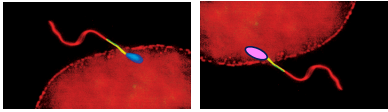




Sexed Semen: Tool for Genetic Improvement.
How Can We Use It Now?



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 **Beef Improvement Federation**
Improving the beef industry through performance evaluation

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35%-40% Fixed time AI pregnancy rate

55%-65% Fixed time AI pregnancy rate



2008 - 0 beef bulls
2013 - 79 + 49 at ST

Introduction

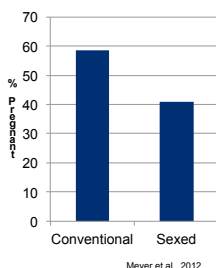
- Gender selected semen is currently being used in the dairy industry to produce replacement heifers with reasonable pregnancy rates.
 - 35-40 % heifers - Weigel, 2004
 - Approx. 50% in heifers and 29% in cows – DeJarnette et al., 2008

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Beef Heifers

- Early studies indicated a 3% to 13% decrease in pregnancy rates in heifers bred with sexed semen. (Deutscher et al., 2002)
- Rhinehart and coworkers observed a 4% to 38% decrease in pregnancy rates in heifers

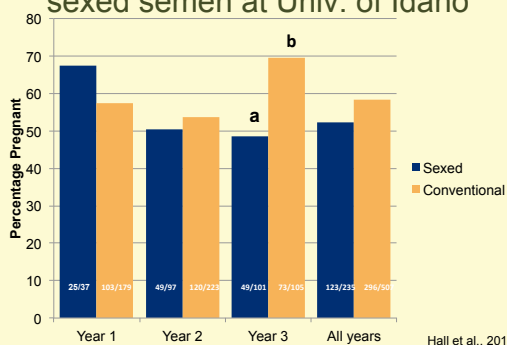


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Pregnancy rates to conventional and sexed semen at Univ. of Idaho



Postpartum cows

- A Southeastern study reported a 33% decrease in pregnancy rates for cows bred with sexed semen.
- Sexed semen performed similarly in postpartum beef cows and heifers.

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FACTORS AFFECTING SUCCESS WITH SEXED SEMEN

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Impact of estrus and semen type on AI pregnancy rates

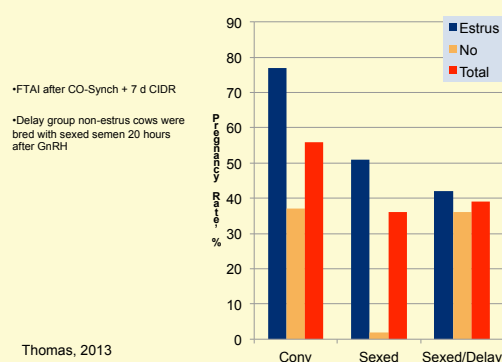
Semen Type	Estrus status by AI		
	In Heat	Not in Heat	Questionable
Sexed	50.0 (28/56)	39.4 (13/33)	62.5 (5/8)
Conventional	60.0 (69/115)	46.7 (42/90)	50.0 (9/18)

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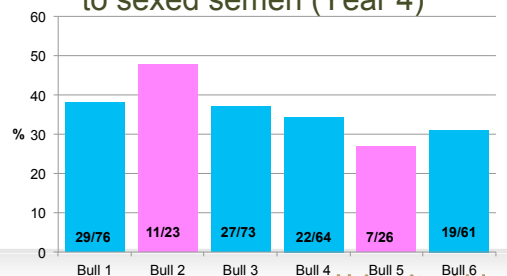
Effect of timing of FTAI in 5 day CIDR protocol on pregnancy rates to sexed semen

Time of FTAI	Head	#AI	%AI
72	202	67	33.2
80	121	47	38.8
Total	323	114	35.3

P > .30



Effect of bull on pregnancy rate to sexed semen (Year 4)

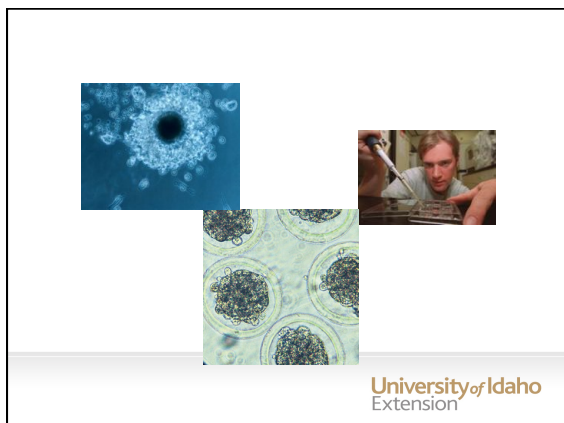


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AI with sexed semen

- Breeding after estrus best; FTAI feasible.
- 10% to 20% decrease in pregnancy rates compared to conventional semen.
- Greater variability in success.
- Similar fertility in postpartum cows and heifers.
- Calves perform the same as calves from conventional AI

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Use of sexed semen in embryo transfer has been discouraged by the semen sexing industry.

