



New reproductive technologies: sexed semen and IVF

Stephen Butler



Introduction

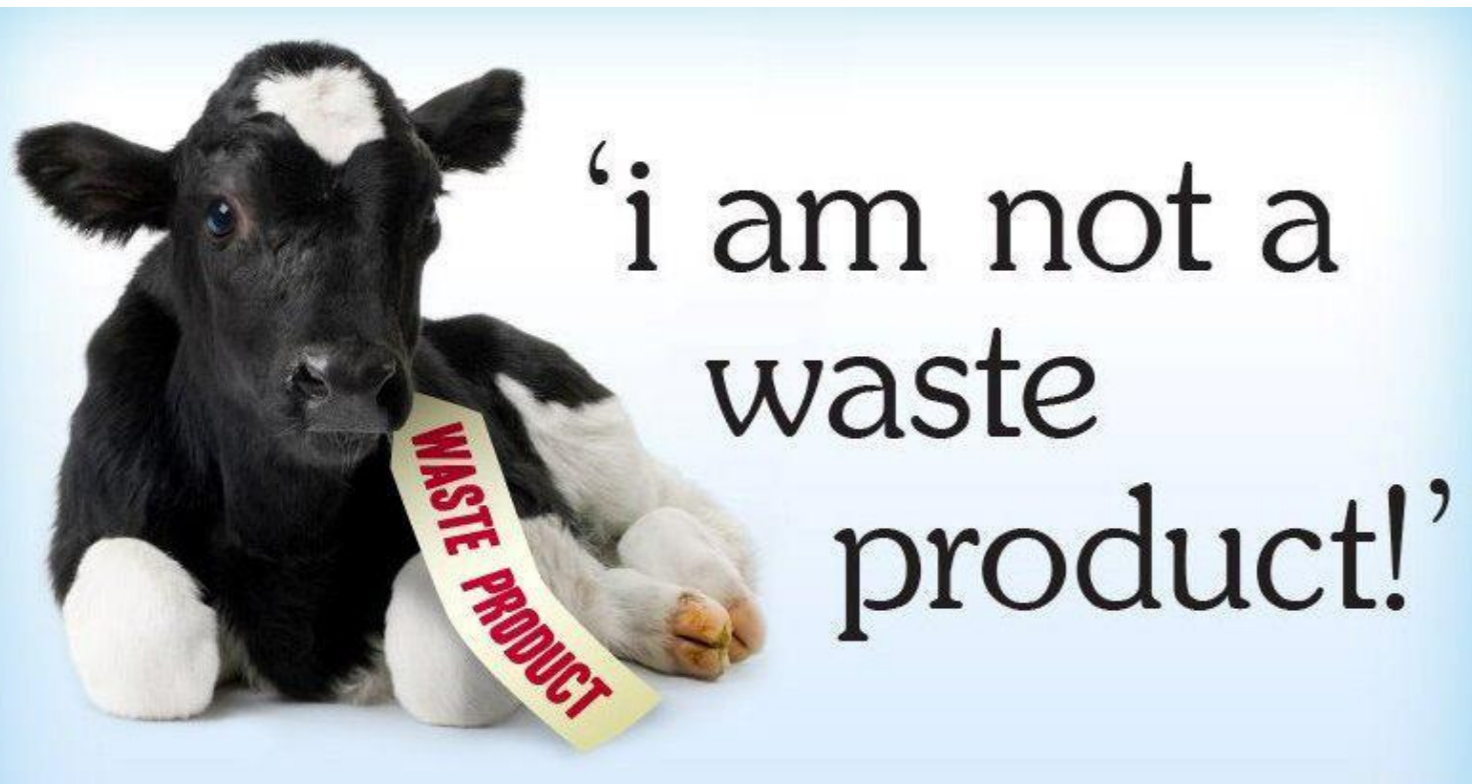
1.5 million dairy cows



800K calves with a dairy sire



½ are valuable



1. What is sexed semen?

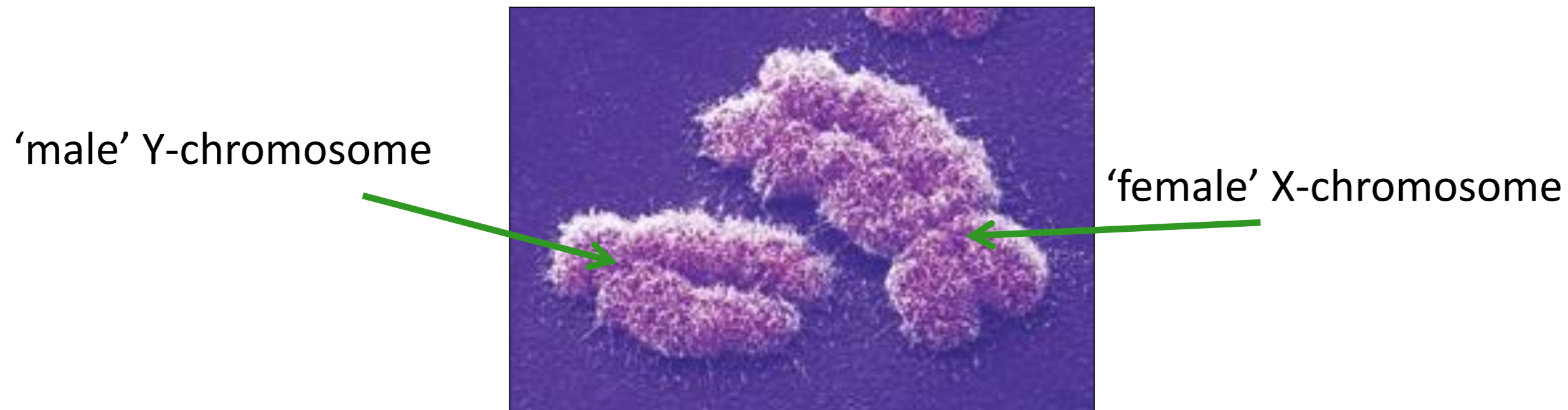
2. Does it work?

