

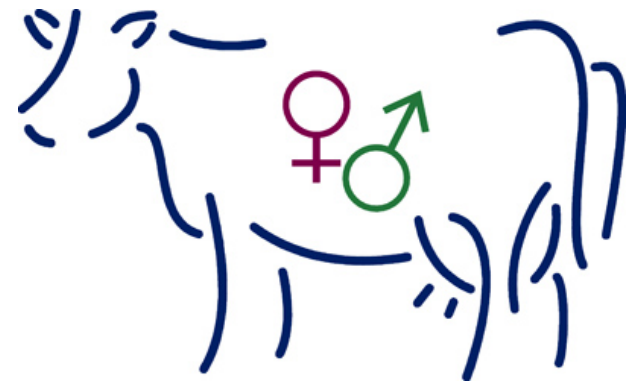
# Sexed Semen Economics

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# Overview

- Fertility with sexed semen
  - Heifers, cows
- Probability calculations
- Economics of sexed semen
  - Heifers, cows
- Other factors to consider



# Fertility



# Sexed semen

- Sort sperm by flow cytometry
  - Stain sperm with fluorescent dye
  - X-chromosome is 3-4% larger than Y-chromosome: has more dye: emits more light
  - Laser detects amount of light: assigns positive or negative charge to each sperm
  - Magnet directs the sperm into X, Y, or other
- ~ 90% accurate (90% heifer calves)
- Expensive, slow, much waste, fewer sperm per dose, lower conception risks

# Percent (%) or Percentage Point?

## Example

- If the conception risk with conventional semen is 55%
- If the decrease in fertility is 25%:  
 $55\% - 25\% \times 55\% = 41.3\%$  conception risk  
A decrease of  $55\% - 41.3\% = 13.7$  percentage points
- If the decrease in fertility is 25 percentage points:  
 $55\% - 25 \text{ percentage points} = 30\%$  conception risk  
A decrease of  $1 - 30\% / 55\% = 45\%$

# Sexed semen conception risks

## Large recent study

Heifers

51 herds

2125 records

$2.1 \times 10^6$  sperm/dose

Cows

56 herds

2369 records

$2.1 \times 10^6$  sperm/dose

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Sire A 46%

Sire B 41%

Sire C 53%

} 46.7%

27.0%

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Sire effect (P < 0.05)

No sperm dosage effect

No sire effect

No sperm dosage effect

# Sexed semen conception risk compared to conventional semen (100%)

- 85% in heifers. (DeJarnette et al., 2007).
- 68% in cows. (Schenk and Everett, 2007)
- 73% in cows. (Crichton et al., 2006)
- 54% in cows. (Andersson et al., 2006)
- 51%, 69%, 72% in heifers (Weigel, 2004)

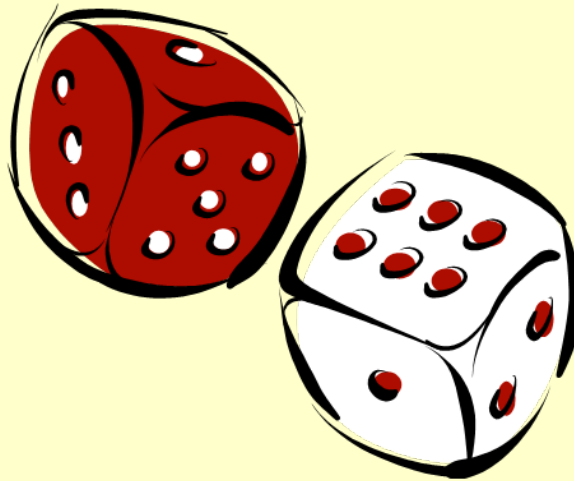
Average CR sexed semen ~ 70 to 80% of conventional CR.  
This is a decrease of 10 to 15 percentage points.  
Sire effect, larger difference with poor management.

