Too Many? Not Enough? Costs and Opportunities

Mike Overton | Zoetis | michael.overton@zoetis.com

Notes:

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COSTS AND OPPORTUNITIES ASSOCIATED WITH DAIRY REPLACEMENT HEIFER INVENTORY

Michael Overton
Zoetis Animal Health

Steve Eicker
King Ferry, New York

zoetis

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Introduction

- Replacement rate, (also commonly called "cull rate" or "herd turnover") is a very controversial subject
- In most dairies, youngstock development for replacement typically ranks as the 2nd or 3rd largest variable cost
- Consequently, producers and consultants tend to focus on this large *explicit* cost and conclude that the goal should be to lower herd turnover as much as possible
  - i.e., they overlook the lost opportunity cost of this decision
- Terminology refresher:
  - Explicit Cost (or Direct Cost):
    - Tangible, out-of-pocket payment; Expenses paid
    - E.g. the rent a dairy pays for an off-site heifer pasture
  - Implicit Cost:
    - Opportunity cost; hidden, non-monetary cost that is difficult to quantify well
    - E.g. rent your neighbor could have made by renting pasture to you but instead houses his wife's horses on it

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However, a Few Things to Consider:

- Excessive focus on the explicit cost of heifer programs while ignoring potential lost opportunity cost of failing to appropriately replace less profitable cows may result in incorrect decision making and reduced whole herd profitability
  - Raising fewer heifers → Lower replacement rate → Lower explicit cost
  - But likely higher implicit cost due to reduced future milk production
- Using cost ranking to prioritize spending cuts is inappropriate. Feed cost is the single largest variable cost. That does not imply that a dairy should feed every other day feeding to save money…
- Spending should be prioritized based on ROI, risk, time-frame, and cash flow

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Definition of Cull Rate and Replacement Rate:

Assuming a stable herd size:

- **Cull Rate (or Herd Turnover):**

  (# Sold + # Died)/Avg # Milking and Dry (all within the same 12-month period)

  EVENTS\5S SOLD DIED for LACT>0 *(numerator)*

  ECON\ID *(denominator)*

  OR

- **Replacement Rate:**

  # 1st time Calvings /Avg # Milking and Dry (all within the same 12-month period)

  COUNT FDAT>-365 LACT=1\B *(numerator)*

  ECON\ID *(denominator)*

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Comparison of Calculation Approaches

	# Fresh	Replacement Rate (Fresh)	Avg Milking and Dry (Year)
Dairy 1	596	35%	1714
Dairy 2	1308	36%	3627
Dairy 3	1649	39%	4214
Dairy 4	771	35%	2185
Dairy 5	620	32%	1940
Dairy 6	1036	37%	2805
Dairy 7	1411	44%	3197
Dairy 8	361	37%	984
Average/Total	7156	38%	18952

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Comparison of Calculation Approaches

	# Fresh	Replacement Rate (Fresh)	Cull Rate (Sold & Died)	# Sold or Died	Avg Milking and Dry (Year)
Dairy 1	596	35%	43%	743	1714
Dairy 2	1308	36%	45%	1620	3627
Dairy 3	1649	39%	40%	1695	4214
Dairy 4	771	35%	36%	781	2185
Dairy 5	620	32%	32%	612	1940
Dairy 6	1036	37%	36%	1001	2805
Dairy 7	1411	44%	40%	1264	3197
Dairy 8	361	37%	24%	238	984
Average/Total	7156	38%	38%	7211	18952

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Comparison of Calculation Approaches

	# Fresh	Replacement Rate (Fresh)	Cull Rate (Sold & Died)	# Sold or Died	Avg Milking and Dry (Year)	Avg Milking and Dry (Last Month)	% Change
Dairy 1	596	35%	43%	743	1714	1650	-4%
Dairy 2	1308	36%	45%	1620	3627	3520	-3%
Dairy 3	1649	39%	40%	1695	4214	4190	-1%
Dairy 4	771	35%	36%	781	2185	2190	0%
Dairy 5	620	32%	32%	612	1940	1970	2%
Dairy 6	1036	37%	36%	1001	2805	2830	1%
Dairy 7	1411	44%	40%	1264	3197	3300	3%
Dairy 8	361	37%	24%	238	984	1040	6%
Average/Total	7156	38%	38%	7211	18952	19040	0%

