

Synchronization and AI Tools and Systems



Division of
Animal Sciences
University of Missouri

Jordan Thomas, Ph.D.
ThomasJor@Missouri.edu
Office: (573) 882-1804
@MizzouRepro
mizzourepro.com



Agricultural Economics Extension

[Division Home](#)[Extension](#)[Research](#)[Teaching](#)[Academic
Departments](#)[OSU Home](#)[Ag Econ Home](#)[Ag Econ Extension Home](#)[Enterprise Budgets Home](#)[2020 Update](#)[Sample Budgets](#)[Excel Tips](#)[Videos and Instructions](#)[Purchase Information](#)[Related Publications](#)[Other Resources](#)[Program Contributors](#)[User Login](#)

Sample Oklahoma Enterprise Budget Summaries

The crop and livestock enterprise budget files listed below are cost and return summaries only. Some are offered in both PDF and editable Excel format. The PDF files were created separately from OSU Enterprise Budget Software. The Excel files are essentially “simple” budget summaries that allow producers to quickly customize for their operations. However, they do not include the advanced interactive budget building features found in the Enterprise Budget Software package (described [here](#)).

Information contained in budget samples reflect expected income and costs based on typical production practices and should only be used as a guide. Individuals should use farm records to identify values specific to their land productive capabilities and farming system when determining the potential costs and returns for their operations.

<http://www.agecon.okstate.edu/budgets/>

Southern Missouri Beef Cow-Calf Planning Budget

This budget presents information useful to beef farmers. Table 1 provides estimates for the 2020 year on a cow-calf operation (50-cow herd size and purchased replacements) in Southern Missouri for a fall and spring calving season. Assumptions were based on price forecasts as of October 2019. Detailed assumptions and feed requirements are summarized in Tables 2, 3 and 4. The production practices used to develop these cost estimates are common for beef farms in Missouri. Farmers are encouraged to modify this budget to fit their operation.

<https://extension.missouri.edu/g679/>

Southern Missouri Beef Cow-Calf Planning Budget

Table 1. Southern Missouri beef cow-calf planning budget for 2021.

	Fall calving	Spring calving
	per cow ¹	per cow ¹
Income over operating costs	-116.62	-77.99
Income over total costs	-238.47	-201.43

Cow Carrying Costs vs Fed Cattle Prices

	1973 Cost	1973 Cost in 2013 Dollars	2013 Actual Cost
Large Round Hay Baler	\$4,200	\$22,050	\$40,000
Diesel Fuel	\$0.17 / gal	\$0.89 / gal	\$3.46 / gal
Nitrogen Fertilizer	\$0.09 / lb	\$0.47 / lb	\$0.63 / lb
Farm Labor	\$1.50 / hr	\$7.87 / hr	\$10 - 15 / hr

	1973 Price	1973 Price in 2013 Dollars	2013 Actual Price
Fed Cattle Price	\$54 / cwt	\$248 / cwt	\$148 / cwt

Gerrish, 2019

- 1. We have to be more efficient converters of energy into pounds of calf**
- 2. Old sunlight is getting more and more expensive**



Long hay feeding seasons and long calving seasons: What's the root cause?

Why do we allow our operations to carry on with these bad habits when there are lower-cost strategies out there?

By Jordan Thomas, Ph.D., State Cow-Calf Extension Specialist - University of Missouri |
Sep 17, 2020

<https://www.beefmagazine.com/nutrition/long-hay-feeding-seasons-and-long-calving-seasons-whats-root-cause>

Opportunities

- High profit producers have a *lower* cost and a *higher* gross income

How?

2012-2016 KFMA Beef Cow-Calf Enterprise Returns Over Variable Costs

	All Farms	High 1/3	Low 1/3	Absolute difference
Gross Income	\$ 972	\$ 1064	\$ 893	\$ 171
Total Variable Cost	\$ 767	\$ 697	\$ 849	\$ -152
Return over variable costs	\$ 205	\$ 366	\$ 44	\$ 322

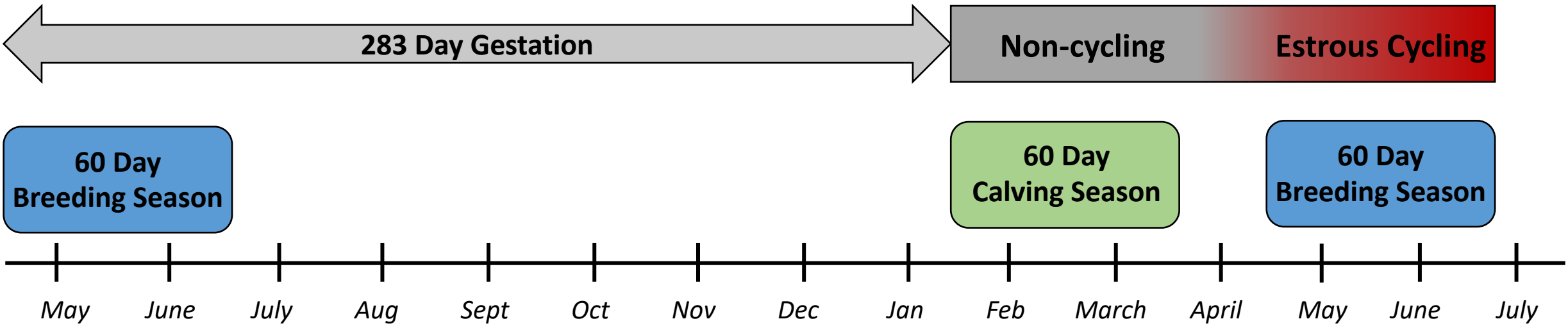
Challenge to U.S. Beef Producers

- Increasing units of production (cows) is likely **not** a worthwhile goal
- Instead, increase **gross margin per unit**
 - Moderating **annual cow carrying costs** (e.g. feed, depreciation, development)
 - Increasing **productivity per unit of production** (e.g. total pounds of calf produced per standard animal unit or per acre)
 - Increasing **value of product** (e.g. price per pound of calf marketed)

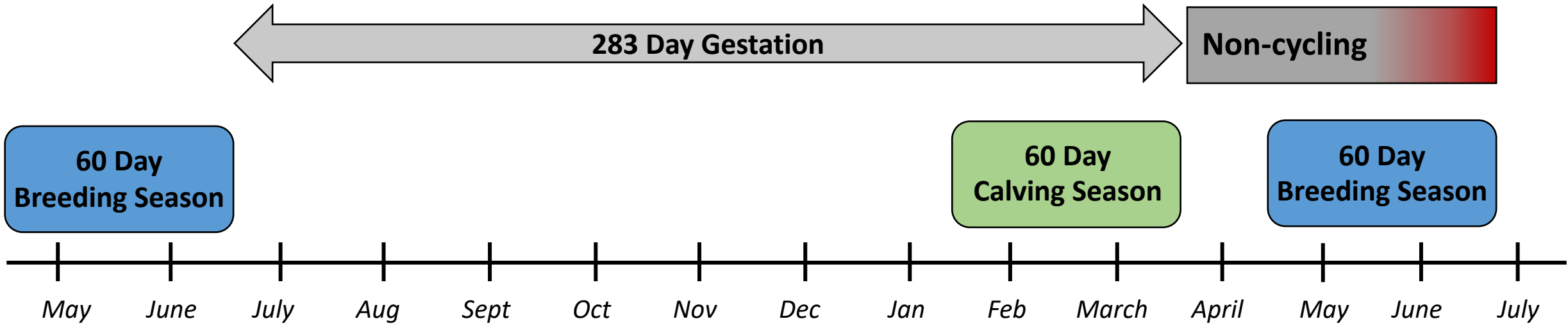
Reproduction affects most parts of this equation!

What are the major determinants of gross margin per cow in a commercial cow-calf enterprise?

- #1 Feed costs:** How much does it cost to carry the cow in terms of feed and supplementation, particularly in the winter months?
- #2 Cow depreciation:** How many years does she conceive, calve, and wean a calf before being culled?
- #3 Age of calves weaned:** How early does she conceive during the breeding season and how old, and therefore heavy, are calves at weaning?
- #4 Quality of calves weaned:** How much value do her calves capture based on health, growth, performance, carcass merit, visual appearance, etc?

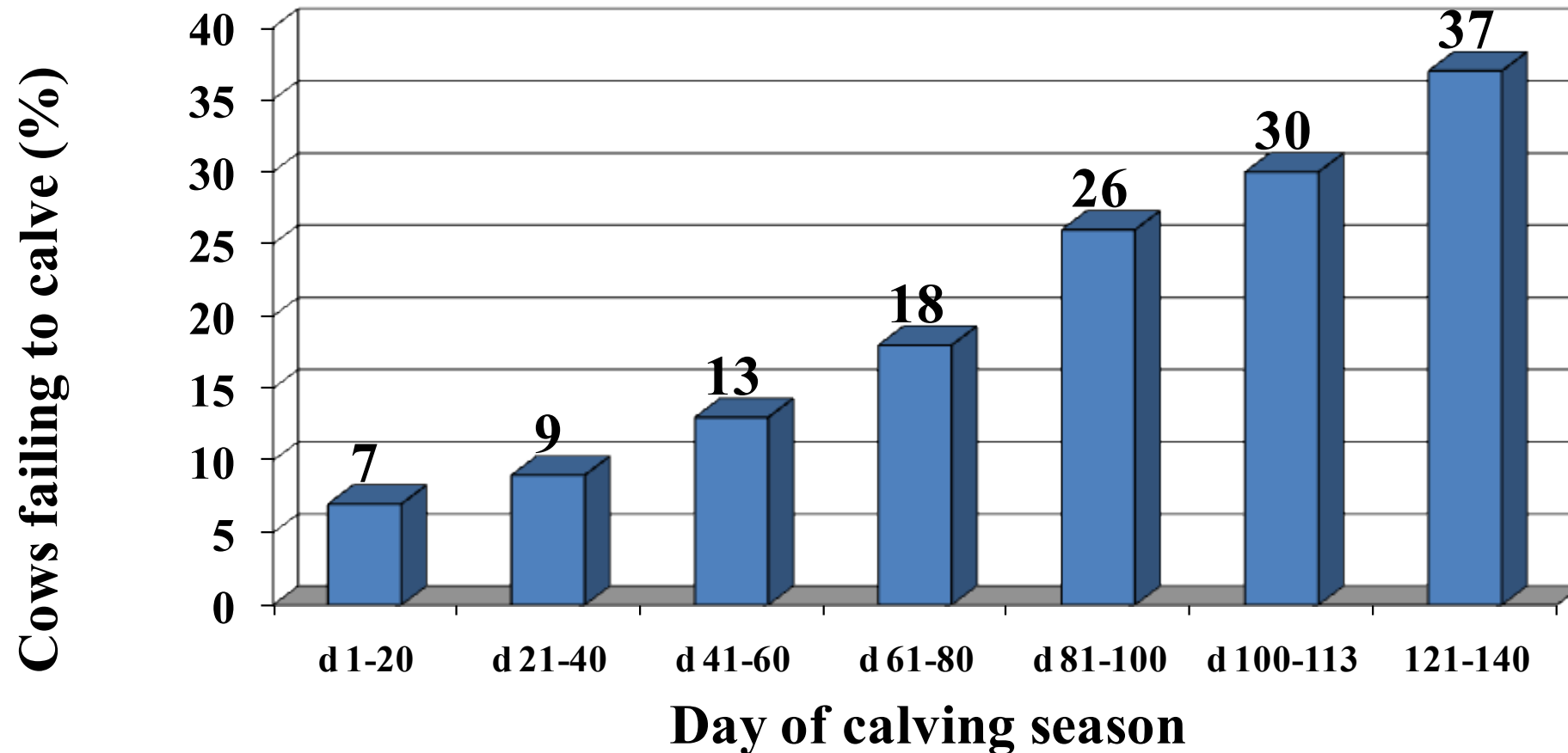


Which cow falls out of the herd faster?
(i.e. has a higher annual cost of depreciation)

