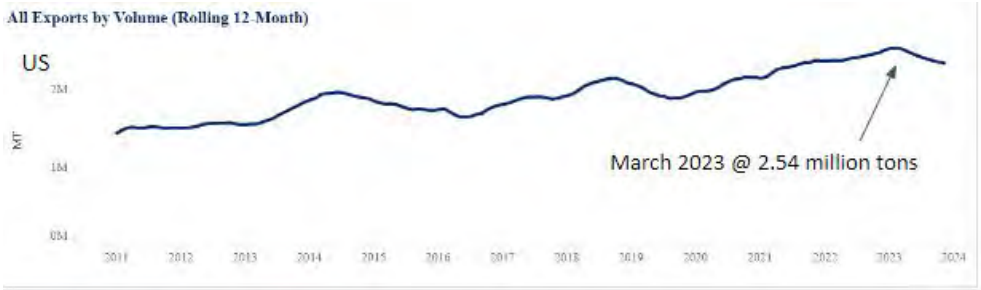
U.S. Exports

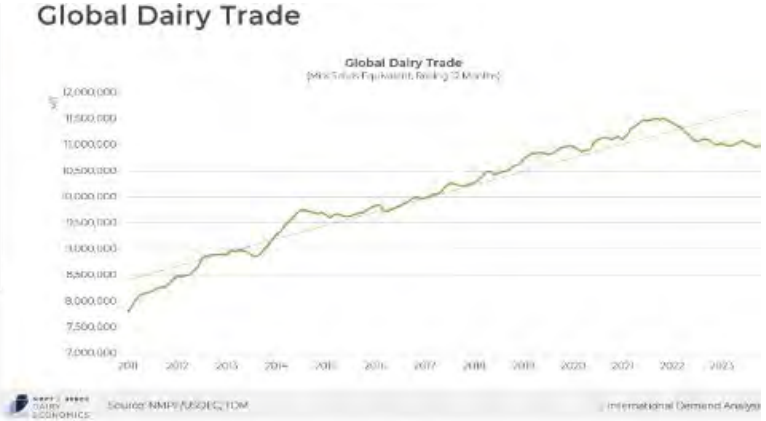
"US production, facing less strict sustainability constraints, will grow the most among the large dairy exporters and reinforce its third position as global dairy Exporter"

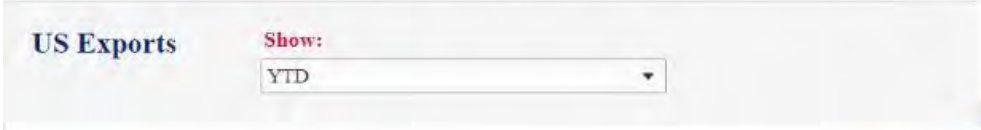
20% share of global exports in 2035, vs. 14% (current)"

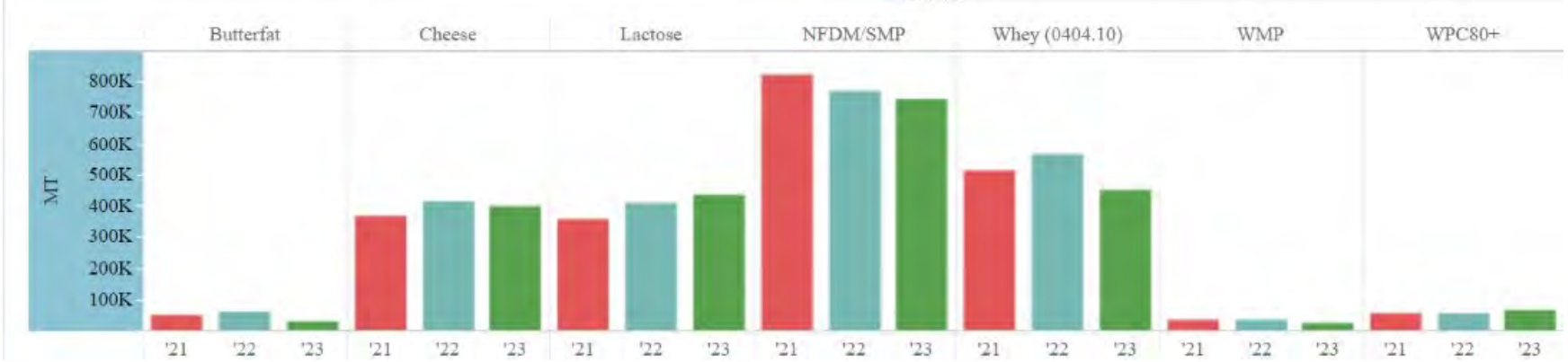
EU Ag Outlook 2023







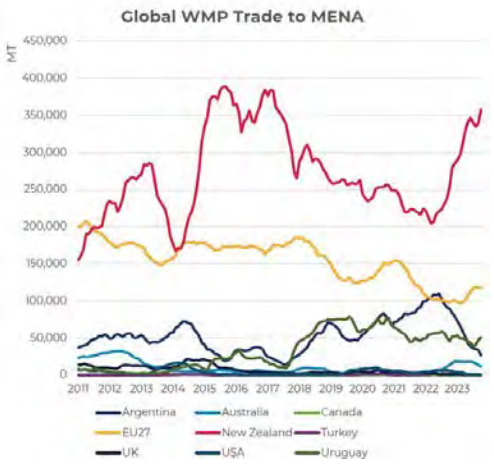


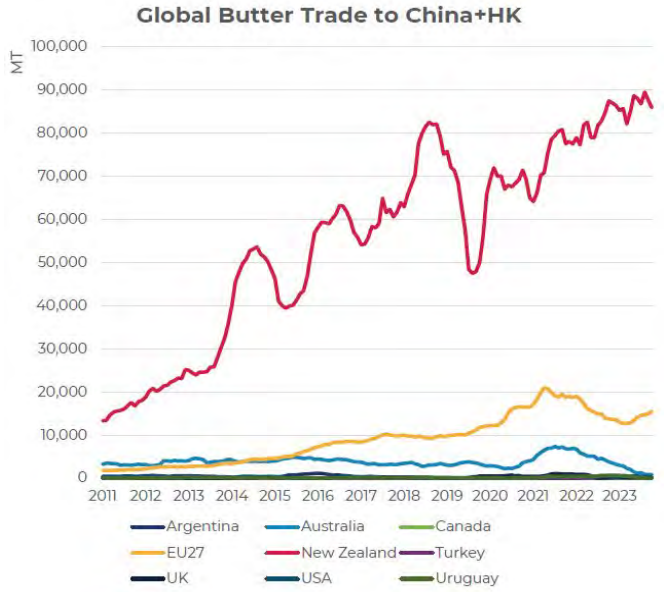


Global WMP & Butter Trade & China

Source : Eurostat COMEXT

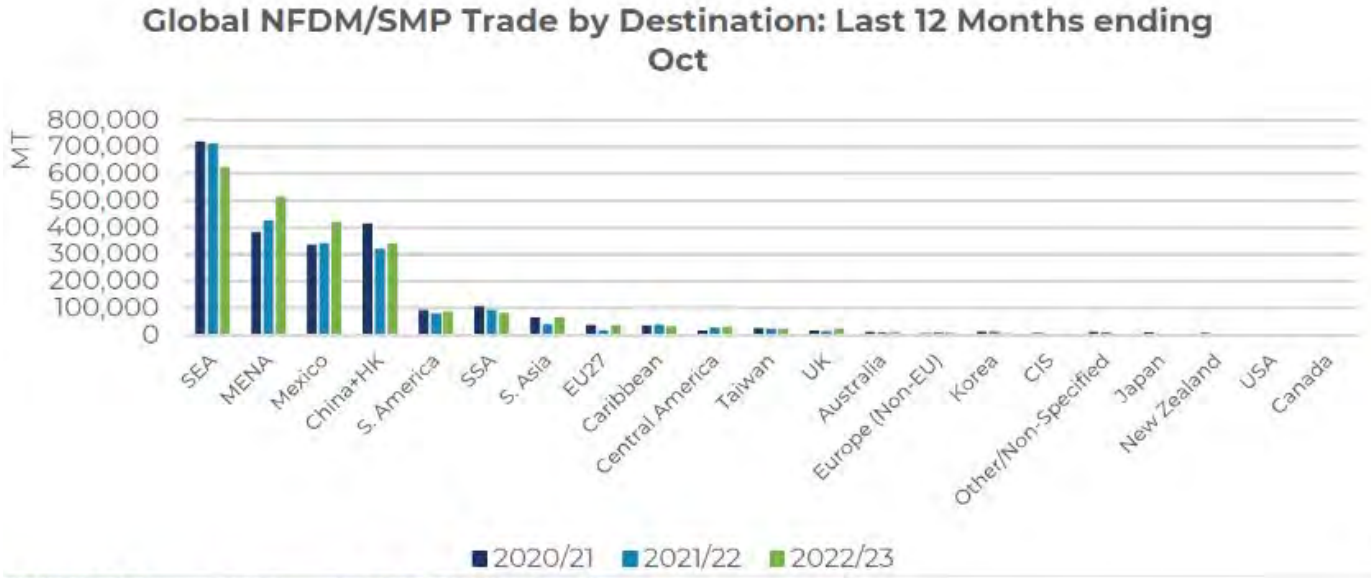
Quantity in Tonnes	MS
Jan-Sep 2023 EU WMP Markets	
Partner	**EU***
Oman	35 770
Algeria	24 755
United Kingdom	14 669
Nigeria	11 983
China	10 818
Dominican R.	7 976
Kuwait	7 633
Singapore	5 940
Egypt	5 150
Senegal	4 869
Saudi Arabia	4 497
Colombia	4 460
Peru	4 149
Qatar	3 648
Israel	3 376
Lebanon	3 149
U.A.Emirates	2 820
Malaysia	2 621
Trinidad,Tob	2 596
South Africa	2 381
Ivory Coast	2 230
Cuba	2 110
Angola	2 108
Yemen	1 945
Cameroon	1 889
Switzerland	1 845
USA	1 682
Serbia	1 669
Bangladesh	1 408
Cape Verde	1 370
Other	**28 062**
TOTAL	**209 580**

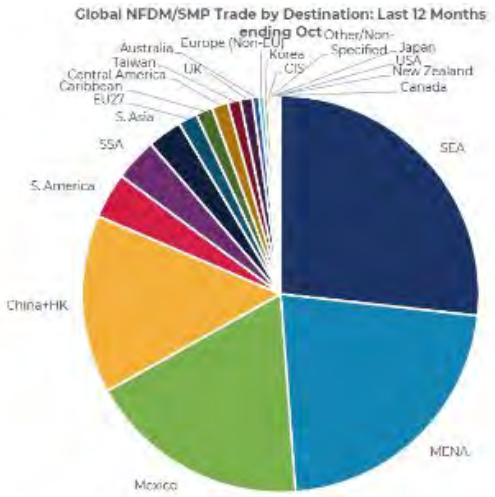


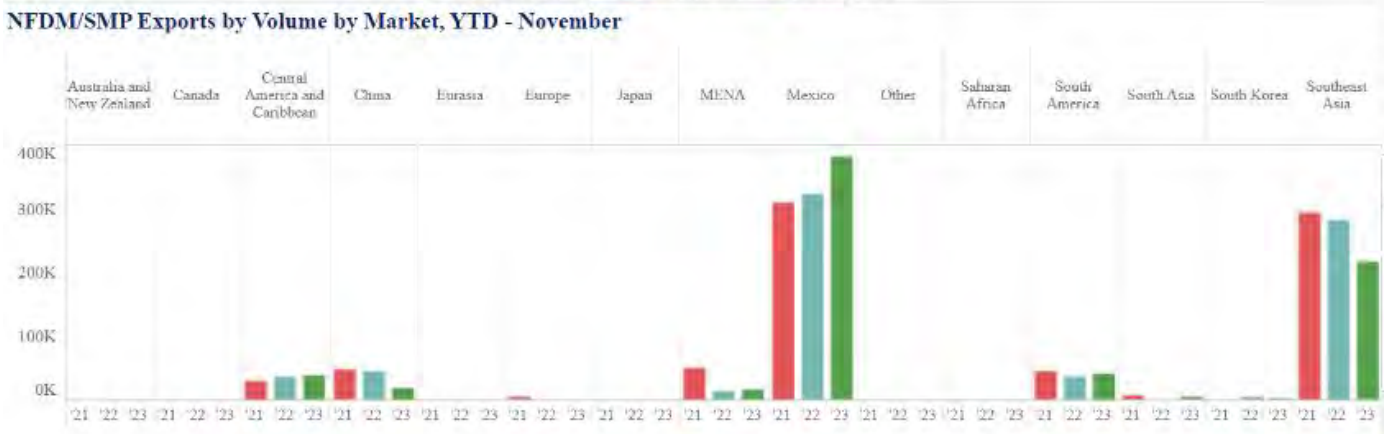


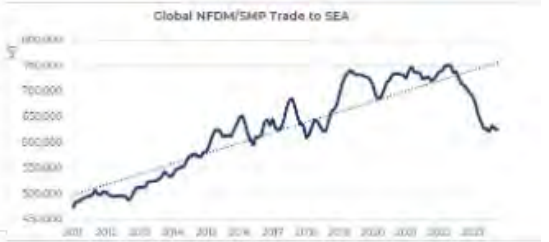
Global trade of NFDM:

"Competition on global markets is expected to increase for SMP, but EU production and exports are expected to remain stable."









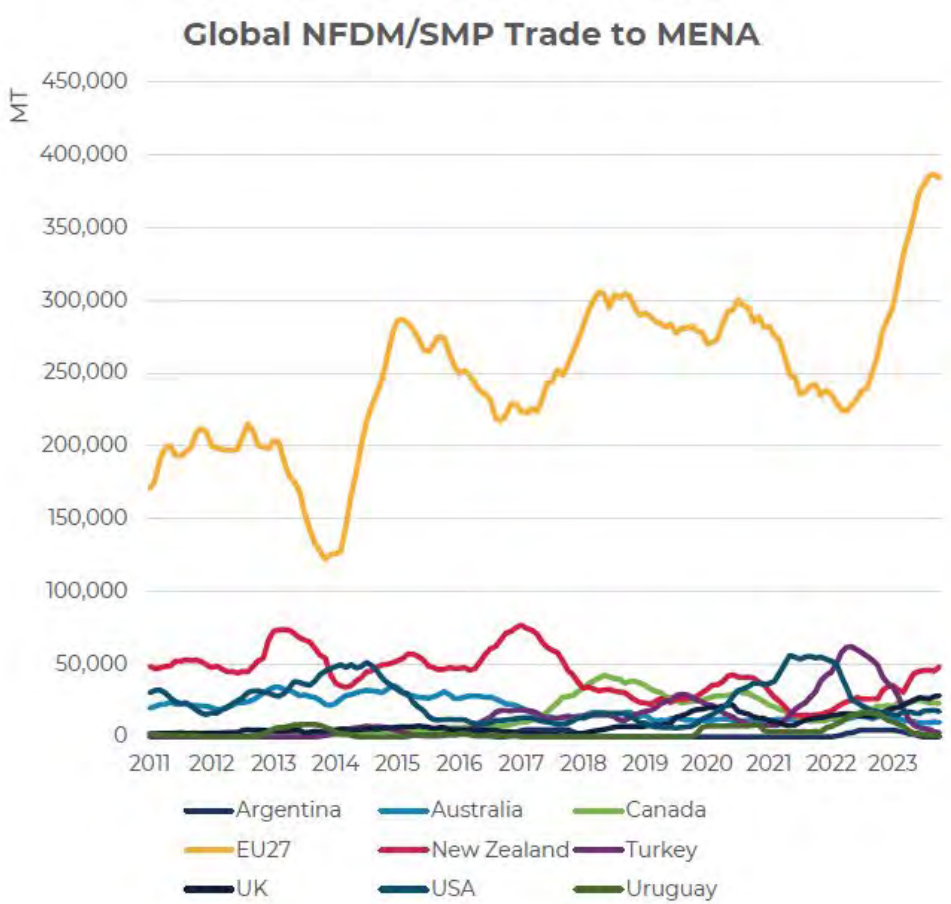
NMPF | USDEC DAIRY ECONOMICS

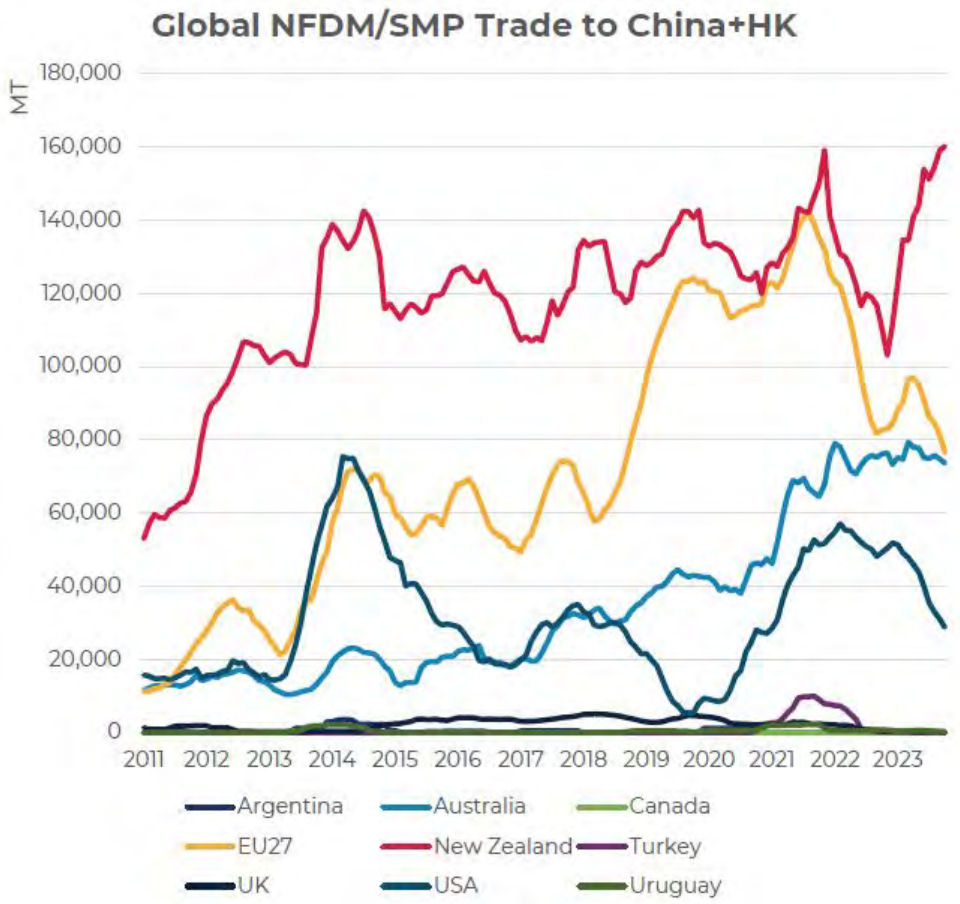
Source: NMPF/USDEC, TDM

Global trade of NFDM- key opportunities

Source : Eurostat COMEXT

Quantity in Tonnes Partner	MS EU*
Algeria	112 442
China	83 681
Indonesia	42 926
Egypt	40 887
Nigeria	34 071
Philippines	33 569
Yemen	31 093
Malaysia	26 316
Saudi Arabia	25 780
Morocco	25 461
Vietnam	20 336
Thailand	17 161
U.A.Emirates	16 442
United Kingdom	16 086
Singapore	15 398
Ghana	13 716
Pakistan	11 307
South Africa	11 015
Libya	10 631
Dominican R.	10 118
N.det.Extra	8 692
Kenya	7 298
Serbia	6 828
Cuba	5 346
Bangladesh	5 323
Oman	5 025
Sri Lanka	4 428
Israel	3 969
Australia	3 955
South Korea	3 931
Other	*57 595*
Total (including UK)	**710 826**

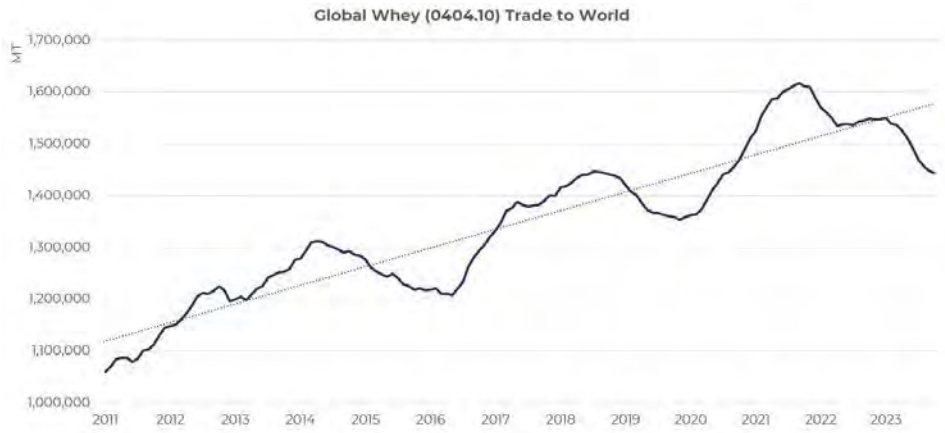


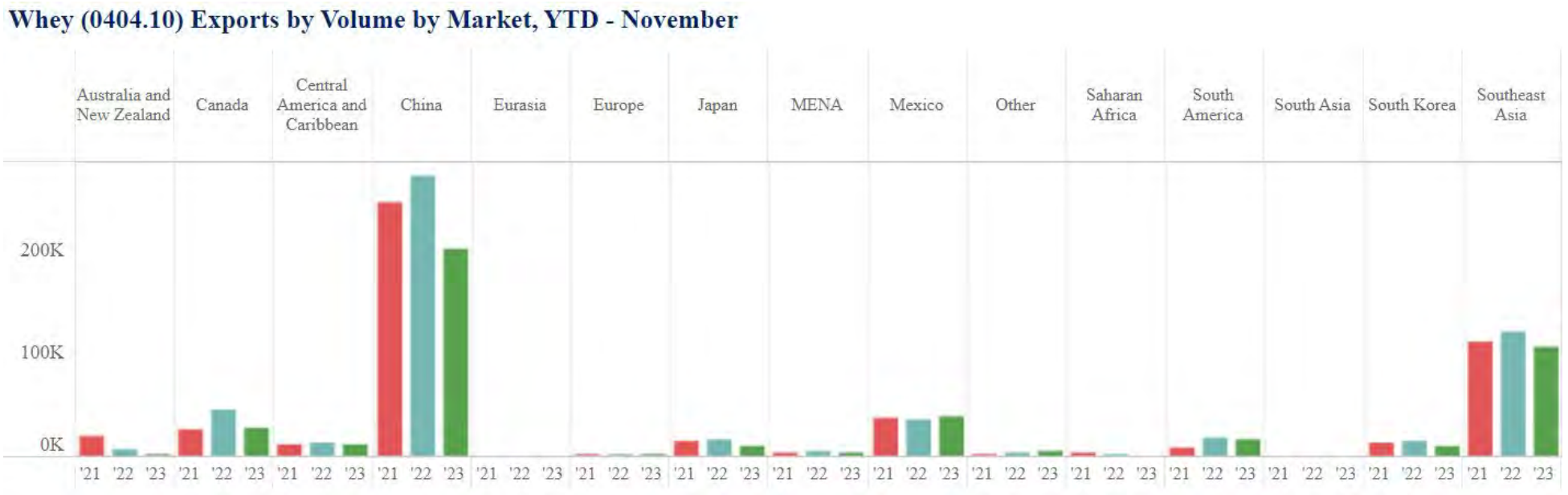


Global Whey trade- key opportunities & risks

Source : Eurostat COMEXT

Quantity in Tonnes 2022 EU Whey Markets Partner	MS EU*
China	206 426
Indonesia	75 611
Malaysia	54 663
United Kingdom	43 394
Thailand	33 460
Vietnam	22 880
N.det.Extra	21 397
Japan	19 344
Philippines	15 496
South Korea	12 976
New Zealand	11 878
South Africa	10 913
Secr.Extra	9 975
Egypt	9 553
Singapore	8 424
Morocco	7 892
India	7 585
Nigeria	6 896
U.A.Emirates	6 221
Pakistan	5 856
Serbia	5 269
Saudi Arabia	5 236
Ghana	4 954
Tunisia	4 588
Switzerland	4 331
Australia	3 217
Myanmar	2 799
Ukraine	2 789
Algeria	2 478
Taiwan	2 316
Other	*34 209*
Total (including UK)	**663 026**



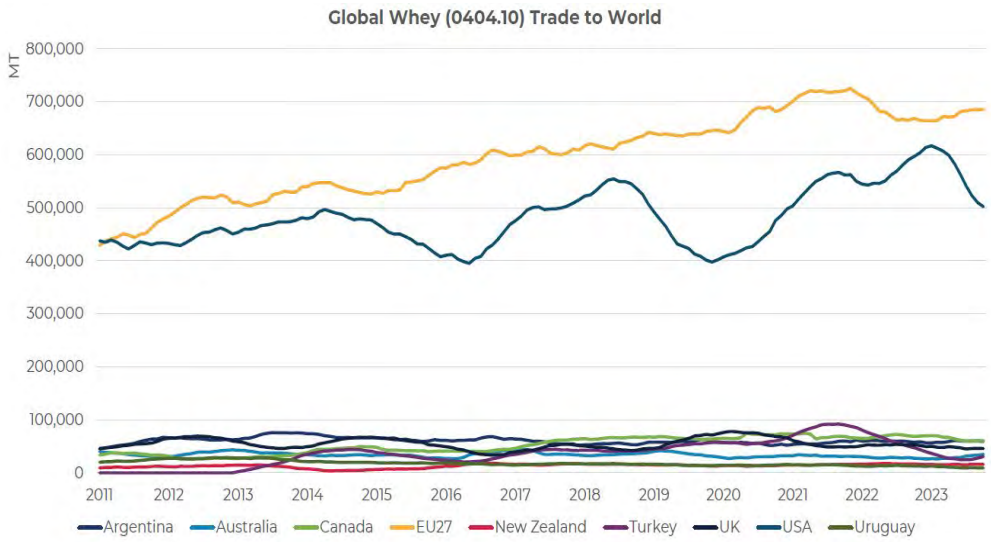


Global whey trade- continued

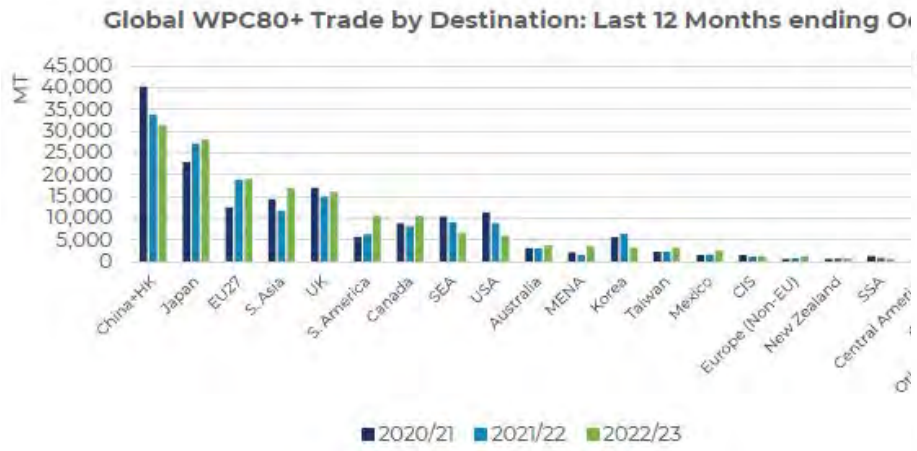
Risks:

Whey products are affected by reduced global demand, due to increasing domestic production in China.

EU Outlook

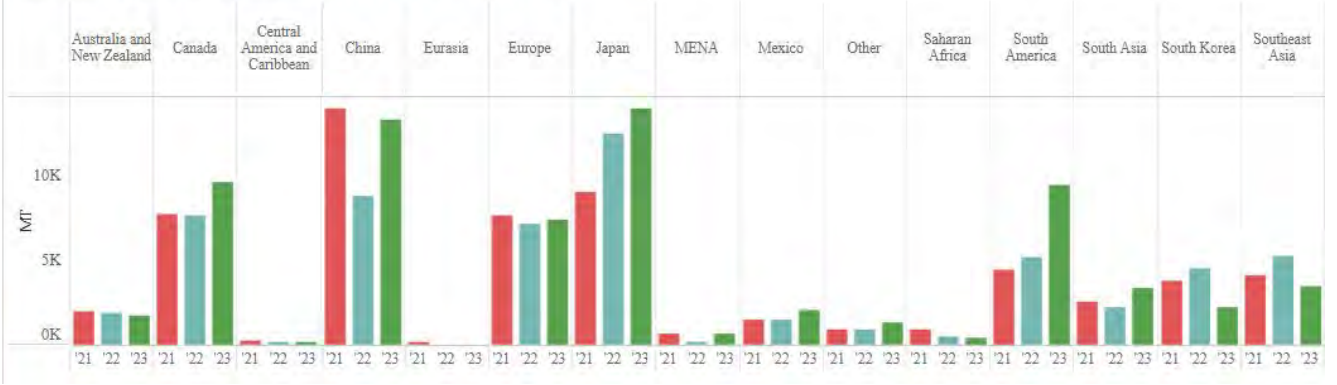


Global WPC80 trade-



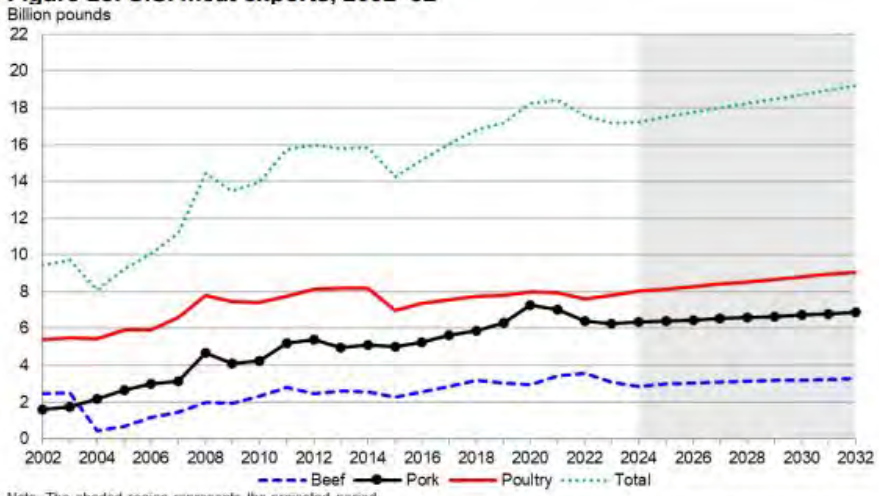
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	YTD	Total
2022	4,091	5,224	5,213	5,577	5,512	5,849	5,702	4,939	5,238	5,829	5,251	5,804	58,425	64,228
2023	4,605	5,756	6,828	5,583	6,457	6,953	5,637	6,615	7,356	6,229	7,211		69,229	69,229

WPC80+ Exports by Volume by Market, YTD - November



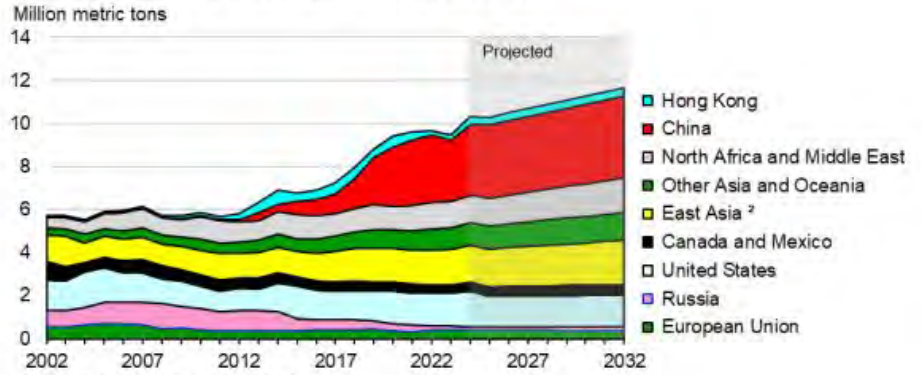
Global protein markets projections

Figure 23: U.S. meat exports, 2002–32



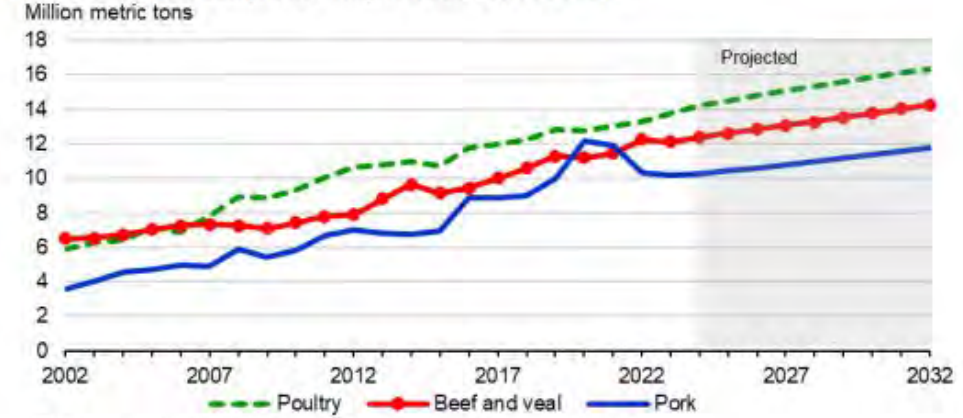
Note: The shaded region represents the projected period.
Source: USDA, Interagency Agricultural Projections Committee, as of November 7, 2022. Short-term projections are updated monthly in the *World Agricultural Supply and Demand Estimates*.

Figure 54. Beef imports, major traders, 2002–32



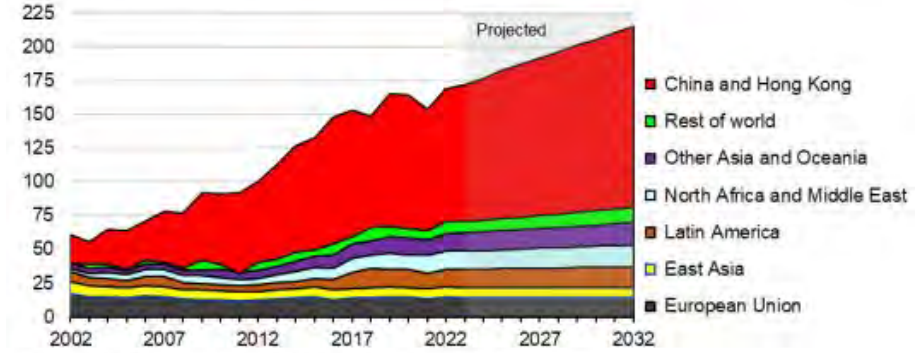
1/ Selected importers, not world total.
2/ Japan, South Korea, and Taiwan.
Source: USDA, Interagency Agricultural Projection Committee, October 2022.

Figure 53. Meat exports, major traders, 2002–32



1/ Major exporters, not world total (see beef, pork and poultry trade tables).
Source: USDA, Interagency Agricultural Projection Committee, October 2022.

Figure 45. Global soybean imports, 2002–32

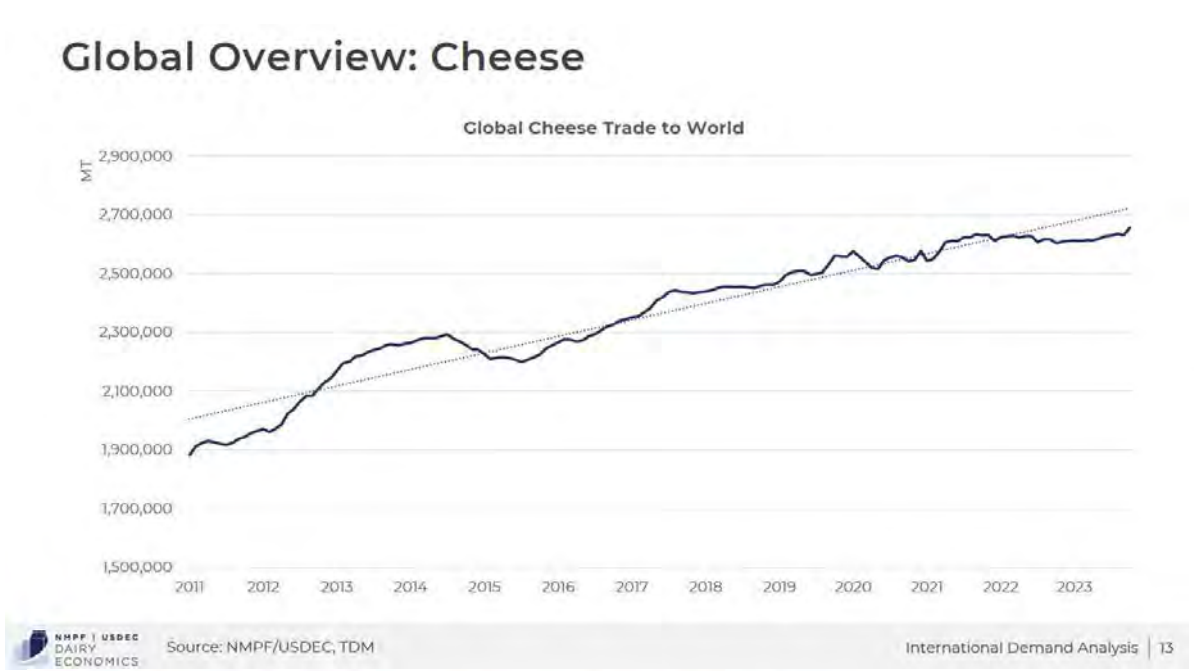


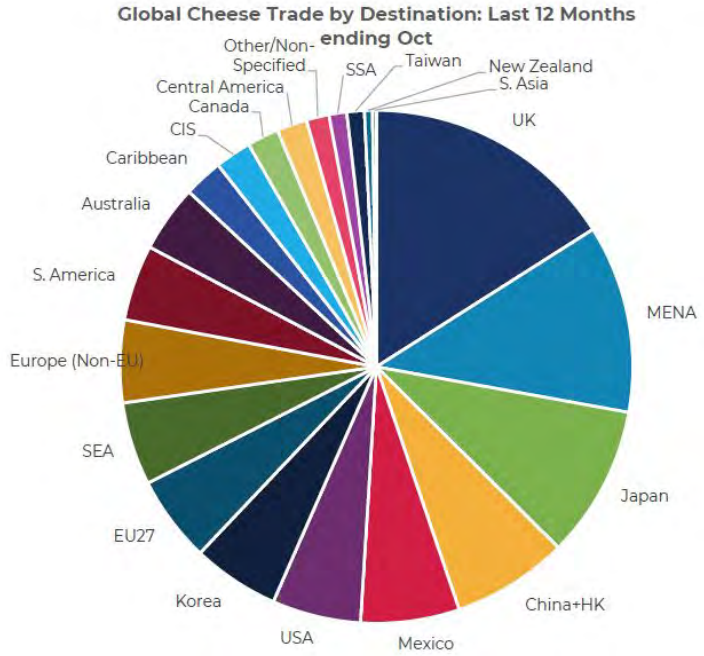
Source: USDA, Interagency Agricultural Projection Committee, October 2022.

Global Cheese Trade vs. U.S exports

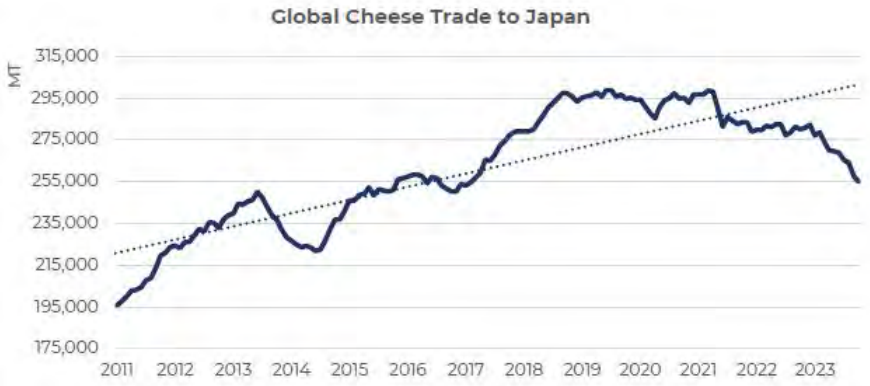
Source : Eurostat COMEXT

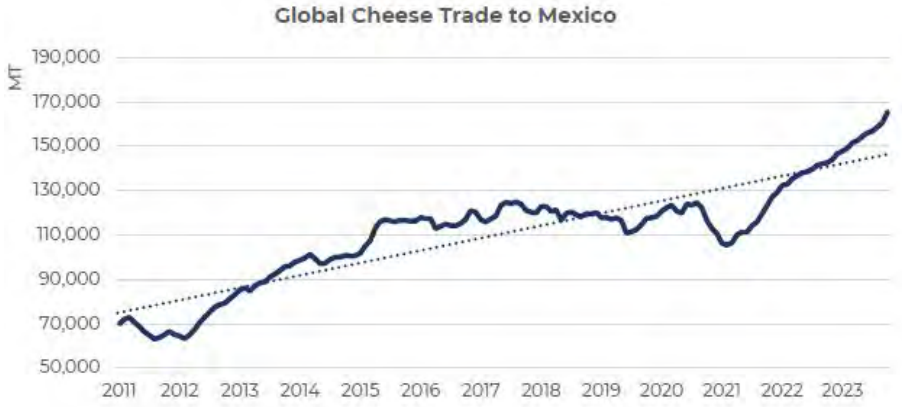
Quantity in Tonnes 2022 EU Cheese Markets Partner	MS EU*
United Kingdom	422 132
USA	129 143
Japan	115 792
Switzerland	70 851
South Korea	59 359
Saudi Arabia	43 072
Ukraine	32 582
China	29 375
Canada	26 412
Australia	26 071
Libya	22 252
Morocco	21 264
Norway	19 038
U.A.Emirates	17 577
Algeria	17 414
Dominican R.	16 967
Mexico	12 953
Egypt	12 452
Iraq	12 065
Serbia	11 362
Bosnia-Herz.	10 973
Israel	10 552
Chile	9 563
Lebanon	9 077
Jordan	8 256
Taiwan	7 639
Bahrain	7 027
Philippines	6 945
Qatar	5 564
N.det.Extra	5 484
Other	*142 140*
Total (including UK)	**1 341 356**

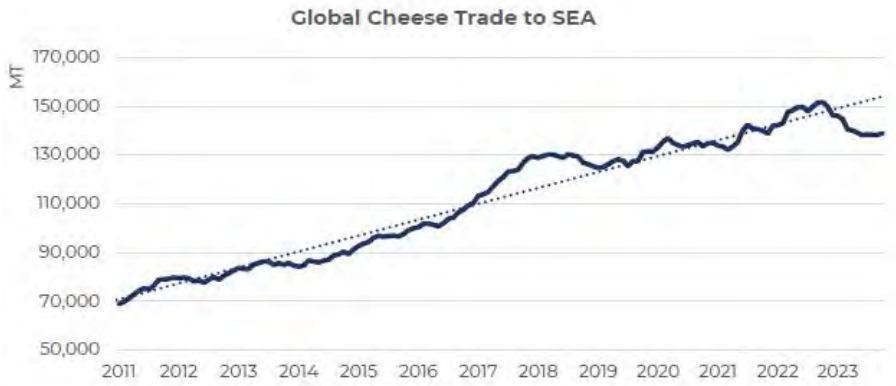




Global Cheese Trade







Milk Utilization; FMMO7 vs. 32&51

Market Summary and Utilization Report, 2022

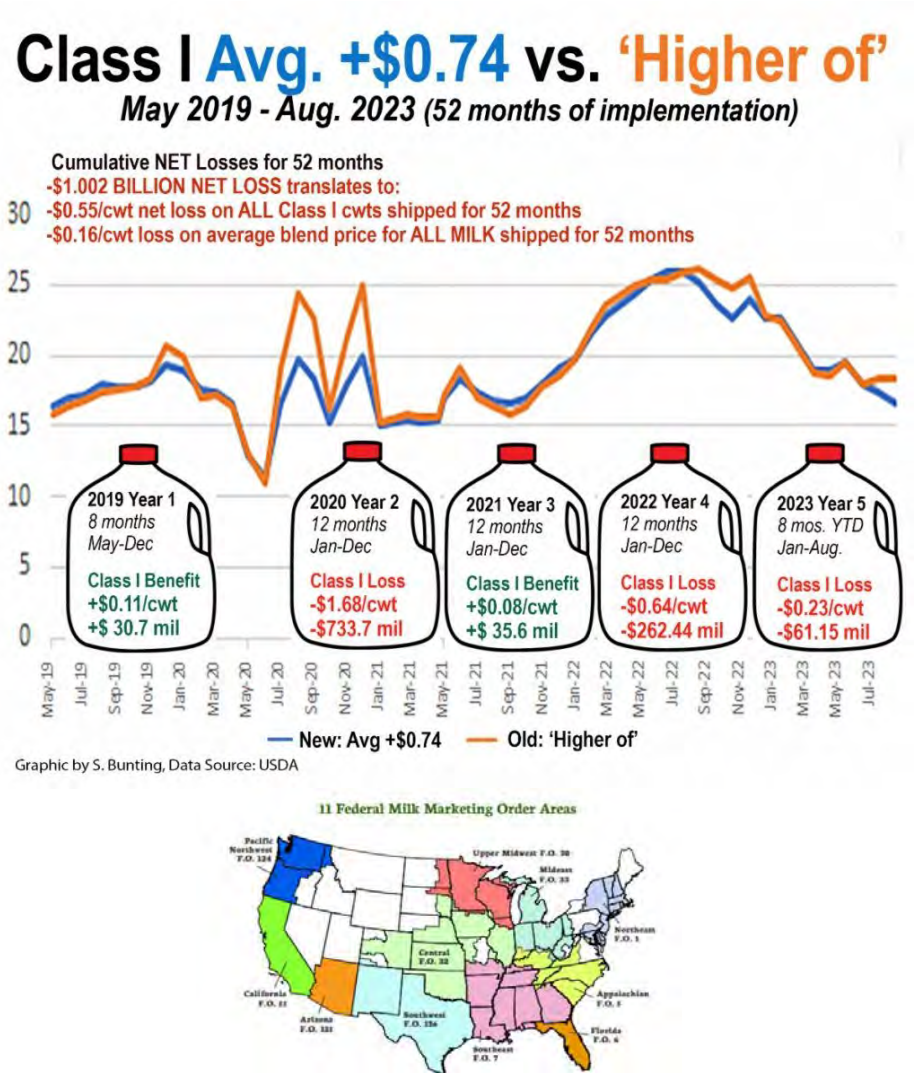
Federal Milk Order Marketing Area [1]	Order Number	Utilization of Producer Milk in All Classes [2]				Uniform Price [3]
		Class I	Class II	Class III	Class IV	
		(percent) [2]				*($ per cwt)*
Northeast (Boston)	001	30	24	29	18	24.98
Appalachian (Charlotte)	005	70	13	8	8	26.39
Florida (Tampa)	006	83	14	2	1	28.36
Southeast (Atlanta)	007	72	19	5	4	26.90
Upper Midwest (Chicago)	030	7	1	91	1	22.11
Central (Kansas City)	032	28	7	53	12	23.13
Mideast (Cleveland)	033	37	9	49	5	23.49
California (Los Angeles)	051	21	5	65	8	23.13
Pacific Northwest (Seattle)	124	21	5	47	26	23.30
Southwest (Dallas)	126	28	6	60	6	23.69
Arizona (Phoenix)	131	27	14	29	30	24.28
All Market Total or Average [3]		27	9	54	10	23.68

[1] Each name in parentheses is the major city in the principal pricing point of the market. [2] Totals may not add to 100 percent due to rounding. Averages are weighted averages. [3] Statistical uniform prices for component pricing orders (Class III price plus producer price differential). For other orders, uniform skim milk price times 0.965 plus uniform butterfat price times 3.5.

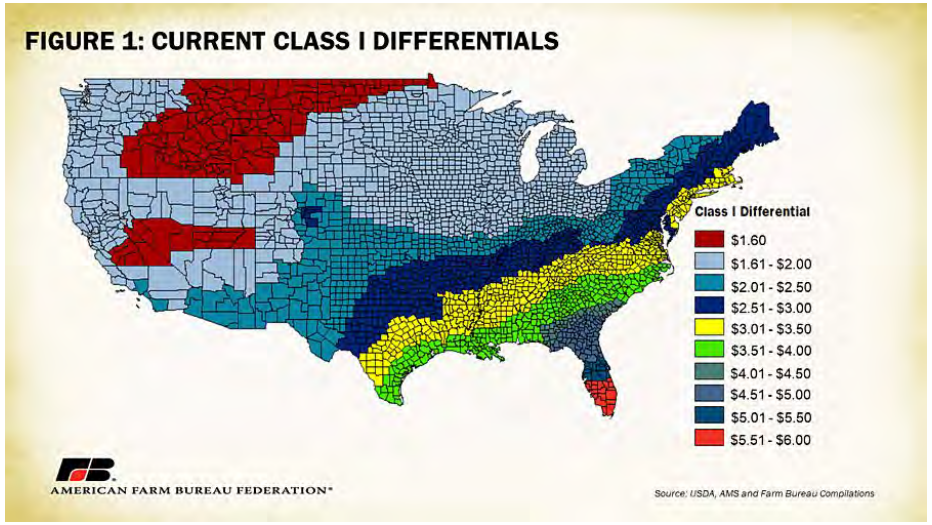
Changes to FMMO7…

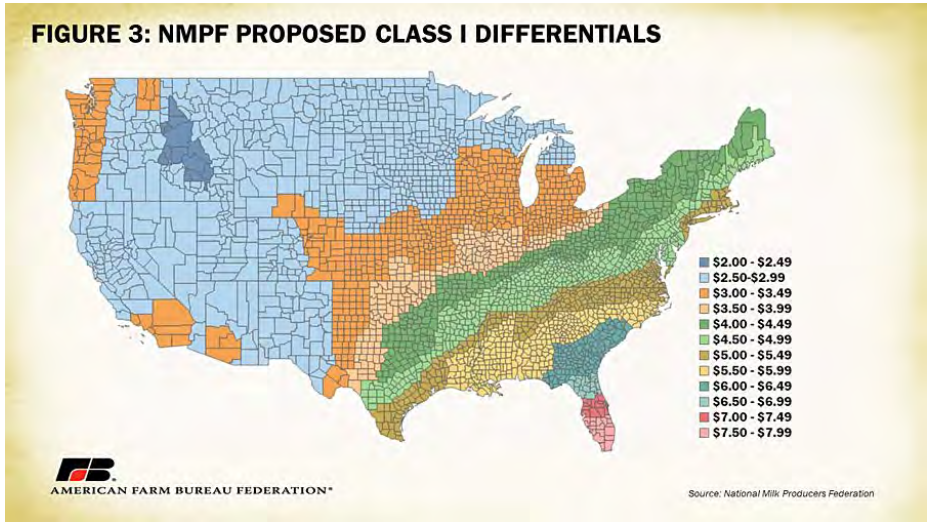
"Return to the "higher of" Class I mover"

"Update Class I differentials throughout the U.S"



Graphic by S. Bunting, Data Source: USDA





Domestic - partnerships

The establishment of the Walmart milk processing plant could signify a transformative shift in the dairy industry, especially in the Southeast. By integrating local dairy farming into its supply chain, Walmart is potentially setting new standards for retail involvement in agricultural production.

link

Walmart's $350-Million Milk Processing Plant in Valdosta, GA – A Closer Look

America's retail behemoth, Walmart, has announced ambitious plans to construct a $350-million milk processing plant in Valdosta, Ga. This strategic initiative is set to revolutionize the dairy industry by supplying over 750 Walmart and Sam's Club stores in Georgia and neighboring states with high-quality, locally sourced milk.

> *"Bruce Heckman, Walmart's vice president of manufacturing, emphasized the company's commitment to providing high-quality milk for our customers that we can offer at the everyday low prices they rely on."*

From buyer to producer: Walmart's strategic shift is reshaping the dairy supply chain.

Critics have voiced concerns that Walmart's preference for purchasing milk from a select few large farms may put smaller farms under further pressure. However, **Georgia Milk Producers**, a dairy farmer trade group, notes that Georgia boasts 89 dairy farms with more than 1,000 cows per farm on average. The new facility is expected to create up to 400 jobs and will source ingredients from local farmers throughout the Southeast region, potentially boosting the local dairy farming industry and economy. Understand more about the local economy in Georgia.

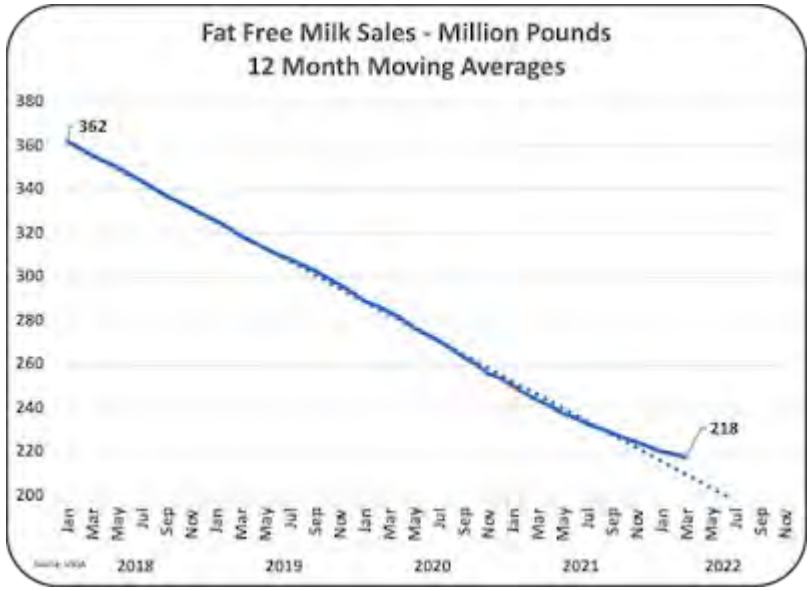
Walmart's Commitment to Sustainable Milk Production – A Sustainable Future

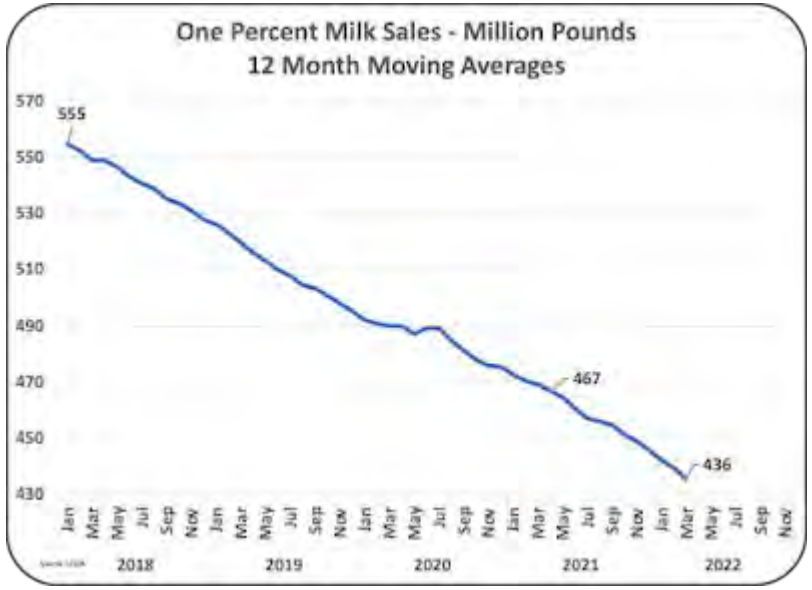
Walmart's move to build its own milk processing plant is not just a business strategy but also a step towards ensuring a sustainable milk supply chain. By controlling production and sourcing locally, Walmart aims to reduce transportation costs and carbon footprint, contributing to more environmentally friendly and sustainable milk production. Dive into sustainability initiatives within the dairy and retail sectors.

