Assisting dairy farmers with the use of genomic testing and reproductive technologies in the USA

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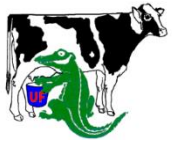

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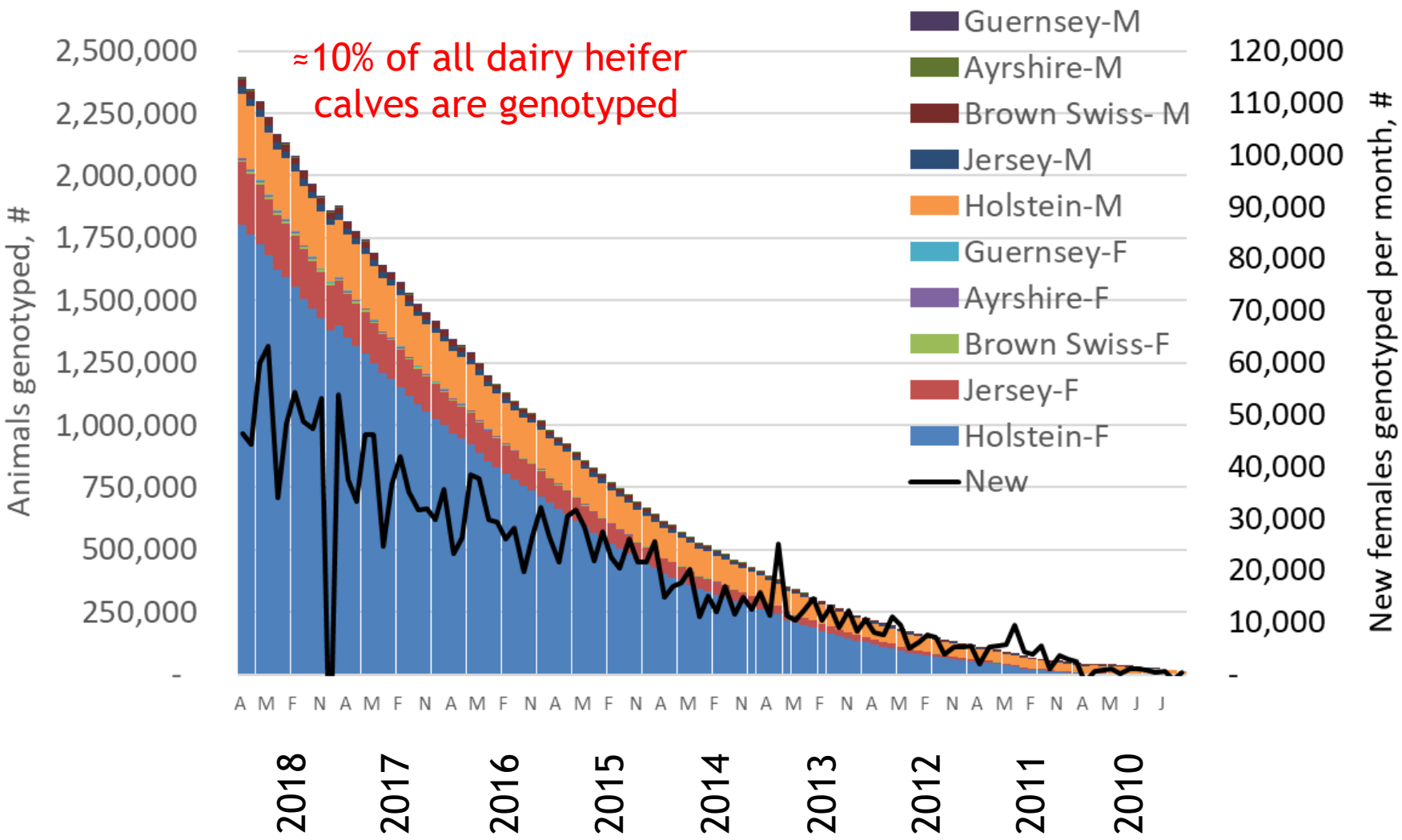
https://vetextension.wsu.edu/research-projects/dairygenomics

Overview

1. Dairy farmer questions, first principles
2. Make more dairy heifer calves than needed?
3. Use beef semen to sell crossbred calves?
4. Embryo transfer?
5. Cow cull rate?
6. Lessons learned from working with dairy farmers and the allied industry

Which one is good? Which one is bad?

Number of dairy cattle genotyped in the USA



https://queries.uscdcb.com/Genotype/cur_density.html (August, 2018)

US Dairy farmer questions

- Does genomics work?
- Which animals do I test?
  - Cows, calves, what age, all animals?
- What do genomic test results mean?
  - Where is my data?
- Does it pay?
  - What is a good plan? Sexed, beef, embryos, culling?
  - How many dairy heifers do I need?
  - Value of fixing misidentifications?
- How can I rank my animals with free information?
  - Traditional breeding values (2 * PTA)
  - Mother's phenotypes
  - Calf health, growth

Does genomics work?