Notice → calving an insufficient number of heifers relative to the number Sold or Died resulted in reduction in herd size

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Replacement Rate is a Balancing Act… Driven by Heifer Availability

- Dairy operations are often viewed incorrectly as negative pressure systems, i.e., cows get sick or die and when they leave the herd, that "pulls" a heifer into the dairy
  - But having a cow suffer a major health event today does not retrospectively cause a replacement heifer to get pregnant 9 months previously
- Assuming a stable herd size, dairies operate as a positive pressure system, i.e., as heifers calve and enter the herd, cows can be replaced

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Replacement Rate is a Balancing Act… Driven by Heifer Availability

- To put it another way… herds "plan" for a "maximum" level of turnover based on how many heifers are raised (assuming no purchases)
- Cows that can, and should be culled:
  1. Dead cows
  2. Incurable or chronic disease issues
  3. Cows that fail to become pregnant
  4. Cows affected by disease leading to reduced production
  5. Poor producers but otherwise healthy
  6. Genetics (heifers +/- cows)

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Culling and Replacement is About Improving the Herd

- Expected or predicted quality of incoming heifers should impact replacement decisions
- Once the obvious biologic failures on the cow side have been replaced, there is usually an opportunity to "upgrade" the dairy via "selective replacement"
  - If numerous heifers are available → more cows *could* be replaced (but not necessarily)
    - If heifer quality is excellent → more cows should be replaced
    - If heifer quality is poor → fewer cows should be replaced
  - If inventory is inadequate, alternative plans need to be made
    - Either heifers must be purchased, or cull cows retained longer

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YES – Turnover Can be Expensive

Estimated Net Herd Replacement Cost/d in Milking and Dry Herd

Replacement Cost	Whole Herd Replacement Rate 31.0%	34.0%	37.0%	40.0%	43.0%	46.0%
$1,600	$0.82	$0.90	$0.97	$1.05	$1.13	$1.21
$2,000	$1.21	$1.33	$1.44	$1.57	$1.69	$1.82
$2,400	$1.59	$1.75	$1.92	$2.08	$2.25	$2.43

- Underlying assumptions:
  - Market cow value = $0.82/lb
  - Average mortality risk = 6%
  - Average condemnation risk at time of slaughter = 7%

No surprise, higher turnover and/or higher replacement heifer cost → higher cost/d for replacement. **But…** this is not the whole story

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Before Proceeding → Brief Overview of A New Economic Model Used Throughout this Presentation

- A spreadsheet-based economic model was built to mimic the major variable costs and revenue streams associated with milking and dry cows from first calving until removal from the herd (up to 10 lactations)
- Imagine building a hypothetical herd:
  - Year 1:
    - Original group (A) of heifers calve for first time and enter lactation (Lact=1)
    - Some get culled but most survive to the next lactation
  - Year 2:
    - Survivors of the original group now becomes Lact=2
    - New group (B) calves for the first time and enter lactation
  - Year 3:
    - Survivors of original group A now become Lact =3
    - Survivors of group B become Lact=2
    - New group (C) calves for first time and enter lactation
  - Process continues

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Economic Model Overview, Continued

- Parity-specific risks, costs, and milk production are modeled and adjusted to a Net Present Value (NPV) at time of first calving using 7% cost of capital:
  - Replacement risk (died, sold with revenue, or sold but condemned)
  - Market cow weight and value
  - Cumulative ECM production and length of lactation for cows removed vs cows that are retained (go dry)
  - Dry period length
  - Calf revenue realized after removing stillbirths, based upon calf type (dairy bull, dairy heifer, or beef cross)
  - Projected transition cow disease costs and management costs (preventive management inputs such as dry cow tubes, vaccines, additives, etc.)

