Economic Aspects of Cow Longevity

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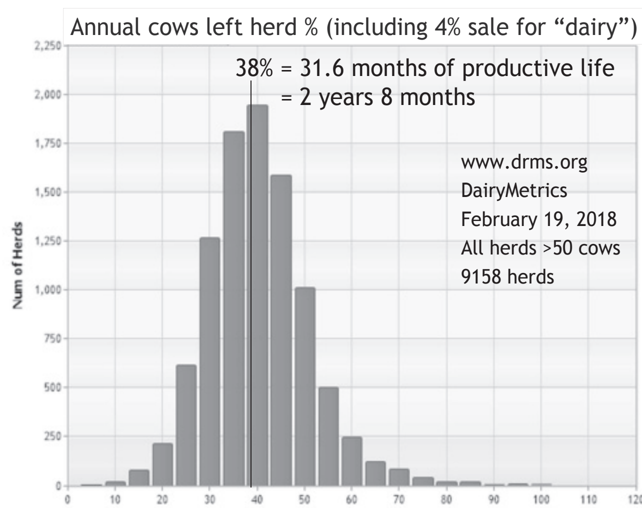
Cow longevity

"The oldest known cow was Big Bertha who was almost 49 when she passed away on New Years Eve in 1993. Big Bertha produced 39 calves"

Natural lifespan is about 20 years

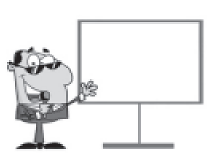
Farmer Jerome O'Leary in the Blackwater Tavern with Big Bertha.

The goal of this presentation is to draw attention to culling risks and economics of culling. Can and should the dairy industry do better?



Overview

- Longevity statistics
- Risk factors for culling
- Economics of longevity
- Culling decision support
- Summary

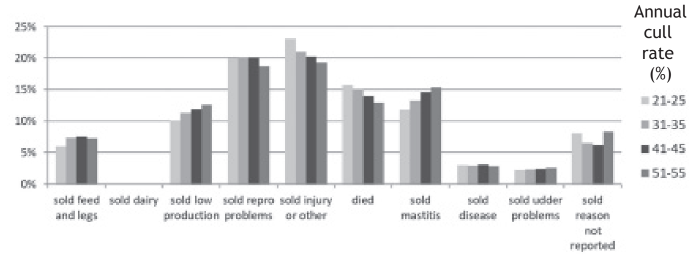


Culling mathematics

1. If national herd size is constant
2. If 1.1 calves born per cow per year
3. If all female calves are raised to become milking cows (no sexed semen)
4. Then national annual cull rate ≈35%
   - Productive life = 1/35%*12 = 34.3 months
   - Cows are culled to make room for calving heifers

Risk factors for culling

Culling reasons are similar in herds with different cull rates



Source: 11,985 DHIA herds

Statistics for 8,400 U.S. dairy herds on DHI milk test, sorted by % cows left per year

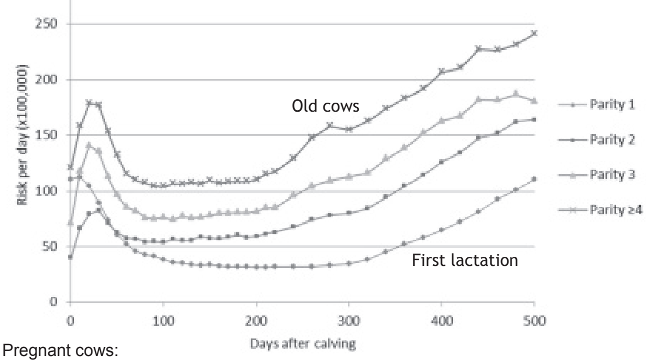
'ows left per year (%)		18	25	31	38	45	52	59
lerds (N)		208	797	1823	2289	1566	789	314
'ows (N)		87	172	213	258	213	184	141
'ows left alive per year (%)		14	20	26	33	39	45	52
'ows died per year (%)		3.9	4.3	5.0	5.3	5.9	6.2	6.3
omatic cell count (x1000)		252	228	224	209	202	218	225
:olling milk yield (kg/yr)		8,144	9,526	10,136	10,535	10,610	10,598	10,250
'alving interval (mo)		14.3	13.8	13.6	13.4	13.4	13.4	13.5
'reg Rate-Year Ave		17.3	18.2	19.2	20.2	19.7	18.5	18.4
let Merit $ for All Cows		37	104	125	145	146	151	122
.ge of 1st Lact Cows (mo)		27.0	26.2	25.5	25.1	25.1	25.2	25.4
ongevity (years), incl. sale		7.96	6.23	5.32	4.73	4.33	4.04	3.83
ongevity (years), sale adj.		9.66	7.01	5.79	5.04	4.55	4.21	3.95