305-day milk yield (UW herd)

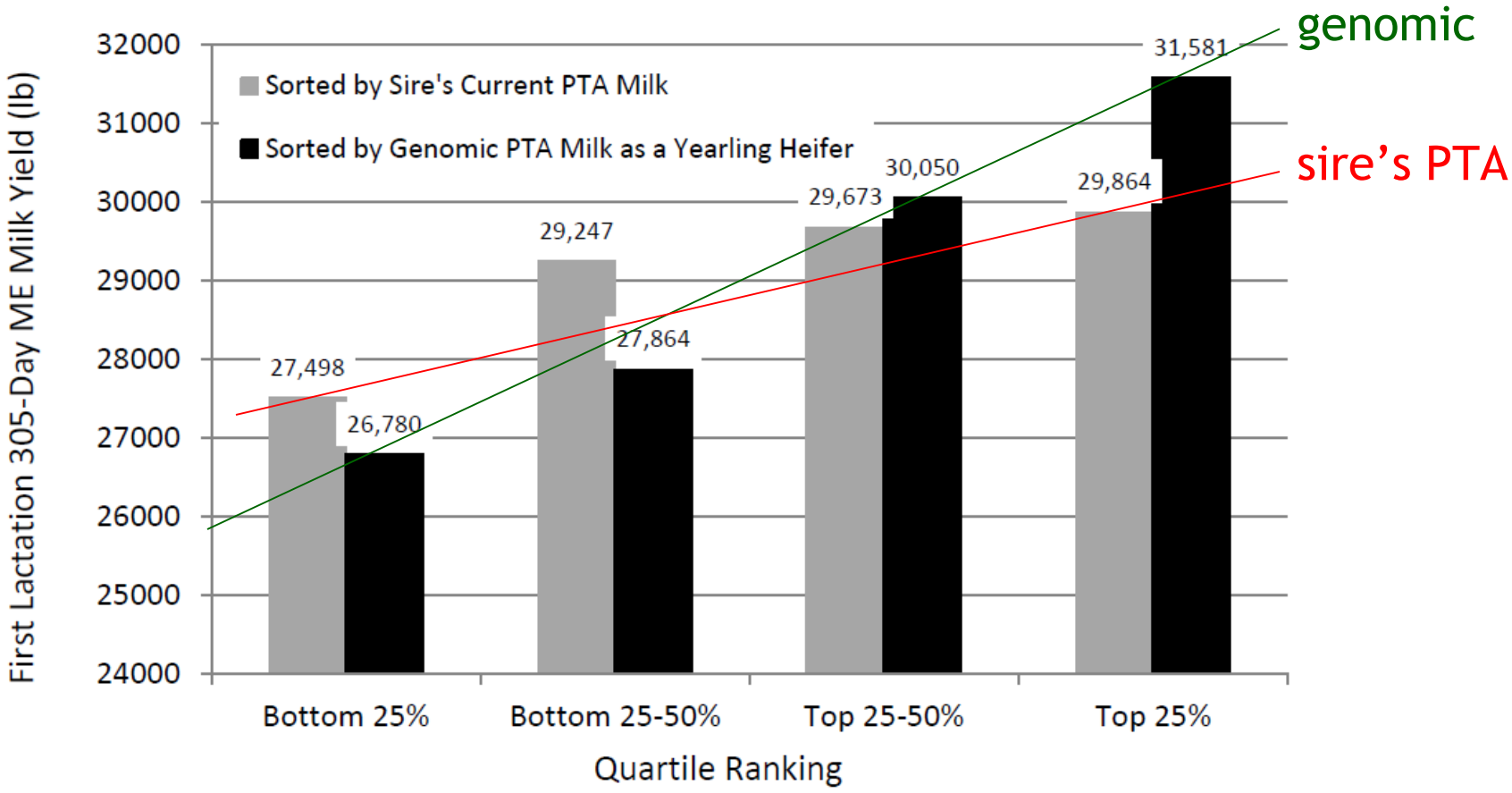