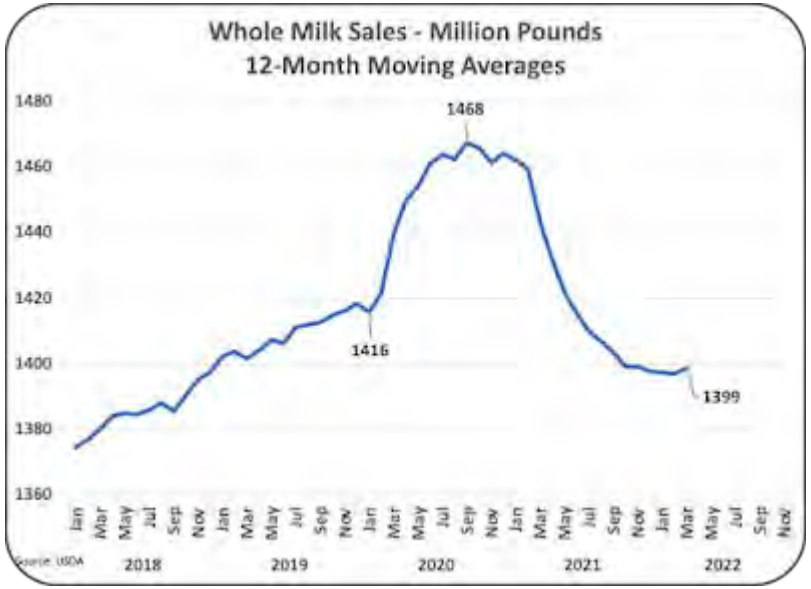
600 lb. gorilla; Fluid milk consumption

Fresh Dairy Product consumption in the EU is to decline (by -0.7 % per year between now and 2035), while exports of FDP will likely decrease after the high levels of 2021-2023, in part due to decreasing demand in China

EU Outlook





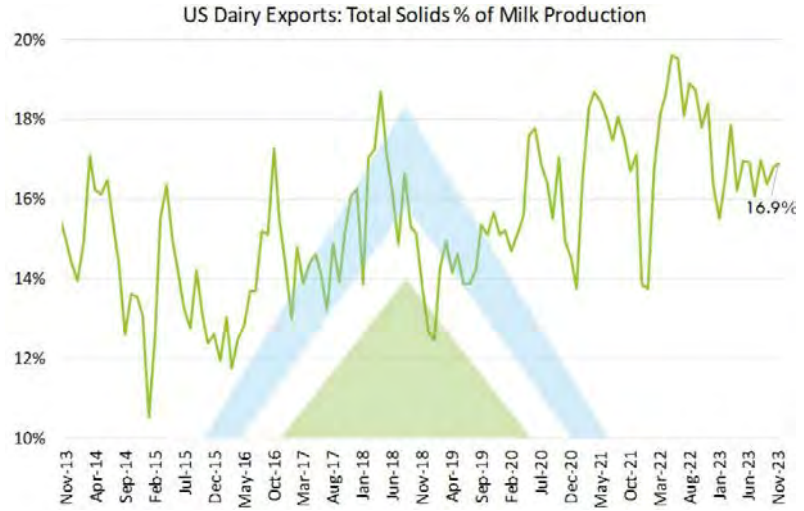


"We've been in a weird spot over the past 24 months where you may have a $5 variance from one farm to the next which is unprecedented,"

Domestic - key risks

Production you can't control or export

California and Wisconsin make up nearly 32% of the total U.S. dairy cows. Idaho, Texas, and New York make up another 20%. Pennsylvania, Minnesota, and Michigan make up 11% and New Mexico and Washington make up 6%

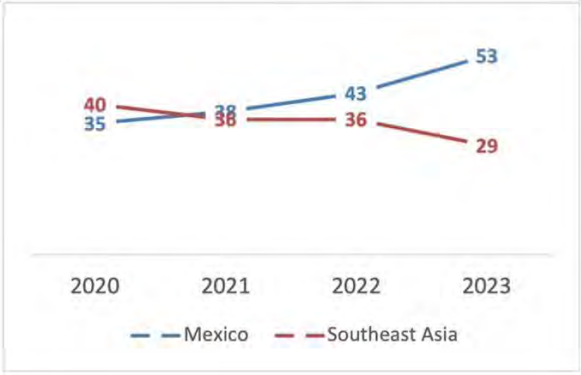


States with the most Cows – 2022 Thousands	
California	1,722
Wisconsin	1,272
Idaho	656
Texas	646
New York	624
Pennsylvania	468
Minnesota	453
Michigan	428
New Mexico	288
Washington	259

States with the Most Milk per Cow - 2022	
State	Milk /Cow
Michigan	27,430
Colorado	25,922
Wyoming	25,763
Texas	25,579
Idaho	25,348
New York	25,096
Wisconsin	25,064
Nebraska	24,842
New Mexico	24,819
Nevada	24,813

States with the largest increases in Milk per Cow 2000 to 2022	
Wyoming	90%
Kentucky	60%
North Dakota	59%
Texas	55%
Nebraska	50%
South Dakota	49%
Wisconsin	45%
New York	44%
Michigan	44%
Indiana	43%

% of US NFDM/SMP Exports to Mexico and Southeast Asia



U.S. exports appx. 70% of appx. 1.2 mill tons annual NFDM/SMP production accounting for half of US Dairy exports.

Chart 4: US importing more from Mexico than China for first time since 2003
China and Mexico as % of US imports (12-month moving average)

Source: BofA Global Investment Strategy, Bloomberg

Mexico- key risks & opportunities

Deglobalization and the movement to nearshoring or friendshoring

Some multinationals are drawn by Mexico's manufacturing-based economy, free-trade agreements and proximity to the U.S. Mexico's economy minister said that some 400 companies were interested in relocating facilities from Asia to Mexico

"Managing production is much easier when plants operate within the same time zone and are only a short flight away," ..."So, whether it's a minor issue at the factory or a significant supply chain disruption, the proximity nearshoring [in Mexico] offers is priceless." link

National Security vs. Securing critical supply chains

"As the United States looks around the world, Mexico provides the most viable commercial solution to those challenges. How do you secure access to medicines, technologies, critical minerals? Mexico is a big part of that solution"
-Council on Foreign Relations

but...

"if you buy an avocado in the United States from Mexico, you have paid money to a cartel. You can extend that to corn and citrus too. Water distribution to Mexican citizens is deeply penetrated by Mexican criminal groups"
"For the two countries to deeply integrate economically requires rule of law in Mexico, and we have the opposite of it."
"China has been the principal supplier of precursor chemicals for fentanyl and for amphetamine, both of which are manufactured overwhelmingly in Mexico."
-Brookings Institution

Over 40 countries, including Iran, Saudi Arabia, United Arab Emirates, Argentina, Algeria, Bolivia, Indonesia, Egypt, Ethiopia, Cuba, Democratic Republic of Congo, Comoros, Gabon, and Kazakhstan have expressed interest in joining the forum, according to 2023 summit chair South Africa.

They view BRICS as an alternative to global bodies viewed as dominated by the traditional Western powers and hope membership will unlock benefits including development finance, and increased trade and investment.

BRICS– EM & the EAST vs WEST

Brasil-Russia-India-China-South Africa

Egypt Iran Saudi Arabia UAE Ethiopia Joined BRICS Jan 1st 24'
Ethiopia strong population growth
Saudi Arabia: Trillion $ economy
SA, UAE & IRAN addition >2x BRICS share of global oil production

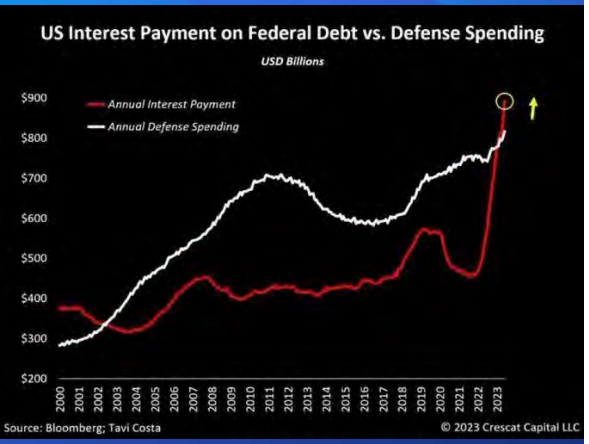
***Algeria not allowed**
Argentina declined invitation

BRICS now represents 45.4% of global population
BRICS now represents 42.3% of global oil production
BRICS now represents 28.7% of global GDP
BRICS now represents 24.7% of global exports

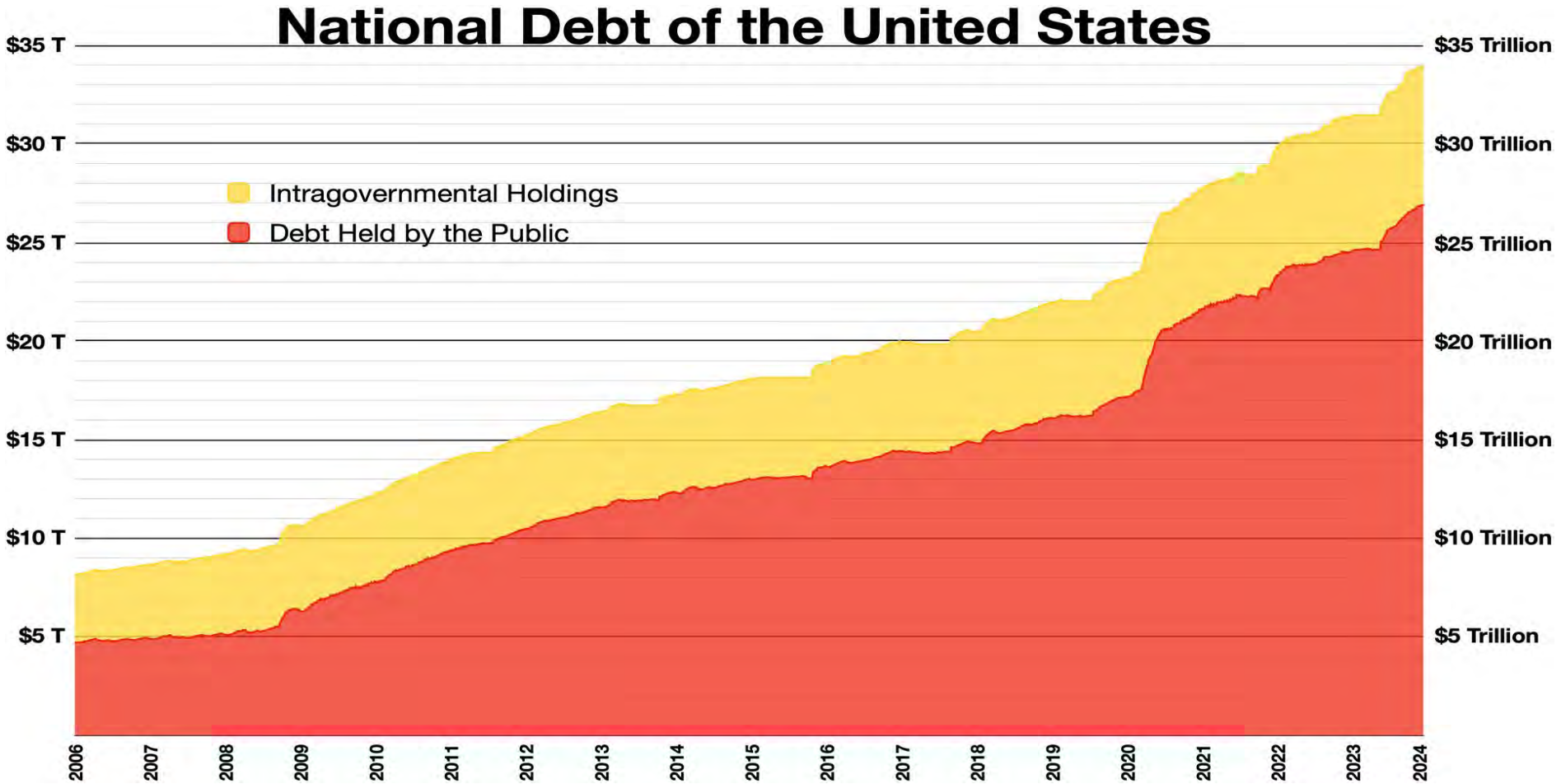
China has been pushing for oil trade to be denominated in yuan, and that Saudi Arabia's acceptance into BRICS could bolster this ambition, potentially shifting the dynamics of global oil trade.

Domestic - key risks

US national debt crossed over $34 trillion, up 55% ($12 trillion increase) in the debt over the last 5 years

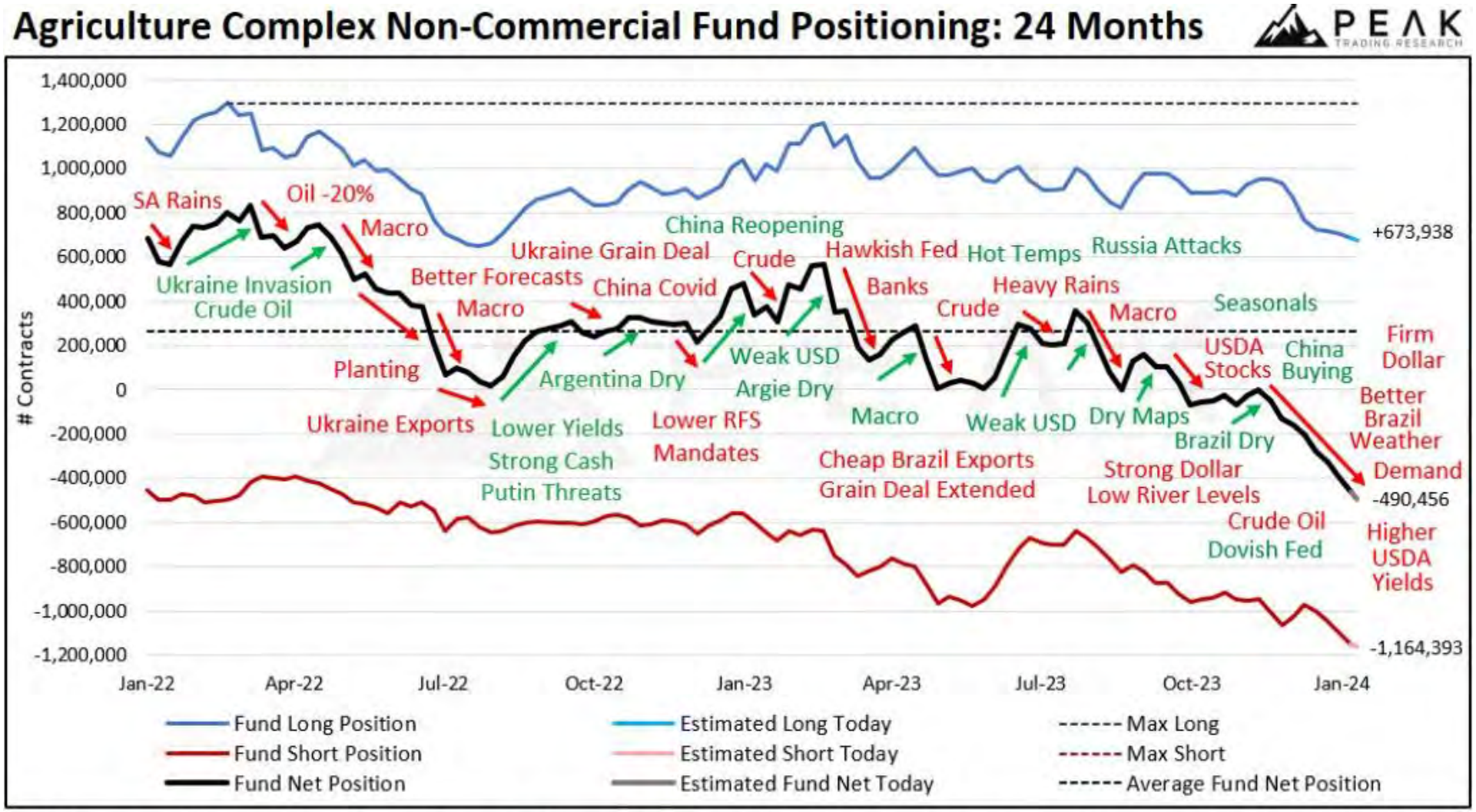


National debt, debt-to-GDP ratio, and the US interest payment — highlight the need for the United States to continue debasing the currency.



Fund speculation- key risks

Hedge Funds are -490k contracts net SHORT across the agriculture complex, matching the MAX bearishness from the Covid-19 macro washout in the summer of 2020. The drivers: Better South American weather, soft demand, and the USDA's higher yields. 🌧️



Includes: Corn, Chicago Wheat, Kansas Wheat, Soybeans, Meal, Bean Oil, Cattle, Hogs, Feeder Cattle, Cotton, Sugar, Arabica Coffee, Cocoa

GHG Neutrality – key risks & value add opportunities

"North American dairy sector, where the U.S. is the primary milk producer, reduced greenhouse gas (GHG) emissions intensity (emissions per gallon of milk produced) by 2.2% per year from 2005 to 2015 even as milk production increased by 2.1%"

2050 endpoint of GHG neutrality link

COMMENTARY · CLIMATE CHANGE

The U.S. dairy industry wants to tackle climate change–but not at the expense of feeding the world

BY KRYSTA HARDEN
December 20, 2023 at 10:08 AM EST

The North American dairy industry has been able to reduce emissions intensity in recent decades, according to the FAO.

“Dairy is really in a spot today where farmers are making plans for the next 20 years or just planning on how they make it through the next 12 months.” The farms in the middle, with 300-to-1,000 cows, may be having the biggest issue with the low milk prices… the most successful dairies in the mid-range have found a niche. That may include dairy beef production or custom harvesting
“

So what now?

“We must expand our demand base, invest in capacity, efficiency and technology throughout the supply chain, diversify our revenue with output the global markets demand and always risk manage to handle massive currency, interest rate & price volatility”

SWOT Analysis FMMO7 Dairy Producers

S STRENGTHS	W WEAKNESSES	O OPPORTUNITIES	T THREATS
Regional self sufficiency Market Stability:	Reliance upon CL1	Growth in organic, grass-fed, UHT, ESL single serve - +protein, local fluid milk markets	Changes to FMMO7
Heavy Class I utilisation Consistent demand	Fluid milk "margins are measured in ¼'s of %'s"	Vertical integration FFMP, BUTTER, SMP, UHT	Competition from regional, national and International Brands
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nuimarkets®
Digital Trading Solutions

Nui Markets – the future of trading

Nui Markets is revolutionizing how the world trades agricultural products

by combining the speed and convenience of a B2B digital trading platform with the specific requirements and industry expertise of a dedicated category marketplace environment.


Watch video


Watch video

Nui solutions enable digital trade of agri-products anywhere in the supply chain

Farm

Primary producer

Secondary producer/ Manufacturer

Retailer

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Digital Trading Solutions

Our reach

Nui is global

Our head office is based in New Zealand, with people in the USA, Europe, Singapore, Dubai, and Argentina.

500+
Companies

73
Countries

308,000T
Traded

NZ$1.356B
Value of traded product

Our platforms

Enterprise

Open Country · DARIGOLD EXCHANGE · Arla · FrieslandCampina · MSG · Hilmar Cheese Company · Valley Milk LLC · Valio · Tirlán · ONEDAIRY · Harvex

Marketplace

Europe | Dairy
Established in 2017 – 100+ companies

North America | Dairy
Established in 2022 – 60+ companies

Brazil | Biofuel
Established in 2022 – Joint venture with Flex Trading

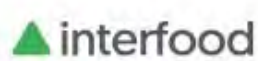
Zero Carbon ekos BUSINESS OPERATIONS

New Zealand International Business Awards 2022

Nui's strength in the dairy Industry

- Nui operate dairy Marketplaces and Enterprise platforms in Europe, North America and Asia Pacific
- We have local experts in each of the major dairy supply and procurement markets around the world
- Global reach connects sellers from the dairy heartlands of New Zealand, Europe and North America with buyers around the world
- Over $1bn of dairy produce (from powder to finished product) has been traded across Nui platforms
- Nui operate over a dozen customized Nui Enterprise platforms for some of the world's biggest dairy producers

Who we work with:



Key benefits of the Nui platform

Improved trade efficiency

Nui platforms streamline the sales process, reducing the time and effort required for a trade to take place. When you start using a Nui platform, this increased level of efficiency is noticeable right from the first trade.

Expanded market access

Nui platforms provide an efficient way for sellers to engage with more buyers, more regularly, with the same level of resources. Consequently, sellers can broaden their network, whilst buyers have greater access to a wider range of products.

Accurate price discovery

Nui platforms make trading more transparent. With price visible to all participants throughout the trade process, negotiation tension is reduced improving confidence of the true market price - encouraging trade.

Enriched market information

Nui platforms take the guesswork out of a trade. Analytics dashboards provide detailed, real-time data about prices, volumes, and activity on the platform. This allows our customers to make more informed trading decisions.

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Service and expertise across the globe

New technology is only the beginning of the Nui proposition.

Engaging with Nui is much more than just a subscription to a digital platform. Part of our critical point of difference is that we only operate in markets where we have real expertise and sector knowledge.

That means that wherever you are, we have a team that can advise and support you to develop your sales and procurement strategies, approach to risk management, trading, and finance, and how to best leverage your investment for business transformation.

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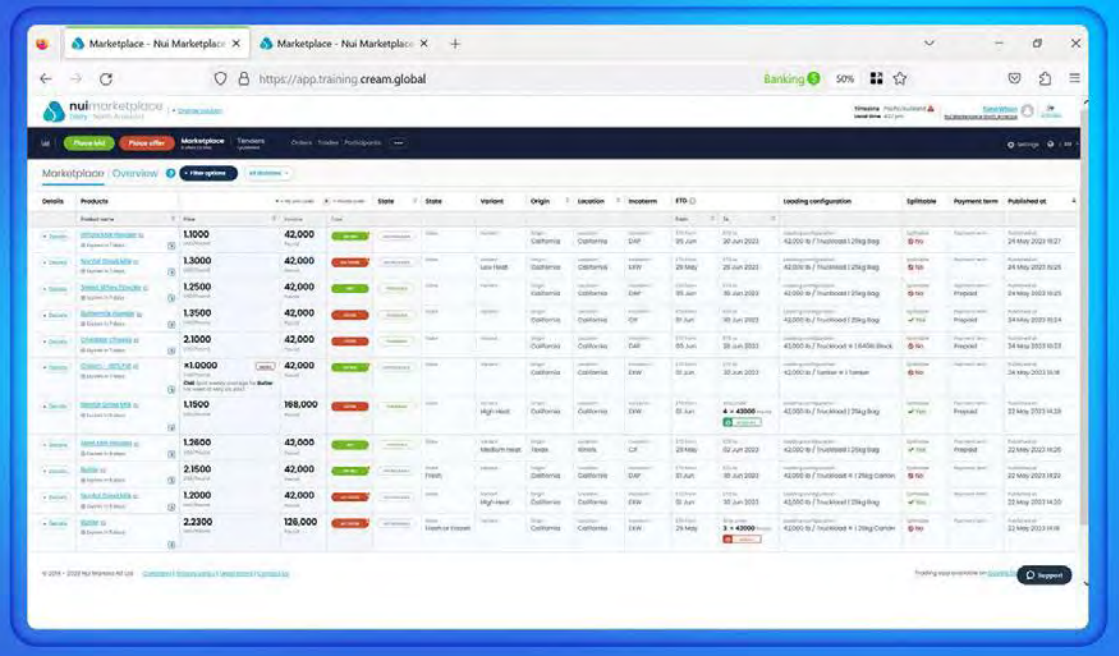
Nui Marketplace

A digital space for all members to trade

Private Enterprise

A digital sales portal for an individual sales enterprise

nuimarkets



enterprise marketplace

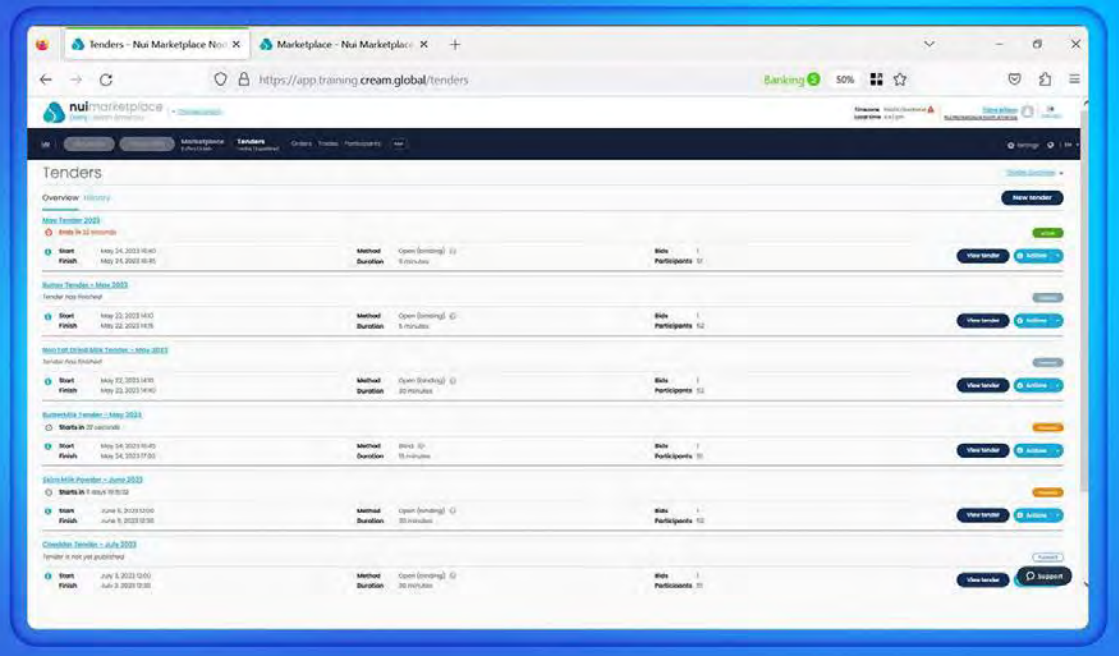
How the 24/7 marketplace works

On both our Enterprise and Marketplace products, you can trade in an open marketplace by the usual means of offers and counter offers to arrive at a deal.

It's easy to do, and because you are only dealing with pre-vetted members, you can have the utmost confidence in the quality of your transactions.

- Ability to trade 24/7
- Access the market and start placing orders, view open orders, make counter offers
- Engage in conversation by asking a question
- Trade in as little as two clicks
- Global support team available 24/7

nuimarkets



enterprise marketplace

Procurement tenders

For procurement teams who want to seek the best supply offer from multiple suppliers.

Procurement tenders are set up in advance so that suppliers have a chance to review and decide whether to engage.

- Set up a tender ahead of time (suggest 24 hours minimum)
- Alerts notify sellers once the tender is published
- Recommendation that each tender runs for 15 minutes
- Tender runs from high to low – you set a price that is high enough to attract interest, and invite suppliers to beat it with each offer
- Auto-extend feature clicks in if an offer is made within the last 30 seconds
- Buyers can set the tender to be as specific as they want about their requirements

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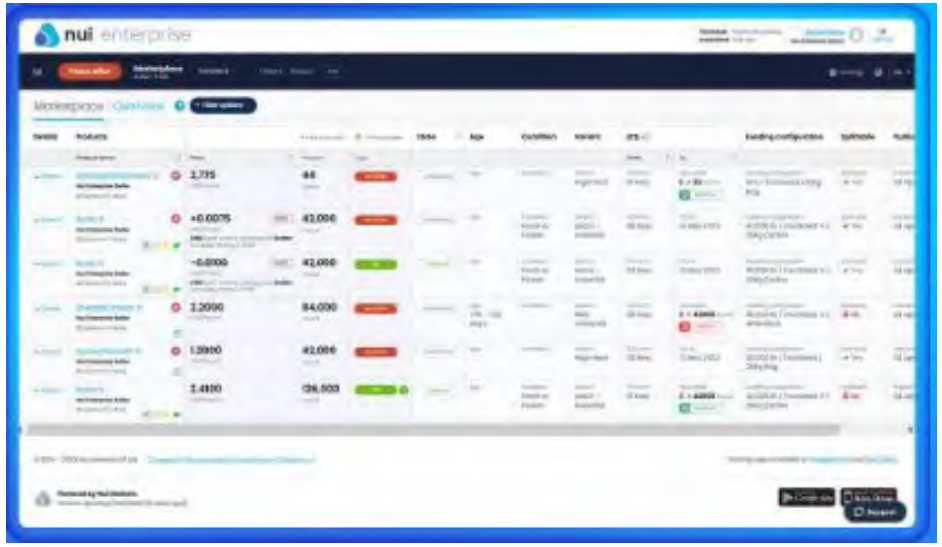
nui | enterprise

One Enterprise platform, custom configurations

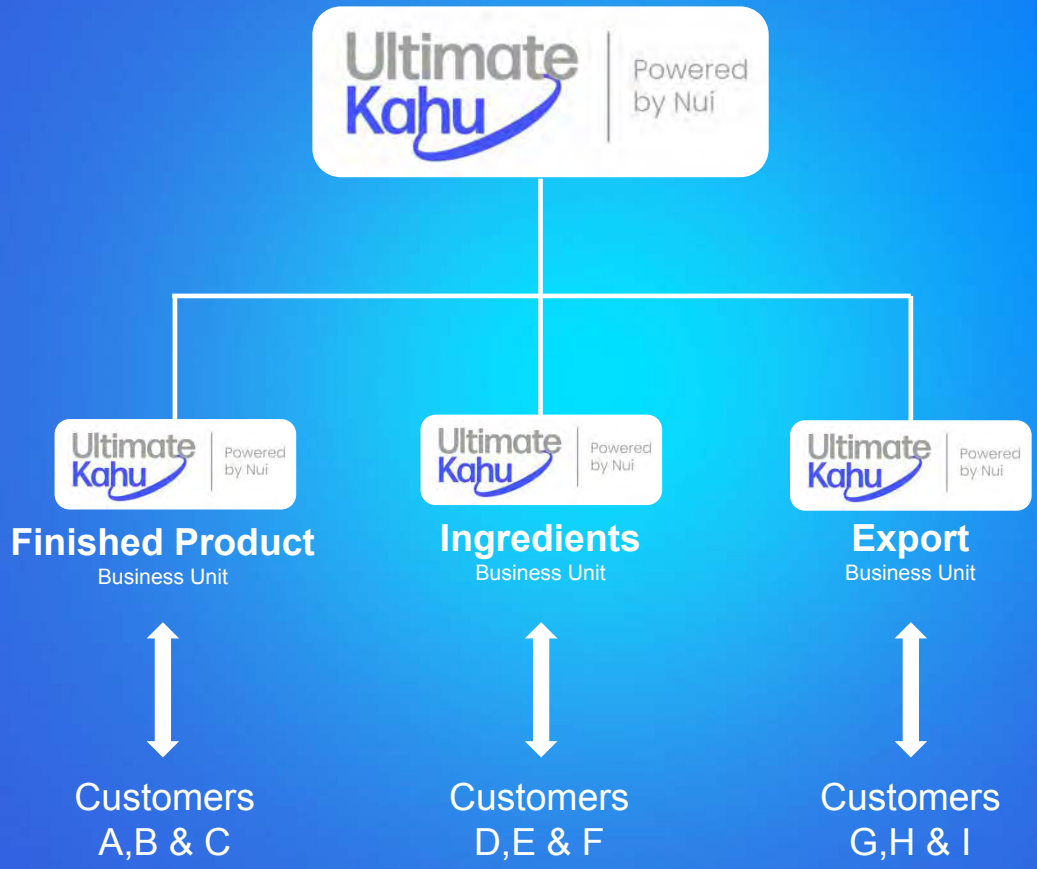


Configure your Nui Enterprise platform to segment the way that works best for you.

- Configurable by sub-division
- Buy side or sell side enterprise development
- Dairy ingredients, dairy commodities, milk, cream
- Dairy now, meats, cattle, sugar, vegetable oils TBD

- Increases efficiency and ease of engagement

Example:



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Thanks to “International Demand Analysis” from the Dairy Economics Team at NMPF and USDEC & USDA &
EC: “EU Ag Outlook” & John Guess CL1 intel

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IDFA
International
Dairy Foods Association

2024 Georgia Dairy Conference

Winning the Future for Dairy

International Dairy Foods Association

Michael Dykes, D.V.M.,
President & CEO
mdykes@idfa.org
202-257-1688

My Background

IDFA International Dairy Foods Association

AUBURN UNIVERSITY
COLLEGE OF VETERINARY MEDICINE

University of Kentucky

IDFA: Broad Representation

IDFA International Dairy Foods Association


Milk


Farmer Co-ops


Cheese


Yogurt


Ice Cream

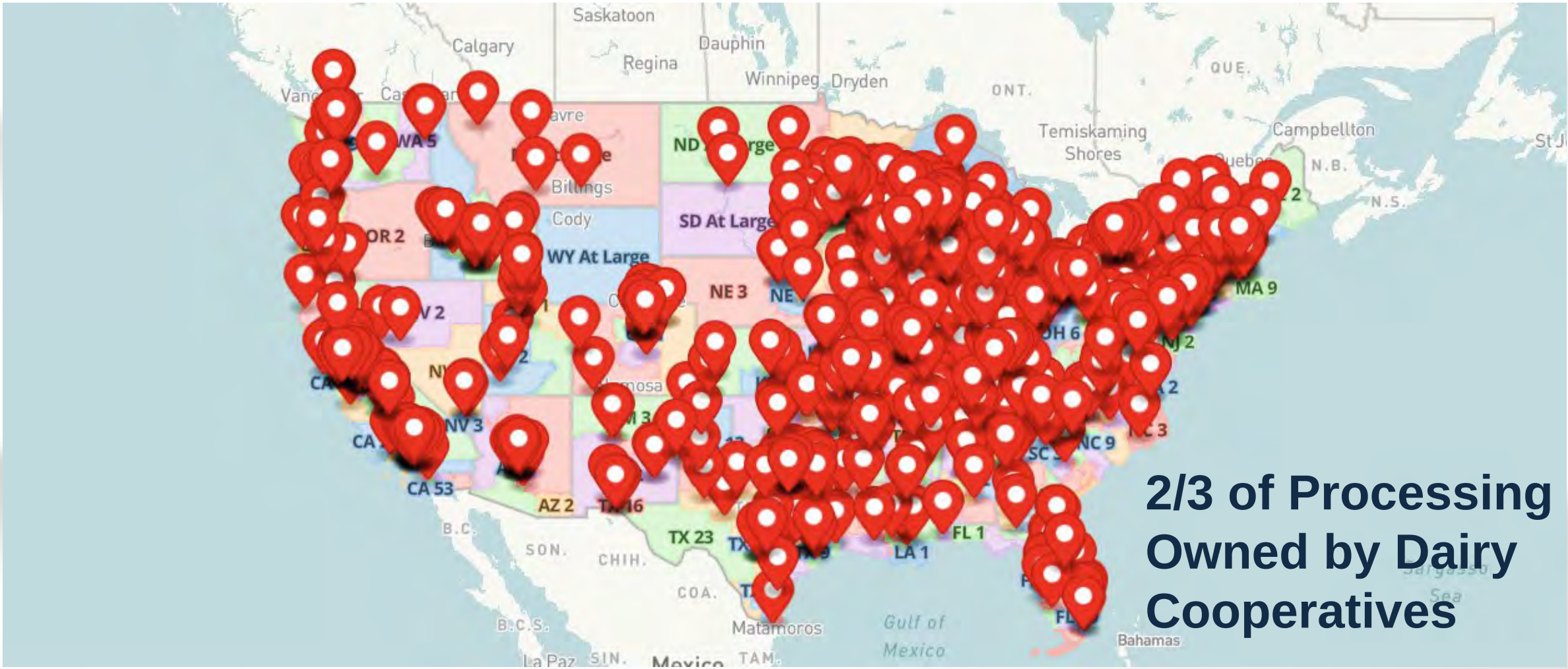

Retailers


Infant Formula


Dairy Ingredients

IDFA: Broad Membership

IDFA International Dairy Foods Association



Delivering Value for Our Members

IDFA International Dairy Foods Association

Advocacy

Regulatory

Communications

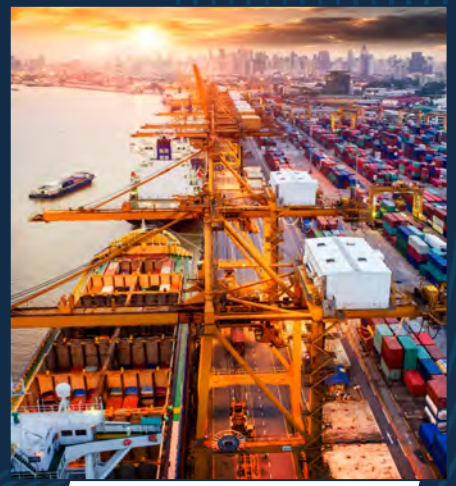
IDFA International Dairy Foods Association

Membership & Programs

People Strategy

How Do We Win the Future?

Embrace A New Vision for Dairy



Reignite Our Competitive Fire

Lean Into Sustainability

Reclaim Our Health Halo

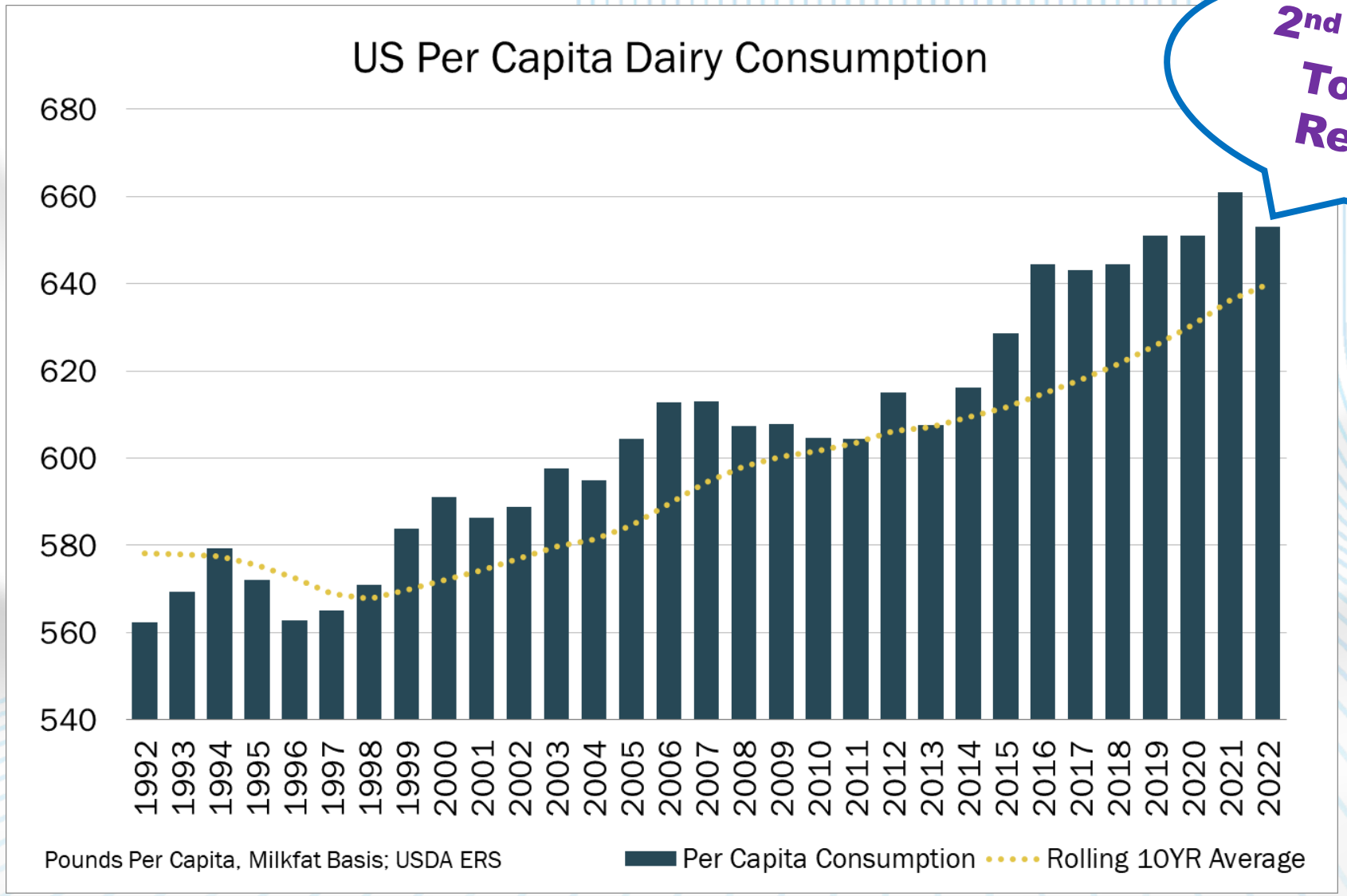
Unite As Industry

Embracing a New Vision for Dairy Begins with Harnessing Our Strengths

IDFA
International
Dairy Foods Association

The Domestic Market for U.S. Dairy

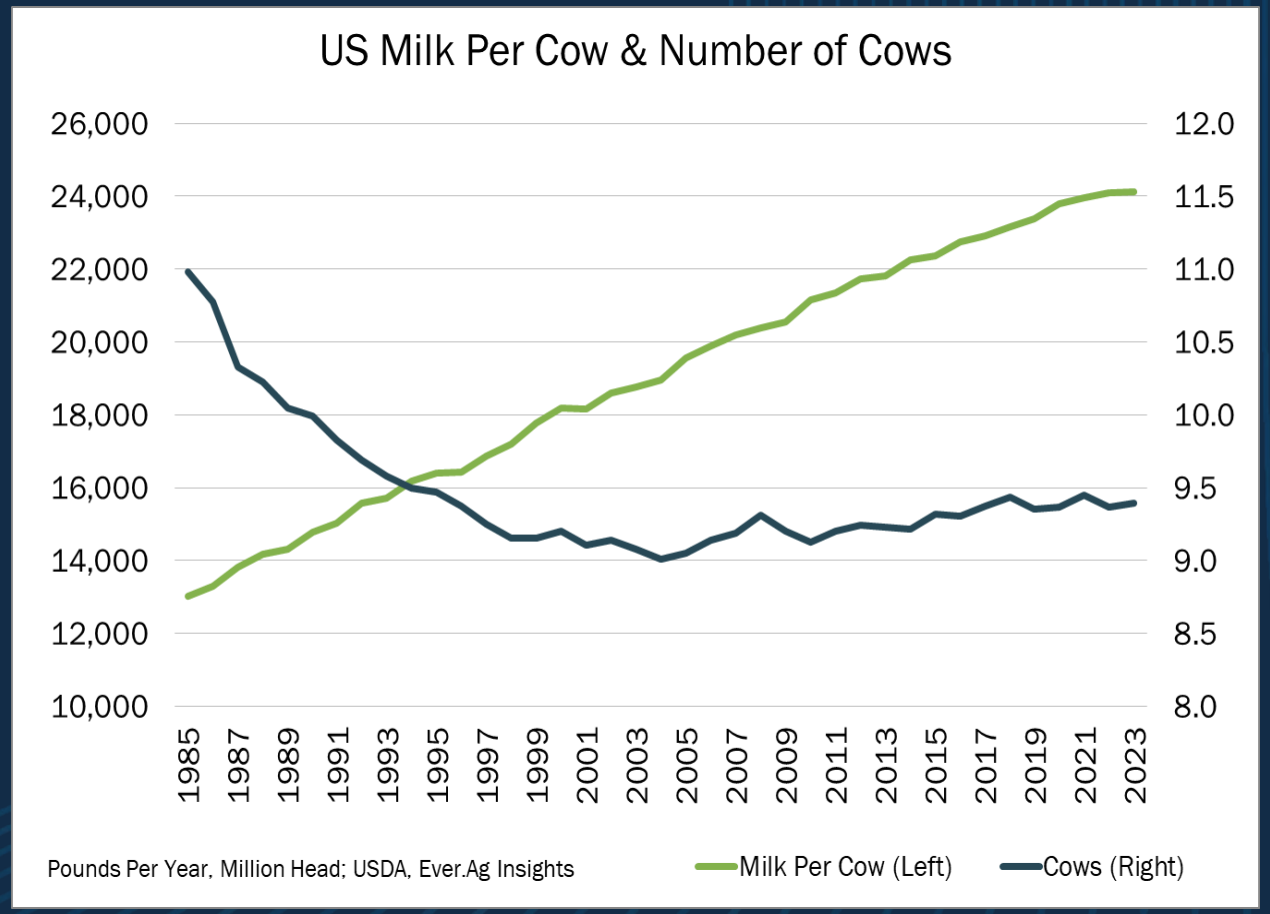
IDFA International Dairy Foods Association

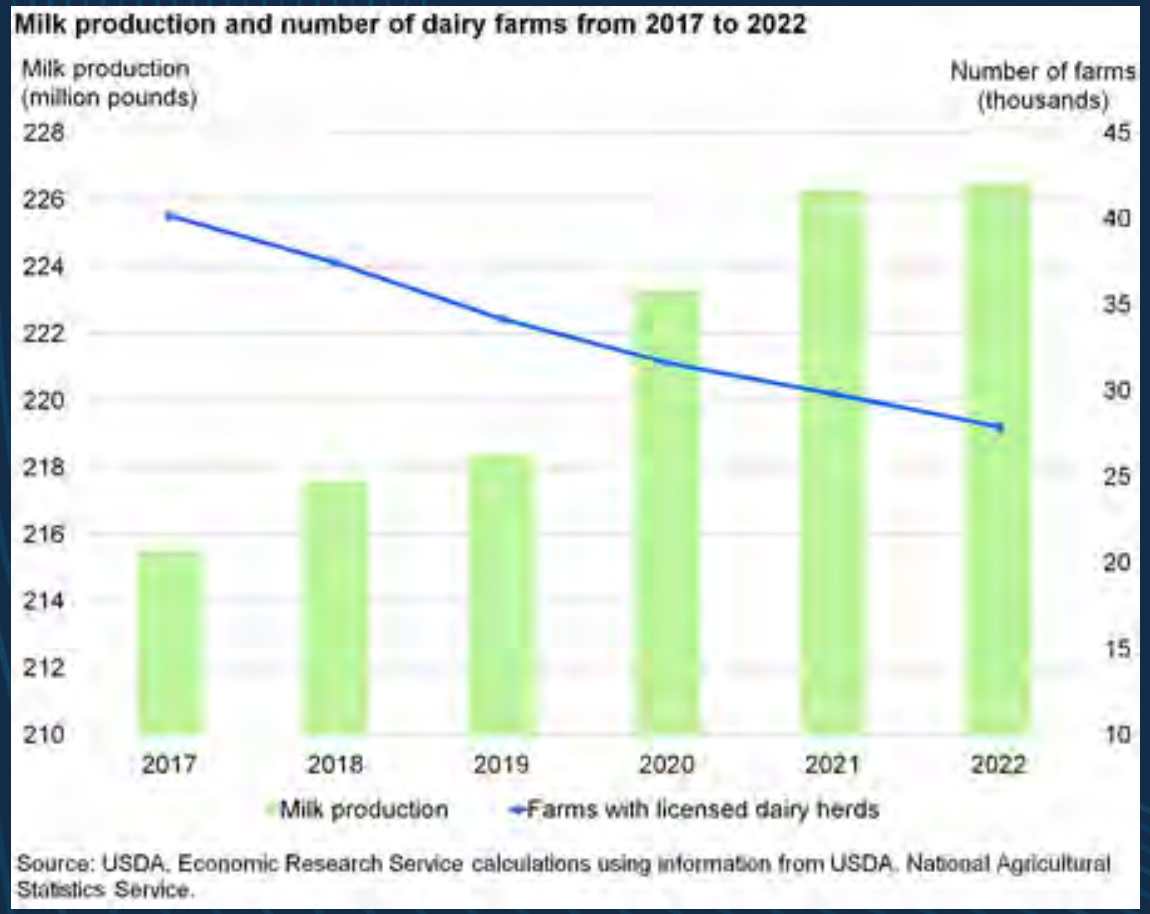


2nd Highest Total on Record!

