Economic Considerations of Sexed Semen on Your Dairy

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Objectives for Today…

- General introduction to sexed semen
- Potential sources of value
- Basic criteria regarding use/ selection of cows
- Early/ expected results from its use
- Pitfalls or "watch outs" regarding its use

Traditional Breeding on Dairies

- Cows are bred for two primary reasons:
  - Initiate new lactation
  - Create female dairy calves for replacements
- National herd replacement rate is basically limited by the supply of heifers
  - ~ 33-37 % of the national herd/year is replaced
    - Based on # of heifers entering the national herd
    - National herd size ~ constant
    - Supply of heifers determined by reproductive efficiency, death loss, ration of live females

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With Sexed Semen (Gender Enhanced Semen - GES)

There is a Potential to Produce More Female Calves

- However, we need more pregnancies to return cows to the next lactation than are needed to produce enough replacements
- Producing extra heifers, above and beyond the industry needs is not desirable

Concept of Sexing Semen Has Been Around for Years

- Variety of methods have been tried:
  - Gender Specific Antibodies
  - Centrifugation
  - Free Flow Electrophoresis
  - Flow Cytometry
    - Droplet deflection and collection
    - Only method with a proven track record

General Sorting Principles

- The X Chromosome is larger than the Y Chromosome
- X-bearing sperm have 3.85% more DNA
- A fluorescent dye that binds to DNA is used to measure DNA content
- Fluorescence in response to laser light is used to determine gender
- Currently, one company has GES on the market, but others are potentially coming

Potential Sources of Value for Sexed Semen…

- Can help ensure an adequate number of replacements
- Can improve rate of genetic improvement by selecting on both cow and bull side
- Increased opportunity to cull poor-doing heifers
- *Potentially*, reduced risk of dystocia (more heifers vs bulls)
- Decreased risk of freemartins (more heifer twins vs bull-heifer co-twins)
- Early adopters may be able to capitalize on current high heifer prices

But…There are Important Considerations

- We do NOT want every cow to produce a heifer calf
  - Extra cost involved with using sexed semen
  - Fertility issues with CURRENT technology
  - Genetic merit considerations
  - Excess heifers (above industry needs) have less value
    - Lower value for the beef / veal industries
  - Also, RISKY if you're only trying to capture value from current high heifer prices

Current Products of Dairy Breeding

- Heifer calves
  - Typically, all are retained and raised as future replacements
  - Little, if any, selective pressure applied due to demand and generally, low reproductive efficiency
- Bull calves
  - Most enter the dairy beef market
    - Veal calves
    - Holstein feedlots
- Freemartins

Potential "Products" from Dairy Pregnancies Using GES Semen

- Female GES-derived replacement heifers
  - Used as replacements
  - Sold as replacements
- Conventional AI or bull derived replacement heifers
  - Used as replacements
  - Sold as replacements
- Bull calves
  - Commercial bull calves for beef (veal or feedlot)
  - Higher-end dairy bulls for breeding purposes (AI or natural service)
- Cross-bred calves (male GES or beef bull)
  - Beef / dairy crossbred heifer calves
- Freemartin calves

Calculating Returns from GES Semen

1. Wet calf value…based on the calf value at birth
2. Sell the bull calf, raise the heifer and sell as a springer
3. Sell the bull calf, raise the heifer and keep her, and produce milk

All are very different modeling approaches

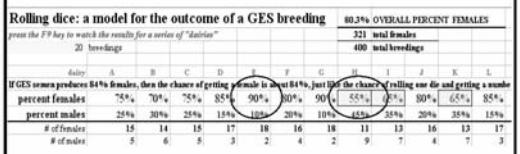
Important Considerations…

- What is the expected sex ratio?
- What is fertility of the product?
- What is the cost of the product?
- On what animals will it be used?

Expected Sex Ratio

- The percent females obtained by GES breeding will have a statistical variation around ~ 85%.
- For a given series of breedings, some dairies will get 85%, some more, and some less
  - It is like rolling a die
    - 1,2,3,4, and 5 are female and 6 is a male
    - 83% chance of getting a 1, 2, 3, 4, or 5
    - Only 17% chance of getting a 6 (male)
  - There's a chance you'll get more than your "fair share" of 6's
- We all need to understand this concept!

