The importance of recording in establishing the value of sexed semen to dairy farmers

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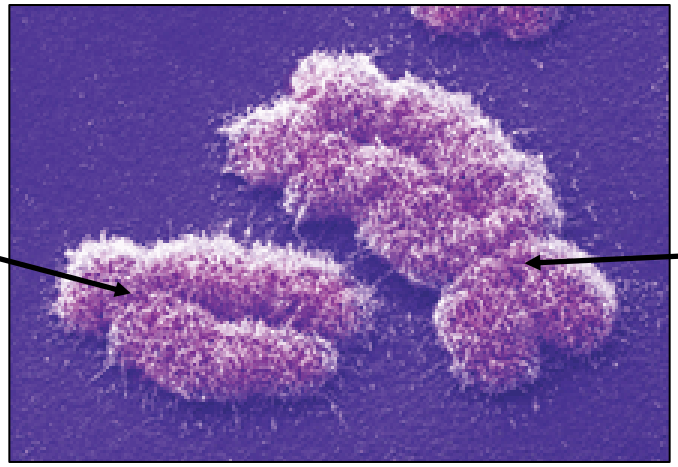
Background

- Semen contains roughly 50% each of male and female sperm
- Sperm identical in size, weight, swimming speed etc.

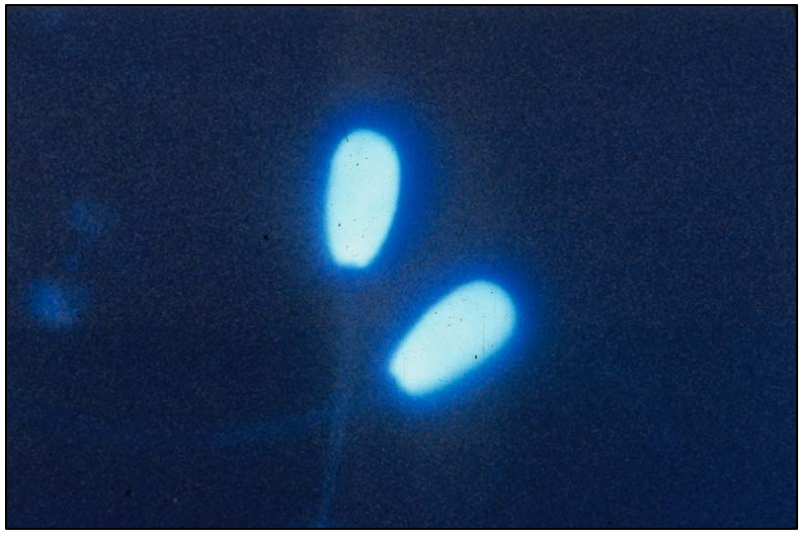
‘male’ Y-chromosome



‘female’ X-chromosome

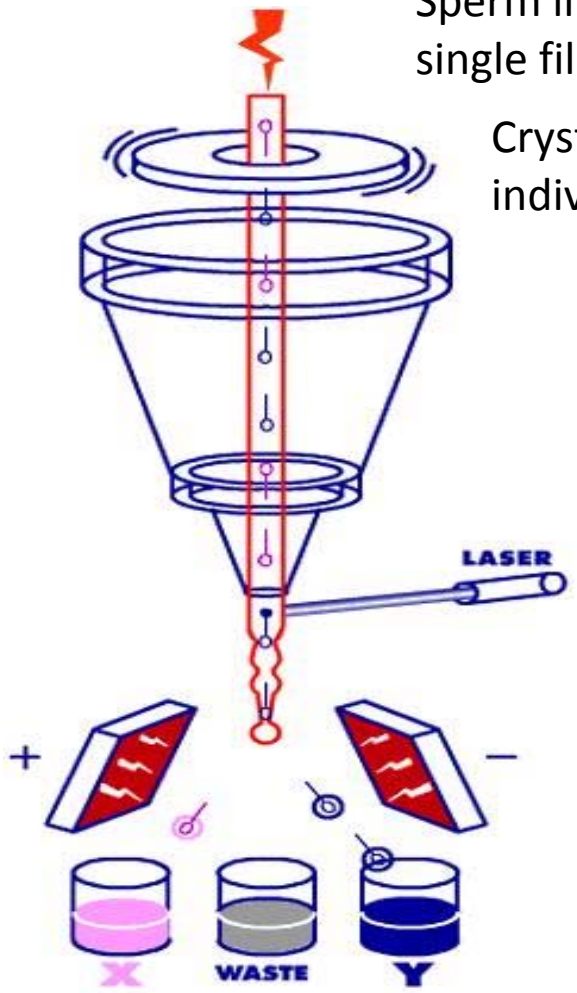
- X-chromosome contains ~4% more DNA than Y-chromosome