3. Elite male dairy bulls?

4. Beef calves from dairy cows?

How is sex determined?

- Semen contains ~ equal No. sperm containing X or Y chromosomes

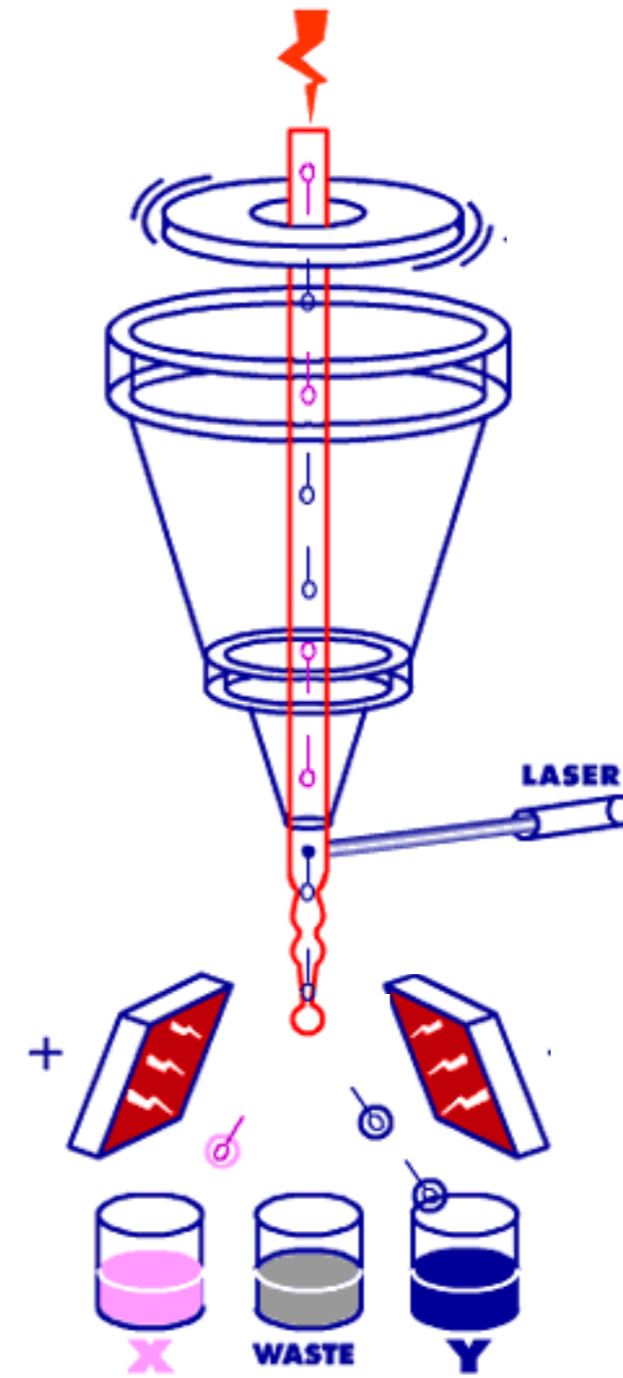


- Sperm identical in size, weight, swimming speed etc.
- A distinguishing feature needed to sort sperm?
- Sperm bearing an X-chromosome contain ~4% more DNA