# Heifer conception risk by service number

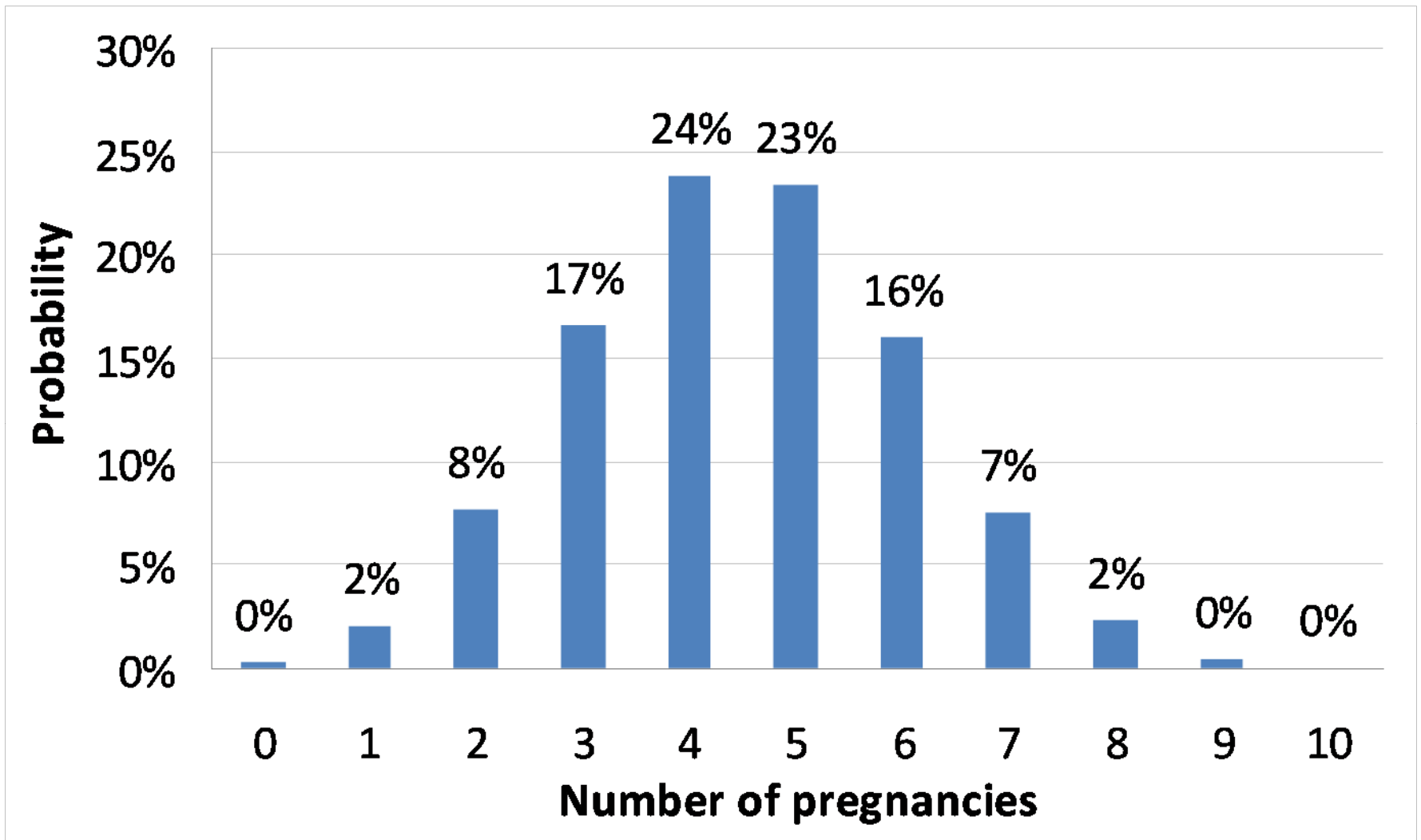
Service number	Michael (2008)*		Kuhn et al. (2006)		Chebel et al. (2006)	
	%	#	%	#	%	#
1	56	(35,558)	53.3	(341,139)	67.8	(6,389)
2	48	(13,841)	52.9	(109,743)	56.3	
3	43	(6,032)	49.7	(36,469)	47.7	
4	39	(2,263)	47.9	(13,433)	37.2	
5	29	(1033)	43.8	(5,119)		
6	25	(601)	39.1	(2,064)		
7	24	(375)	32.7	(907)		