One random outcome of "rolling a die" 20 times per dairy



Rolling dice: a model for the outcome of a GES breeding

80.3% OVERALL PERCENT FEMALES

321 total females

400 total breedings

press the F9 key to watch the results for a series of "dairies"

20 breedings

dairy	A	B	C	D	E	F	G	H	I	J	K	L
If GES semen produces 84% females, then the chance of getting a female is about 84%, just like the chance of rolling one die and getting a numbe												
percent females	75%	70%	75%	85%	90%	80%	90%	55%	65%	80%	65%	85%
percent males	25%	30%	25%	15%	10%	20%	10%	45%	35%	20%	35%	15%
# of females	15	14	15	17	18	16	18	11	13	16	13	17
# of males	5	6	5	3	2	4	2	9	7	4	7	3

How will the you feel if, *based on random chance alone*, only 55% of births are female when 85% is expected?

Reduced Fertility is Being Reported with Current Technology

- Conception rates **greatly** decreased compared to routine AI

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Actual Data from 1 Western Dairy
541 breedings (with known outcomes)

CR	#Preg	#Open
36	68	123
26	24	67
49	49	52
31	11	24
40	16	24
40	17	25
49	20	21
	205	**336**

CR's vary across sires

Overall, 38% CR

Normal, non-sexed
1st Service CR = 59%

36% drop (21 points)

Results are Consistent with Reports from NY (Lactation = 0)

Farm	Baseline CR	Sexed Semen CR	%drop
1	55	39	29
2	55	41	25
3	66	51	23
4	59	45	24
5	68	39	43

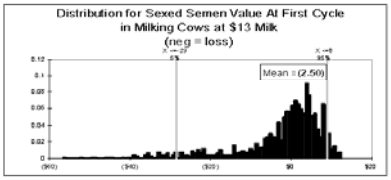
Overall, ~ 30% drop

What is the Cost of Using Sexed Semen

- Typically, $25-45 premium/ unit of semen
- Example: Western producer
  - Blend of proven and young sire, sexed $40
  - Normal blend price for heifers $5-10

Which Animals Should We Use Sexed Semen In?

- Using current technology on mature cows would be painful:
  - Ex: 1st service CR of 33% dropping to ~ 21% and using it only during the first 21-day breeding cycle
  - Extra value of heifers produced overshadowed by loss in PR



Use in Virgin Heifers

- Producers often start breeding virgin heifers earlier to try and compensate for decreased CR
  - Don't want to run out of time
- Can lead to other problems…
  - Increased risk of dystocia
  - More stillbirths
  - Premature culling of fresh heifers

Reports of Higher Risk of Stillbirths

- Western herd example
  - ~ 50% higher risk of stillbirths
- Avg of 5 New York herds
  - ~ 25% higher risk
- Some potential reasons:
  - Producers breeding heifers earlier than normal
  - Limited availability of sires
    - Non-calving ease
    - Sires sent to machine in TX (can never come home… may not send the best sires?)

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Today…Estimate Value of Current Technology on Virgin Heifers (Value of Wet Calves)

- Spreadsheet Model Based on Wet Calf Prices (Overton and Eicker)
- Examine returns expected from **current** technology used at first service or first 2 services
- Identify pitfalls of relying only on wet calf prices
- Spreadsheet model assumptions:
  - CR hit of 32%
  - Higher risk of stillbirths
  - $35 premium for GES
  - 8 potential breeding cycles
  - Demo

Modeling Results (Lact = 0): Effect of Calf Price Differential

- Breakeven price differential for wet calves (using the assumptions of the model, $35 premium for SS):
  - Breeding for 1st service only = ~ $200
  - Breeding for 1st 2 services only = ~ $260
  - As the value of bull calves increases, the breakeven price differential becomes greater
  - Ex: $75 bulls 1st only = ~$190 1st 2 = ~ $255
  - $200 bulls 1st only = ~$220 1st 2 = ~ $275

Modeling Results (Lact = 0): Effect of Semen Premium Cost Changes

- Breakeven price differential for wet calves (using the assumptions of the model and $100 bulls)

	Sexed Semen Premium			
	$25	$30	$35	$40
1st Cycle Only	$165	$180	$200	$215
Cycle 1 and 2	$220	$240	$260	$280