U.S. dairy consumption is evolving: **We eat more than we drink** while the world demands more & more

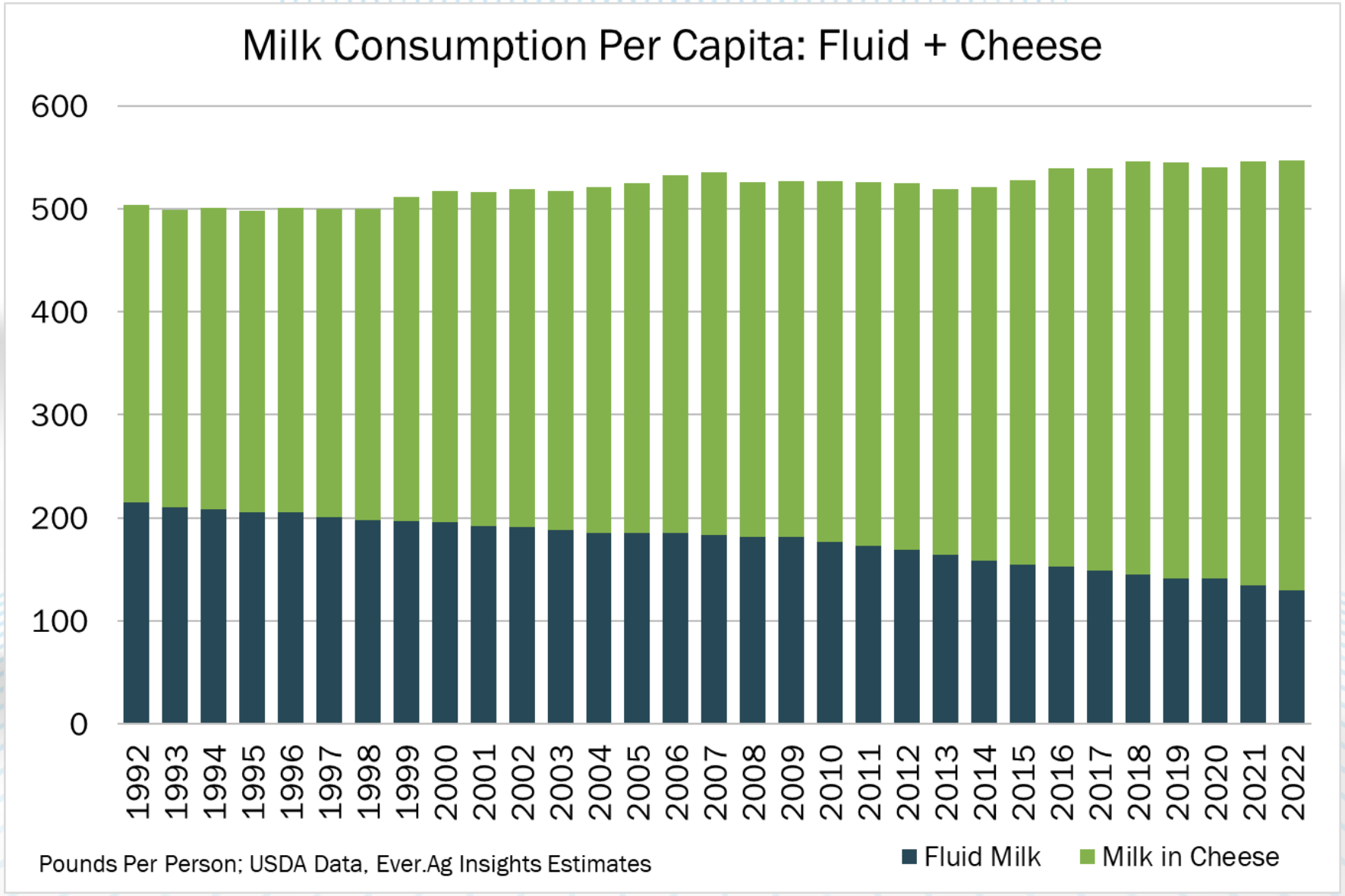
U.S. Dairy Most Efficient In the World



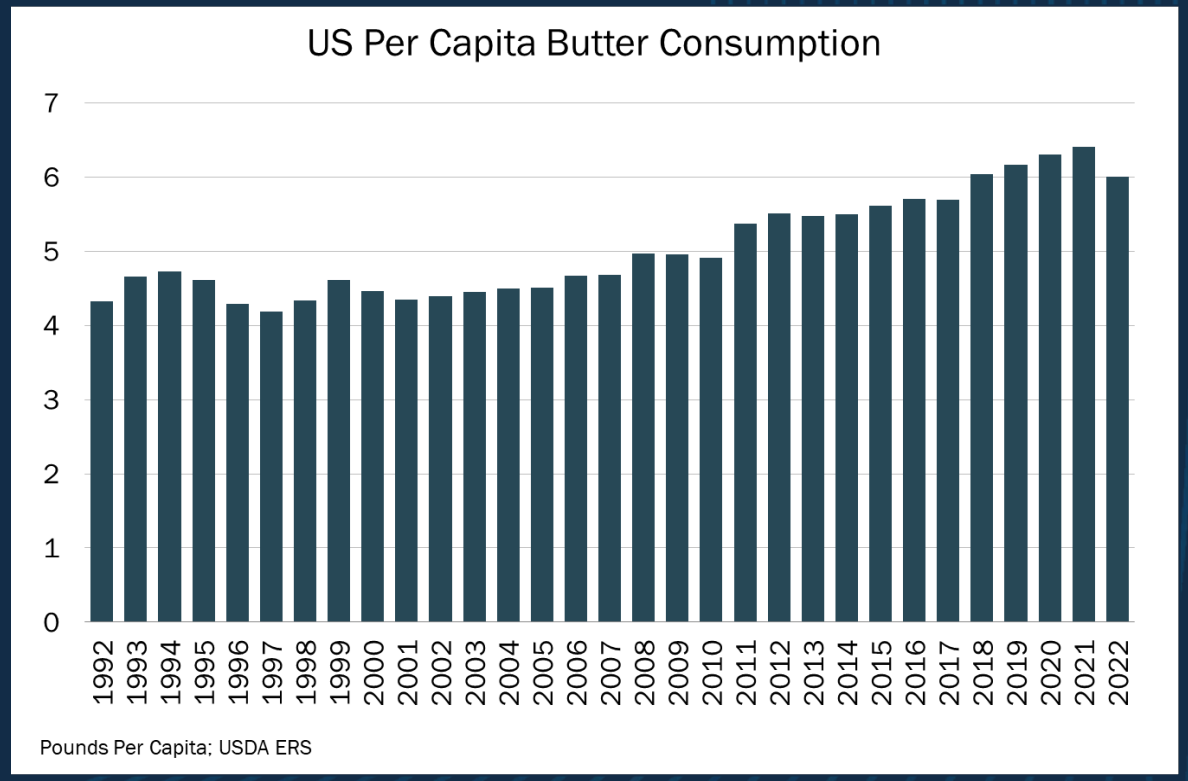


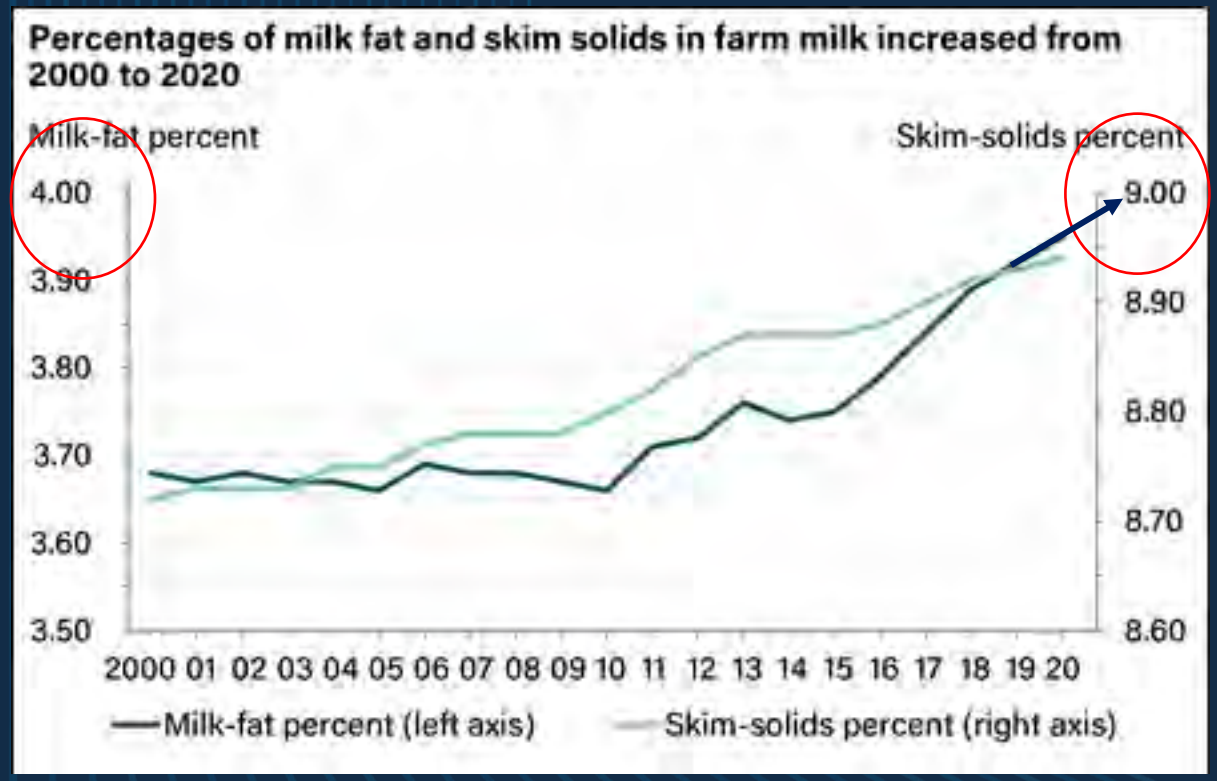
And U.S. Dairy Is Evolving

IDFA International Dairy Foods Association



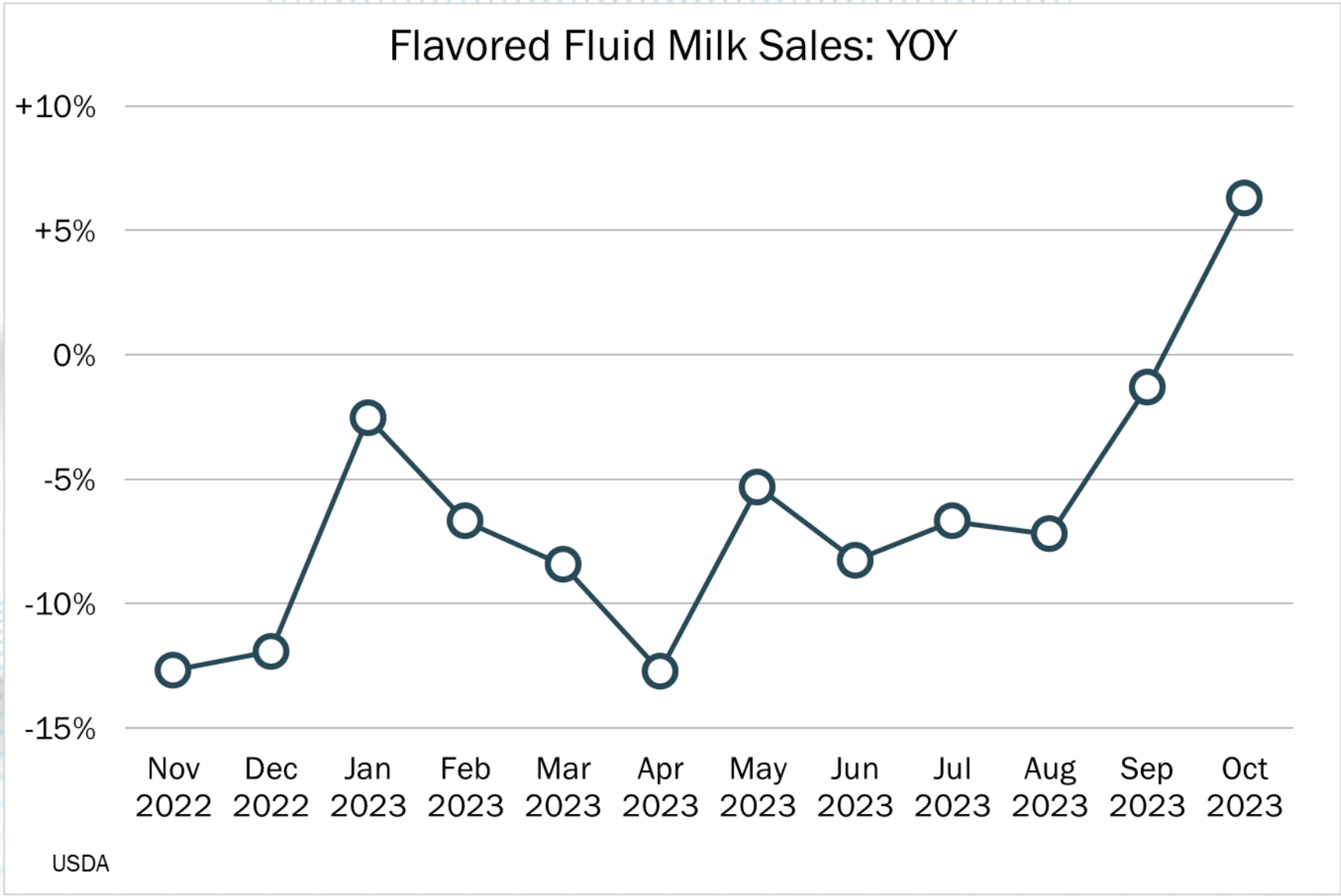
Milkfat Is Driving Premiumization





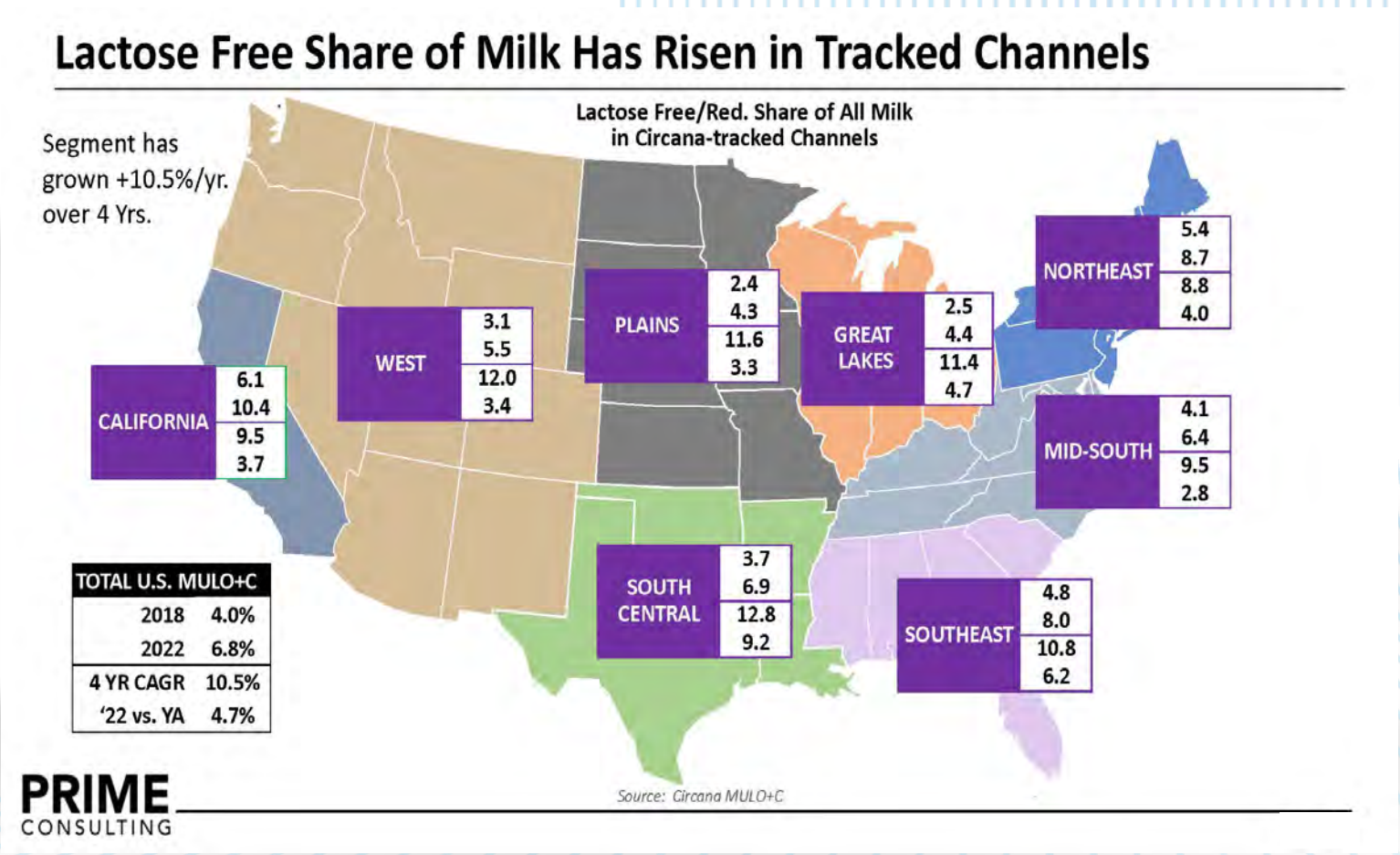
Flavored Milk: Premiumization + Nutrition

IDFA International Dairy Foods Association



Lactose-Free & UF Milk Show Muscle

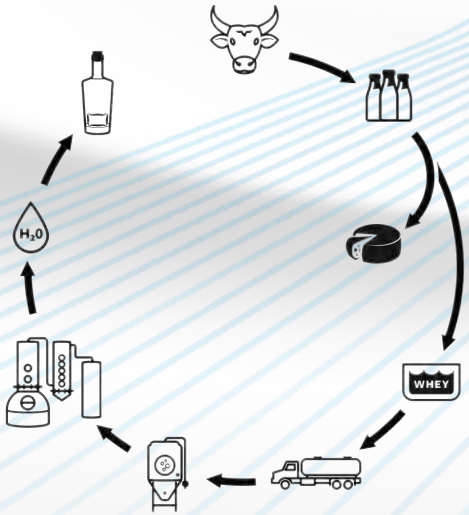
IDFA International Dairy Foods Association



Ultrafiltered Milk UP 7.7% year-over-year through mid-November. UF Milk has 2.4% market share among milk.

Upcycling Byproducts = Added Value

IDFA International Dairy Foods Association



Innovative Thinking: Out-of-the-Jug

Butter

Cheese

Yogurt

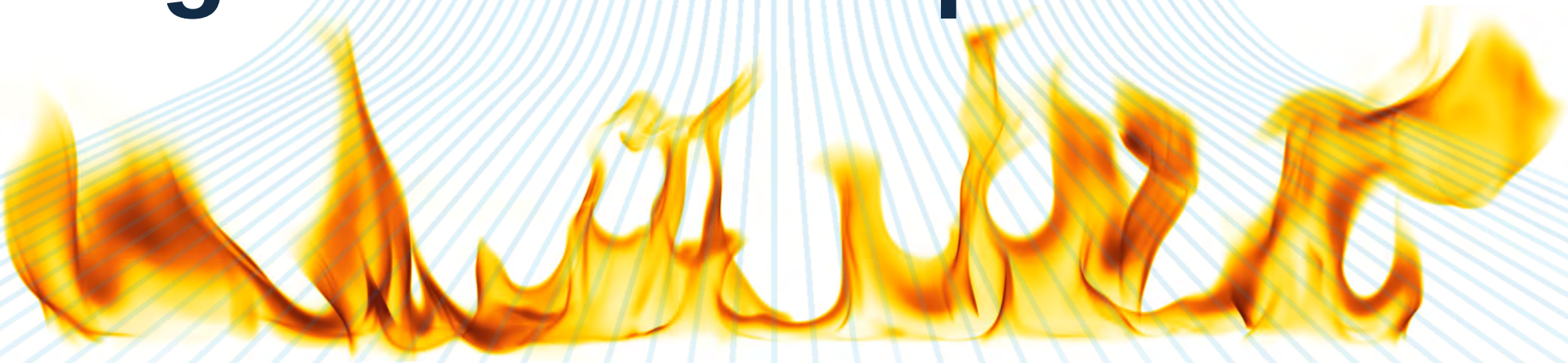
Ice Cream

Ingredients

Milk Permeate
Protein
???

Dairy Forum
2018

Reignite Our Competitive Fire



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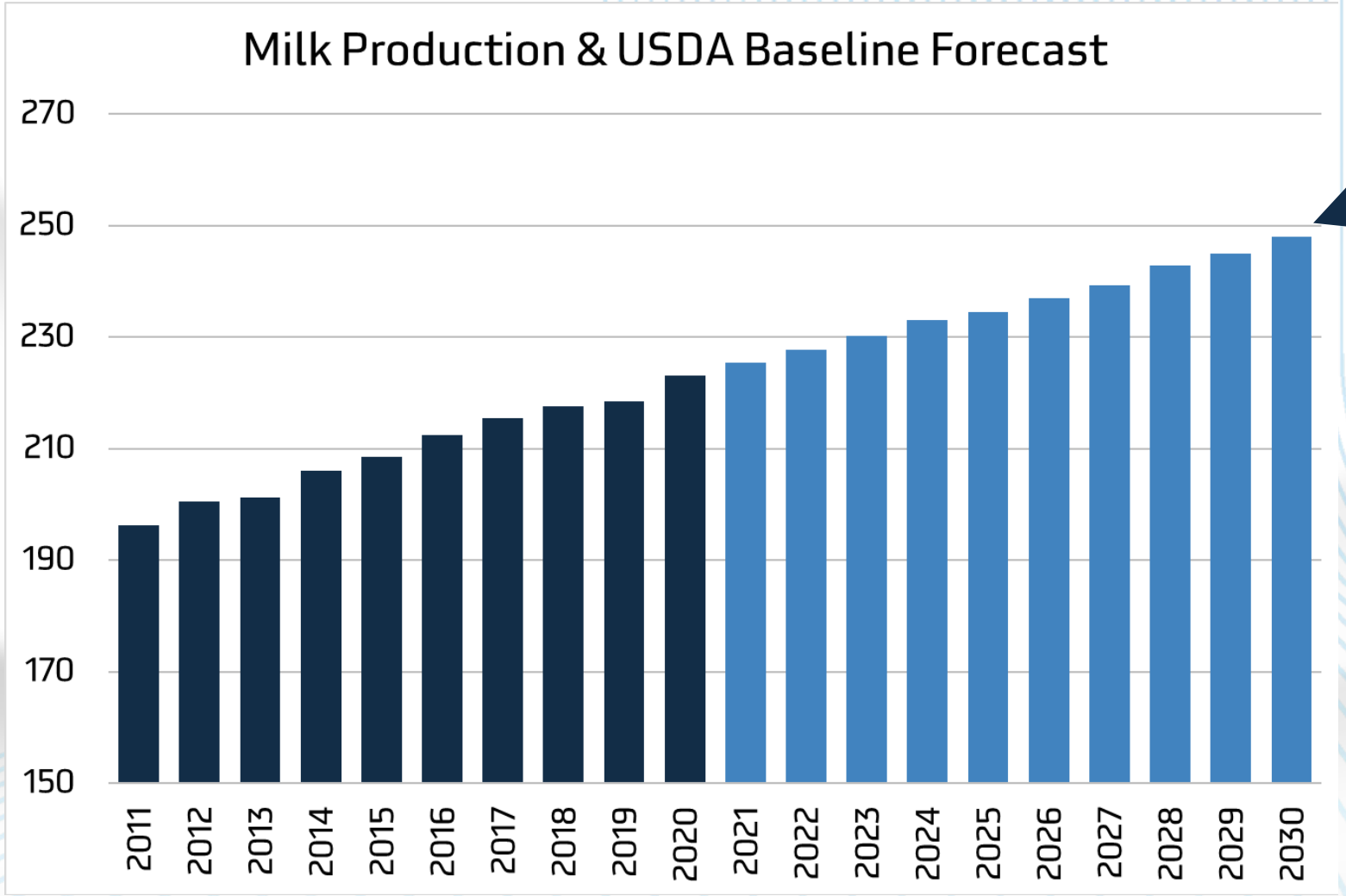
International
Dairy Foods Association

U.S. Productivity Demands Export Markets

IDFA International Dairy Foods Association



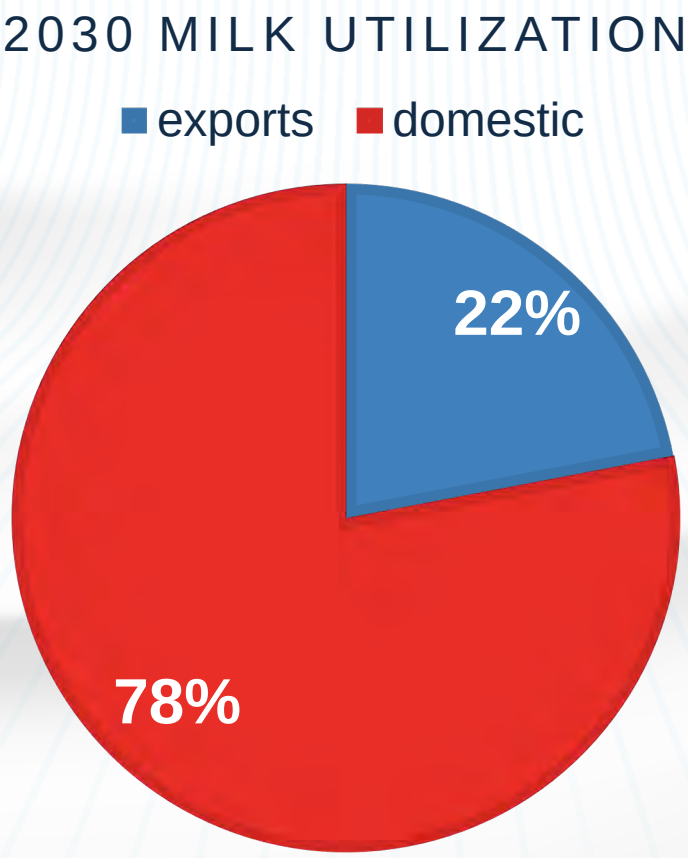
20B LBS
More Milk
Projected
by 2030

The goal is equal parts high-value & commodity goods, supplied reliably & sustainably, at competitive prices.

U.S. Productivity Demands Export Markets

IDFA International Dairy Foods Association

U.S. exports 18% of milk production
Must export 22% to keep pace with production
Milk production will grow by 20 billion pounds



What Is the Game Plan?

1. Build globally competitive market access
2. Defend against unfair barriers
3. Expand existing agreements
4. Embrace new tools & policies
5. Form new alliances

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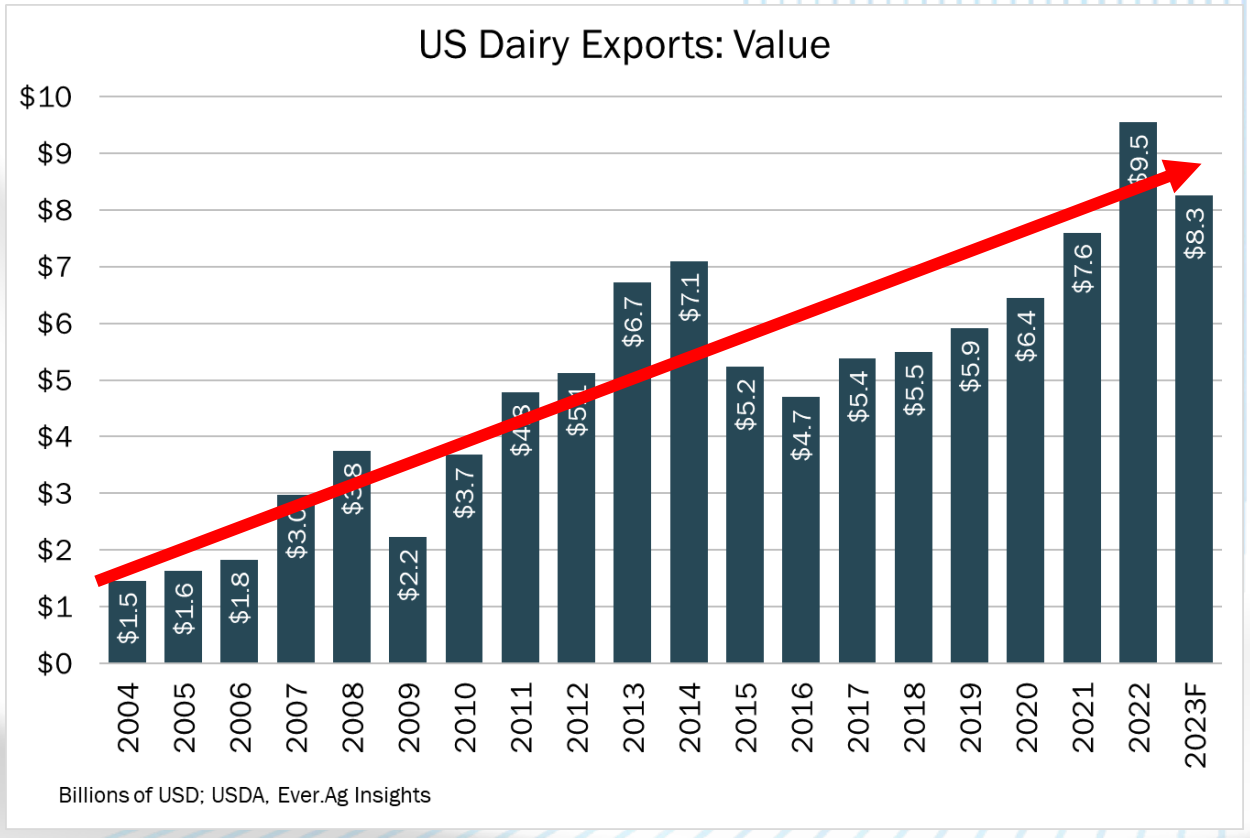
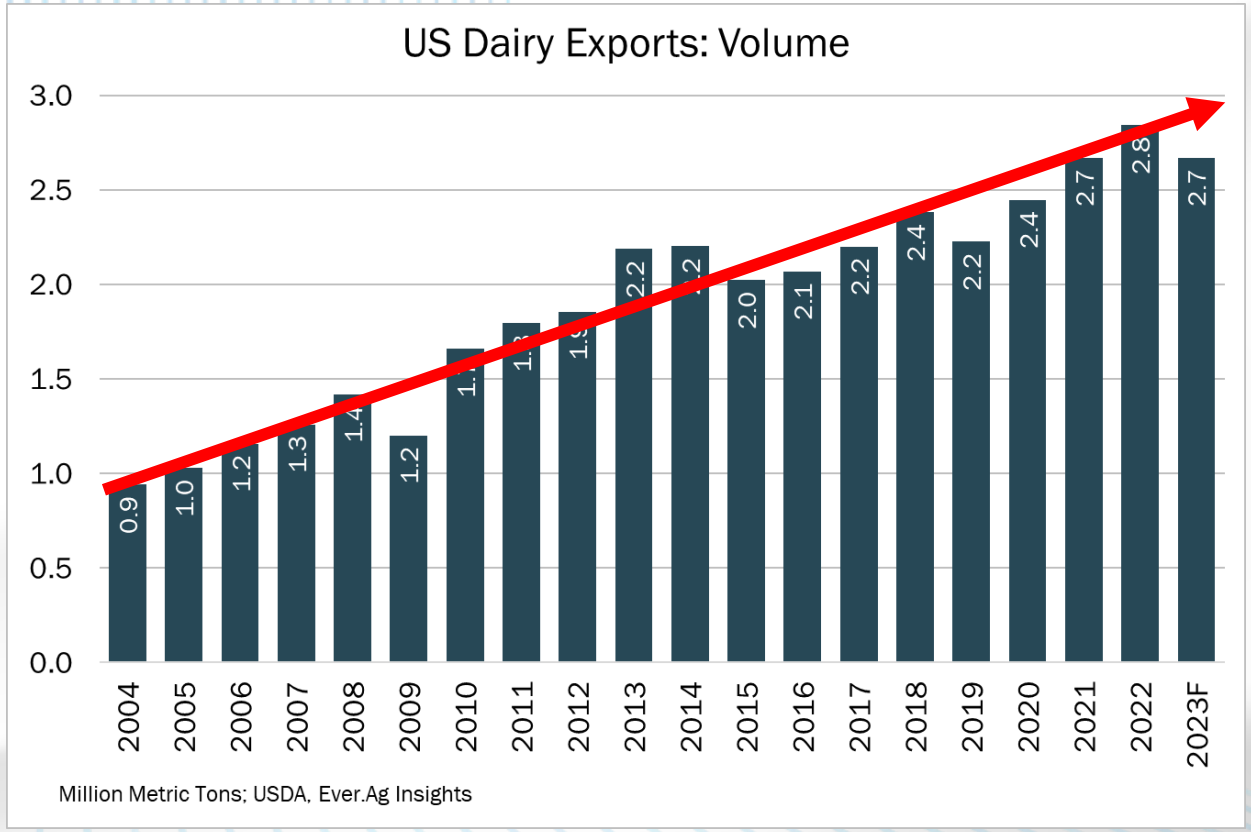
The Global Market for U.S. Dairy: Growth

IDFA International Dairy Foods Association





Response? Adopt a Growth Mindset

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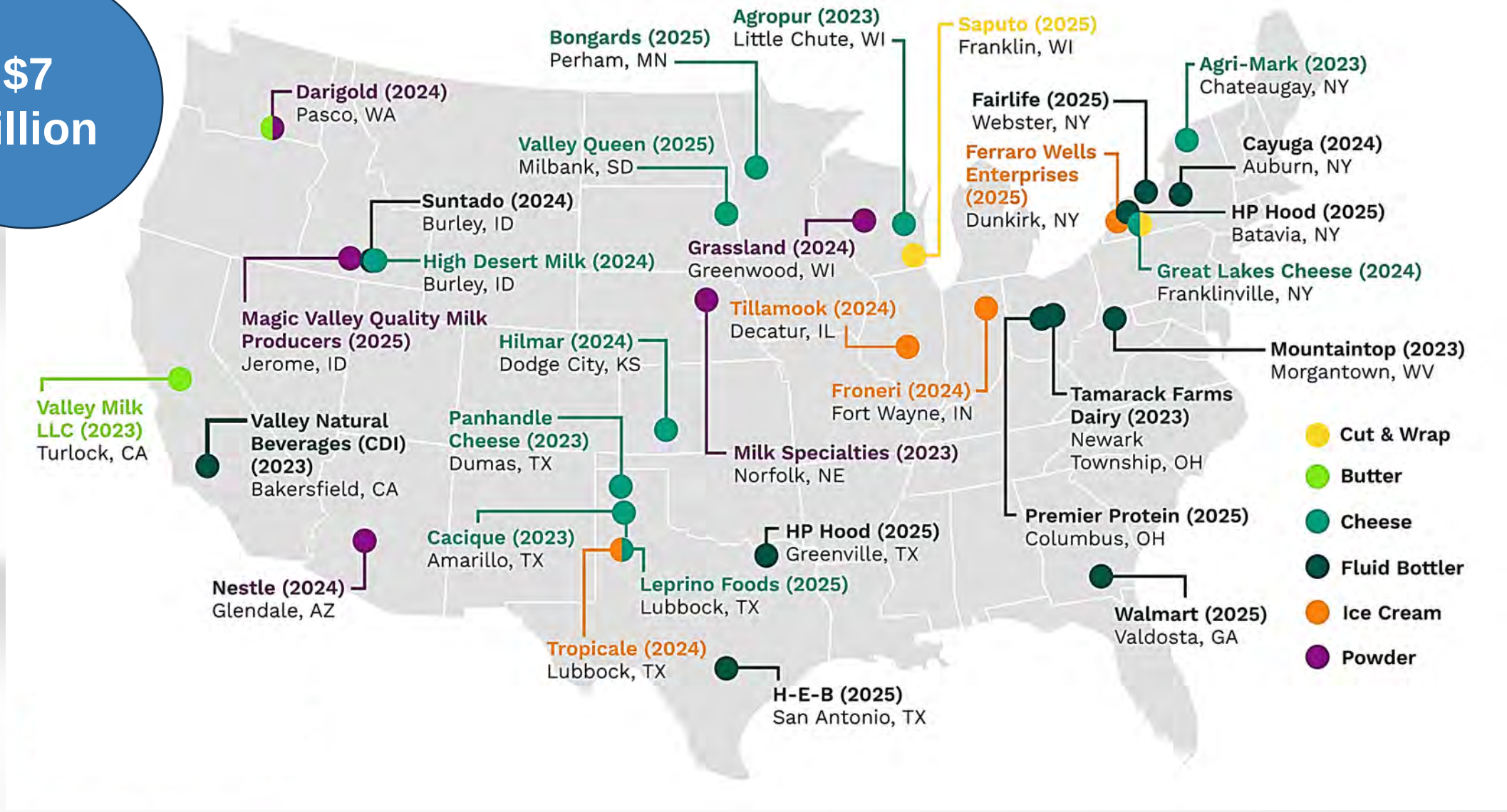
$7 Billion



Where Are Congress & Administration?

Lack of engagement putting:

- Capital at risk
- Jobs at risk
- Growth at risk
- Influence at risk

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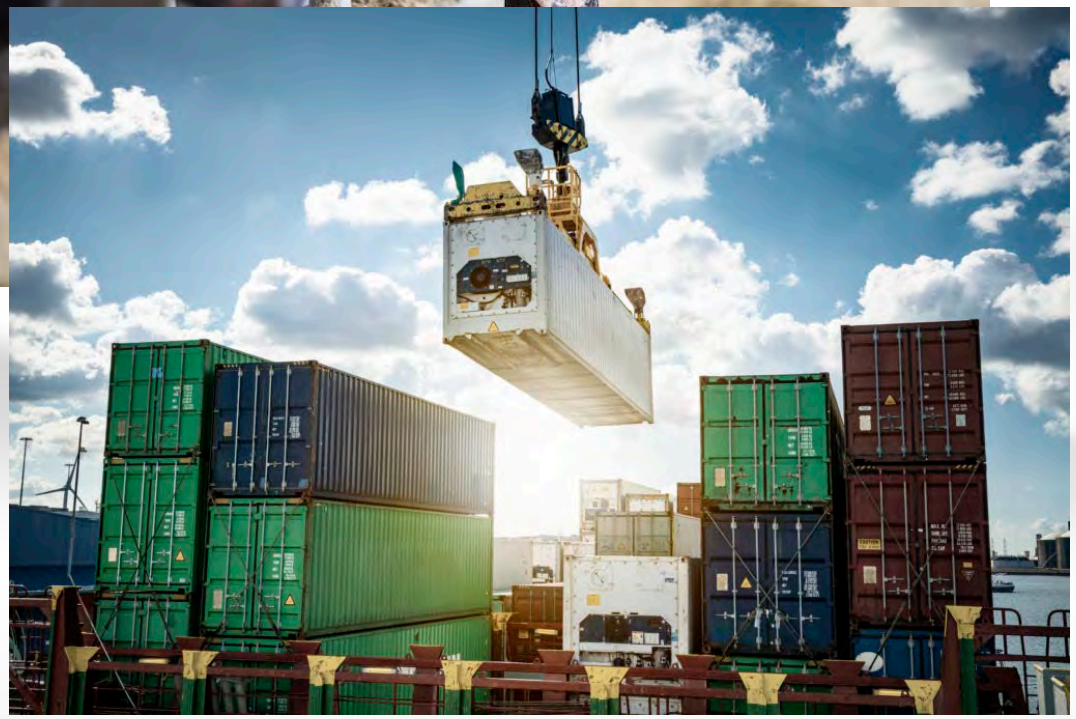
10 Reasons for U.S. Dairy's Advantage

IDFA International Dairy Foods Association



1. Economic Stability & Regional Peace
2. Advanced Infrastructure & Supply Chains
3. Lots of Land
4. Abundant Water (though shifting)
5. Record of Food Safety
6. Leaders in Ag Productivity
7. Robust Animal Welfare Standards
8. Growing Edge in Sustainability
9. Competitive Prices
10. States & Regions Where Regulation is Less Burdensome

We'll Need to Lean Into Sustainability to Win the Future

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U.S. Dairy's BIG Advantage

This U.S. glass of milk has the LOWEST carbon intensity footprint in the WORLD!

Let’s Reclaim Dairy’s Health Halo to Win the Future

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Elevate Dairy In ‘Good for You’ Group

- Affirm & expand dairy in Dietary Guidelines
- Expand SNAP Healthy Fluid Milk Incentive Program
- Reverse harmful proposed cuts to WIC dairy benefits
- Return whole/2% & maintain flavored milk in school meals
- Showcase dairy’s science showing health & nutrition benefits
- Ensure dairy foods can carry ‘healthy’ label

SNAP Healthy Fluid Milk Incentives

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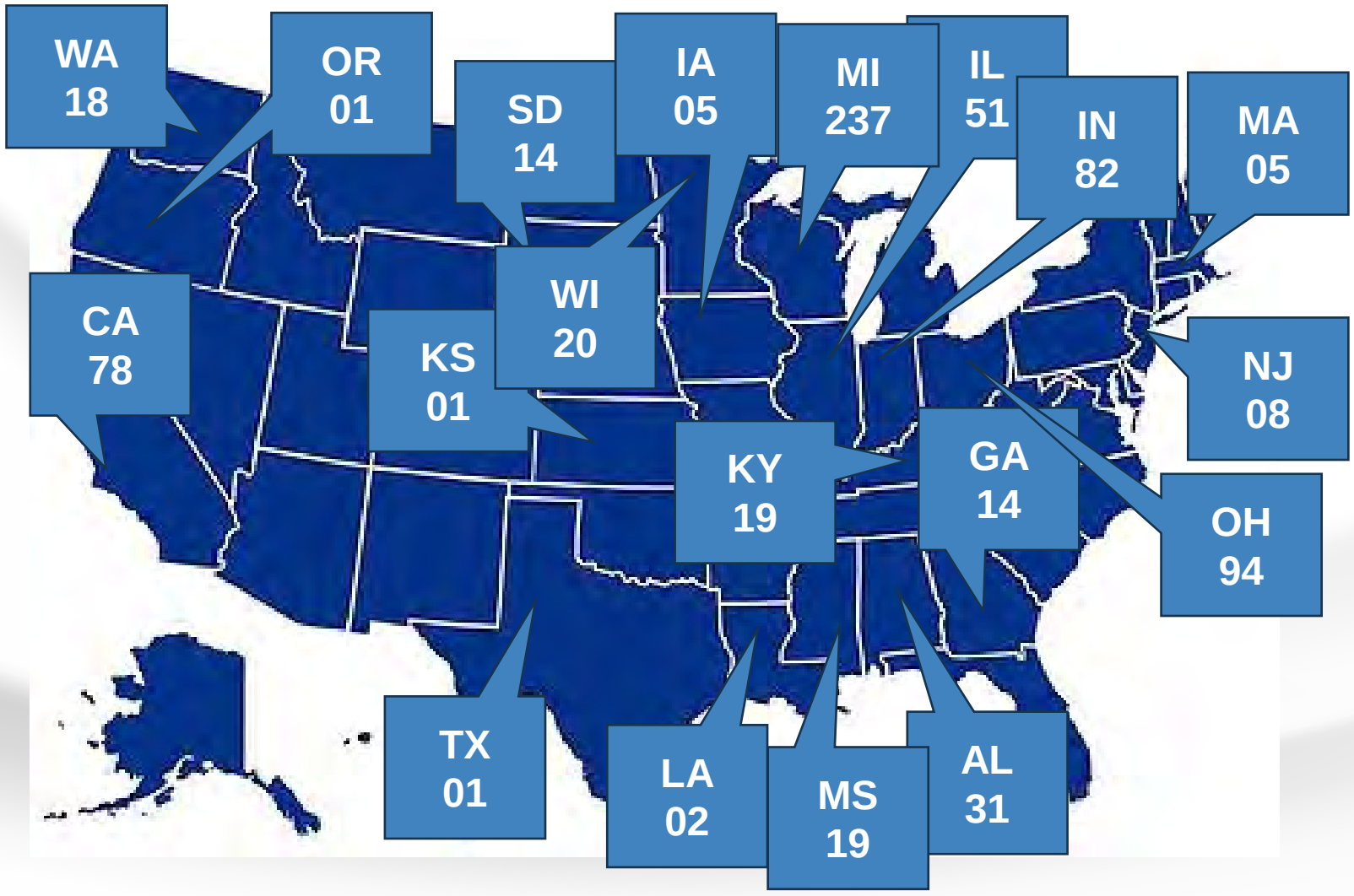

Healthy Fluid Milk Incentive Projects

- Add Milk! will be in 700+ locations across 19 states by the end of this year
- Program moving to Indian Reservations (Oglala Sioux Nation of SD pictured here)
- SNAP redemptions surging thanks to POS, education, & in-store promotion
- $9M appropriated to date

Dairy Nutrition Incentive Program – DNIP

IDFA International Dairy Foods Association

Dairy Nutrition Incentive Program

- Bipartisan bills introduced in House & Senate
- DNIP would expand the HFMIP to increase SNAP participant access to a variety of nutritious dairy products
- Includes whole, reduced-fat milk, cheese, yogurt, and more
- $10M in mandatory, annual appropriations
- **What's next?** We need your advocacy

Let's Expand SNAP Dairy Incentives Right NOW!

Use this QR Code
to Advocate to your
Elected Officials

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Watershed Moment for Whole & 2% Milk

- Congress banned it in 2010, Congress can restore it in 2024
- Passed House 330-99 with huge Bipartisan support
- Up to 80% of voting adults & parents want whole & 2% back
- Growing Bipartisan support in Senate
- We need YOUR engagement!

Advocate TODAY for Whole & 2% Milk!

1000+
Letters
& Emails
Already!

Use this QR Code
to Advocate to your
Elected Officials

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We United to Save Flavored Milk!

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The following dairy companies have signed on to the Healthy School Milk Commitment.

AE Dairy
Bartlett
Borden
Cloverland
Crystal Creamery
DFA Dairy Farmers of America
Danone North America
Darigold
Diversified Foods Inc.
Driftwood
Gallikers
Gossner Foods
Harrisburg Dairies
Hollandia Dairy
Hood
hy-point Farms
Kleinpeter
M&B Products
Marburger Farm Dairy
Maryland & Virginia Milk Producers Cooperative Association
Meadow Gold Hawaii's Dairy
Plains Dairy
Plainview Milk Products Cooperative
Pocono Mountain Dairies
Prairie Farms
Rock View Family Farms
Schneider's Supreme Dairy
Shamrock Farms
Shehadey
SmithFoods
Suiza
Sun Valley Foods
Tofft's
Turner's
UnitedDairy
Upstate Niagara Cooperative, Inc.
Wawa

Long-Term Solutions Needed

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- **Goal:** Keep milk on the tray
- School milk carton shortage impacting 10% of schools across the country
- IDFA worked with USDA to get emergency authorities/flexibilities
- IDFA working with processors, packaging companies, USDA, schools & other partners to solve short-term challenge
- **Long Term:** New packaging providers, shelf-stable, more realistic bidding process

Farm Bill – ????????

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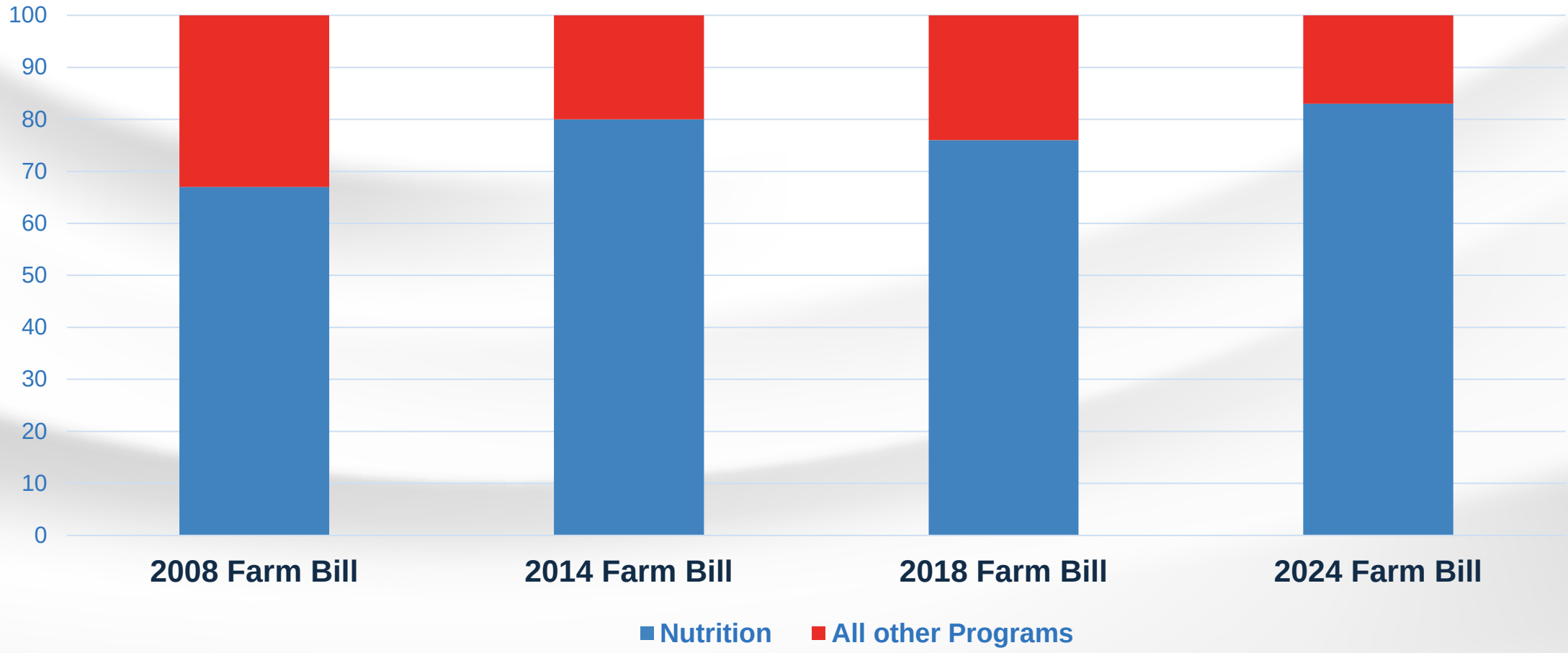
Nutrition vs. Other Farm Bill Titles (% of Baseline)

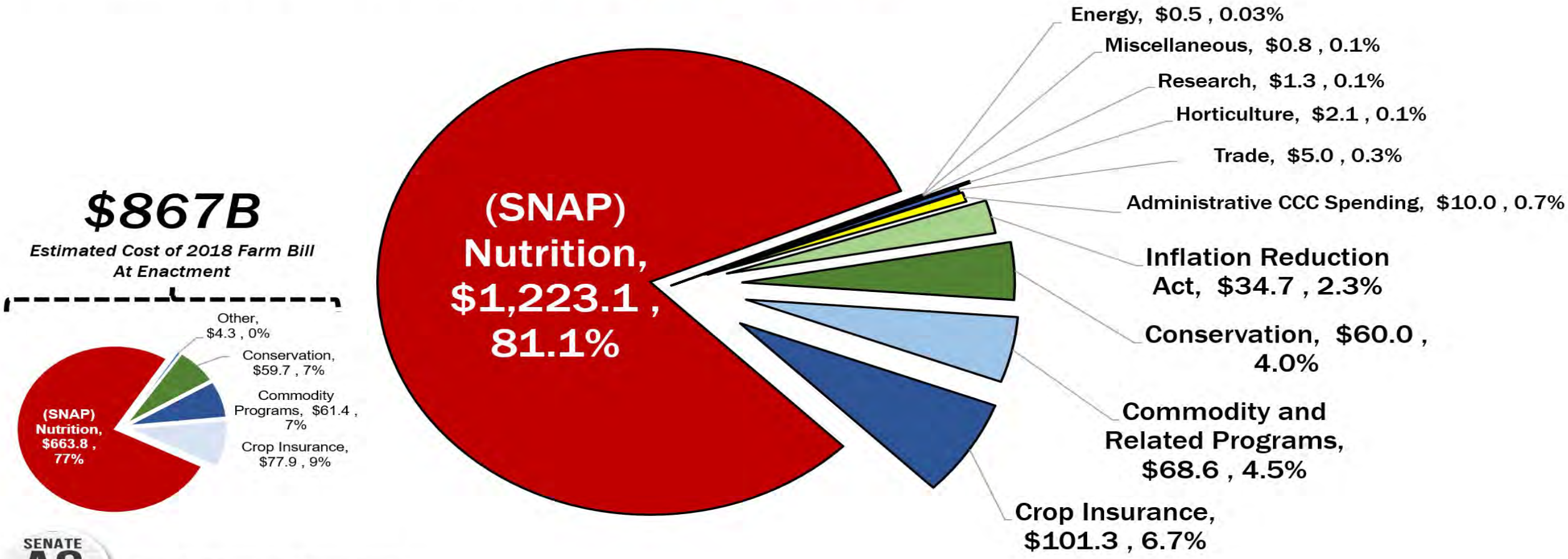


Nutrition Is Central to The Farm Bill

IDFA International Dairy Foods Association

The 2023 Farm Bill Scoring Baseline*

Billion Dollars, Fiscal Year 2024 to 2033, Total Spending $1.51 Trillion



SENATE AG COMMITTEE

Senate Ag Committee Republicans

*Senate Ag GOP Analysis, Congressional Budget Office May 2023 Baseline, Congressional Research Service, *Includes Inflation Reduction Act Outlays*

IDFA's Farm Bill Priorities

IDFA International Dairy Foods Association

Farm Bill

- Expand the Healthy Fluid Milk Incentives Projects to include additional dairy products (*Dairy Nutrition Incentive Program*)
- Authorize USDA to conduct regular cost of processing studies
- Make the Dairy Forward Pricing Program (DFPP) permanent
- Keep FMMO issues out of Farm Bill

What's next? We need your advocacy and engagement to get DNIP across the finish line.

We Must UNITE to Win the Future

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FMMO Reform – You Will Decide

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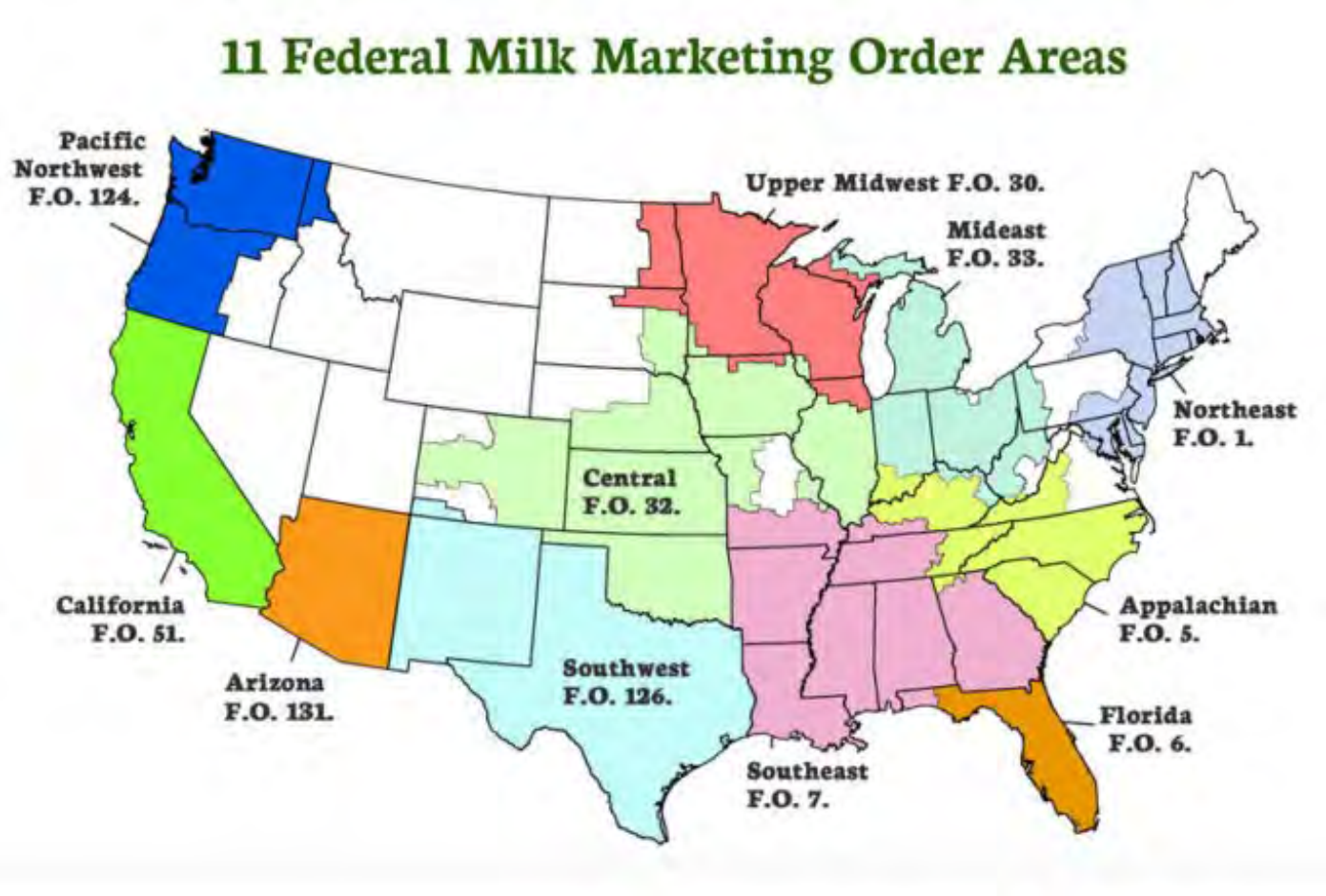


For dairy to succeed in the future at all levels, our pricing must evolve to support greater profitability & innovation throughout the supply chain.

The industry must emerge stronger & more united than ever before to win the future.

IDFA
International
Dairy Foods Association

Thank You!

Michael Dykes, D.V.M.,
President & CEO
mdykes@idfa.org
202-257-1688

Enhanced Nutrition Sorghum

A Major Forage Quality Advance

Tom Kilcer
Advanced Ag Systems LLC
www.advancedagsys.com
tfk1@cornell.edu

Sorghum Check Off
Northeast SARE

SUCCESSFUL LIVESTOCK PRODUCTION

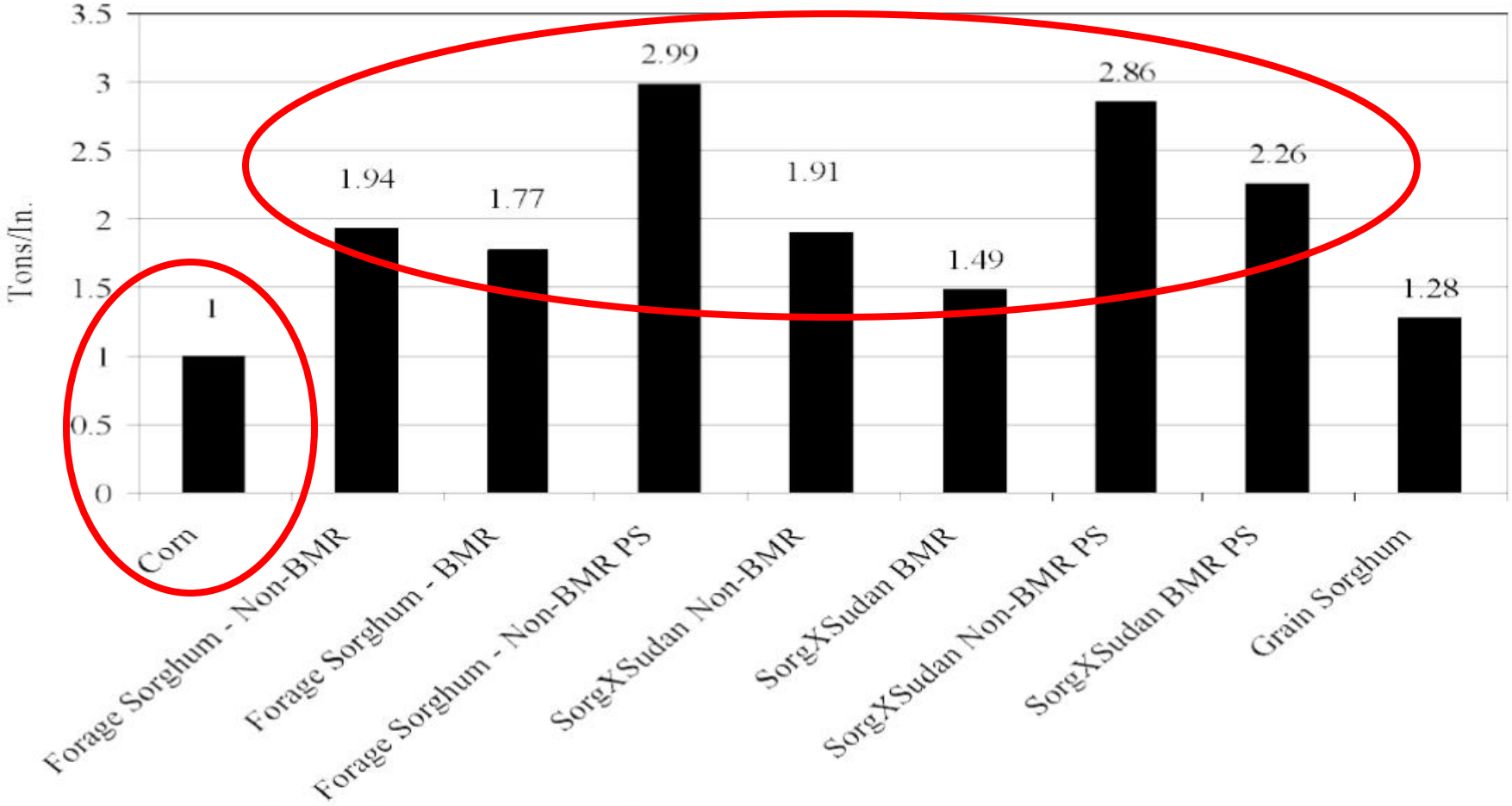
- **GROWING**
  - **ENERGY**
  - **PROTEIN**
  - **DIGESTIBLE FIBER**
  - **SUFFICIENT AMOUNTS & LOW COST**

Not Just Corn and Alfalfa

BMR Sorghum

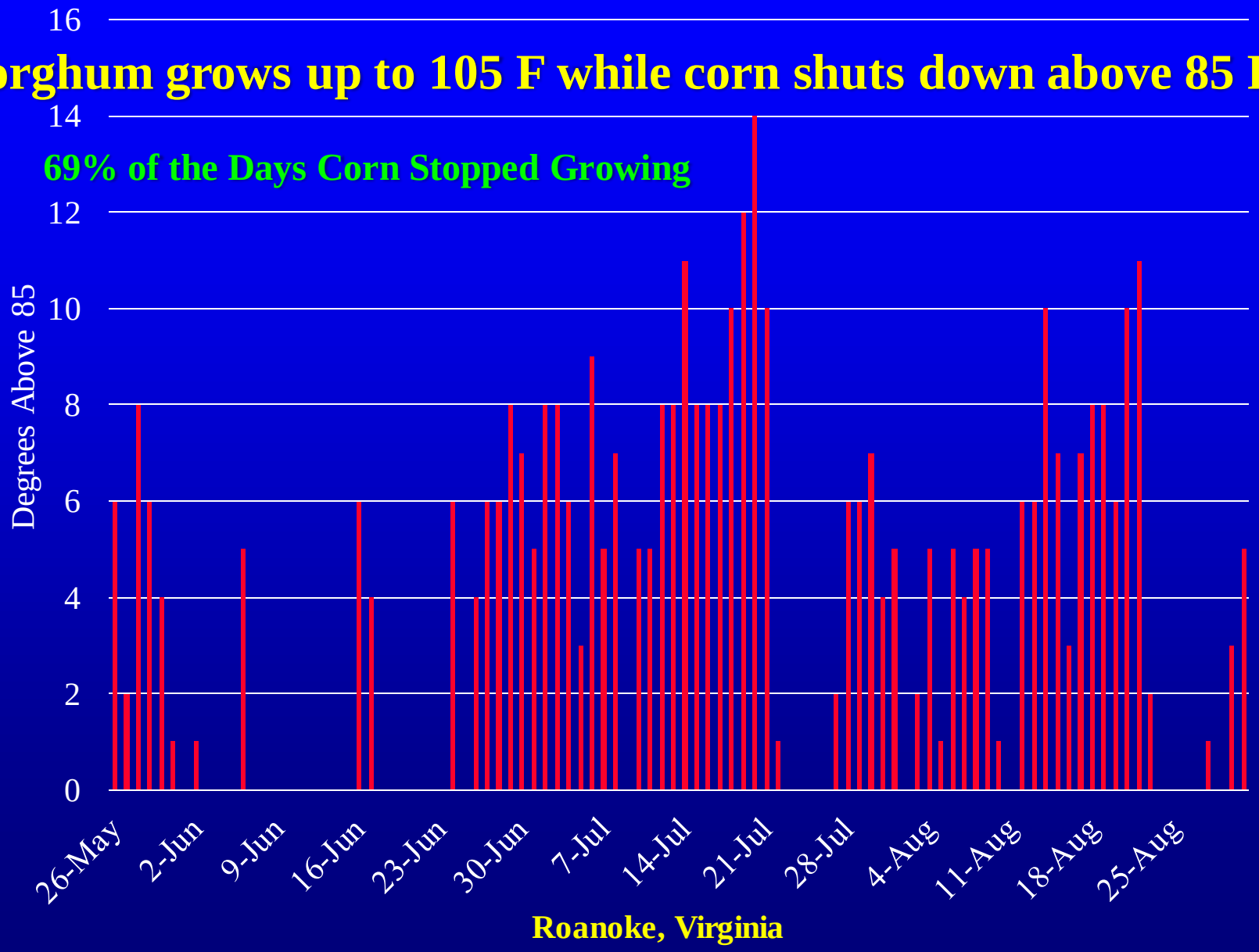
- Planted after winter forage and haylage- balance work
- Improves soil structure: fine root system
- Lower cost $/acre (seed **$20/A** vs Corn **$180/A**)
- WIPES OUT CORN ROOTWORM
- No processing needed (counterproductive)
- Deer hide in it and eat the neighbor's corn
- Non-BMR is excellent low-cost for growing optimum heifers without getting fat
- Drought/heat tolerant

Water is the Key!