Fluorescence Activated Cell Sorting



Sperm with fluorescent DNA binding dye



Changing herd breeding strategy



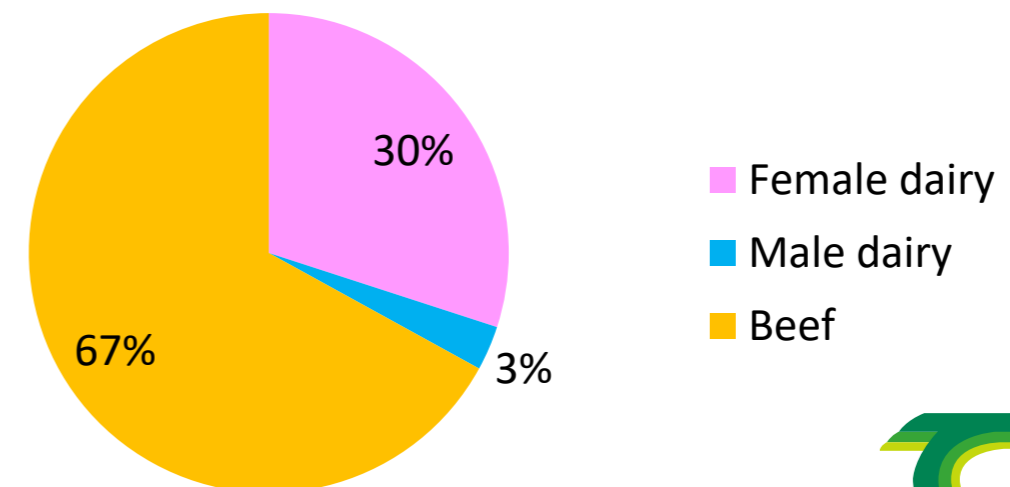
