Session II. Quality and Fertility.

Anand Workshop 2014

Life's Lessons

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Things WE've learned and relearned

- Processing systems are important
  - What is done in one part of the process impacts other parts
- Semen that looks good in the lab – may not perform well in the cow

Things I've learned and relearned

- The number of sperm required for optimum fertility varies from bull to bull
  - For some bulls it is a lot lower than we think.
- Package size can influence fertility

Things I've learned and relearned

- Field handling can have a big impact on fertility
- Incubated motility measures the ability of sperm to survive in the freezing media but may not relate to the number of cows pregnant.

Things I've learned and relearned

- Libido may have a major impact on the number of sperm harvested.
- Bulls perform differently in synchronized cows than in cows bred during natural heat.

US AI Semen Production Systems

- All have similar goals and objectives but different systems and methods to achieve.
- All want to maximize the number of doses available from top genetic bulls while maximizing the fertility potential of each bull.

The CRI Production System

- System developed based on years of research.
- Breeding information from 400 employed inseminators who annually serviced > 1.6 million cows.
- We allowed the cow to tell us.

CRI System

- Initial evaluation of semen
  - Volume
  - Concentration
  - Morphology
  - Motility
- How much do I have and is it good enough to process?

CRI Collection and Lab Activity: Dairy Labs

- 2,150 bulls
- 44,000 ejaculates
- 90% qualified for processing
- 10% fail to survive the freezing process

Beef Labs: higher number of batches which do not quality pre-, or post-

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- Dose rate for new bulls: 20 million, “Pregcheck” evaluations from pregnancy information allows best setting of future sperm dose rate.
- Pregcheck, and SCR monitors fertility.
- Precheck + is a monitor of Sorted semen fertility by bull.

CRI System

- Goal is to be above the “threshold” level of sperm required for maximum fertility.