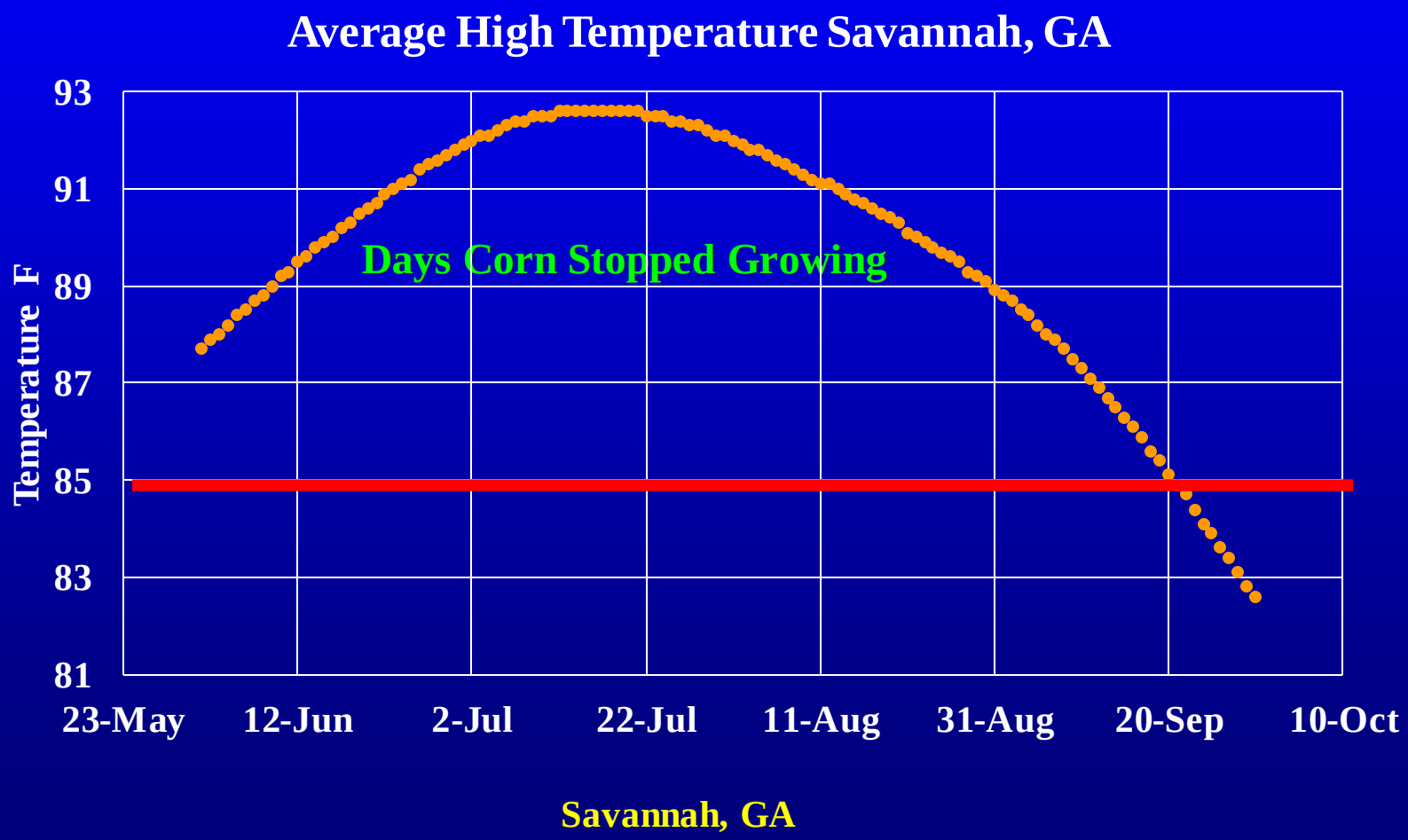


Days When Corn Stopped Growing

Sorghum grows up to 105 F while corn shuts down above 85 F.

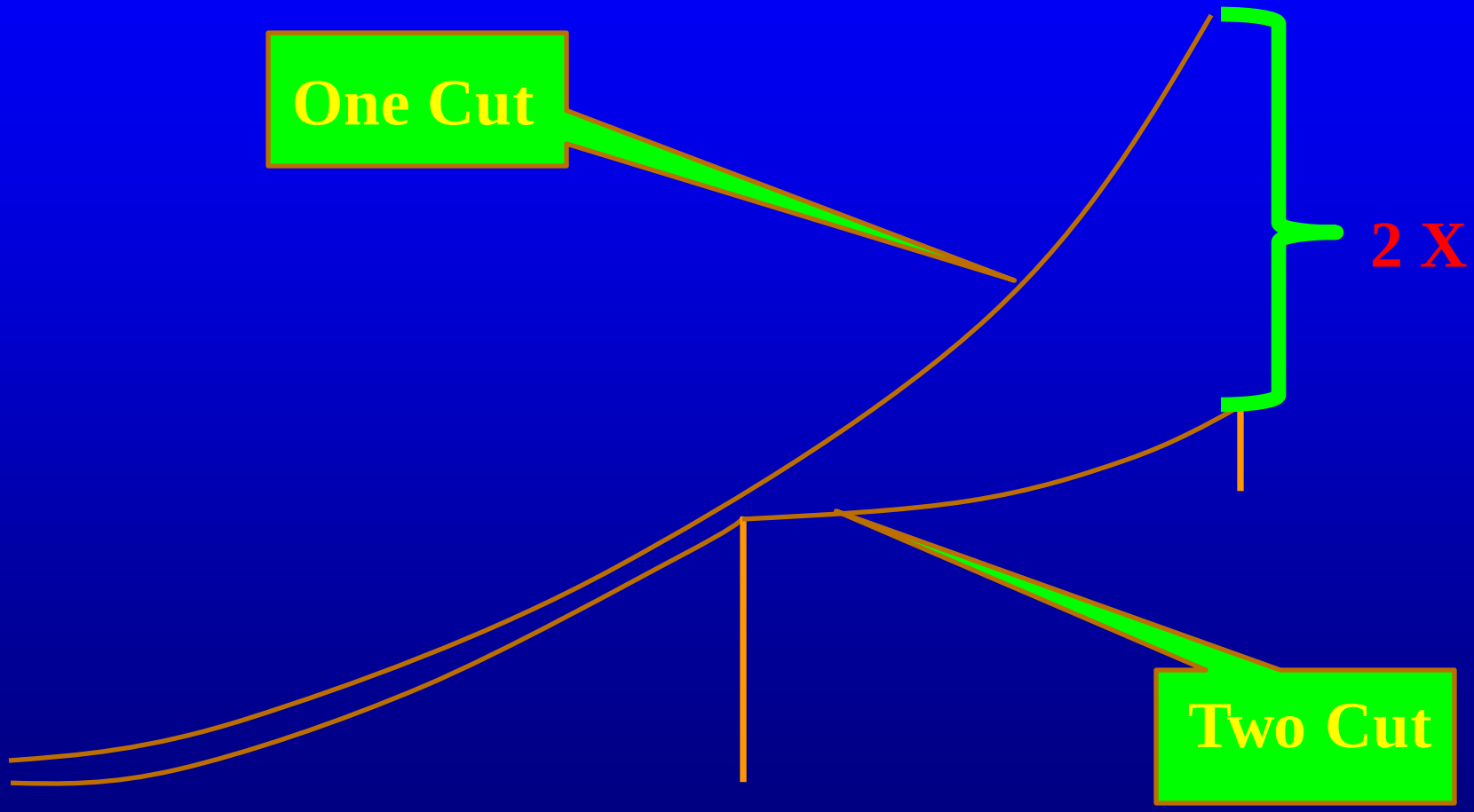


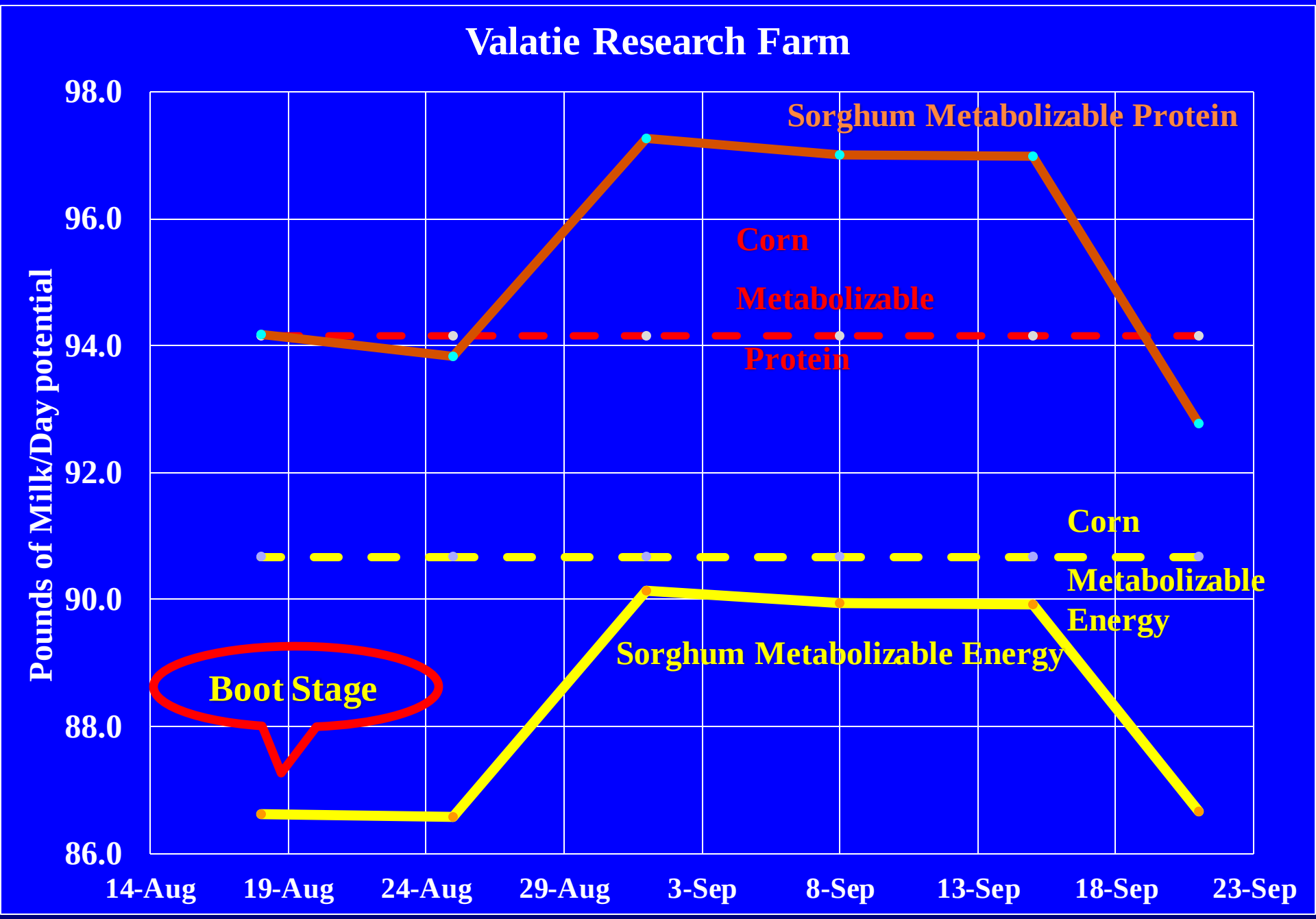
Sorghum grows up to 105 F while corn shuts down above 85 F.



One Cut Sorghum Sp.

Dry Matter Additions

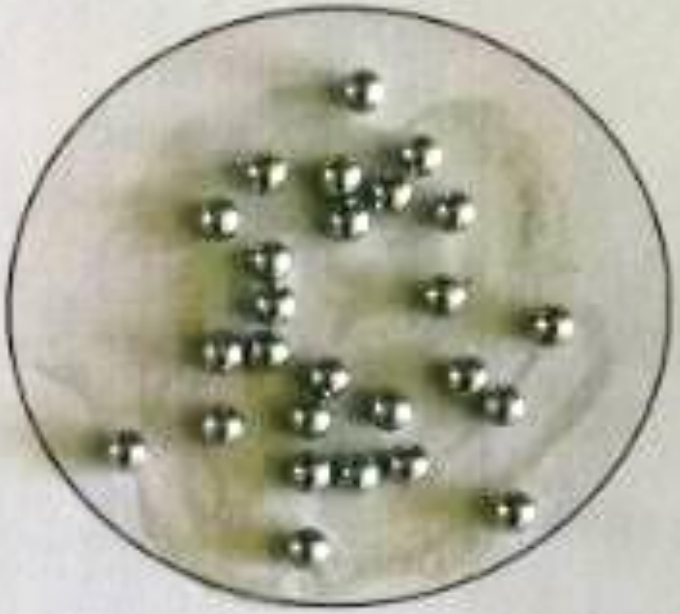



Valatie Research Farm
Pounds of Milk/Day potential
98.0
96.0
94.0
92.0
90.0
88.0
86.0
14-Aug
19-Aug
24-Aug
29-Aug
3-Sep
8-Sep
13-Sep
18-Sep
23-Sep
Sorghum Metabolizable Protein
Corn Metabolizable Protein
Corn Metabolizable Energy
Sorghum Metabolizable Energy
Boot Stage


Green Seed Head: tip like cooked oatmeal
Tan Seed Head: soft dough half way down seed head
Advanced Ag Systems LLC

Forage Sorghum Seed

18,500 seeds/Lb.



#3 Steel Shot

BlackCloud FS Steel

Photoperiod Sensitive

Did Not Help

Photoperiod Sensitive

does not head;

nor dry;

nor increase energy concentration

The potential of eliminating the grain sink for enhancing biofuel traits in sweet sorghum hybrids

by

Jebril Ali Abdalla Mohamad Jebril

B.S., Sabha University, 1994
M.S., University Putra Malaysia, 2005

measured. Elimination of the grain sink significantly increased °Brix % (17.8%), dry biomass (27.8%), juice yield (23.9%), and total sugar yield (43.5%).

The A_3 cytoplasm mediated male sterility increased biomass, soluble solids, and total sugar in sweet sorghum hybrids

Jebril Jebril [a], Donghai Wang [b], Kraig Rozeboom [a], Tesfaye Tesso [a,*]

[a] *Department of Agronomy, Kansas State University, Manhattan, KS 66506, United States*
[b] *Department of Biological and Agricultural Engineering, Kansas State University, Manhattan, KS 66506, United States*

Male Sterile Sorghum

Biomass 29% increase

Total sugar 57%

Resistant to lodging and disease.

Impact of Nutrient Make-up

Corn Silage energy partition

Plant Fiber &Sugars	Grain Starch

Fertile Seeded

Male Sterile
No Fertile Seed

$$CO2 + H2O = CHO + O2$$

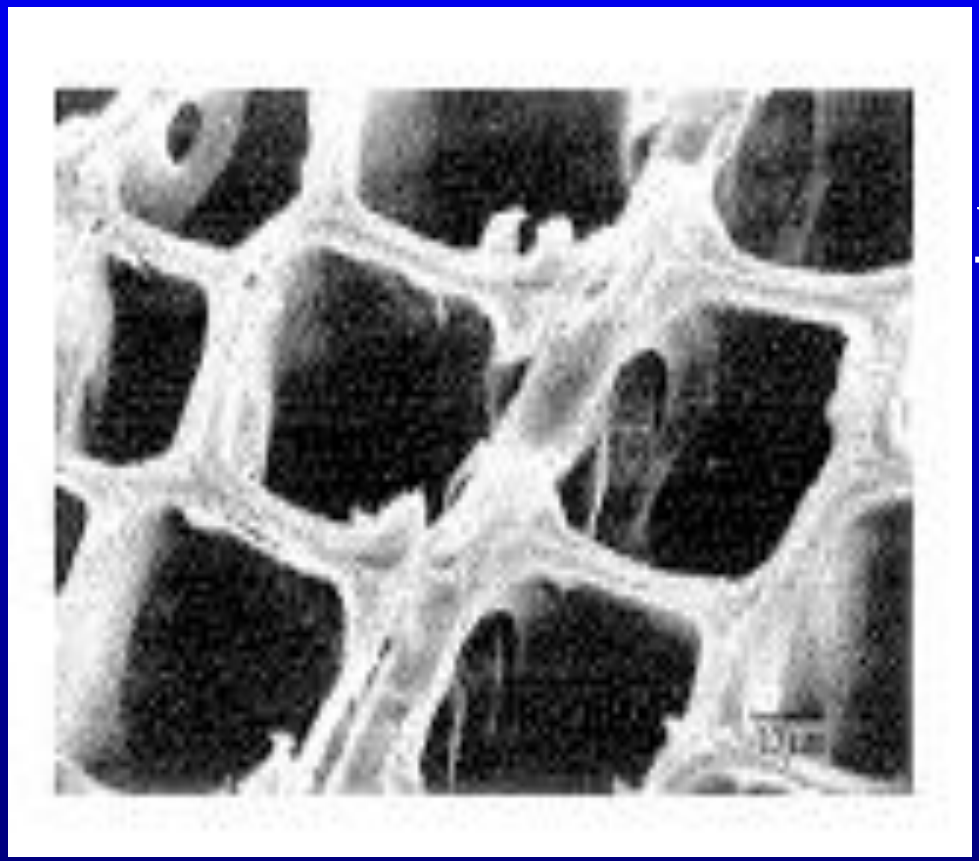
Impact of Nutrient Make-up: Male Sterile BMR Sorghum

Same Total Energy – Different Source

Plant Fibers &

Plant Cell Sugar and Starch

Sugar and Starch stored in forage plant cells, not in seed head

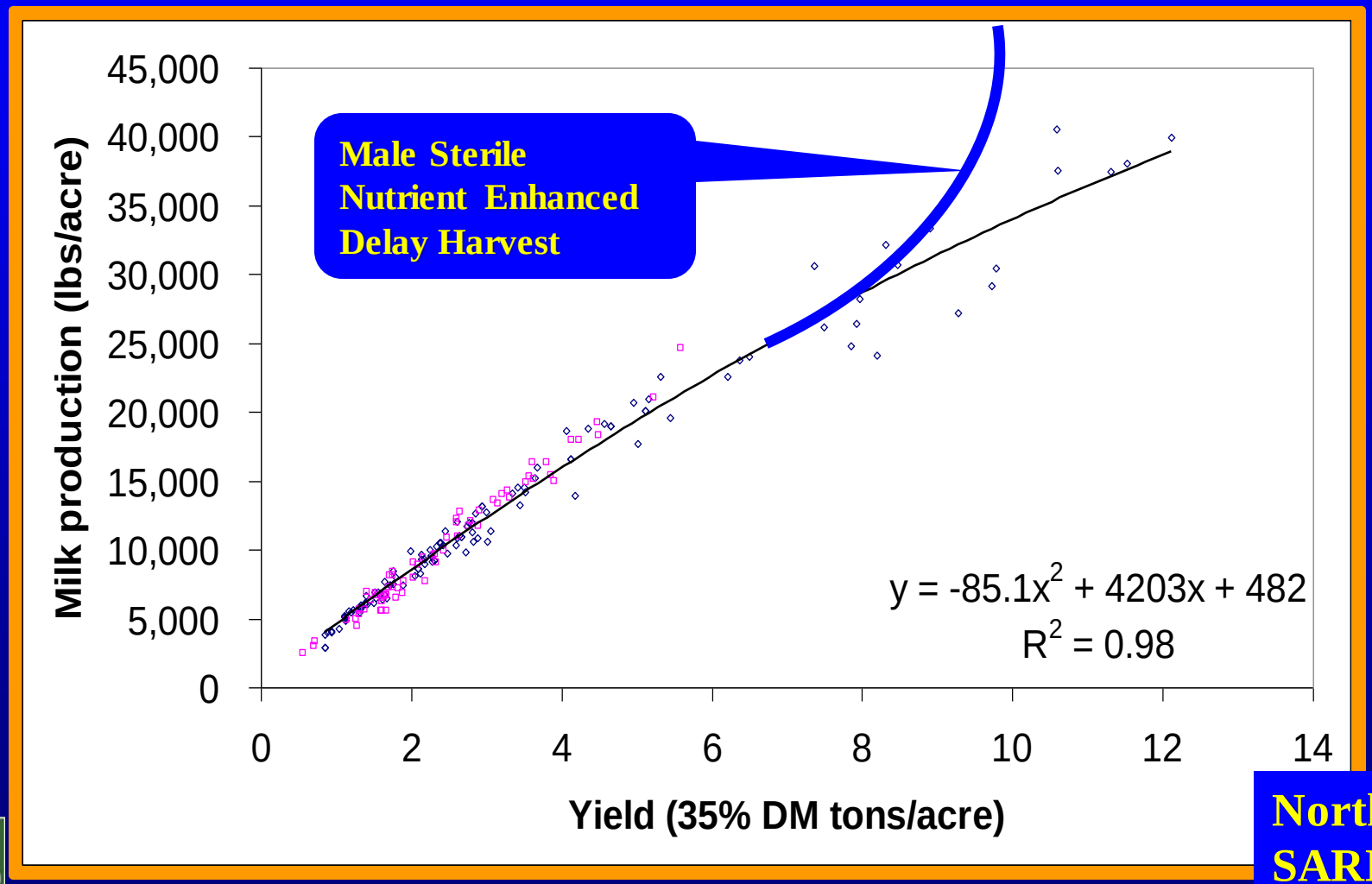


Dr. R. Grant, Miner Institute

- **Cells must be ruptured for bacteria to enter**
  - Slow Steady nutrient release
  - Higher rumen pH so higher components
  - High Sugar boost protein and fat levels in milk
  - NO processing needed.

Interim Research Results

All sites and years



Kilcer et al. 2003. What's Cropping Up? 13(4): 4-6.

NMSP

Northeast SARE Research

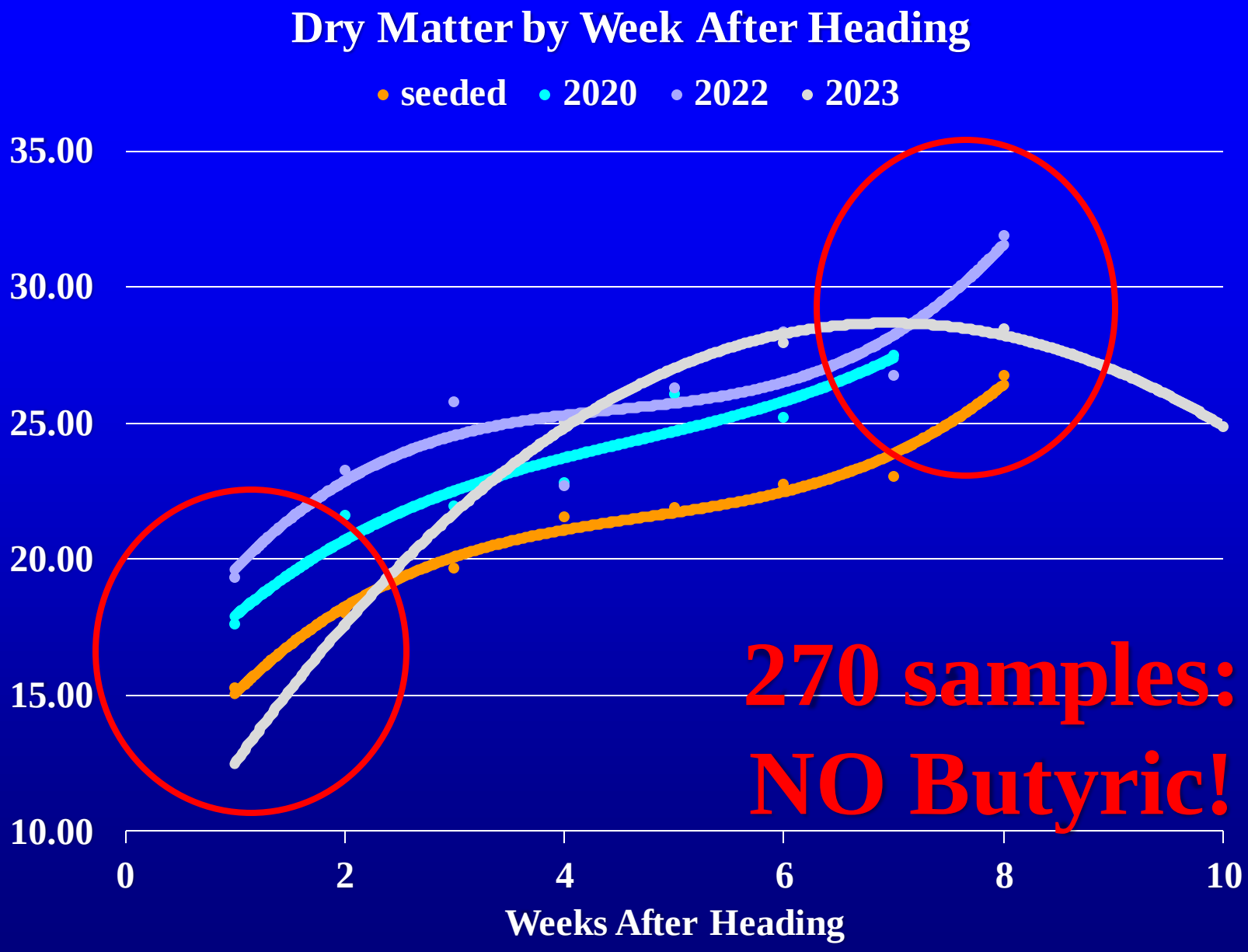
BMR MALE STERILE- NO SEED

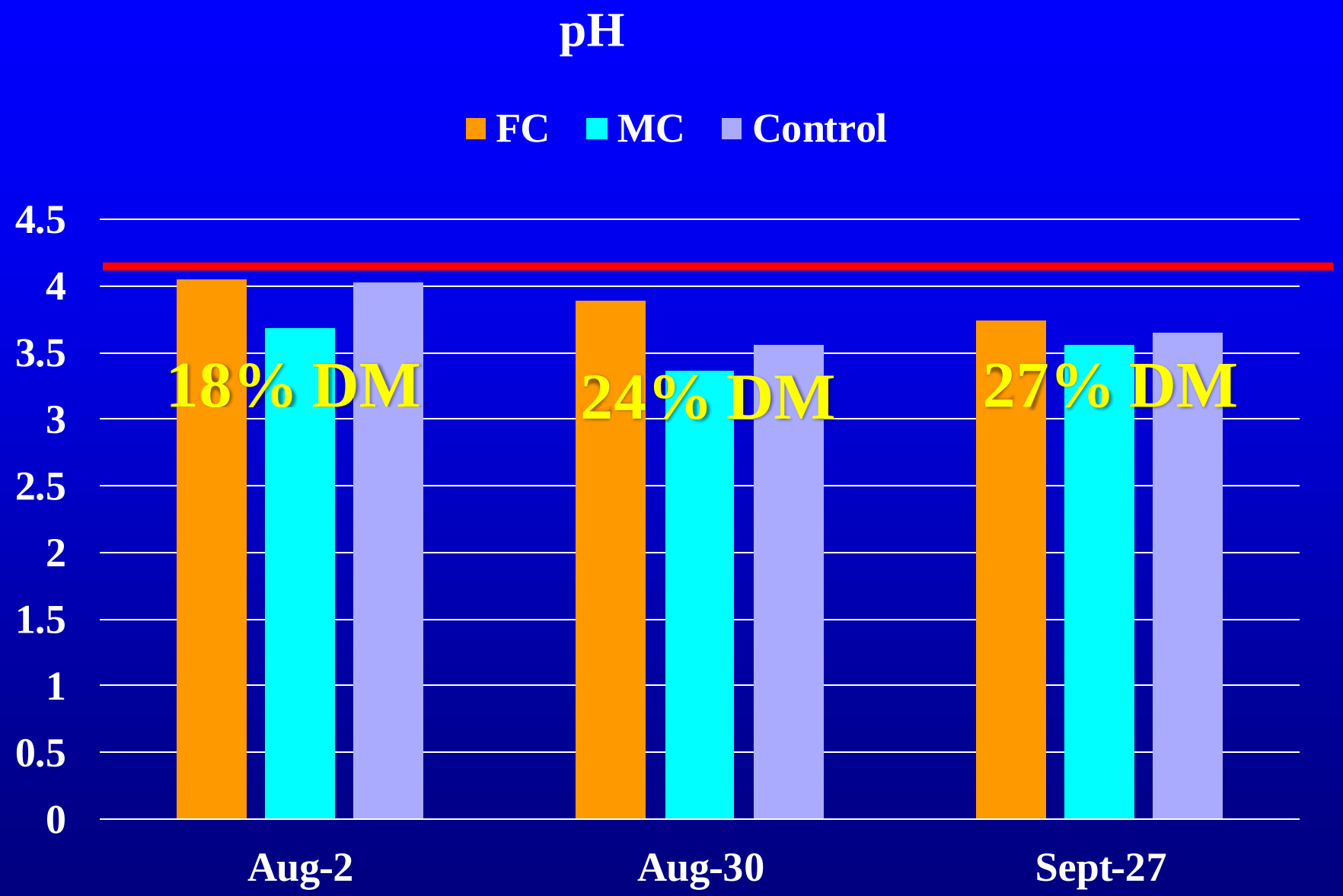
24.4 Tons/A @35% DM

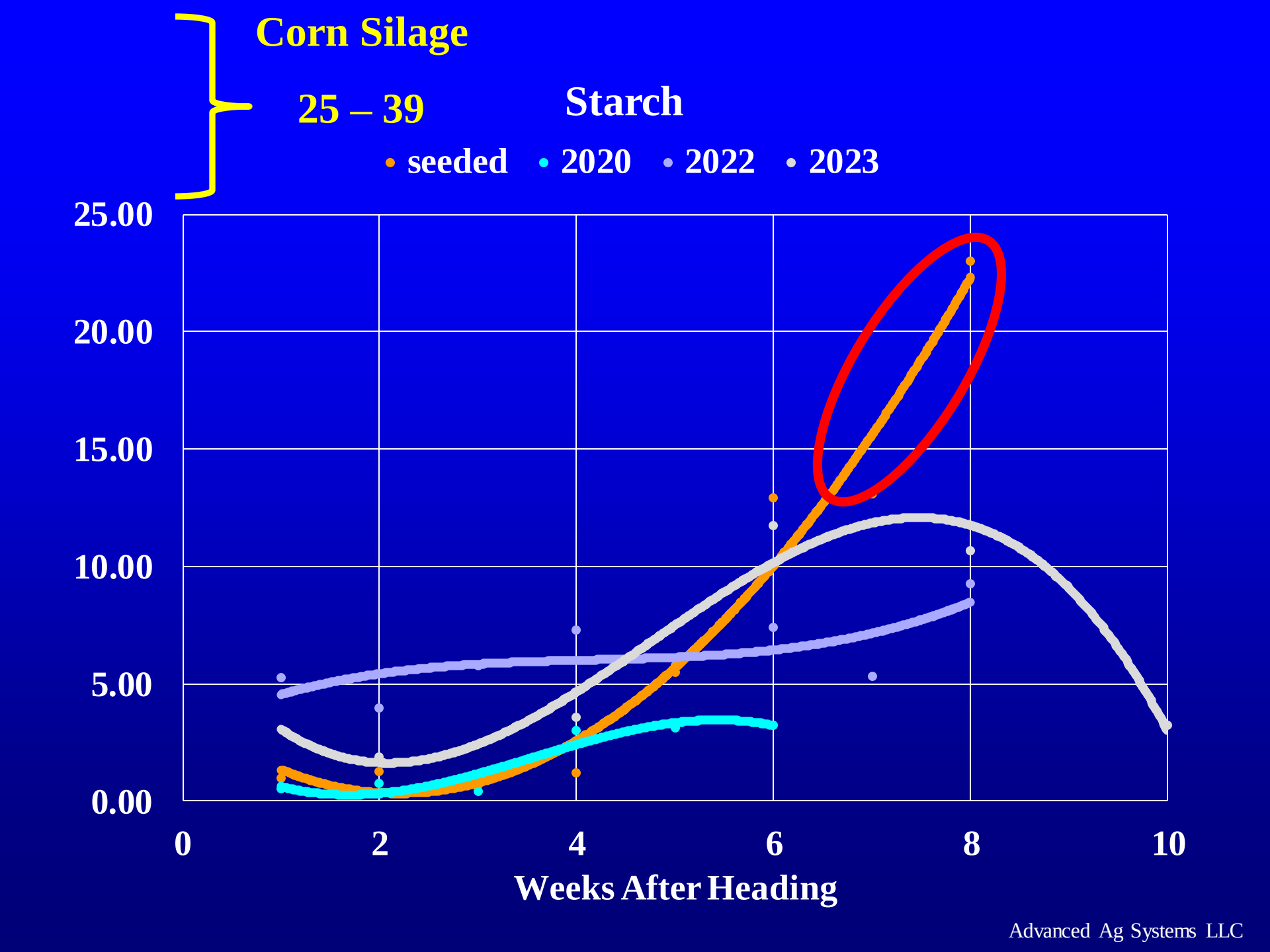
Advanced Ag Systems LLC

BMR MALE STERILE- NO SEED

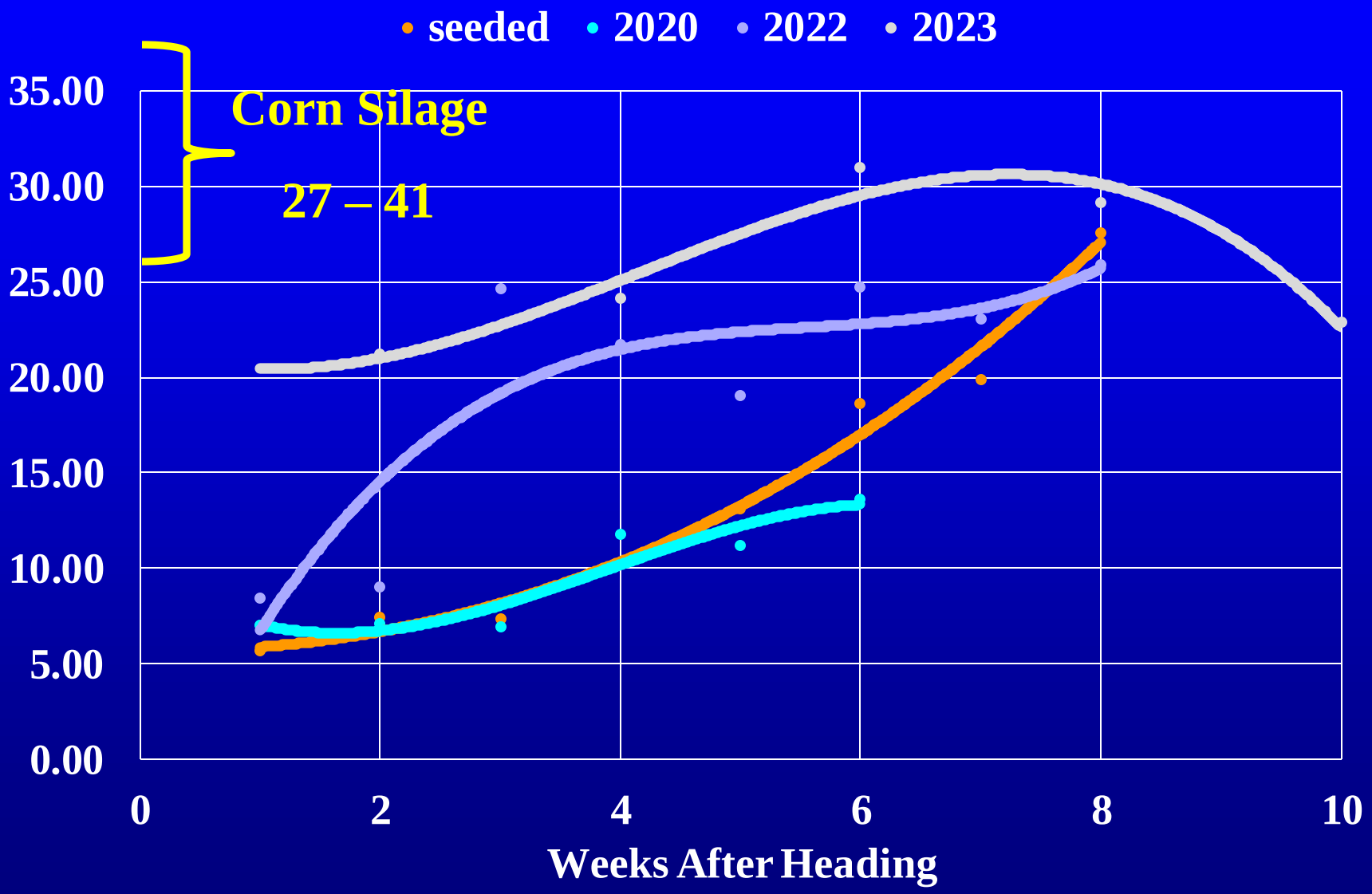
31.6 Tons/A @35% DM


Dry Matter by Week After Heading
seeded
2020
2022
2023
35.00
30.00
25.00
20.00
15.00
10.00
0
2
4
6
8
10
Weeks After Heading
270 samples:
NO Butyric!

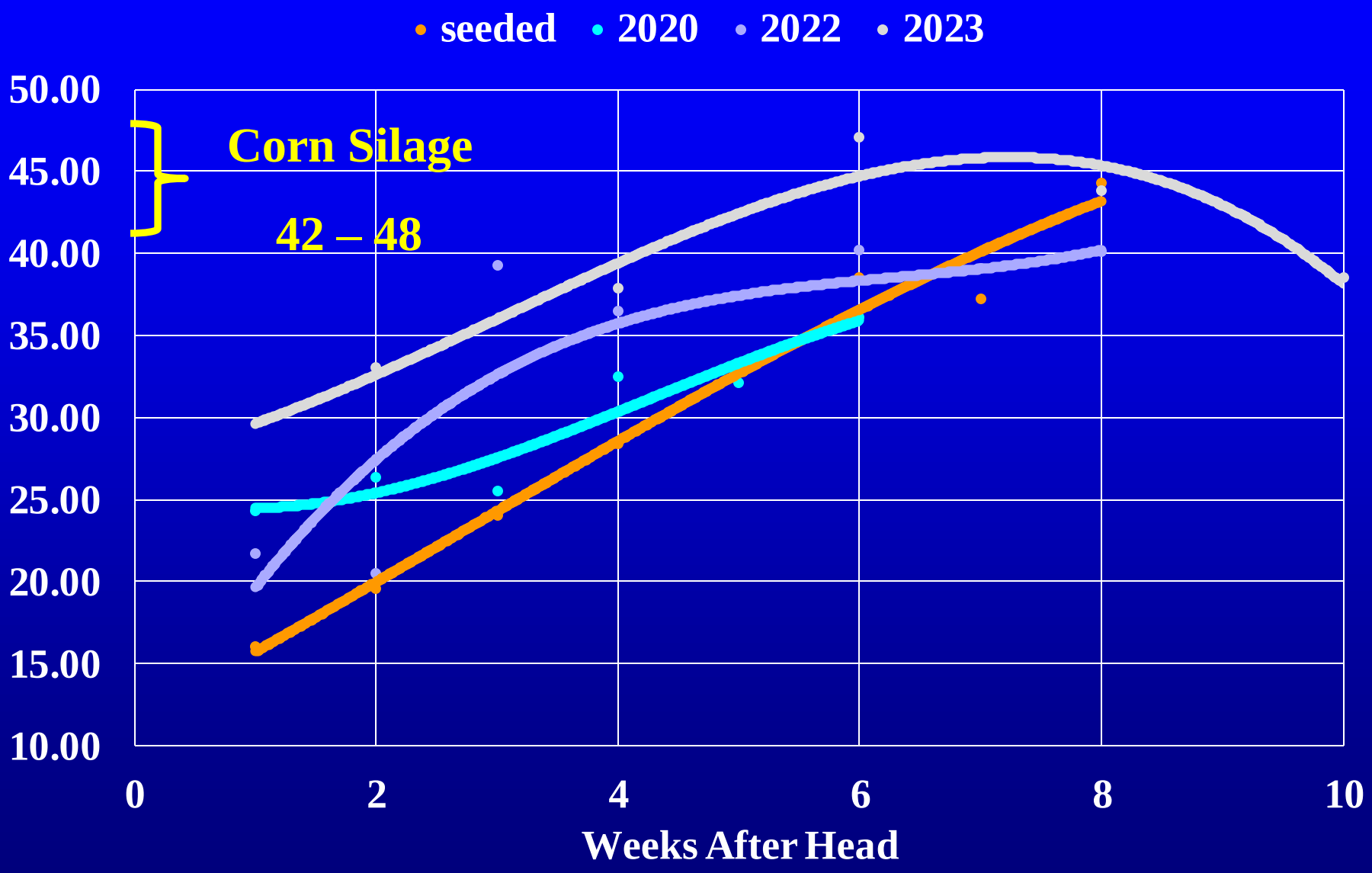

pH
FC
MC
Control
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
18% DM
24% DM
27% DM
Aug-2
Aug-30
Sept-27


Corn Silage
25 – 39
Starch
seeded
2020
2022
2023
25.00
20.00
15.00
10.00
5.00
0.00
0
2
4
6
8
10
Weeks After Heading

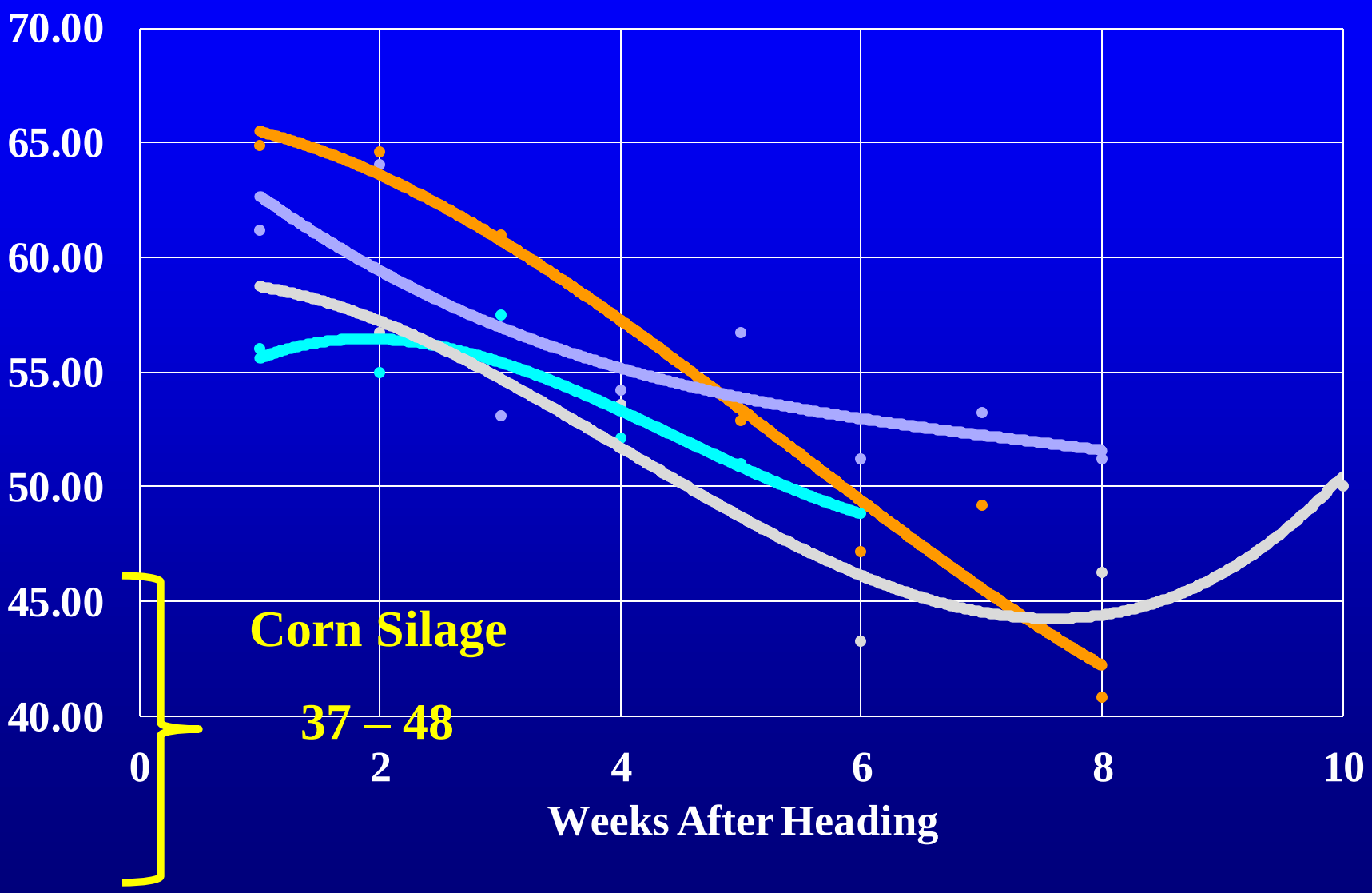
NSC: Non Structural Carbohydrates

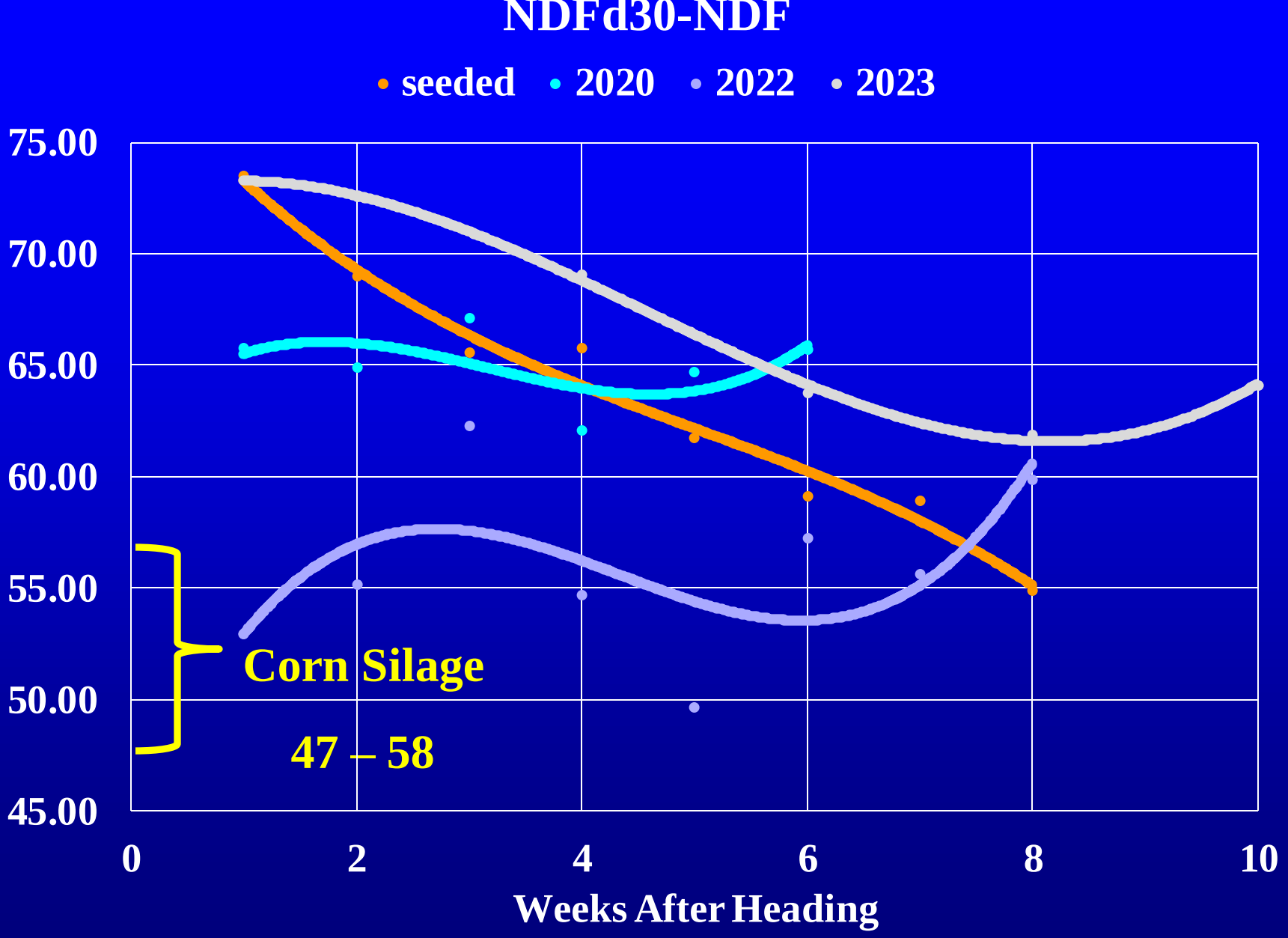


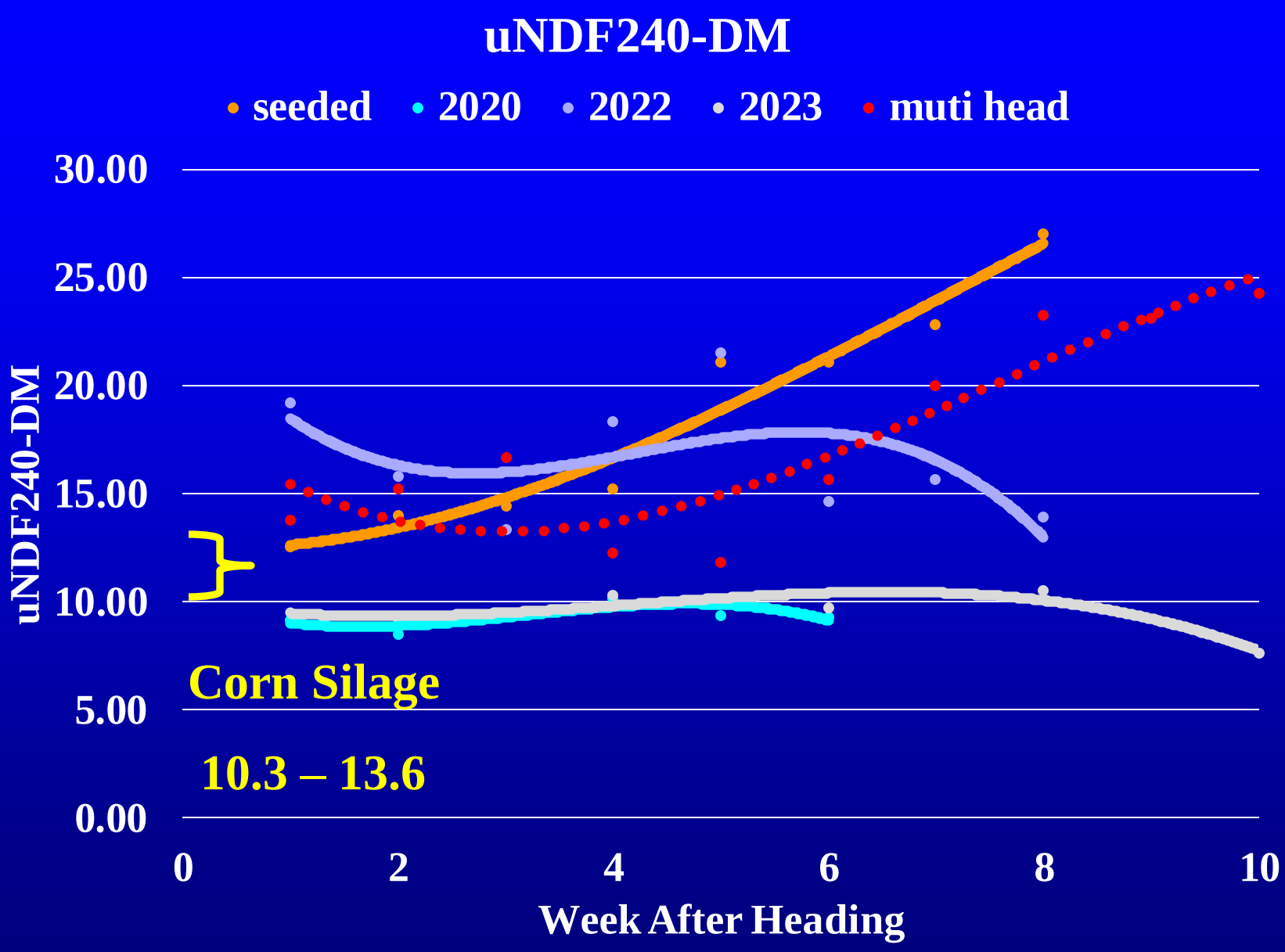
NFC Non Fiber Carbohydrate



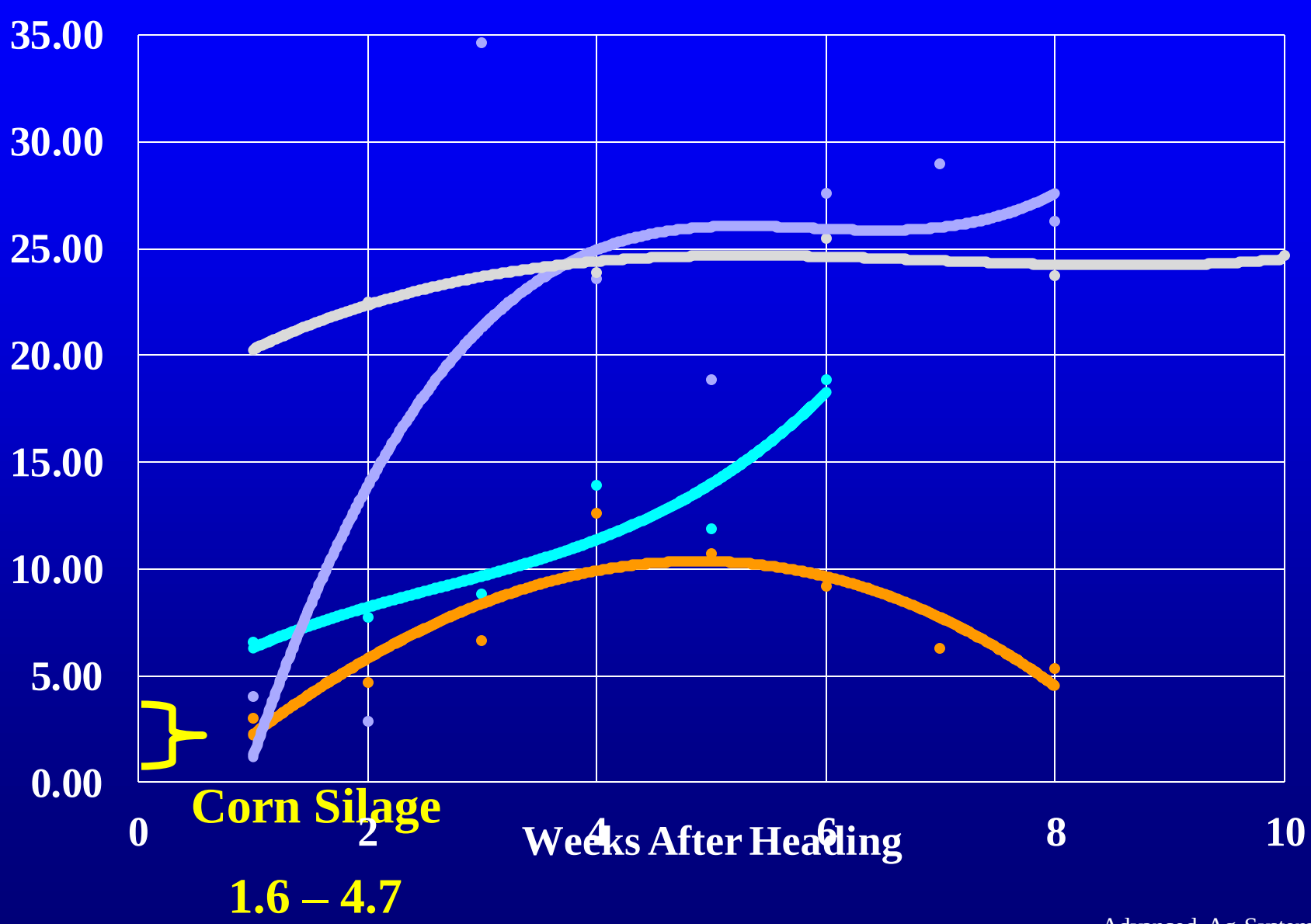
NDF


seeded
2020
2022
2023
70.00
65.00
60.00
55.00
50.00
45.00
40.00
Corn Silage
37 – 48
0
2
4
6
8
10
Weeks After Heading


NDFd30-NDF
seeded
2020
2022
2023
75.00
70.00
65.00
60.00
55.00
50.00
45.00
0
2
4
6
8
10
Weeks After Heading
Corn Silage
47 – 58


uNDF240-DM
seeded
2020
2022
2023
muti head
30.00
25.00
20.00
15.00
10.00
5.00
0.00
uNDF240-DM
Corn Silage
10.3 – 13.6
0
2
4
6
8
10
Week After Heading

Water Soluble Carbohydrate: Sugar (wet chem)



Journal of Dairy Science, Emanuele, 2015

Control

- **Added 1.5% - 3% sugar**
- **3 – 5% Sugar**
- **5-7% sugar added**

High-producing cows made 4.7 pounds more milk with added sugar

Pennsylvania Farm 150 acres of male sterile

Feeding just over a month

Fat and Protein up 0.2

Ration	ME Milk	MP Milk
Base Corn Silage	85.5	87.9
Augus		
Augus		
Augus		
Augus		
Sept.		
Sept.		
Sept. 21 sorghum	79.4	87.5

Sorghum is NOT Corn Silage

Ration	ME Milk	MP Milk
Base Corn Silage	85.4	85
August 10 sorghum	84.1	91.8
August 17 sorghum	84.5	93.6
August 24 sorghum	84.6	92.3
August 31 sorghum	85.6	93.1
Sept. 7 sorghum	83.5	88.7
Sept. 14 sorghum	85.4	93.1
Sept. 21 sorghum	85.5	92.1

Item	Base CS 2022	Sorghum-PA 2022	Sorghum-NY 2022	Base CornSilage 2020	Sorghum-NY 2020
Corn silage, lbs. DM	20		0	20	0
Alfalfa silage, lbs. DM	13.5	13.5	13.5	15	15
Sorghum silage, lbs. DM		20	20		18.8
Corn, lbs. DM	5.8	6.4 (+.6)	6.4 (+.6)	6	6.9 (+.9)
Soy Plus, lbs. DM	3.2	3.4	3.8	3.5	2.4 (-1.1)
Diet sugar, % (WSC)	3.8	12.5	13.7		
Predicted ME-Milk, lbs.	**85.5**	**85.2**	**85.9**	**85.5**	**87.9**
Predicted MP-Milk, lbs.	**85.1**	**85**	**85.4**	**85.5**	**92.1**

$5,000/100 cows

BUT!