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Model Outcome (and Economic Concept Used in this Presentation): Income over Cost (IOC)

- Similar to IOFC (income over feed cost) but IOC goes a bit further:
  - (Milk + Wet Calf Revenue) – (Feed + Dry Cow + Transition + Replacement Cost)
  - IOC is first tabulated as a Lifetime Value
    - A cohort of animals enter the "herd" and experience lactation-specific production, reproduction, culling risks
    - Lifetime production (and costs) are adjusted back to a net present value as of the day of calving
  - Then, IOC is converted:
    - Average Value/d (Lifetime Value/# days in adult herd)
    - *Annualized Value* (Average value/d * 365 d)

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Examining the Relationship Between Replacement Rate and Milk Production on IOC*

Relative Milk Production	Herd Replacement Rate 34%	37%	40%	43%
2% Below Average	$2,284	$2,249	$2,207	$2,161
Average Cow	$2,364	$2,329	$2,288	$2,242
2% Above Average	$2,443	$2,409	$2,368	$2,322

A higher replacement rate is costly IF production does not change

- Increasing RR can be valuable if culling and replacement yields a higher level of production
- Reducing RR can result in lower revenue if low producing cows are retained or if replacement is delayed

*IOC = (Milk & calf revenue) – (Lactating & dry cow feed cost + Transition cost + Net Replacement cost)

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Striving for Continuous Improvement…

- *It is critically important to continue working to reduce the risk of cows losing sufficient value to **warrant** replacement!*
  - Reduce disease risk, improve repro, reduce lameness, etc.
  - Genetics, nutritional management, improve cow comfort, etc. are all important
- But, while we are doing all of that, let's also continue focusing on making good economic decisions to improve profitability
- Remember, the question that we need to continuously ask ourselves…

  "Is the immediate and long-term value of *THIS* **slot** improved by keeping the current cow or by replacing her with a fresh heifer?"
- Increasing replacement rate *can* improve profitability…

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Net Replacement Cost for a Cow

- If we approach a cow like a loan:
  - Interest rate: 7%
  - Number of months of payments: (1/RR)*12
    - 37% RR → 1/.37 = 2.7 yr * 12 mo/yr = 32 months
  - Amount of loan (fresh heifer cost):$2200
  - Future (residual) value = NPV of net salvage value (minus dead/condemned)
    - Projected market value today = $960
    - Projected losses:
      - 5% mortality/year over 2.7 years = 13%
      - 5% condemnation risk at time of slaughter
    - Future market value after losses =$836
      - NPV in 2.7 years of $836 = $696
  - ($2200 - $696)/(2.7*365) = $1.52/d of productive life

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Net Replacement Cost vs. Marginal Milk

- In the previous example, replacement cost = $1.52/d
- 2.7 years minus 2 dry periods = 875 days → $1.72/d of lactation
- If milk = $0.20/lb and feed = $0.14/lb dry matter → marginal milk value = $0.14/lb of milk
  - 12 lb marginal milk/d of lactation to pay the animal's cost
- So, how much more milk is need if RR = 40% vs. 37%?
  - Using similar assumptions → $1.86/d of lactation
  - 13 lb marginal milk/d of lactation
  - 1 extra lb of milk/d of lactation
- Don't you think that if you selectively removed a few more poorly performing cows, herd average would go up > 1 lb/day???

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Raising a Few More Heifers → More Options

- More heifers → More Options
  - Calving more heifers → opportunity to selectively remove poor quality heifers from inventory based on genomic testing early in life *BEFORE* investing heavily in raising
  - More *potential* replacement of the cow herd:
    - Can be a good thing if each animal is evaluated individually (i.e., not all replacement heifers deserve to become a milking cow)
      - Chance to "upgrade" a cow slot with a better animal
    - Can be a bad thing
      - Costly to raise replacements
      - Reduces the number of beef-cross calves produced
      - *Blindly* adding an animal simply because you raised her, and she represents the next generation (holds promise) is a bad thing

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CAUTION! Not Raising Enough Replacements Can be a HUGE Mistake

- Raising fewer heifers → saves cash flow now but can hurt long term profits
- If a herd with a 39% replacement rate "decides" to raise only enough heifers to support a 35% replacement rate, they are "deciding" to retain cull cows longer (assuming that no management changes occurred that truly changed replacement risk)
- 39% → 35% replacement rate due to insufficient heifers…
  - Now, the average market cow is retained ~ 100 days longer
  - Under current conditions, miking these less productive cows longer than optimal results in lost opportunity of approximately $150-$200 or more per delayed replacement

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Question for every producer…

- At what production level should a healthy, "Do Not Breed" cow be replaced?
- i.e., how many pounds of milk should a cow be producing to still be considered "good enough to keep in the herd"?

