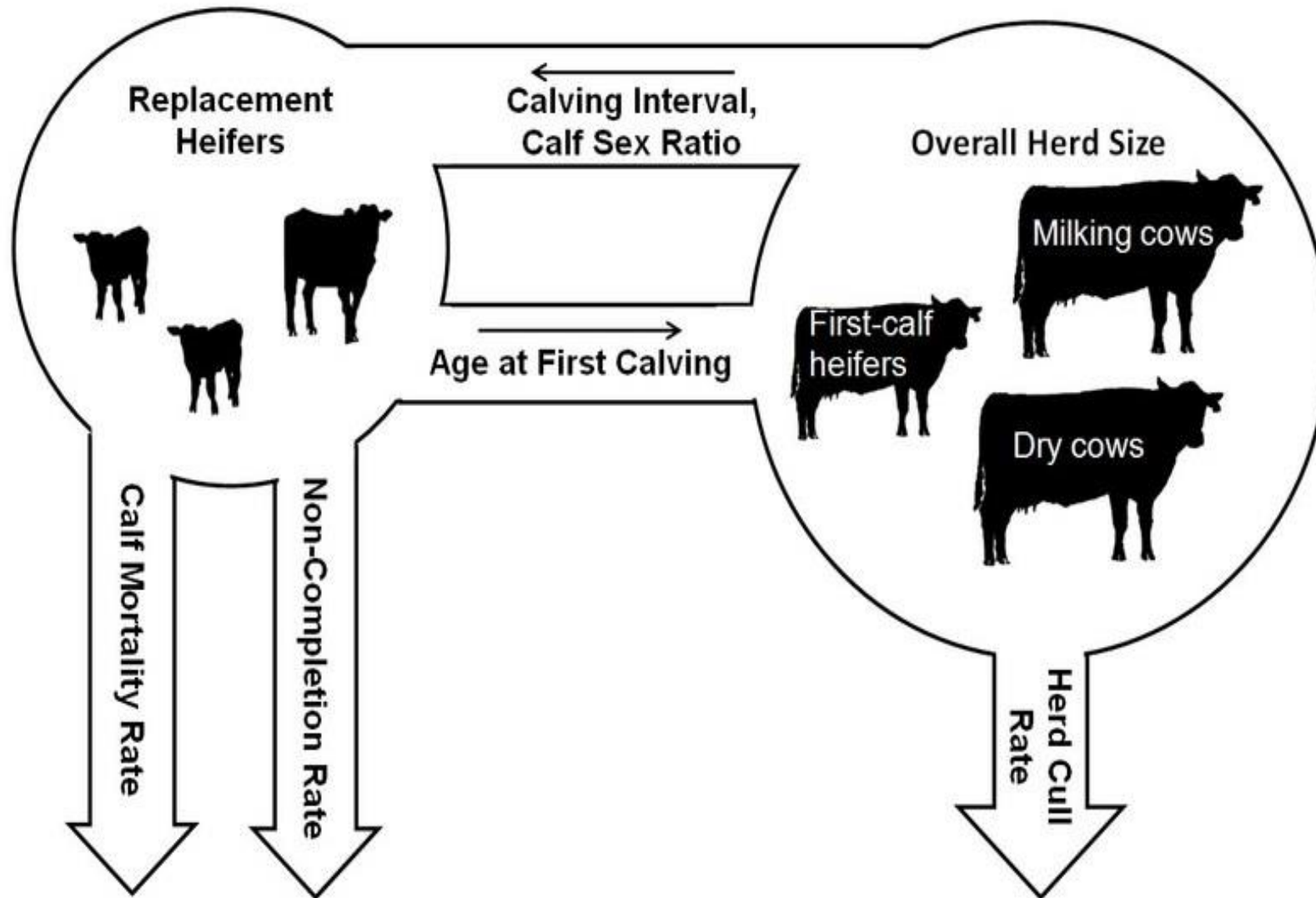


Sexed Semen in Dairy: Processing, Opportunities and Challenges

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Dairy Herd Balance



حساب إحتياجات المزرعة من عجلات الإستبدال

- نسبة الإستبعاد فى الأبقار الكبيرة * 150%

المزرعة بها 100 بقرة حلابة ونسبة الإستبعاد 15%
إذا العدد المطلوب دخولة من عجلات الإستبدال هو 22 عجلة موسم أول