BUT!

BUT!

How to Screw it UP!

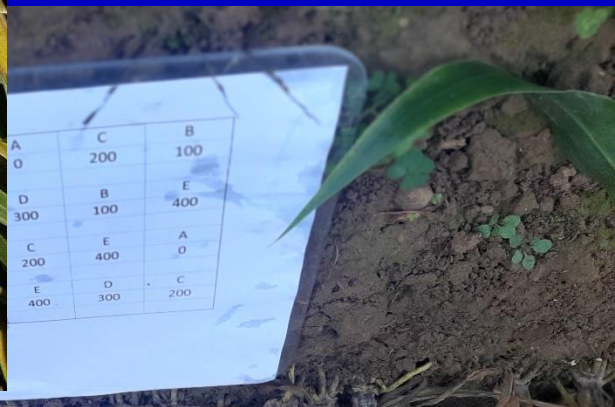
Uniformity of Stand is Critical in

Corn, Sorghum, and Winter Forage

Phil Needham

270-785-0999

http://needhamag.com


A
0
C
200
B
100
D
300
B
100
E
400
C
200
E
400
A
0
E
400
D
300
C
200

Distance Between Plant In-Row

row width	Seeds/Acre			
	30000	60000	90000	120000
7.5	27.9	13.9	9.3	**7.0**
10	20.9	10.5	**7.0**	5.2
15	13.9	**7.0**	4.6	3.5
30	**7.0**	3.5	2.3	1.7

Seeds/Acre when planting pounds of seed

	seed/lb	
seed/acre	13500	19000
70,000	5.19	3.68
80,000	5.93	4.21
90,000	6.67	4.74
100000	7.41	5.26
110000	8.15	5.79
120000	8.89	6.32

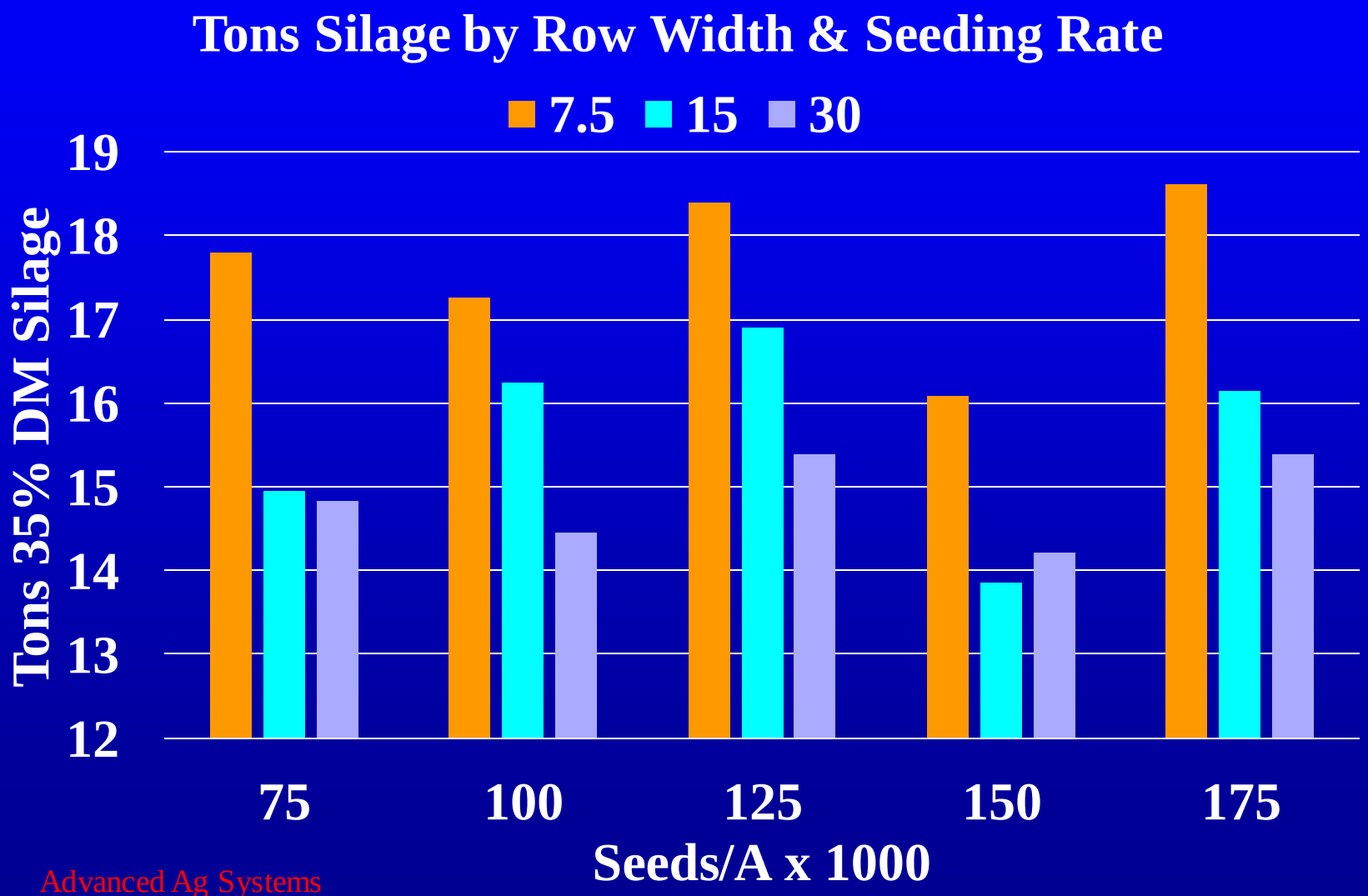
40% Over Planted

Narrow row,

equidistant plant spacing

better the standability and yield

18% More Yield Better Standability, Less Weeds



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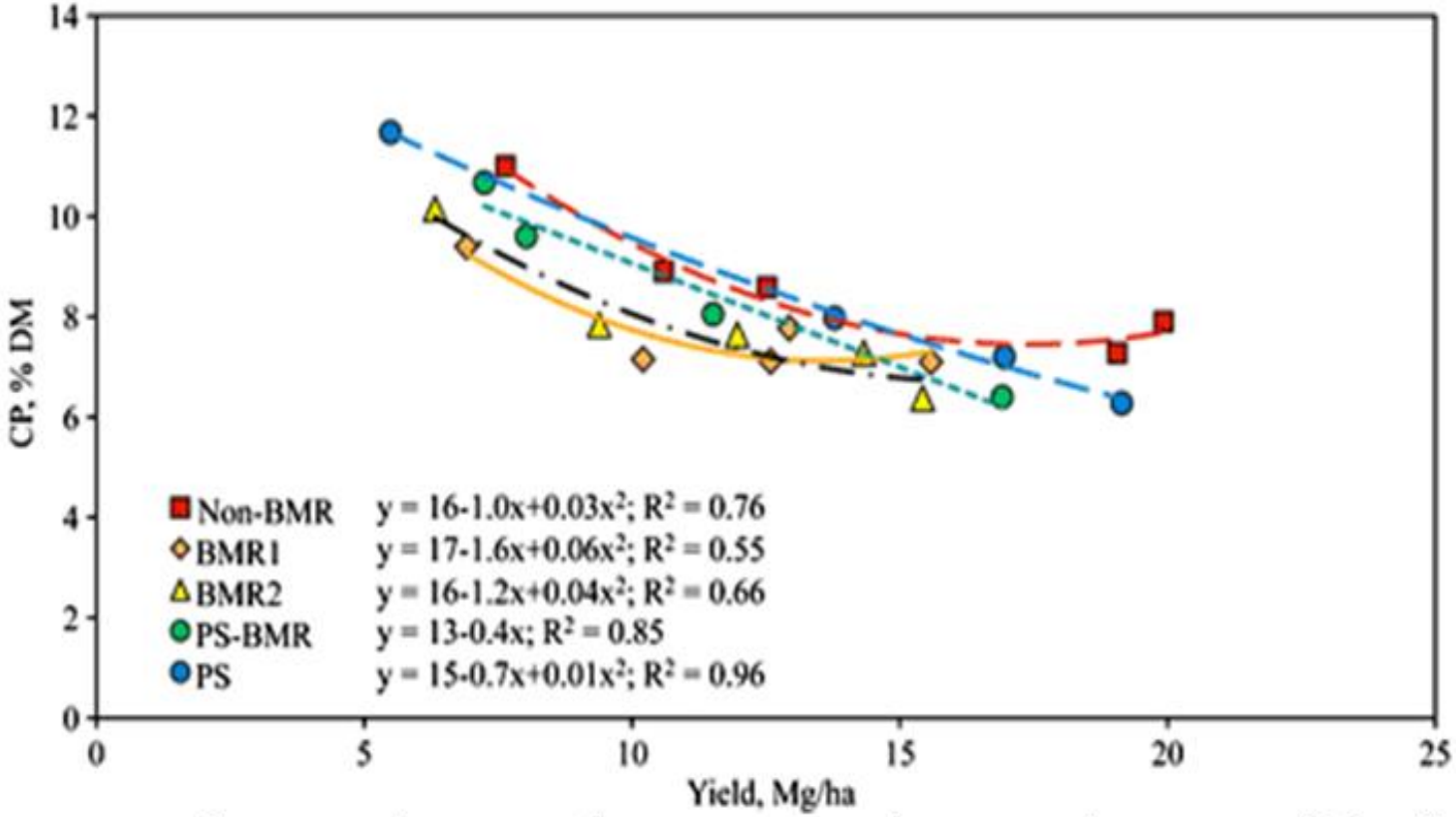
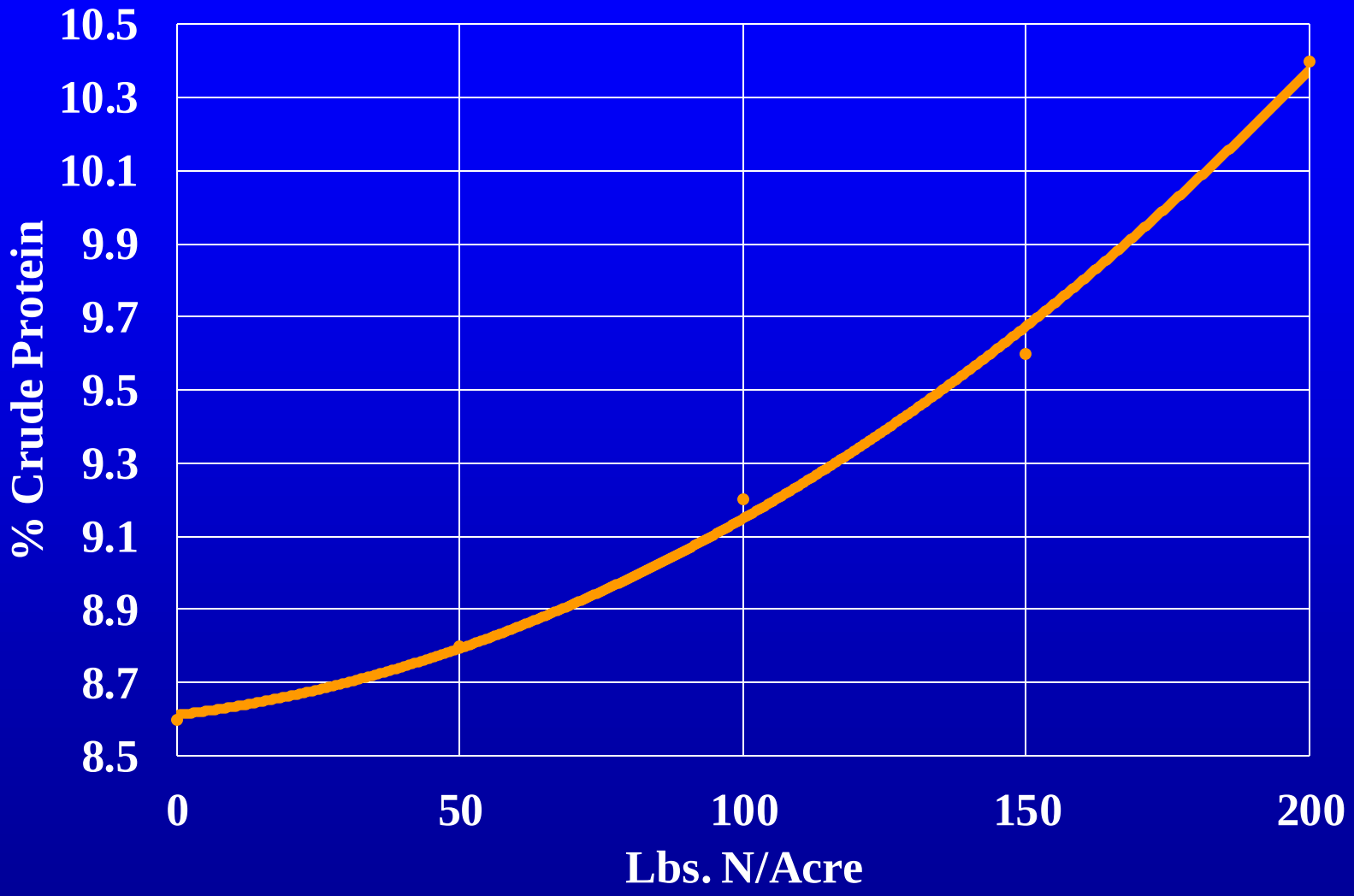


Fig. 4. Crude protein (CP, % DM) in response to forage sorghum DM yield (Mg/ha).

McCuiston et. al 2010

Advanced Ag Systems LLC

Crude Protein



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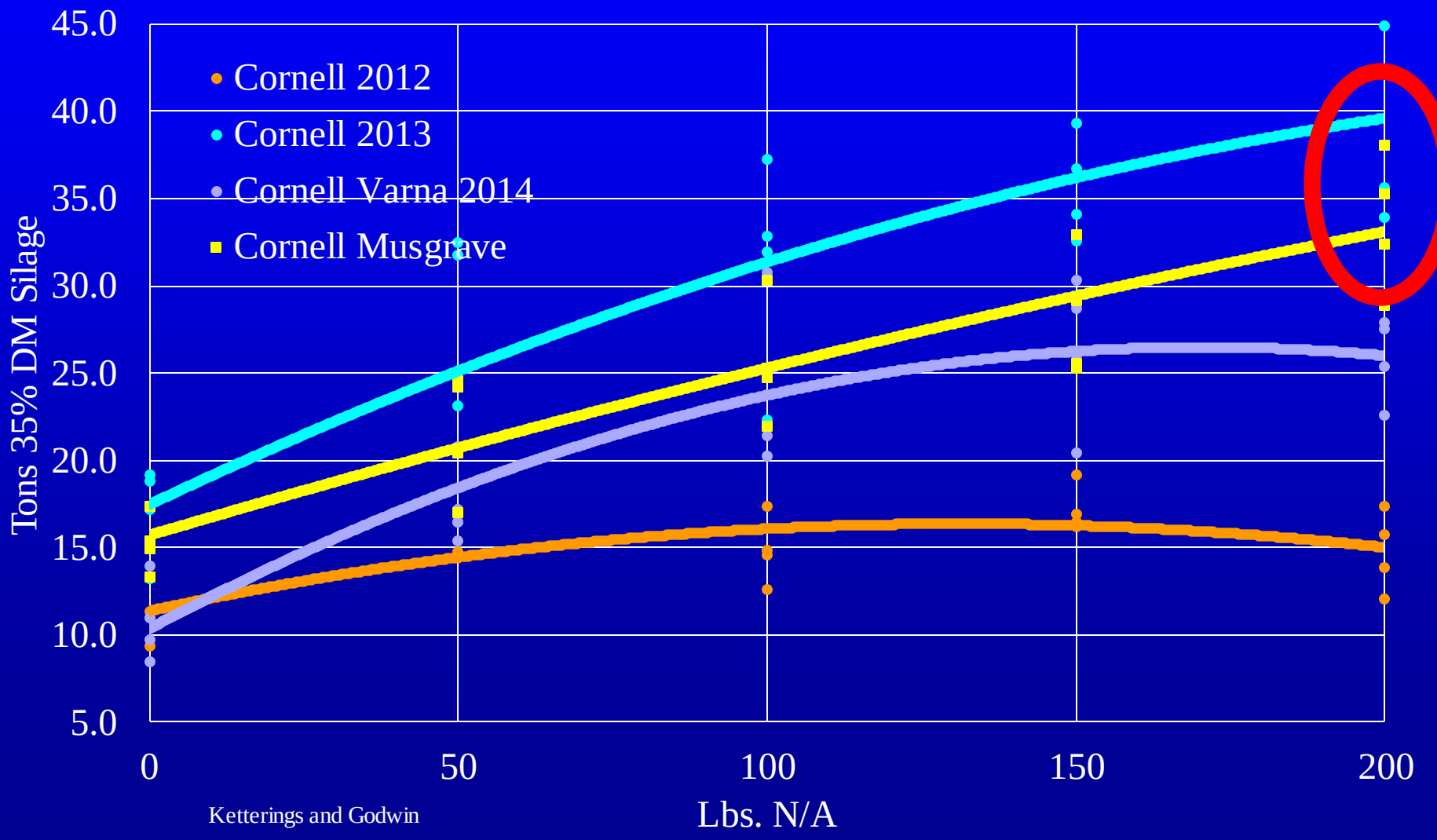
25 Tons of Silage/Acre =
17,500 lbs. of DM/A

17,500 @ 11% Crude Protein
= 1925 lbs of Protein

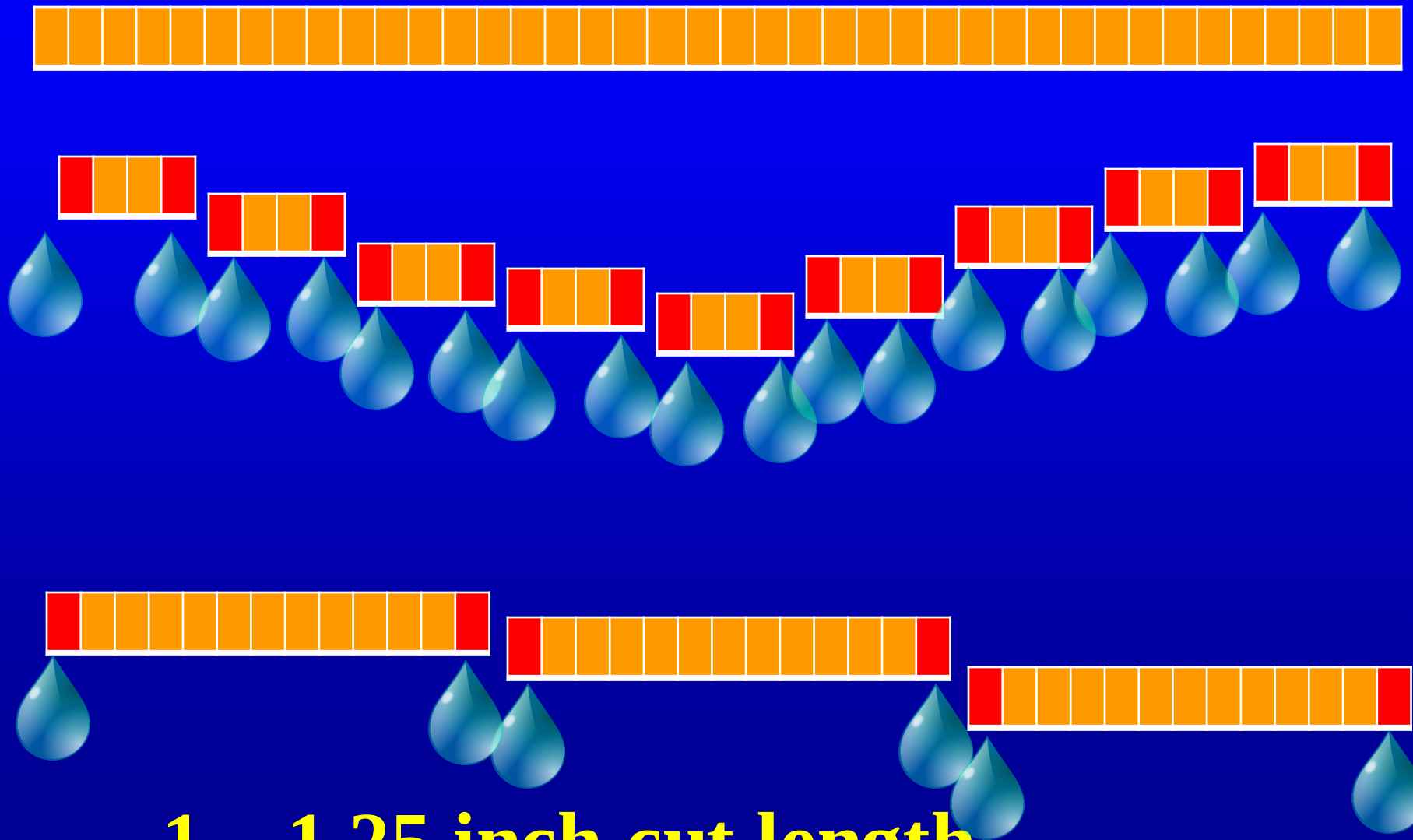
2464 lbs of Protein = 308 lbs. N/A

Sorghum N Trial Cornell



Ketterings and Godwin

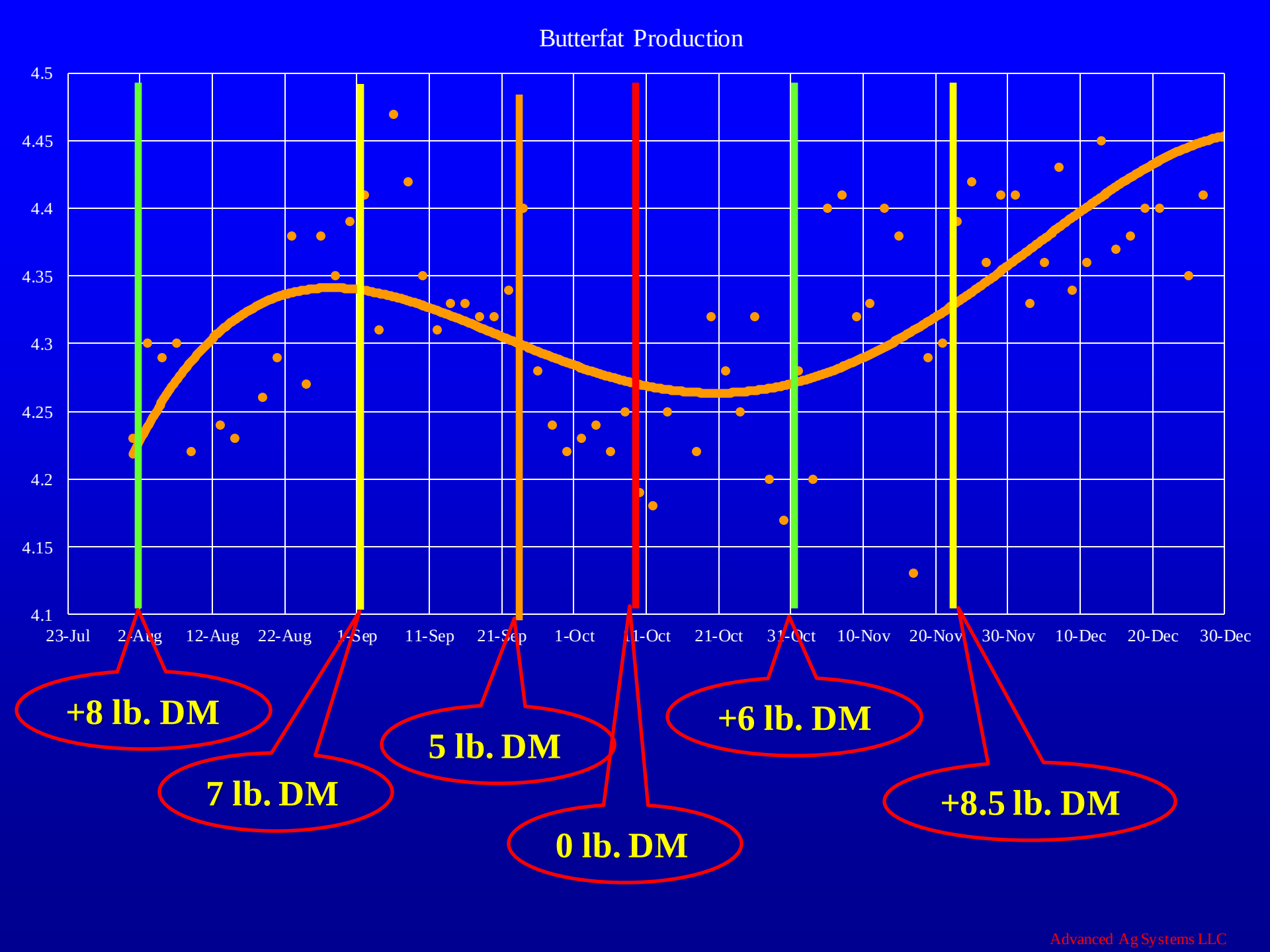
Advanced Ag Systems LLC



1 – 1.25 inch cut length

High Sugar High Moisture Fermentation

- Longer cut less sugar lost in fermentation
- Longer cut less leachate
- Homolactic **NOT** buchneri bacteria
- Perfect fermentation @ 16 – 18% DM
- More water/weight to haul
- Can silo walls handle the hydraulic pressure?



Cows Don’t Lie


Questions??
Advanced Ag Systems LLC.
http://www.advancedagsys.com
tfk1@cornell.edu

32 Tons of Silage/Acre =
22,400 lbs. of DM/A

22,400 @ 11% Crude Protein
= 2464 lbs of Protein

2464 lbs of Protein = 394 lbs. N/A

Enhanced Nutrition Sorghum

A Major Forage Quality Advance

One of the greatest pains to human nature
is the pain of a new idea
It makes you think that after all,
your favorite notions may be wrong
Your firmest beliefs ill-founded.

***Naturally.. Men hate a new idea and are disposed more or less to ill treat the original man who brings* it**

Walter Bagehot *Physics and Politicsill-treat*

Advanced Ag Systems LLC

“Navigating the Commodity Terrain”

By Darren R. Frye

WATER STREET SOLUTIONS®

Special Thanks

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Outline

- ✓ 30 Year Commodity Cycle
- ✓ Yield Curve – Interest Rate Cycle
- ✓ Economic Activity Composite
- ✓ Credit Market Debt / Gross Domestic Product
- ✓ Government Inflows and Outflows
- ✓ $1 of Debt / Annual Income
- ✓ Confidence
- ✓ Commodity Charts
- ✓ Transitional Assets
- ✓ Plan for Change
- ✓ Summary

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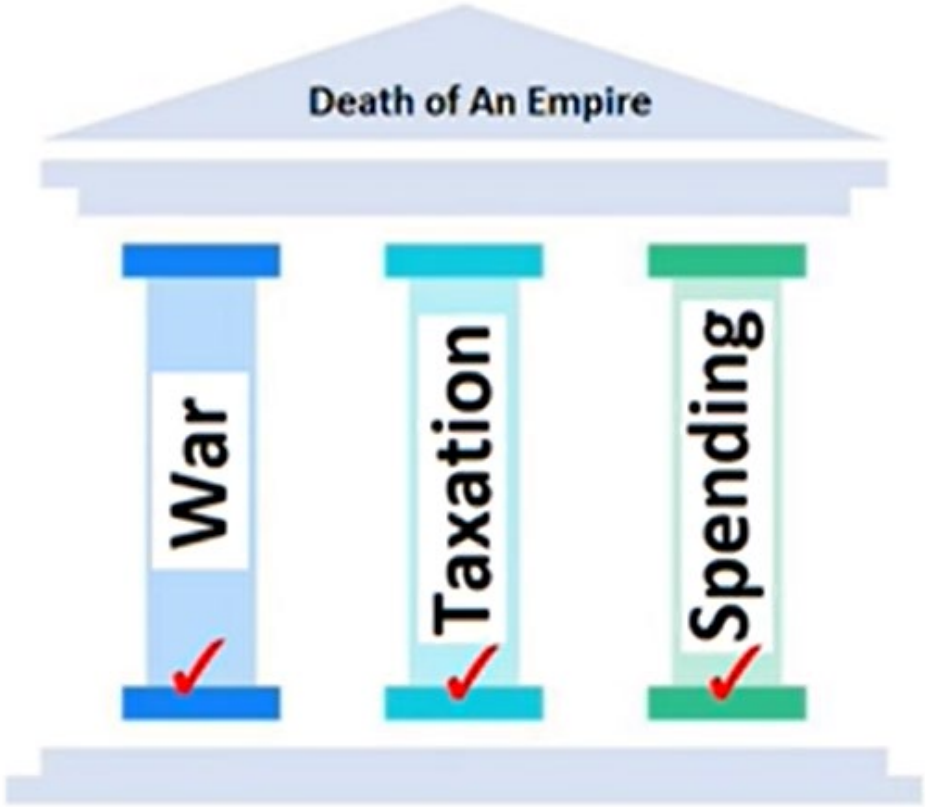
Failure of an Empire



Three Pillar of Government Excess

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Recession or Worse

2024

* Risks are rising

* Yield Curve
  - Distortions
  - Timing

* Economy
  - EAC

* Can The Fed Kick The Can Down The Road?

* Where is money going to hide?

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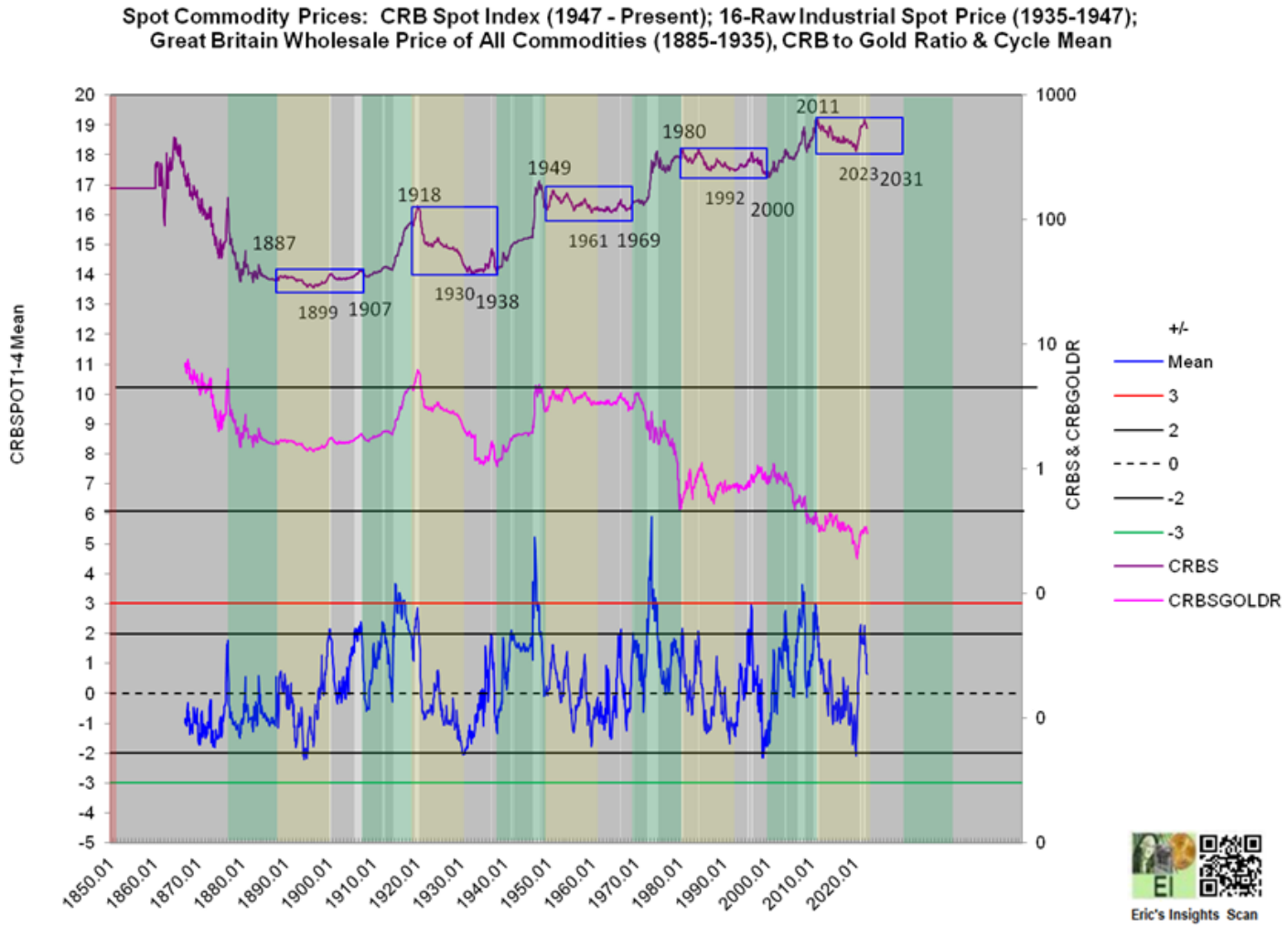
Commodity Cycle



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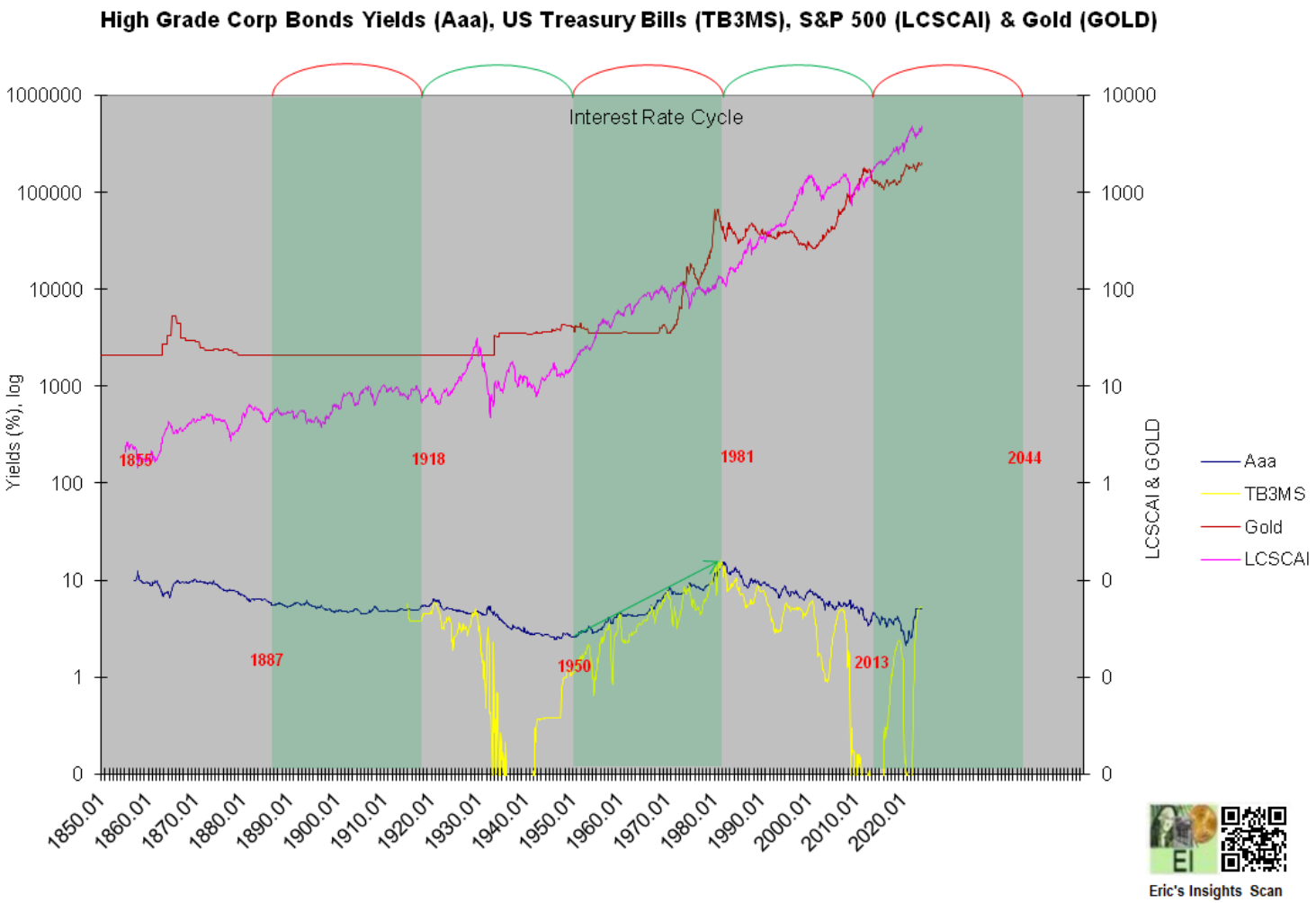
Long-Term Interest Rate Cycle



Eric's Insights Scan

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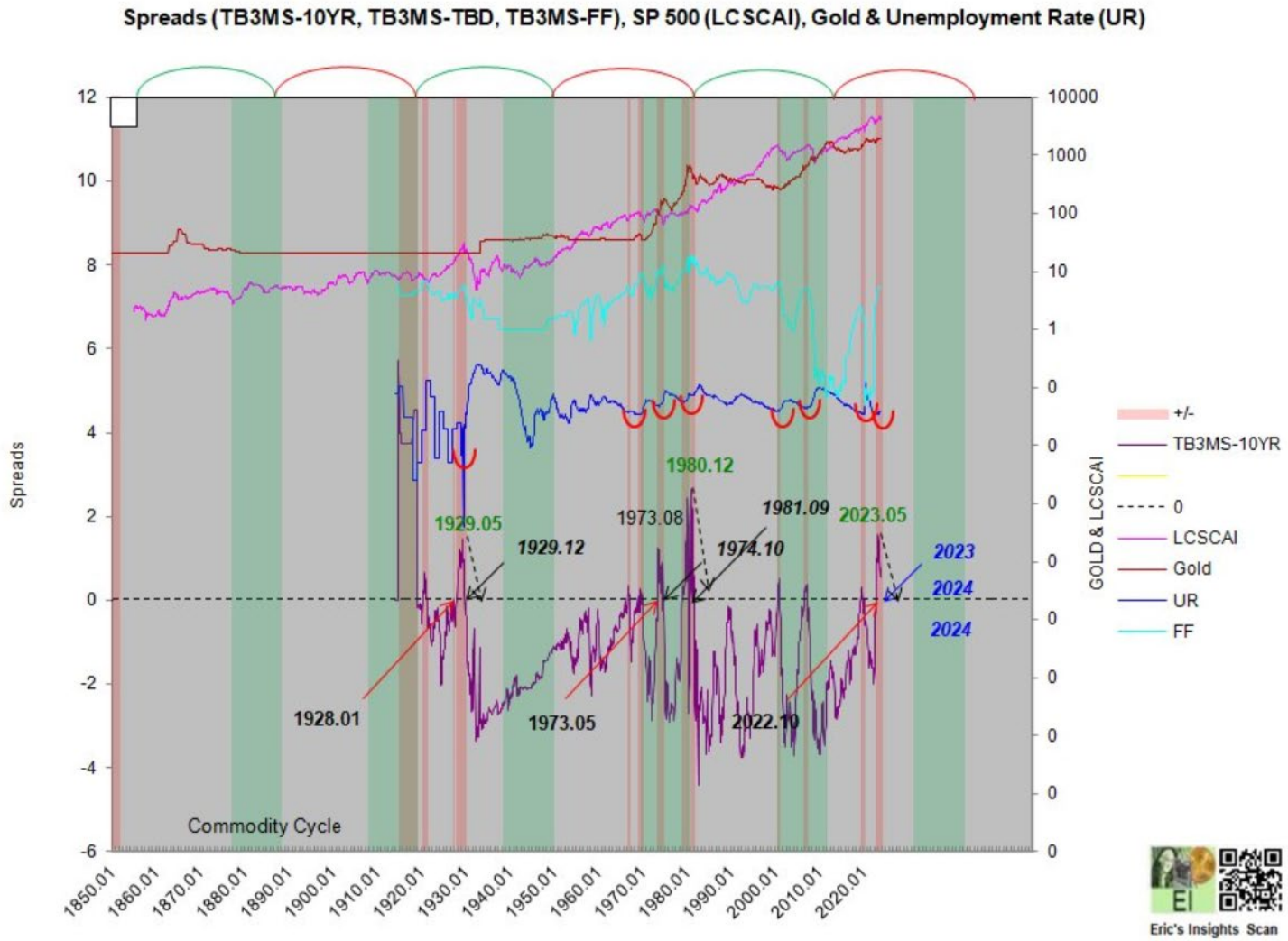
Yield Curve



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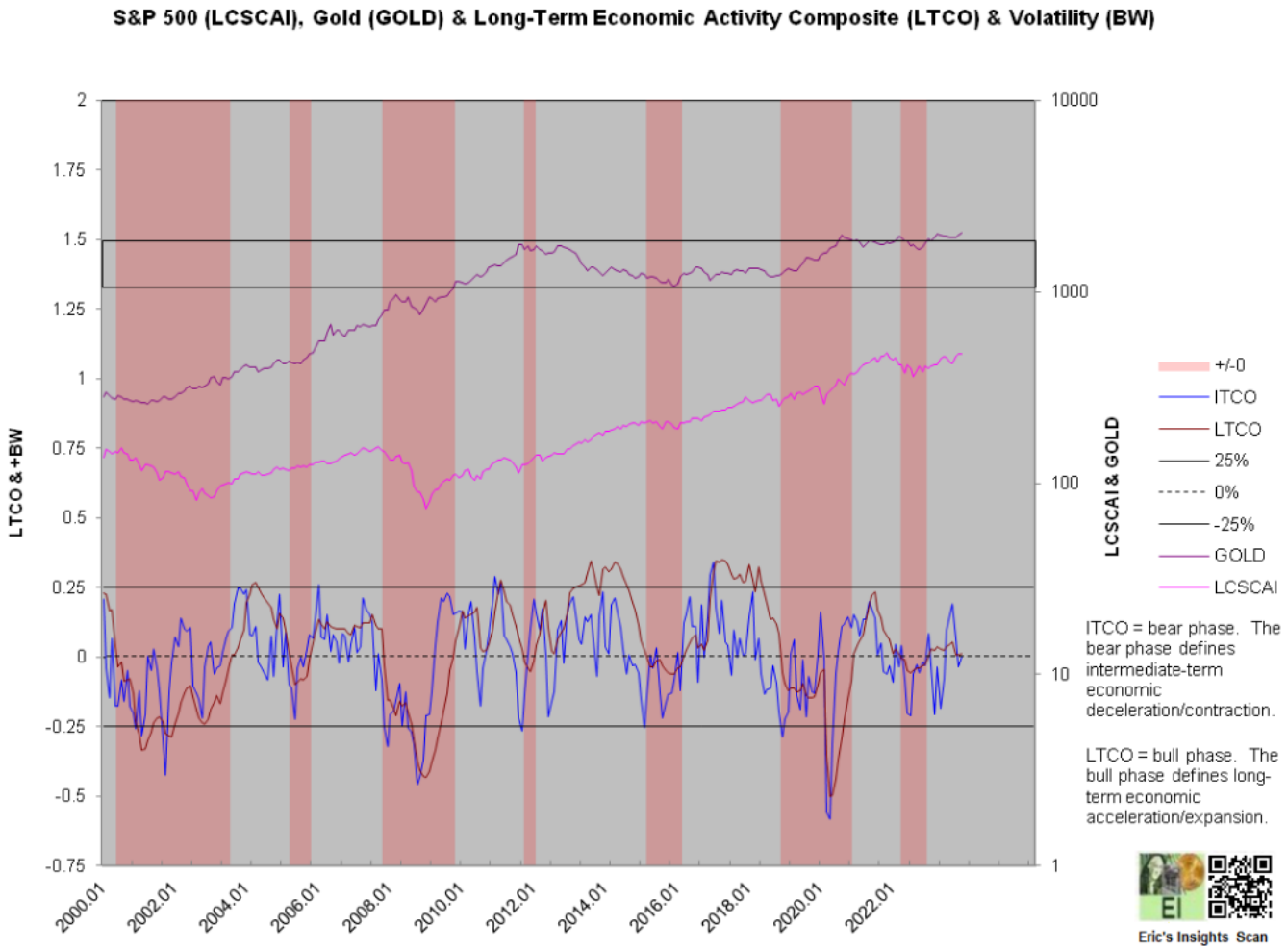
Economic Activity Composite



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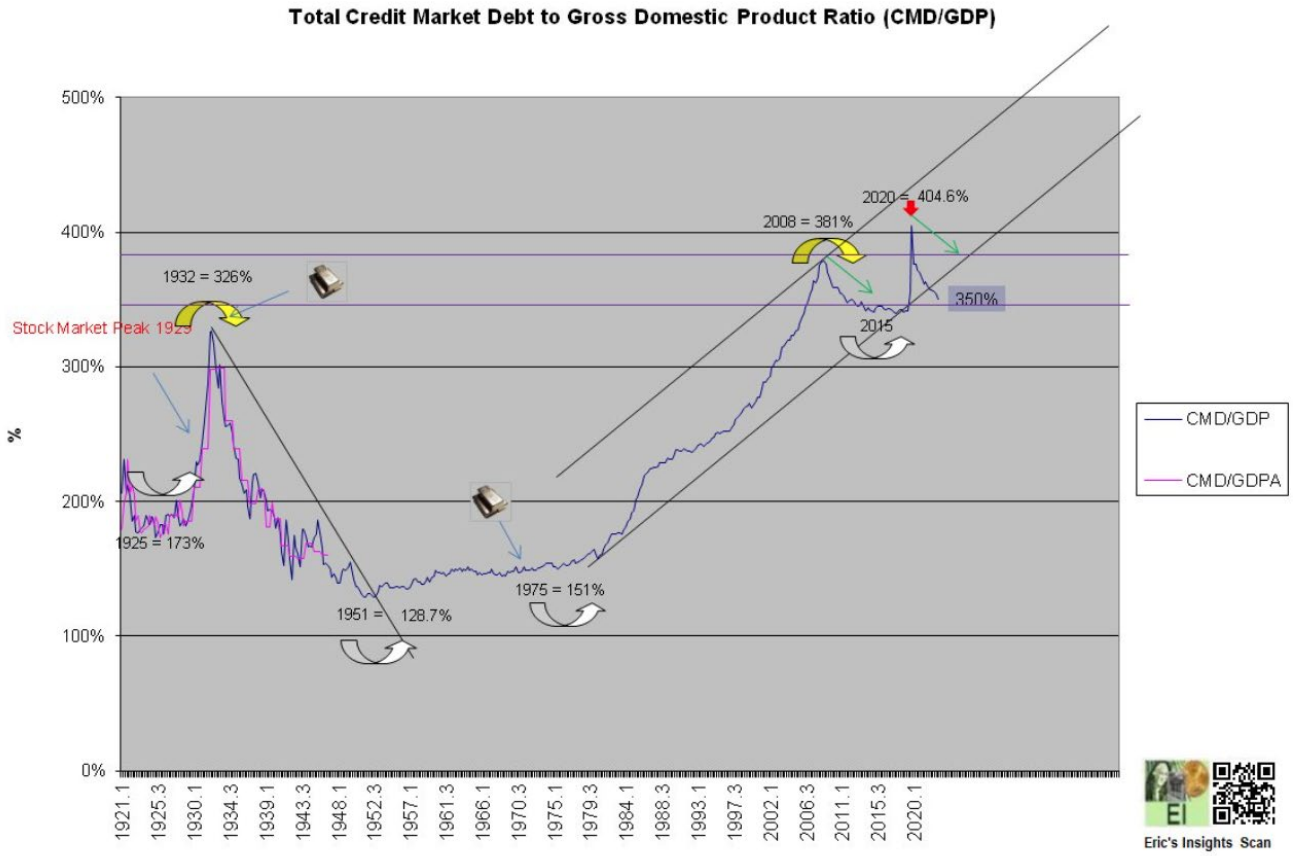
Credit Market Debt / Gross Domestic Product



Eric's Insights Scan

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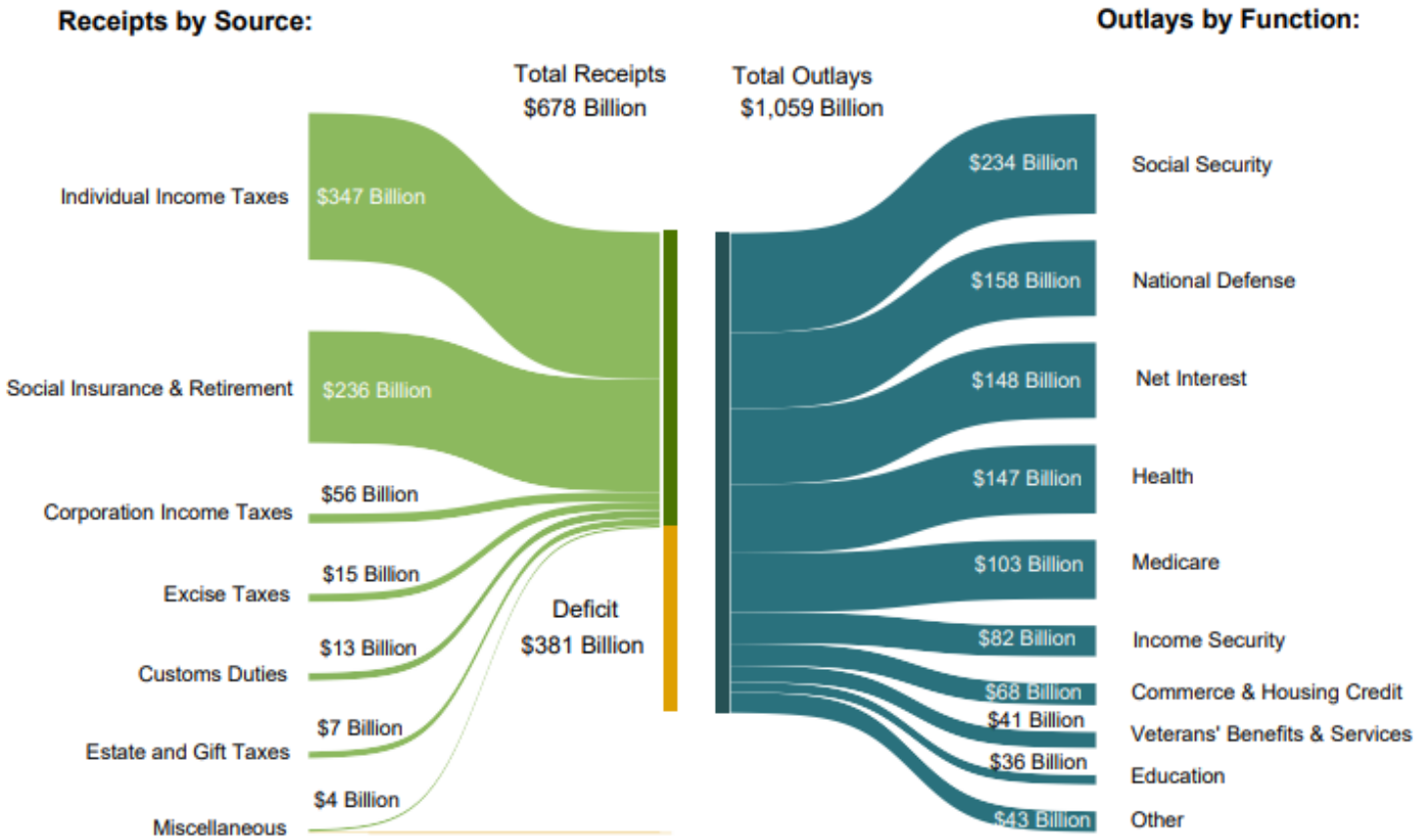
Inflows and Outflows Fiscal 24

Figure 2. Cumulative Receipts, Outlays, and Surplus/Deficit through Fiscal Year 2024



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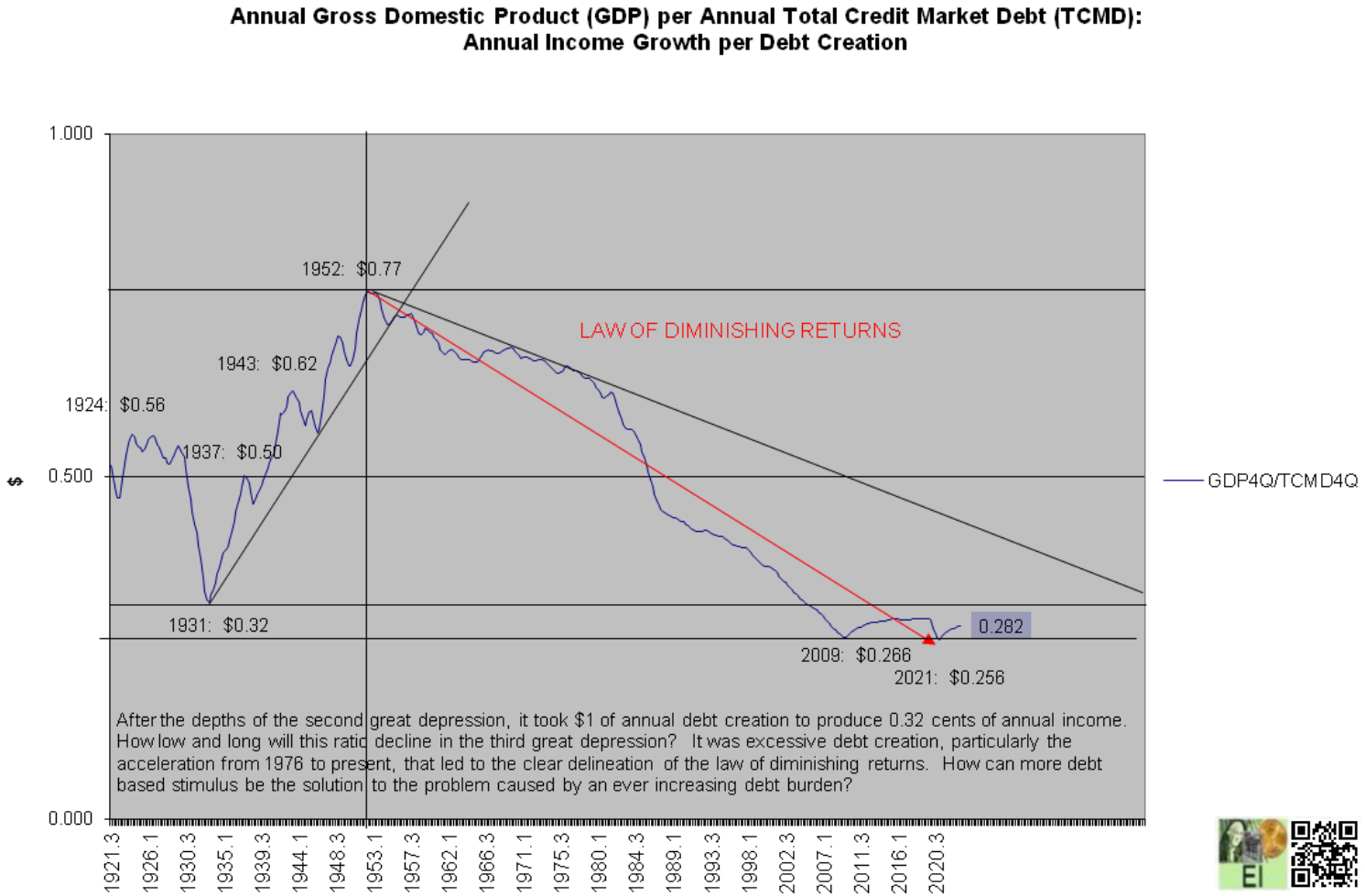
$1 of Credit / $ Annual Income



Eric's Insights Scan

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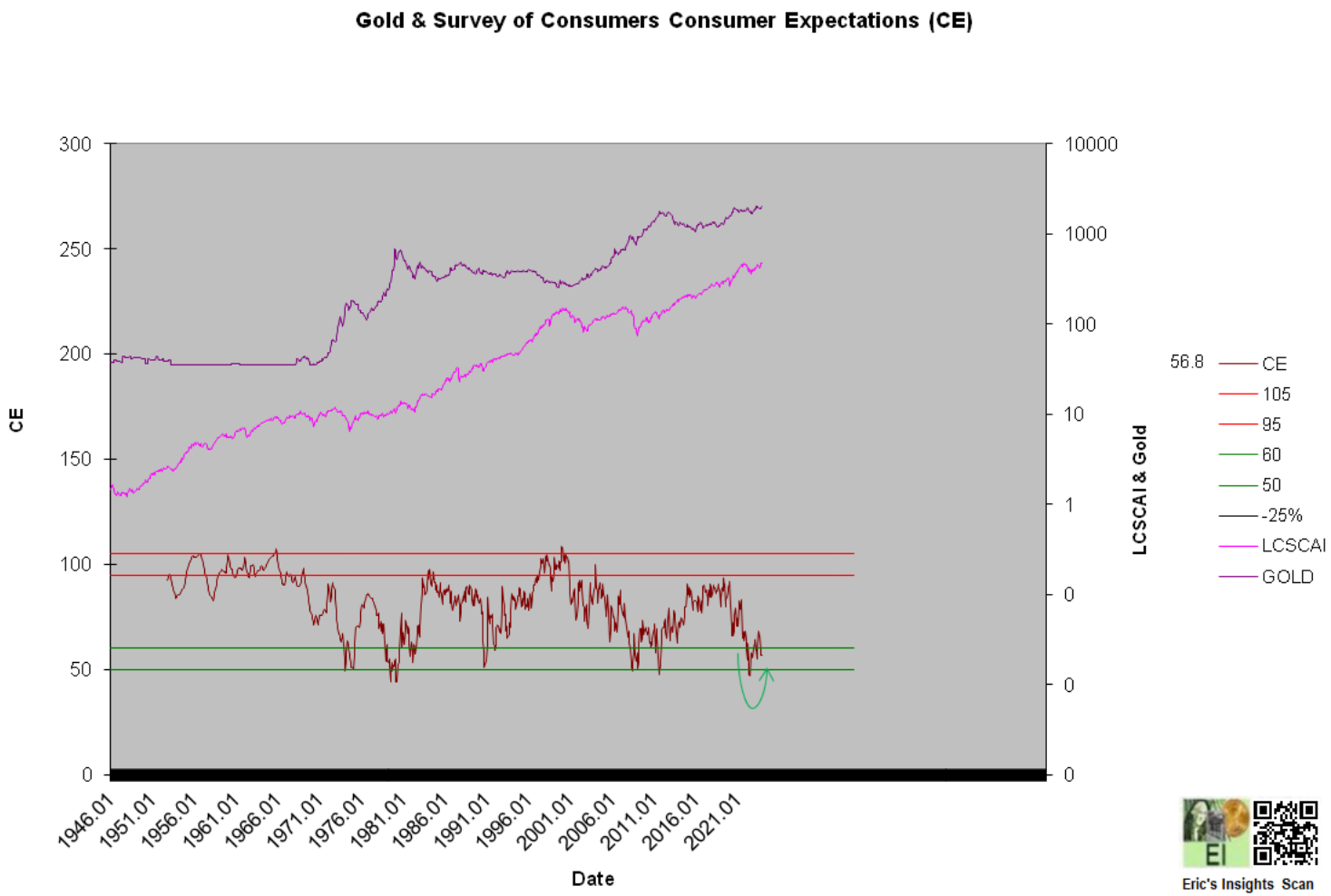
Consumer Confidence



Eric's Insights Scan

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Joke

Three contractors are bidding on a broken fence at the White House. One from Nashville, another from Orlando, and the third from Chicago.