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Replacement Timing for a Designated Cull Cow

	Unit	Current Cow	Replacement
Projected 305d Milk (lactation = 1)	Lb	xxx	22,500
Milk /day (lact=1, then lifetime incl dry)	Lb	65.0	72.8
Milkfat	%	4.1%	3.9%
Protein	%	3.3%	3.2%
Milk price	Lb	$0.233	$0.224
Annual herd turnover	%		39%
Expected productive life	Yrs		2.6
Annual mortality risk	%		5%
Interest rate	%		7%
Beef value/unit body weight	Lb	$0.80	
Condemnation risk at culling	%	7%	
Current cost or market value/cow		$1,063	$2,400
Time discounted net salvage value			$877
Projected replacement cost, $/day			**$1.98**

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Projected replacement cost, $/day			**$1.98**
Maintenance (+ growth) feed/day	Lb	23.0	23.0
Marginal milk feed factor	Lb	0.45	0.43
Dry Matter Intake/day	Lb	52.0	54.4
Feed Cost	Lb	$0.140	$0.140
Feed Cost/cow/day		$7.28	$7.62
Income over feed and variable cost/cow/day		$5.56	$6.38
IOFC & VC (includes 100% of repl cost), $/day		**$5.56**	**$4.41**

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Dry Matter Intake/day	Lb	52.0	54.4
Feed Cost	Lb	$0.140	$0.140
Feed Cost/cow/day		$7.28	$7.62
Income over feed and variable cost/cow/day		$5.56	$6.38
IOFC & VC (includes 100% of repl cost), $/day		**$5.56**	**$4.41**
Decline in milk/day	Lb	0.18	
Absolute Breakeven milk (empty stall)	Lb	32.5	
Days to absolute breakeven	Days	181	
Target level of milk/ for replacement	Lb	**58.3**	
Days until target level milk is reached	Days	37	
IOFC & VC from today to Target day, $		**$21**	
Lost IOFC & VC if sold at absolute breakeven milk		**-$316**	

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At 0.18-lb decline/d for each additional day of delay in replacement, there is an average lost opportunity of $1.75/d

-$316/181 d = -$1.75

-$1.75 * 100d = -$175/market cow due to delayed replacement

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Projected Milk Production (i.e. "Quality") of Incoming Replacements Influences When Cows Should be Replaced

Milk production level for targeted replacement of DNB cows:

		Projected 305 Milk for Lact=1 (lb)						
		18,000	19,000	20,000	21,000	22,000	23,000	24,000
Milk Price/Lb	$0.17	34	36	39	41	43	45	48
	$0.18	38	40	43	45	48	50	53
	$0.19	42	44	47	50	52	55	58
	$0.20	45	48	51	54	57	60	62
	$0.21	49	52	55	58	61	64	67
	$0.22	53	56	59	63	66	69	72
	$0.23	56	60	63	67	70	74	77

Other important variables other than incoming heifer quality:
- Replacement cost
- Beef value
- Expected turnover risk
- Feed cost

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Producing a "Better-Quality" Heifer

- "Better-quality" means:
  - Higher genetic potential
  - Closer to mature size at calving (both height and weight)
    - Assuming ~725 kg mature weight (Holstein):
    - 92-95% of mature body weight (~675 kg or 1490 lb) pre-calving
    - 1st Post-calving wt: 82-85% of MBW (~600 kg or 1350 lb)
    - 95% of mature height at calving (~1.4 m or 55")
  - Timely: older heifers means greater lost opportunity cost
  - Fewer calfhood health issues that may carry over to impact future productivity

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Why is it SO Important that Heifers are Grown Better PRIOR to First Calving?