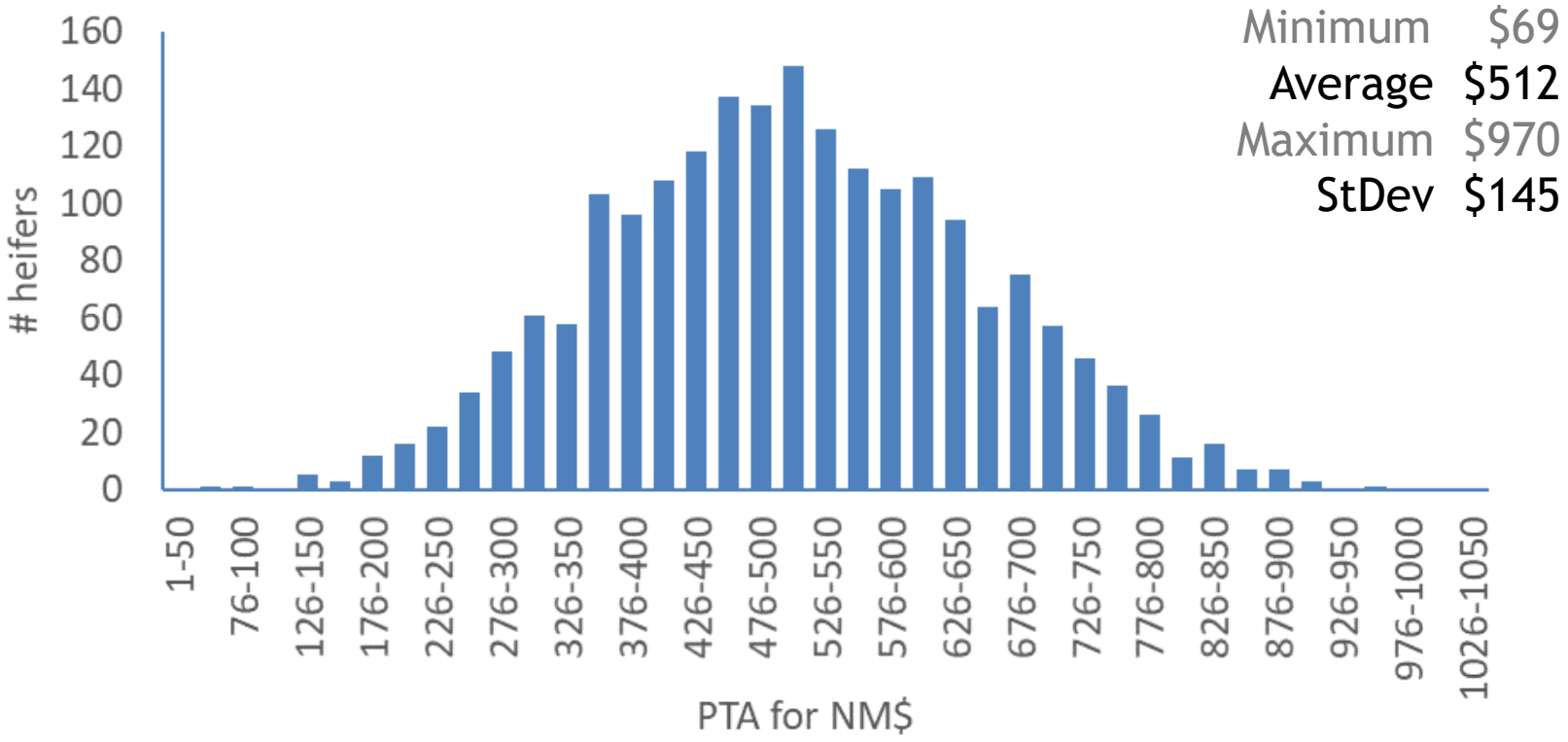