\* Raw data, mostly conventional semen, some sexed semen

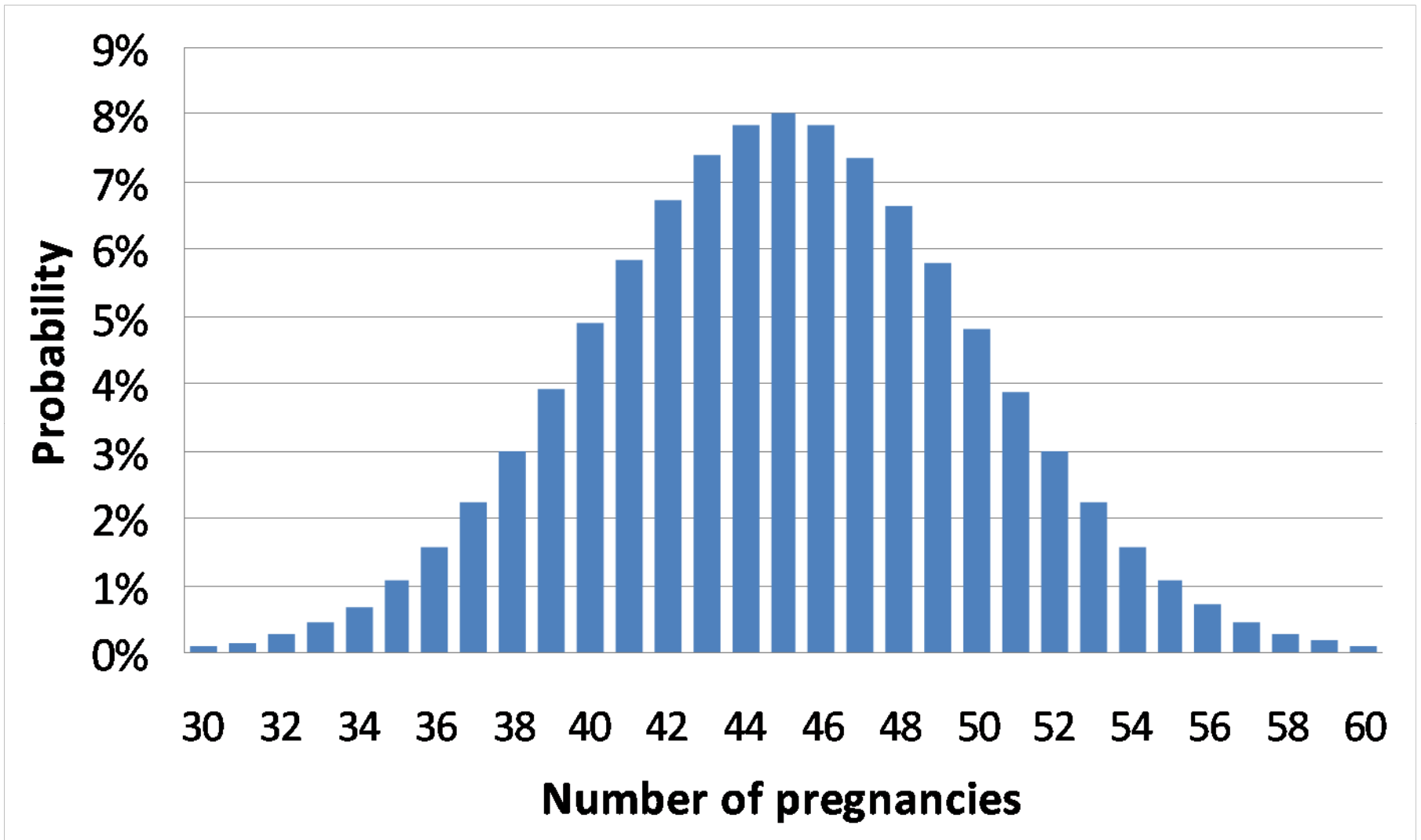