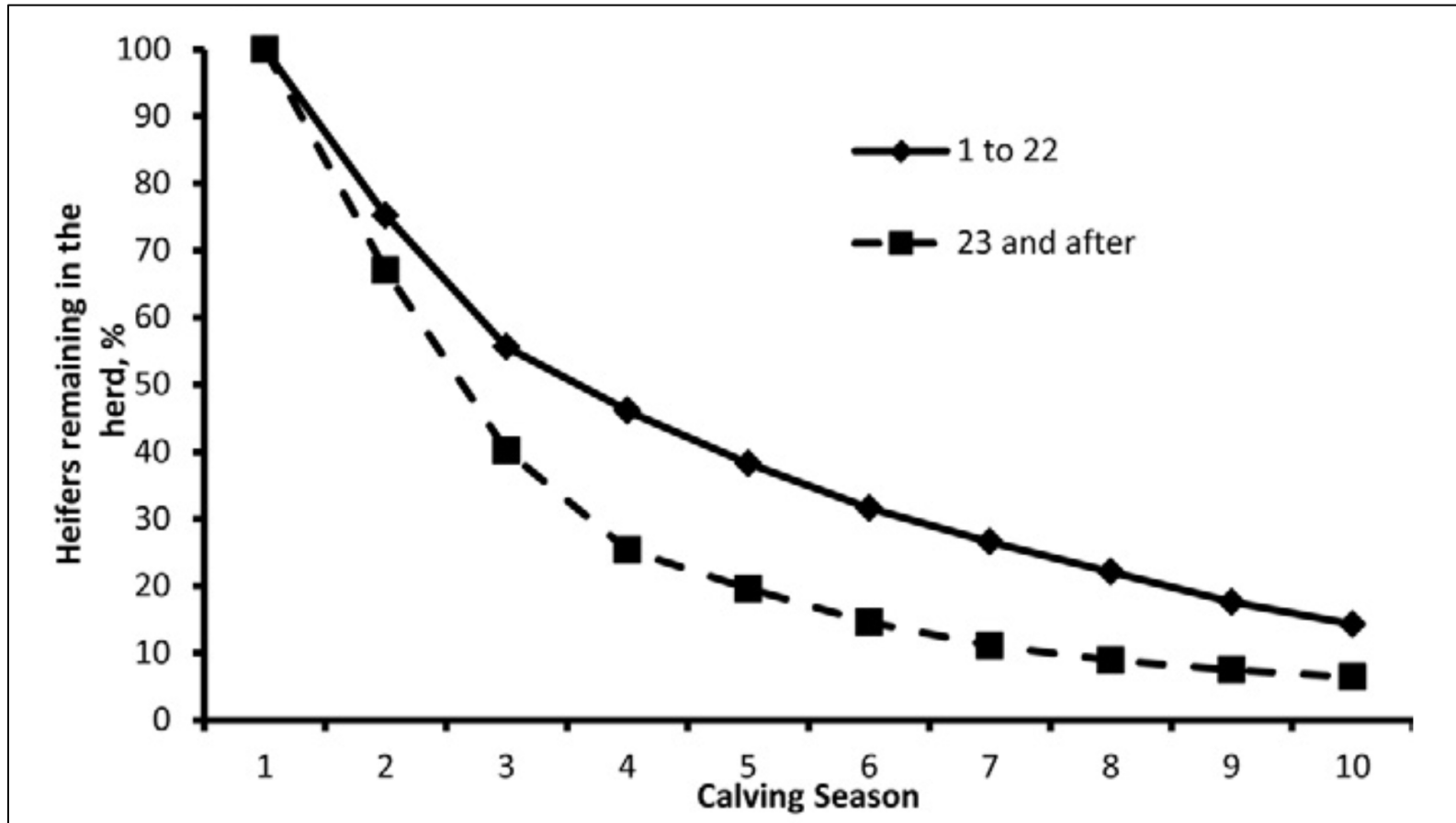


Cows Falling Out of the Herd

Effect of calving date on the number of cows calving the subsequent year
(Burris and Priode, 1958)



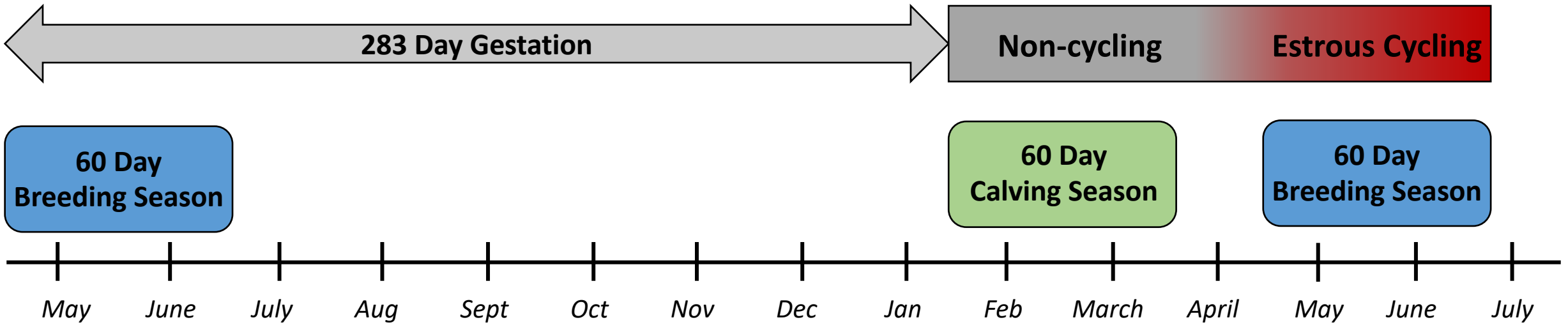
Cows Falling Out of the Herd



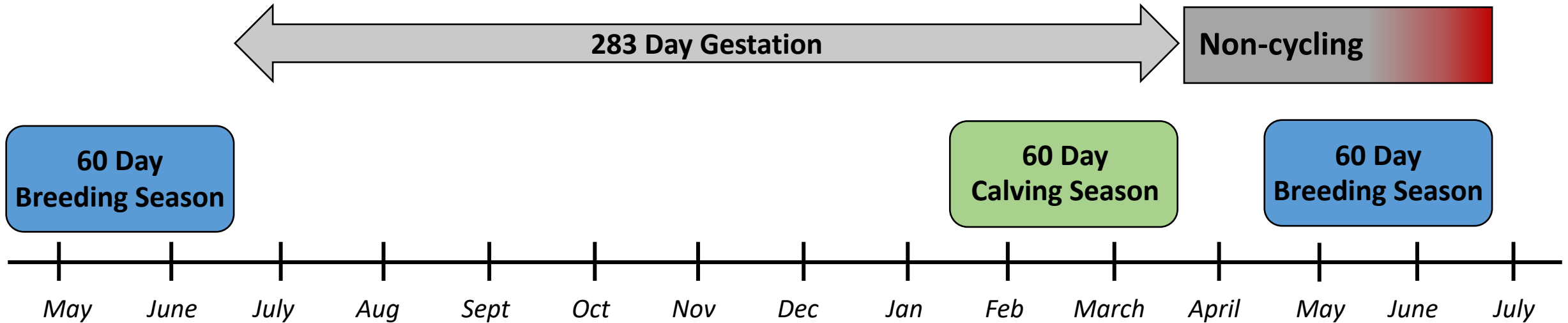
Commercial beef heifers on producer operations that were retained by producers as replacement heifers ($n = 2,195$).

Heifers that calved during the first 21-d period with their first calf remained in the herd longer than heifers that calved later ($P < 0.01$)