Figure 1. Average first lactation ME 305-day milk yield for 411 Holstein cows in the Allenstein Dairy Herd at UW-Madison, according to quartile for genomic PTA milk at 12 months of age and quartile for sire's current PTA for milk yield.

http://wdmc.org/2015/Weigel.pdf

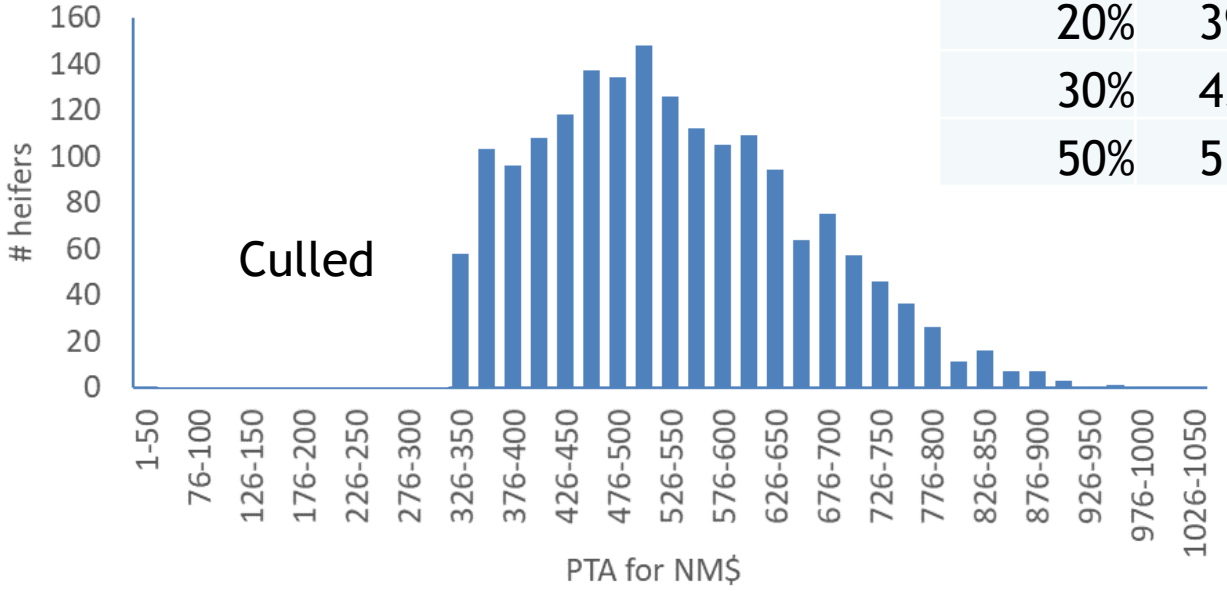
gPTA Net Merit Dollars for 2000 heifers

NM$ = lifetime profit index from USDA



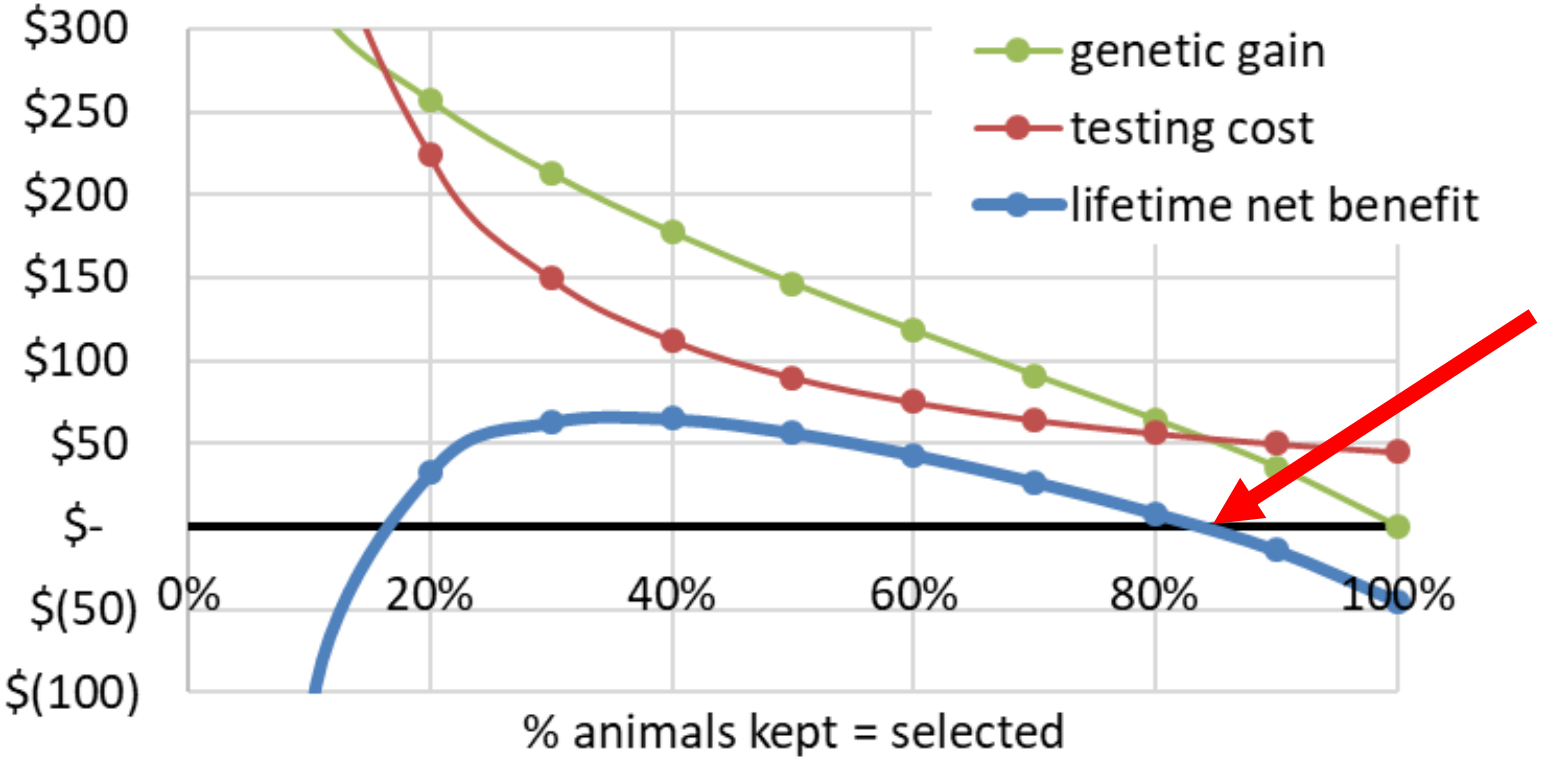
gPTA Net Merit Dollars for 2000 heifers

Culled	Min	Average	Gain	StDev
0%	69	512	0	145
10%	318	537	25	126
20%	391	564	52	112
30%	436	585	73	103
50%	510	631	119	88