# Probability Calculations



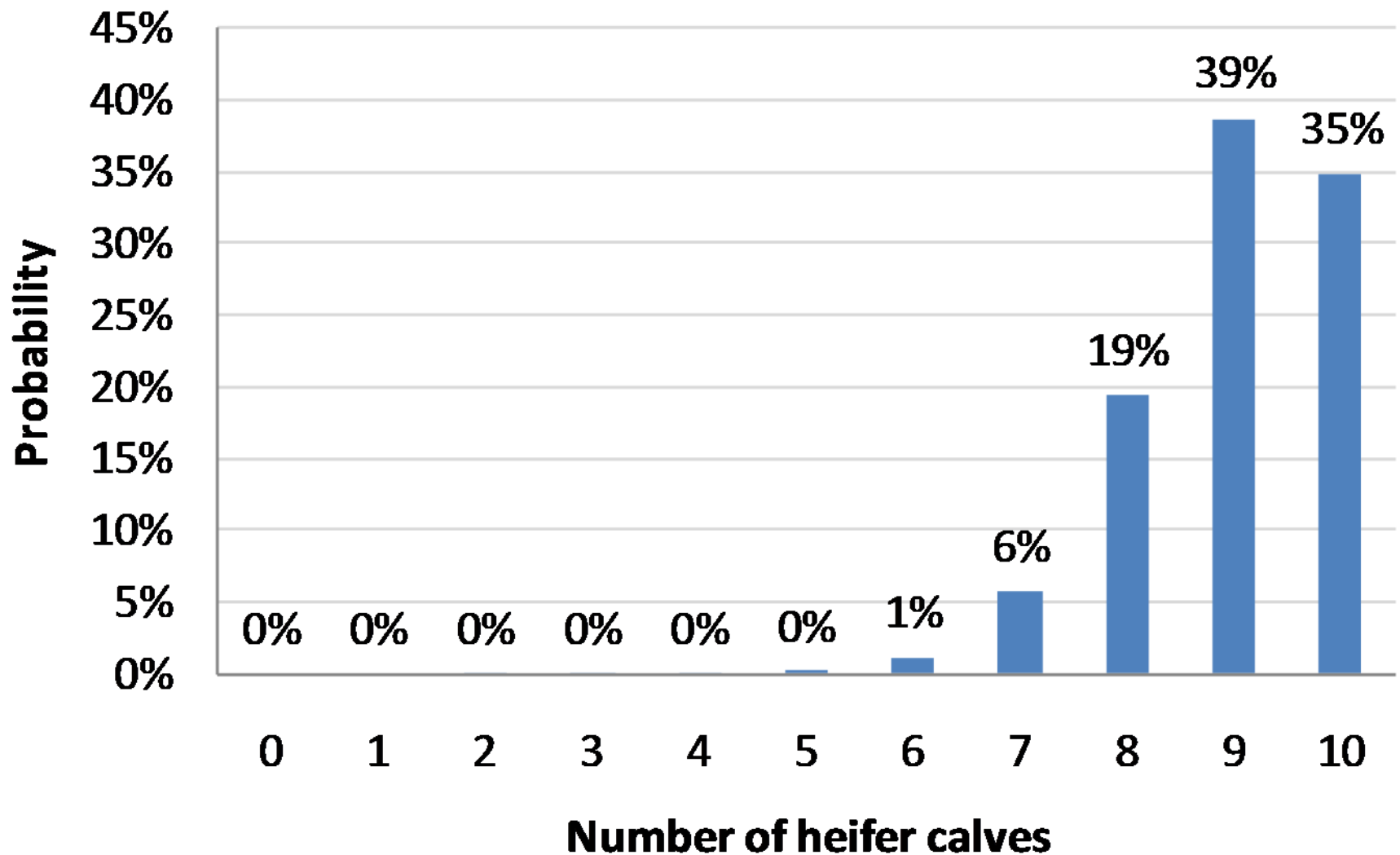
# 10 Heifers Bred; 45% Probability of Conception