Fluorescence Activated Cell Sorting



Sperm stained with a harmless, DNA-binding dye (Hoecsht 33342).

Fluorescence Activated Cell Sorting



Sperm injected into flow cytometer in single file at 60 mph, 40 psi.

Crystal vibrator breaks stream into individual droplets

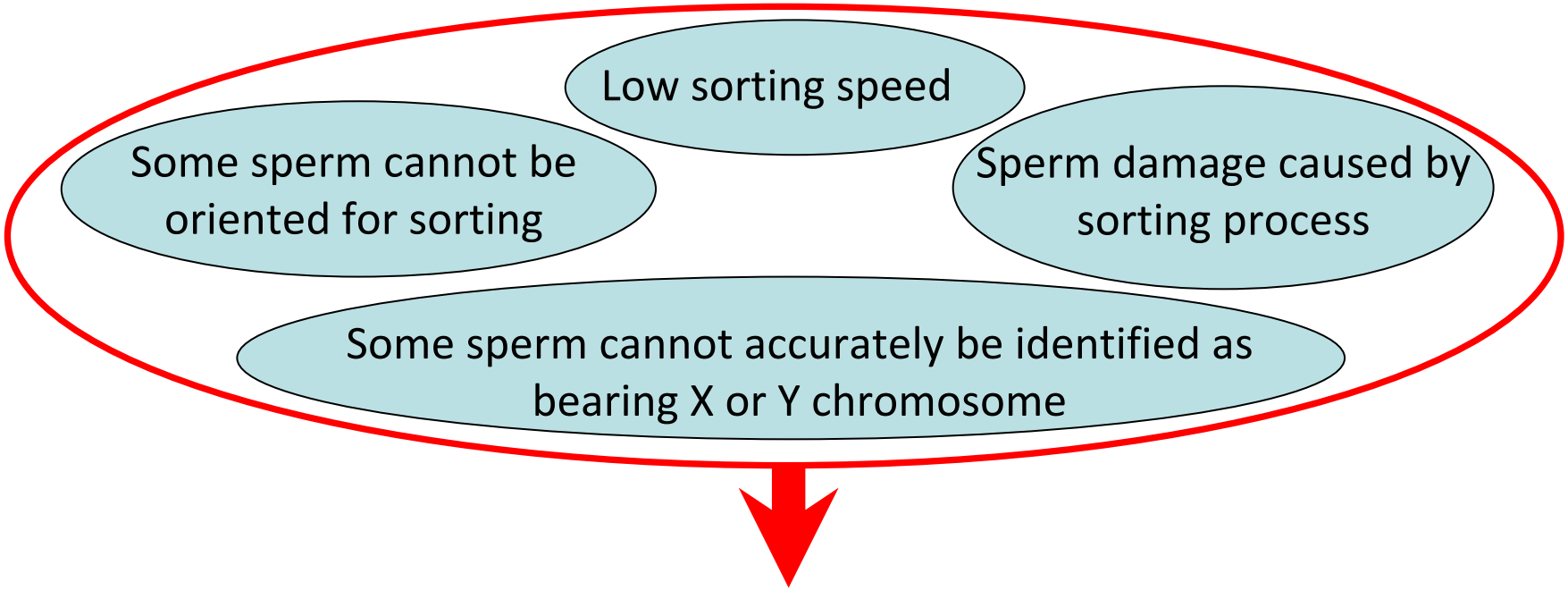
Sperm pass in front of a laser beam, stained DNA emits fluorescence

