Virginia Cooperative Extension

PUBLICATION 400-013

GnRH Based Estrus Synchronization Systems for Beef Cows

John B. Hall, Extension Animal Scientist, Beef, Virginia Tech
W. Dee Whittier, Extension Specialist and Professor, Virginia-Maryland Regional College of Veterinary Medicine, Virginia Tech
Jim Myers, Extension Veterinarian; Senior Extension Agent, ANR, Virginia Tech
Mark Cline, Graduate Student, Virginia Tech
David Cuddy, Graduate Student, Virginia Tech

New systems of synchronizing estrus (heat) in cows for artificial insemination (AI) have been developed using commercially available Gonadotropin Releasing Hormone (GnRH). These systems allow producers to artificially inseminate cows with little or no heat detection. For the first time, producers have a reliable system that results in acceptable pregnancy rates to timed AI.

Adoption of AI in the U.S. beef industry remains relatively low at 3 to 5% of the cows in the US bred AI annually. Until recently, the rewards of engaging in an estrus synchronization and AI program, for most commercial producers, were not sufficient to offset the time and labor involved. Purebred breeders, producers of commercial replacement heifers, or producers that retained ownership through the feedlot obtained the benefits of an AI program with significantly higher prices for their products. However, for the average beef producer, the rewards of AI from better genetics in the cowherd or higher weaning weights were not easily recognized and AI pregnancy rates with existing synchronization systems were sometimes disappointing.

Changes in the beef industry demand reevaluation of AI in commercial herds. Feeders and packers want large groups of uniform calves and are willing to pay a premium for superior performance and carcass characteristics. Herd bulls possessing superior EPD's with high accuracy in several traits are often difficult for commercial producers to locate or afford. However, estrus synchronization and AI allows commercial producers affordable access to these bulls.

In Virginia, programs like those of the Buckingham Cattlemen's Association or Central Virginia Cattlemen's Association, where large numbers of cows are synchronized and artificially inseminated by a technician, are examples of effective use of AI in commercial cows. The resulting calf crops are grouped and sold in truckload lots at a considerable price advantage. A portion of this advantage is due to AI with the remainder from sorting, health programs, and numbers of calves. In addition, these groups are building a favorable reputation for uniform high-quality calves. Recent advances in estrous synchronization using GnRH are allowing these groups to take advantage of AI.

What does GnRH do?

GnRH is a hormone naturally produced in cows that causes the cow to release another hormone – luteinizing hormone (LH). Luteinizing hormone, in conjunction with follicle stimulating hormone (FSH), enhances the growth of ovarian follicles that contain the developing egg. Large amounts of LH also cause ovulation (egg release). After ovulation, a corpus luteum (CL) forms on the ovary and produces progesterone which prepares the uterus for pregnancy and prevents return to heat.

During a natural estrous cycle, GnRH through FSH and LH causes follicles to form and grow in small groups or waves on the ovary (Figure 1). The largest (dominant) follicle (A) of the wave keeps new follicles (B) from growing. However, the dominant follicle must ovulate (C) in a few days or it will regress (D) and a new wave of follicles will start to grow. As long as the CL produces progesterone, the cow will not release enough GnRH and LH to cause ovulation. The CL will regress and stop producing progesterone if the cow does not become pregnant. Once the CL regresses, GnRH and LH release increase and the dominant follicle grows large and produces estrogen that causes the signs of heat. A surge of LH is then released and the cow ovulates.

www.ext.vt.edu

Produced by Communications and Marketing, College of Agriculture and Life Sciences, Virginia Polytechnic Institute and State University, 2009

VirginiaTech 1872 Invent the Future

VIRGINIA STATE UNIVERSITY

How are GnRH systems different from other estrus synchronization systems?

Traditional estrus synchronization systems only synchronized heat, not ovulation. For example, the two shot Lutalyse® system results in cows ovulating at various times over 5 to 7 days. In order to achieve acceptable pregnancy rates, producers had to check heat for 5 to 7 days and breed cows 12 hours after heat. That meant gathering cows 2 to 3 times to synchronize heats and then pulling groups of cows in heat out of the herd to be bred. Since cows didn't all come in heat on one day, groups of cows had to be pulled and bred over a 5 day period. This equals 10 round-ups, which involves considerable effort for a smaller operation (< 75 cows) with limited labor and facilities. In addition, the AI technician's availability and expense becomes a factor with only a few cows to breed each trip.