- Cows don't typically reach their mature size until ~ 4th lactation
- If heifers weigh 82-85% of mature weight after calving (~1350-1375 lb), much less growth is required in first lactation
- Consider the following derived from published research[1]:
  - Holsteins calved at ~ 1225 lb
  - Over the course of a 305-d of lactation:
    - ~7% of energy consumed went to growth (200 lb)
    - Represents sufficient energy to support ~ 2,100 lb milk
  - Imagine if the calving weight had been 1325 lb and half of the energy consumed could have been diverted to milk instead of growth ➔ represents ~ 1000 lb more milk during first lactation

[1]Olson, K., et al. (2010). Energy balance in first-lactation Holstein, Jersey, and reciprocal F_1 crossbred cows in a planned crossbreeding experiment. *Journal of Dairy Science*. 93(9), 4374-4385.

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What is the Value of Producing a "Better" Heifer?

- A retrospective analysis of farm data project was conducted to help investigate the "lifetime" value of improving heifer quality
- Data from heifers that calved for the first time in 2017-2018 for two Holstein dairies were used
  - These two dairies were chosen because they had genomic test results AND animal weights recorded at 1-3 d after first calving
  - To be included, each animal had to have the following info:
    - Projected 305d milk (NOT mature equivalent)
    - 1st calving weight (within 1-3 days of first calving)
    - Genomic test results
  - These animals were followed through 4 lactations

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Modeled 305M in Various Ways for Lactations 1-3

Multivariable regression was used to examine the relationship between key variables and net revenue (Income over Cost)

Questions to be answered:

- What factors are associated with 1st lactation 305M?
- What factors are associated with the difference from 1st lactation 305M to 2nd lactation?
- What factors are associated with the difference from 2nd lactation 305M to 3rd lactation?
- What factors are associated with the difference from 3rd lactation 305M to 4th lactation?
- **Goal was to be able to predict milk impact across the first 4 lactations as a result in changes in heifer "quality"**

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Key Economic Inputs Used in the Model

Replacement cost (Fresh Heifer value):			$2000
Market cow value: $0.65/lb		Interest (cost of capital):	7%
Lactating ration:	$0.14/lb DM	Dry cow feed cost/d:	$3.00
Dairy bull calf:	$35 (22%)	Dairy heifer calf:	$200 (45%)
Beef cross calf:	$150 (33%)	DOA risk (all calves):	4%
Component-based milk pricing (4% fat, 3.3% protein):			$0.20/lb
Transition management cost (preventive medicine):			$75
Weighted average transition disease cost/lactation:			$125

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Key Economic Outputs

- Net Replacement Cost/d:
  - (Replacement cost – NPV of net salvage value)/(# days in lactation + # days dry)
- Income over Cost (IOC) – similar to Income over Feed Cost (IOFC) but also includes other items:
  - (Milk + Calf Revenue) – (Feed + Dry Cow + Transition + Replacement Cost)
  - Reported as a Lifetime Value but converted to:
    - Average Value/d (Lifetime Value/# days in adult herd)
    - Annualized Value (Average value/d * 365 d)

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Results of the First Statistical Model: Predictors of Milk in *First Lactation*

- Standard Least Squares Means (LSM) model for prediction of 1st lactation 305M:
- Explanatory Variables:
  - Month of calving
  - Weight at 1st calving (lb)
  - Genomic PTA Milk
  - Age at 1st calving (d)
  - Weight at 1st calving (lb)^2
  - Genomic body size composite (BDC)

Age at First Calving (d) \ Weight at First Calving	1200	1250	1300	1350	1400	1450
650	20843	21227	21563	21853	22094	22289
675	20861	21245	21582	21871	22113	22307
700	20880	21264	21601	21890	22132	22326
725	20899	21283	21620	21909	22151	22345
750	20918	21302	21638	21927	22169	22364
775	20936	21320	21657	21946	22188	22382
800	20955	21339	21676	21965	22207	22401
Lb 305M per lb increase in weight at first calving	7.7	6.7	5.8	4.8	3.9	

For each additional day of age, 0.7 lb more 305M
- But, 1 day of extra raising cost >>> $0.09 to $0.10 more marginal milk value

For each lb of Genomic PTAM, 3 lb more 1st lactation 305M

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Summarization of Projected Value Across a Lifetime for Heifers Calving into These Herds