- واقع الحال فى مزارع اللبان فى مصر

Factors affecting number of heifer replacement

- HS----- Herd size حجم القطيع
- CI ----- Calving interval الفترة بين ولادتين بالشهر
- calf sex ratio (SR) نسبة المواليد الإناث
- calf mortality rate CM نسبة النفوق
- AFC ----- Age at first calving العمر عند أول ولادة

The Formula

No= 100

CI = 14 M

SR = 50%

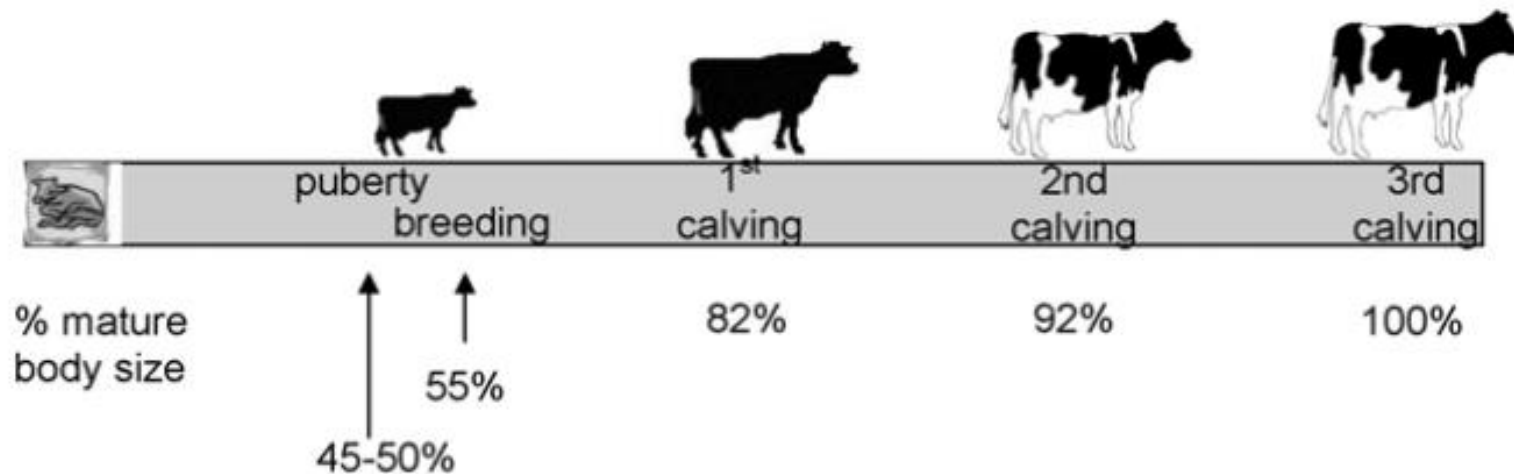
CM 10%

AFC 25 M

1(one period)*HS*12/CI*SR*(1-CM)*AFC/24

1*100*12/14*.5*(1-0.1)*24/25

How big should a heifer be at breeding? At calving?



يشكل تحد كبير



% Deaths by week of life



أولاً: مرحلة الرضاعة

الهدف الرئيسى هو الوصول للوزن والعمر المناسبين
عند أول ولادة

التحدى

- 1- الوقاية من الأمراض
- 2- الإقلال من معدلات النفوق
- 3- الرعاية الكاملة للعجلة منذ اليوم الأول للولادة وحتى أول ولادة لها .

(الوقاية خير من العلاج)

Target parameters

Age(M)	Height(cm)	Diff.	Weight(kg)	Diff.
0	75	30cm(5cm/month)	35	25 kg/month(835 g/d)
2	85		85	
4	95		135	
6	105		185	
9	110	30cm(1.67cm/month)	260	
12	115		335	
15	125		410	
24	135		610	

