
Timing of artificial insemination with breeding protocols utilizing sex-sorted technology
Dr. Ben Voelz
Technical Services and Sales Support Manager
benjamin.voelz@stgen.com

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PRESENT
FUTURE
PAST
2

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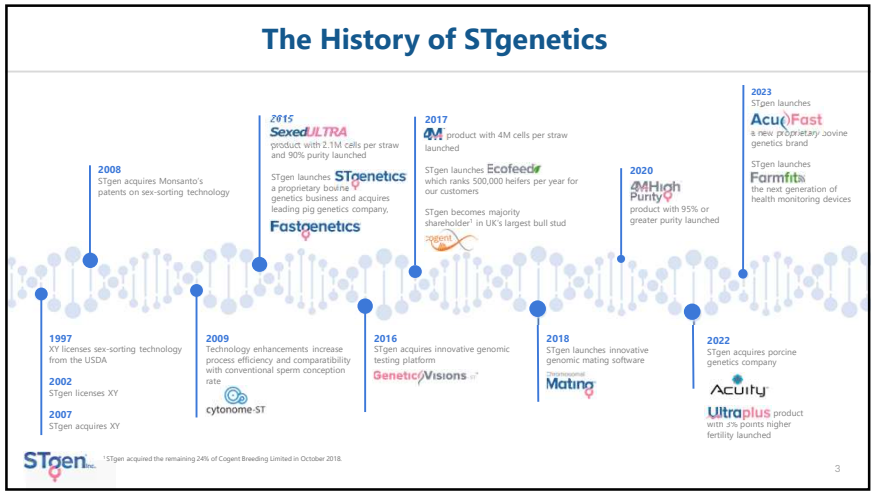
The History of STgenetics
2008
STgen acquires Monsanto's patents on sex-sorting technology
2015
SexedULTRA
product with 2.1M cells per straw and 90% purity launched
STgen launches STgenetics a proprietary bovine genetics business and acquires leading pig genetics company, Fastgenetics
2017
4M product with 4M cells per straw launched
STgen launches Ecofeed which ranks 500,000 heifers per year for our customers
STgen becomes majority shareholder[1] in UK's largest bull stud
2020
4MHigh Purity
product with 95% or greater purity launched
2023
STgen launches
Acu Fast
a new proprietary bovine genetics brand
STgen launches
Farmfits
the next generation of health monitoring devices
1997
XY licenses sex-sorting technology from the USDA
2002
STgen licenses XY
2007
STgen acquires XY
2009
Technology enhancements increase process efficiency and comparatibility with conventional sperm conception rate
cytonome·ST
2016
STgen acquires innovative genomic testing platform
GeneticVisions
2018
STgen launches innovative genomic mating software
Mating
2022
STgen acquires porcine genetics company
Acuity
Ultraplus product with 3% points higher fertility launched
STgen
[1]STgen acquired the remaining 24% of Cogent Breeding Limited in October 2018.
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Ultraplus Conception Rate gain
14% better than the first
3% better than the best
XY
Sorting technology
2005-2015
SexedUltra
+8%
2015-2017
4M
+3%
2017-2021
Ultraplus
+3%
2022
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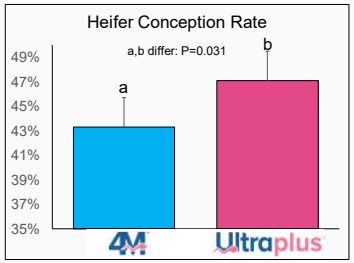
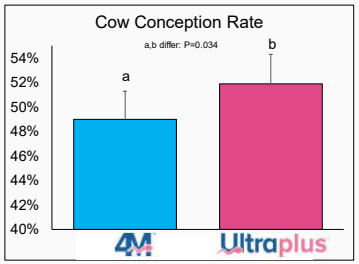
Ultraplus™ Field trial data demonstrates Ultraplus™ advantage.

- Improved Heifer Conception Rate (+3.8%)
- US study: 3,604 inseminations
- Improved Cow Conception Rate (+3%)
- UK study: 15,434 inseminations