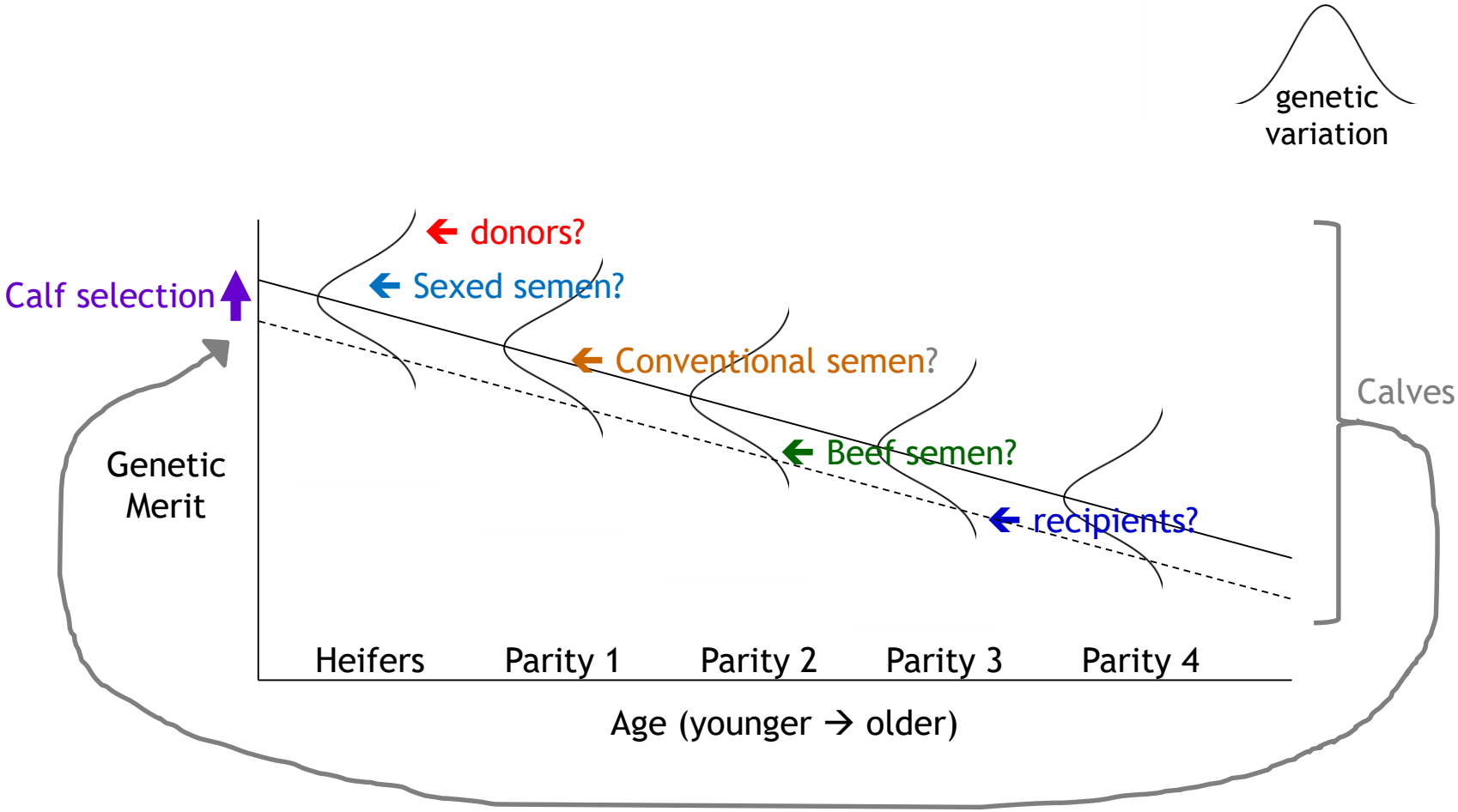
Simple math: Value of genomic test per kept calf

- Genomic reliability vs. parent average reliability
- $45 testing cost
- Lifetime net benefit = genetic gain – testing cost