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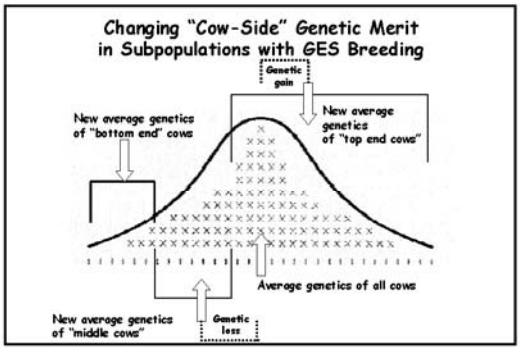
However, IF Fertility Issues are Addressed…

- Huge opportunity to use in lactating cows
  - Potential to capture value of improved genetic merit
  - Mature cows provide greater genetic merit information (more reliable)

Modeling Option 3: Sell the Bull Calf, Raise and Milk Heifers

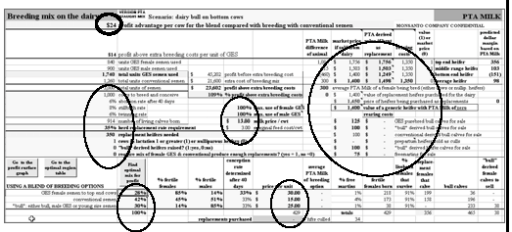
- Modeling project:
  - John Fetrow — Steve Eicker
  - Mike Overton — Albert deVries
  - Ken Leslie — Gary Rogers
- A large source of potential benefit is from genetic merit gain
  - Ability to make progress by selecting from both male and female side



What is the **Best Mix** of Breedings?

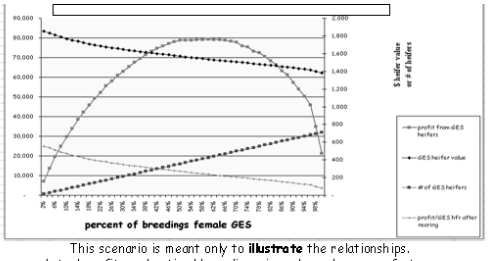
- Given the "**products**" of each type of breeding, the "**profit**" of those breedings can be calculated
  - Herd's profit depends on:
    - Herd's genetic merit (value of the heifers produced)
    - Proportion of the population that is bred with female GES
  - The profit of a female GES breeding is not a fixed number
    - If you breed only the very top cows to female GES, you get a few very valuable heifers
    - If you breed most of the herd with female GES, you don't gain much advantage per heifer, but you get more heifers

Spreadsheet Model of the Value of Genetic Gain



The optimum breeding mix depends on a lot of factors specific to the dairy.

Economics of Female GES: **One Example** 1,000 cows; Only Female GES and Conventional AI



This scenario is meant only to **illustrate** the relationships.
Actual profits and optimal breeding mixes depend on many factors.

General Concepts of Choosing the Best Breeding Mix for a Dairy

- **Herds with better genetics would tend to use more female GES**
  - More of the heifers produced would be of high merit and worth having (or selling)
  - Herds with good information about the genetics of their cows (and particularly their growing heifers) will have a competitive advantage in the use of female GES
  - Herds that want to *assure* full replacements will use more female GES
  - Expanding herds will enjoy *some* biosecurity advantages

Comments Regarding Expansion…

- **Counting on GES alone is a bad approach for herd expansion!**
- Need to grow in discrete chunks
  - **i.e. The size of the next free-stall barn/ pen**
- New barns need to be filled rapidly.
- Expansion herds still need to buy cows

A Potential Watch-out Re: GES and Extra Heifers!

- Will the dairy have the capacity for additional calves?
  - **Hutches**
  - **Pens**
  - **Labor**
  - **CAPITAL!**
  - **etc**

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Concluding Thoughts…

- **GES may turn out to be a major new tool for the dairy industry**
  - Potential to dramatically shift the way cows are bred **IF** the fertility problems can be addressed
  - Potential to improve both quality and availability of heifers
- **Be careful with the current technology…weigh risks vs potential rewards**
  - Upfront cost versus delayed returns
  - Use caution when estimating expected returns
    - High calf prices may not persist with more heifers available
  - Don't forget about current issues:
    - Lower fertility and increased dystocia/ stillbirths

Thanks For Your Attention!

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