Fluorescence is measured and a +ve or –ve charge is applied to each single droplet

Sperm pass between charged deflector plates: +ve droplets go one direction, -ve another

Uncharged droplets pass through as waste

Limitations of FACS



Combined loss = 75% of original semen sample

Only 10-15% of original sample is marketable, sexed semen

Limitations of FACS

- **Sperm numbers**
  - **2 million vs 20 million**
- **Reduced conception rates in sexed vs conventional semen**
- **Recommended for use in heifers only**

Sexed semen use

- Published studies comparing CR with frozen semen
  - Frozen sexed ~80 % of conventional
    - ie. conventional CR = 50%, Sexed CR = 40%
    - ie. conventional CR = 70%, Sexed CR = 56%

- NZ study comparing CR with fresh semen
  - Fresh sexed ~94 % of conventional
    - ie. conventional CR = 50%, Sexed CR = 47%
    - ie. conventional CR = 70%, Sexed CR = 66%

Fresh sexed semen

- Avoids losses associated with freeze-thaw process (approx 50%)
- Collect, sort and inseminate within 24-36 hrs
- Well suited to seasonal systems
- Potential to extend sexed semen use to all cows
- Main problem = availability during peak demand

Benefits of sexed semen use

- 90 % heifer calves
  - Greater numbers of heifer calves
  - Replacements born earlier
- Increase rate of herd expansion
- Select best cows to breed replacements from
- Fewer low value dairy bull calves
- Reduce difficult calvings and associated problems
- Improve biosecurity

Negatives of sexed semen use

- Huge importance of fertility in seasonal system
- Cost = ~twice the price of conventional
- High wastage during sorting process
  - Lower demand bulls? GS bull team?
- Excellent straw management and handling required

Causes of decreased fertility

Low sperm number

Fluorescent dye

Laser light

Physical damage

Early capacitation

Semen handling errors

Potential solutions

Increase sperm number

Change dye

Pulse laser

Decrease sorting pressure

Semen preservatives

Timing of AI

Extreme care in handling

Management Strategies

- Consider only if current pregnancy rate to AI is 60% or better
- Use only in healthy cycling females in good body condition
- Inseminate only animals observed in heat
- Use only experienced AI technicians
- Diligence with thawing and handling