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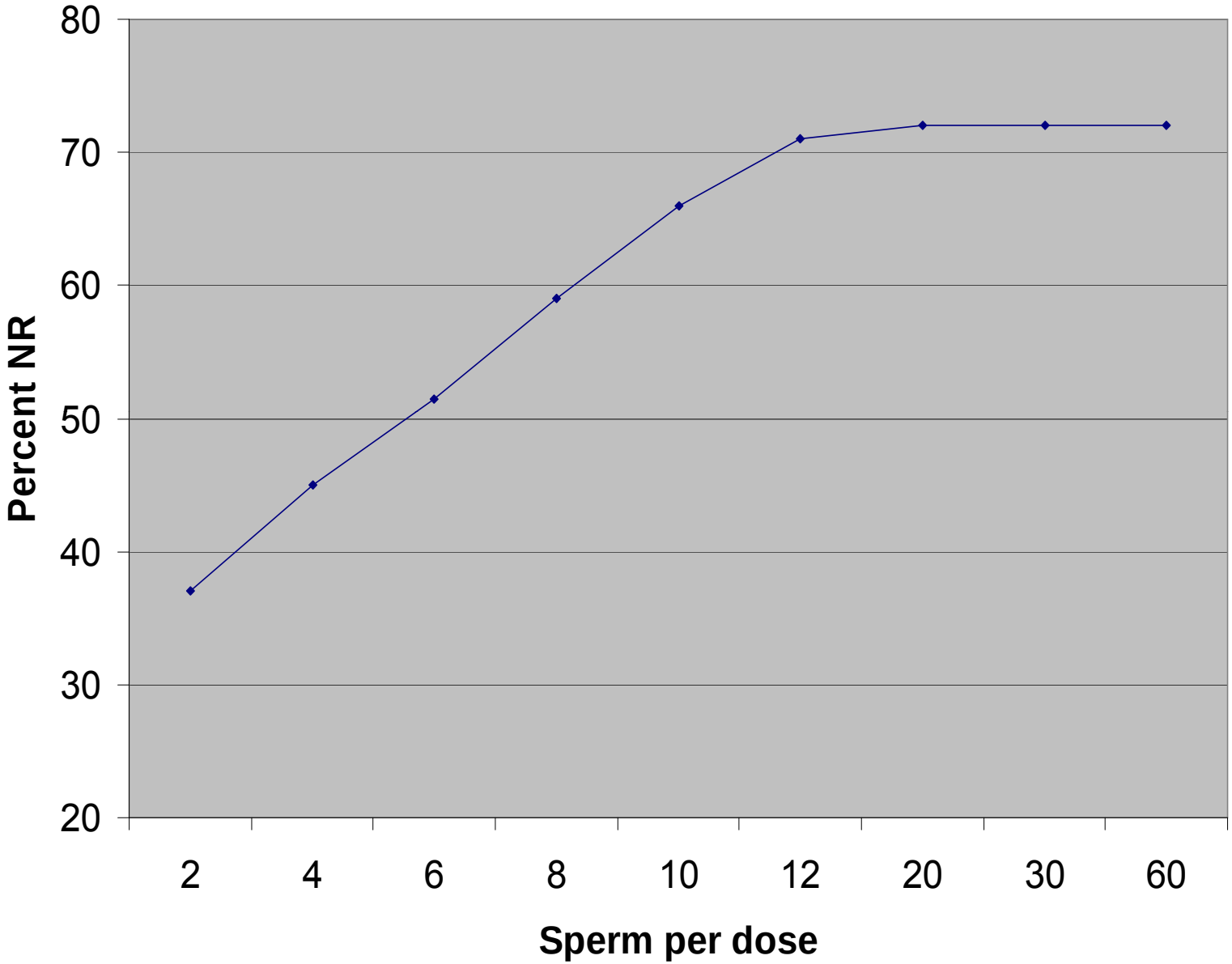
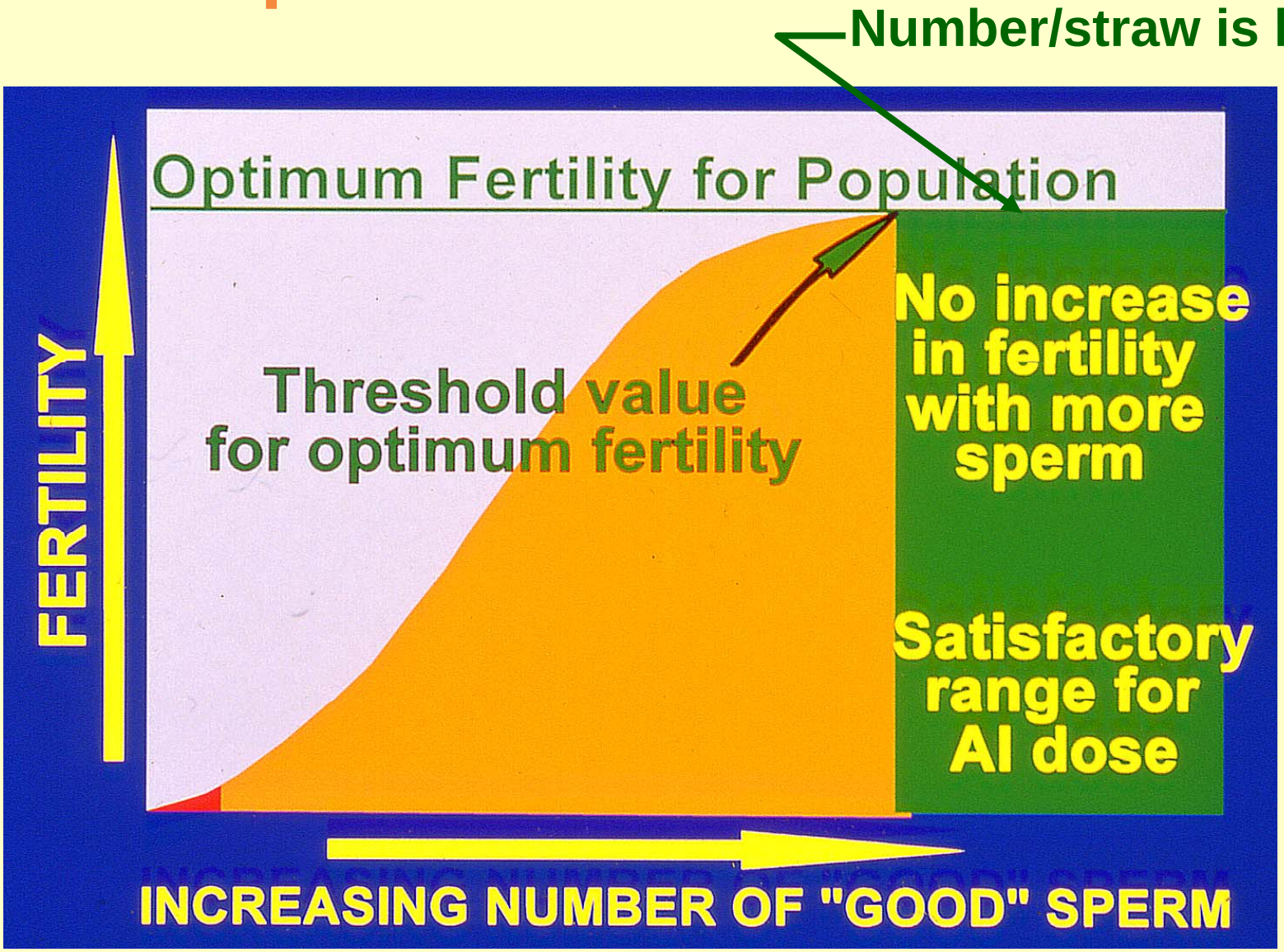
Sperm per Dose