Nashville - $700

Orlando - $900

Chicago - $2700

And that my friends is how our government works !

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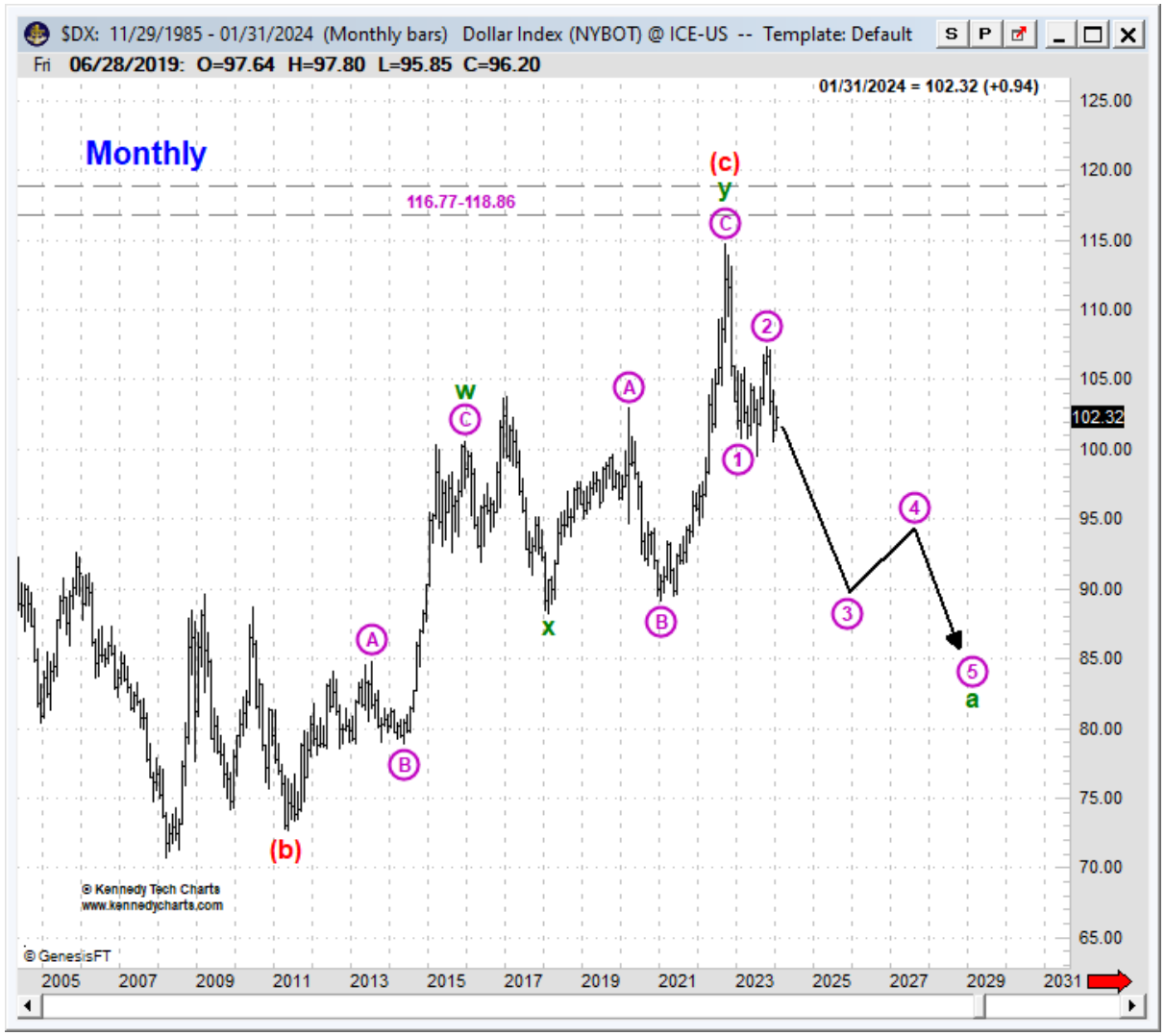
US Dollar – Monthly



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US Dollar – 2 Day

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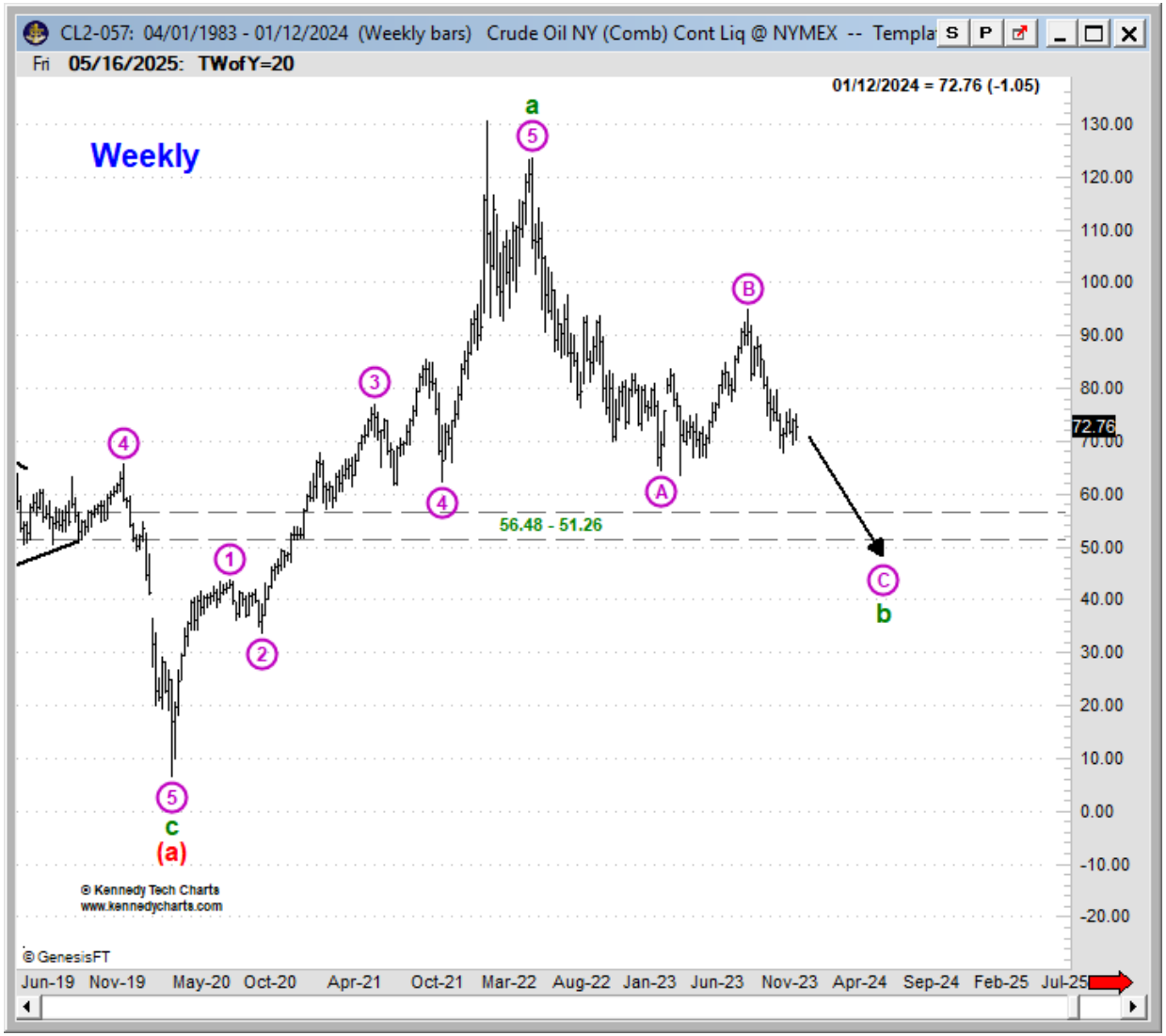
Crude Oil – Weekly



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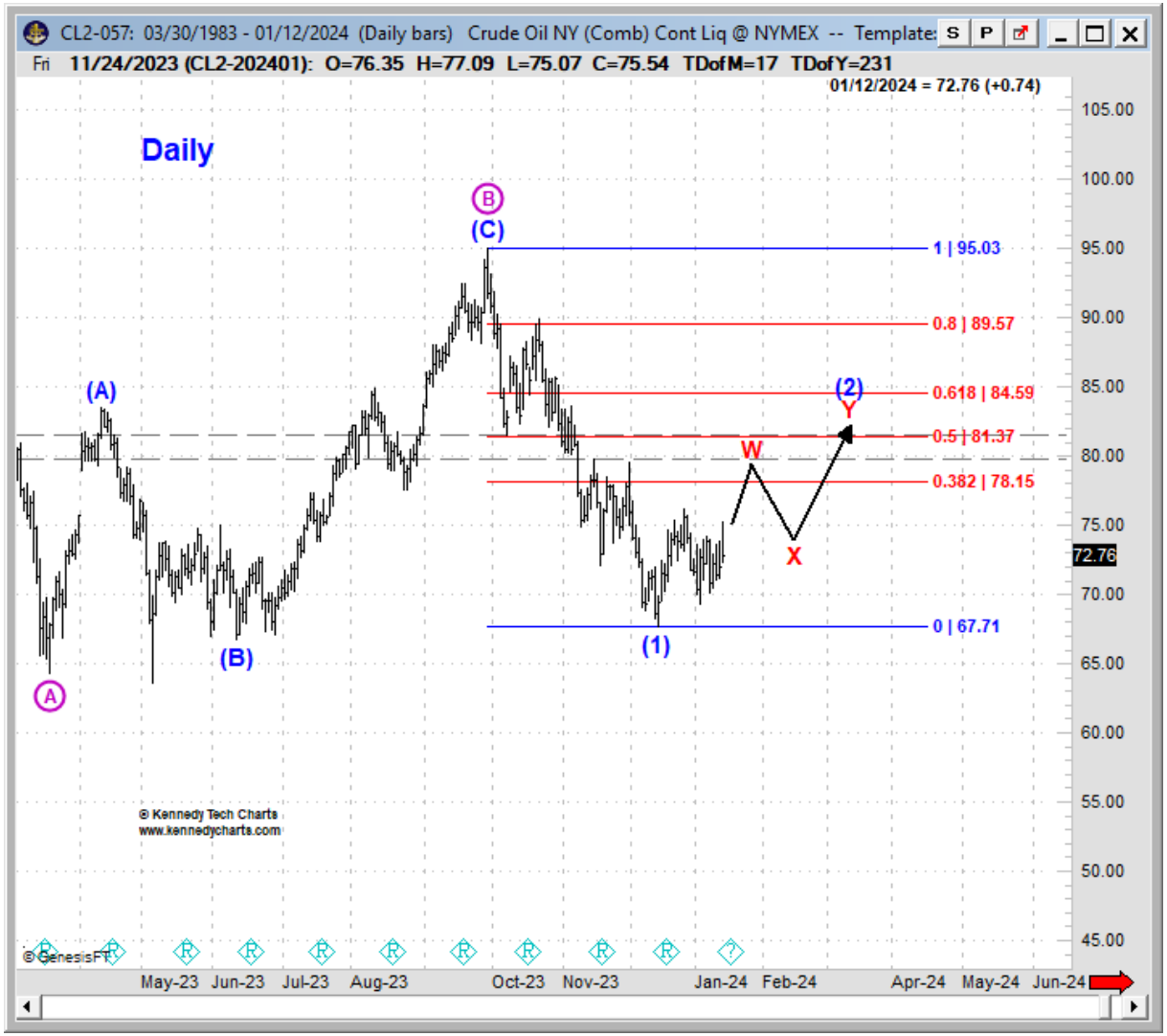
Crude Oil - Daily



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Milk – Weekly

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Milk - 2-Day

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Plan for Change

- ✓ Awareness
- ✓ Manage Debt
- ✓ Transitional Assets
- ✓ Manage Profit Margins/Proactive Hedging
- ✓ Industry Consolidation
- ✓ Manage Growth

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Transitional Assets

- ✓ Owned Outright
- ✓ No Counter Party Risk
- ✓ Non-Depreciable
- ✓ Widely Recognizable
- ✓ Liquidity

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Summary

- ✓ Big Changes- Horizon
- ✓ Dig Your Well, Before Thirst Sets In
- ✓ Opportunities Abound
- ✓ Exercise Wisdom and Caution
- ✓ Blessings- 2024 and Beyond

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Questions?

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For More Information

Scan the QR Code

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Email	Email me at drfrye@waterstreetag.com
Follow	Follow us on X @WaterStreetAg

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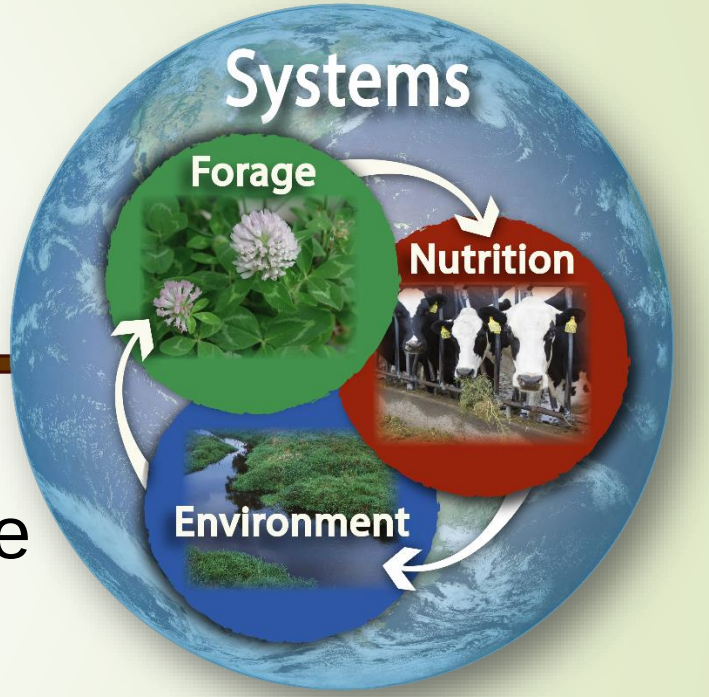
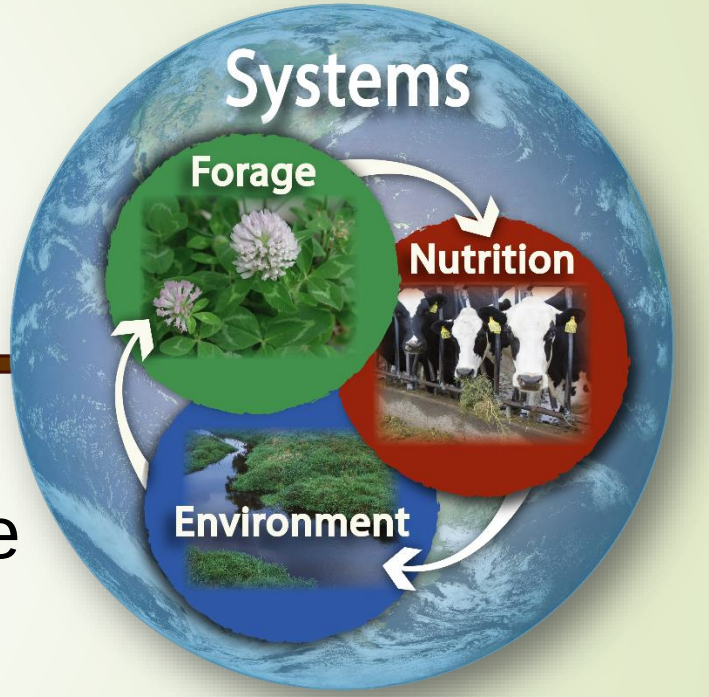
Feeding & Managing the High Performing Rumen



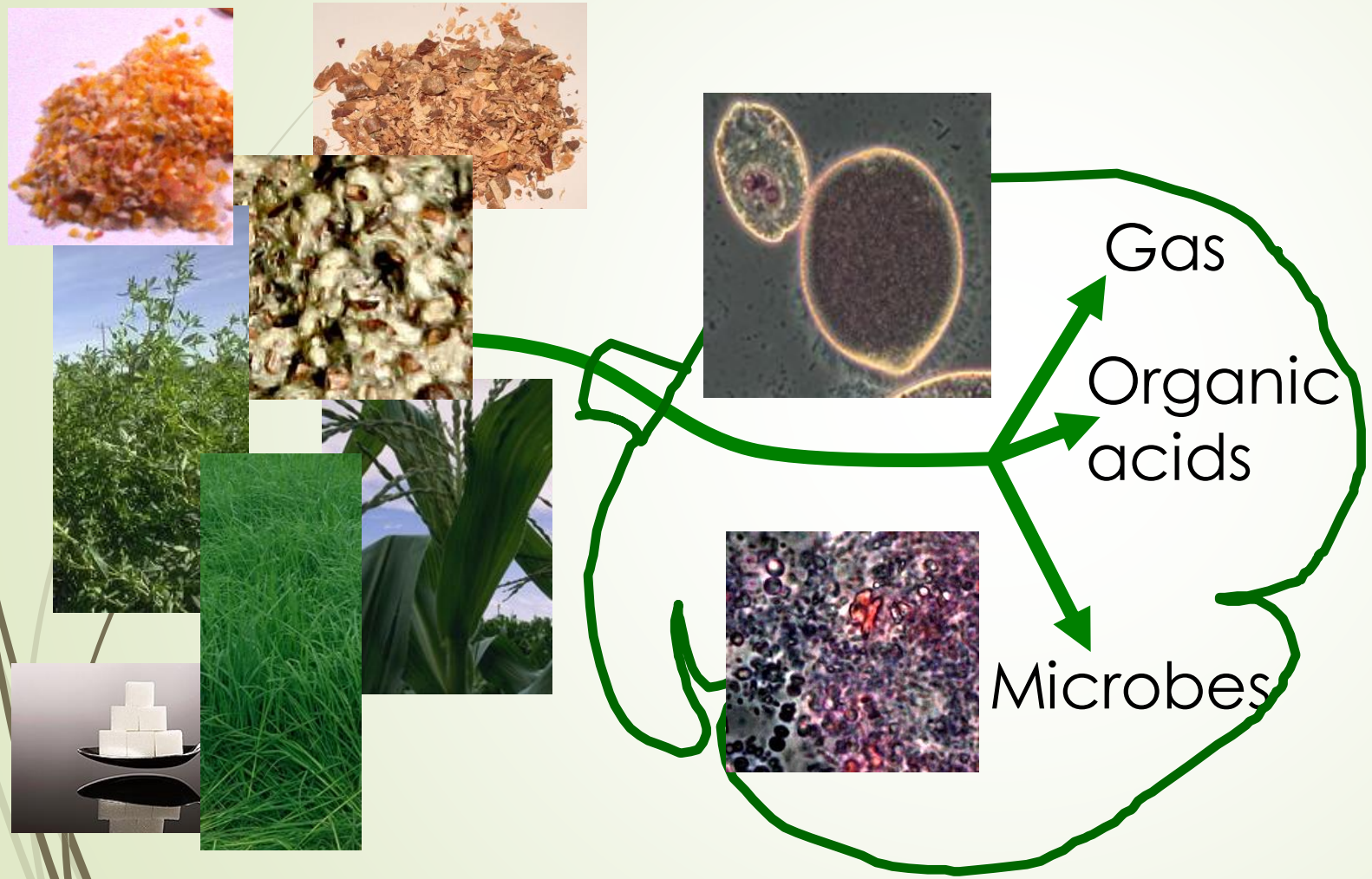
Mary Beth Hall, PhD
USDA – Agricultural Research Service
U.S. Dairy Forage Research Center
Madison, WI

Keeping The Rumen Happy & Healthy



Mary Beth Hall, PhD
USDA – Agricultural Research Service
U.S. Dairy Forage Research Center
Madison, WI

A Matter of Fermentation & The Cow



What Matters In The Rumen

Fermentation

Digestibility of feed drives system.

Good: Digested to produce nutrients to support the cow.

-- Even intake

-- Not too acid / enough fiber

Bad: Too much (?) fermentation/acid

-- Low rumen pH

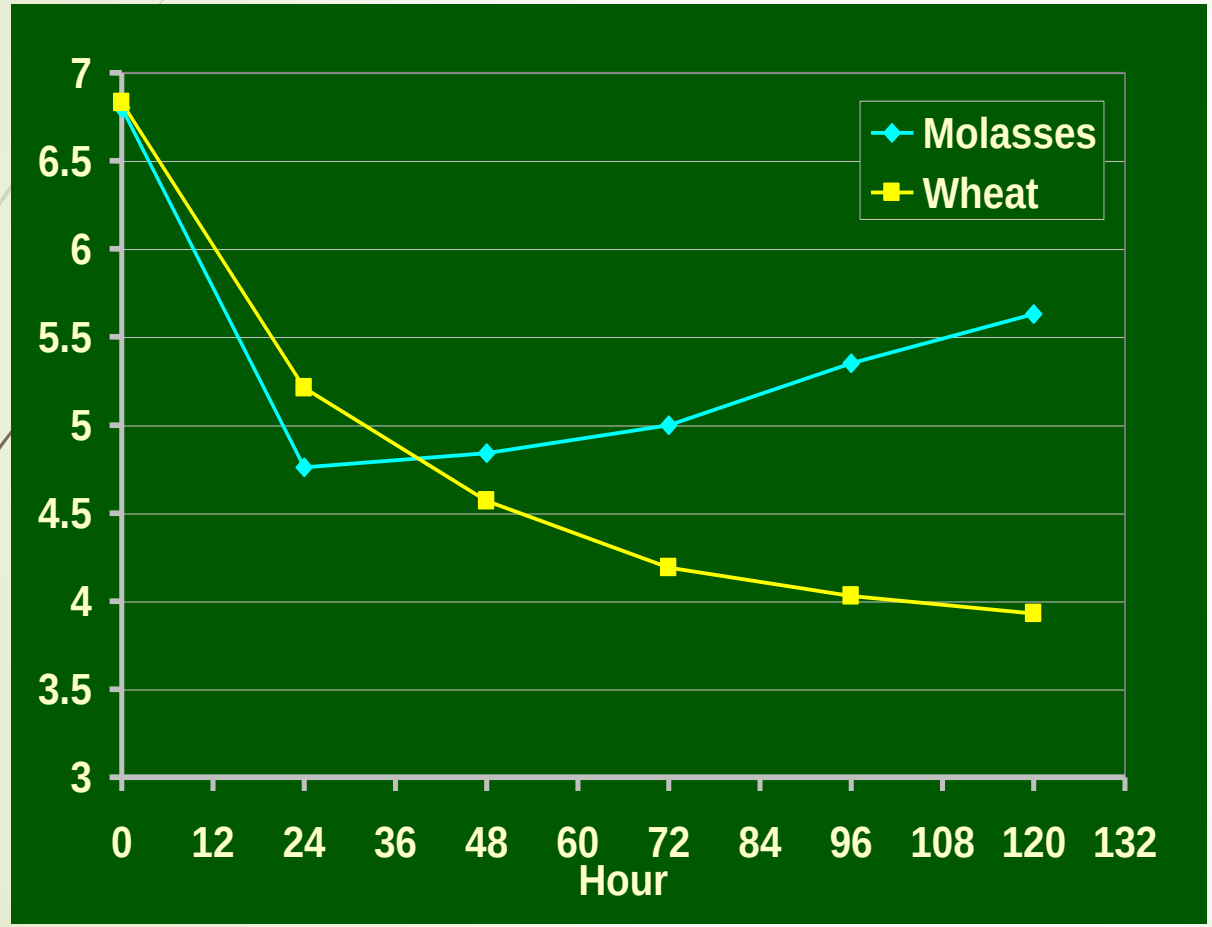
-- Depresses fiber digestion

-- Makes cows sick: acidosis, laminitis

-- A matter of timing?

Rumen Acid: Sources, Management

Rumen pH: dose with crushed wheat or molasses



Randhawa et al., 1982

- We measured intake of a day's ration post-feeding:
  - By 3 hour: 30%
  - By 9 hour: 60%
- Feeding pattern matters: Slug feeding? Sorting?
- How fast is the starch?
- Fiber dilutes the NFC.

Timing and what feed doses the rumen matter for keeping pH in line.

What Matters In The Rumen

Particle Size

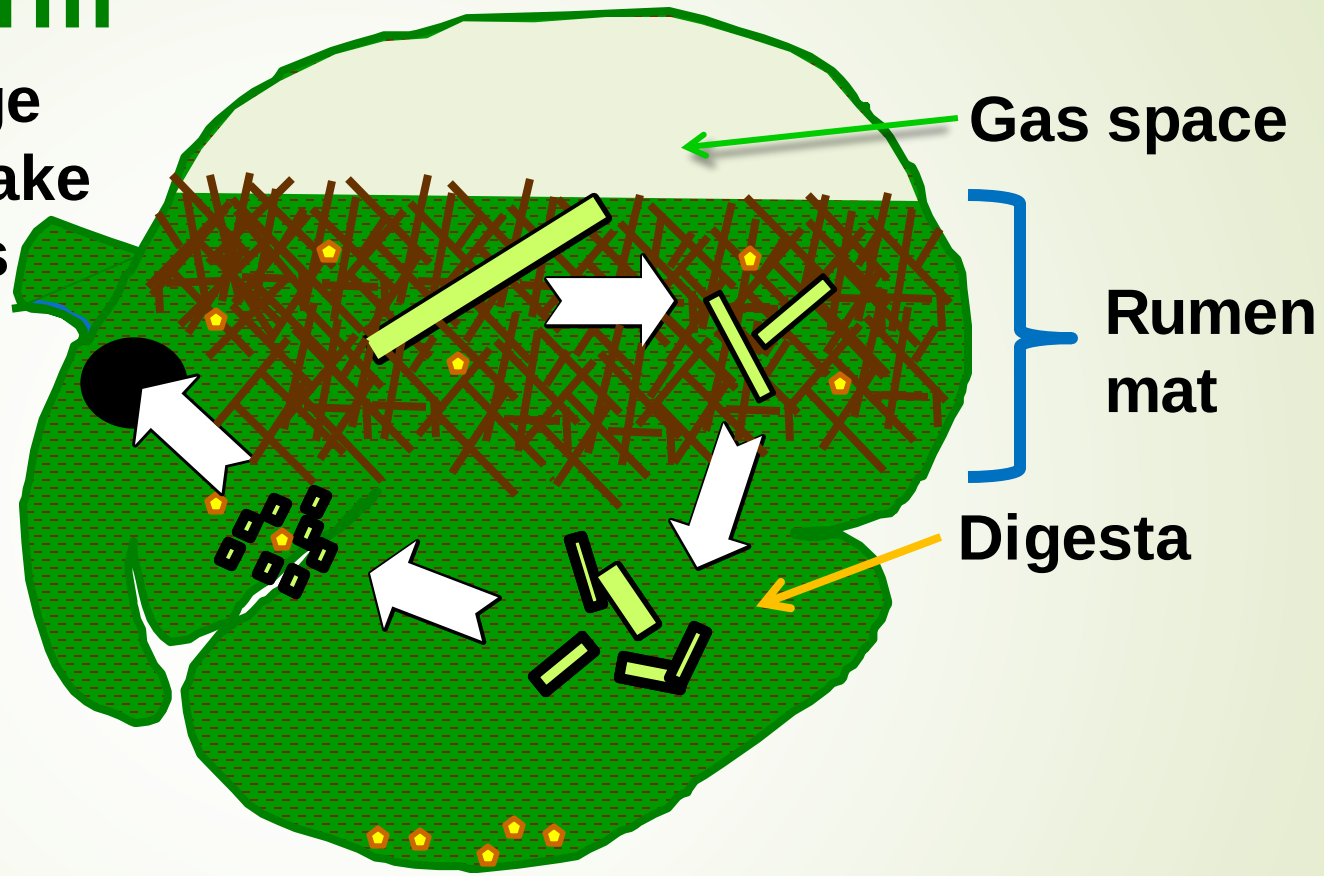
-- “Large” particle size encourages rumination and rumen buffering.

-- Large particles hold other feeds in the rumen to be fermented, fiber helps particles leave the rumen, too.

-- Forage is the main source of large particles / “effective fiber”.

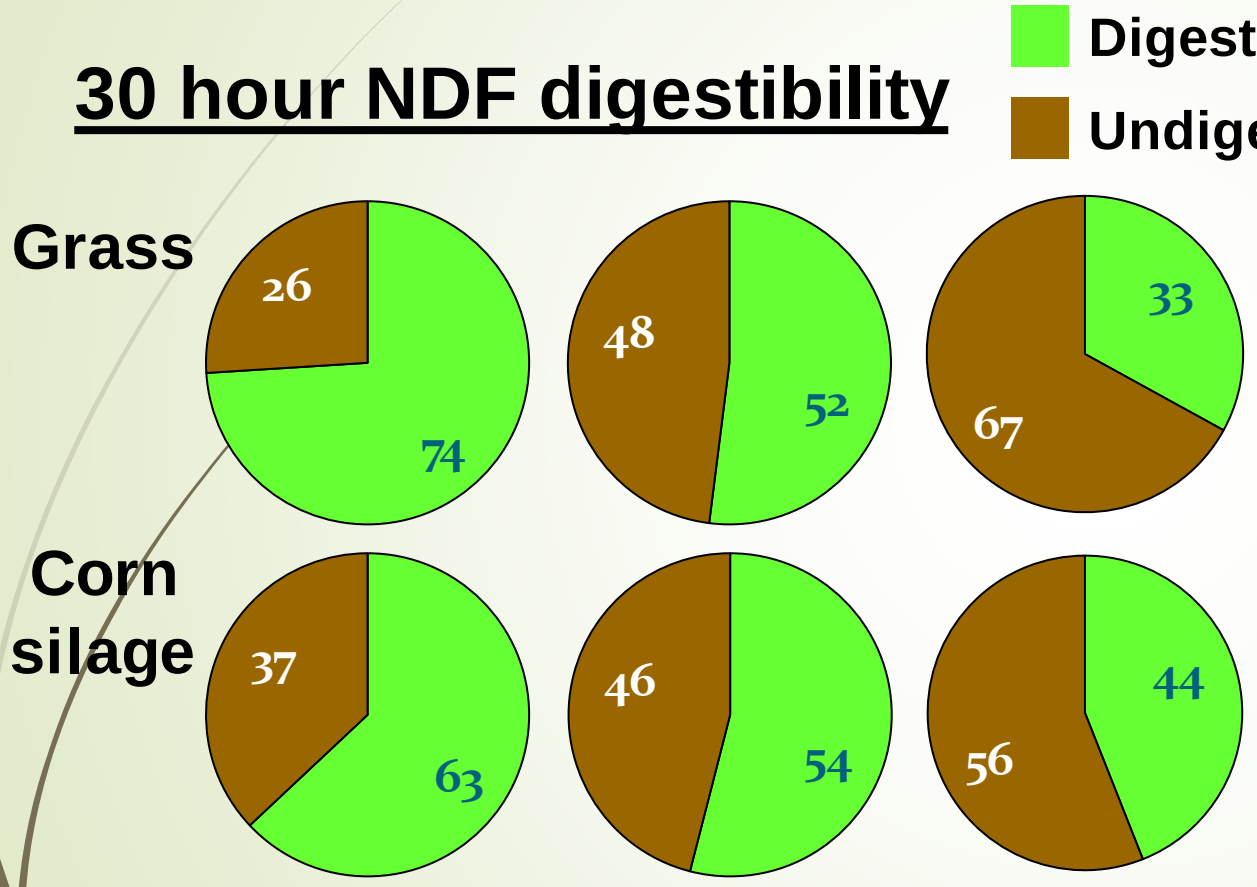
Physical Form

The larger forage particles can make a mat that holds feeds in the rumen.

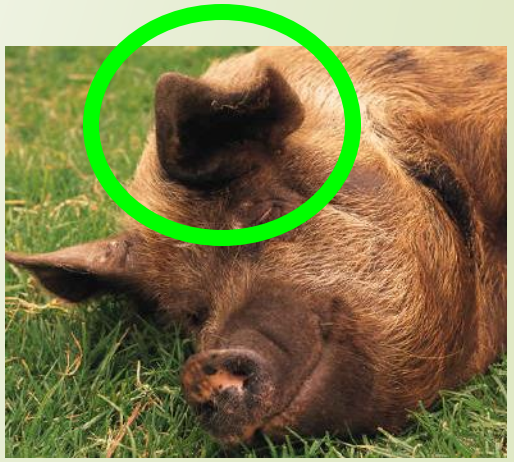


Longer time in the rumen gives more time for rumination and fermentation to digest feeds and break down particles. This affects the size of particles we see in manure. pH?

Forage Quality Sets The Limit



- If low digestibility, can't feed as much, will limit nutrients to the cow. Rumen effect?
- You can't feed past wrong quality forage.



Hall and Mertens, 2012

Particle Size + Carbohydrates + ….

Minimum Forage NDF	Minimum Total NDF	Maximum Starch
19	25	30
18	27	28
17	29	26
16	31	24
15	33	22

What about the other carbohydrates?

Adjustments.

Optimal diet forage NDF concentration

15 <- Higher dry matter intake -> 25

Faster ruminal clearance rate of forage NDF ->

Finely chopped forages ->

Higher diet starch, lower NFFS concentrations ->

Higher diet starch degradability ->

<- Supplemental buffers

Grain fed separately, infrequently ->

Limited feed bunk space, slug feeding ->

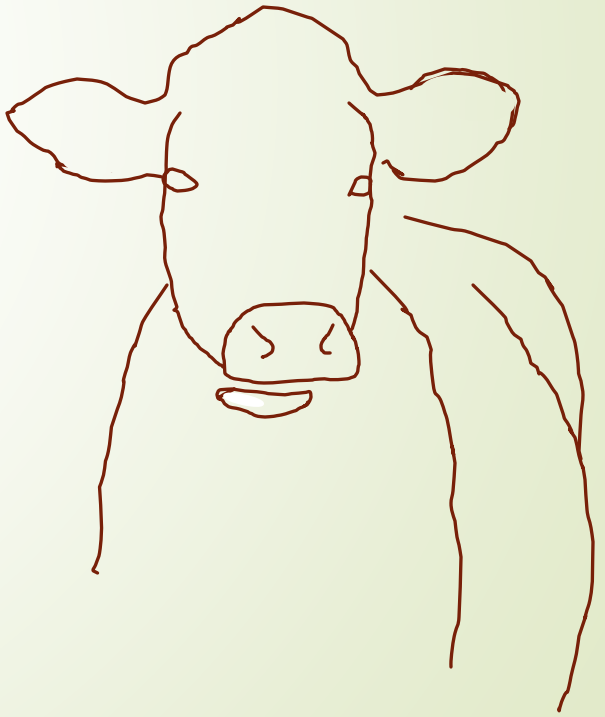
Greater daily variation in diet composition ->

NASEM, 2021

Rumen: Still A Lot We Can't Measure…

Courtesy of Ken Nordlund

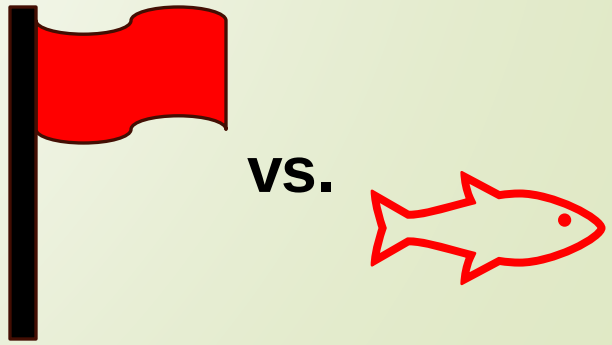
- Make sure the ration formulation, feed analyses, and mixing numbers and procedures are right….



Go See The Cows

© Ginger Larson

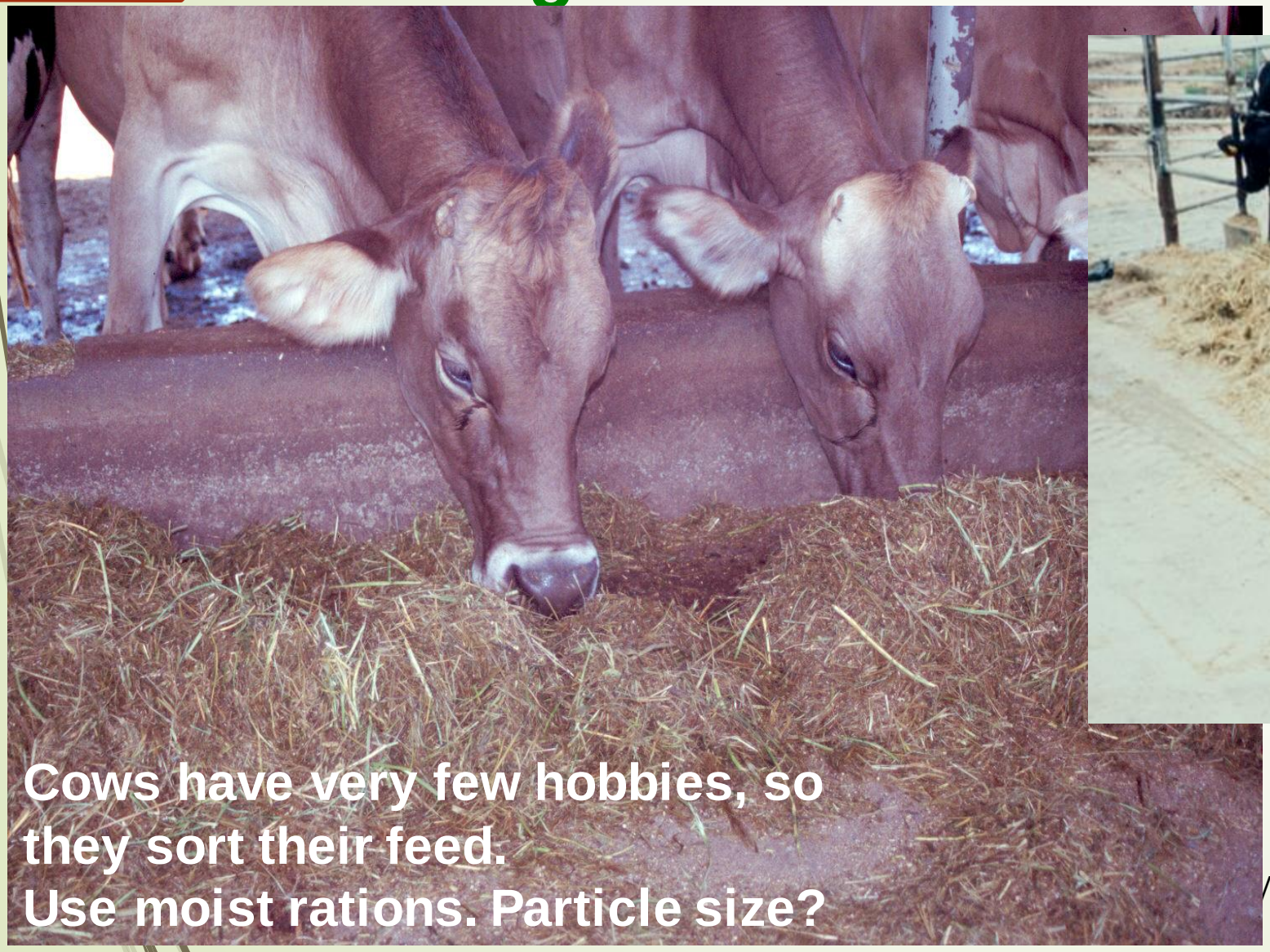
- The cows are the only ones on the farm who are always right.
- See what's going on. Find out if it's what you expect, what you want, if it's fine, or needs change.
- Look at the whole picture.
- Non-invasive.



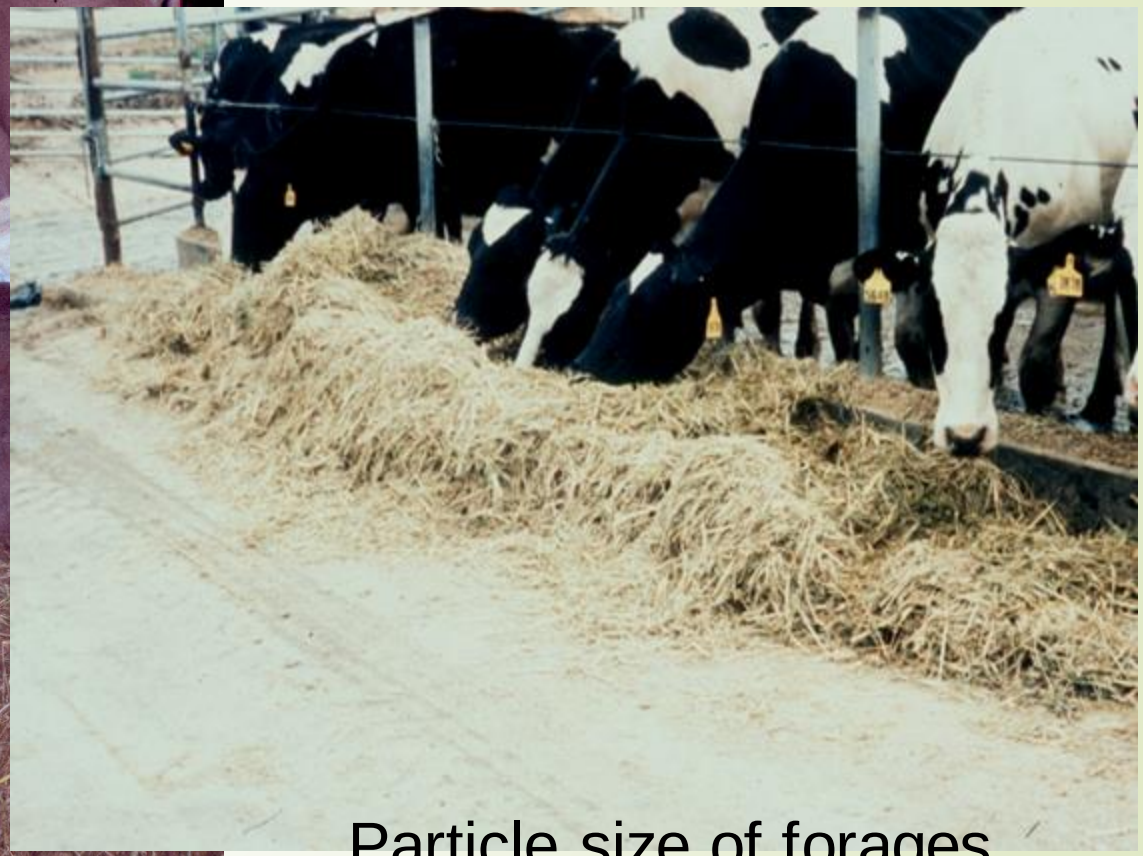
Getting The Whole Picture To Make Sense

- Cows: BCS, coat, lameness, and more…
- Feed: Mold/dust, analysis, consistency, mixing, existence….
- Bunk: Mold, clean, fresh, heating, mixed, weigh back…
- Water: Clean, fresh, available…
- Facilities: Comfortable, clean, ventilated, cooled….
- Employees…..

Walking The Feed Bunk



Cows have very few hobbies, so they sort their feed.
Use moist rations. Particle size?



Particle size of forages matters: too short, not enough rumination, too long, cows sort.

/24

Walking The Feed Bunk

Spoilage

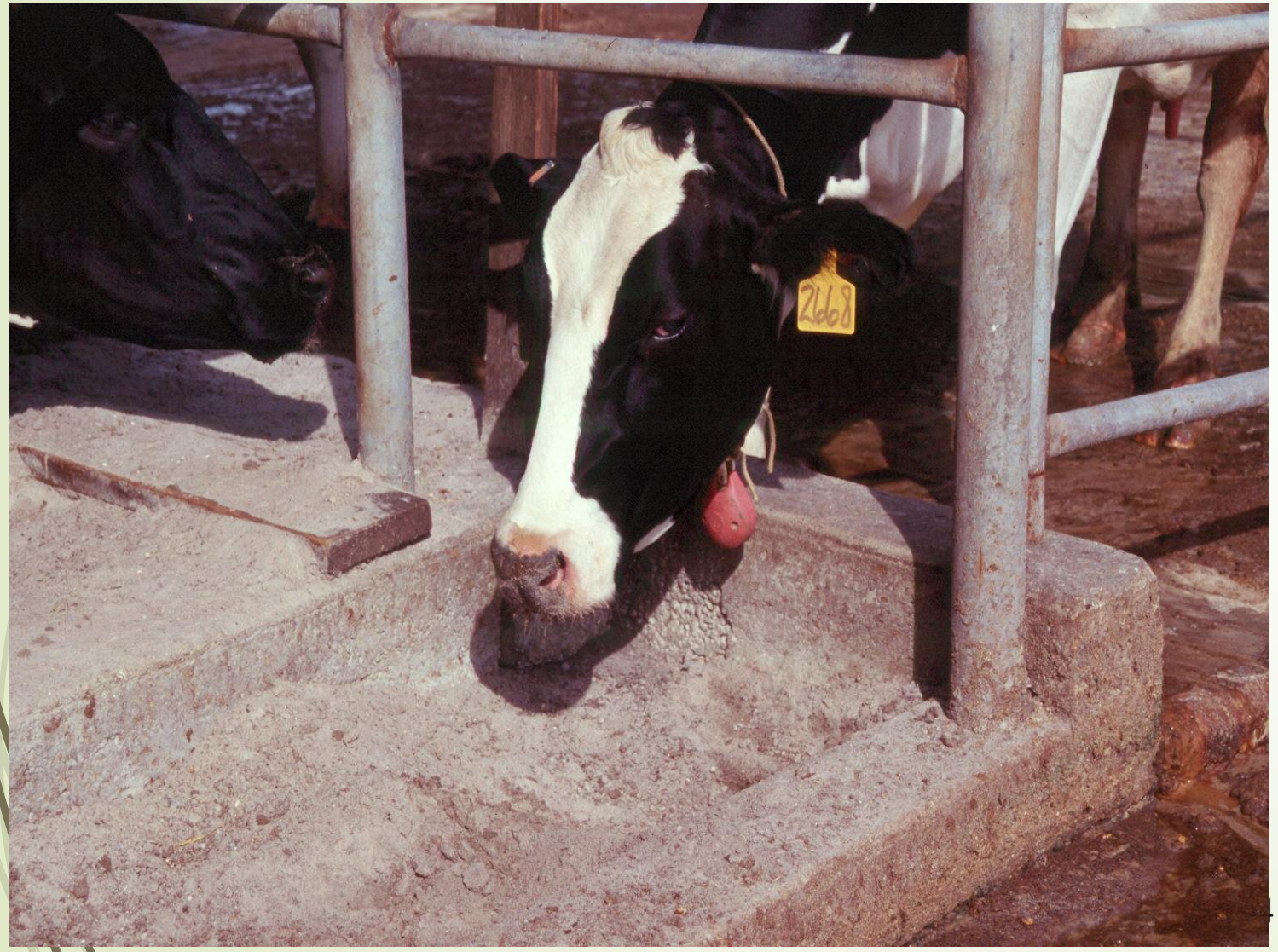
- Properly mixed?
- Sorting?
- Spoilage?
- Enough bunk space?
- Slug feeding?

Among The Cows: How They Spend Time

At least 40 - 50% of all cows not sleeping, drinking, or eating should be chewing their cuds.

Manure, ok.