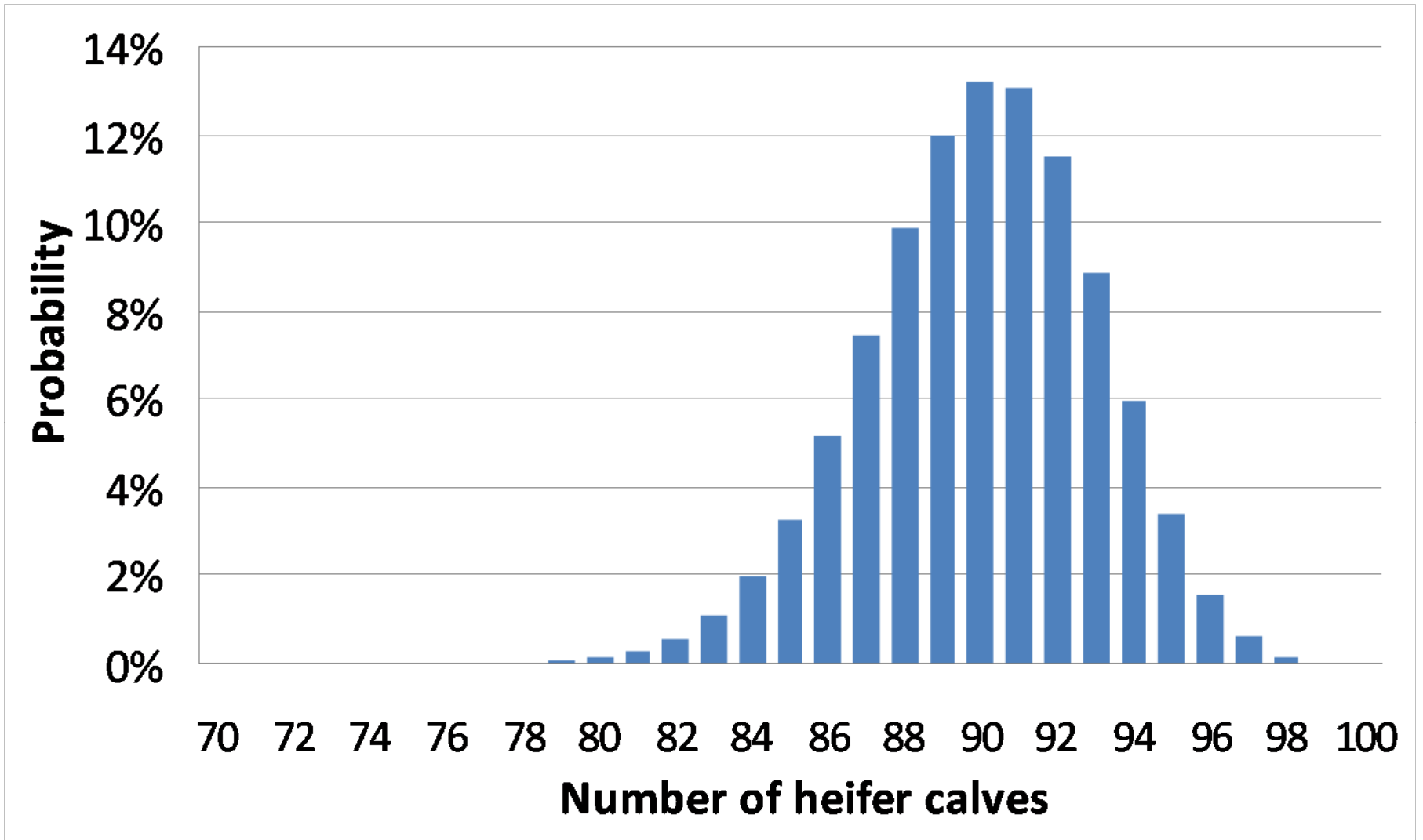
# 100 Heifers Bred; 45% Probability of Conception