- Fertility increases as the number of sperm per dose increases up to a point beyond which adding more sperm will not result in higher fertility


80
70
60
50
40
30
20
Percent NR
2
4
6
8
10
12
20
30
60
Sperm per dose

More sperm/dose ?



All Bulls Are NOT Equal

- Bulls differ in where they reach the "Threshold"
- Some - "Threshold" ~ 20 Million
- Some - "Threshold" ~ < 10 Million

Relationship of Semen Quality and Quantity to Fertility

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Sperm Attributes and Defects

- Compensable deficiencies – impact fertility when numbers of sperm in a dose are below threshold level
- Uncompensable deficiencies – result in subfertility regardless of sperm dose.

Sperm Attributes and Defects

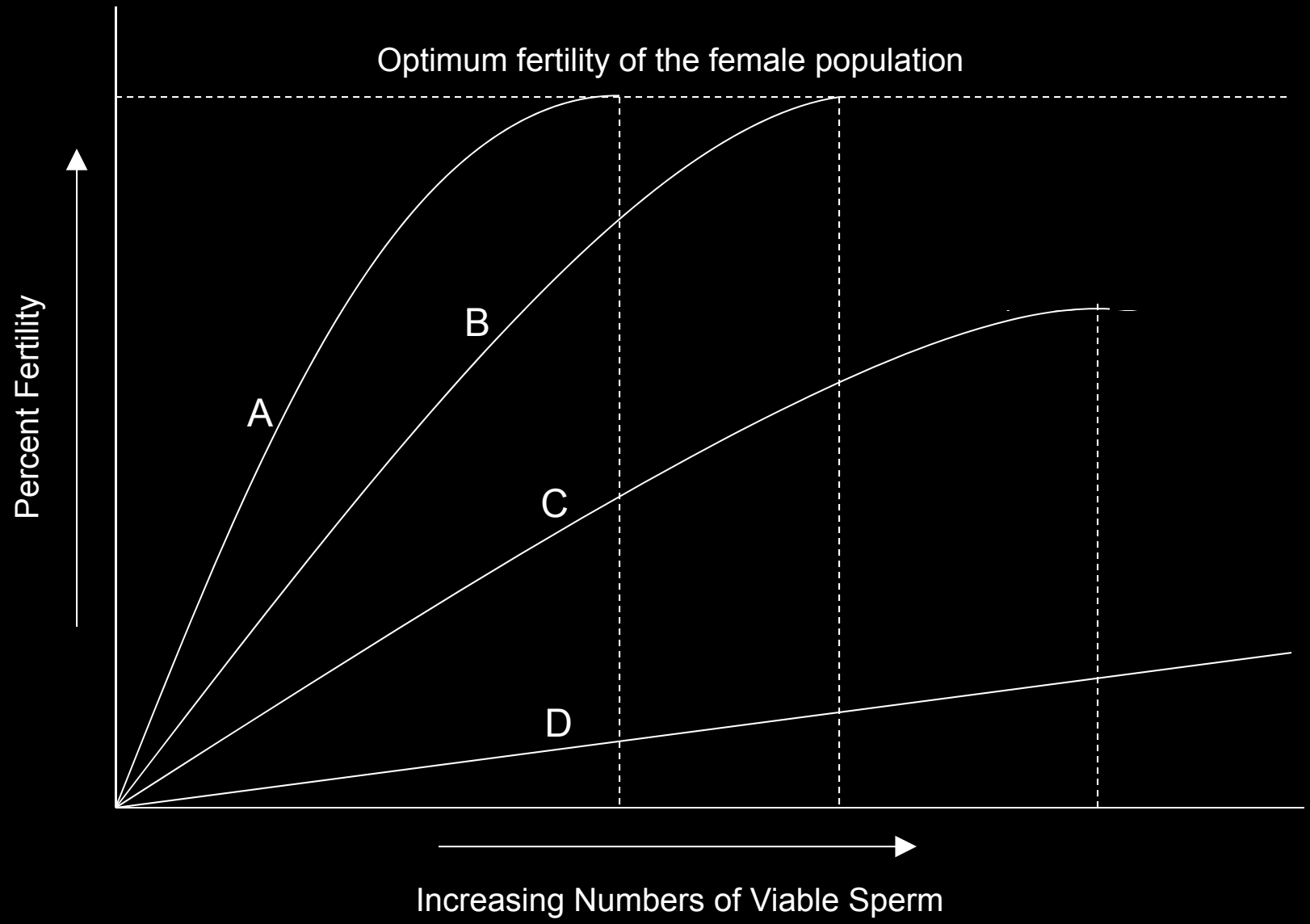
- Uncompensable deficiencies – incompetent sperm that can fertilize the ova but not sustain an embryo.
  - Uncompensable because they pre-empt fertilization by competent sperm
    - Only controlled by bull selection