Genomic testing pays if > 15% surplus dairy heifer calves

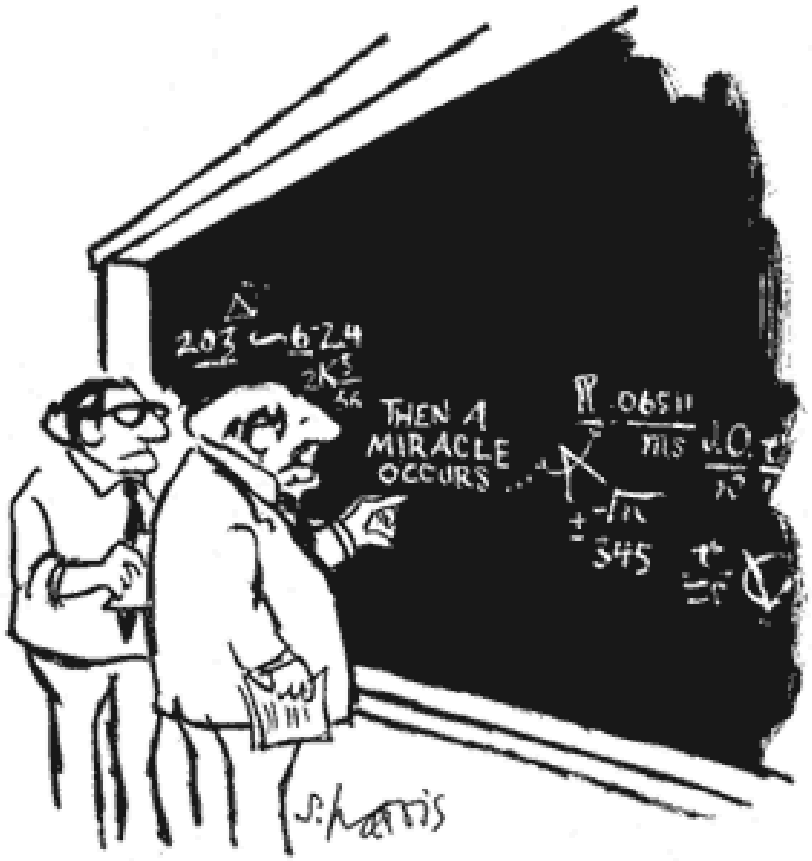
Genetic model



Herd budget model

Genetics, phenotype, prices, …

Bottom line:
Profit per milking cow per year



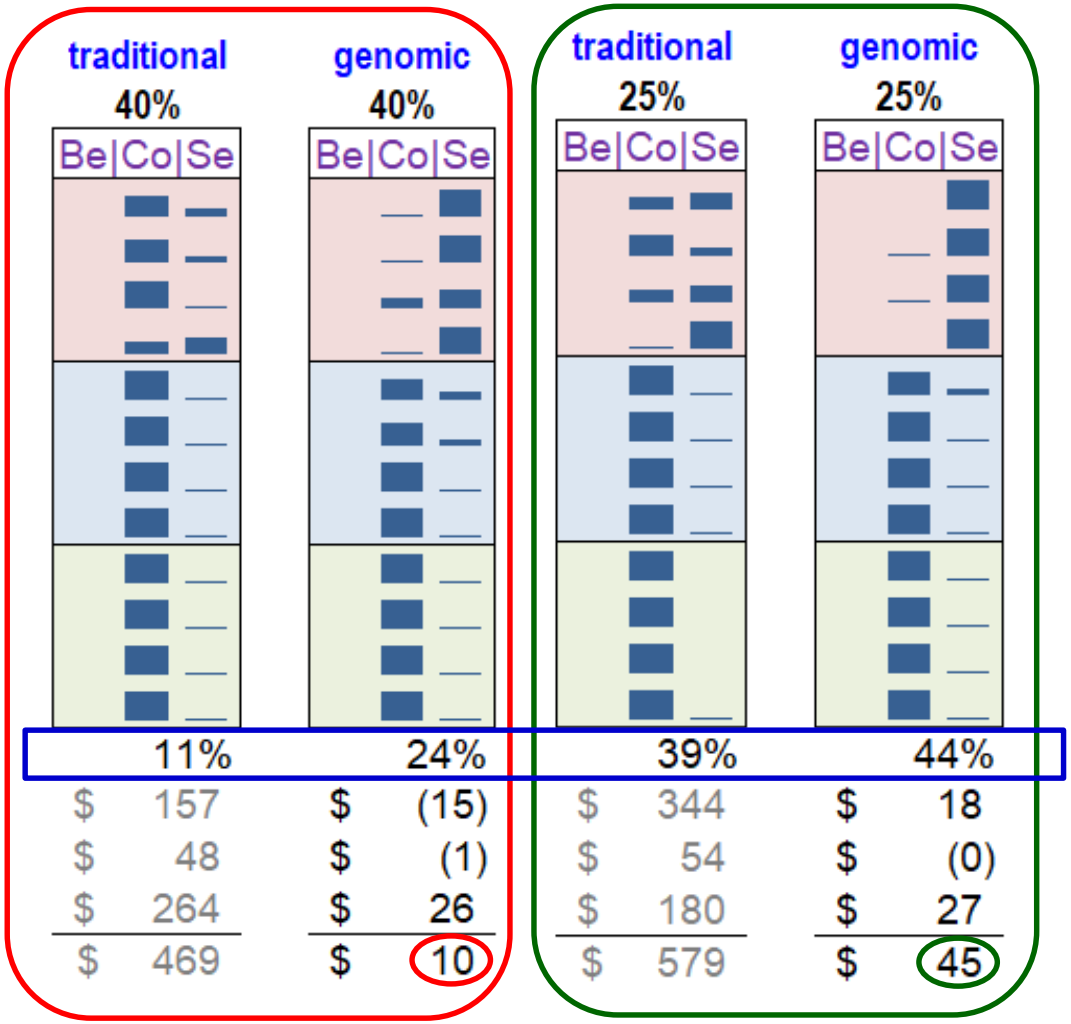
2. Make more dairy heifer calves than needed?

- Use sexed semen
- Higher selection intensity
- Greater selection gain
- Sell surplus dairy calves
- Other advantages dairy calves

Example. Make surplus dairy heifers?