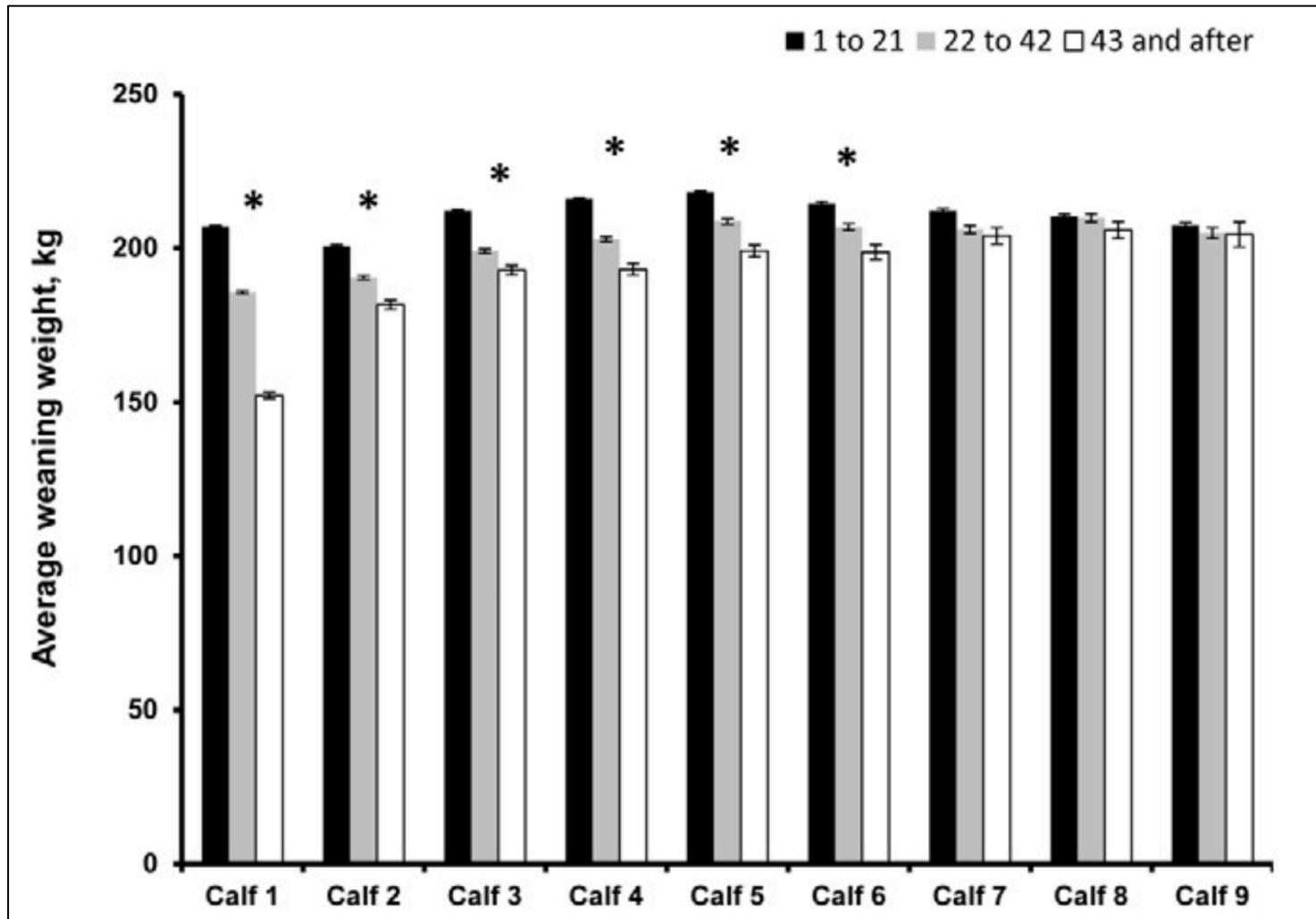
(Cushman et al., 2013)



Which cow brings in the most revenue?
(i.e. weans heavier calves and more total calves over lifetime)



Earlier Conception = Increased Calf Age



Calf weaning weights based on heifer calving period for the U.S. Meat Animal Research Center (USMARC) cows.

Heifers that calved in the first 21 d of their first calving season weaned a heavier calf in each of their first 6 calving seasons ($*P < 0.05$).

(Cushman et al., 2013)

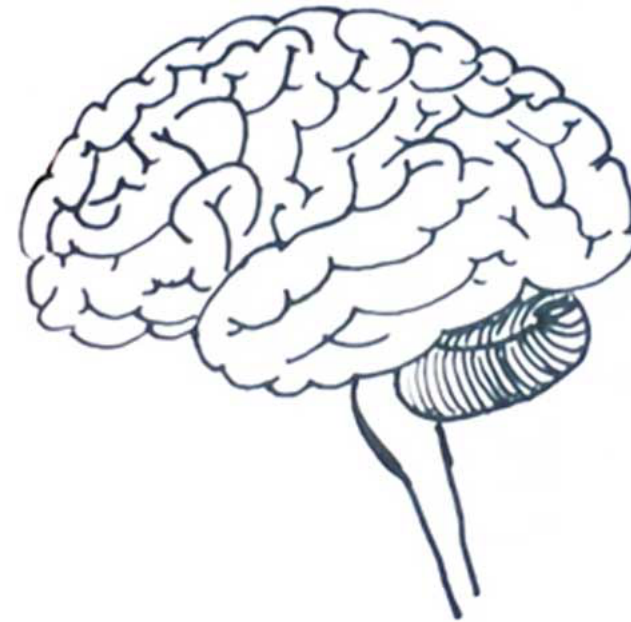
What is the most valuable
reproductive technology?

What does the word “*technology*” mean?



Technology is not just *inventions*

What does the word “*technology*” mean?



“Systematic application of knowledge for practical purposes”

Shorten the Calving Season

- Use a shorter breeding season and/or market late-conceiving females based on a pregnancy diagnosis
- Culling cows is an opportunity **not** a failure on our part
 - Free up equity that is currently tied up in animals that are poor investments
- The cow herd will never reach a level of productivity that you do not cull for
 - Calving seasons do not spontaneously get shorter

Shorten the Calving Season

- “Grass sells a lot better wrapped in calf hide than it does wrapped in cow hide”
 - Allocate forage (let alone equity) to more profitable enterprises
- Better strategies than carrying late-conceiving or open cow
 - Extending length of the grazing season, feeding less hay/supplement
 - Adding additional weight to calves post-weaning
 - Increasing number of highly productive, early-conceiving cows
 - Adding a stocker enterprise during months of peak forage availability

Front-Load the Calving Distribution

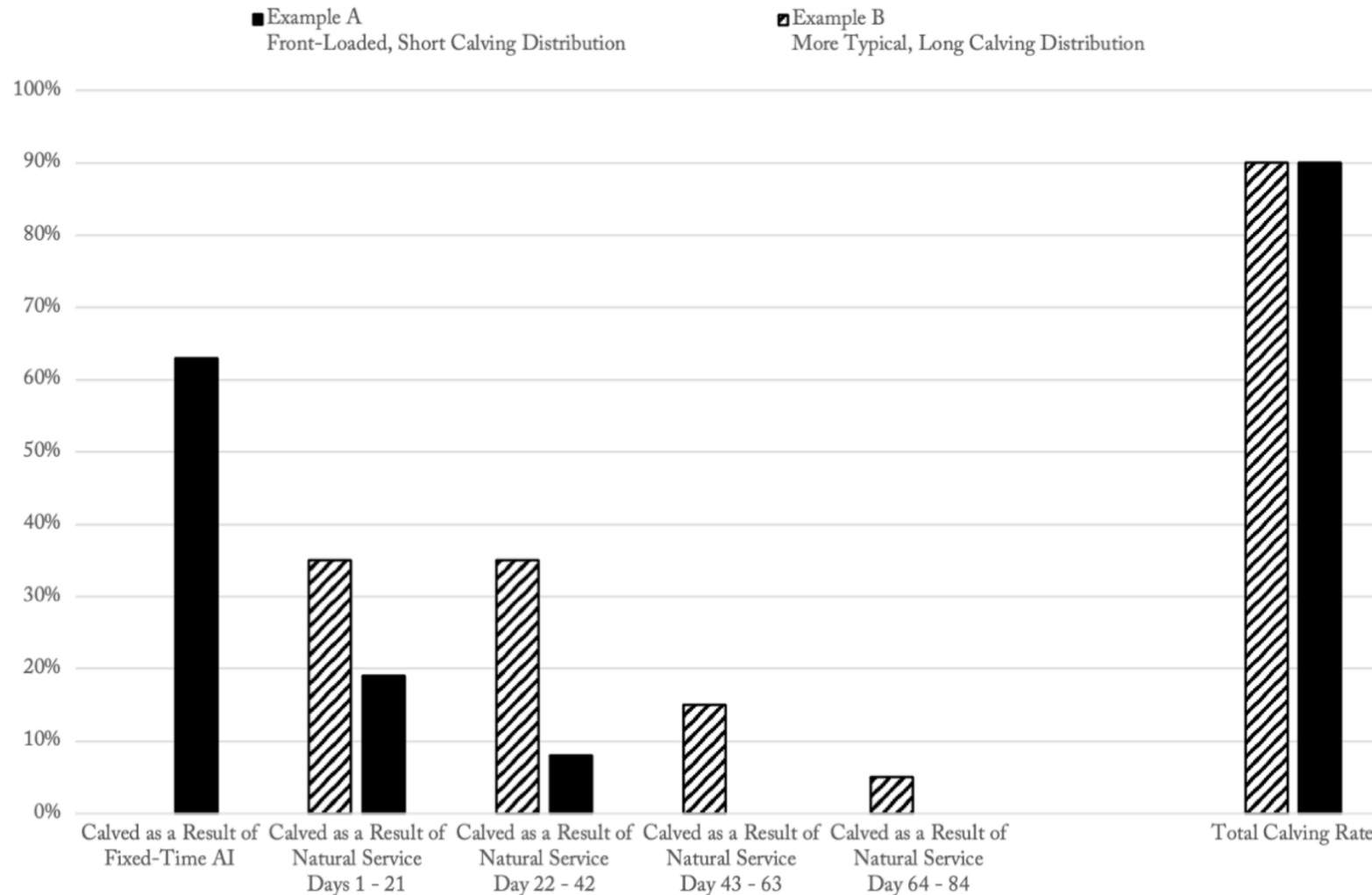


Figure 3. This illustration compares the calving distribution produced by two herds in which the breeding period had been managed differently. In Example A, all cows received a fixed-time artificial insemination on Day 0 of the breeding period, followed by exposure to natural service bulls for two full estrous cycles after AI. In Example B, all cows were exposed to natural service bulls from Day 1 to Day 84. In both examples, the same final pregnancy percentage or calving rate of 90% is assumed. However, the calving distributions illustrate herds with very different levels of reproductive performance.

Front-Load the Calving Distribution

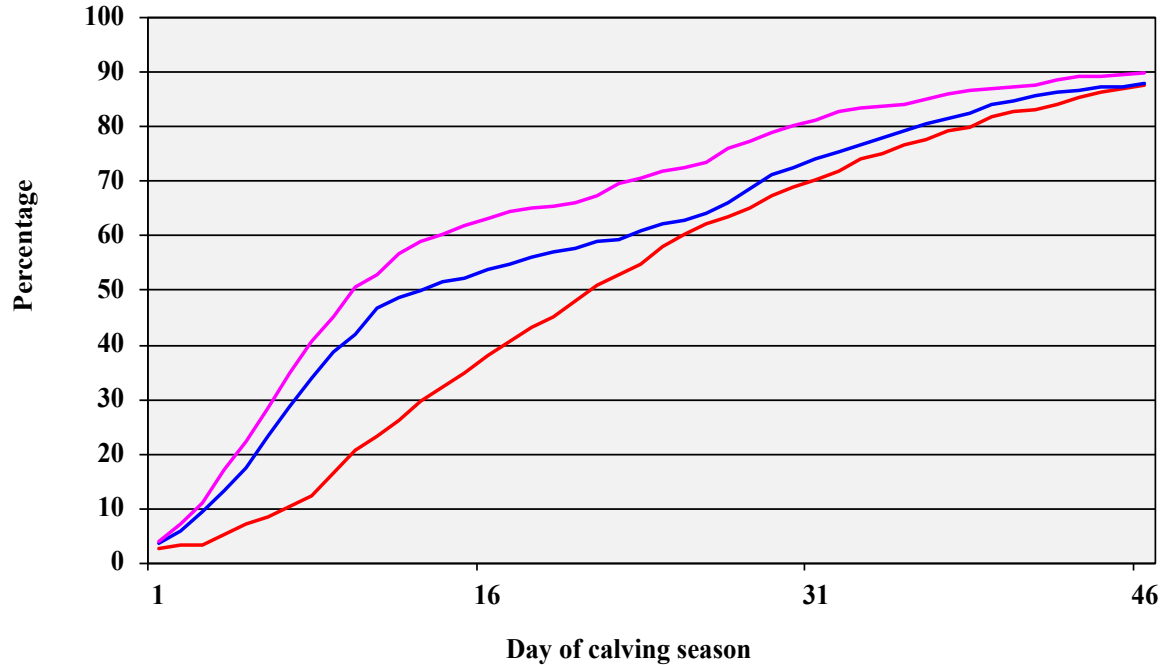
Table 2. Illustration of the impact of calving distribution on age and weight of calves at weaning.

