Keys to a Successful Estrus Synchronization and Artificial Insemination Program

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Overview

- Factors affecting pregnancy rate.
- Things to do before fixed-time AI.
- Things to at fixed-time AI.
- Things to do after fixed-time AI.
- How do I determine what may have gone wrong during a FTAI program?

Factors affecting pregnancy rate

- Pregnancy rate = estrous detection rate x conception rate.
- Estrous detection rate = number detected in estrus/number exposed to breeding.
- Conception rate = number pregnant/ number detected in estrus.

What pregnancy rate can I expect?

Estrous Detection Rate x Conception Rate = Pregnancy Rate

Estrous detection rate	Conception rate	Pregnancy rate
95	70	67
75	70	53
95	50	48
75	50	38

Importance of Beef Females Conceiving Early in the Breeding Season

Steer Progeny	Heifer Progeny
↑ Weaning weight	↑ Weaning weight
↑ Hot carcass weight	↑ Prebreeding weight
↑ Marbling score	↑ Precalving weight
↑ % Average choice or greater	↑ % Cycling before breeding
↑ Carcass value	↑ Pregnancy rate

Larson and Funston, 2009 — Funston et. al., 2011

Where do I begin?

- Natural service vs. AI?
- Heifers vs. Cows?
- Estrus detection vs. Fixed-time AI (FTAI)?
- Who will do the AI?
- Who will choose the sire? Where to purchase semen, etc?

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Things to do before fixed-time AI

Criteria That Heifers Should Meet

- What has the pregnancy rate in your heifers been over the past few years?
- Have your heifers received growth promoting implants?
- Have you selected an appropriate target weight? Target weight approximately 65% of mature body weight.
- What proportion of your heifers have a reproductive tract score of ≥ 4?

Criteria That Cows Should Meet

- What has the pregnancy rate in your cows been over the past few years?
- What was the body condition score of your cows at calving? Should be ≥ 5.
- What is the current body condition score of your cows?
- How many days postpartum will your cows be when estrus synchronization is initiated?

Fundamental Principles of Sire Selection

Key questions before purchasing semen:

Do you keep replacement heifers?

How/when do you sell your calves?

Be Proactive:

Understand EPD/Selection Indexes

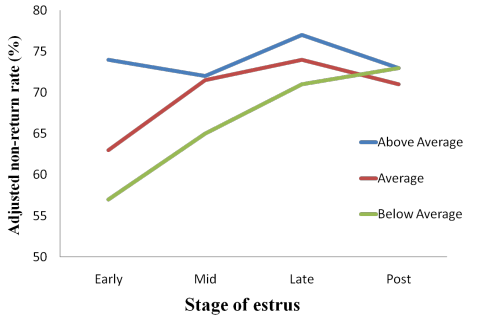
Know what your looking for!

Don't waiver!

Where should I purchase semen for FTAI?

- Semen from one of the four major AI companies.
  - 4127/6749 (61%; 31 sires, 3 were below 50%)
- Semen from a custom collection site
  - 134/276 (49%; 16 sires, 7 were below 50%)

Why do sire fertility rankings differ between FTAI and estrous detection based protocols?



Macmillian and Watson 1975

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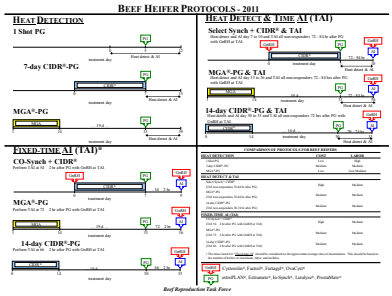
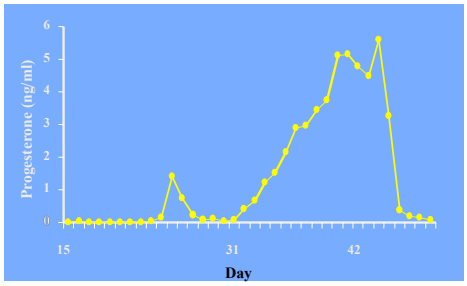
Which estrus synchronization protocol should I choose?

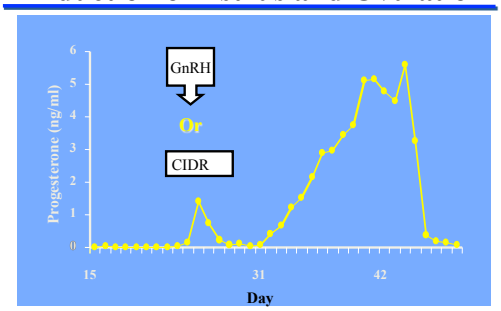


Problem of Anestrus!