Introduction of Sexed Semen

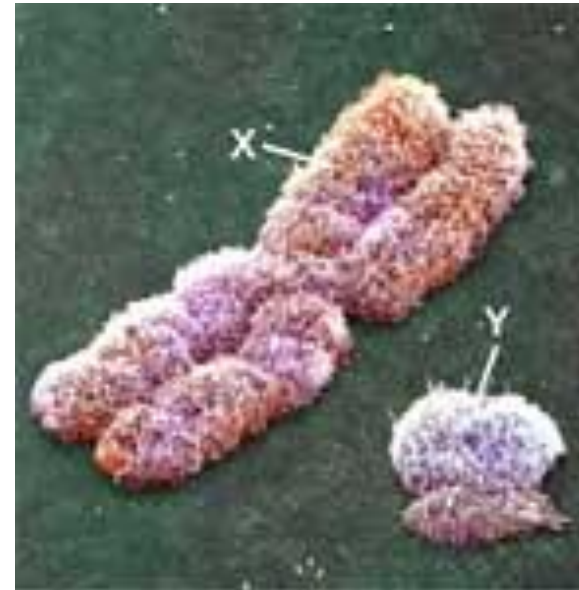
- Sperm contain an X or a Y chromosome.
- Ova contain only an X chromosome.
- When fertilization occurs:
 - X-sperm + X-ova = XX female
 - Y-sperm + X-ova = XY male

History of Sexed Semen

- 1980's: Technology to separate X and Y sperm via flow cytometry was developed.
- 1996: XY, Inc. became the exclusive worldwide licensee of sperm separation in non-human mammals.

How are sperm separated?

- The X chromosome is larger and contains approximately 3.8% more DNA than the Y chromosome.



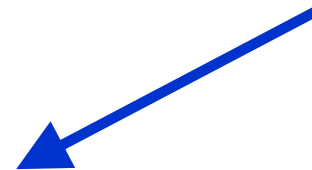
How are sperm separated?



Semen collection

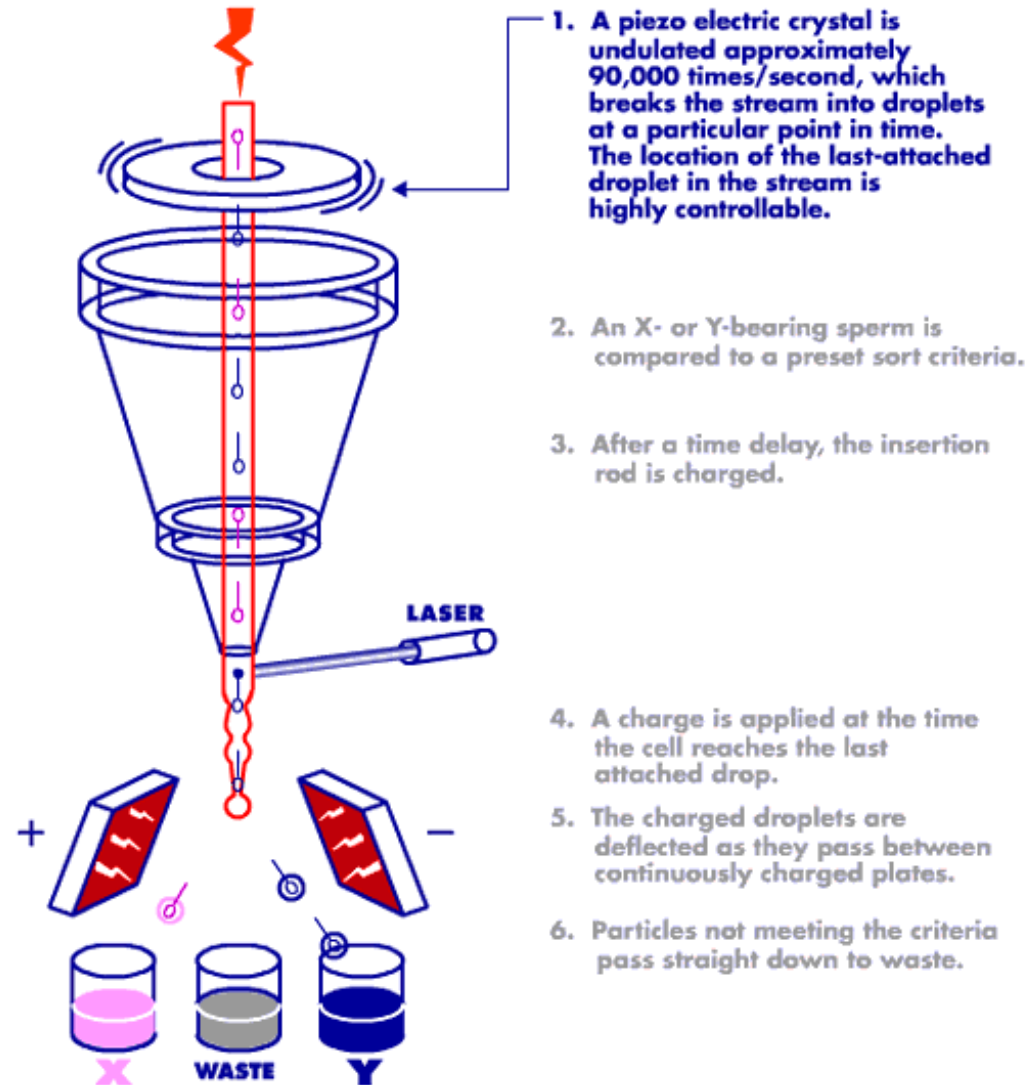


Evaluation, initial extension,
staining, and incubation



Initiation of separation

How are sperm separated?