Among The Cows

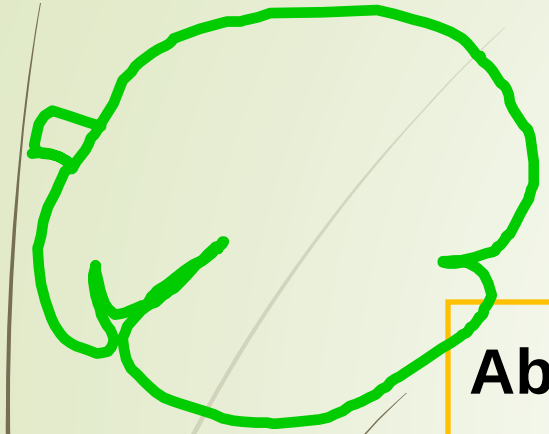


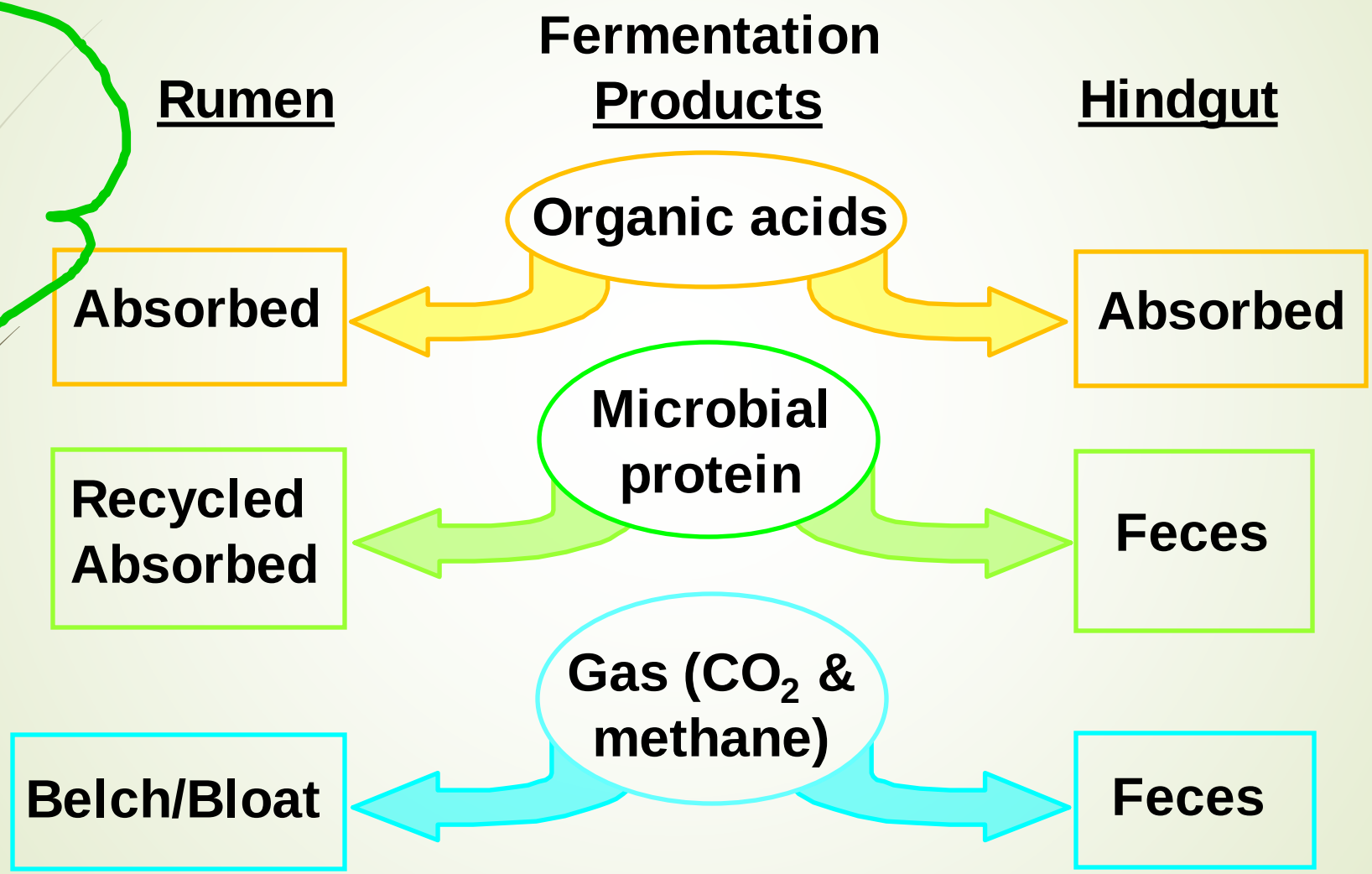
Cows will eat more “dirt”, salt, or bicarbonate when they have digestive upset.

Among The Cows: Manure

In context, manure gives insights into the interaction between the cow and her diet. Qualitative, not quantitative.

Where Feed Ferments Affects Manure



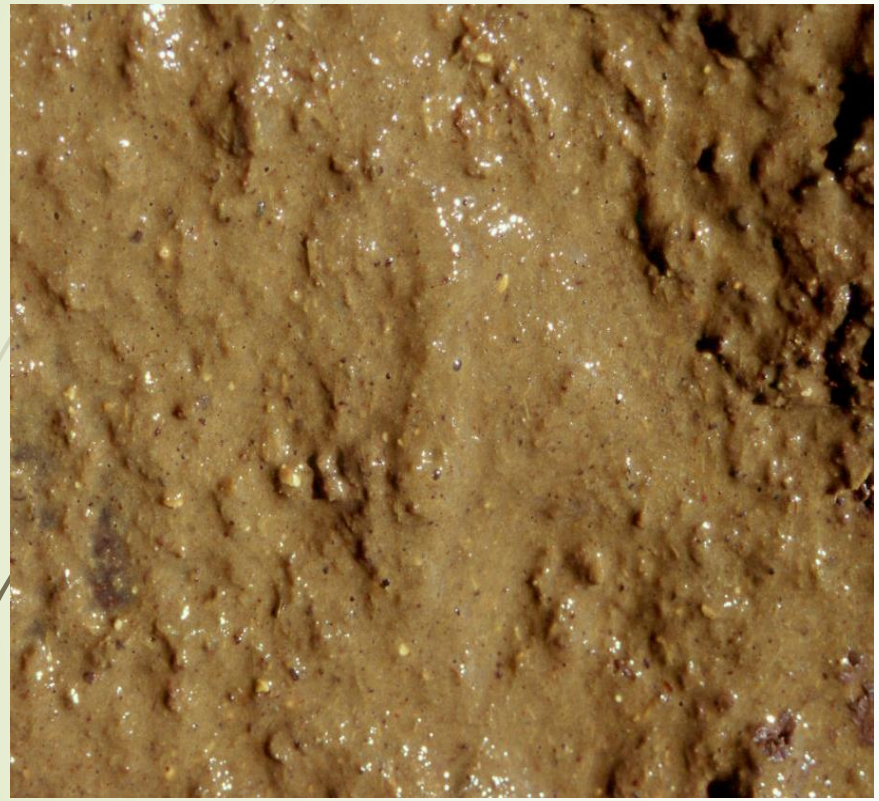


Consistency, The Good Stuff

For lactating cows, soft, but forms up.

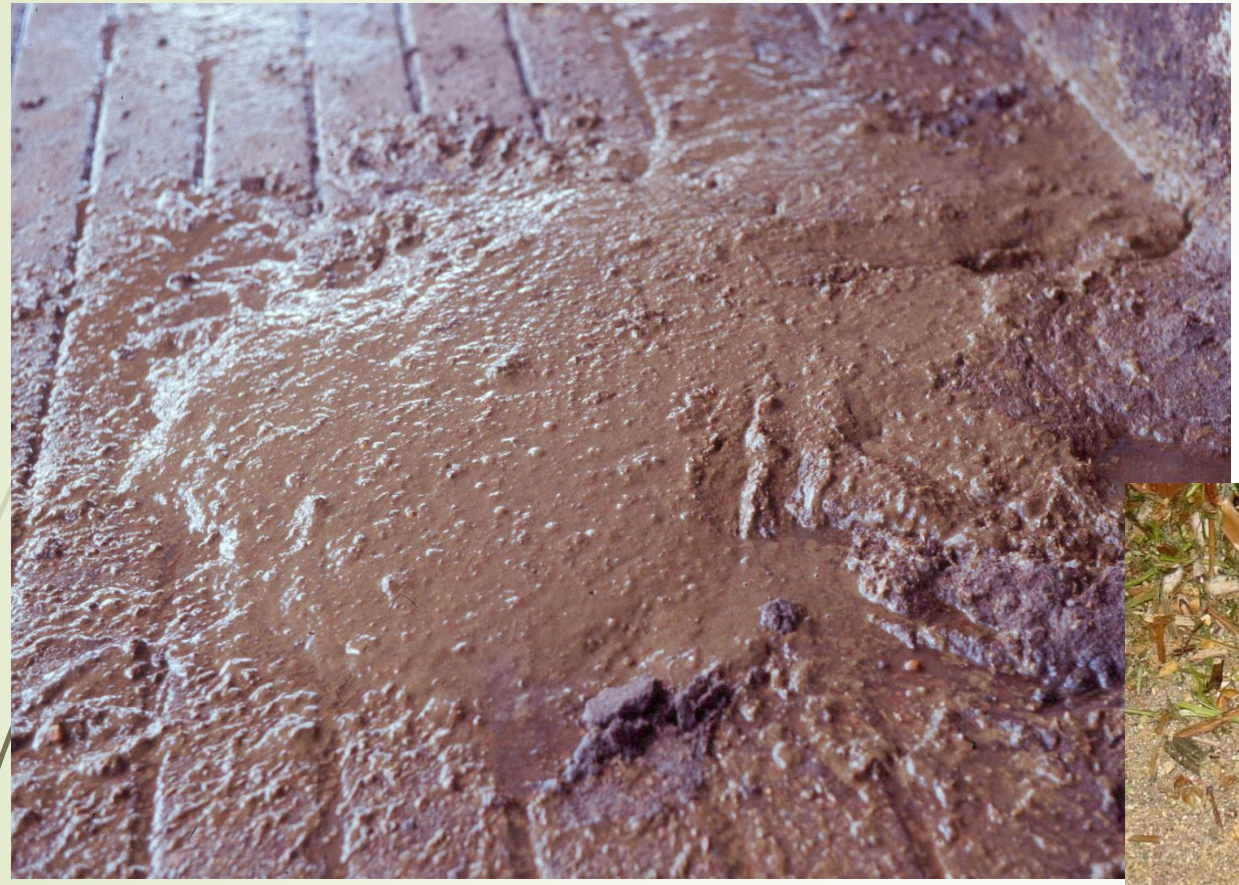
Suggests the rumen is healthy.

Not Normal, Foamy



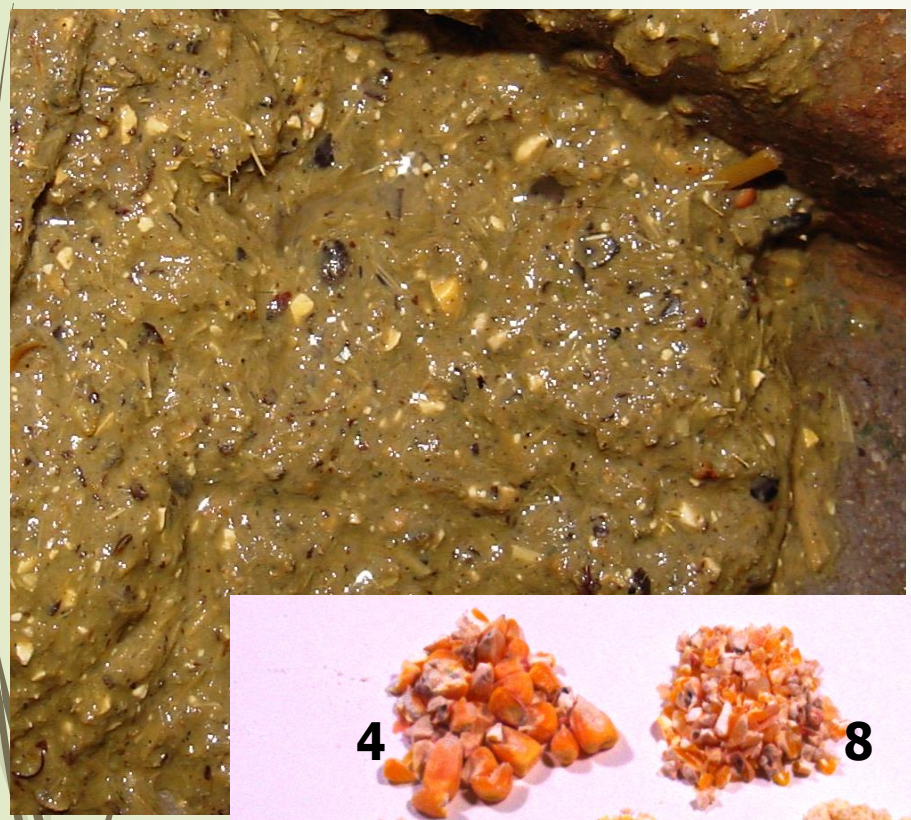
Excess fermentation in the hindgut created acid & gas. Feed didn't digest in the rumen and small intestine where it should have.

Not Normal, Diarrhea



A sign of ruminal acidosis/digestive upset or eating spoiled feed. Can be caused by disease, as well.

Not Normal, Undigested Feed



Eaten does not mean digested.
Need a finer grind?
Is forage feeding / particle size adequate?
Slug feeding? Sorting?
Why is it escaping the rumen?

Not Normal, Lots of Variation

Except for maybe 5% of the cows, cows eating the same diet should have similar manure. If not, are they sorting their feed?
Go look.

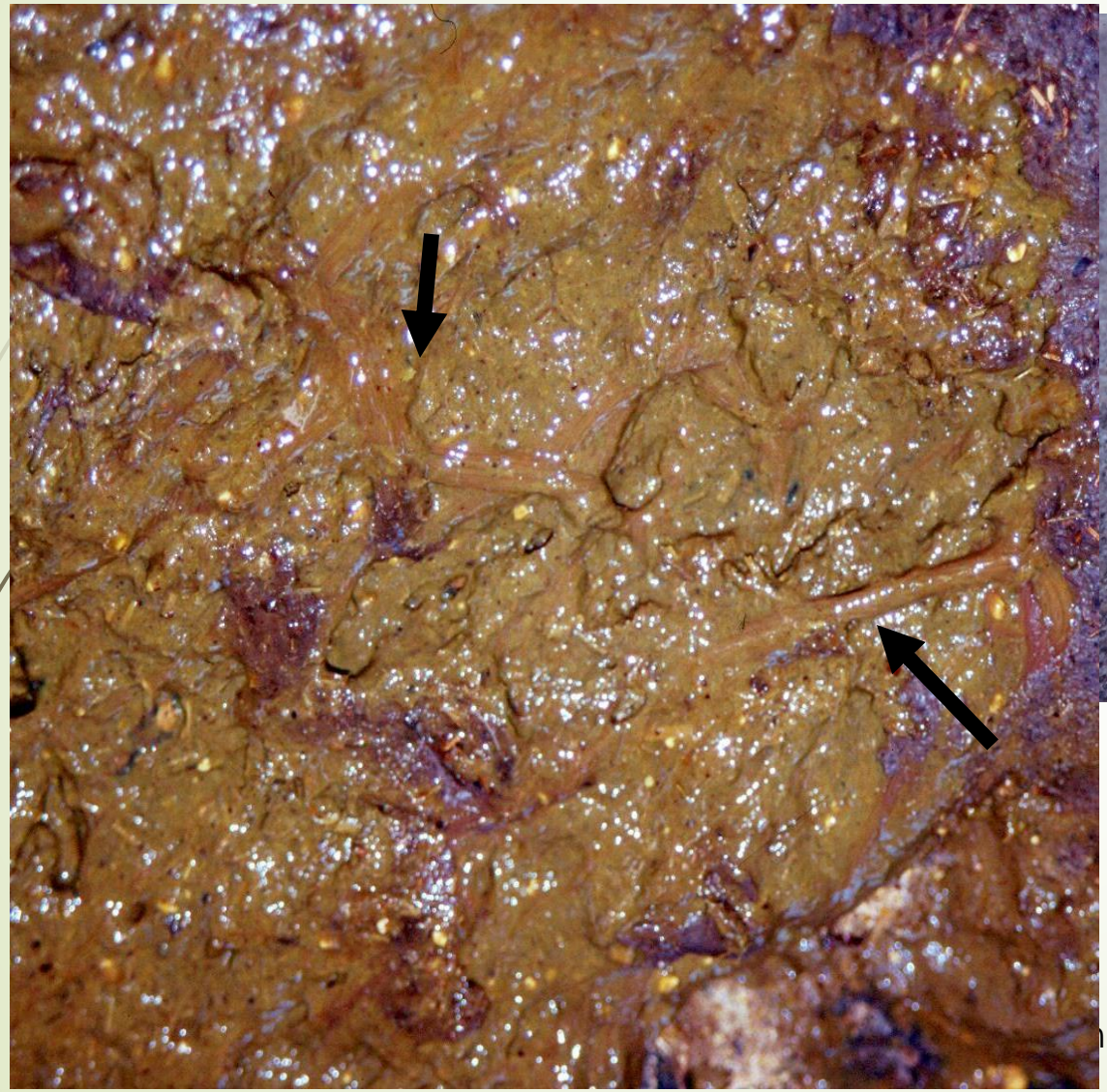
Not Normal

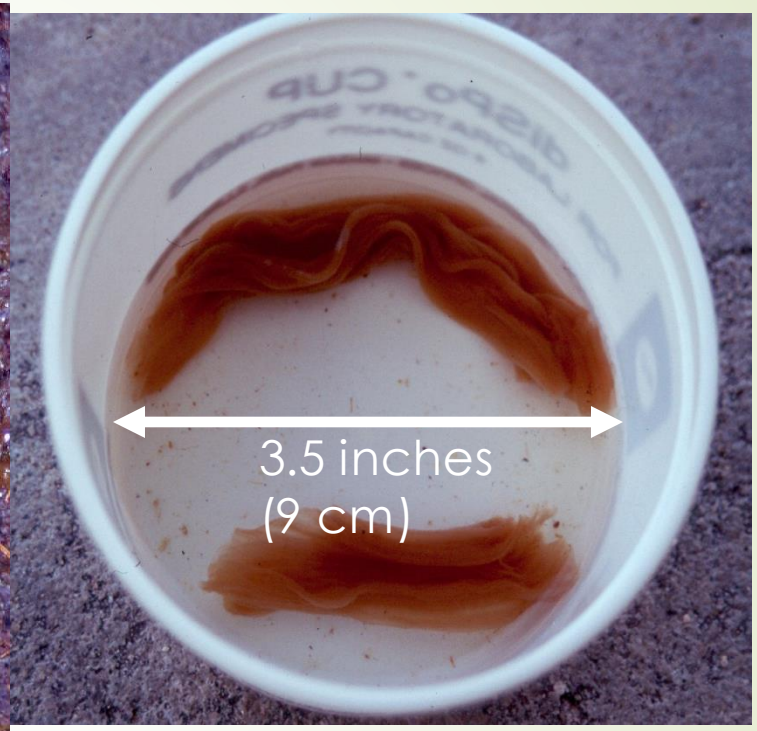
Pasty

Dry

Splattered

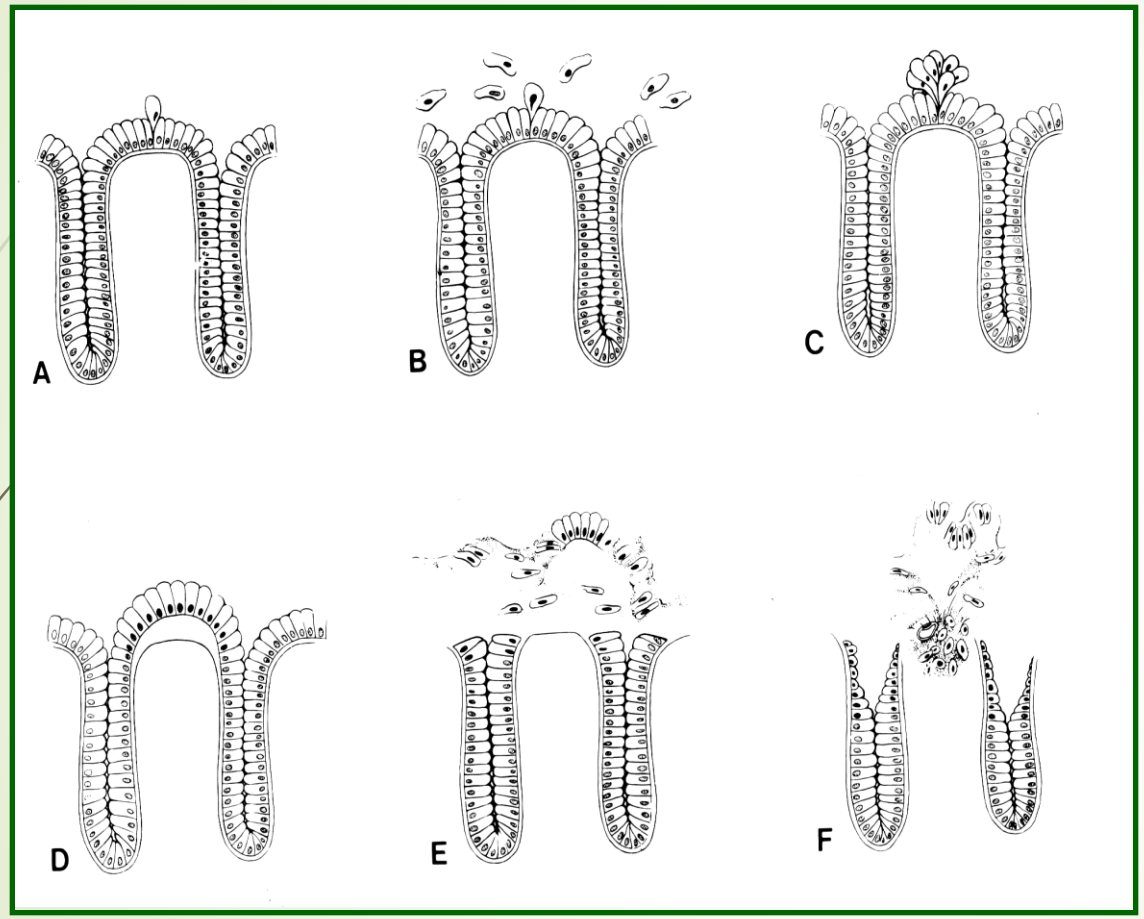
Not Normal, Mucin Casts





Sign of past damage to the large intestine.
Can be brown, gray, or almost black.

Not Normal, Mucin Casts



Damaging the lining of the large intestine creates mucin casts.

This can happen due to too much fermentation in the hindgut.

Rumen is better buffered.

Henrikson et al., 1989. Laboratory Investigation 60:72-87

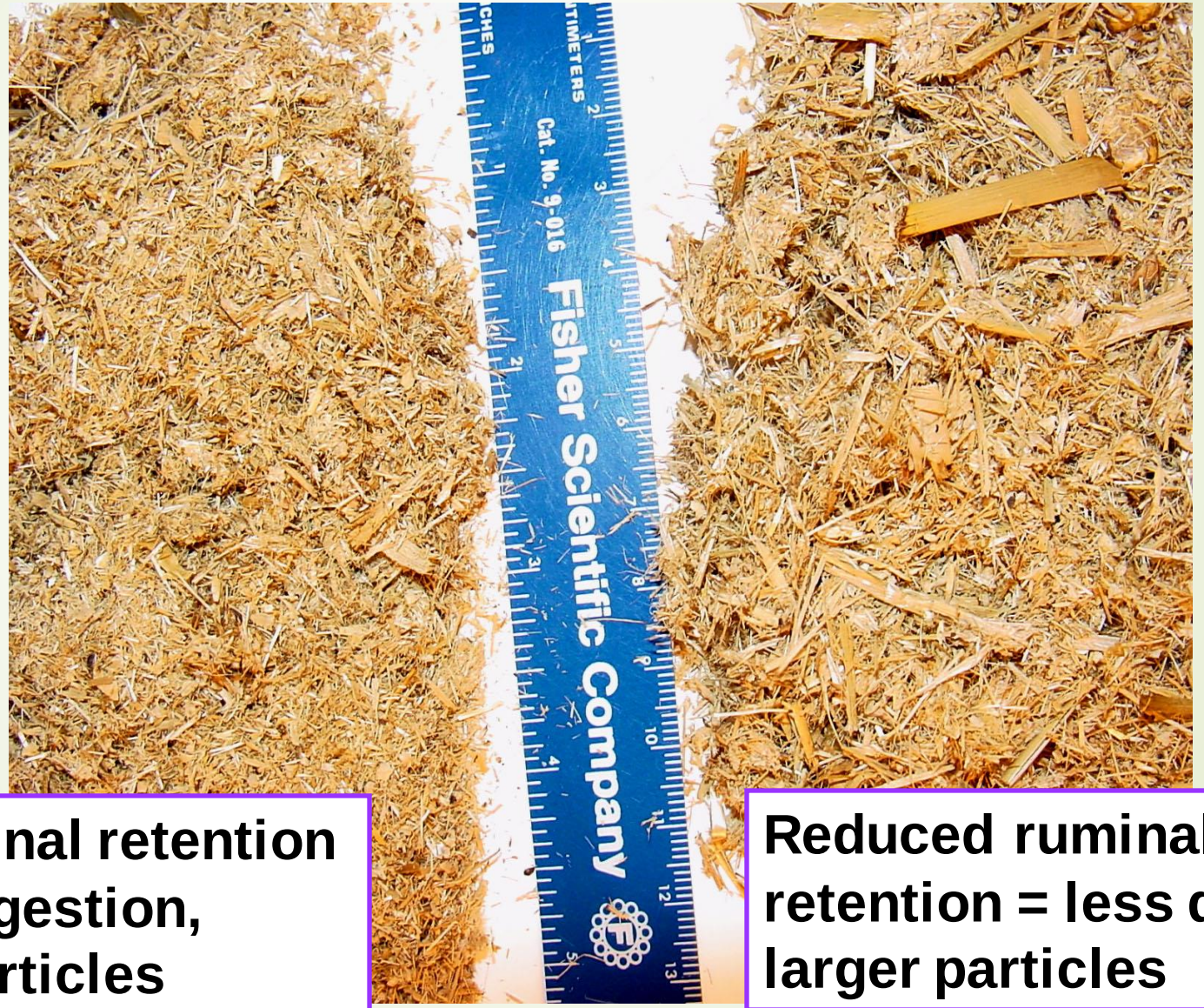
1/16 inch (1.6 mm) openings

UF Coed Manure Sampling Team

"We know our stuff."

Manure: Particles

Manure: Fecal Particle Size



Good ruminal retention = better digestion, smaller particles

Reduced ruminal retention = less digestion, larger particles

Fecal Particles: Coarse, Undigested Feed

33.5% roughage:
19% corn silage
5.5% ctsd hulls
9% alfalfa hay

Found in a pool of bubbly diarrhea.

Fecal Particles: Coarse, Undigested Feed

Before corn processors were popular…..
Milk production increased when ground corn was added to the ration.

Among The Cows

Uterine infection or gut irritation?

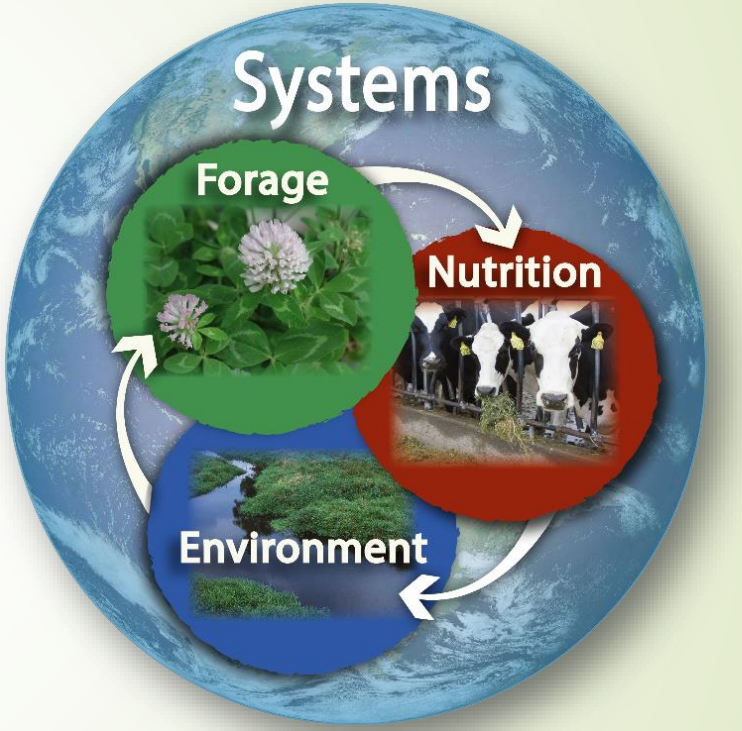
In Context

- Get an idea of the variation
  - In groups
  - Between groups
  - Between rations

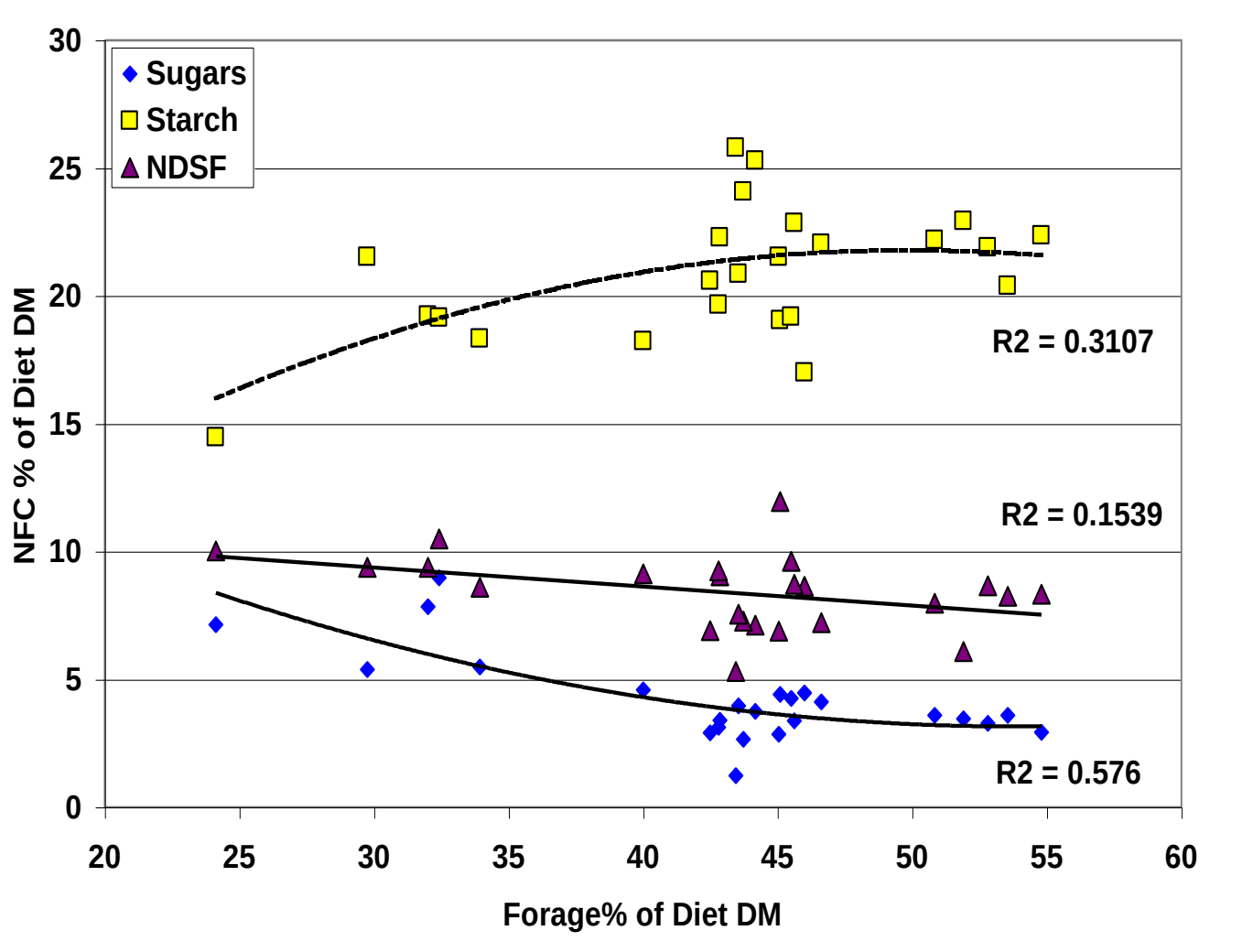
- Manure appearance
- Fecal particle size
- Undigested feed
- % Rumination
- Eating behavior
- Animal health
- Production
- Environment
- Management
- …….

Use these together to build a case as to whether rumen health is being supported.

Questions?



Forage & Nonfiber Carbohydrates



Hall and Van Horn, 2001

NEWTRIENT™
INNOVATIVE SOLUTIONS IN RESOURCE RECOVERY

Monetizing Manure Projects

Georgia Dairy Conference
January 17, 2024

NEWTRIENT™

REPRESENTING NEARLY ALL U.S. DAIRY FARMERS

NEWTRIENT'S MISSION

To reduce the environmental footprint of U.S. dairy and make it economically viable to do so

SUSTAINABILITY IS NOW TABLE STAKES

TODAY'S CONSUMER EXPECTATIONS

Source: The Hartman Group, September 2019; Nielsen, November 2018; Futerra, November 2018; Innova Market Insights, October 2019

PRESSURE INTENSIFIES TO LOWER CARBON EMISSIONS

INVESTOR GROUPS

BlackRock, Vanguard, State Street

GLOBAL DAIRY SUPPLY CHAINS

Starbucks, Ahold Delhaize, Coca-Cola, Mars

GLOBAL DAIRY LEADERS

Arla, Danone, Fonterra, Nestlé, Unilever

COUNTRIES

MARKET DRIVERS

- Companies setting **aggressive carbon reduction goals** or seeking to green their portfolio
- **Increased regulations** on certain sectors (i.e. transportation)
- **Increased support from government programs** for the adoption of climate-smart practices (Inflation Reduction Act, Climate-Smart Commodities, etc.)

AGGRESSIVE CARBON REDUCTION GOALS

BRIEF: Microsoft to purchase up to $2m in carbon credits from Land O'Lakes

February 8, 2021 Jack Ellis

Booming Airline Traffic Could Force Carriers to Buy Carbon Offsets as Early as 2024

Skift

Nestle moves closer to GHG emission reduction goal

NEWTRIENT™

INCREASED REGULATION

BIOMASS MAGAZINE

Dominion Energy, Vanguard Renewables partner on dairy RNG

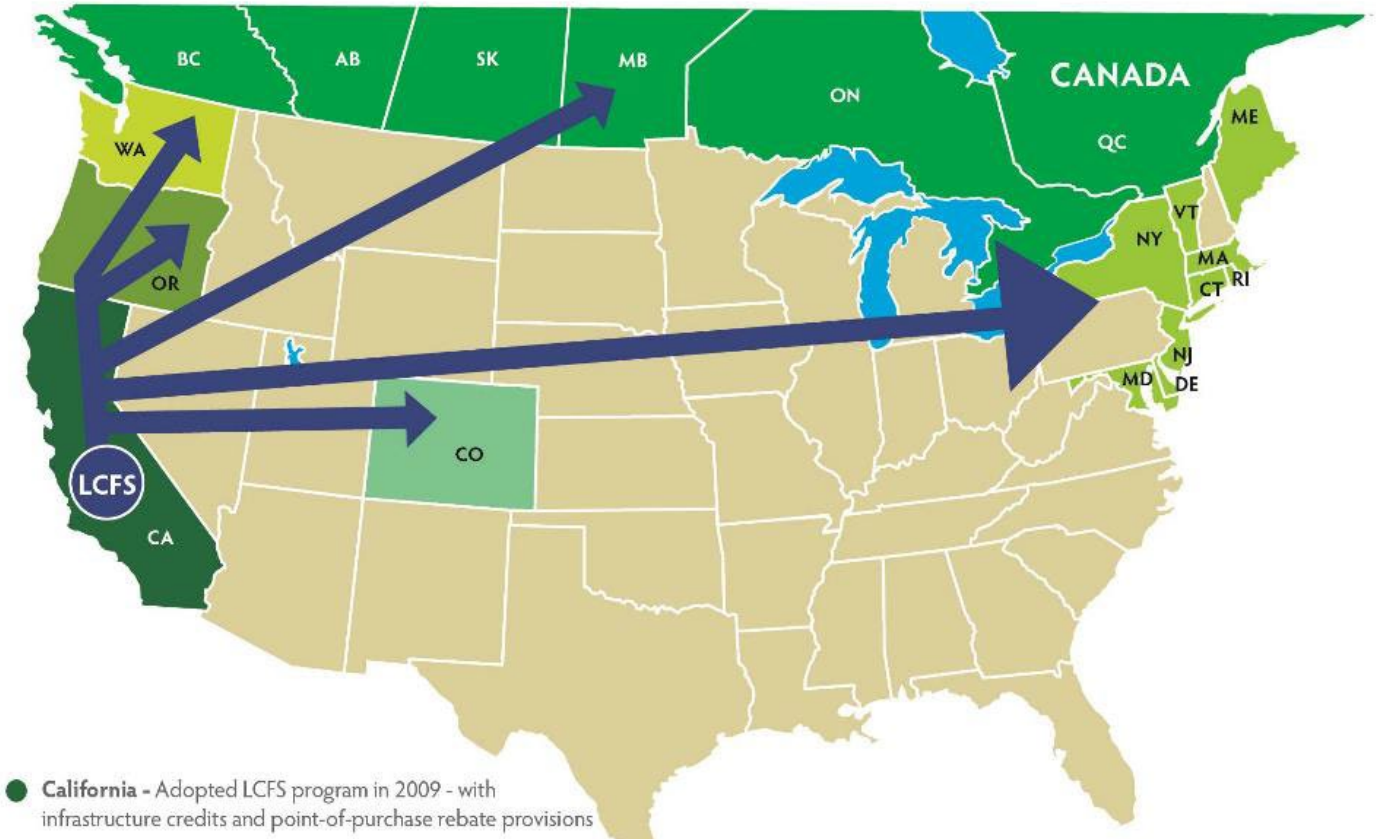
By Dominion Energy | December 11, 2019

Dominion Energy and Vanguard Renewables announced today a more than $200 million, nationwide strategic partnership to convert methane from U.S. dairy farms into clean, renewable natural gas (RNG) that can heat homes, power businesses and fuel vehicles. Multiple projects are under development in Georgia, Nevada, Colorado, New Mexico, and Utah with additional projects planned

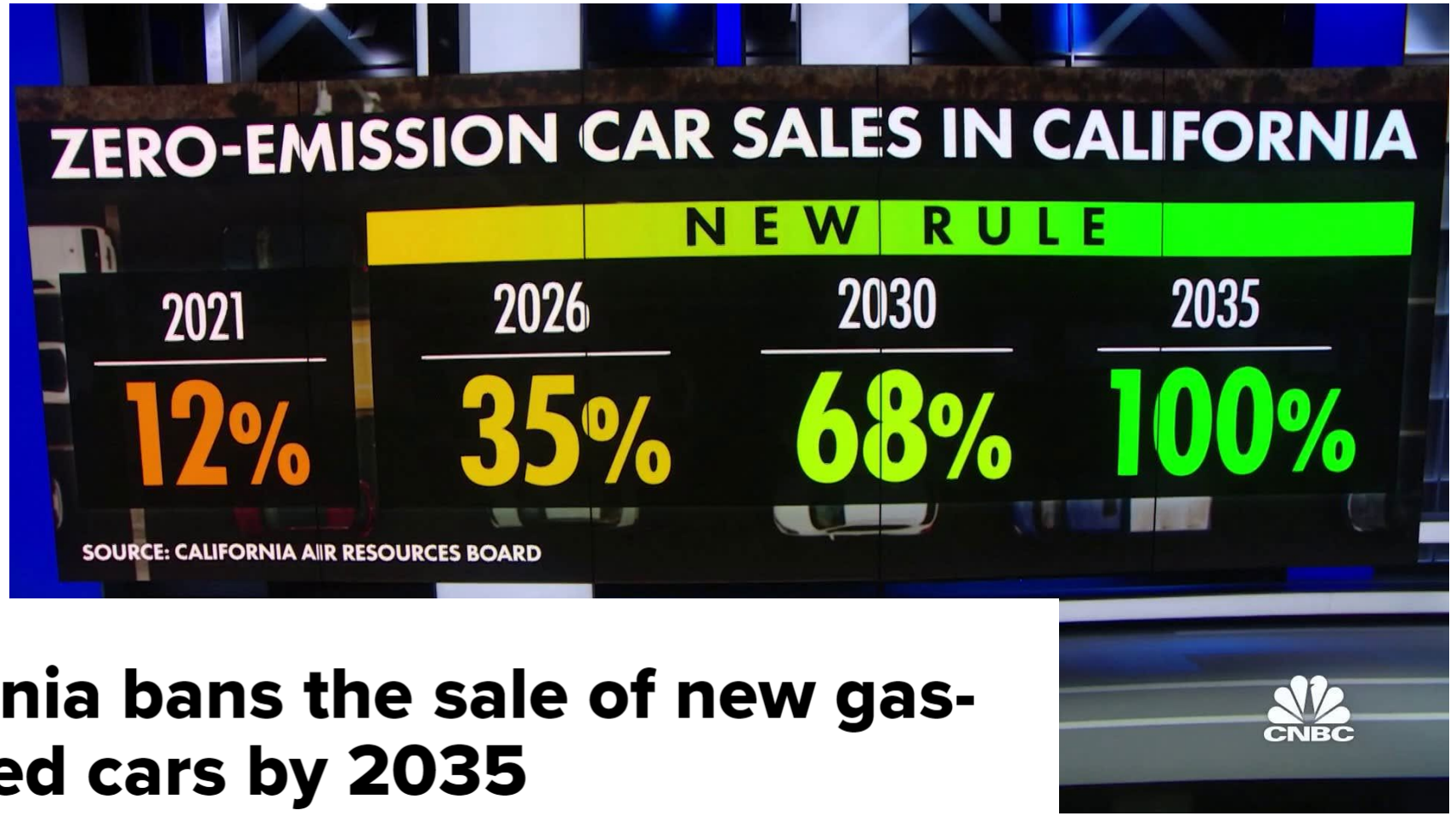
The Washington Post

Turning manure into money

Farmers and utilities are burning methane for energy — and curtailing a powerful greenhouse gas in the process



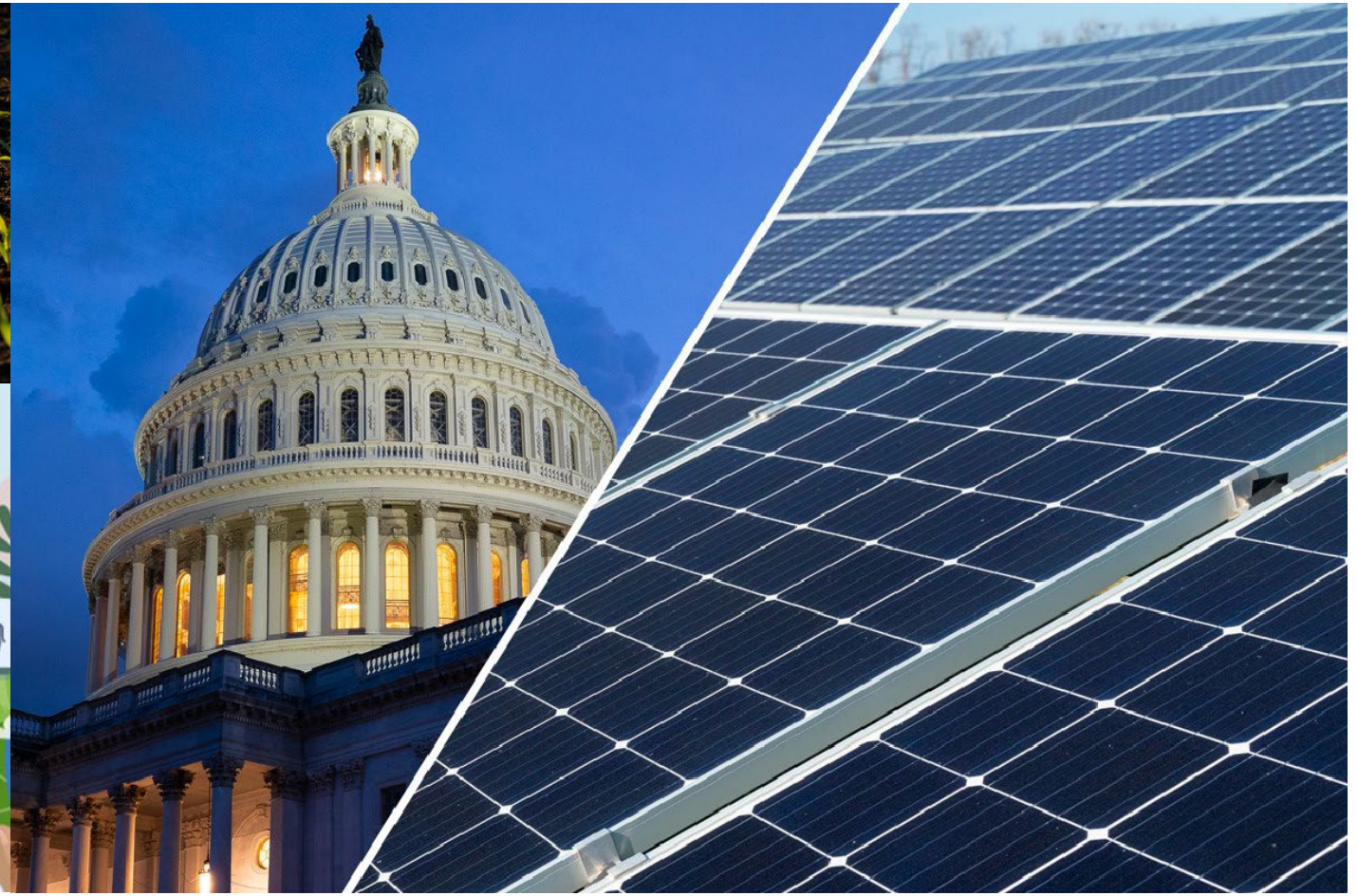
- **California -** Adopted LCFS program in 2009 - with infrastructure credits and point-of-purchase rebate provisions
- **Oregon -** Implemented "Clean Fuels" in 2016 - a program similar to LCFS, without infrastructure credits and point-of-purchase rebate provisions
- **Connecticut, Maine, Maryland, Massachusetts, New Jersey, New York, Oregon, Rhode Island, and Vermont -** Adopted ZEV mandate
- **Canada -** *Environment Canada* released the regulatory design paper for a national "Clean Fuel" program in late 2018
- **Washington -** Considering implementing program similar to Oregon's "Clean Fuels"
- **Colorado -** Considering adopting ZEV mandate



CLIMATE

California bans the sale of new gas-powered cars by 2035

INCREASED SUPPORT FROM GOV PROGRAMS



How is the Value Determined?

Current Manure Value as Fertilizer

* Calculations based on ASABE Standards for 75 lbs./day milk production (305 day lactating & 60 days dry)

Fertilizer Value Per Ton as Excreted

2,000	lbs in a ton
49,077	lbs manure/cow/year[1]
24.54	Wet Tons/Cow/Year
$10.82	**Fertilizer value per wet ton**
4	X Concentration in drying to >80% DM
$43.29	Raw manure value of dry manure
27%	Reduction for loss of Volatile Nitrogen[2]
$31.46	**Fertilizer value per dry ton**

[1]ASABE values based on for 305 days lactating, 40 days dry cow, 20 days heifer before first calving.

[2]Assumes 100% loss of volatile nitrogen as NH_3

Data Updated November 03, 2022

Potential Revenue from Carbon Reductions

**Annual manure costs for a 3,500-cow dairy farm*

Avoided Manure Application Costs 2019 - Scrape to Lagoon

3,500	cows
36	gallons/cow/day
365	days
45,990,000	gallons/year
30,813,300	gallons/year through pivots
$0.01	cost per gallon through pivots
$308,133	cost per year through pivots

15,176,700	gallons/year by
$0.025	cost/gallon custom applicator
$379,418	cost/year custom applicator
$687,551	Total cost per year
3500	Cows
86	lbs per cow
305	day milking per year
91,805,000	lbs per year
918,050	CWT's per year

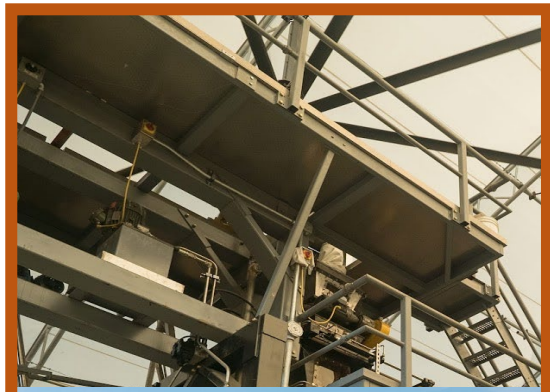
$0.75 Cost per CWT

$196.44 Cost per Cow

Costs Include

- **Equipment**
- **Labor**
- **Utilities**
- **Consumables**
- **Services**
- **Management**

Potential Revenue from Carbon Reductions



$ Practice/ Tech Changes

- LCFS Credits
- Payments for Carbon Reductions
- Manure-based products (fertilizers)

← New Profit Stream

$196.44/ cow/ year

← Reducing Annual Costs of Manure Management

TODAY'S ACTIVE MANURE MARKETS

Carbon Markets Snapshot

January 8, 2024

US$ per RIN (Renewable Fuel Standard) 2023	
D3	$3.350
D4	$0.805
D5	$0.795
D6	$0.803
US$ per Metric Ton of CO2e (State LCFS Programs)	
Oregon Clean Fuels Program (CFP) Credit	$92.00
California Low Carbon Fuel Standard (LCFS) Credit	$68.50
EU€ per Metric Ton of CO2e (EU ETS Allowance)	
EEX EU Allowances (EUA)	€66.49

US$ per Metric Ton of CO2e (Voluntary Carbon Offsets) *Source: AlliedOffsets*	
Agriculture	$16.87
Biochar	$218.12
Chemical Processes	$2.56
Energy Efficiency	$3.12
Forestry	$5.72
Household Devices	$6.26
Renewable Energy	$1.92
Transportation	$2.55
Waste Disposal	$3.47
Carbon Removal	$0 - $3,700

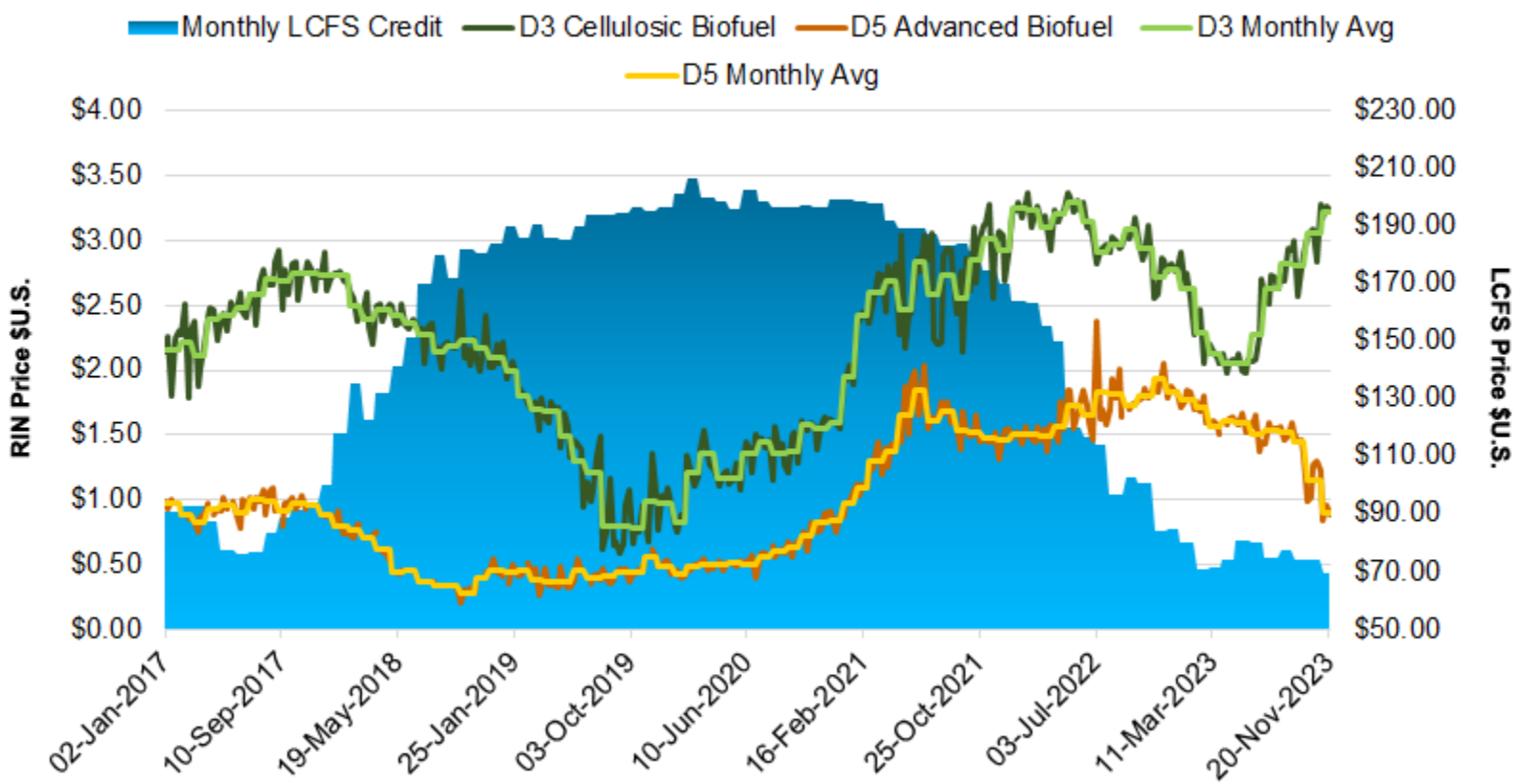
Daily Full RIN Update

D-Code	US$ per RIN (Renewable Fuel Standard)		
	2022	2023	2024
D3	$3.420	$3.350	$3.412
D4	$0.815	$0.805	$0.805
D5	$0.805	$0.795	$0.795
D6	$0.805	$0.803	$0.797

TODAY'S ACTIVE MANURE MARKETS

Average RIN and LCFS Prices

NGI



Source: Compiled by NGI from Environmental Protection Agency and California Air Resources Board data, NGI calculations

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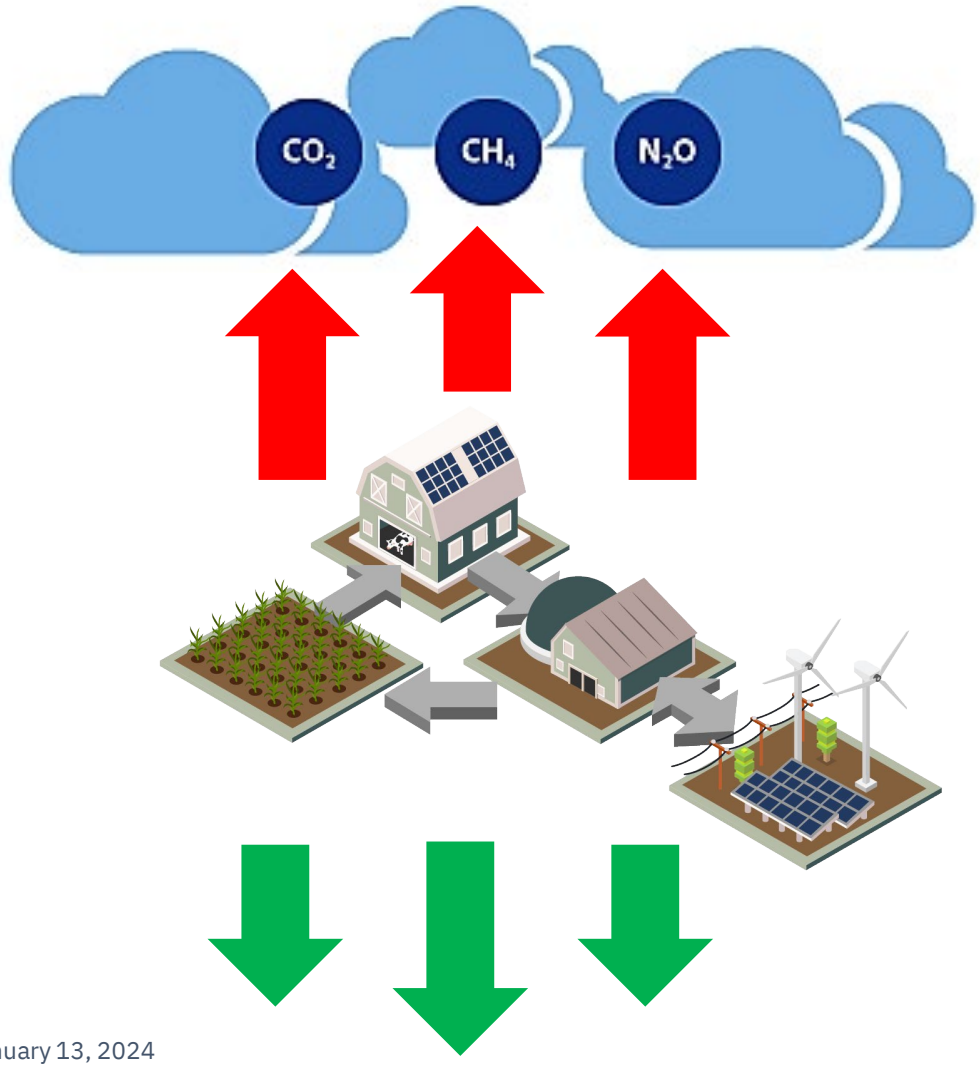
CARBON CREDITS



releasing GHG's

created emissions

=

CO_2e Before

+

CO_2e Project

−

CO_2e After

=

Credited CO_2e

=

capturing carbon

avoided emissions

=

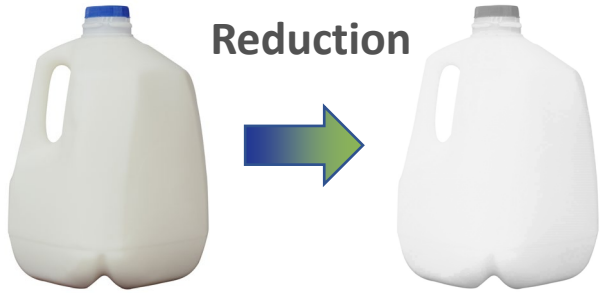
TWO PATHS TO DETERMINE VALUE

1

Carbon INSETS

reducing emissions within the supply chain and offering farmers incentives to reduce emissions