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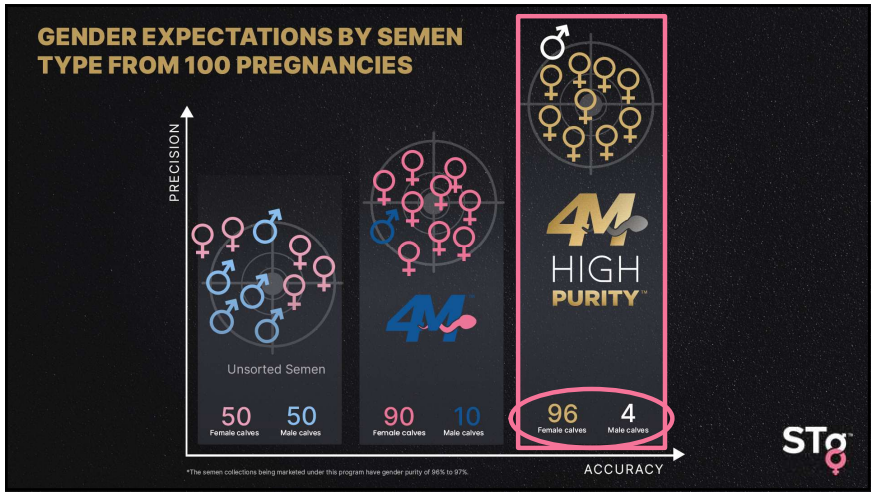

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Heifer Inventory Management

- **Hot topic of discussion over the past 5+ years**
  - **Rising feed costs**
  - **Decreased value of dairy steer calves**
  - **Increased value of BxD calves**
- **Opportunity to use a sexed and beef only breeding strategy**
  - **Sexed female dairy → top genetics**
  - **Beef → bottom genetics**

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Current Heifer Inventory

What is the cost to raise a heifer in 2024?

What opportunities are present if we correct heifer inventory?

What are the challenges we face to achieve the correct heifer inventory?

By AGE	Goal	Count	Difference
0-1	170	193	23
0-2	170	207	37
0-3	170	202	32
0-4	170	191	21
0-5	170	136	-34
0-6	170	156	-14
0-7	170	180	10
0-8	170	197	27
0-9	170	193	23
0-10	170	225	55
0-11	170	224	54
1-0	170	234	64
1-1	170	164	-6
1-2	170	225	55
1-3	170	180	10
1-4	170	231	61

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Strategic Breeding Strategies

- Create the right number of heifers from the best genetics available
  - Genomic testing
- Mating programs
  - Sire suggestions
  - Semen type to use
- Maximize fertility & ROI for dairy
  - Sexed female dairy
  - Beef x Dairy
    - Conventional beef
    - Super conventional male beef
    - 90% Sexed male beef

How can we implement these strategies?

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Heifer Inventory

Strategy to Reach Target Number of Heifers

Total vs Goal

Type	Quantity
Total Fresh	640
Dairy Bulls	15
Beef Calves	417
Heifer Calves	179
+/- Needed	+10

	Lactation #							
Service #	Heifers		1		2		3+	
	High $NM	Low $NM	High $NM	Low $NM	High $NM	Low $NM	High $NM	Low $NM
1	Sexed	Beef	Sexed	Beef	Beef	Beef	Beef	Beef
2	Sexed	Beef	Beef	Beef	Beef	Beef	Beef	Beef
3	Sexed	Beef	Beef	Beef	Beef	Beef	Beef	Beef
4+	Beef	Beef	Beef	Beef	Beef	Beef	Beef	Beef

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Estimated Semen Usage Needs / month

Lact	Embryo	% of breeding	Sexed	% of breeding	Conv	% of breedings	Beef	% of breeding	Total	% of breeding
Heifers	0	0%	364	77%	0	0%	107	23%	**471**	29%
Lact=1	0	0%	81	18%	0	0%	366	82%	**447**	28%
Lact=2	0	0%	0	0%	0	0%	277	100%	**277**	17%
Lact=3+	0	0%	0	0%	0	0%	423	100%	**423**	26%
Total	**0**	**0%**	**445**	**28%**	**0**	**0%**	**1172**	**72%**	**1617**	**100%**

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Strategic Breeding Strategies

- Predict semen usage and make precise breeding decisions
- Control heifer replacement creations
- Maximize the calf value using BxD
- Remove decision making away from the breeder

ID	LACT	TBRD	SEMEN
2184	1	0	SX HOL
2189	1	0	SX HOL
2195	1	0	SX HOL
3343	9	0	CON BEEF
3681	8	0	CON BEEF
3814	2	0	SX BEEF
3906	7	0	CON BEEF
3959	6	0	SX HOL
4071	7	0	CON BEEF
4140	1	0	SX HOL
4143	4	0	SX BEEF
4145	1	0	SX HOL
4163	1	0	SX HOL
4166	1	0	SX HOL
4172	1	0	SX HOL
4277	6	0	CON BEEF

ID	LACT	TBRD	CBRD	SEMT
17477	2	0	H	SXJ
17506	2	0	J	SXH
17517	2	0	H	SXJ
17553	2	0	H	SXJ
17558	2	0	J	CHR
17562	2	0	X	CHR
17563	2	0	H	SXJ
17628	2	0	H	SXJ
17656	2	0	H	SXJ
17667	2	0	H	SXJ
17767	2	0	H	SXJ
17782	2	0	J	SXH
17806	2	0	H	SXJ
17811	2	0	J	SXH
17816	2	0	J	CHR