(Mo-Flo diagram courtesy of XY Inc.)

How are sperm separated?

- ~ 35,000 sperm pass the laser per second
- ~ 5,000 X sperm are sorted per second
- X sperm are collected
- Y sperm and unknown and dead sperm are discarded

Sexed semen processing

- After sorting, the semen is:
 - Packaged into 1/4 mL straws
 - Frozen and stored in liquid nitrogen

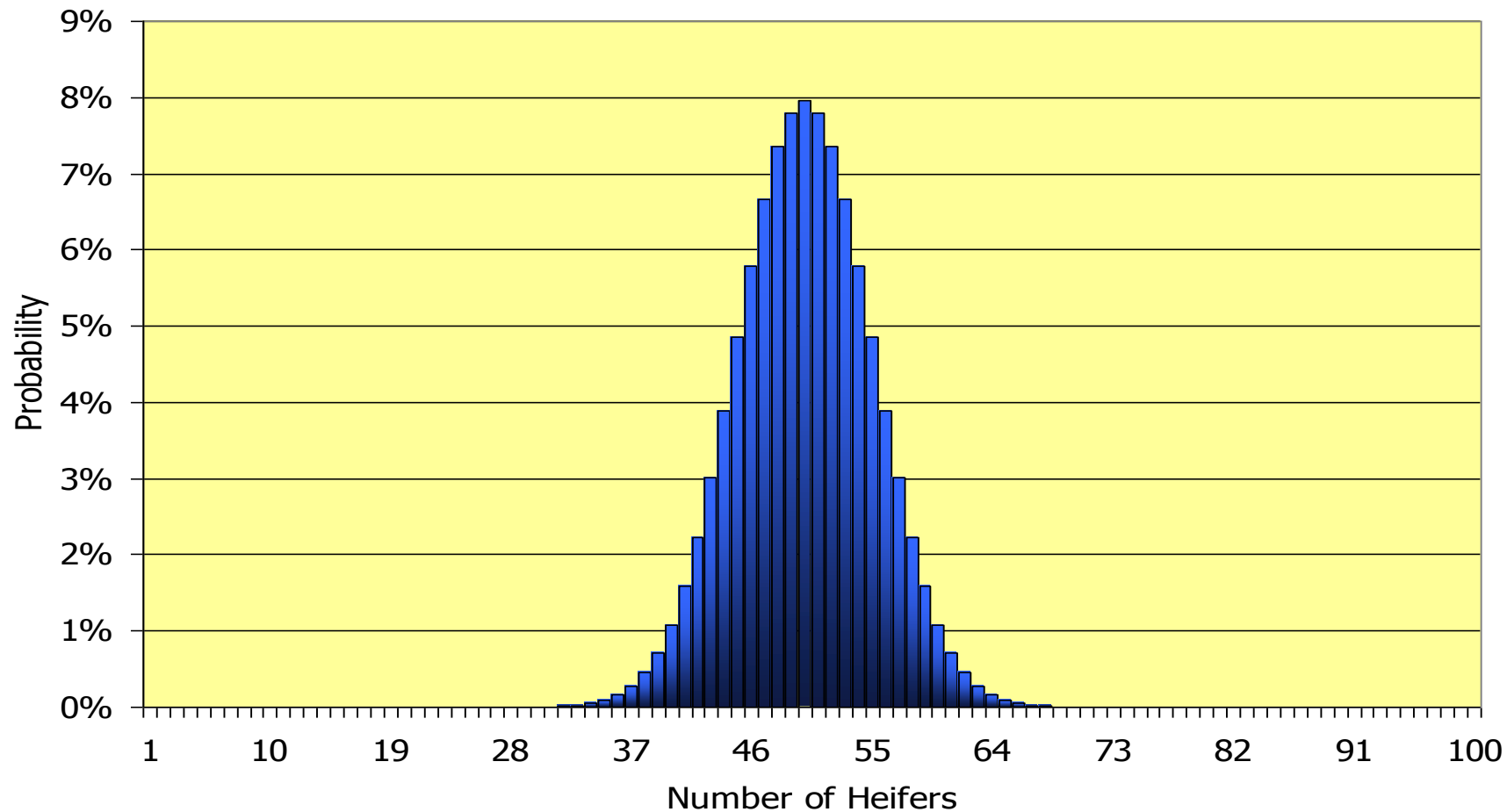
Opportunities with Sexed Semen



Opportunities

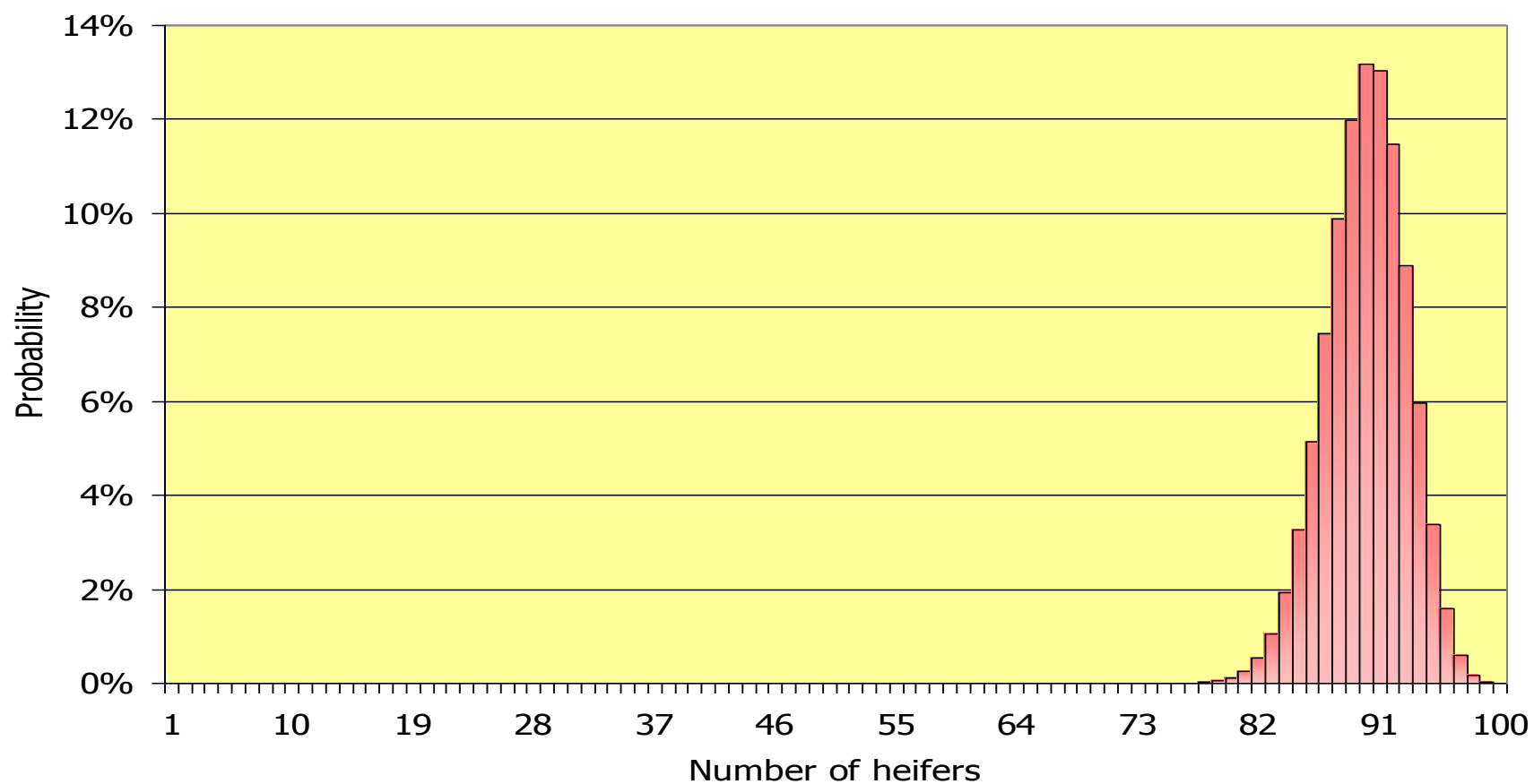
- Flow cytometry is the only reliable sexed semen technology available today.
- Breed heifers with X sperm to decrease calving difficulty.
- Eliminate biosecurity risks with closed herd expansion.
- On average 9 out of 10 calves will be of the desired sex.