# 10 Calves Born; 90% Probability of Heifer Calf



# 100 Calves Born; 90% Probability of Heifer Calf



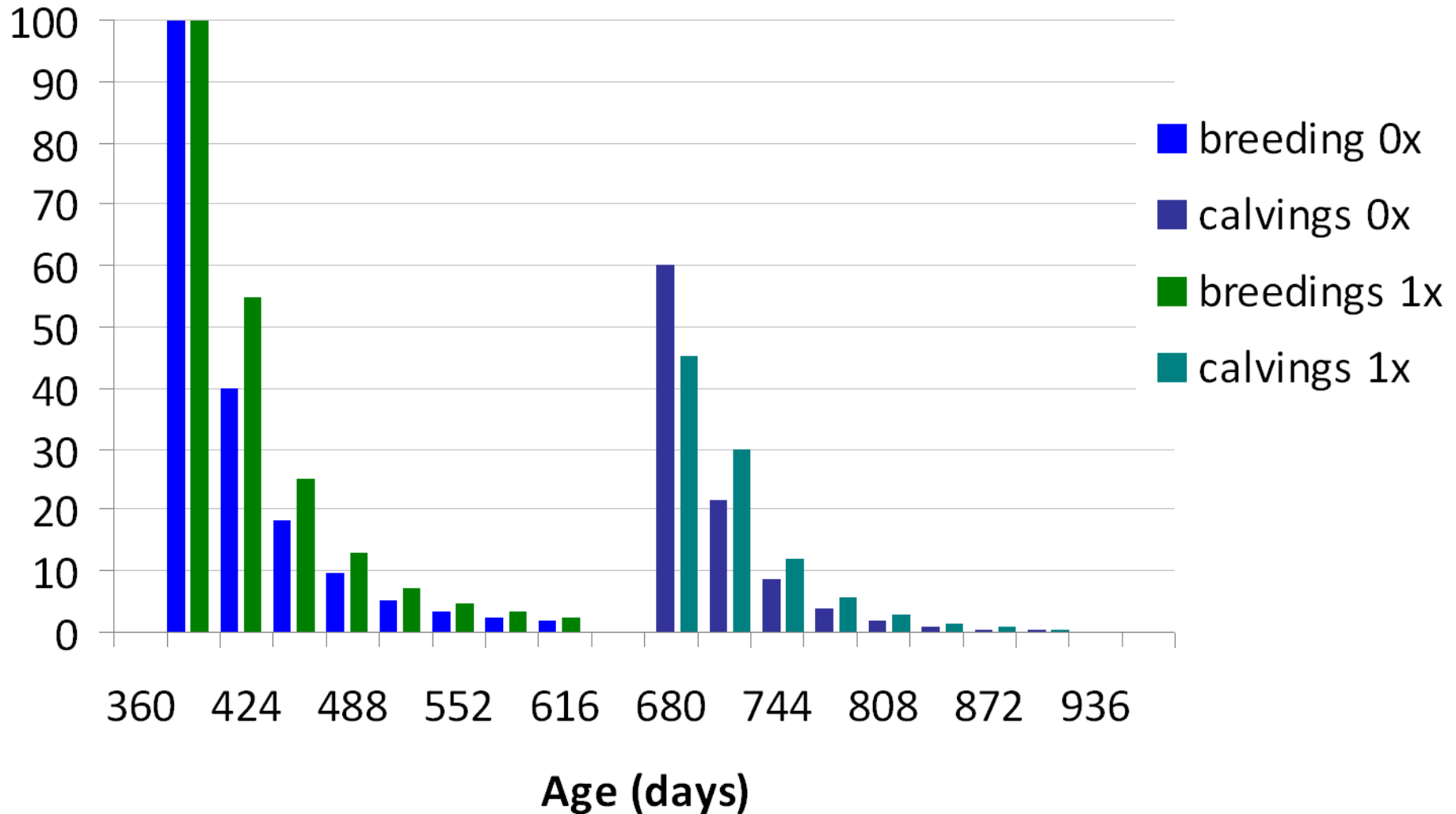
# Economics for Heifers



# Assumptions

- Age first breeding 400 days (13.2 months)
- 65% estrus detection rate (32 days between breedings)
- Maximum 8 services before cull
- Conception risks conventional semen 60% → 20%
- Conception risk sexed semen 75% of conventional
- Sexed semen \$40, conventional semen \$10
- Cost to raise heifer \$2/day
- Value heifer calf \$450, bull calf \$50
- Market value calving heifer \$1800
- Cull value open heifer maximum \$980
- Genetic improvement not considered

# 0x vs. 1x sexed semen



# Heifer statistics (1)

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	# Sexed semen breedings				
	0x	1x	2x	3x	4x
Avg. age at first calving, days	703	712	716	718	719
Breedings/heifer enrolled	1.81	2.11	2.27	2.37	2.42
Service per conception	1.83	2.15	2.33	2.44	2.51
Breeding cost/pregnancy, \$	11	26	32	36	38
Calving/heifer enrolled	99%	98%	98%	97%	96%
Heifer calves/heifer enrolled	47%	66%	75%	80%	82%
Average conception risk	55%	47%	43%	41%	40%

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# Heifer statistics (2)