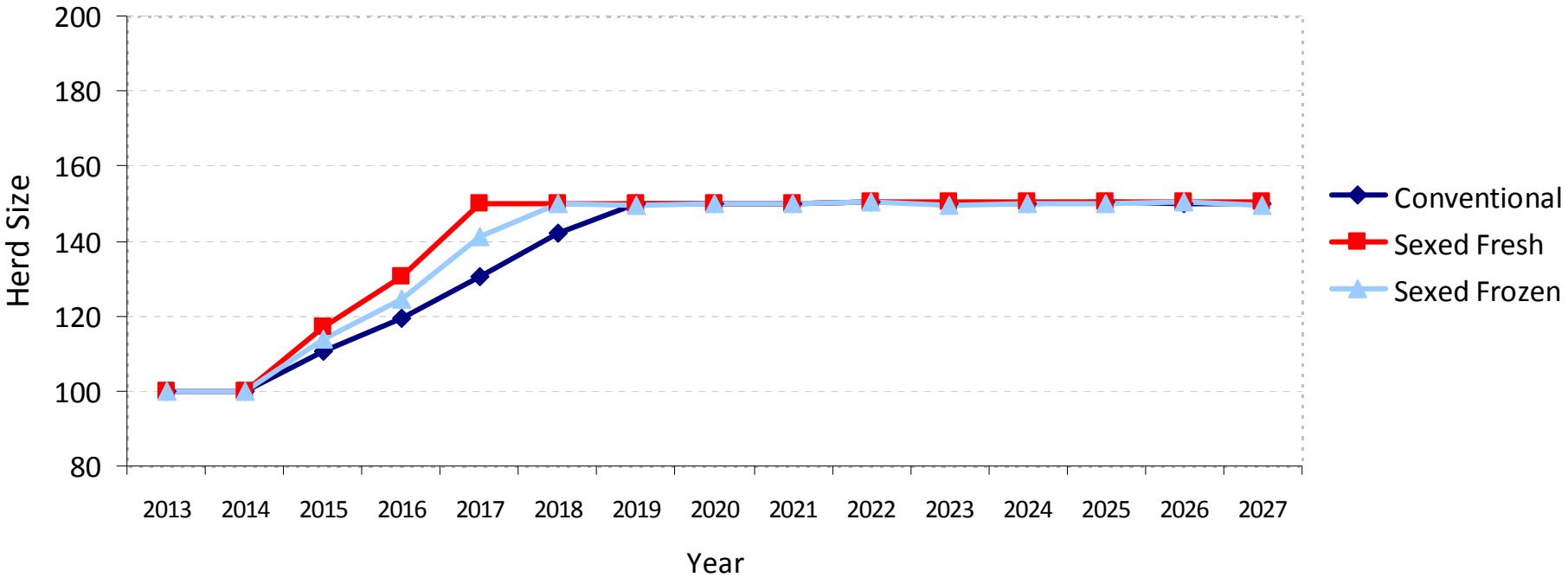
Modelling scenarios – Sexed semen use on heifers only

Heifers only:

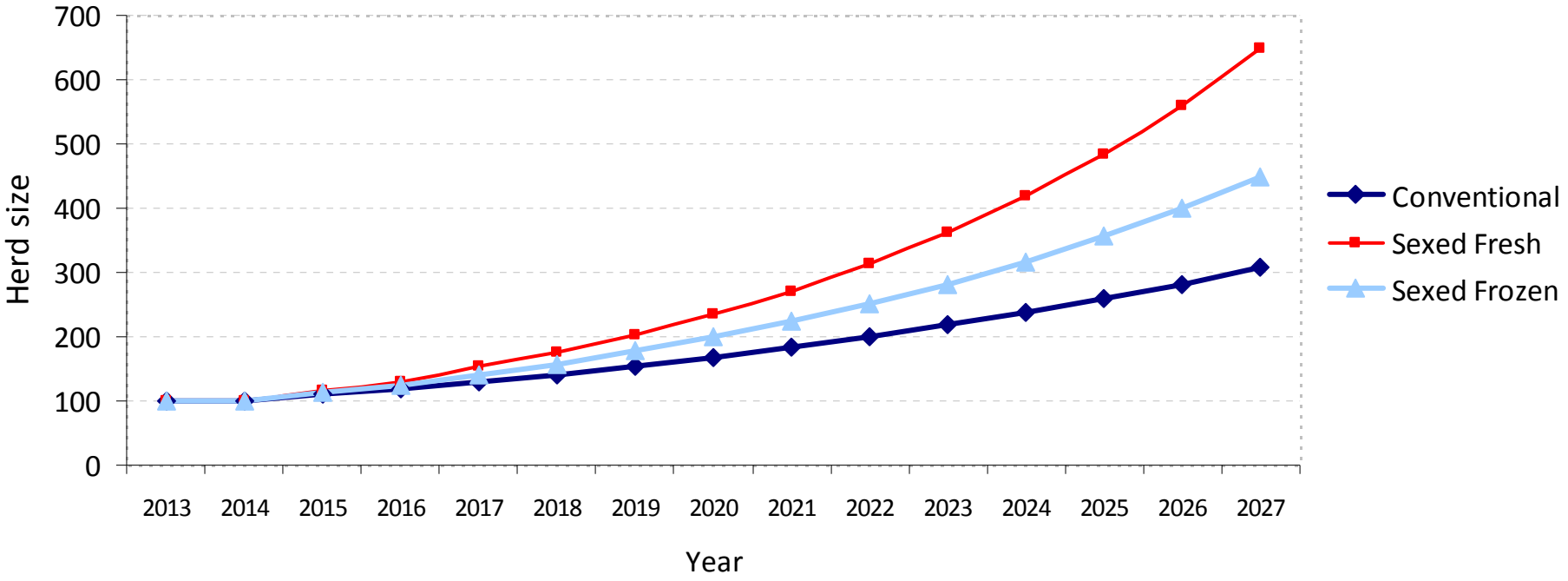
1. **Land limited**
2. **Land unlimited**