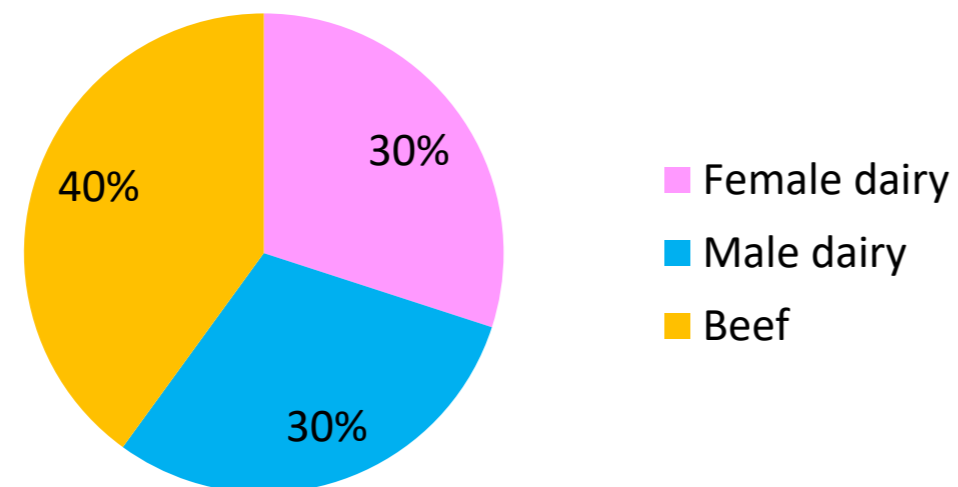
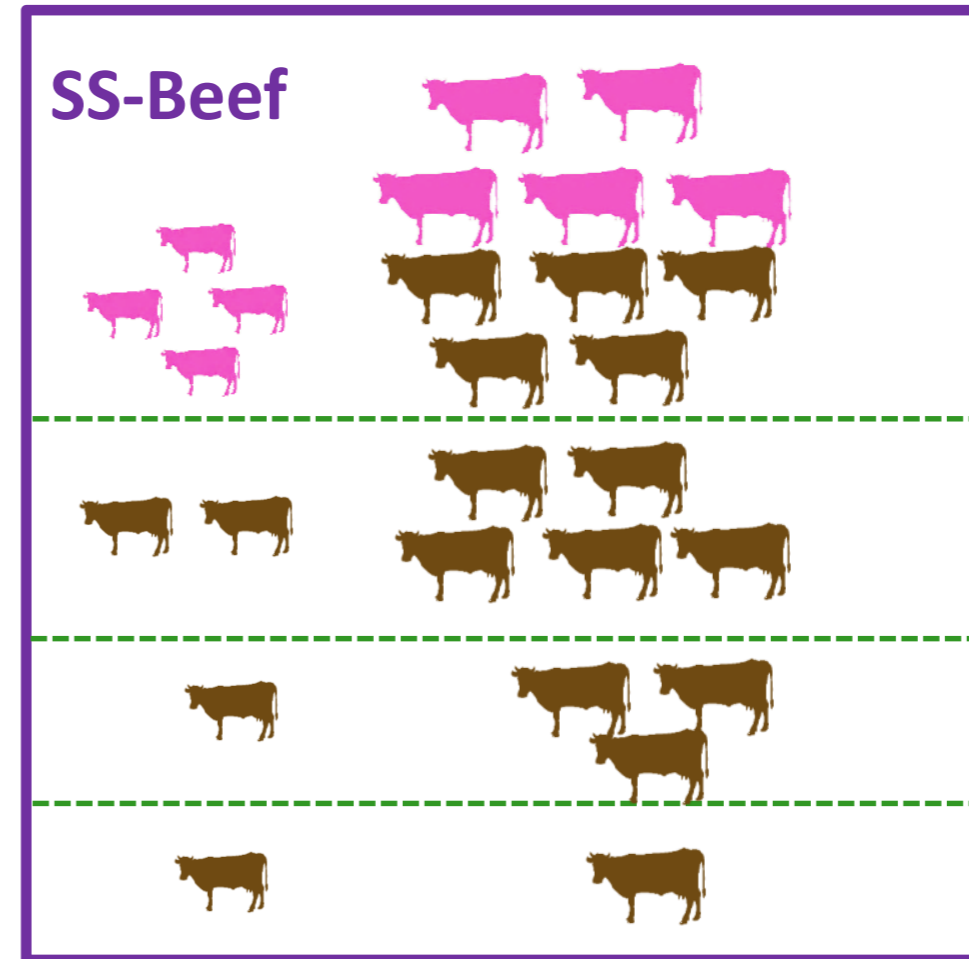
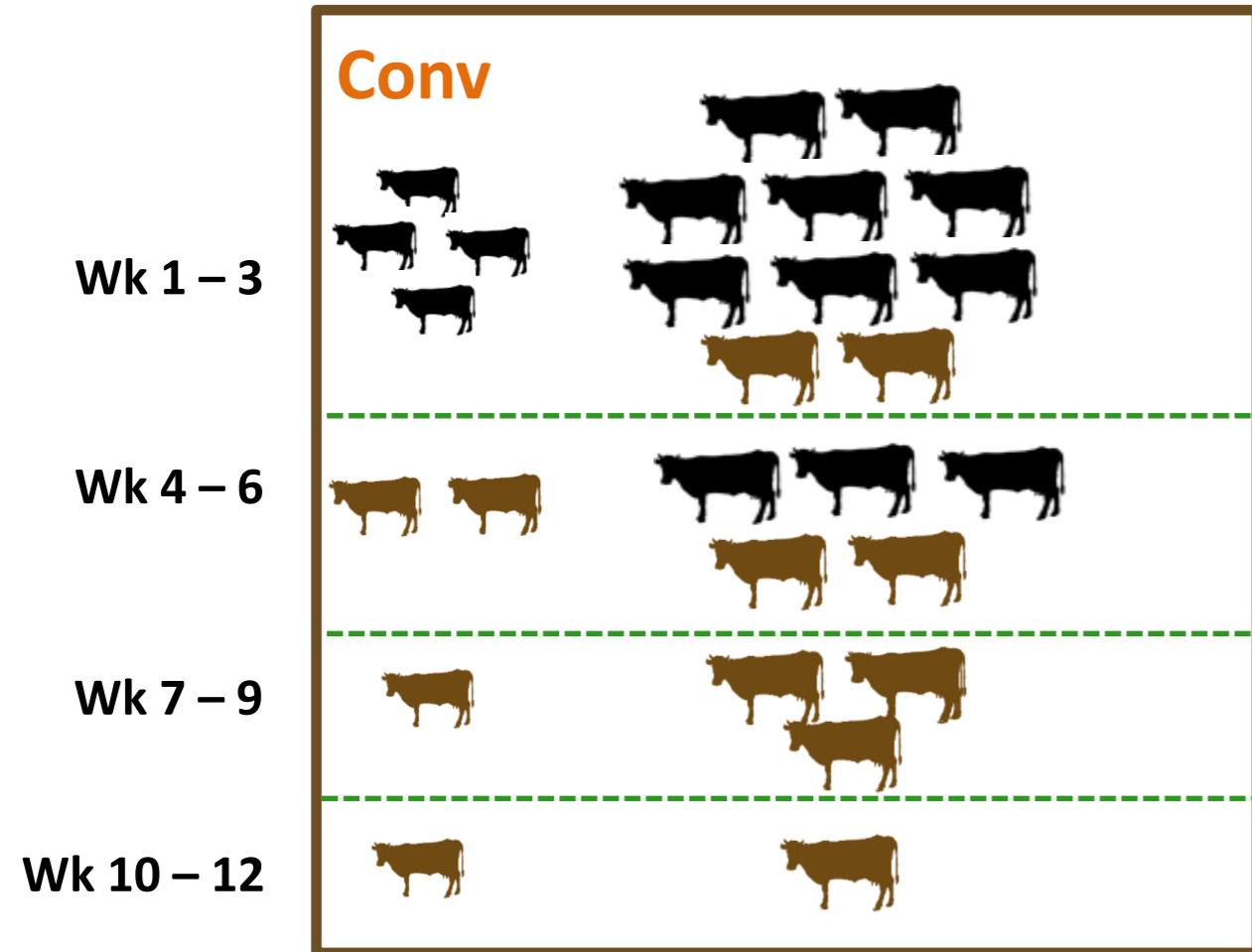
Conv. dairy semen