	Calving Period	Number of Calves	Age at Weaning	Weaning Weight	Pounds of Calf Weaned
Example A Front-Loaded, Short Calving Distribution	Calved as a result of fixed-time AI	63	220 days	510 lbs	32,130 lbs
	Calved as a result of natural service, Days 1 - 21	19	199 days	468 lbs	8,892 lbs
	Calved as a result of natural service, Day 22 - 42	8	178 days	426 lbs	3,408 lbs
	Overall	90	212 days	494 lbs	44,430 lbs
Example B More Typical, Long Calving Distribution	Calved as a result of natural service, Days 1 - 21	35	210 days	490 lbs	17,150 lbs
	Calved as a result of natural service, Day 22 - 42	35	189 days	448 lbs	15,680 lbs
	Calved as a result of natural service, Day 43 - 63	15	168 days	406 lbs	6,090 lbs
	Calved as a result of natural service, Day 64 - 84	5	147 days	364 lbs	1,820 lbs
Overall	90	191 days	453 lbs	40,740 lbs	

This illustration compares the age and weight at weaning for the calf crops produced by the two herds presented in Figure 3. Herd size is assumed to be 100 cows for each example. In Example A, cows conceiving to natural service are assumed to have conceived at the end of each 21-day period, as estrus was synchronized in this example to occur prior to fixed-time AI on Day 0. In Example B, cows conceiving to natural service are assumed to have conceived at the midpoint of each 21-day period on average, as no estrus synchronization was used. These calculations assume a 70 lb birth weight and an average daily gain of 2 lbs from birth to weaning. Weaning was assumed to have occurred on Day 220 after the start of the calving season. Despite identical pregnancy percentages obtained overall, the front-loaded, shorter calving distribution from Example A produces nearly 10% more total pounds of calf weaned.

Why Use Estrus Synchronization?

Cumulative Calf Crops at the MU Thompson Research Center Over 12 Years



— Natural Service (3 years; n = 526)
 — Fixed-time AI (4 years; n = 766)

— Estrus Detection & AI (5 years; n = 1040)

(Patterson, 2008)

Economic Impact of Decreasing Length of the Calving Season in a Beef Herd

Year	2006	2007	2008	2009	2010	2011	2012	2013
Mean calving day	79.2	80.9	59.2	56.2	53.7	47.2	39.5	38.7
Difference from 2006/2007	0	0	21.7	24.7	27.2	33.7	41.4	42.2
Per calf increase in value	0	0	\$87	\$99	\$109	\$135	\$166	\$169
Herd increase in value	0	0	\$19,100	\$29,700	\$32,700	\$40,500	\$49,800	\$50,700

(Lamb et al., 2015)



Guide to Estrus Synchronization Products



Jordan Thomas, PhD,
Assistant Extension Professor,
Animal Sciences, University of Missouri

Scott Poock, DVM, DABVP,
Associate Extension Professor,
College of Veterinary Medicine, University of Missouri

Rachael Bonacker,
Graduate Research Assistant,
Animal Sciences, University of Missouri

Katy Stoecklein,
Graduate Research Assistant,
Animal Sciences, University of Missouri

Jaclyn Ketchum,
Graduate Research Assistant,
Animal Sciences, University of Missouri

 Reviewed June 2019

Guide to Estrus Synchronization Products

[View reprint and copy guidelines >](#)

Related programs

[Show Me Select Reproduct...](#)

<https://extension.missouri.edu/publications/g2022>

Estrus synchronization of beef cows and heifers is simple and easy, due to extensive research efforts at the University of Missouri and other institutions. Several [protocols and other resources](#) have been developed to allow beef producers to effectively synchronize estrus and ovulation among the herd.

Estrus synchronization will involve use of one or more of the following compounds: prostaglandin F_{2α} (PG).

Feedback

Mizzou Repro

You **Tube**
facebook.



2021 Beef Cow AI Protocols

PG estroPLAN, Estrumate, In-Synch, Lutalyse, Lutalyse HighCon, ProstaMate, SYNCHSURE

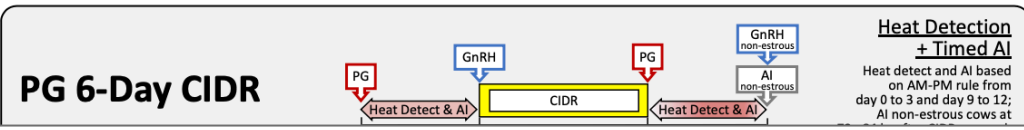
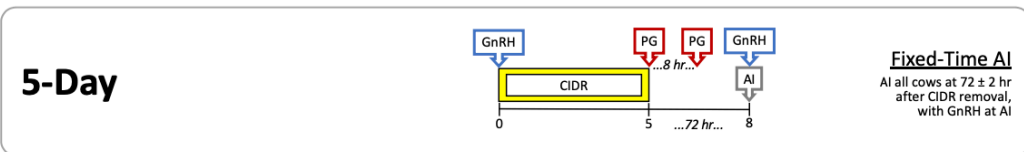
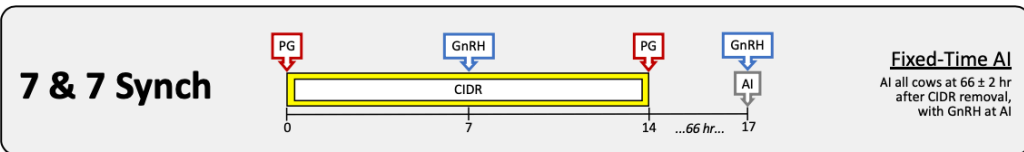
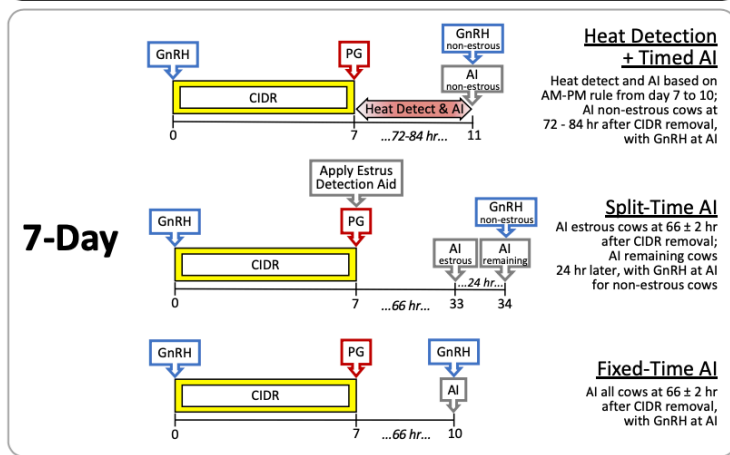
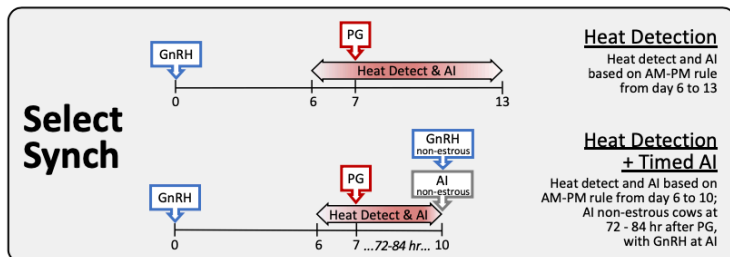
GnRH Cystorelin, Factrel, Fertagyl, GONABreed, OvaCyst

CIDR Intravaginal progesterone Controlled Internal Drug Release

Pharmaceutical products used for estrus synchronization should be administered at the label dose. Consult product packaging. Label-approved applications vary from product to product, and pharmaceutical products for synchronization should be used in the context of an ongoing veterinarian-client-patient relationship.

For more information on proper handling and administration of synchronization products, see University of Missouri Extension publication G2022, *Guide to Estrus Synchronization Products*.

Protocol recommendations are based on peer-reviewed research in the field of hormonal control of the bovine estrous cycle. This is not an exhaustive list of all possible protocols but provides commonly used and effective options.



Estrus Synchronization Recommendations for Artificial Insemination of Beef Cows

Jordan Thomas, Ph.D., Assistant Professor and State Beef Reproduction Specialist • University of Missouri Division of Animal Sciences 573-882-1804 • ThomasJor@Missouri.edu • @MizzouRepro • Animal Science Research Center, 920 E Campus Dr, Columbia, MO 65211

Select Synch: This protocol requires heat detection and will require performing AI over multiple days. Note that heat detection needs to begin on the day prior to administration of PG. Because it does not involve a CIDR, this protocol has a lower overall pharmaceutical cost but is less effective in inducing cyclicity in anestrus cows. Because of this, Select Synch is not a commonly recommended protocol. It may, however, be a cost-effective option for producers who are very comfortable with heat detection and AI, have plenty of time and labor, and are managing herds in which the majority of cows are cycling prior to the start of the protocol.

7-Day: The 7-Day CO-Synch + CIDR protocol is one of the most commonly used protocols across the industry for fixed-time AI of beef cows. It is a simple protocol involving only two animal handling events before fixed-time AI is performed. If fixed-time AI is not feasible or desired, AI can be performed based on heat detection. Because this protocol has been found to be reasonably effective among both anestrus and cycling cows, it is a good option for typical cow groups when a minimal number of animal handlings is desired.