Optimal breeding mix policy

Be = beef semen
Co = conventional semen
Se = sexed semen



3. Use beef semen to sell crossbred calves?

- Sell crossbred calves at a premium (Certified Angus)
- Use low genetic dams with beef semen
- Use high genetic dams to make dairy heifer calves
- Reduces selection intensity of dairy heifer calves

Value of crossbred calves reduces the value of genomic testing

policy	user-defined	optimal	optimal	optimal
reliability	traditional	traditional	genomic	genomic
beef premium	cross: +$100	cross: +$100	cross: +$100	cross: +$0
breedings	Be|Co|Se	Be|Co|Se	Be|Co|Se	Be|Co|Se
heifers, 1				
heifers, 2				
heifers, 3				
heifers, 4+				
cows 1, 1				
cows 1, 2				
cows 1, 3				
cows 1, 4+				
cows 2+, 1				
cows 2+, 2				
cows 2+, 3				
cows 2+, 4+				
surplus dairy calves (%)	5%	11%	5%	32%
Δ operational revenue - cost	$ 189	$ 179	$ 178	$ 211
Δ sold calves	$ 88	$ 90	$ 88	$ 49
Δ kept dairy calves	$ 267	$ 283	$ 271	$ 267
profit(/milkingcow/yr)	$ 544	$ 551	$ 538	$ 528

4. Embryo transfer?

In-vitro fertilization (IVF) + embryo transfer (ET) economics

1. Select oocytes from best heifers/cows

Study conclusion: some IVF-ET almost always economically warranted

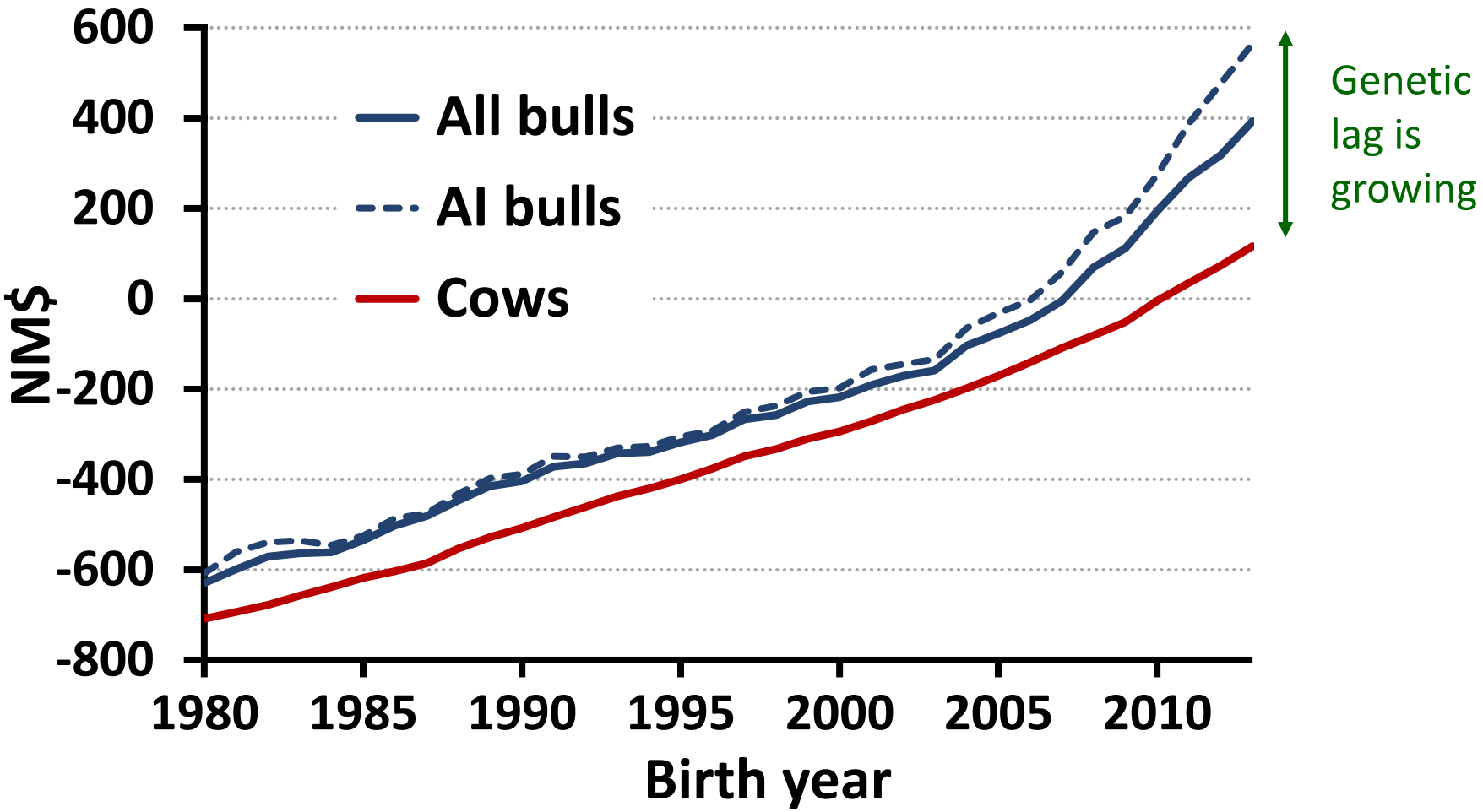
Kaniyamattam et al., 2018. J. Dairy Sci. 101:1540

- ↑ Cost ($160/IVP-ET)
- How much IVP-ET is optimal?