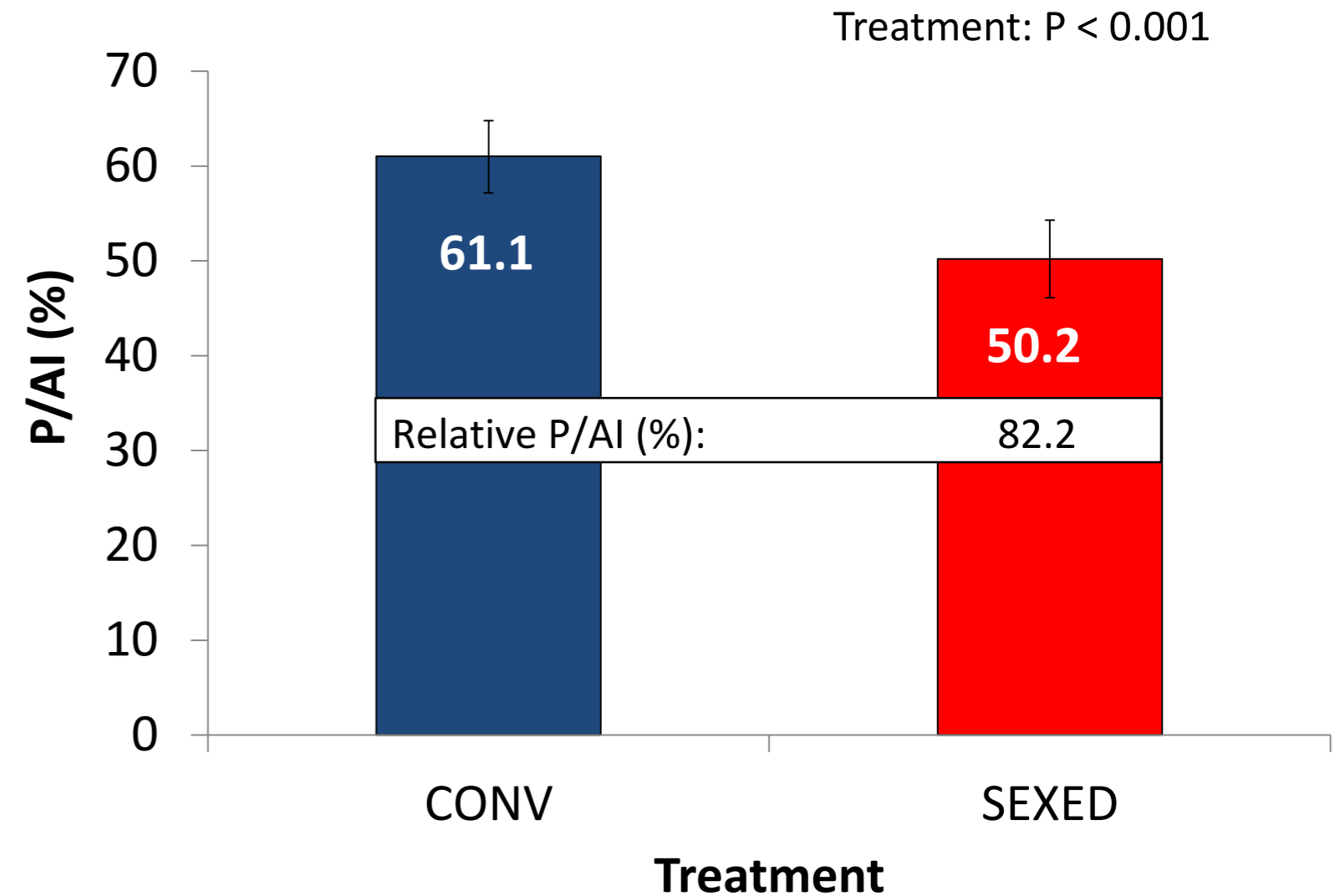
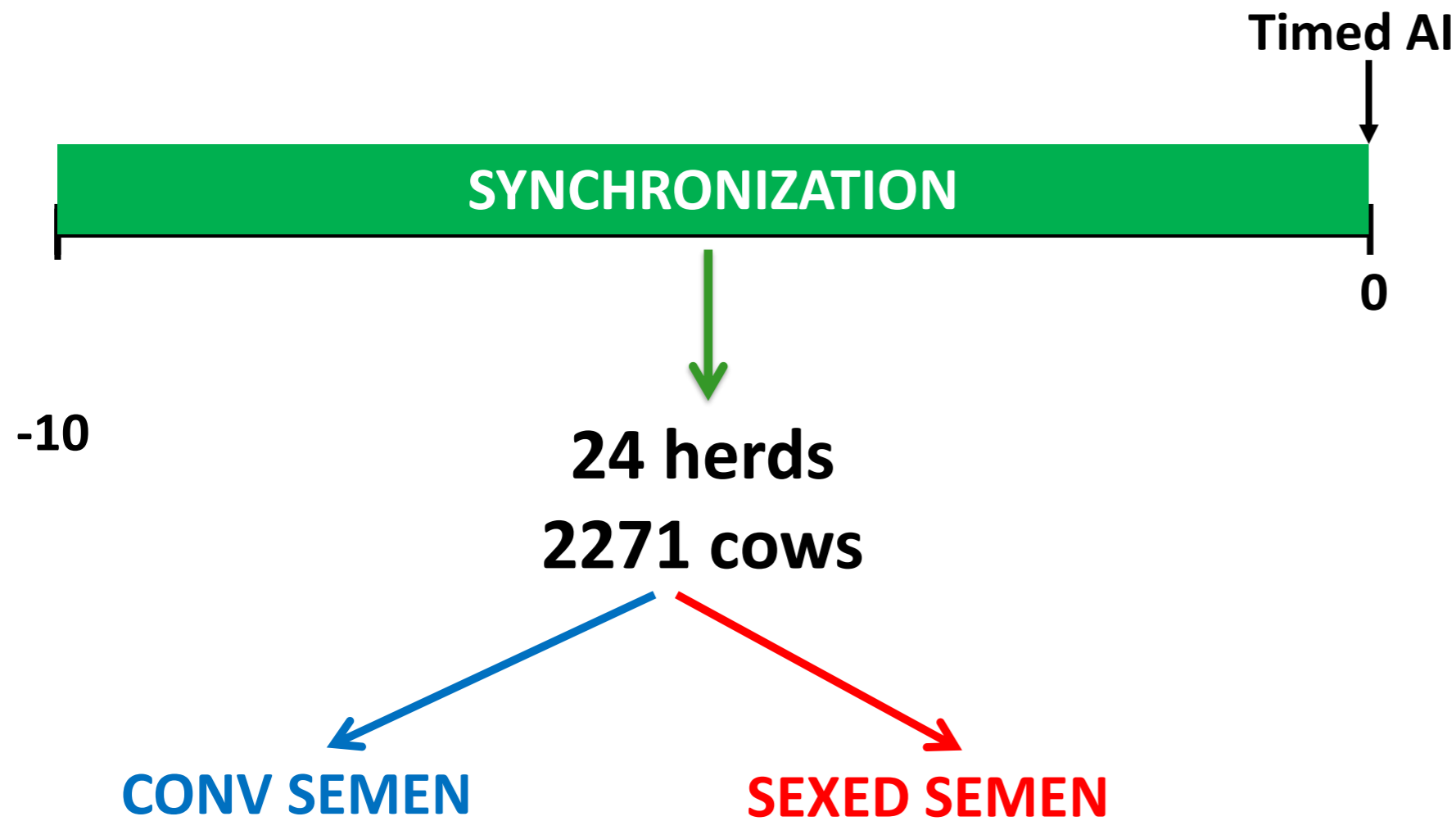
Conv. beef semen