Importance of Progesterone for Cyclicity

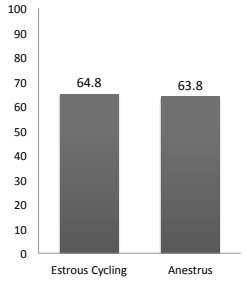


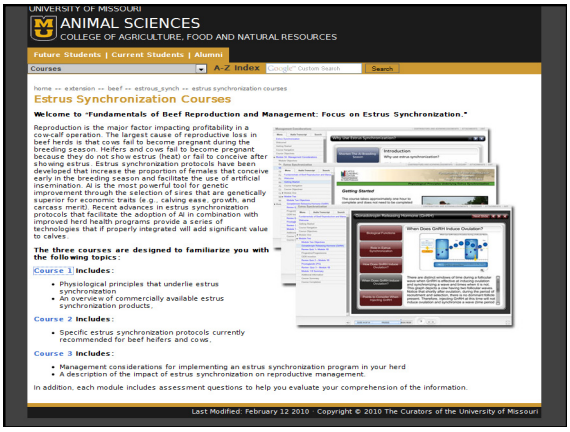
Induction of Estrus and Ovulation



FTAI Pregnancy rate in Anestrous Cows

- 2341 Cows
  - – 4 Studies
    - Bader et al., 2005
    - Schafer et al., 2007
    - Busch et al., 2008
    - Wilson et al., 2010
  - – Estrous Cycling -
    - 1329/2341 = 57%
  - – Anestrus
    - 1012/2341 = 43%





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When should I administer prebreeding vaccines?

- Is there adequate time for the vaccine to provide immunity at breeding and during early gestation?
- Will the vaccine (e.g. MLV-IBR) reduce pregnancy rates following AI?

Prebreeding Vaccination Recommendations

- Replacement heifers should be vaccinated before and at weaning.
- Both heifers and cows should be vaccinated 30 days before breeding.
- Animals that have not been previously vaccinated should not receive prebreeding vaccinations near the time of breeding.

Facilities for Fixed-time Artificial Insemination

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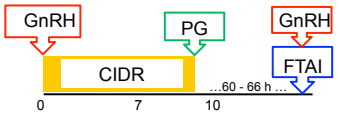
Large's Portable AI Barns

- MU Extension funding placed 8 barns across Missouri

Things to do at Estrus Synchronization and Fixed-time AI

Prepare a Calendar of Action Points



Sun	Mon	Tues	Wed	Thurs	Fri	Sat
	1	2 Insert CIDR & GnRH	3	4	5	6
7	8	9 Remove CIDR & PG	10	11	12 GnRH & FTAI	13

60 - 66 h after PG, give GnRH and FTAI ALL cows

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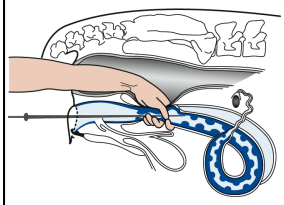
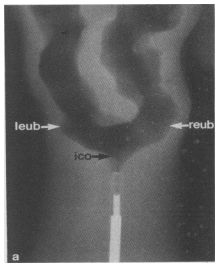
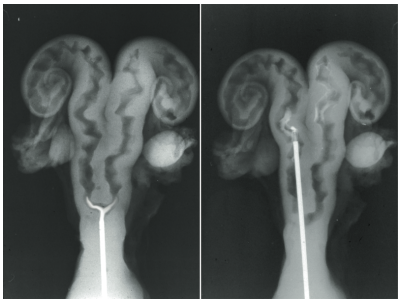
Location of Semen Deposition is Important!

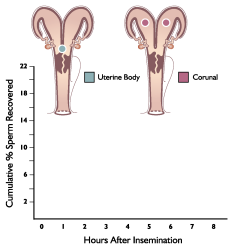
Cow

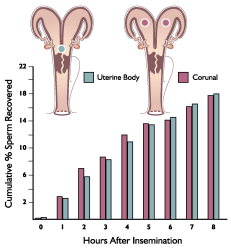


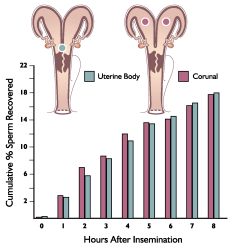


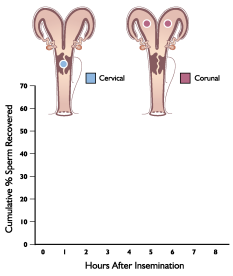
Location of Semen Deposition

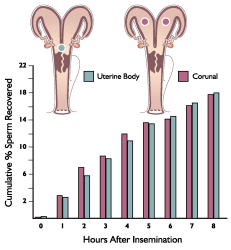


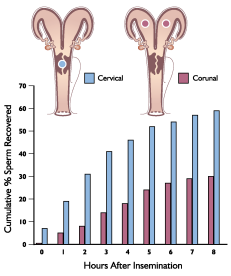












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Artificial Insemination Technique

- Cervical deposition occurs in > 20% of inseminations.
- There is a 10% decrease in conception rate when semen is deposited in the cervix compared to the uterus.
- No advantage to depositing semen in the uterine horns compared to the uterine body.