Source: DRMS (2019). Available at www.drms.org Accessed March 10, 2019

Large Florida dairy producer on longevity:

- *"25 years ago I thought what was a good long lived cow was all type related."*
- *"One day I made a list of all our oldest cows to try to find out what their commonality was. Nobody was going to win a show. No records were being set. They all got bred the first or second time (mostly first) and never went to the hospital. They were all the cows you only saw twice a year."*
- *"I wonder if some longevity benefit is just from cows not shoved into too small of a hole. Management has a lot of effect."*

Risk of culling (including death) per day (non-pregnant cows). Holstein herds in the USA



Pregnant cows:
risk = 25% of risk of open cows

De Vries et al. (2010) J. Dairy Sci. 93:613

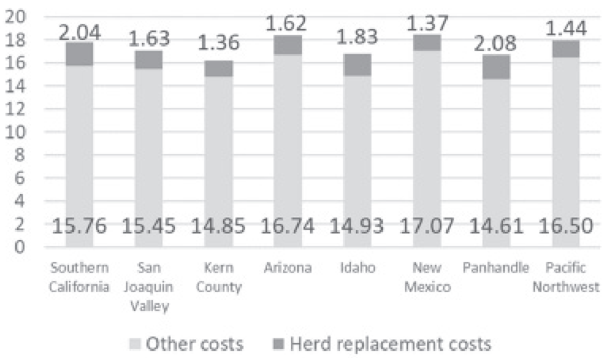
Economics of longevity

Lifetime profit is not the goal

- Rule: optimize profit per unit of most liming factor
  - $/cow/year
  - $/milking cow/year
  - $/lbs phosphor/year
  - $/acre/year
  - $/labor unit/year
  - ….

Herd replacement costs per cwt milk

≈ 10% of total operational cost



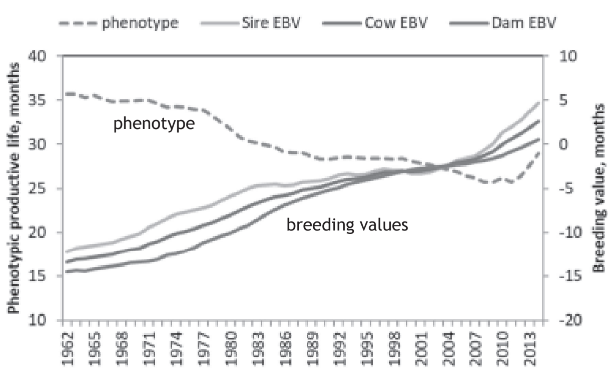
Frazer LLC, Dairy Farm Operating Trends, December 31, 2017

Depreciation costs

- Heifer rearing/purchase costs: $1500 to $2500
  - 2019: 8-month pregnant heifers sold for: <$1000
- Salvage value: $500 to $1000 (5% dead)
- Depreciation = heifer cost – salvage value

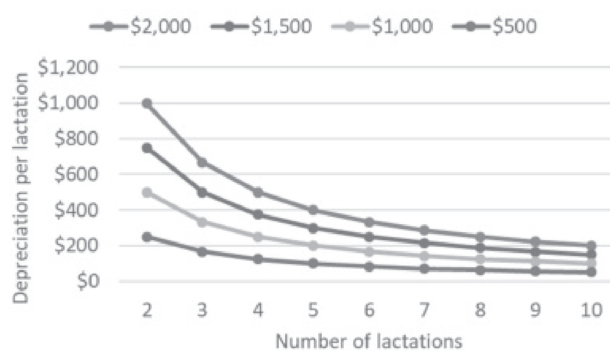
annual replacement percentage	productive life (years)	depreciation per cow $ 1,500	$ 1,000	$ 500
15%	6.67	$ 225	$ 150	$ 75
20%	5.00	$ 300	$ 200	$ 100
25%	4.00	$ 375	$ 250	$ 125
30%	3.33	$ 450	$ 300	$ 150
35%	2.86	$ 525	$ 350	$ 175
40%	2.50	$ 600	$ 400	$ 200
45%	2.22	$ 675	$ 450	$ 225