7 & 7 Synch: The 7 & 7 Synch protocol results in a greater proportion of cows exhibiting standing estrus as well as a significant increase in pregnancy rates to fixed-time AI in comparison with the 7-Day CO-Synch + CIDR protocol. The treatment schedule is similar to the 7-Day CO-Synch + CIDR protocol, but cows are handled one additional time, a week prior to GnRH administration. At the start of the protocol, a CIDR is inserted and PG is administered. This results in a greater proportion of cows ovulating in response to GnRH, ultimately improving uniformity among cows in stage of the estrous cycle at the end of the protocol. If maximum pregnancy rates to AI are desired and producers are willing to handle cows three times prior to fixed-time AI, this protocol is recommended. 7 & 7 Synch is also highly recommended if using sexed semen for fixed-time AI. If using sexed semen, consider applying estrus detection aids at the time of CIDR removal and PG administration on Day 14 in order to identify cows that are the best candidates to receive sexed semen.

5-Day: The 5-Day CO-Synch + CIDR protocol is similar to the 7-Day CO-Synch + CIDR but involves a shorter period of CIDR treatment. As a result, it requires administering two doses of PG approximately 8 hours apart. Because of the additional handling of cows and the additional pharmaceutical cost, the 5-Day protocol is a less commonly recommended protocol. However, research suggests a modest improvement in pregnancy rates to AI following the 5-Day CO-Synch + CIDR protocol in comparison with the 7-Day CO-Synch + CIDR protocol.

PG 6-Day CIDR: This protocol works very well for producers who are comfortable with heat detection and AI but also want the benefits associated with use of a CIDR. This protocol may also be used in heifers. Females expressing estrus and receiving AI from days 0 to 3 do not receive the subsequent GnRH, CIDR, or additional dose of PG. As a result, these costs are not incurred for all females. Although it does require more time and labor, the PG 6-Day CIDR protocol may be a good option for producers who are comfortable with heat detection and would like to avoid having large numbers of females to AI on any one day.

Bos indicus PG 5-Day CIDR: This protocol, also sometimes referred to as Bee-Synch II, has been found to be advantageous in *Bos indicus* and *Bos indicus* cross cows. This protocol is therefore recommended for producers with purebred *Bos indicus* (e.g., Brahman) or crosses of *Bos indicus* and *Bos taurus* (e.g., Brahman x Angus crosses, Brahman x Hereford crosses, etc.). Currently, it is unclear whether this protocol or other options should be preferred among *Bos indicus*-influenced cows when the percentage of *Bos indicus*-influence is very low. However, it is a simple protocol that has been effective in *Bos indicus* and *Bos indicus* cross cows, particularly in

<https://extension.missouri.edu/publications/g2024>

2021 Beef Heifer AI Protocols

estroPLAN, Estrumate, In-Synch, Lutalyse, Lutalyse High-Con, ProstaMate, SYNCHSURE
 Cystorelin, Factrel, Fertagyl, GONABreed, OvaCyst
 Intravaginal progesterone, Controlled Internal Drug Release
 Melengestrol acetate feed additive: MGA, HeifermaX
 Pharmaceutical products used for estrus synchronization should be administered at the label dose. Consult product packaging. Label-approved applications vary from product to product, and pharmaceutical products for synchronization should be used in the context of an ongoing veterinarian-client-patient relationship.

Estrus Synchronization Recommendations for Artificial Insemination of Beef Heifers

Jordan Thomas, Ph.D., Assistant Professor and State Beef Reproduction Specialist • University of Missouri Division of Animal Sciences 573-882-1804 • ThomasJor@Missouri.edu • @MizzouRepro • Animal Science Research Center, 920 E Campus Dr, Columbia, MO 65211

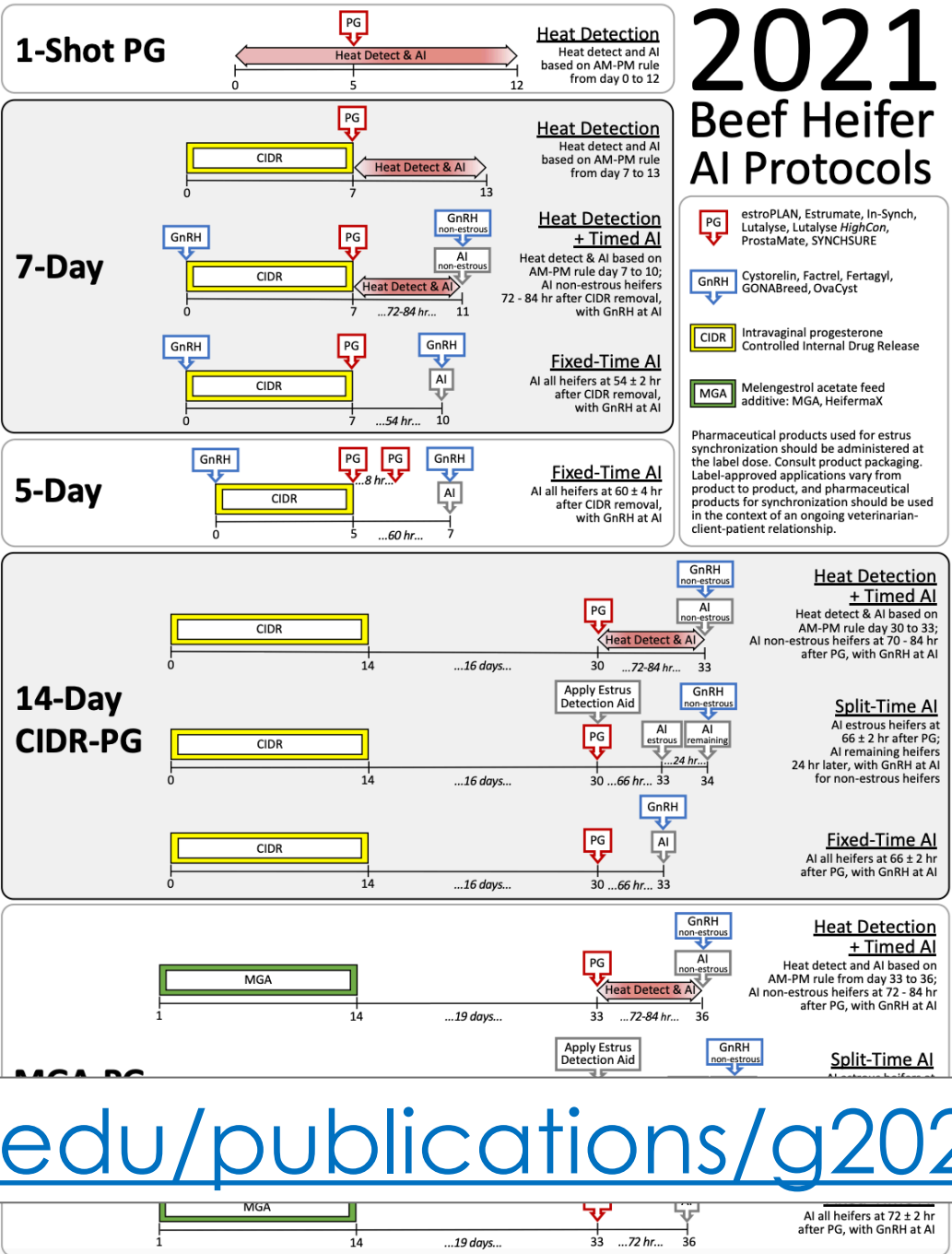
1-Shot PG: This protocol is simple, consisting only of administration of PG. However, this protocol requires heat detection and will require performing AI over multiple days. Because it does not involve a CIDR, MGA, or GnRH, it has a lower overall pharmaceutical cost. However, this protocol will not be effective among heifers that have not yet reached puberty. Also note that this protocol involves a significant time commitment for heat detection and AI, and heat detection needs to begin 5 days prior to PG. This protocol is an option for producers who are comfortable with heat detection and AI, have plenty of time and labor, and know that heifers are already cycling.

7-Day: The 7-Day CO-Synch + CIDR protocol involves only two animal handlings prior to fixed-time AI, and it offers acceptable results in heifers. Note that the recommended timing of fixed-time AI following the 7-Day CO-Synch + CIDR protocol is earlier for heifers (54 hours after CIDR removal) than cows (66 hours after CIDR removal). This protocol works best among heifers that have already reached puberty. For mixed groups of pubertal and prepubertal heifers, longer presynchronization-based protocols like the 14-d CIDR-PG protocol are preferred. However, the 7-Day CO-Synch + CIDR protocol is a good option if heifers have reached puberty prior to the start of the protocol and scheduling issues will not allow use of long-term protocols.

5-Day: The 5-Day CO-Synch + CIDR protocol is similar to the 7-Day CO-Synch + CIDR but involves a shorter period of CIDR treatment. As a result, it requires administering two doses of PG approximately 8 hours apart. Research suggests a modest improvement in pregnancy rates in comparison to the 7-Day CO-Synch + CIDR protocol. However, because of the additional handling of animals and the additional pharmaceutical cost, this is a less commonly recommended protocol for heifers. Like the 7-Day CO-Synch + CIDR protocol, this protocol works best among heifers that have already reached puberty. For mixed groups of pubertal and prepubertal heifers, longer presynchronization-based protocols like the 14-Day CIDR-PG protocol are recommended.

14-Day CIDR-PG: A very effective protocol commonly used across the United States, this protocol involves treatment with a CIDR for 14 days. A subfertile period of heat activity will occur in the days after CIDR removal, but AI should not be performed at this time. Instead, PG is administered 16 days after CIDR removal, followed by heat detection, split-time AI, or fixed-time AI. This protocol is highly recommended for heifers due to the pregnancy rates obtained in mixed groups of pubertal and prepubertal heifers. In addition, the longer protocol schedule provides an opportunity to perform other tasks at CIDR insertion, such as prebreeding exams and vaccinations. Sexed semen can be used effectively with this protocol with heat detection or split-time AI. If using sexed semen, consider using estrus detection aids to identify heifers that are the best candidates to receive sexed semen.

MGA-PG: This protocol involves inclusion of melengestrol acetate (MGA) in a feed mixture for a period of 14 days. A subfertile period of heat activity will occur in the days after removal of MGA from the feed, but AI should not be performed at this time. Instead, PG is administered 19 days after the last feeding of MGA. This protocol works well with heat detection, split-time AI, or fixed-time AI. Compared to CIDR-based protocols, this protocol requires less handling of animals and is also very cost-effective. However, there are several important factors to consider in designing a feeding program that works well with MGA. These considerations include the acclimation of heifers to eating the feed carrier, the inclusion rate of MGA in the feed (0.5 mg per head per day), the total amount of the feed carrier fed to achieve the required daily dose of MGA, the feeding schedule, and the bunk space allotted to each animal. This protocol is usually recommended only for experienced cattle feeders and for situations in which heifers are already being fed daily during the development program. Note



<https://extension.missouri.edu/publications/g2025>

2021 Sexed Semen Recommendations and AI Approaches

Sexed Semen for Artificial Insemination: Recommendations and AI Approaches

Jordan Thomas, Ph.D., Assistant Professor and State Beef Reproduction Specialist • University of Missouri Division of Animal Sciences 573-882-1804 • ThomasJor@Missouri.edu • @MizzouRepro • Animal Science Research Center, 920 E Campus Dr, Columbia, MO 65211

Sexed Semen: Sexed semen contains an enriched proportion of either X or Y chromosome-bearing sperm cells. The bovine X chromosome is larger than the Y-chromosome, resulting in X chromosome-bearing sperm cells containing approximately 3.8% more total DNA content. By staining sperm cells with a dye that incorporates proportionally with DNA content, sperm cells can be differentiated as X or Y chromosome-bearing. This difference in DNA content is the basis for generating sexed semen using one of two commercial processes.