What to do if a storm is going to hit?

What to do if a storm is going to hit?

- Fixed-time AI – breed at the scheduled time.
- Estrous detection:
  - Breed according to estrus and perform a cleanup AI.
  - Breed according to estrus and 9 to 11 days later inject females not inseminated with PG.
  - Switch to FTAI.

How important is temperament?

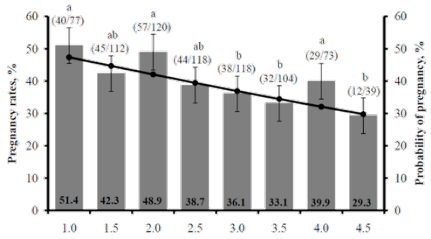
- Behavioral responses of cattle when exposed to human handling.
- As cattle temperament worsens
  - Response to human contact becomes more agitated and/or aggressive.
- Selection for temperament (docility)
  - Heritable trait – up to $h^2 = 0.50$
  - Mainly for safety reasons

How to assess temperament?

- Chute Score
  - Cattle are individually restrained in the chute
  - Scored in 1-5 scale according to behavior
    1. Calm with no movement
    2. Restless movement
    3. Frequent movement with vocalization
    4. Constant movement, vocalization, shaking of chute
    5. Violent and continuous struggling

Effect of Cattle Temperament on Pregnancy Rate

- Females with excitable temperament
  - Delayed puberty and reduced pregnancy rates



Cooke et al., 2011

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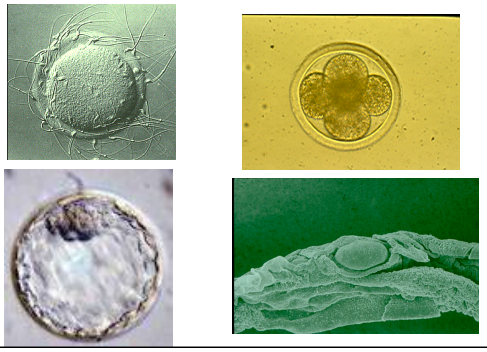
Things to do after fixed-time AI

Embryonic/Fetal Mortality



Factors Affecting Embryonic/Fetal Mortality

- Genetic factors.
- Heat stress.
- Asynchrony between the embryo and maternal environment.
- Effect of the sire.
- Nutrition.
- Shipping stress.

When can I ship cattle after fixed-time AI?

Effect of time of transport after insemination on pregnancy rates

	Days after insemination that transportation occurred			
	1 to 4	8 to 12	29 to 33	45 to 60*
Synchronized pregnancy rate	74%	62%	65%	
% pregnancy loss compared to transportation on days 1 to 4		12%	9%	6%*
Breeding season pregnancy rate	95%	94%	94%	

*Loss compared to percent pregnant prior to transportation (pregnancy determined by transrectal ultrasonography)

Data adapted from Harrington et al., 1995, and T. W. Geary unpublished data

How do you determine what went wrong?

- Calculate the conception rate and/or pregnancy rate – Is it actually low?
- Ask for help – Veterinarian, AI rep, extension specialist, etc.
- Don't make any assumptions.
- When trouble shooting try to systematically work through the possibilities.

What are the primary problems?

- Cattle are not good candidates for an estrus synch/AI program.
- Protocol compliance.
- Sire selection.
- Semen handling.
- Facilities.
- Shipping (trucking) stress.
- Cattle lose weight during the breeding season.
- Unlikely that the biological activity of the ES products is compromised.

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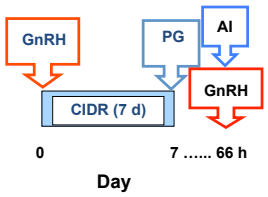
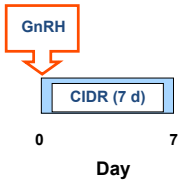
What do you do if you inject the wrong product?