The new GnRH systems synchronize follicular growth and ovulation so all cows ovulate within a few hours of one another. Another advantage of the GnRH systems is that they induce ovulation and estrous cycles in non-cycling cows. If cows are given an injection of GnRH (See insert for a list of commercial products), then enough LH is released to cause the largest follicle on the ovary to ovulate and form a CL. A new wave of follicles will start to grow since GnRH "removed" the dominant follicle (Figure 2). Now, the follicular growth of the cows is synchronized.

Seven days later an injection of an analog of prostaglandin PGF2a is given which regresses the CL to synchronize final follicular growth and heat. Two days after PGF2a injection, a second injection of GnRH is given to cause all cows to ovulate at approximately the same time. Since ovulation is now synchronized, all the cows in the herd can be bred by timed-AI in one or two groups.

GnRH Products Available

- Cystorelin® – Merial
- Factrel® – Fort Dodge
- Fertygyl® – Intervet

Remember these are prescription products and must be purchased through a licensed veterinarian with whom you have a veterinary/client relationship.

How the GnRH systems work

The GnRH based synchronization systems are illustrated in Figure 3. Ovsynch and CO-Synch® are timed AI systems whereas Select-Synch® requires heat checking. All systems start with an injection of GnRH (100μg) to synchronize follicular growth, followed 7 days later by an injection of a prostaglandin product (PGF) (i.e. Lutalyse®, Estrumate®, In-Synch®, or Prostamate®) to bring the cows into heat. The dosage of PGF varies with the product, so read and follow label directions carefully. With Ovsynch and CO-Synch , a second shot of GnRH causes ovulation. Many cows in these programs will never show heat. With Select-Synch®, cows will show heat and ovulate naturally, but over 2 or 3 days.

Pregnancy rates with the GnRH synchronization systems can be maximized by incorporating additional strategies. First, cows on the Ovsynch program should be insemi-

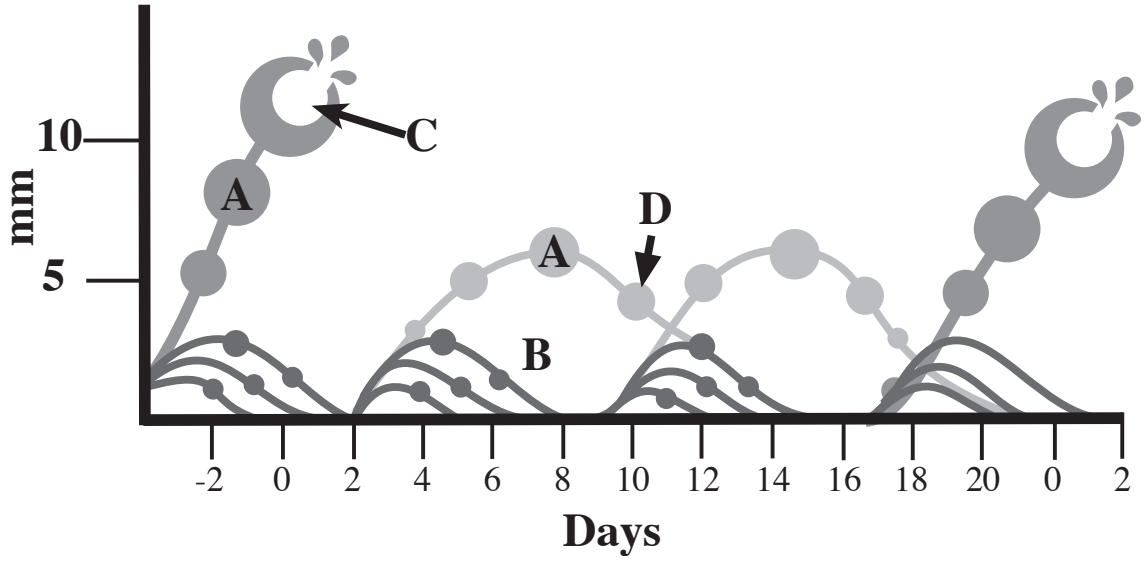


Figure 1. Follicular waves and follicular structures during the estrous cycle of the cow. Day 0 = day of heat. Dominate follicles A; Subordinate follicles, B; Ovulating follicle, C; and regressing follicle D.