Heifers (no.) expected in 100 calvings – conventional semen



(ABS Global)

Heifers (no.) expected in 100 calvings – sexed semen



(ABS Global)

Recommendations for use of sexed semen

- Use only in well-managed virgin heifers.
- Inseminate 12 h after heat is observed.
- Thaw using warm water at 95 to 98 degrees F for a minimum of 30 seconds.
- Time, temperature, hygiene, and skill.

First service strategy

- Use sexed semen at first service only.
- Use conventional semen at second and later services.
- Results: decreased average age at calving for heifers inseminated with sexed semen as compared with those inseminated with conventional semen.

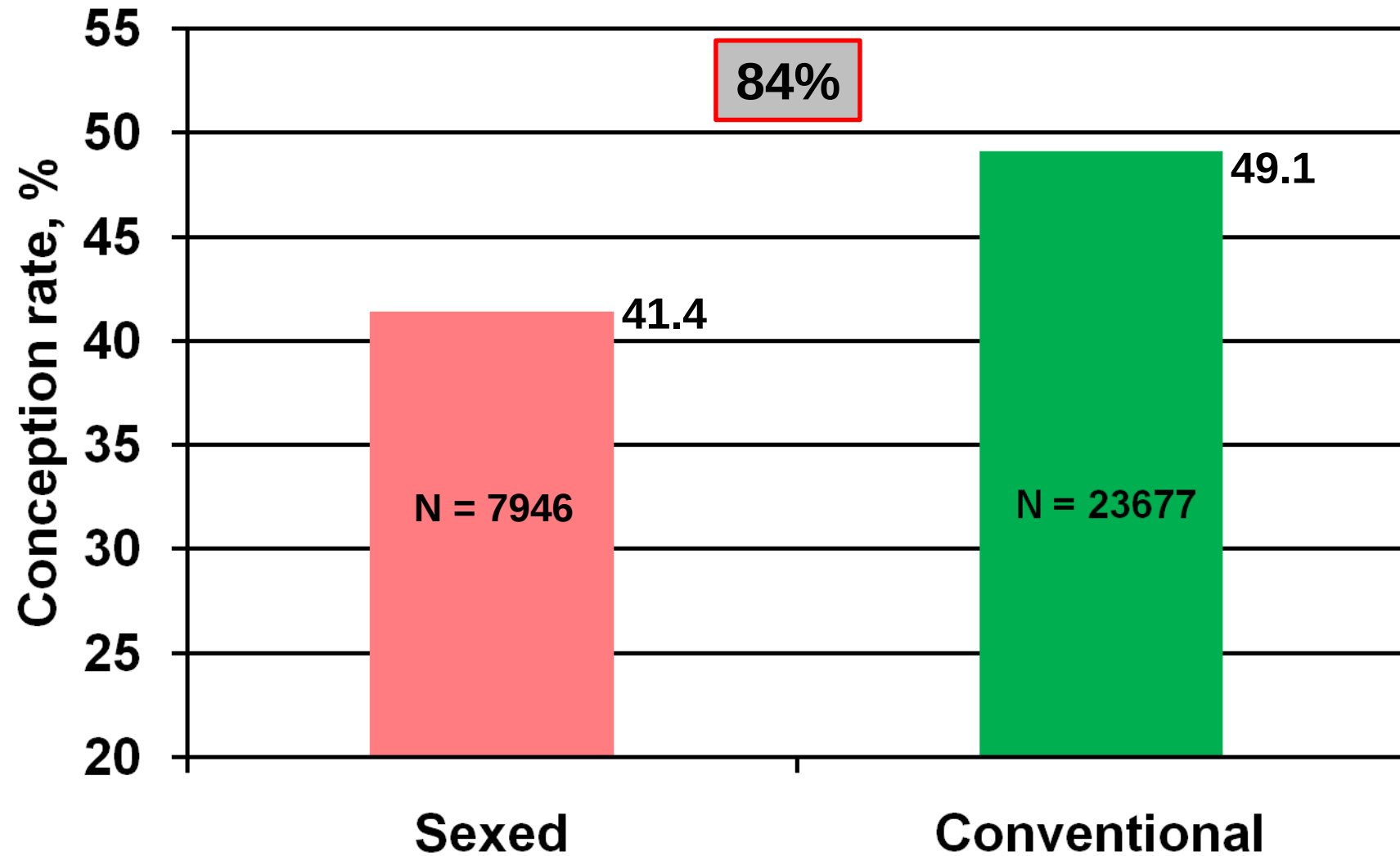
What results can you expect?