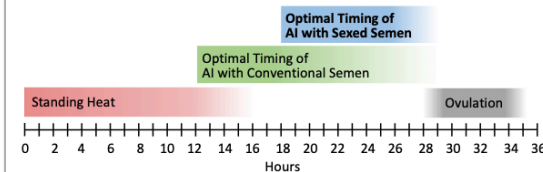
SexedULTRA 4M: SexedULTRA and SexedULTRA 4M are trademarks of Inguran LLC and refer to sexed semen produced using a USDA-developed and patented process now licensed to Sexing Technologies. Stained sperm can be effectively sorted using this flow cytometry-based sorting procedure. Flow cytometry-based sperm sexing has undergone a number of improvements, increasing its efficiency and viability over the last few decades. The sex-sorted semen product using this technology is presently available and marketed commercially for both beef and dairy breeds under the trade name SexedULTRA 4M. The “4M” refers to 4 million sperm cells per unit, an increase from the 2 million cells per unit that was previously standard for sex-sorted semen.

Sexcel Sexed Genetics: Sexcel is a recently developed sexing technology produced by ABS Global (Genus plc) using their proprietary IntelliGen technology. This sexing process also involves staining of sperm cells and differentiation of X and Y chromosome-bearing sperm based on DNA content. To produce a sexed product, however, a laser ablation process is used to selectively destroy sperm cells carrying the undesired chromosome. Sexcel is currently marketed for X-sorted semen for a variety of breeds.

Differences from Conventional Semen: Due to the sexing procedure and subsequent cryopreservation, sexed semen can result in reduced pregnancy rates compared with conventional semen. This reduction appears to be more severe for some bulls than others. Production of sexed semen may simply not be possible for some bulls if their sperm cells are found to not remain viable after sorting, freezing, and thawing. Sexed sperm cells appear to have a shorter fertile lifespan after insemination. To mitigate this, some research suggests that sexed semen requires more precise timing of insemination in relation to ovulation. If AI is performed after heat detection, optimal timing of AI after onset of standing heat is somewhat later if using sexed semen. When timed AI is performed, females that fail to exhibit standing heat prior to AI have particularly decreased pregnancy rates if sexed semen is used. With this understanding, strategies have been developed to optimize pregnancy rates when AI is performed with sexed semen.

Considerations for Using Sexed Semen: In any planned mating of cattle, one sex of calf is usually preferred over the other. Either a bull or heifer calf may be preferred from a given mating, either due to genetic merit for certain traits or simply the needs of the operation for calves of a certain sex. For seedstock operations, using sexed semen allows for targeted production of herd sires or breeding females from specific matings. In the commercial industry, there may be value in using sexed semen to skew the sex ratio of the calf crop toward steer production or to selectively produce heifer calves from specific females or groups. For example, there may be value in producing greater numbers of high-quality replacement heifer candidates or in marketing larger quantities of uniform high-quality feeder steers. However, sexed semen costs more per unit than conventional semen. A higher cost per unit for a lower pregnancy rate translates to a higher cost per pregnancy. This cost is also increased when considering the missed opportunity to obtain greater pregnancy rates early in the breeding season through use of conventional semen. Before deciding to use sexed semen, consider the value difference between the sexes of calves. Weigh whether this value difference is large enough

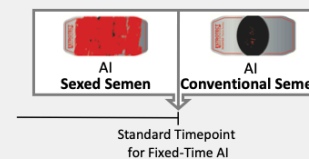
Heat Detection



When performing AI after heat detection, AI with sexed semen should occur approximately 18 - 24 hr after the start of the female's standing heat

Heat Detection: Sexed sperm cells often remain fertile for a shorter period of time in the female reproductive tract following insemination. Therefore, artificial insemination with sexed semen should be performed closer to the timing of ovulation. Length of standing heat in cattle is highly variable; however, ovulation occurs approximately 30 hours after the start of the standing heat behavior. Therefore, in order to achieve optimal pregnancy rates with sexed semen, a female that expresses standing heat should receive AI approximately 18 to 24 hours after the start of that female's standing heat behavior. Note that this is later than the time recommended for AI with conventional semen. For accuracy, it is strongly suggested to apply estrus detection aids and to monitor heat activity a minimum of three times daily (e.g., dawn, noon, and dusk).

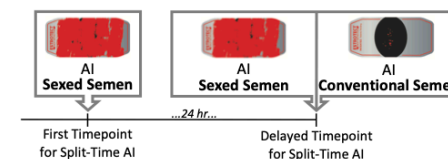
Fixed-Time AI



Apply estrus detection aids at the final animal handling prior to fixed-time AI. Use sexed semen for females with activated patches at the time of fixed-time AI. Use conventional semen for females with non-activated patches.

Fixed-Time AI: Simply performing fixed-time AI at a later time when using sexed semen is not recommended. Increasing the interval to AI may make the timing of insemination too late for a proportion of the females. Results from published research trials suggest similar, if not worse, pregnancy rates are obtained when timing of fixed-time AI is delayed for sexed semen. However, results from multiple research trials have shown that acceptable pregnancy rates with sexed semen can be obtained among females that exhibit standing heat prior to fixed-time AI. If using sexed semen for fixed-time AI, therefore, select a protocol that is likely to result in a large number of animals expressing standing heat over a narrow window of time. Recommended protocols that accomplish this include the 14-Day CIDR-PG protocol for heifers and the 7 & 7 Synch protocol for cows. Additionally, apply estrus detection aids (e.g., Estrotect breeding indicators) at the last animal handling prior to fixed-time AI. For best results, restrict use of sexed semen to only those females with activated patches at the time of fixed-time AI. To generate more favorable pregnancy rates and keep costs moderate, use of conventional semen is recommended for females with non-activated patches.

Split-Time AI



Apply estrus detection aids at the final animal handling prior to split-time AI. Use sexed semen for females with activated patches at the first timepoint for split-time AI. Delay AI for remaining females until 24 hr later. At that time, use sexed semen for females with activated patches and use conventional semen for females with non-activated patches.

Split-Time AI: Use of a split-time AI approach can increase the number of females in which sexed semen can

<https://extension.missouri.edu/publications/g2026>

Estrus Synchronization Recommendations for Natural Service Bull Breeding

Jordan Thomas, Ph.D., Assistant Professor and State Beef Reproduction Specialist • University of Missouri Division of Animal Sciences 573-882-1804 • ThomasJor@Missouri.edu • @MizzouRepro • Animal Science Research Center, 920 E Campus Dr, Columbia, MO 65211

Introduction: While artificial insemination is an excellent choice for an increasing number of producers, it is not the only option after a synchronization program. A variety of simple synchronization protocols can be used effectively with natural service. This can allow producers to capture some of the benefits of estrus synchronization without making the full jump to an AI program. Adding in a synchronization program in bull-bred herds provides many of the benefits seen by producers who are implementing AI, but with less out-of-pocket costs, labor, and time commitment. This is also an excellent tool to progressively shorten an extended-length calving season in order to prepare to use AI in future years.

Goals and Gains: The goal of any estrus synchronization program is to increase the number of females bred early in the season. This results in increased age, uniformity, and value of calves at weaning. Increasing the proportion of the herd pregnant early in the season can also help to shorten the length of the calving season in the cow herd, resulting in reproductive improvements in future breeding seasons.

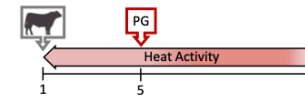
Bull Considerations: Natural service programs are dependent on bulls for success, and synchronization will result in a larger proportion of females in heat during a shorter window of time. Any bull used for breeding should receive a breeding soundness exam by a veterinarian prior to turnout. As well as evaluating the semen quality and scrotal circumference of the bull, the veterinarian will also assess the bull's overall condition and physical structure. Individual bulls vary widely in their ability to cover cows. If using synchronization, it is advisable to err on the conservative side with respect to the bull-to-cow ratio used. Most recommendations are to stock mature bulls at a rate of 1 bull to no more than 25 cows. Use of young, inexperienced sires after synchronization is discouraged due to the concentrated breeding window, but bull-to-cow ratios should be reduced if young bulls are used (e.g., 12 cows for a yearling bull and 18 cows for an 18-month-old bull). Single sire breeding pastures also inherently involve more risk. Periodic observation of breeding groups is recommended to ensure mating is taking place and females do not continue to return to estrus throughout the breeding season.

Cow and Heifer Considerations: No technology will replace good management or make up for cows or heifers that are in poor condition. Heifers should be developed to 55-65% of their expected mature body weight prior to breeding. Also consider having heifers evaluated by a veterinarian to ensure adequate pelvic area and reproductive maturity. For best results in a synchronization program, cows should be at least 45 days post-calving and at a body condition of 5 or greater. Consider culling animals that aren't meeting these criteria; this ensures that the expense and effort of synchronization and bull power will not go to waste.

Selecting a Protocol: Depending on the group of cows or heifers receiving synchronization, protocols vary in their level of potential impact. For example, the 1-Shot PG protocol is simple, but PG is only effective among cows and heifers that are already cycling. Synchronization protocols that utilize progestin products, like MGA or a CIDR, have proven effective at hastening puberty attainment in heifers if some of the heifers in the group are not yet cycling. A CIDR is also an excellent tool to drive late-calving cows towards resuming estrus more quickly. Note that MGA is FDA-approved only for use in heifers and should therefore not be used in protocols for mature cows. It is important to adhere to the suggested timing of each protocol. Longer term protocols like the 14-Day CIDR and MGA protocols require a waiting period between progestin removal and bull exposure. Heat activity will occur in the period of time after progestin removal; however, exposing animals for breeding on this heat results in subfertility. Instead, plan on waiting approximately 10 days before introducing bulls, and expect the breeding season to start as those heifers begin to come in heat again. Make a calendar and ensure

2021 Protocols for Natural Service Bull Breeding

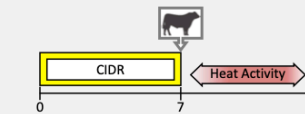
1-Shot PG



Natural Service
Introduce bulls and administer PG on the 5th day of bull exposure

1-Shot PG Natural Service: This protocol involves only a single administration of PG. Animals that exhibit standing heat in the 4 to 5 days leading up to PG will not respond to PG. Therefore, bulls should be introduced 4 to 5 days in advance of PG. This results in greater pregnancy rates early in the breeding season compared with simply introducing bulls on the day of PG administration. Animals bred in the days leading up to PG may still be safely administered PG without risking abortion. This protocol does not involve a CIDR, MGA, or GnRH and therefore has a lower pharmaceutical cost. However, this protocol is not effective for inducing cyclicity among anestrus cows or among heifers that have not yet reached puberty. If a large proportion of animals are not cycling, protocols involving a CIDR or MGA are better alternatives.