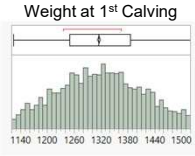
When accounting for the other variables:

- Age at first calving was NOT important:
  - Each additional day of Age at 1st Calving = -$0.03 in annualized IOC
- Size at calving was VERY important:
  - Each additional lb of weight at 1st calving = $0.41 in annualized IOC but varied by weight
  - 1200 → 1250 lb = $0.54/lb; 1400 → 1450 lb = $0.26/lb
  - Weight range for 90% of heifers:

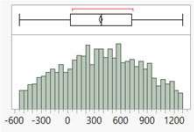
    1125 to 1520 lb = ~ $160 in IOC
- Genetics was MOST important:
  - Each additional lb GPTAMilk = $0.39 in annualized IOC
  - Range for 90% of heifers:

    -550 to 1300 = ~ $720 in IOC

Weight at 1st Calving



Genomic PTAMilk



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There is a lot of mention about "Lifetime Milk", But Just To Be Crystal Clear…

I am NOT Promoting More Lifetime Milk Per Cow as the *SOLE FOCUS*

- Improving the health, management and genetics such that animals have the ***capacity*** for greater lifetime milk is GREAT!
- BUT:
  - Lifetime productivity is a reasonable outcome to compare ONLY IF key inputs are held constant
    - i.e., parity-specific turnover
  - ***Greater net revenue per day per slot is a much better goal***
  - Growing better quality heifers and getting them into production sooner is much better than the alternative
  - Keeping animals in the herd longer as the ***sole*** focus increases lifetime milk but will reduce herd profitability

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Consider the Following Two Investment Options

- Option A:
  - Invest $10,000 today
  - In 5 years, you get back $20,000
- Option B:
  - Invest $10,000 today
  - In 3 years, you get back $17,716

Which option do you want?

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Two Investment Options

- Option A:
  - Invest $10,000 today
  - In 5 years, you get back $20,000
  - Rate of return = 15%
  - Lifetime profit = $10,000
  - Avg profit per year = $2000
- Option B:
  - Invest $10,000 today
  - In 3 years, you get back $17,716
  - Rate of return = 21%
  - Lifetime profit = $7,716
  - Avg profit per year = $2572

Assuming both options are available for renewal, which option do you want?

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Now, A Comparison of Two Heifer Options

- Option A:
  - Heifer cost of $1500
  - 1st calving:
    - 1275 lb @ 760 d
    - GPTAM of 25
  - Lact=1 305 M: 20,000 lb

Lact	Culling Risk	Milk/Lact (PREG & Ret)
1	20%	21297
2	26%	26330
3	34%	27102
4	38%	28484
5	41%	28861
6	44%	28697
7	48%	29377
8	49%	28084
9	60%	29759
10	100%	8486
	30%	**25283**

- Option B:
  - Heifer cost of $2200
  - 1st calving:
    - 1350 lb @ 710 d
    - GPTAM of 475
  - Lact=1 305 M: 23,500 lb

Lact	Culling Risk	Milk/Lact (PREG & Ret)
1	30%	25089
2	35%	29783
3	48%	29787
4	66%	30161
5	72%	30560
6	76%	30386
7	83%	31106
8	86%	29738
9	99%	31511
10	100%	7826
	40.0%	**27629**

Which option do you want?

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Comparison of Two Heifer Options

	Option A	Option B
Average ECM/DIM (ALL)	75	81
Total Projected Days (Milk + Dry)	1147	842
Projected lifetime milk (lb ECM)	75,300	60,800
Average IOC/Lifetime	$4,994	$3,738

- Which would you say is the winning option?

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Comparison of Two Programs

	Option A	Option B
Average ECM/DIM (ALL)	75	81
Total Projected Days (Milk + Dry)	1147	842
Projected lifetime milk (lb ECM)	75,300	60,800
Average IOC/Lifetime	$4,994	$3,738
Avg Projected Lifetime IOFC/DIM	$6.28	$7.37
Net Replacement Cost/Day	$0.72	$1.76
Avg IOC/Day	$4.35	$4.44
Annualized Average IOC	$1,589	$1,619

- Now, which would you say is the winning option?