Mistake 1 – Inject PG on Day 0 Instead of GnRH



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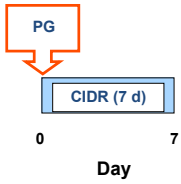

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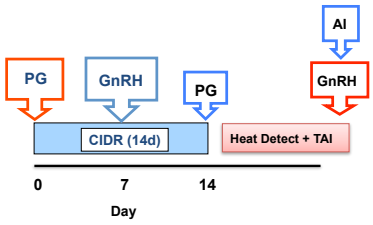
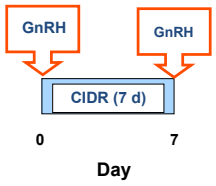


Mistake 2 – Inject GnRH on Day 7 Instead of PG



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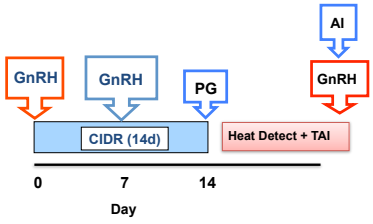

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Summary

Things to do before fixed-time artificial insemination

- Keep accurate calving, breeding, and pregnancy records.
- Animal identification should be clear and easily readable.
- Ensure herd health and disease prevention with a well designed prebreeding vaccination protocol. Vaccinate females a minimum of 30 days before the breeding season begins.
- Decide which estrus synchronization protocol best fits your breeding program, facilities, and personnel (see protocol sheets in AI catalogs).
- Ensure all products are purchased and on-hand prior to initiation of the protocol.
- Prepare the calendar of actions to ensure protocol compliance.

Sire Selection

- Determine if you will purchase or raise replacement heifers.
- Decide how you will market your calves.
- Select proven AI sires with high-accuracy EFDs that match performance goals.
- Purchase semen from a Certified Semen Services (CSS) collection facility.
- Prepare or update your semen inventory.
- Make sure females meet the criteria for being good candidates for estrus synchronization.

Heifer Criteria

- Heifers should weigh 65% of their mature body weight by the start of breeding.
- At least 50% of heifers should have a reproductive tract score (RTS) ≥ 4 by two weeks prior to the start of synchronization or 6 to 8 weeks prior to the breeding season.

Summary Cont.

Cow criteria

- Synchronize and inseminate only cows with BCS at calving of ≥5. (1 = emaciated; 9.0 = Obese)
- The average days postpartum of the group of cows to be synchronized should be ≥ 40 by the start of estrus synchronization and experience a minimum of dystocia.

Things to do at the same time of estrus synchronization and artificial insemination

- Meticulously follow the estrus synchronization protocol!
- If detecting estrus, spend as much time observing the animals as possible.
- Use a minimum of one person to detect estrus per 100 head of cattle.
- Use estrous detection aids to facilitate visual observation of estrus.
- Use a properly trained technician for AI.

Things to do after fixed-time artificial insemination

- To distinguish between AI and bull bred pregnancies at pregnancy diagnosis, you should wait approximately 10 days to turn in clean up bulls after AI.
- Pregnancy check by 75 days after AI via ultrasound or 80 to 90 days after AI via rectal palpation to distinguish AI from bull bred pregnancies.
- If cattle need to be shipped do so between days 1 to 4 after AI and avoid shipping cattle between days 5 to 42 after AI.
- Maintain breeding females on an adequate nutrition and mineral program

PAY ATTENTION TO DETAILS!!!

Acknowledgements

MU Faculty & Grad Students

- Dave Patterson
- Scott Poock
- Ky Pohler
- Jackie Atkins
- Emma Jinks

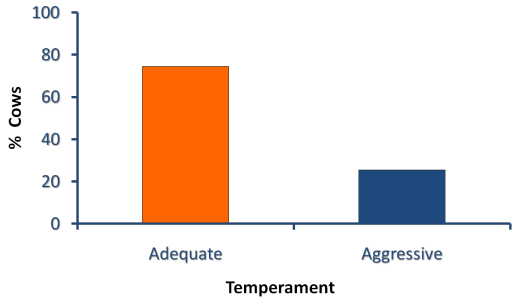
South Dakota State Univ.

- George Perry

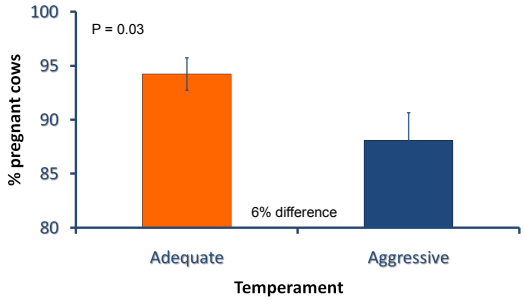
How is the time of estrus expression and ovulation synchronized?