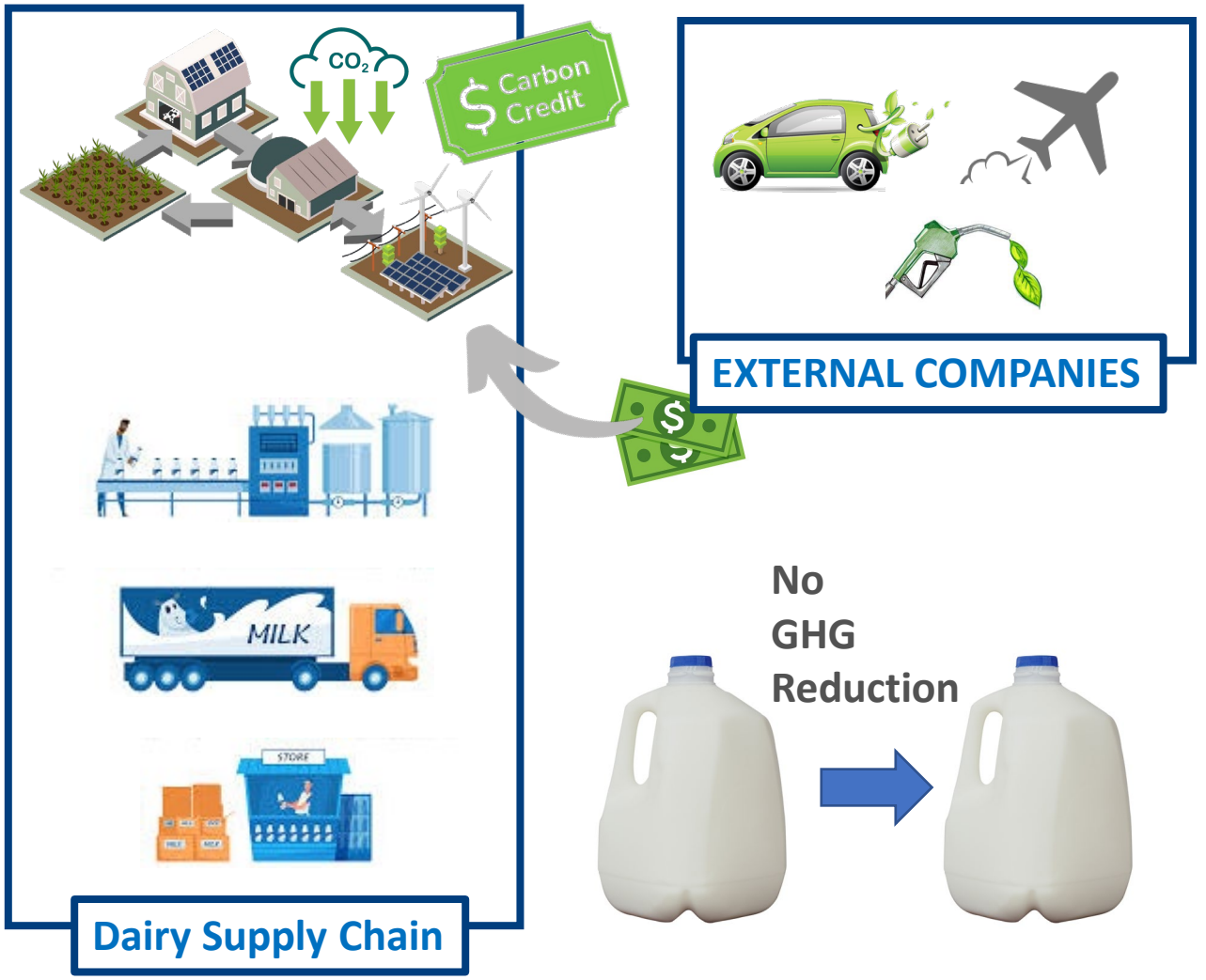
GHG Reduction



TWO PATHS TO DETERMINE VALUE

2 Carbon OFFSETS

selling carbon offsets outside the dairy supply chain



Assessing Dairy's Impact

NEWTRIENT™

OPPORTUNITIES TO REDUCE REDUCTIONS

Estimated GHG contribution of each "print" to the total*:

ENTERIC METHANE 35%

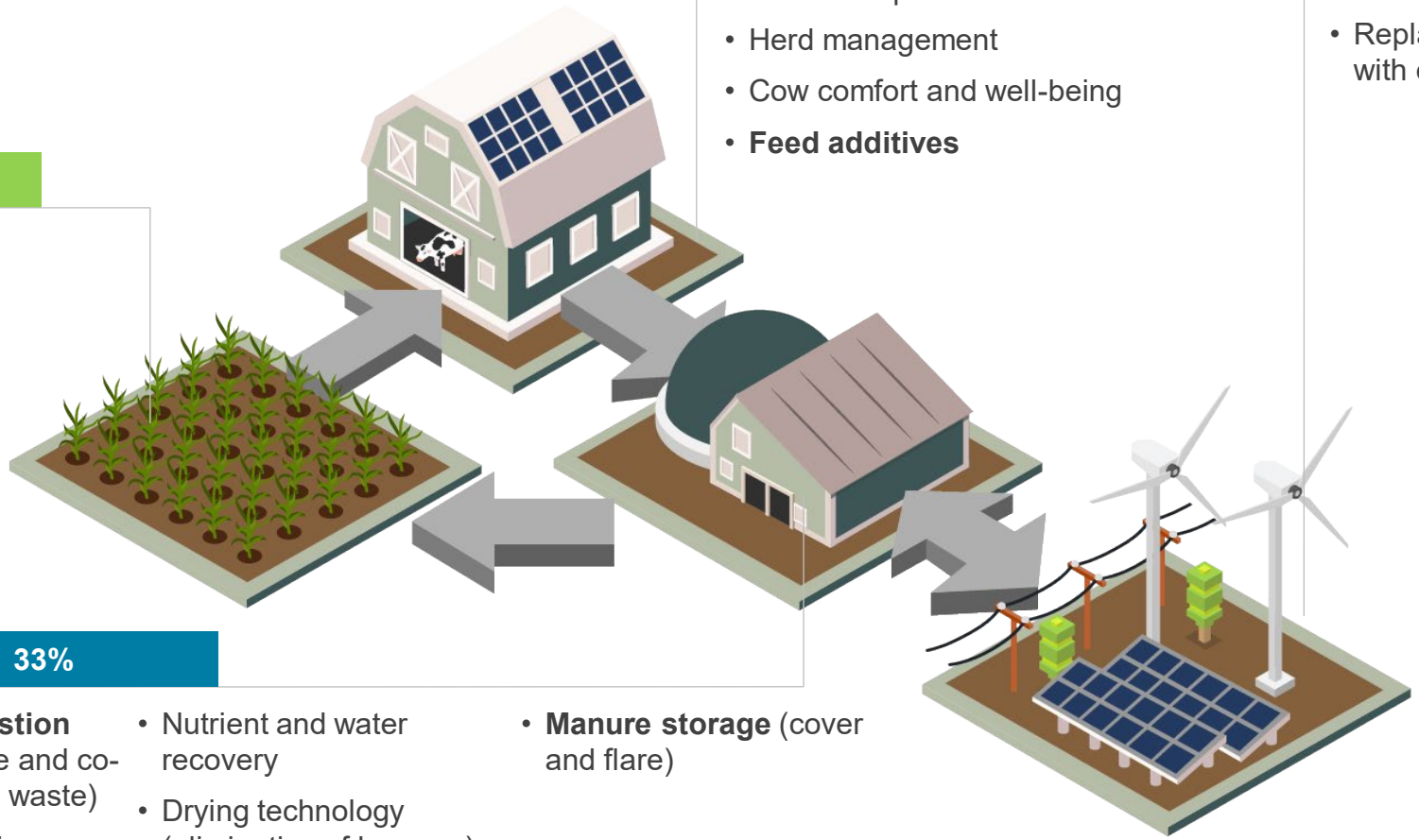
- Diet management
- Genetic improvement
- Herd management
- Cow comfort and well-being
- **Feed additives**

ENERGY 6%

- **Renewable energy:**
- Energy efficiency:
- Replacement of fossil-fueled engines with electric motors

FEED 26%

- **No/low-till farming**
- **Cover crops**
- Nutrient management
- Precision agriculture
- Water use efficiency



MANURE 33%

- **Anaerobic digestion** (includes manure and co-digestion of food waste)
- Renewable fertilizers
- Nutrient and water recovery
- Drying technology (elimination of lagoons)
- **Manure storage** (cover and flare)

Assessing a Dairy's Impact

Estimated GHG contribution of each "print" to the total*:

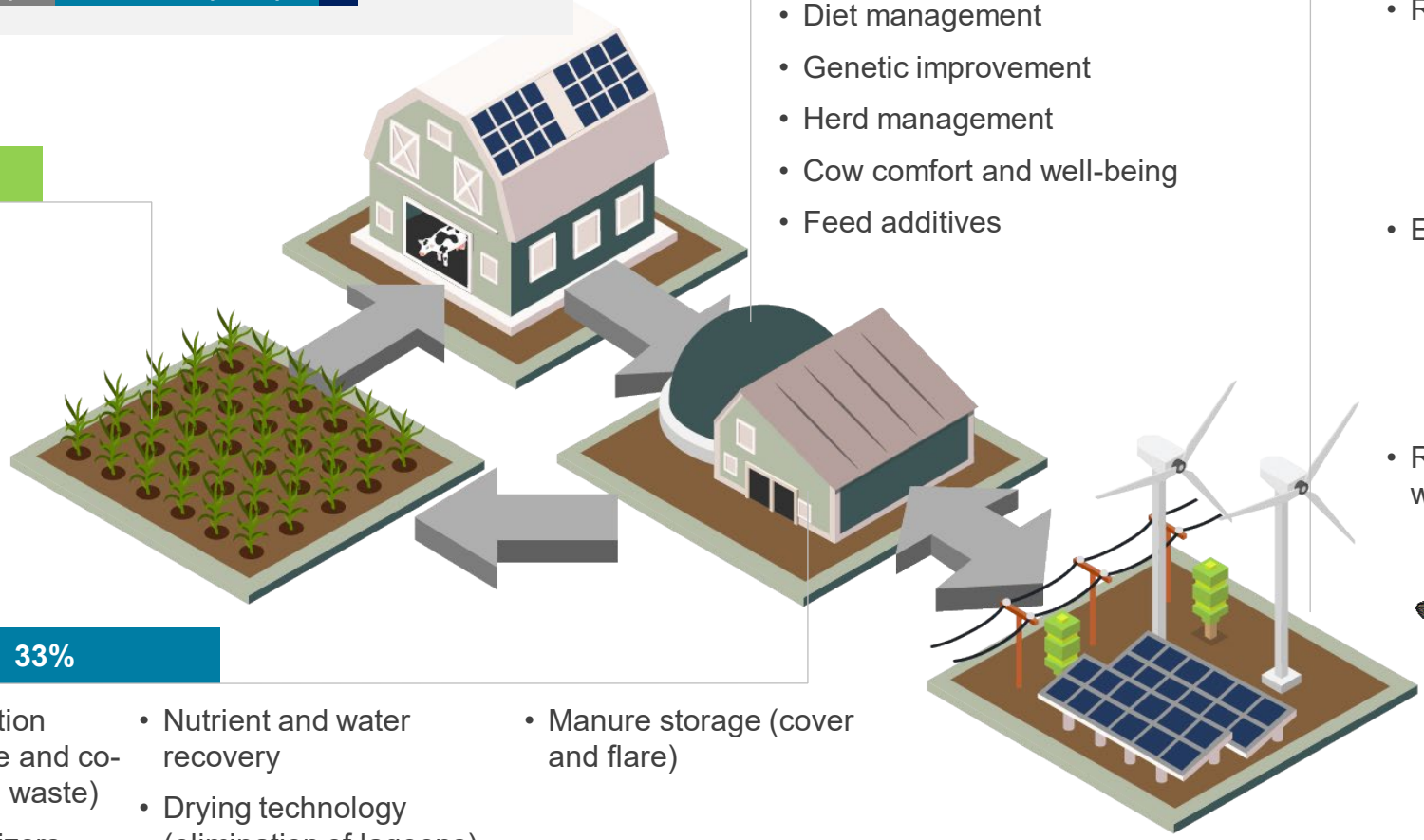
Feed (26%) | Enteric (35%) | Manure (33%) | – Energy (6%)

FEED 26%

- No/low-till farming
- Cover crops
- Nutrient management
- Precision agriculture
- Water use efficiency

ENTERIC METHANE 35%

- Diet management
- Genetic improvement
- Herd management
- Cow comfort and well-being
- Feed additives



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- Renewable fertilizers
- Nutrient and water recovery
- Drying technology (elimination of lagoons)
- Manure storage (cover and flare)

ENERGY 6%

- Renewable energy:
  - Renewable electricity
  - Renewable natural gas
  - Renewable energy from wind and solar sources
- Energy efficiency:
  - LED lighting
  - Variable speed pumps
  - Milk pre-cooling technology
  - Soft start motors
- Replacement of fossil-fueled engines with electric motors

= 1

Assessing a Dairy's Impact

Estimated GHG contribution of each "print" to the total*:

Feed (26%) | Enteric (35%) | Manure (33%) | – Energy (6%)

FEED 26%

2.9

- No/low-till farming
- Cover crops
- Nutrient management
- Precision agriculture
- Water use efficiency

ENTERIC METHANE 35%

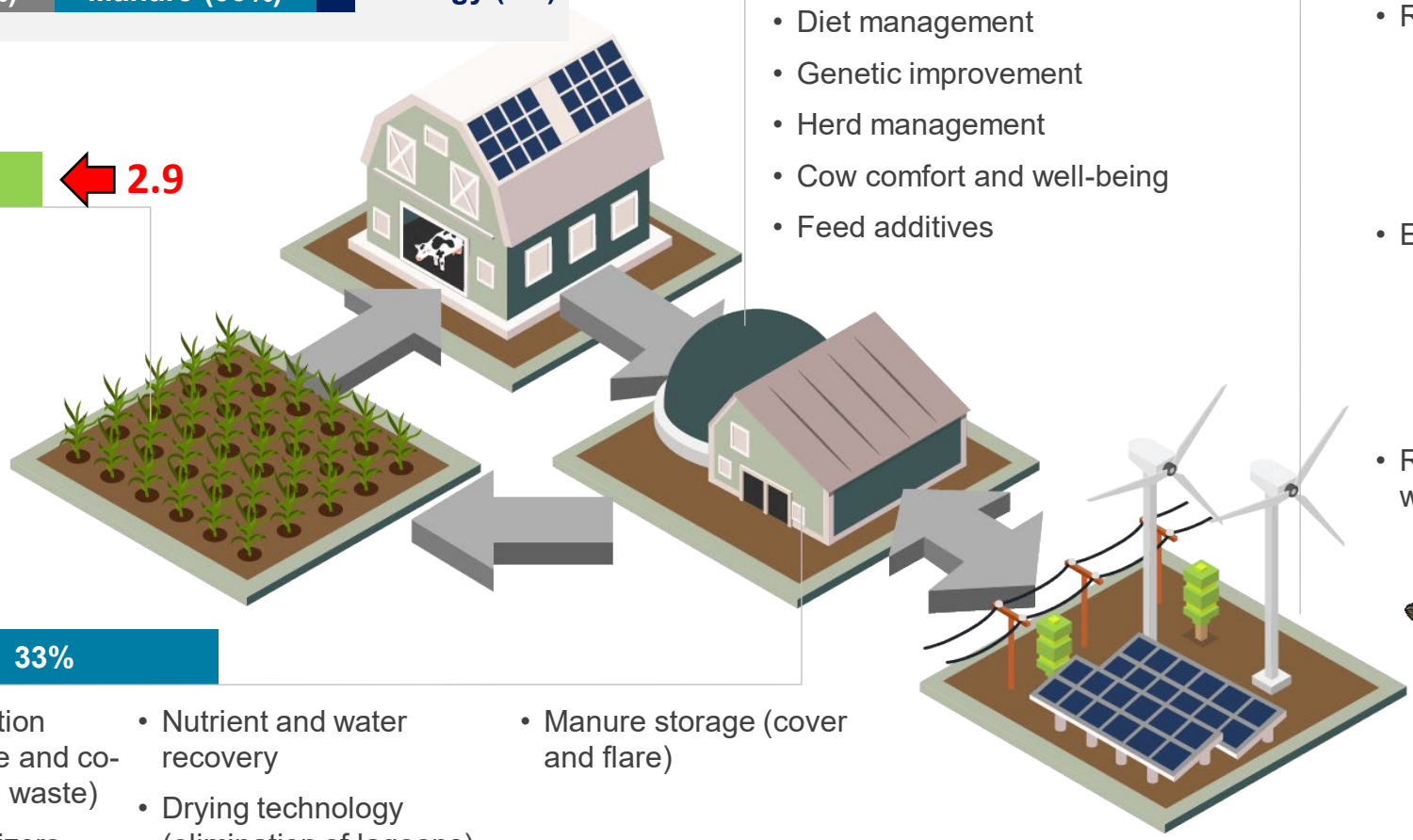
3.9

- Diet management
- Genetic improvement
- Herd management
- Cow comfort and well-being
- Feed additives

ENERGY 6%

.7

- Renewable energy:
  - Renewable electricity
  - Renewable natural gas
  - Renewable energy from wind and solar sources
- Energy efficiency:
  - LED lighting
  - Variable speed pumps
  - Milk pre-cooling technology
  - Soft start motors
- Replacement of fossil-fueled engines with electric motors



MANURE 33%

3.7

- Anaerobic digestion (includes manure and co-digestion of food waste)
- Renewable fertilizers
- Nutrient and water recovery
- Drying technology (elimination of lagoons)
- Manure storage (cover and flare)

= 11.1

Assessing a Dairy's Impact

Estimated GHG contribution of each "print" to the total*:

Feed (26%) | Enteric (35%) | Manure (33%) | – Energy (6%)

4 ENTERIC METHANE 35%

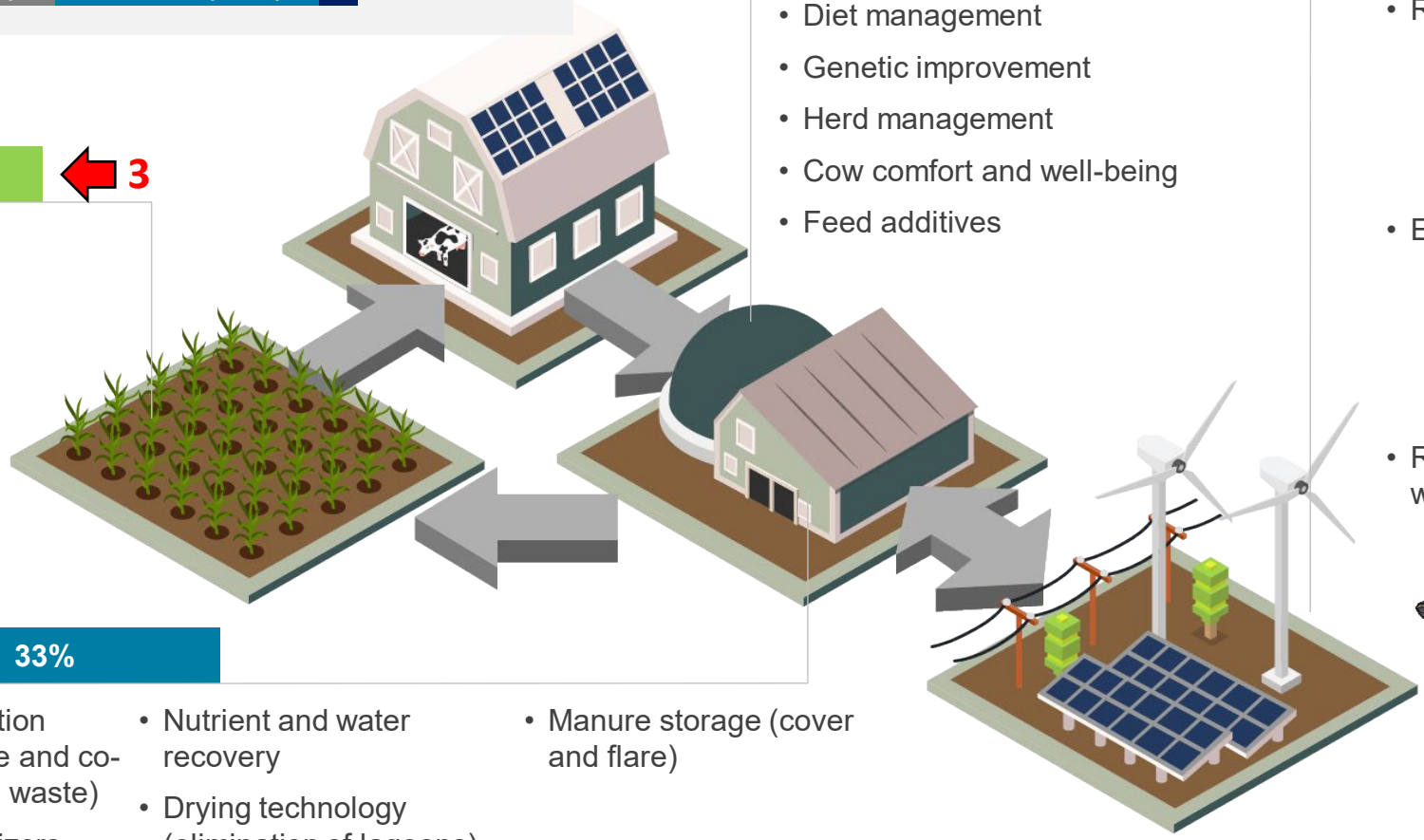
- Diet management
- Genetic improvement
- Herd management
- Cow comfort and well-being
- Feed additives

1 ENERGY 6%

- Renewable energy:
  - Renewable electricity
  - Renewable natural gas
  - Renewable energy from wind and solar sources
- Energy efficiency:
  - LED lighting
  - Variable speed pumps
  - Milk pre-cooling technology
  - Soft start motors
- Replacement of fossil-fueled engines with electric motors

FEED 26% 3

- No/low-till farming
- Cover crops
- Nutrient management
- Precision agriculture
- Water use efficiency

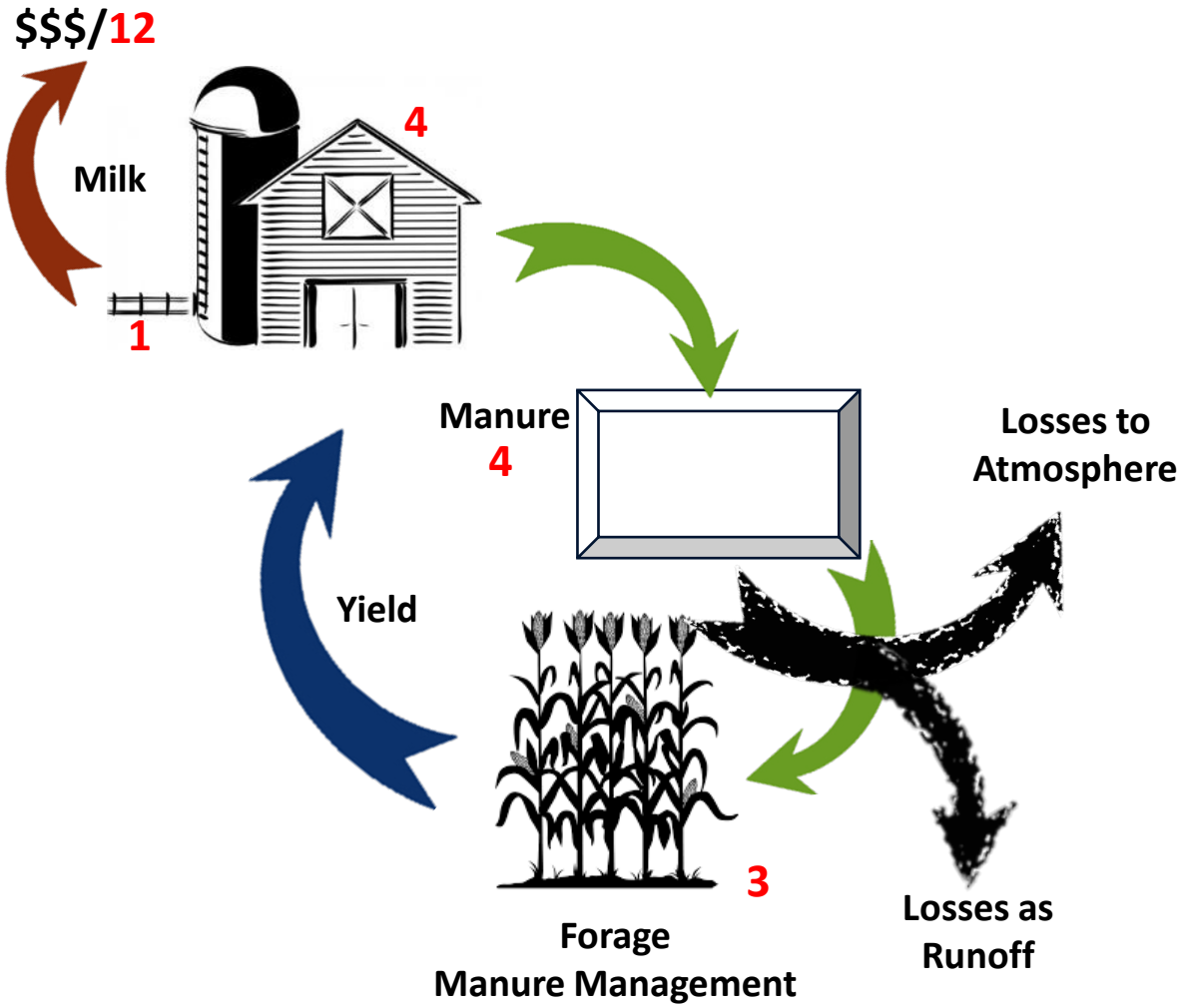


4 MANURE 33%

- Anaerobic digestion (includes manure and co-digestion of food waste)
- Renewable fertilizers
- Nutrient and water recovery
- Drying technology (elimination of lagoons)
- Manure storage (cover and flare)

= 12

Transforming the Use of Manure



Current State

Manure is being generated and reapplied in its raw form in pursuit of nutrient balance and for an expected crop yield.

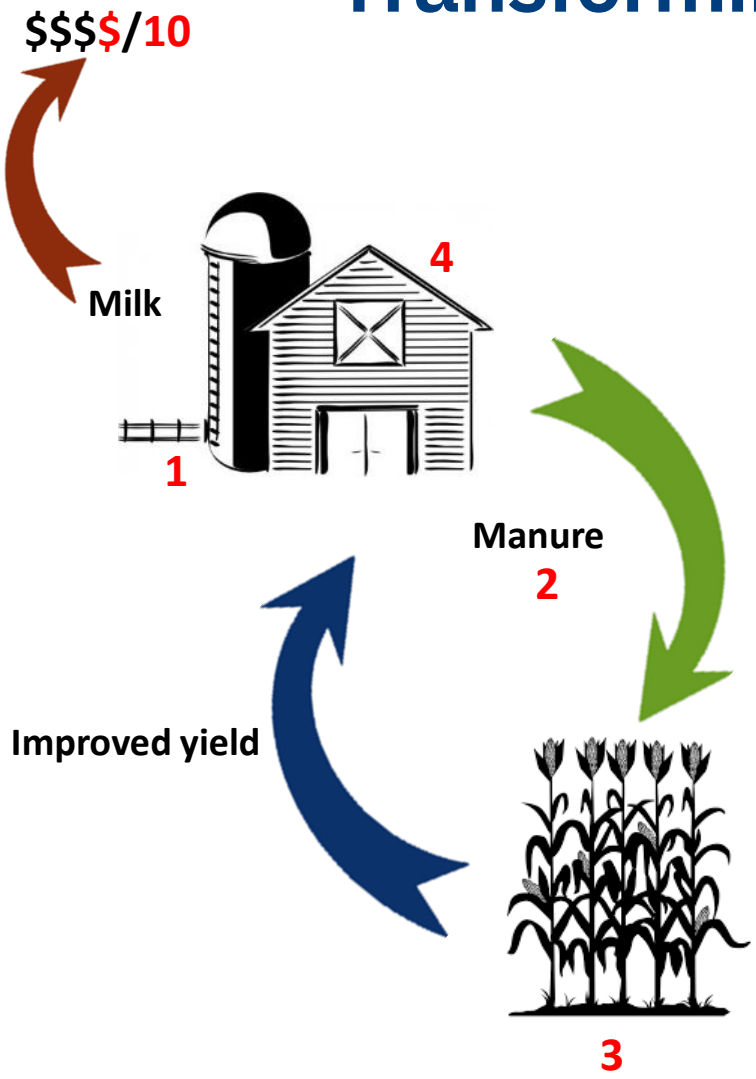
All manure application rates are adjusted for “normal“ fugitive nutrient losses to achieve these yields.

Without proof of that nutrient balance, there is always a tension between nutrient needs and the need to manage the ever-growing supply of manure.

This creates an increased use of commercial fertilizer, an uncertain regulatory environment, it undermines consumer and community trust and places a potential burden on the environment.

We have the technology to improve this situation and solve these problems

Transforming the Use of Manure

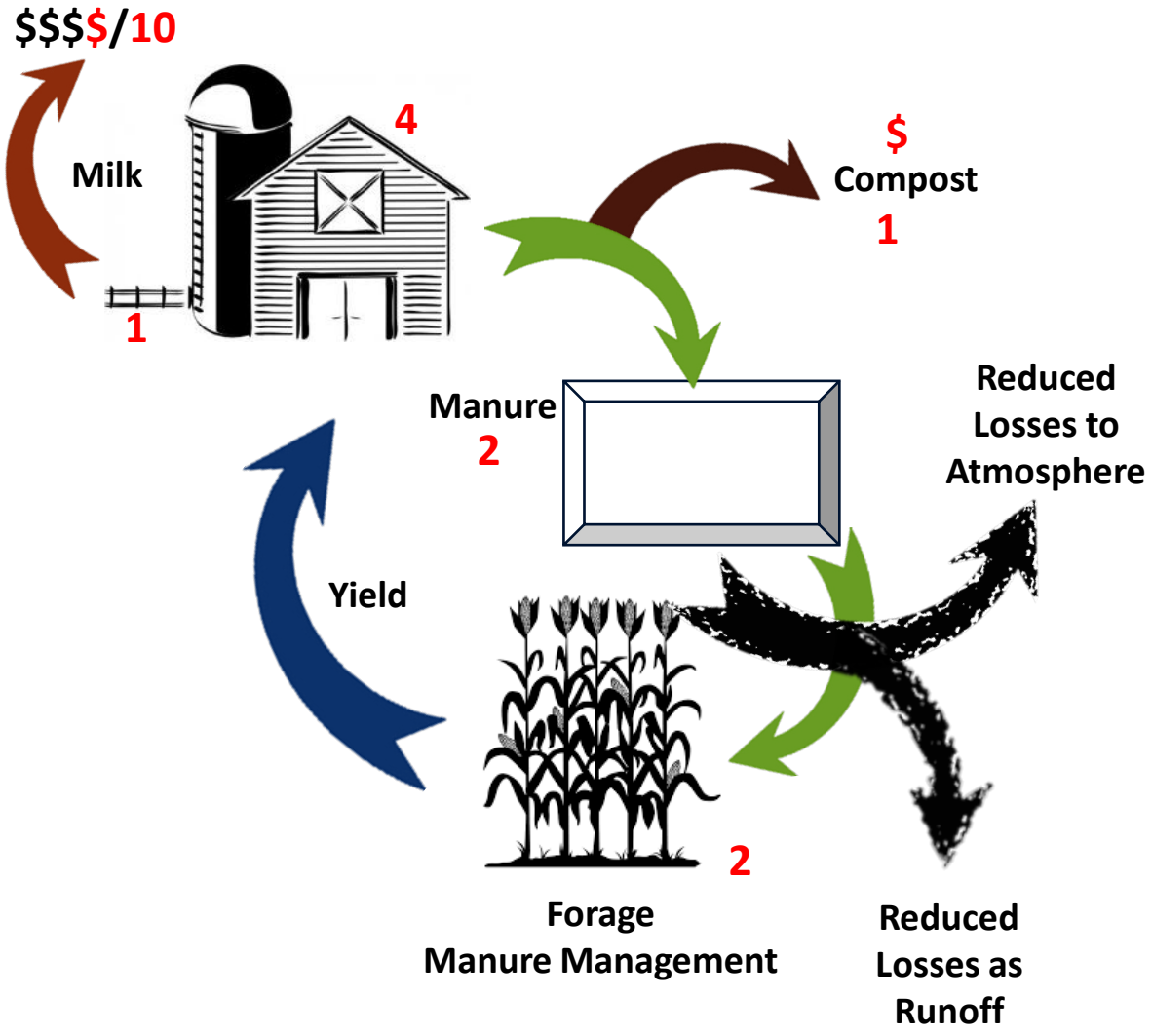


Healthy soils
Water management benefits
Less commercial fertilizer
No external discharge

Simplest Internally Balanced System

- No loss of valuable nutrients
- Regulatory certainty
- Enhance the reputation of dairy and dairy farming
- Grow consumer and community trust
- Enhance the natural environment

Transforming the Use of Manure



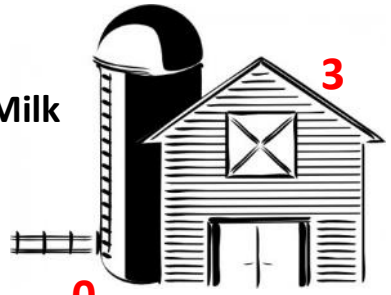
Simple Balanced System with Simple External Product

Healthy soils
Water management benefits
Less commercial fertilizer
No external discharge

Transforming the Use of Manure

$$$$$/0

Milk

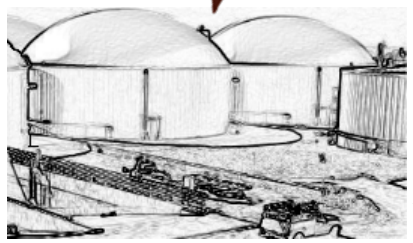


3

0

Manure

0



$$

Electricity
Natural Gas
Heat

-3

Future State

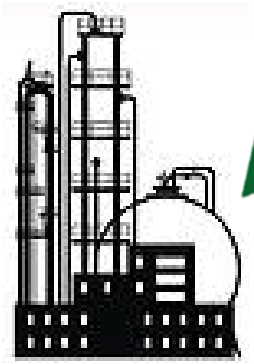
Balanced fields

Leveraged energy value

Leveraged value-added products

Leveraged environmental attributes

1



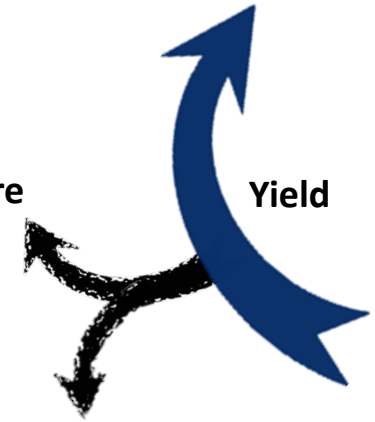
Fertilizer
Products

-1

$$

Products
Credits

0



Yield

Minimal
Losses to
Atmosphere

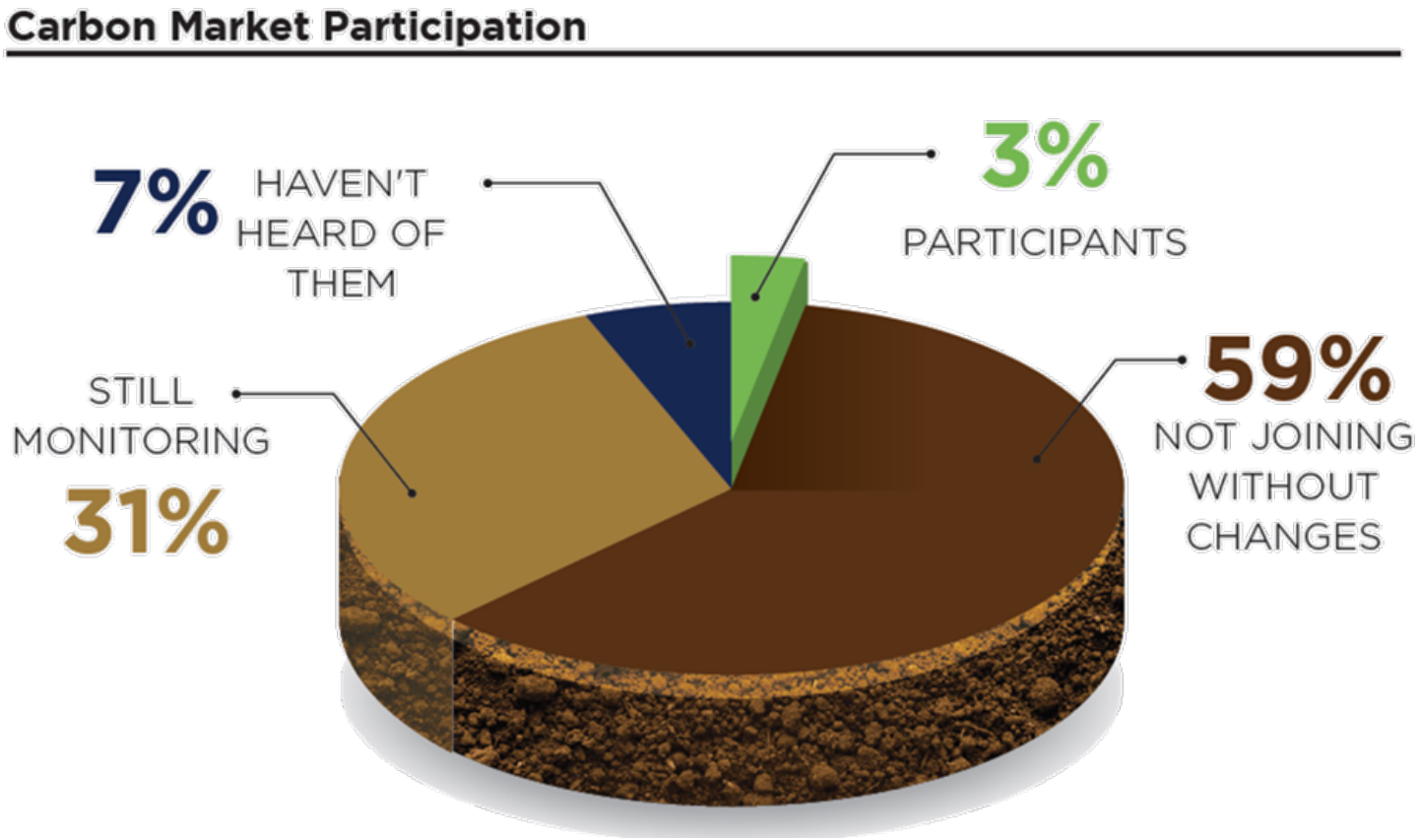
Minimal
Losses as
Runoff

So, what are the challenges today?

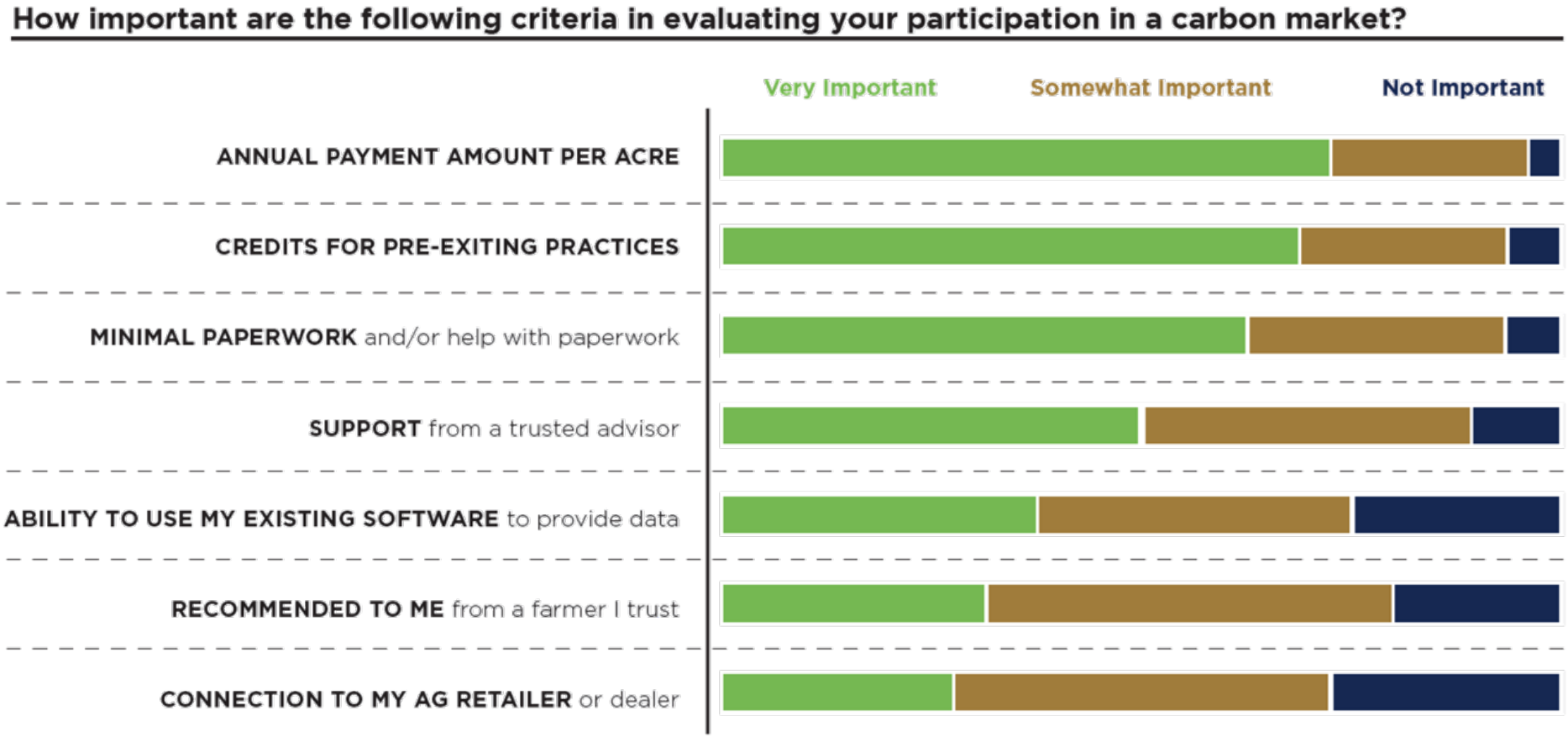
NEWTRIENT™

Not all Farmers are Ready to Engage

97% OF FARMERS SURVEYED AREN'T YET READY TO PARTICIPATE IN CARBON MARKETS, ALTHOUGH 93% ARE AWARE THEY EXIST.



What Do Farms Want from Carbon Markets?



Carbon Markets are Promising, but Not a Silver Bullet

- Complex to navigate
- Inconsistent funding
- Need to stack together multiple benefits on the farm
- Growing credibility within programs
- Criticism of environmental benefits within environmental groups

Little Consistency in Approach

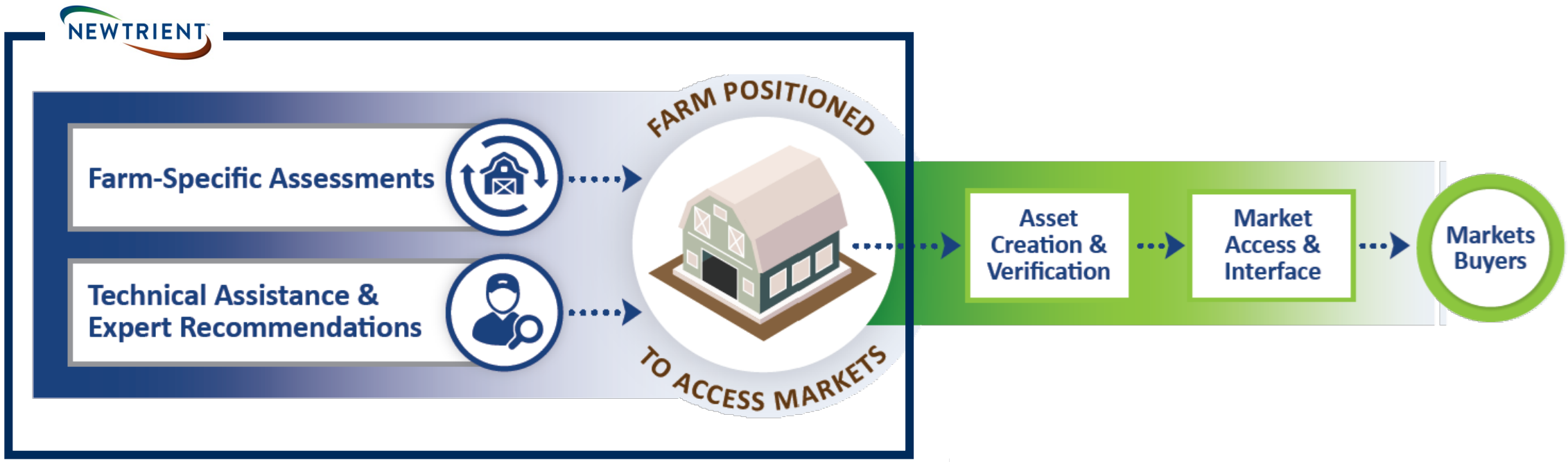
- No universal, precise measure of reductions, captures, etc.
- Contract duration
- Acreage minimum
- Lookback period
- Stacking with government programs (e.g., cost-share)
- Targeted buyers
- Product linkages
- Data control and privacy

Overcoming the Challenges

NEWTRIENT™

NEWTRIENT'S FOCUS

Newtrient's Standardized Approach to Farm Assessments



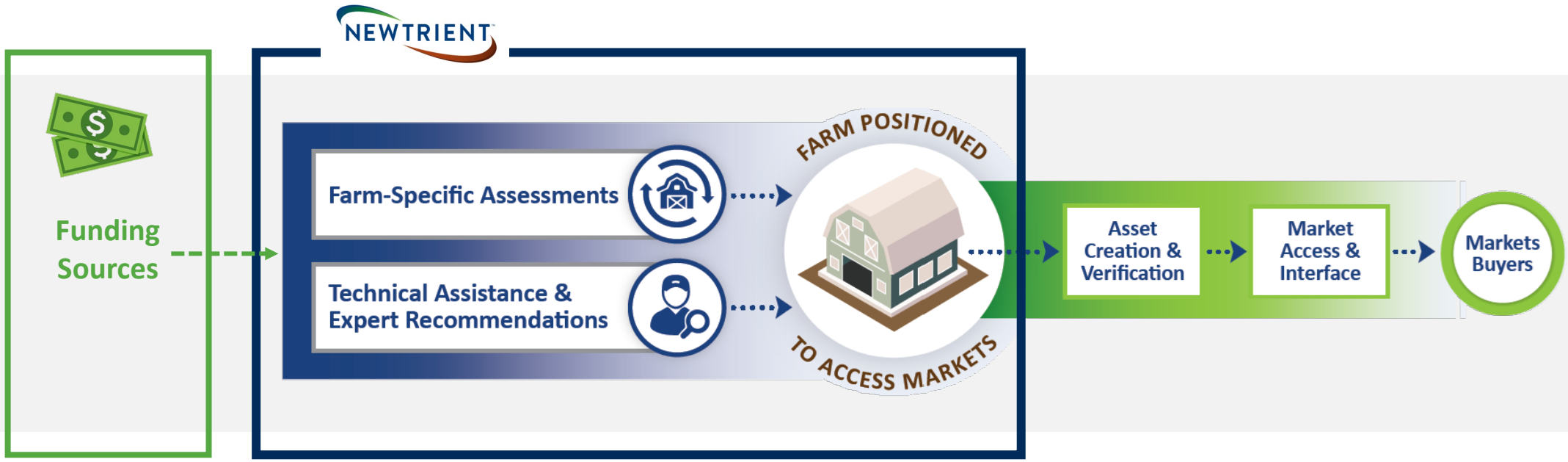
Farm-Specific Assessments

A qualified greenhouse gas (GHG) baseline assessment of the dairy farm's current state, including practices and technologies used on the farm. Assessments will address the total farm GHG footprint, including enteric methane, manure and energy, in addition to practices associated with feed production.

Technical Assistance & Expert Recommendations

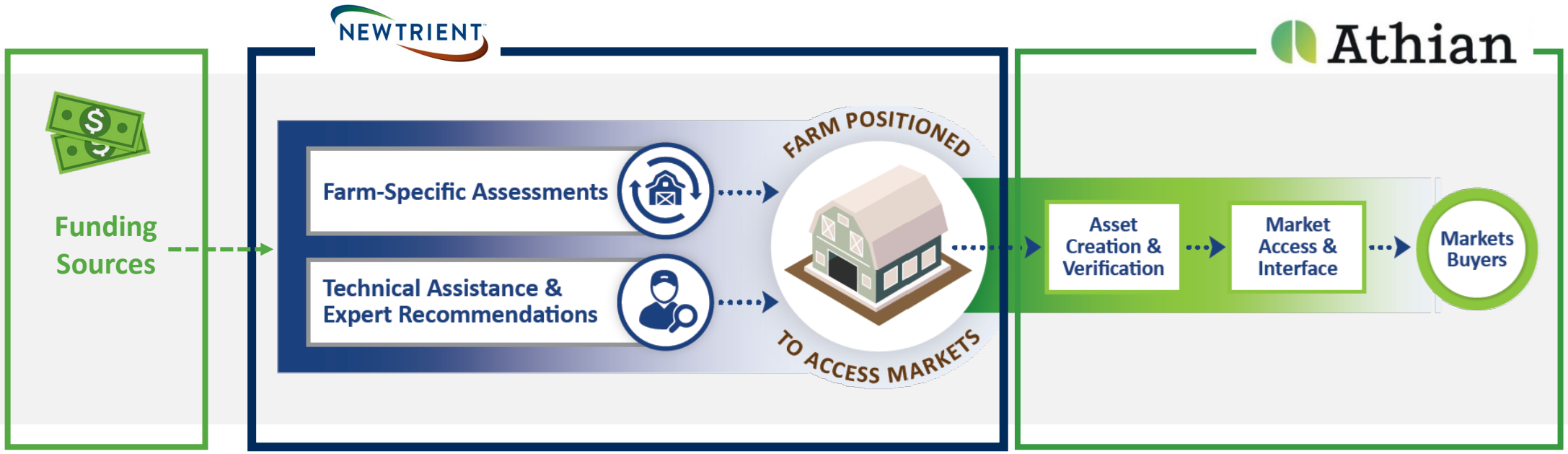
A farm-specific plan with recommendations on climate-smart practices that are economically viable to reduce the GHG footprint.

Scaling Solution Constrained by Funding Sources & Available Markets



Preferred Assessment Tool

Newtrient Overcomes Constrained by Finding Funding Sources & Access to Markets

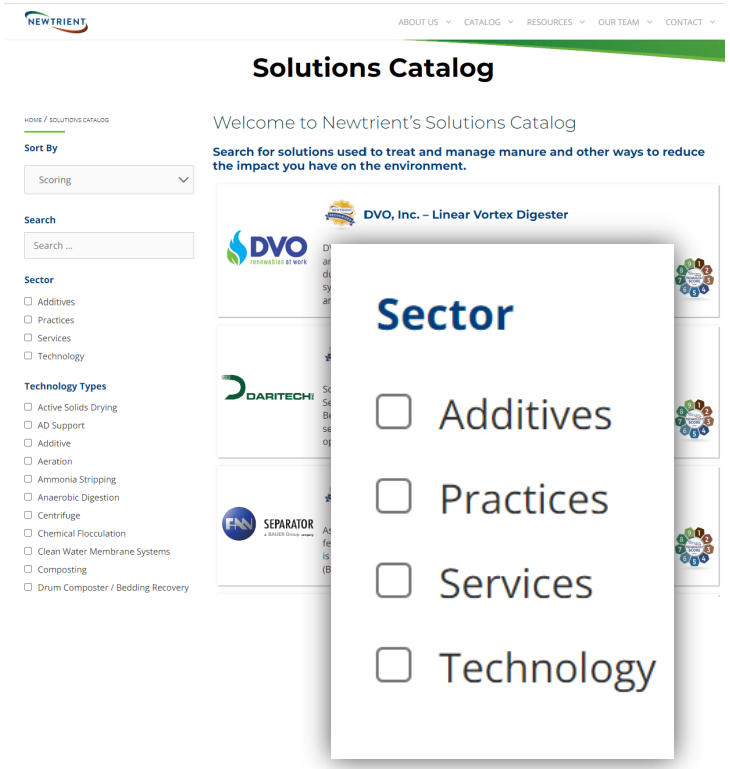


Preferred Assessment Tool

Contact Us

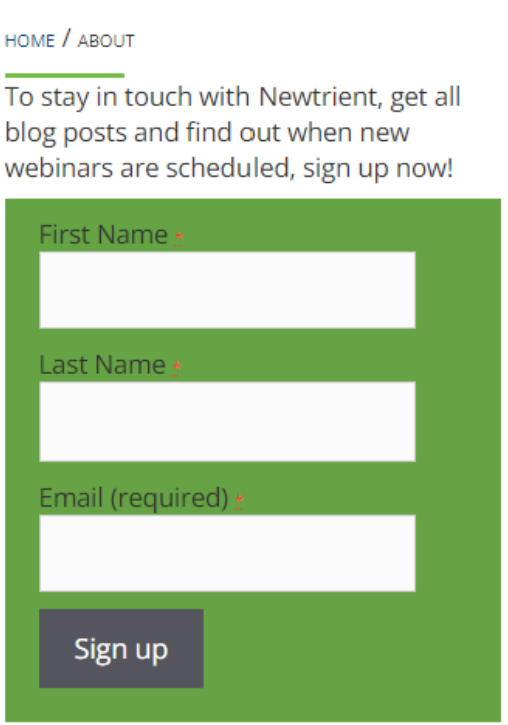
OUR RESOURCES

SOLUTIONS CATALOG



WEBINARS

NEWSLETTER



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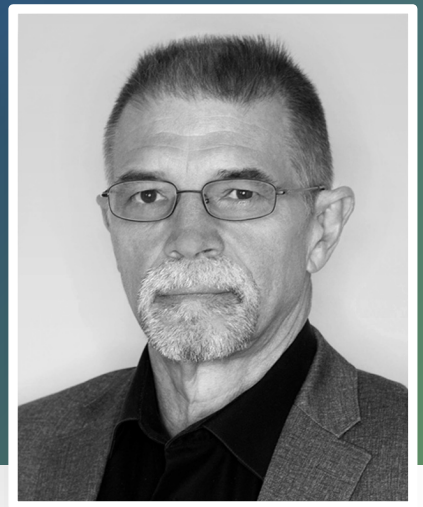

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Questions?