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How to use gender-sorted semen in reproductive programs

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Review of the Literature

- Optimal time of insemination with conventional semen is accepted to be 4-16 hours after onset of estrus (Dransfield et al., 1998; Stevenson et al., 2014)
- Early observational studies indicated that postponement (16 to 40 h after onset of estrus) of AI with gender-sorted semen improved P/AI compared with AI between 4 to 12 h after onset of estrus (Sá Filho et al., 2010; Sales et al., 2011; Bombardelli et al., 2016)
- In contrast, inseminating cows with sexed semen 16 h after GnRH yielded more P/TAI than when cows were inseminated 24 h after GnRH. (Lauber et al. 2020)
- More research is needed to determine the optimal time of insemination with gender-sorted semen

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Effect of interval between the induction of ovulation or the onset of estrus and artificial insemination on fertility of lactating Holstein cows

V. G. Santos, P. D. Carvalho, C. Maia, A. H. Souza, J. A. L. Castro, A. M. F. Pereira, G. Arsenos, S. Priskas, P. Ross, J. Moreno, M. C. Wiltbank, and P. M. Fricke

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Exp 1 - Objective and Hypothesis

Objective:

Evaluate the effect of the interval between induction of ovulation and artificial insemination on fertility of lactating Holstein cows

Hypothesis:

Insemiantion around 16 h after the last GnRH treatment of the synchronization protocol will increase P/AI compared to insemination at other intervals.

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Exp 1 – Material and Methods

- 13,318 lactating Holstein cows from 2 commercial farms were used.
- Cows were synchronized with a Double-Ovsynch protocol for first postpartum insemination. Cows failing to conceive were resynchronized with a GGPPG protocol.
- Cows were inseminated between 13 and 23 h after the last GnRH treatment.
- Dairy sexed female, beef sexed male, and beef conventional semen was used based on recommendation of consultants to the farms.
- Exact time of the last GnRH and the AI recorded for all the animals

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Exp 1 – Material and Methods

Item	Value
Farms	2
Cows	13,318
First AI	14,089
Resynch AI	6,806
Total AI	20,895
DIM	102 (69 - 598)
TBRD	1.6 (1 – 8)
Lactation#	2.4 (1 – 10)
Milk production (lb/d)	92.5 (30 - 229)
Milk production (Kg/d)	41.9 (16 - 104)

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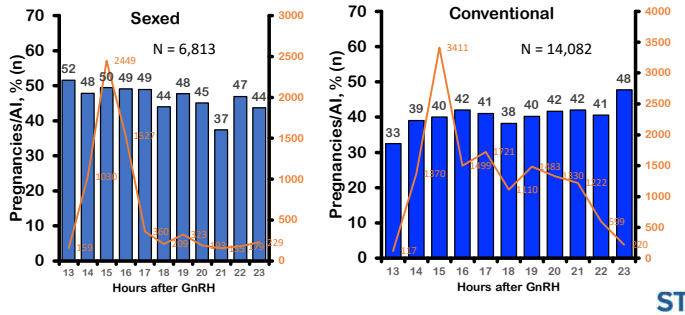
Effect of interval between GnRH and AI and sexed vs conventional semen on P/AI (raw data) – Exp 1



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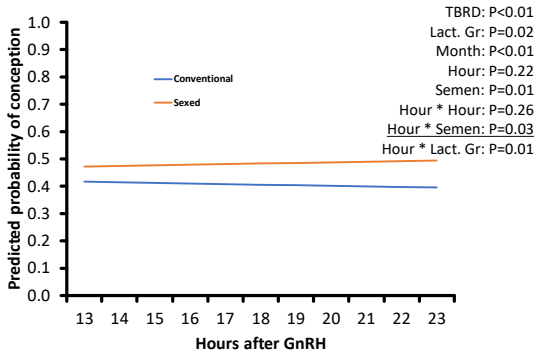
Predicted probability of conception based on hours after the GnRH at AI and type of semen



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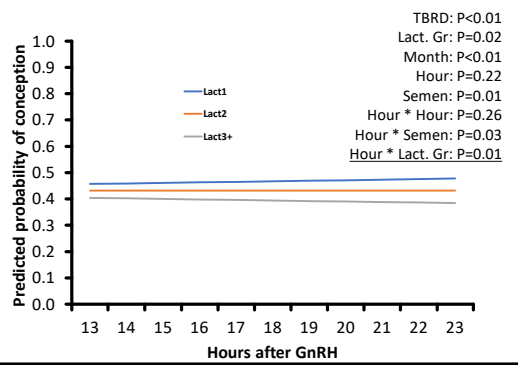
Predicted probability of conception based on hours after the GnRH at AI and Lact group



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Exp 2 - Objective and Hypothesis

Objective:

Evaluate the effect of the interval between induction onset of estrus detected by an activity monitor and timing of insemination on P/AI

Hypothesis:

Insemiantion around 16 h after the onset f estrus will result in more P/AI compared to insemination early after the onset of estrus or after 24 h.