- Know the basic principles of the estrous cycle and how estrus synchronization products work.
- Resources are available:
  - Fundamentals of beef reproduction and management: Focus on estrus synchronization. http://animalsciences.missouri.edu/extension/beef/estrous_synch/
  - Physiological principles underlying estrus synchronization - see appendix.

Incidence of Temperamental Cows



Effect of Temperament on Pregnancy rates



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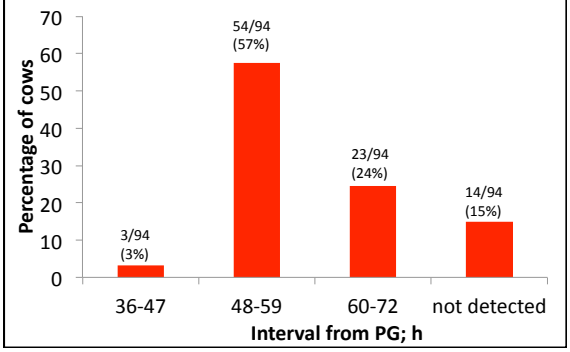
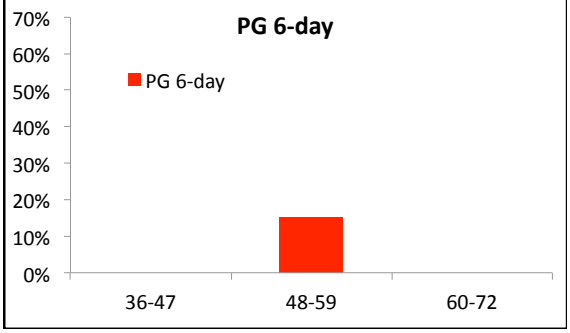
Normal PG 6-day CIDR Estrus Response



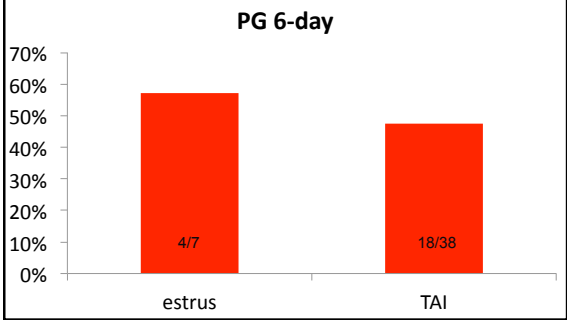
Observed Estrus Response



Solution

- Animals detected in estrus inseminated based on estrous detection
- Changed to Fixed-Time AI
  - –Cows not observed in estrus were inseminated at ~72 hours after PG (late for protocol)

Pregnancy Success



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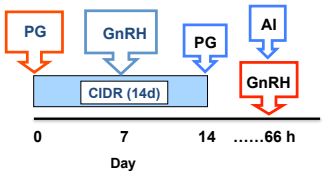
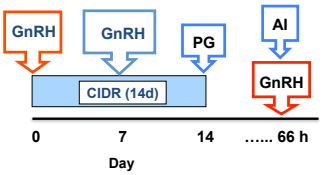


Mistake 2 – Inject GnRH on Day 7 Instead of PG



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Summary

- Pregnancy rate = Estrous detection rate x Conception rate
- Heifers and cows need to meet the criteria for FTAI?
- Sire selection is of critical importance.
- Prepare a calendar of actions to ensure protocol compliance.
- Prebreeding vaccinations.

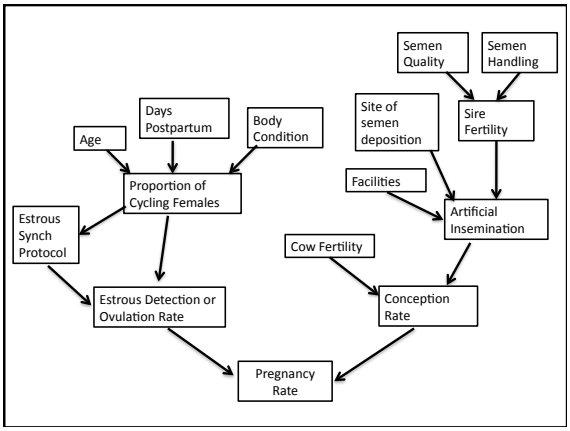
Summary

- If necessary, ship cattle between days 1 and 4 after FTAI.
- Wait about ten days to turn in cleanup bulls.
- Pregnancy diagnosis about 75 days after FTAI.
- PAY ATTENTION TO DETAILS!

Summary

GnRH- PGF- GnRH in TAI

GnRH- PGF- GnRH in TAI



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