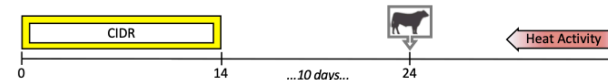
7-Day CIDR



Natural Service
Introduce bulls at CIDR removal

7-Day CIDR + Natural Service: This protocol involves treatment with a CIDR for 7 days, with bulls introduced on the day of CIDR removal. Although this protocol does involve the cost of a CIDR, it can effectively induce cyclicity among a proportion of anestrus cows and heifers that have not yet reached puberty.

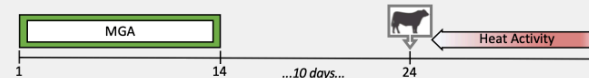
14-Day CIDR



Natural Service
Wait approximately 10 days after CIDR removal before introducing bulls

14-Day CIDR + Natural Service: This protocol involves treatment with a CIDR for 14 days. A subfertile period of heat activity will occur in the days after CIDR removal, and bulls should not be introduced during this time. Instead, bulls should be introduced approximately 10 days after CIDR removal. Heat activity occurring in the days immediately after bull introduction will likely be minimal, and the majority of heat activity will begin a full estrous cycle length (18 to 24 days) after the initial subfertile heat activity that followed CIDR removal. This protocol is highly recommended for heifers due to the pregnancy rates obtained in mixed groups of pubertal and prepubertal heifers. In addition, the longer protocol schedule provides an opportunity to perform other tasks at CIDR insertion, such as prebreeding exams and vaccinations. This protocol can also be used in postpartum cows, but length of the protocol schedule can make implementation difficult depending on the length of the previous calving season.

MGA



Natural Service
Wait approximately 10 days after removal of MGA from feed before introducing bulls

MGA + Natural Service: This protocol involves inclusion of melengestrol acetate (MGA) in a feed mixture for a period of 14 days. A subfertile period of heat activity will occur in the days following removal of MGA from the feed, and bulls should not be introduced during this time. Instead, bulls should be introduced approximately 10 days after the last feeding of MGA. Some heat activity may occur in the days immediately after bull introduction, but the majority of heat activity will begin a full estrous cycle length (18 to 24 days) after the initial subfertile heat activity that followed MGA withdrawal. Compared to CIDR-based protocols, this protocol requires less

PG estroPLAN, Estrumate, In-Synch, Lutalyse, Lutalyse HighCon, ProstaMate, SYNCHSURE

CIDR Intravaginal progesterone Controlled Internal Drug Release

MGA Melengestrol acetate, a progestin feed additive: MGA, HeifermaX

Pharmaceutical products used for estrus synchronization should be administered at the label dose. Consult product packaging. Label-approved applications vary from product to product, and pharmaceutical products for synchronization should be used in the context of an ongoing veterinarian-client-patient relationship.

<https://extension.missouri.edu/publications/g2027>

7 & 7 Synch: An Estrus Synchronization Protocol for Postpartum Beef Cows

Jordan Thomas
Assistant Professor, Animal Sciences

Rachael Bonacker
Graduate Research Assistant, Animal Sciences

Carson Andersen
Graduate Research Assistant, Animal Sciences

Overview

Researchers at the University of Missouri recently evaluated a new protocol for synchronization of estrus among postpartum beef cows. This protocol was found to be highly effective both for cows receiving embryo transfer (ET) and cows receiving fixed-time artificial insemination (AI). Extensive field trials with the 7 & 7 Synch observed improvements in the proportion of cows expressing estrus and in the proportion of cows becoming pregnant to embryo transfer or to AI.

Introduction

Estrus synchronization is a widely applicable reproductive technology that allows producers to improve



New September 2020

7 & 7 Synch: An Estrus Synchronization Protocol for Postpartum Beef Cows

 **DOWNLOAD THIS PUBLICATION >**

[View reprint and copy guidelines >](#)

Contents

- [Overview](#)

<https://extension2.missouri.edu/g2023>

Relationship between Follicular Waves and GnRH

YES

In cows, response rate to GnRH is only 65% at a random time point.

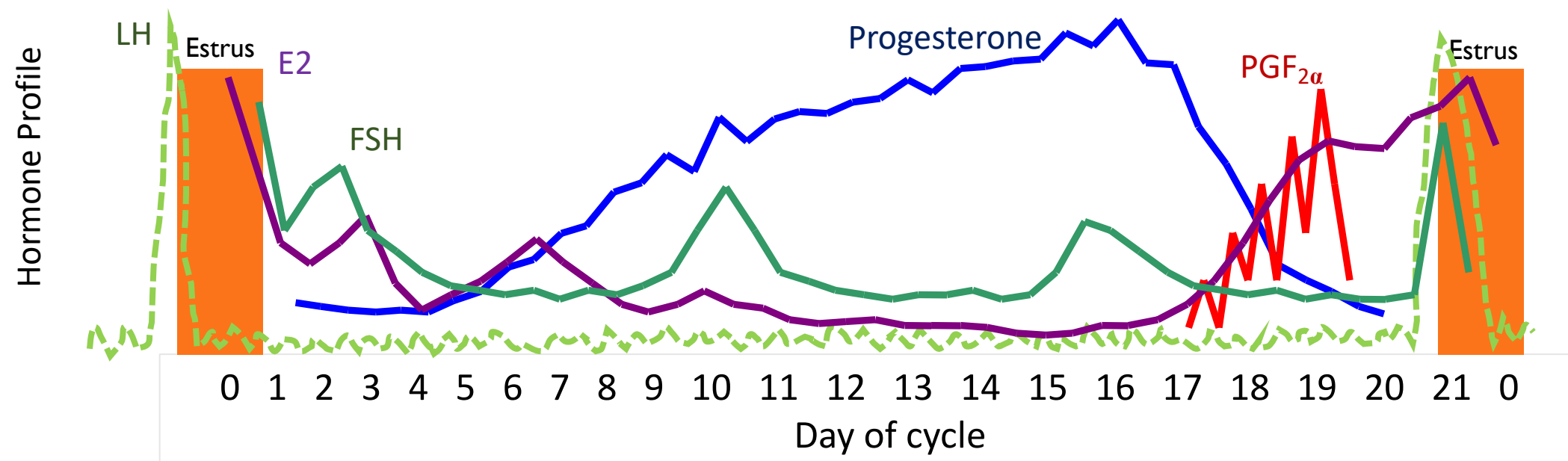
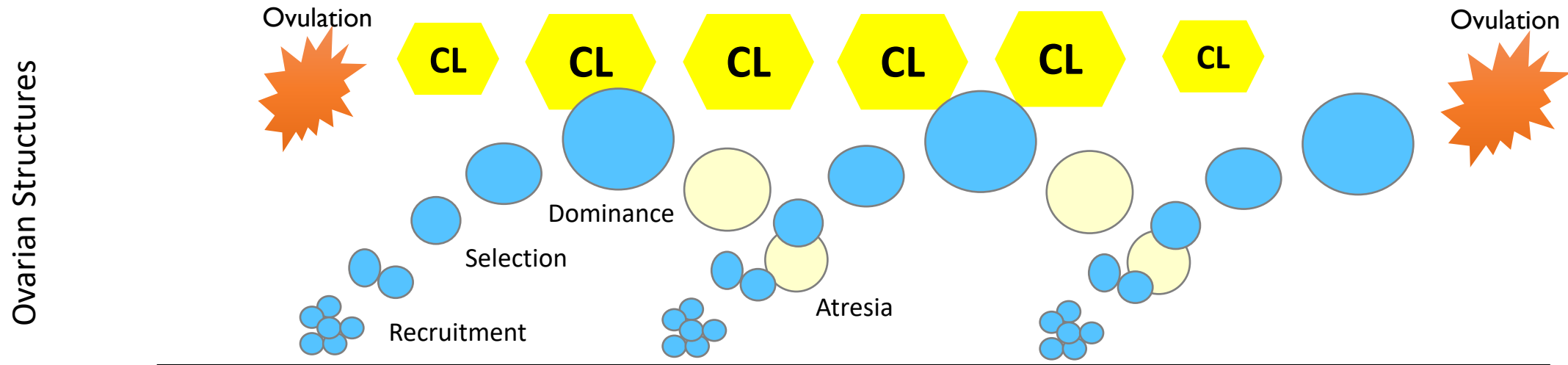
(Vasconcelos et al. 1999, Geary et al. 2000)