SPERM ATTRIBUTES and DEFECTS

COMPENSABLE = "problem" causes low fertility which can be minimized or overcome by increasing the sperm/ dose. **Before sperm enters oocyte.** **(many can be detected)**

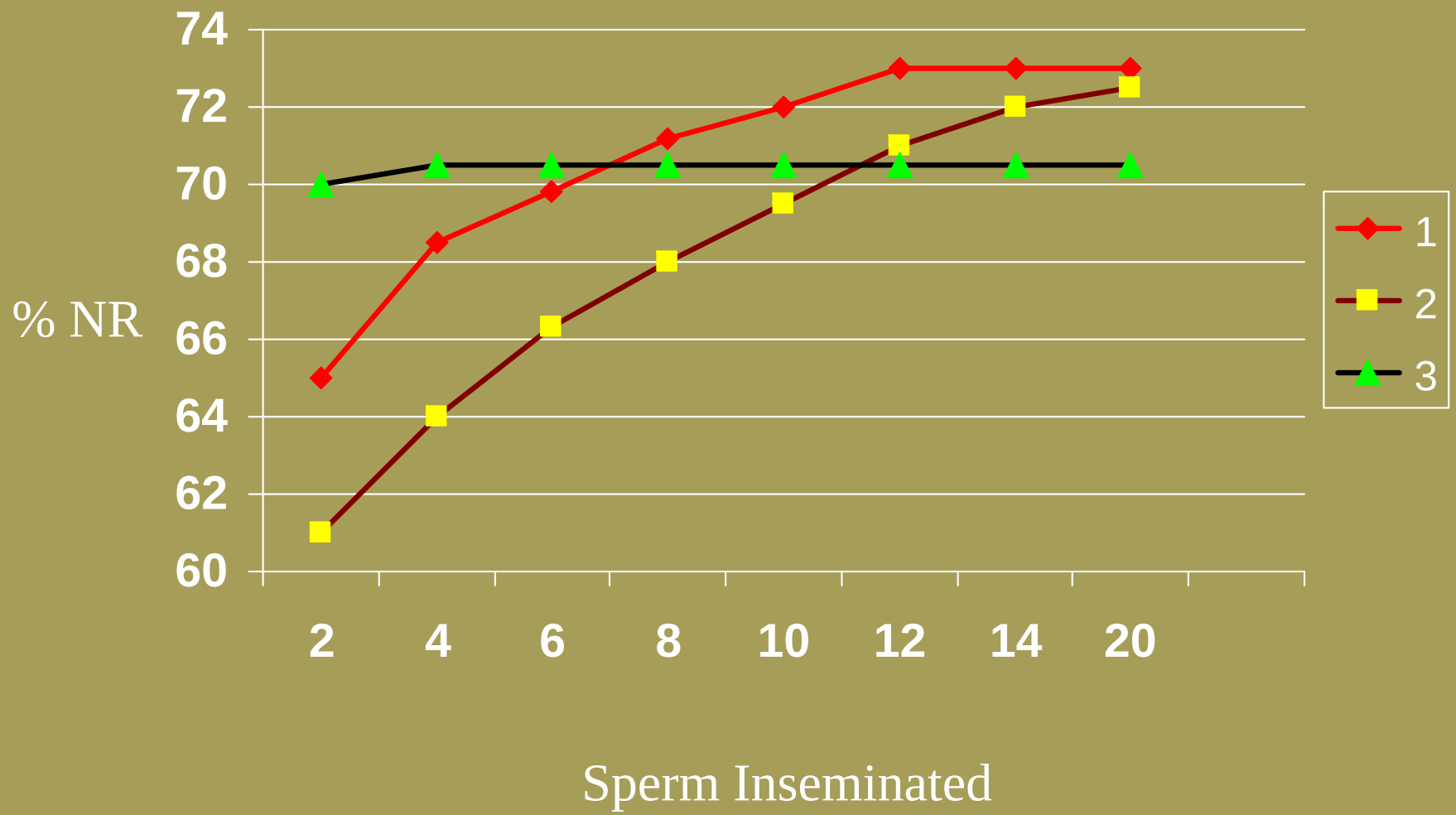
UNCOMPENSABLE = "problem" causes low fertility which persists regardless of sperm/ dose. **Affects steps after sperm enters oocyte** (defective genome, chromatin damage, or unknown factors cause delayed cleavage, low embryo quality, late signal to CL, etc. **(some can be detected)**