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A Few Notes About Heifer Inventory

- Heifer inventory and "heifer completion rate" are two items that are often monitored by consultants
  - Crappy monitor (lag of 2 years); why not measure stages of heifer growth?
- But the statement – "you should not have more than X% of your herd as heifers" – is very problematic
- Heifer inventory (% of adult herd) is driven by several factors:
  - Reproductive rate of the herd
  - Type of semen used (sexed vs. conventional vs. beef)
  - Heifer management and removal practices (disease, death, selective culling)
    - Is 88% completion rate "better" than 80%???
    - Focus on the right things to measure → leading indicators + morbidity, mortality, fertility, etc.
- Excessively high inventory → costly; probably not optimal
- Too few replacements → we wait for cows to get lame, mast, sick, skinny, before they are replaced

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Estimated Heifer Inventory (live birth to calving) Expressed as % of Milking and Dry Cows

(Assumes 24 months age at first calving and creating "just enough" heifers)

Replacement Rate	% of Heifers Born Alive that Actually Calve				
	70%	75%	80%	85%	90%
33%	80%	77%	74%	72%	70%
37%	90%	86%	83%	81%	78%
41%	100%	96%	92%	89%	87%
45%	109%	105%	101%	98%	95%

Example: for a 1000 cow herd with a 38% replacement rate and 80% heifer completion, need ~86% of milking and dry herd or ~860 heifers from birth to calving

Under normal economic conditions, excessively high replacement rate and heifer inventories are not optimal but there is not a single, optimal target for inventory

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Planning for the Future – How Many Heifers?

- Remember: the number of future replacements that calve creates the "limit" for cows that may be replaced
- Typically work from historical replacement needs and historical youngstock removal risks
- Risky:
  - What happened in the future may not repeat itself
    - "Anticipate" future replacement needs
  - Heifer quality changes
  - Add in a bit of a buffer for flexibility
    - Adds cost but provides a bit of insurance

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Raising a Few More Heifers → More Options

- More heifers → More Options
  - Calving more heifers → opportunity to selectively remove poor quality heifers from inventory based on genomic testing early in life *BEFORE* investing heavily in raising
  - More ***potential*** replacement of the cow herd:
    - May be a good thing if each animal is evaluated individually (i.e., not all replacement heifers deserve to become a milking cow)
      - Chance to "upgrade" a cow slot with a better animal
    - May not be optimal
      - Costly to raise replacements
      - *Blindly* adding an animal simply because you raised her, and she represents the next generation (holds promise) is a bad thing

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Example for Dairy X

Annual Replacement Rates for the Past 10 Years

Year	New	AVG	RR	
2012	1180	2731	43%	
2013	1079	2684	40%	
2014	1010	2671	38%	
2015	1096	2706	41%	
2016	1035	2727	38%	
2017	1133	2766	41%	
2018	1096	2833	39%	
2019	1066	2818	38%	
2020	997	2774	36%	
2021	1029	2806	37%	
Mean	1072	2752	39%	
	24		2.2%	std dev
Target	1096			

Baseline target for "just enough" replacements:
- 1072 + 24 = 1096
- 1096 springers → can support 40% turnover assuming stable herd size

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Projecting Heifer Needs for Dairy X

At a minimum, we need to produce enough heifers to meet anticipated future culls

	All	L=1	L=2	L>2
Avg # Milking and Dry	2752	992	769	991
# Sold	927	233	218	476
# Died	145	28	27	90
Herd Turnover (i.e., Replacement Rate)	39%	26%	32%	57%
	1072+24	**1096**		

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Projecting Heifer Needs for Dairy X

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Herd Turnover (i.e., Replacement Rate)	39%	26%	32%	57%
	1072+24	**1096**		

# Heifers Needed for Replacement		**1096** Net # Heifers that "Enter Lactation"
% of Pregnant Heifers that leave prior to Calving	3%	
		1130 # Heifers that Get Pregnant
% of Breeding Heifers that Conceive	95%	
		1189 # Heifers Enter Breeding Pen
% Sold prior to breeding	3%	
% Dead prior to breeding	3%	
		1265 # Heifers Born Alive
% DOA	4%	
		1318 # Dairy Females births
Heifer completion (born alive to calving)	**87%**	