	# Sexed semen breedings				
	0x	1x	2x	3x	4x
Profit/heifer enrolled	266	276	276	273	269
Cull revenue/heifer enrolled	11	16	20	25	30
Value of calf/heifer enrolled	214	280	312	329	337
Value of heifer/heifer enrolled	1766	1753	1741	1730	1720
Raising cost/heifer enrolled	1699	1715	1722	1724	1724
Breeding cost/heifer enrolled	19	54	73	85	92
Dystocia losses/heifer enrolled	7	5	3	2	2
Profit/breeding	147	131	121	115	111
Profit/breeding \$	14.71	5.40	3.99	3.41	3.10

# Heifer sensitivity analysis (1)

Conventional CR (%) <sup>1</sup>	Sexed CR (%)	Sexed semen price (\$)	Heifer calf value (\$)	Profit per heifer enrolled, conventional semen (\$)	Additional profit per heifer enrolled (\$)			
					----- Number of sexed semen services			
					1	2	3	4
60	50	35	500	287	42	56	59	59
60	50	45	500	287	32	40	41	38
60	45	35	500	287	24	28	24	17
60	45	45	500	287	13	11	4	(5)
50	45	35	500	226	39	53	57	56
50	45	45	500	226	28	36	37	34
50	40	35	500	226	16	16	9	(1)
50	40	45	500	226	6	(1)	(12)	(25)

# Heifer sensitivity analysis (2)

Conventional CR (%) <sup>1</sup>	Sexed CR (%)	Sexed semen price (\$)	Heifer calf value (\$)	Profit per heifer enrolled, conventional semen (\$)	Additional profit per heifer enrolled (\$)			
					----- Number of sexed semen services			
					1	2	3	4
60	50	35	300	202	5	2	(2)	(6)
60	50	45	300	202	(6)	(14)	(21)	(27)
60	45	35	300	202	(10)	(21)	(33)	(43)
60	45	45	300	202	(20)	(38)	(53)	(65)
50	45	35	300	145	5	4	(1)	(5)
50	45	45	300	145	(5)	(13)	(21)	(28)
50	40	35	300	145	(13)	(28)	(42)	(56)
50	40	45	300	145	(24)	(45)	(63)	(80)

Value of a new born heifer calf when she is either raised (Raised) or sold and a pregnant heifer is purchased back (Sold)

Raising cost (\$)	Purchase cost (\$)	Value of new born heifer calf (\$)	
		Sold	Raised
2000	2300	450	203
1800	2300	450	380
1600	2300	450	557
2000	2000	450	-55
1800	2000	450	122
1600	2000	450	299

Assumptions: 8% annual interest, discounted monthly. Market price newborn heifer calf is \$450. Raising cost is equal in each month. Heifer purchased at 23 months of age and raised on farm one more month. Heifers calve at 24 months of age. Culling of raised heifers not considered.