Sexed semen



Sexed semen fertility performance

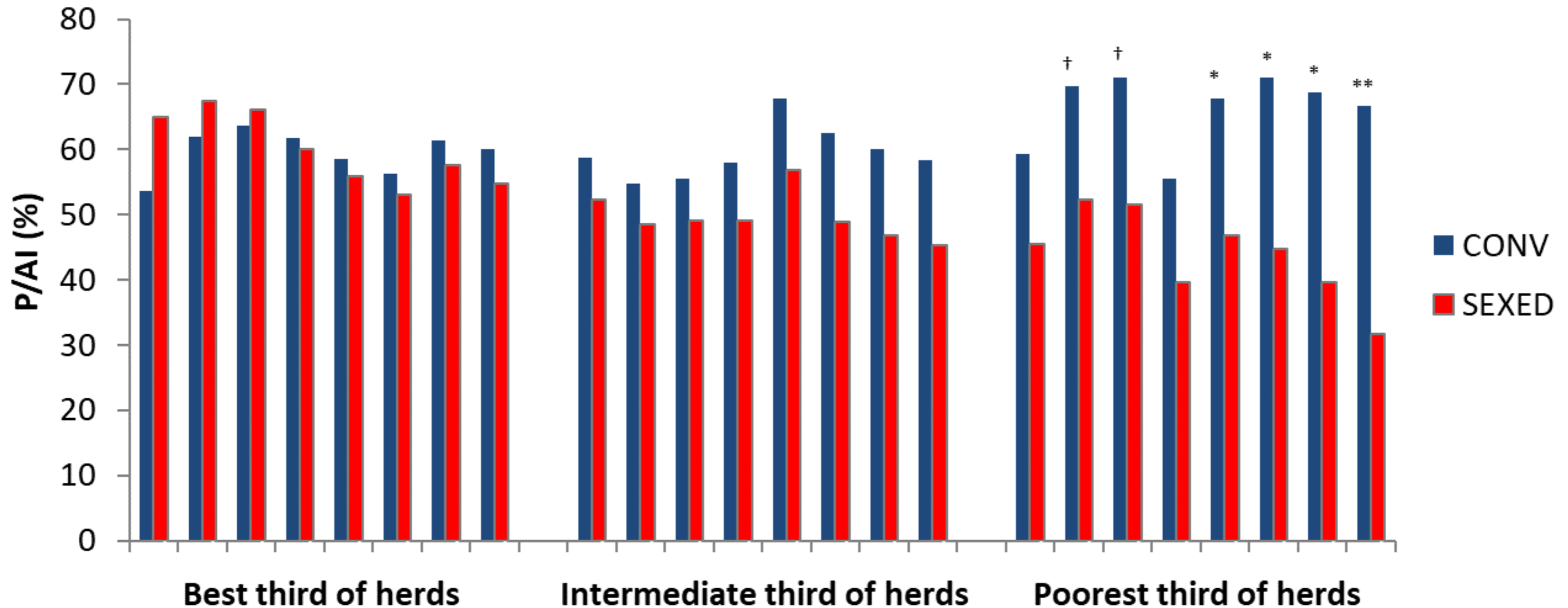


Herd variation in P/AI

Rel. P/AI = 100% (91% to 121%)

Rel. P/AI = 84% (78% to 89%)

Rel. P/AI = 67% (48% to 77%)