Notice: Prior to breeding, this herd removes 3% for chronic health issues

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Projecting Heifer Needs for Dairy X

At a minimum, we need to produce enough heifers to meet anticipated future culls

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	1072+24	**1096**		

Moving forward, the herd would like to remove 5% after weaning using genomic results in addition to the baseline 3% being culled due to health issues

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Projecting Heifer Needs for Dairy X

At a minimum, we need to produce enough heifers to meet anticipated future culls

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% of Pregnant Heifers that leave prior to Calving	3%	
		1130 # Heifers that Get Pregnant
% of Breeding Heifers that Conceive	95%	
		1189 # Heifers Enter Breeding Pen
% Sold prior to breeding	8%	
% Dead prior to breeding	3%	
		1336 # Heifers Born Alive
% DOA	4%	
		1392 # Dairy Females births
Heifer completion (born alive to calving)	**82%**	

(vs. 1318 previously shown)

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Projecting Heifer Needs for Dairy X

At a minimum, we need to produce enough heifers to meet anticipated future culls

	All	L=1	L=2	L>2
Avg # Milking and Dry	2752	992	769	991
# Sold	927	233	218	476
# Died	145	28	27	90
Herd Turnover (i.e., Replacement Rate)	39%	26%	32%	57%

1072 + 24 + 57 **1129** Available to calve

Now have built in an additional 3% cushion (potential surplus).
These numbers support (but do not necessitate) a 41% RR

Cushion for unanticipated needs	8%	**57**	Cushion (extra heifers/year)
New herd turnover supported: 41%			
# Heifers Needed for Replacement		**1129**	Net # Heifers Available to Calve
% of Pregnant Heifers that leave prior to Calving	3%		
		1164	# Heifers that Get Pregnant
% of Breeding Heifers that Conceive	95%		
		1225	# Heifers Enter Breeding Pen
% Sold prior to breeding	8%		
% Dead prior to breeding	3%		
		1376	# Heifers Born Alive
% DOA	4%		
		1426	# Dairy Females births
Heifer completion (born alive to calving)	**82%**	**(or 76% if surplus is sold)**	

(vs. 1318 previously shown)

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Summary

- In the previous example, producing extra heifers (cushion) could be viewed as 0.1% total cost of "insurance"
  - $20,000 forsaken beef-cross calf revenue/$20 million total revenue
- Yes, dairy heifers are costly to raise… but it is essential to have enough to support replacement needs
  - Do not focus so heavily on explicit costs and ignore potential lost opportunity costs
- Improved management can help lower the cost of raising and enhance the "quality" of the heifers, thus improving profit potential
- Remember, herds plan for a maximum replacement rate in 2.5 to 3 years based on breeding approaches used today

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A Few Other Points for Consideration…

- A new replacement heifer provides the LUXURY of replacing the worst cow, or alternatively, selling a springing or fresh heifer
- If too few replacements, need to keep cull cows longer.
  - This is bad for the cow/welfare
  - Bad for market value
  - Bad for public opinion
  - Bad for total herd profitability
- If "excess" replacements, creates an opportunity to replace low performing low genetics cows BEFORE they get sick, lame, mastitic, skinny, etc.
  - Better for cow welfare
  - Better for market value
  - Better for public opinion
  - Better for profitability

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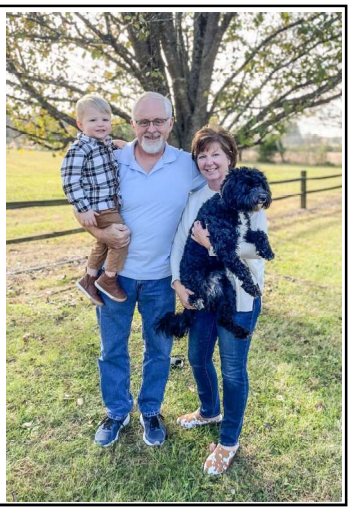
Thank You for Your Attention!

Questions?

Michael.Overton@zoetis.com



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