Sexed semen and Embryo Transfer (MOET)

Experiment	% Transferable embryos		Semen dosage (million)		Heifers or cows
	Sexed	Conventional	Sexed	Conventional	
Schenk et al., 2006*	18.6/16.5	43.5	10.0/2.0	40	Both
Hayakawa et al., 2009	53.4	68.1	5.0	5.0	Heifers
Peippo et al, 2009 (Expt. 1)	70.3	75.0	6.0 to 8.0	30 to 45	Heifers
Peippo et al, 2009 (Expt. 2)*	53.9	65.5	6.0 to 8.0	30 to 45	Heifers
Larson et al., 2010*	39.5	60.5	8.4	80	Cows

* Effect of semen type on % transferable embryos (P < 0.05)

A 20% to 35% reduction in transferable embryos

In Vitro Fertilization (IVF) with sexed semen



- Only need 600-1500 sorted sperm to fertilize oocyte in vitro.
- Upwards of 1400 ova fertilized per straw.
- Ovum pick-up is typical method for harvesting oocytes.

In Vitro Fertilization (IVF) with sexed semen

- Pregnancy rates to IVF embryos produced with sexed semen 30% to 50%.
- Pregnancy rates of 36-40% even when shipped during culture. (Pontes et al., 2010)
- Reduced cleavage or blastocyst rates. (Zang et al., 2003; Blondin et al., 2009)

Reverse Sorting

- Sorting of previously frozen conventional semen
- Allow sexing of semen from bulls no longer producing semen.
- Used for IVF

Development of Maternal Lines for Use with Terminal Sires



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Compared to other meat animals true use
of maternal lines mated to terminal sires
is limited in beef cattle.

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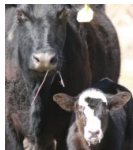
Subset of elite cows



One time FTAI with
X-Sorted semen +
Natural service

66% to 75% ♀

Subset of elite cows



Three times AI with X-
Sorted semen on
observed estrus

85% - 88% ♀

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How Many Cows Needed to Create Replacements

Traditional System

- 300 cow herd
- 15% replacement rate
- 90% weaning rate
- Takes up 1/3 of the herd and produces 45 steers that may not excel in market place
- Need 45 replacements
- Breed 100 cows to maternal bulls

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X-Sorted Systems

FTAI + Natural Service

- 15% replacement rate
- 90% weaning rate
- 66% ♀
- 75 cows → 45 heifers
- 22 steers
- 25% of herd

3x estrus detection + AI

- 15% replacement rate
- 90% weaning rate
- 83% ♀
- 60 cows → 45 heifers
- 9 steers
- 20% of herd

Gender ratios and performance of female calves

	Year 1		Year 2		Year 3	
Semen Type	GSS	CON	GSS	CON	GSS	CON
Female to Male Ratio	78:22	47:53	68:31	50:50	62:38	56:44
Growth Performance (kg)*	259.8	258.7	277.7	273.2	277.0	271.8

GSS = gender-selected semen; CON = Conventional semen.

* Growth performance = 205 d adj wt.

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Increased Value of Using Sexed Semen to Develop Maternal Lines

- Some increase in value of progeny from terminal sires and SS dams
- **Increased productivity of maternal line**
 - Increased selection pressure (20% vs 30%)
- May need to retain ownership to capture full value

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Heifer-Heifer System



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Current and future techniques in genetic evaluation in commercial herds including EPDs and gene markers may soon make selection of replacement heifers at a very early age possible.

Heifer-Heifer

- All replacement heifers bred to X-sorted semen with desired maternal traits.
 - Reduced dystocia
 - Decreased generation interval
 - Replacement heifers older at breeding
(Kill et al., 2012; 340P)
- Some use currently in dairy industry

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Shifting Gender Ratios



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Shifting Gender Ratios

- Seedstock application produce more of the desired sex
 - Commercial bull producer = Y-sorted
 - Replacement heifer operation = X-sorted
 - Creating female lines = X-sorted
- Commercial application
 - Marketing advantage
 - Meeting specific customer needs

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Impact of various sex ratios on value of calves from NMCREEC

Increased cost of GSS	\$0	\$5	\$10	\$15	\$20
Increased cost /300 units	\$0	\$1500	\$3000	\$4500	\$6000
Value of change in sex ratio			\$4,320	\$8,640	\$12,960

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The greatest value in shifting gender ratios for cow/calf operations may be in enabling smaller operations to sell full tractor trailer loads of steers.

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Summary/Conclusions

- FTAI pregnancy rate with GSS varied from 35% to 50%
- A single AI to sexed semen followed by natural service can successfully alter gender ratios.
- Depending on cost of GSS ratio, shifts of 60:40 male:female may be profitable; 70:30 ratio is a goal.
- A better understanding of the impact of bull as well as timing of AI on fertility to GSS is needed.

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Gender Ratio Project

- 60 cows bred to X-sorted semen
 - HA females
- 240 cows bred to Y-sorted semen
 - Terminal sires
 - Angus
 - SimAngus
 - Simmental
- 65% steers
- 76 harvested to date
 - 836 lb HCW
 - 14 sq in REA
 - 0.6 in BF
 - YG 3
 - 92% Choice
 - 44% upper 2/3 Choice



The Future

- Fertility of sexed semen will improve
 - Decreased sorting damage
 - Synchronization systems
 - Bull selection
- Applications will continue to develop
- Sexed semen will not “ruin” the industry

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Sexed semen is a technology
whose time has come in the
beef industry;
however, producers need to
understand the risks and
limitations.

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