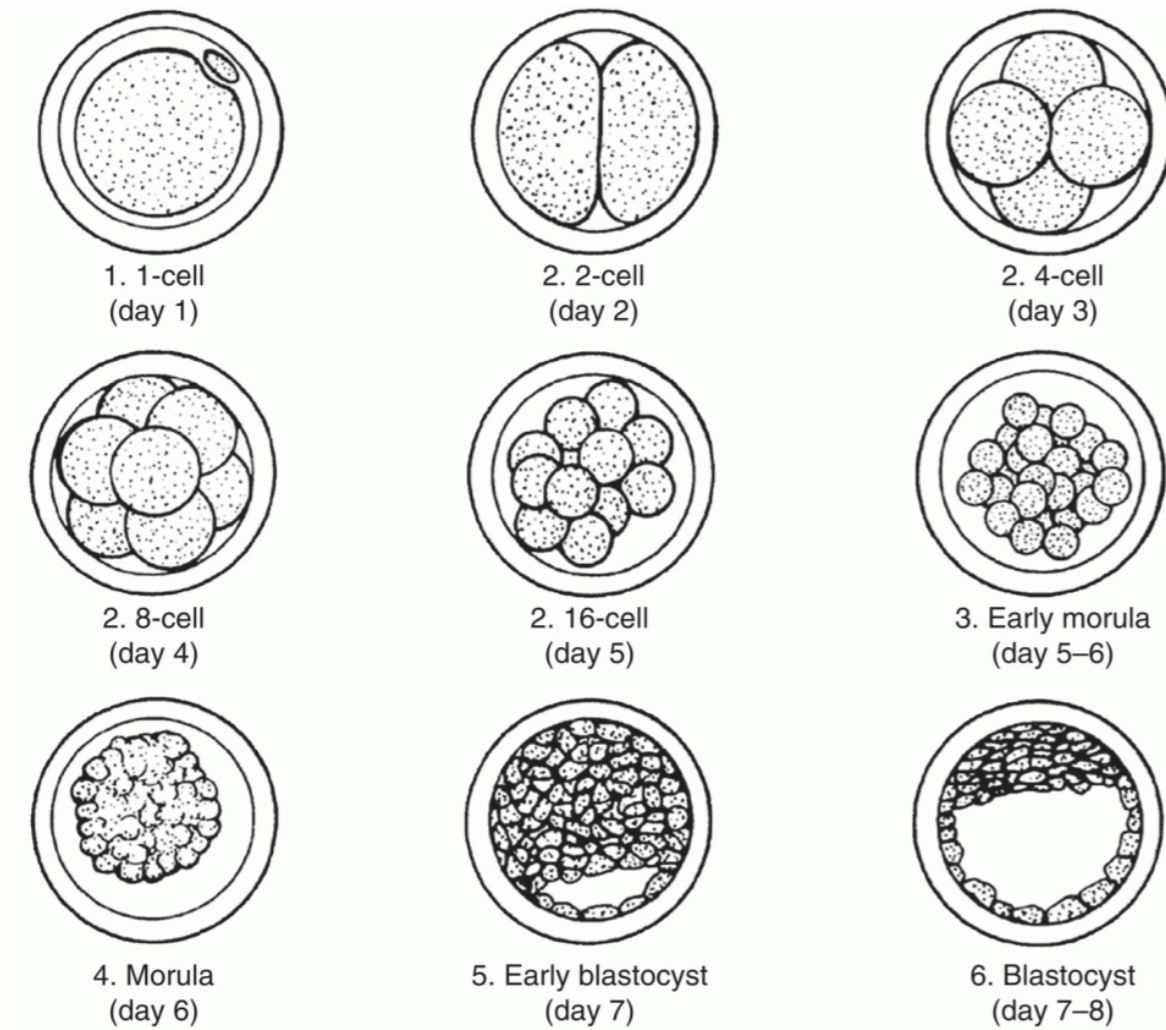


Drake et al (2020) JDS

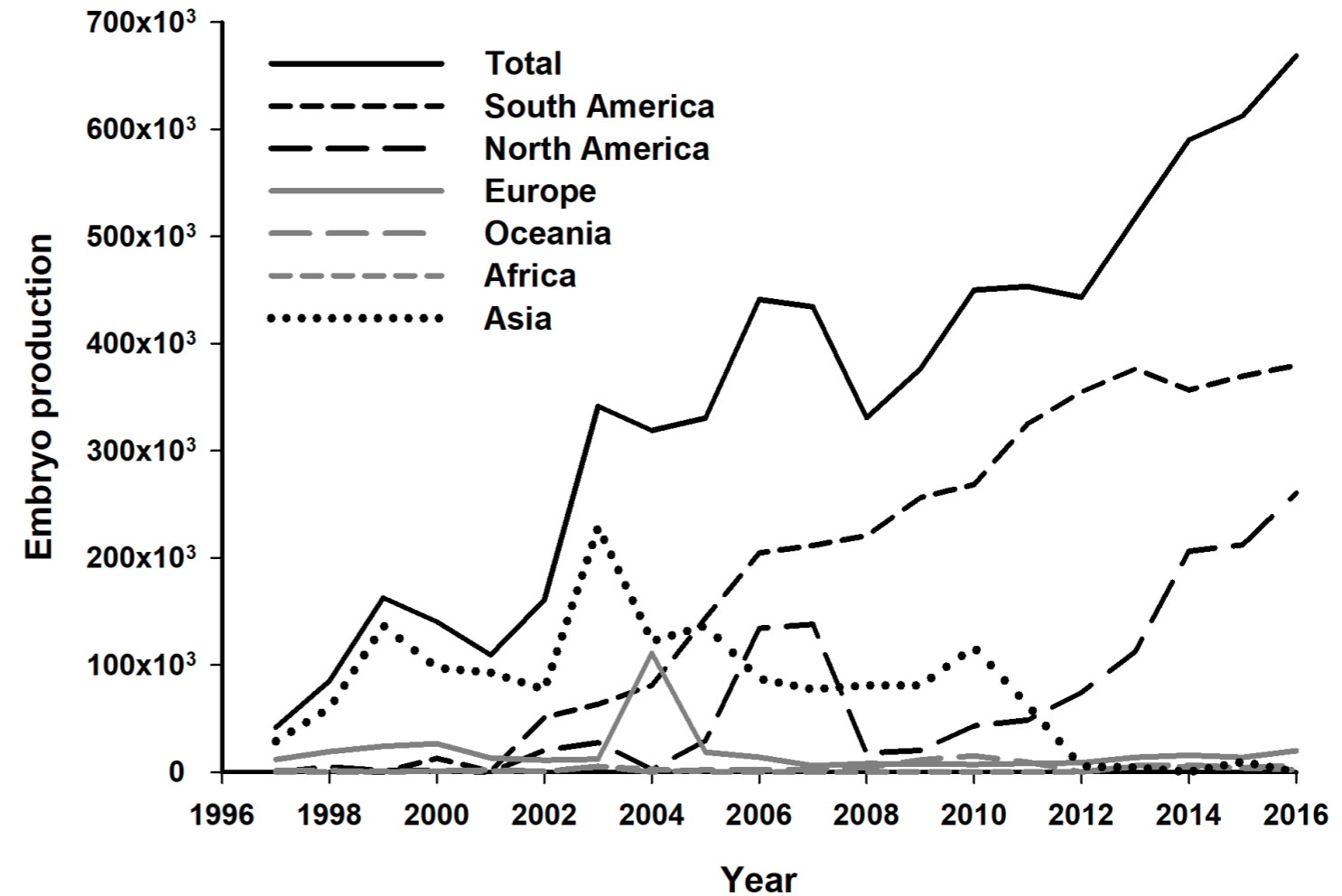
A future with sexed semen....