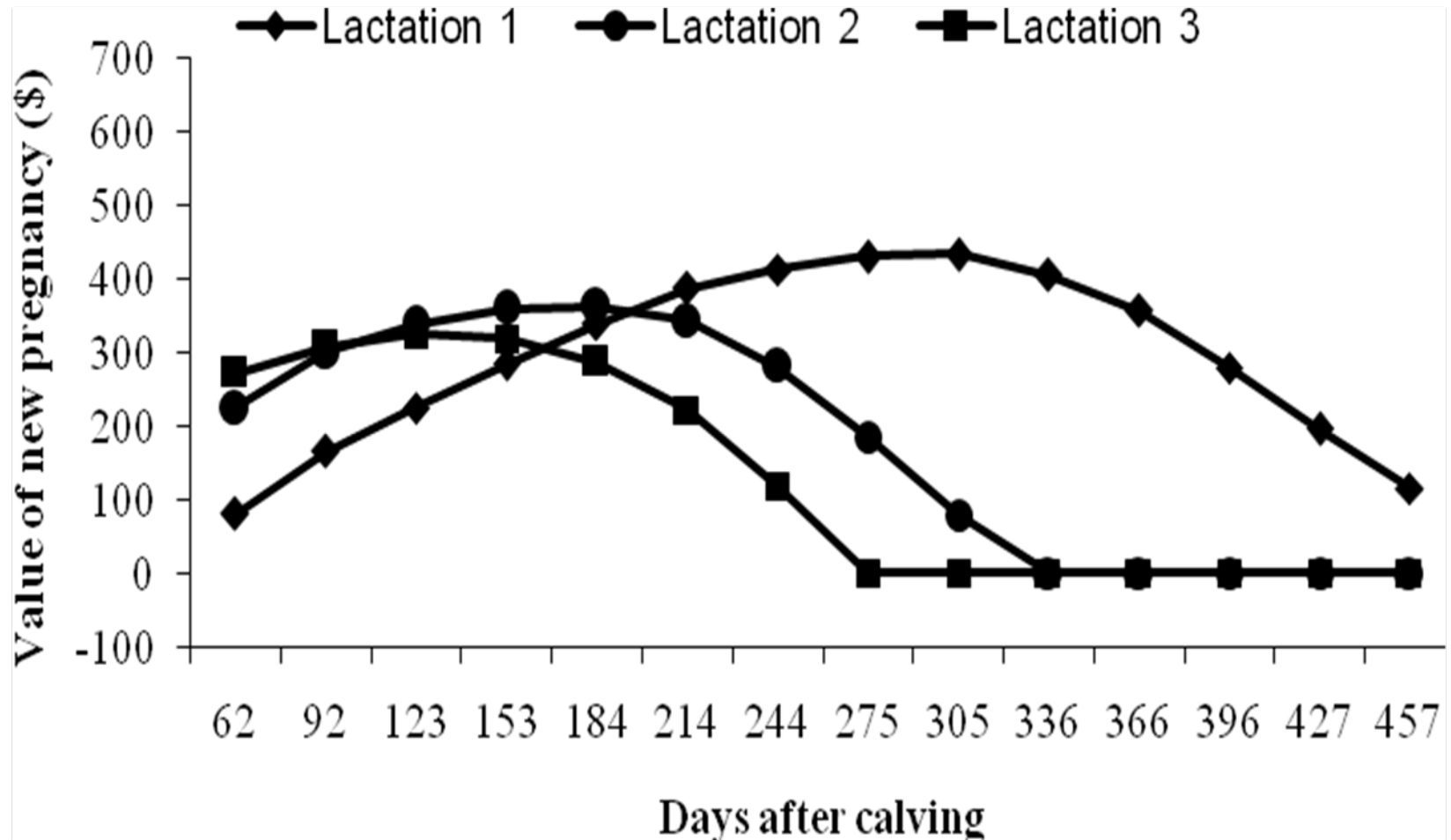
# Economics for Cows



# Sexed semen in cows

	Conventional Semen	1x Sexed Semen
Conception risk	35%	25%
Semen cost	\$10	\$40
% Heifer calves @ \$450 per calf	49%	90%
% Bull calves @ \$50 per calf	51%	10%
% Abortions and dead calves	10%	10%
Value of new pregnancy	\$200	\$200
Expected calf value per pregnancy	\$218	\$369
Cows not pregnant after service	65%	75%
Calf revenue	\$76	\$92
Semen cost	\$10	\$40
Non-pregnant cow cost	\$130	\$150
Net return	(\$64)	(\$98)
Gain (loss) of sexed semen breeding	-	(\$34)

# Value of new pregnancy (conventional semen)



# Break-even sexed semen conception risk for cows

Sexed semen cost	Value heifer calf	Value of new pregnancy	Conventional conception risk		
			35%	30%	25%
\$40	\$400	\$300	32%	28%	25%
\$40	\$400	\$100	31%	28%	24%
\$40	\$500	\$300	31%	27%	23%
\$40	\$500	\$100	29%	26%	23%
\$50	\$400	\$300	34%	30%	26%
\$50	\$400	\$100	35%	30%	27%
\$50	\$500	\$300	32%	28%	25%
\$50	\$500	\$100	31%	28%	25%

# Considering genetics

- \$32 extra value of sexed semen per heifer entering breeding pool, IF **top third** is bred with sexed semen (Fetrow et al. 2007)
  - Breed other heifers with conventional semen
- How to select your best heifers?
  - Molecular techniques?



# Other farm considerations

- Need to have the facilities to raise extra heifers.
- Value of biosecurity? (closed herd)
- More voluntary culling.
- Excellent breeding skills needed.
- It takes almost 3 years before heifers out of sexed semen breedings today are calving.
  - Springing heifer price?



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