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Exp 2 – Material and Methods

- 12,126 lactating Holstein cows from 2 commercial farms were used.
- Onset of estrus and timing of AI were recorded
- Cows were inseminated between 0 and 40 h after the onset of estrus determined by an activity monitor system (SCR).
- Dairy sexed female and beef conventional semen was used based on recommendation of consultants to the farms.

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Exp 2 – Material and Methods

Item	Value
Farms	2
Cows	12,126
First AI	11,810
Resynch AI	10,643
Total AI	22,453
DIM	99 (21 – 296)
TBRD	1.8 (1 – 8)
Lactation#	2.2 (0 – 9)
Milk production (lb/d)	70.1 (18 – 145)
Milk production (Kg/d)	31.8 (8 – 66)

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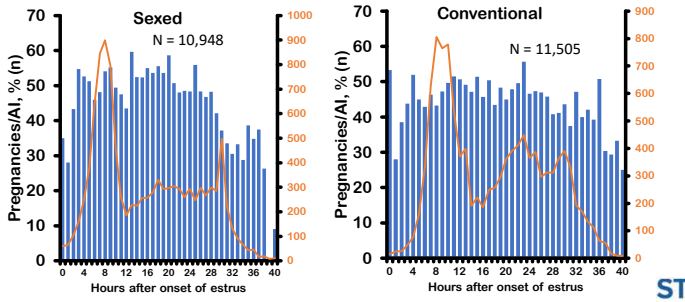
Effect of interval between onset of estrus and AI and sexed vs conventional semen on P/AI (raw data) – Exp 2



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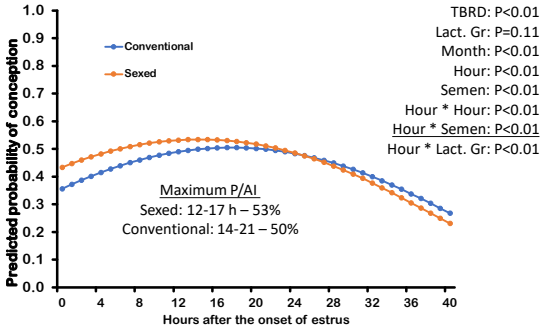
Predicted probability of conception based on hours after onset of estrus at AI and type of semen



TBRD: P<0.01
Lact. Gr: P=0.11
Month: P<0.01
Hour: P<0.01
Semen: P<0.01
Hour * Hour: P<0.01
Hour * Semen: P<0.01
Hour * Lact. Gr: P<0.01

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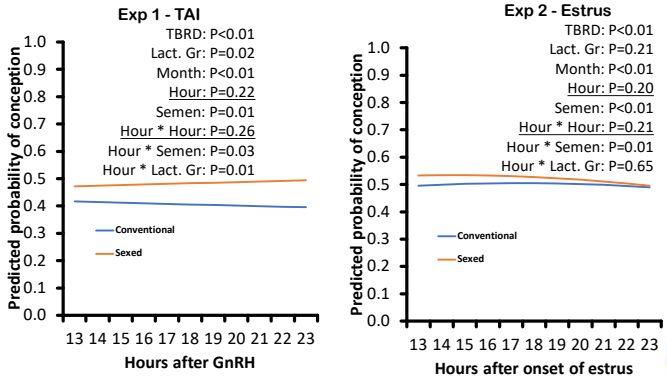
Predicted probability of conception based on hours after GnRH/onset of estrus at AI and type of semen on P/AI

(Only AI between 13-23h)



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Conclusions

- Great advancements in gender-sorted semen technology have been made over the past 10 years.
- Improvements in reproductive efficiency of dairy farms has allowed for use of gender-sorted semen in both heifers and cows.
- Heifer inventory management utilizing a sexed and beef semen breeding strategy have become widely adopted requiring gender-sorted semen usage in cows and heifers

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Conclusions

- Insemination between 13-23 h after the last GnRH of the synchronization protocol did not affect P/AI (Exp 1)
- Insemination of cows early after the onset of estrus (0-2h) or after 24h after the onset of estrus decreased P/AI compared to insemination between 13-23 h after the onset of estrus (Exp 2)
- Gender-sorted semen should be used like conventional semen with time of insemination 13-23 h after the last GnRH of a synchronization protocol or after the onset of estrus

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