- Sexed semen use set to increase
 - ✓ Diminished number of male dairy calves
 - ✓ Still require elite merit male dairy calves for breeding
 - ✓ ART to produce elite merit dairy calves?
- Increased number of non-replacement calves
 - ✓ ART to increase calf crop beef value?

In Vitro Embryo Production



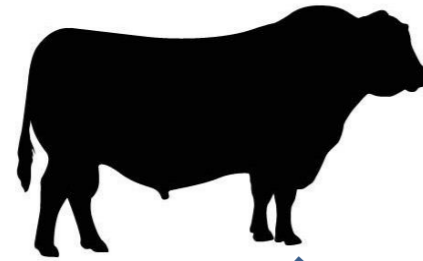
Stringfellow and Givens (2010). Manual of the International Embryo Transfer Society, 4th edn



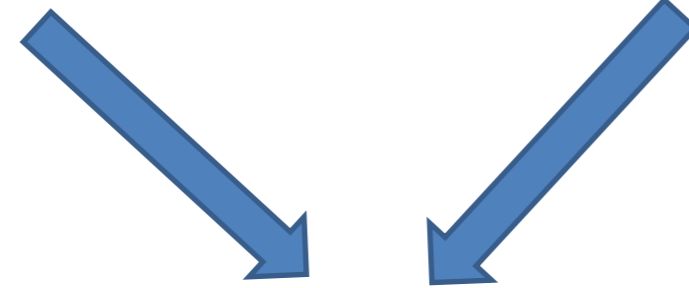
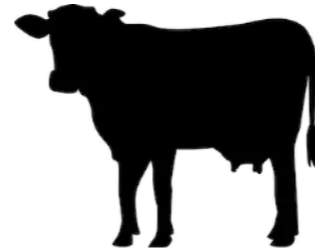
Total bovine embryo production (Viana et al. 2018)

Traditional method

Elite bulls



Elite cows/heifers



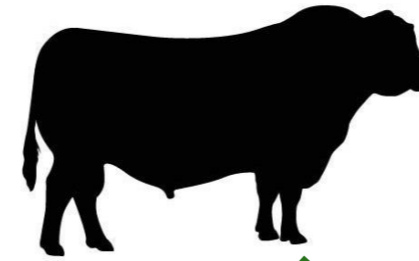
Single bull/dam combination per year

One calf per year

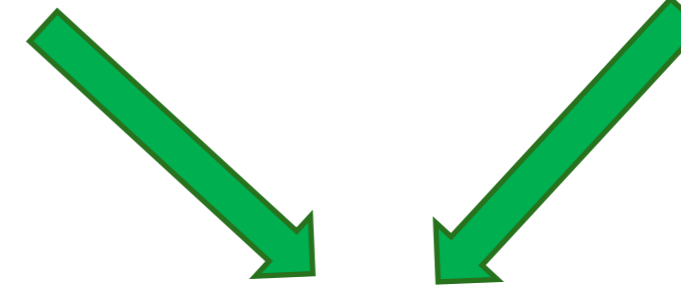
Slow genetic gain

OPU/IVF/IVP/ET method

Elite bulls



Elite cows/heifers



Oocytes collected once a week

IVF/IVP

Multiple bull/dam combinations per year

8 to 12 embryos per month

16+ calves per year

Accelerated genetic gain

Donors:

Prepubertal

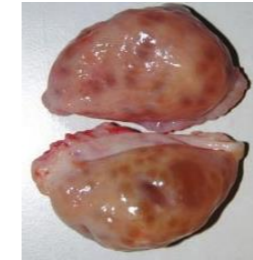
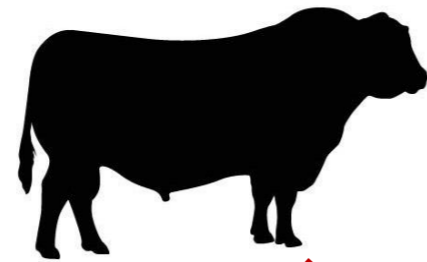
Early postpartum

Pregnancy

Commercial beef embryo

Elite dairy-beef bull
(beef **breed A**)

Slaughterhouse ovary
($\leq 50\%$ dairy breed,
 $\geq 50\%$ beef **breed B**)



Oocytes collected once post-slaughter

IVF/IVP

Bull dam combinations to maximise offspring heterosis

Embryo transferred to dairy cow surrogate dam

Superior beef merit from dairy offspring (75-100% beef breed)

Conclusions

- Sexed semen is a powerful technology
 - ✓ Select best dams → heifer calves
 - ✓ Rearing, management benefits
 - ✓ More valuable calf crop
- IVP embryos
 - ✓ Trial in 2021
 - ✓ Accelerate genetic gain
 - ✓ Beef calves from dairy cows



Acknowledgements