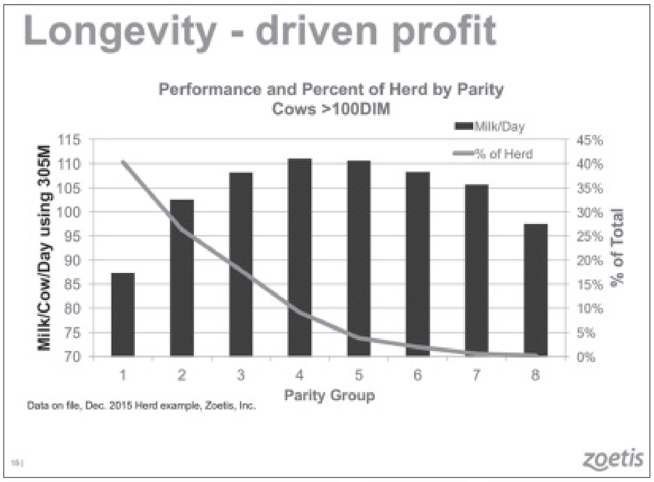
Productive life (longevity) for Holsteins in USA phenotype and breeding values



Source: https://www.cdcb.us/eval/summary/trend.cfm

Cow depreciation per lactation



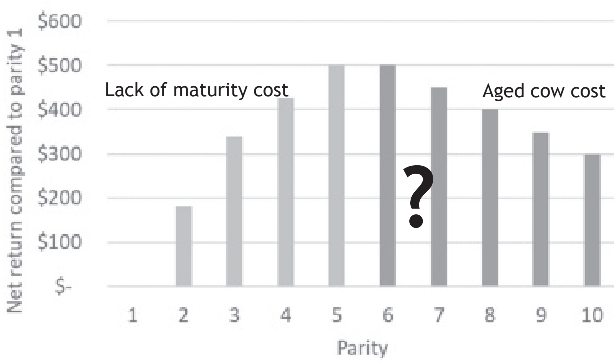


More lactations: replacement cost ↓, milk yield ↑, genetic level ↓

Genetic improvement

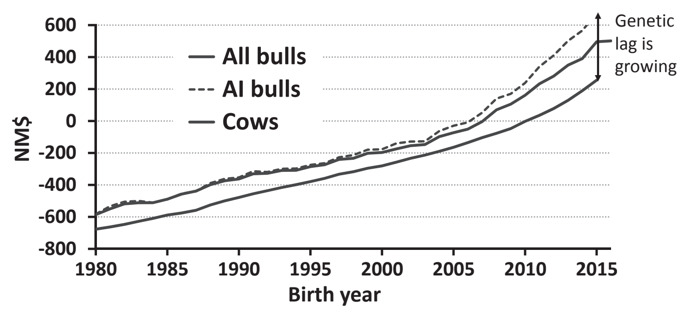
1950 champion cow: 154 000 lb milk in 13 lactations
11,846 lb/lactation

Difference in net return per parity



Without genetic progress

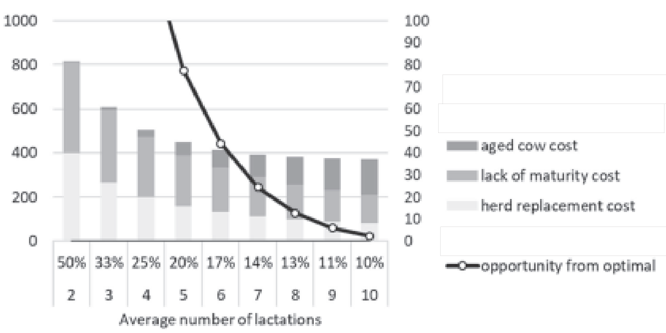
Genetic trend (PTA Net Merit$ selection index)



Lifetime Net Merit = economic selection index from USDA

USDA

Cost of herd structure



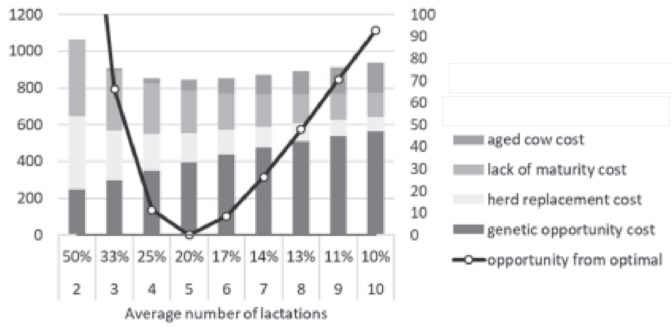
$/year

Literature Review: Culling <=> Genetics

After review of existing work: Increased genetic progress in sires should increase cow cull rates by *a few percent* at most.