■ Conception rate:

- Holstein heifers: 41% to 57%
- Greater than 70% of herds achieved a heifer CR > 70% of first service CR obtained using conventional semen

In well-managed virgin heifers, the conception rate will be ~70% to 85% of conventional semen.

Sexation data



(ABS Global, 2008)

Conception rate by service number

Service	Sexed semen, % (n)	Conventional semen, % (n)	Sexed semen relative to conventional,%
First	47.0 (26,465)	56.4 (21,864)	83.3
Second	43.1 (6,375)	53.8 (13,389)	80.1
Third	38.1 (2,567)	45.4 (11,772)	83.9

Challenges with Sexed Semen



Challenges

- With good management, conception rates will average 70 – 85% of conventional semen.
- The lower concentration of sperm (2.1 million per dose) can affect the fertility of the semen.
- Potential damage due to cold shock is greater in the 1/4 mL straw.

Why not increase the number of sperm per dose?

- Processing is slow (3,000 to 6,000 sperm per second) = 1 hour to produce 1 straw with 20 million sperm.
- Research has focused on maximizing fertility of low concentration of sperm in heifers.

Why isn't sexed semen available from all bulls?

- Not all bulls are suitable for sorting
 - Demand
 - Genetics
 - Semen quality
 - Poor motility
 - Poor morphology
 - Inadequate concentration



Why isn't sexed semen available from all bulls?

- Reduction in total sperm available for freezing and distribution
 - ~20% of total sperm are able to be used
 - 80% of sperm are discarded
 - Y-chromosome bearing sperm
 - Abnormal or dead cells
 - Sperm cells not recognized by the laser

What results can you expect with sexed semen in cows?

■ Conception rate:

- Holstein cows: 15% to 41%
- Possible effect of:
 - Parity
 - Days in milk
 - Insemination at heat vs. timed AI

In cows, conception rates are ~ 45% to 66% of conventional semen.

“The key to the value of sexed semen...lies in the opportunity to have better heifers.”



(Fetrow et al., 2007)

Economics including the value of increased genetics

- Heifer value = 3500 \$
 - Inseminate the top 30% of heifers with sexed semen.
 - Inseminate the remaining 70% of heifers with conventional semen.
 - Results:
 - \$22 profit per animal for all animals in the breeding pool

Which economic factors should be considered?

- Value of heifers relative to bulls
- Cost of sexed semen relative to conventional semen
- Genetic merit of the heifer to be inseminated
- Value of a heifer relative to the cost to raise a heifer

مدى تأثير محصول العجلات بنوعية الإدارة

	ادارة عادية	ادارة جيدة	ادارة محترفة
عدد الامهات	100	100	100
الفترة بين الولادتين (شهر)	16	14	13
نسبة المواليد الاناث	50	50	60
نسبة استبعاد العجلات	10	6	3
عمر العجلات عند الولادة (شهر)	27	25	23
محصول العجلات	30	39	56

باستخدام
تلقيحات مجنسة في
العجلات فقط



اقتصاديات استخدام التلقيحات المجنسة

ادارة محترفة	ادارة جيدة	
100	100	عدد الامهات
40	40	عدد العجلات الملقحة
250(2.5 تلقيحة)	250(2.5 تلقيحة)	عدد التلقيحات المستخدمة للأبقار
100 (2.5 تلقيحه)	60(1.5 تلقيحة)	عدد التلقيحات المستخدمة للعجلات
350	310	أجمالي المستخدم
$=250 \times 60 + 100 \times 240$ 39000	$=310 \times 60$ 18600	التكلفة
؟؟؟؟ → 20400		فرق التكلفة
85	70	محصول الاناث

Final thoughts

- Use only in well-managed virgin heifers.
- Consider genetic merit of heifers.
- Inseminate 12 h after heat is observed. Do not use timed AI.
- Recognize the inevitable decrease in conception rate.

Final thoughts

- What is the conception rate in your heifers with conventional semen?
- What management factors contribute to high or low conception rates (with conventional semen or sexed semen?)