1st and 2nd Services					
Conventional		**Sexed Fresh**		**Sexed Frozen**	
SR	CR	SR	CR	SR	CR
0.9	**0.7**	0.9	**0.66**	0.9	**0.56**

Land limited: maximum herd size = 150 cows



Land unlimited - Herd size growth



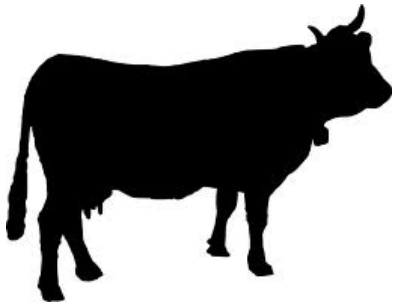
Issues related to Animal Recording?

Incorrect parentage allocation

Wrong sire recorded at AI

2 different sires used within short period

Undetected mating



After parturition, calf assigned to incorrect dam

- **As intensity of recording is relaxed…**
  - **Error rates in parentage assignment increase…**
    - **Reduced genetic gain**

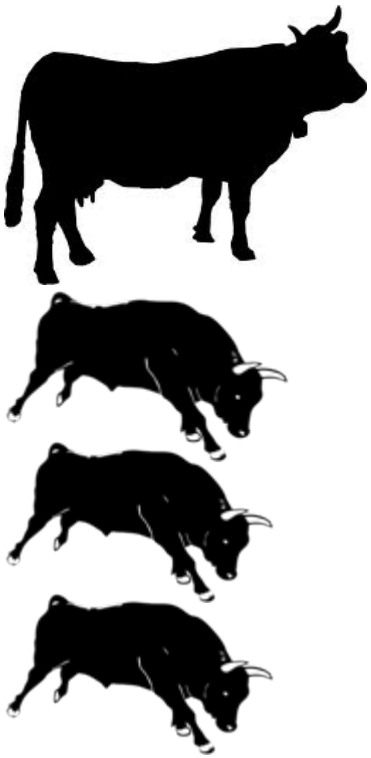
Incorrect parentage allocation

Population	Estimated %
German dairy cattle	7%
Israeli Holstein cows	12%
UK dairy cattle (misfathering)	10%
Dutch dairy cows (misfathering)	9-12%
New Zealand dairy cattle	12-15%

Data from Oliehoek and Bijma (2009)

"When the percentage of wrong parent information is above 15%, the population structure and type of errors should be taken into account" (Oliehoek and Bijma, 2009).

Verifying parentage



Known dam

Two or more potential sires

Use DNA technology to identify sire

Recording of different types of semen products

- Frozen conventional semen
- Fresh conventional semen
- Frozen sexed semen
- Fresh sexed semen

- Different levels of bias
  - 90:10 or 75:25

Conclusions

- **Sexed semen has reliable effect on gender offspring**
- **Reduced conception rate**
- **Animal recording challenges:**
  - **Correct parentage ID**
  - **Correct semen product ID**

Questions?