De Vries (2017), J. Dairy Sci. 100:4184-4192

Cost of herd structure
Genetic opportunity cost

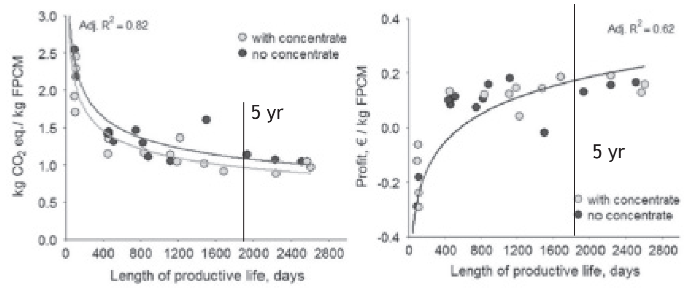


$/year

Productive life: green house gasses, profitability

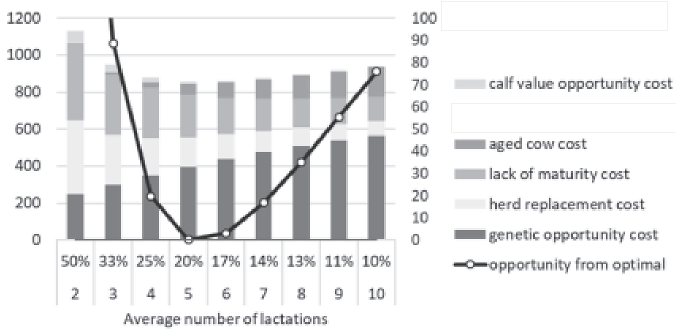
Green house gas

Profit/kg milk



Grandl et al. (2019). Animal 13:1 p198

Cost of herd structure
Premium for crossbred calves



$/year

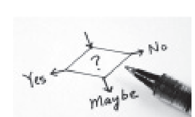
Culling decisions support

Observations on cost of herd structure

- Optimum often >4 years (25% cull rate)
- Optimum sensitive to inputs
- Extended longevity most valuable:
  - Heifer cost >> salvage value
  - High milk price, low feed cost
  - High premium crossbred calves
  - Little genetic progress
  - Good aged cows

Is there something to decide?

- Most culling is for economic reasons (Fetrow et al., 2006)
- Criteria for culling vary between farmers (Beaudeau et al., 1996)
- Differences between farmers and advisors (Haine et al., 2017)
- Culling decisions are not a priority (Huire et al., 1993)
- But: Frequent calls for decision support
- Older decision models: ≤30% annual replacement is economically optimal (Fetrow et al., 2006)
- But: optimal replacement rate is farm dependent



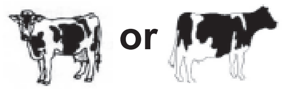
Optimal replacement decisions

Complicated: need to predict future cash flows of incumbent and challenging cow(s)

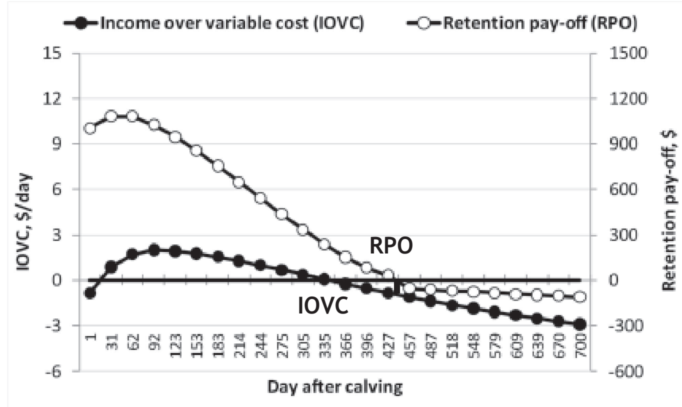
- Consider **opportunity cost** = cost sacrificed on an average challenging cow by keeping the incumbent cow in the herd *(Van Arendonk, 1991)*

  Future cash flow (incumbent)
- Future cash flow (challenger)

= Retention pay-off (RPO)