examination

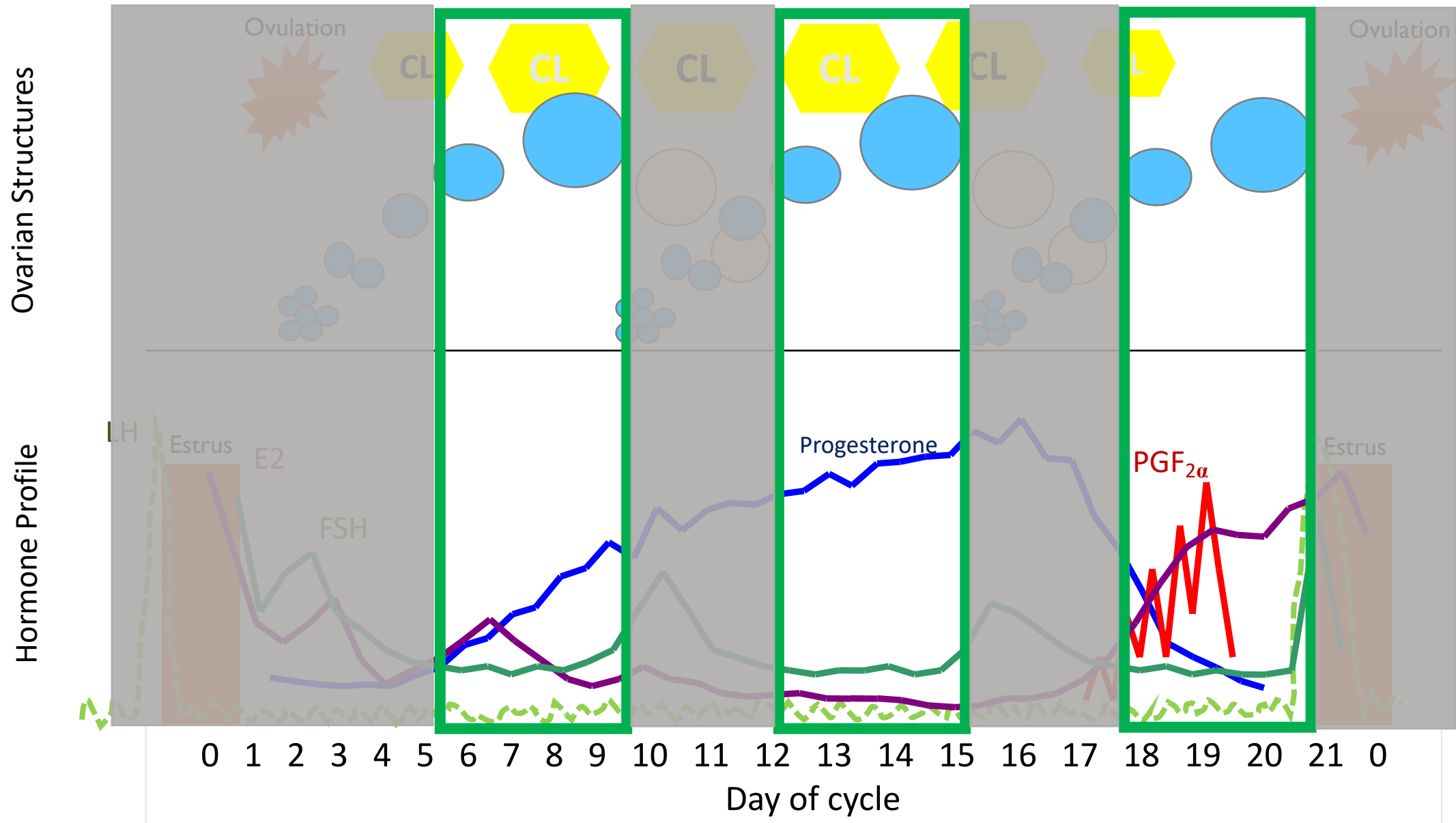
NO

Follicles, less than 10 mm in diameter (premature) and regressing follicles (aged and not healthy)

Physiology of the Bovine Estrous Cycle



Physiology of the Bovine Estrous Cycle

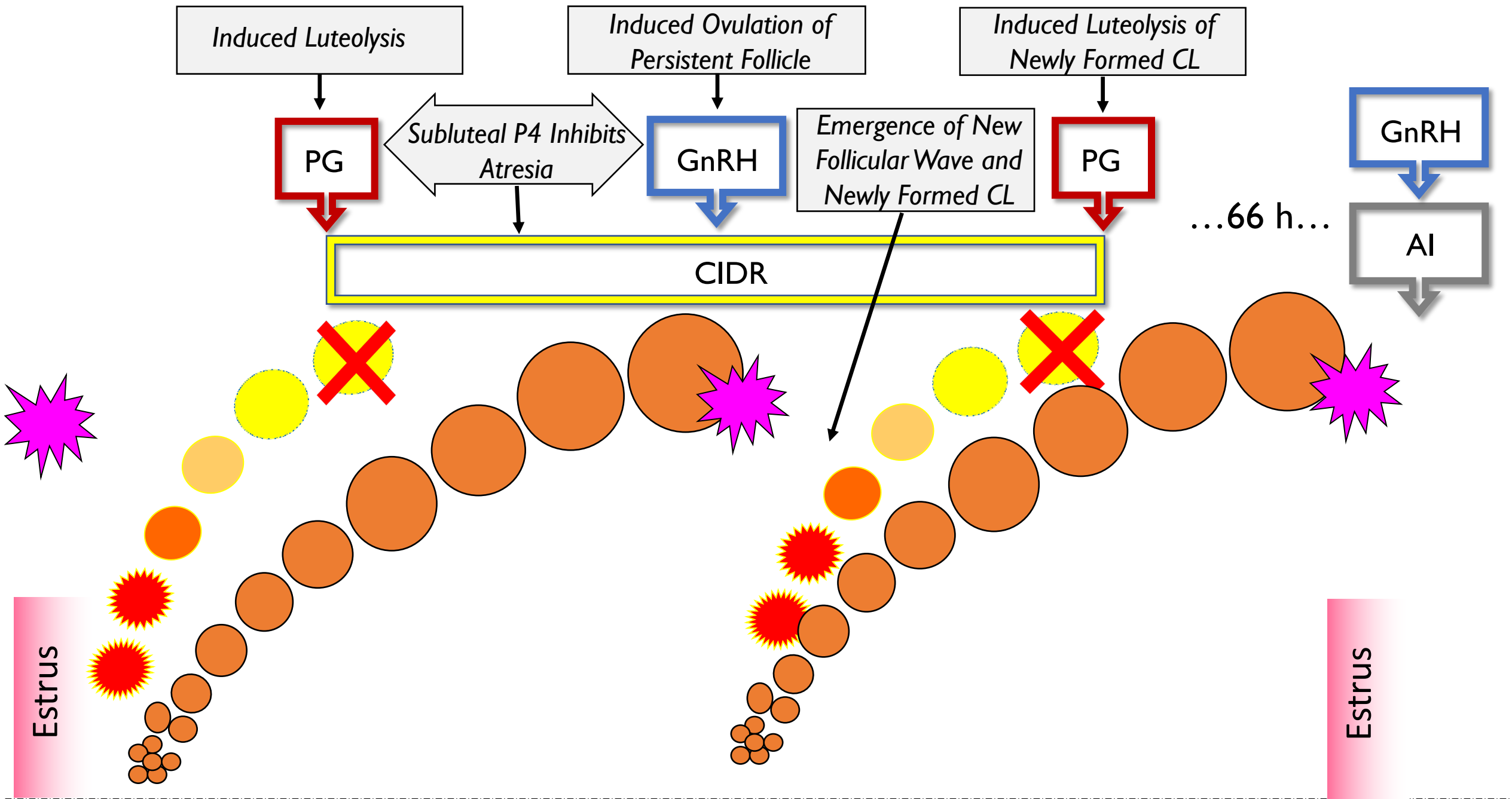


7 & 7 Synch

(Bonacker et al., 2020a and 2020b; Andersen et al., 2020)

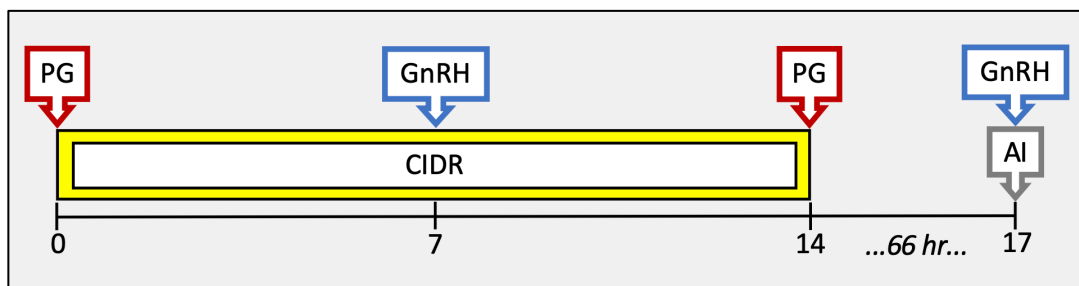
- Research trials with > 3,000 beef cows on >20 producer locations across Missouri, Kansas, and South Dakota
 - Full range of cow age, parity, condition, and postpartum intervals
- University of Missouri Agricultural Experiment Station beef herds
 - Southwest Research Center (Mount Vernon)
 - South Farm Beef Research and Teaching Farm (Columbia)
- Cross Country Genetics, Westmoreland, Kansas
 - Kirk Gray, DVM, MS; Clay Breiner, DVM; Joel Anderson, DVM

<https://extension2.missouri.edu/g2023>



7 & 7 Synch

(Bonacker et al., 2020a and 2020b; Andersen et al., 2020)



	Estrus Expression Before Fixed-Time AI
7 & 7 Synch	82% ^a (631/773)
7 Day CO-Synch + CIDR	64% ^b (495/776)

<https://extension2.missouri.edu/g2023>

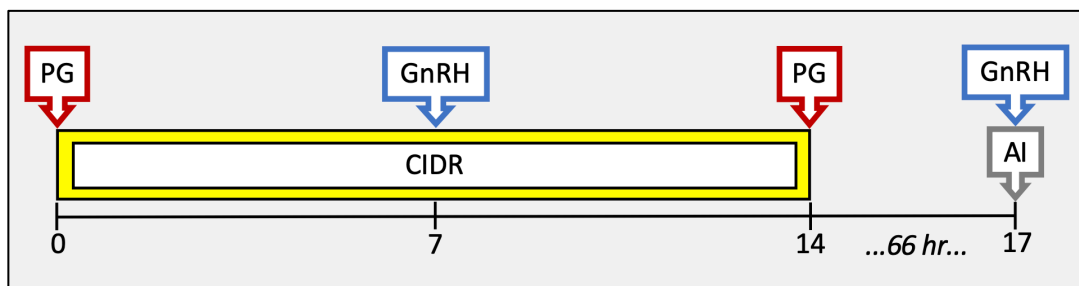






7 & 7 Synch

(Bonacker et al., 2020a and 2020b; Andersen et al., 2020)



	Estrus Expression Before Fixed-Time AI
7 & 7 Synch	82% ^a (631/773)
7 Day CO-Synch + CIDR	64% ^b (495/776)

	Pregnancy Rates to Fixed-Time AI	
	Conventional	Sexed Semen
7 & 7 Synch	72% ^a (280/389)	52% ^c (199/380)
7 Day CO-Synch + CIDR	61% ^b (233/383)	44% ^d (171/386)

<https://extension2.missouri.edu/g2023>

Tools vs Context

- Estrus synchronization has no value in and of itself
 - Tool to achieve earlier conception within breeding period
- Artificial insemination has no value in and of itself
 - Tool to generate more calves sired by specific sire(s)
- Value comes from the reproductive management context in which the right tools are used appropriately together
 - Increase total value of calves weaned across the ranch
 - Decrease costs associated with cow depreciation
 - Decrease costs associated with inefficient use of labor, facilities, feed, or other resources





Extension
University of Missouri

Jordan Thomas, Ph.D.
ThomasJor@Missouri.edu
Office: (573) 882-1804
@MizzouRepro
mizzourepro.com