Relationship of Semen Quality and Quantity to Fertility



- The minimum number of sperm to achieve the maximum fertility for a bull is independent of the maximum fertility of the bull.

Effect of Sperm per Dose



Effect of Preservation Media on Motility and Fertility

A lesson from Professor Ed Graham –

An unpublished story

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Effect of Media on Motility

Extender	0 HR	3 HR	9 HR
University Special	65	60	55
Milk	48	30	5

University Field Trial

- Objective: compare fertility of semen extended in a University extender and our regular heated whole milk extender.
- Design:
  - 10 bulls – split ejaculates at 6 million per dose
  - 4 production days per bull
  - Semen used by 10 inseminators

Effect on Fertility

Extender	Services	% NR
University Special	6,879	55.6
Milk	7,127	71.7

University Special Extender Study - Conclusion

- Results were very surprising in light of the vastly superior microscope motility and survival of sperm after incubation.

- If our objective was to impress people that own microscopes we'd use a different system.

Incubated Motility Observations

- Saacke et al reported a strong relationship between incubated motility and NR.
  - semen held for 3 hours at 38C then progressive motility observed and recorded.

Incubated Motility Observations

- Begin 3 hr incubated motility observations as a matter of routine.
- Continued for seven years.
- Semen was culled based on 0hr observation but not on 3hr
  - if it passed 0hr, it was used

Incubated Motility Observations

- Statistically evaluated field results of > 8 million inseminations from ~ 105,000 ejaculates from 2,751bulls.
- Conclusion:
  - There was no significant relationship between incubated motility and NR.
  - (r^2 = 0.17)

Controlling Bacterial in Semen

- All CSS participants use the CSS antibiotic cocktail.
- Antibiotics will be added to the neat semen and extender to provide effective microbiological control of:
  - Mycoplasmas
  - Ureaplasmas
  - Histophilus somni
  - Campylobacter fetus subsp. venerealis

CSS Guidelines

- Effective microbiological control is the condition in which the number of organisms potentially present are reduced to below the threshold of infectivity.

CSS Antibiotics

- Final conc of 50 µg tylosin, 250 µg gentamicin and 150/300 µg of Linco-Spectin in each mL of frozen semen.
- Includes a 3 minute neat semen incubation step.
- Controls many more organisms than Penn/Strep or P/S/Poly B

CRI Bacteria Control

- Stress and use protocols to reduce contamination during collection and in the lab.
- Use CSS antibiotic protocol
- Culture random samples from each laboratory each month.
  - Goal is “no growth”

USA Fertility Estimates

- Technician Non-Return Rates (disappearing fast)
- Sire Conception Rate (SCR)
- Agri Tech Analytics
- Palpated pregnancy:
  - Pregcheck, Synchcheck, Pregcheck +

SCR: Sire Conception Rate

- Calculated by AIPL (USDA)
  - Breeding information from cows on test used to estimate sire fertility with a herd.
  - Corrected for numerous environmental factors. National coverage.
  - Millions of cows per year; 700-800 sires per year.

Field Handling of Semen

Important to Remember

- University of Zurich study reported at ESDAR
  - Semen stored in either Central Storage or field for 7 months
  - Sperm motility and acrosome integrity measured using flow cytometry

Field Handling of Semen

Important to Remember

- Semen stored in central storage was significantly better than semen stored in the field.
- They investigated further and found results were related to how inseminators typically handled semen at the time of straw removal and at the time of transfer.

Field Handling of Semen

Important to Remember

- Inseminators that had poor semen handling techniques had poor fertility results.