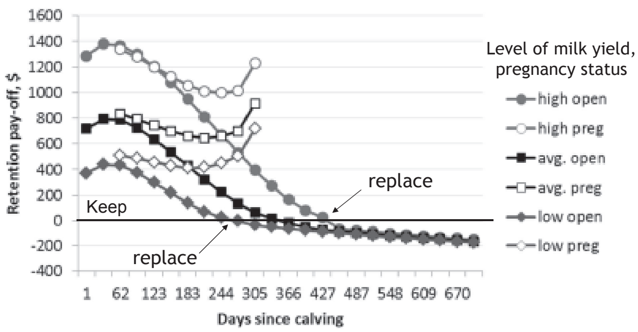
2 criteria for culling: Lower milk price



Parity 1, milk price $0.13/lbs

Value of keeping the cow in the herd

Compared to immediate replacement with a heifer



Higher milk yield and pregnancy protect against culling

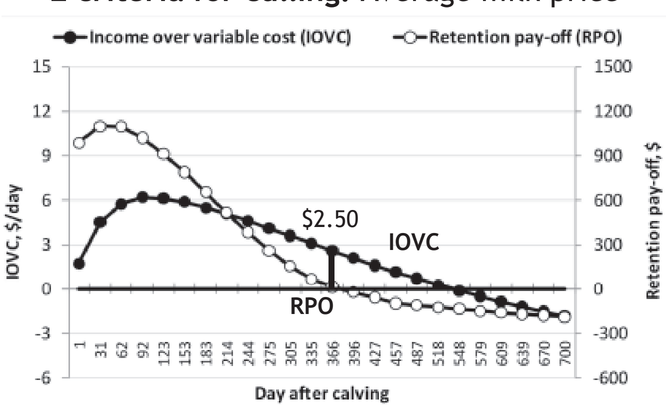
Keep Value and Keep Pct

in Florida herd with 1300 cows

012 - COMBINATION-- LOW COWS & 30 DAY DRY-OFF barn#2

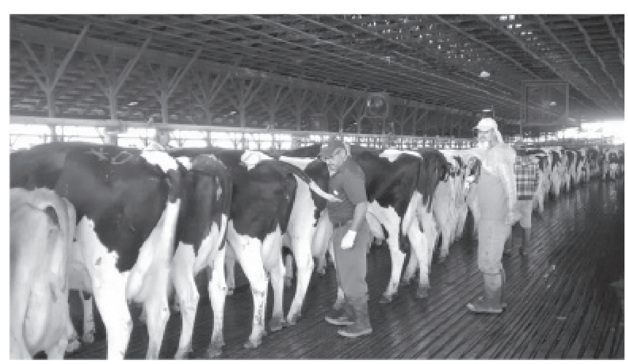
GRP	Index	Days In Milk	Prev T.D. Milk	Curr T.D. Milk	KEEP VALUE	KEE PCT	Pre SCC Act	Cur SCC Act	LTD Milk	Proj ME Milk	RAT	No Br	CDE	Bred Heat Date	Due Date	Date To Dry
7	1437	434	50.0	48.5	-413	3	1131		24799	22473	D		C			
16	72	64		11.6	-382	4										
7	490	398	53.0	52.4	-361	4	325		22484	21350	C		C			
6	2194	350	58.0	44.6	-310	4	141		21872	26304	B		C			
16	77	63		15.5	-229	5										
7	1330	210	44.0	44.6	-243	5	1600		5621	13553	E		C			
7	409	366	48.0	44.6	-133	6	93		24323	24235	B		C			
16	73	64		31.0	-26	7										
16	61	69		36.9	231	11										
7	1859	289	44.0	34.9	298	14	33		15139	19246	E	1	P	08/07	05/13	03/19
7	2791	242	55.0	36.9	306	14	33		9021	20905	D	2	P	10/08	07/14	05/20
4	2866	202	69.0	68.0	344	15	3430		8401	26884	A		C			
7	1198	310	41.0	34.9	413	17	100		15790	18697	E	1	P	07/17	04/22	02/27
7	2291	279	56.0	34.9	412	17	54		12804	20768	D	1	P	08/14	05/20	03/26
8	1754	281	66.0	46.6	513	22	123		15621	23069	D	1	P	08/14	05/20	03/26
7	2513	394	42.0	29.1	523	23			17904	21607	C	4	P	08/18	05/24	03/30
7	2642	315	45.0	36.9	561	24	141		11638	18001	E	1	P	07/10	04/15	02/20

2 criteria for culling: Average milk price



Parity 1, milk price $0.19/lbs

Going through the cull list



B = beef = cull

Summary

- Average longevity has changed little over time
- All culling driven by economics (choice)
- Increasing longevity makes economic sense
- Faster genetic progress reduces optimal longevity, a little
- Do we nee better tools to support replacement decisions?

Thank you

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