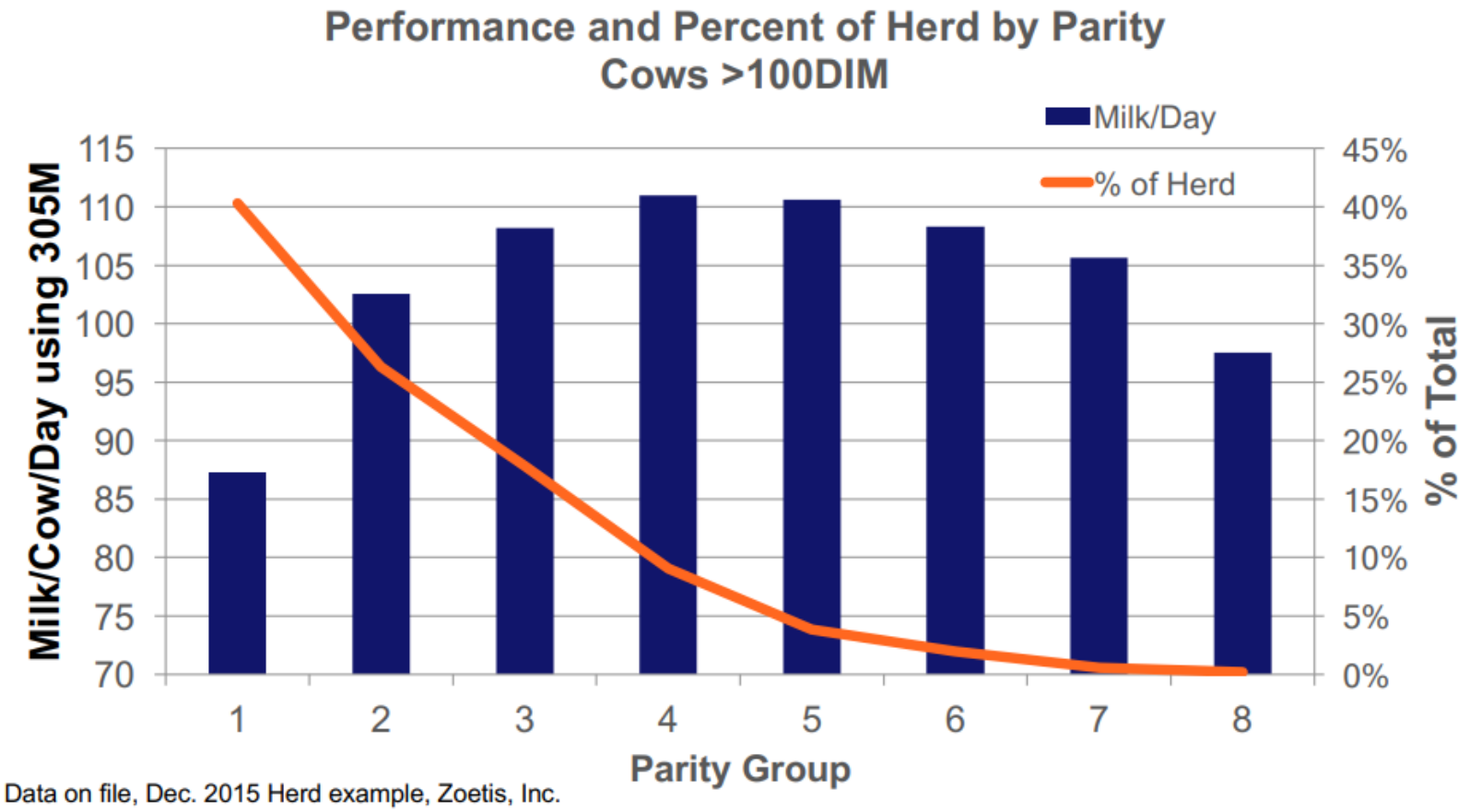
5. Cow cull rate?

- How should genetic progress affect culling?
- What is the optimal cull rate?

Genetic trend (PTA NM$ selection index)



Longevity - driven profit



Data on file, Dec. 2015 Herd example, Zoetis, Inc.

zoetis

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

What is the value of genomic testing?

- Ranges from negative to >$50 per milking cow per year
- Depends on:
  - Cow cull rate, genomic testing cost, reproduction, use of sires, genetic variation, genetic trend, breeding mix, prices: crossbred calf, dairy calf, semen, …
  - Other decisions made with genomic test results

6. Lessons learned from working with dairy farmers and the allied industry

1. Workshops, farm visits, newsletters, presentations, videos
2. Farmers like independent advice (not sales people)
3. Advisor needs to know dairy farming (boots on the ground)
4. Keep it simple, use farmer data
5. “What-if” modeling helps clarify the questions
   - Limit inputs and outputs
   - Side-by-side comparison of alternatives

Thank you

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