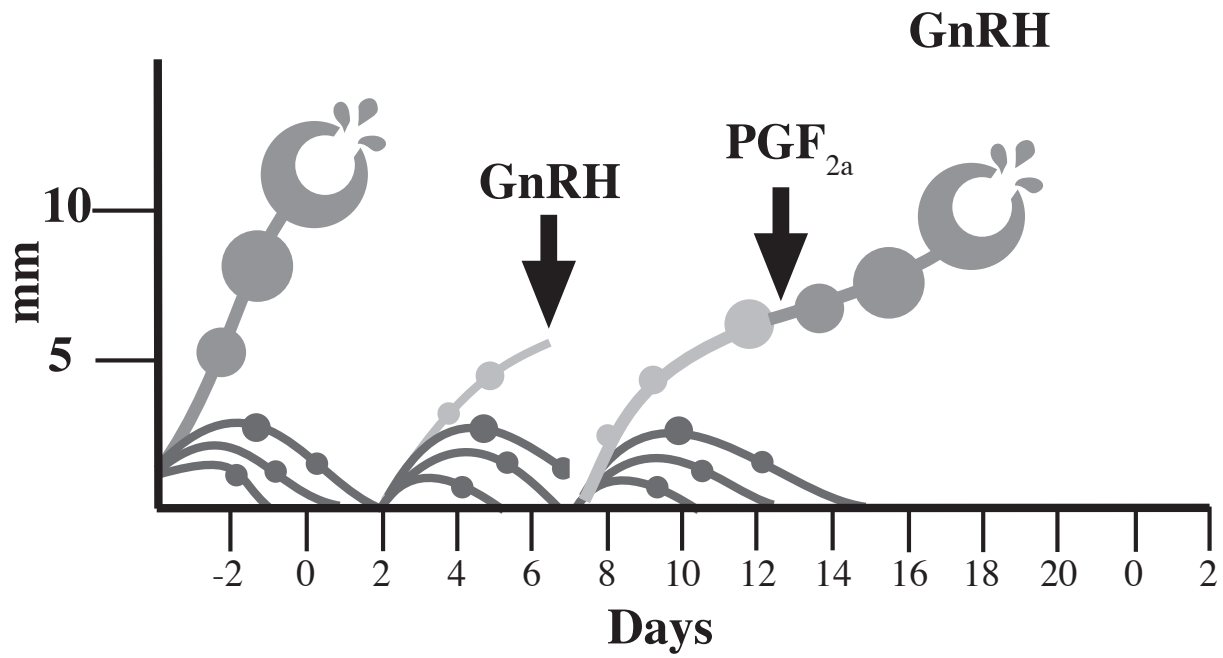


Figure 2. Synchronization of follicular growth and ovulation by GnRH and PGF2a. GnRH eliminates the dominate follicle resulting in a new wave of follicles approximately 2 days later. Prostaglandin (PGF2a) lyses (kills) the corpus luteum which allows the new follicle to ovulate.

nated 16 to 18 hours after the second GnRH. This means the second GnRH injection should be given in the late afternoon with breeding occurring the next morning. Also, 80 to 90% of the cows on Ovsynch or CO-Synch will not be observed in heat. The GnRH will actually cause ovulation before the cow begins to show heat.

With all these systems, about 8 to 15% of the cows are in heat between the PGF injection and the second GnRH injection (or 48 hours). These cows should be inseminated 12 hours after the beginning of standing heat. Therefore, some heat detection is necessary to insure maximum pregnancy rates.

CO-Synch works best when the second GnRH injection and breeding are delayed until 64 hours after prostaglandin injection. Once again, any cows that come into heat early need to be bred in response to that heat. Often many of these "early" cows will be inseminated at the same time as the cows that are timed bred. Proper pre-breeding nutrition is essential to success of the systems. Cows must be in body condition score 5 or better to achieve maximum pregnancy rates. Separation of calves from cows for 48 hours after PGF injection may improve reproductive response in cows of body condition score 3 or 4.

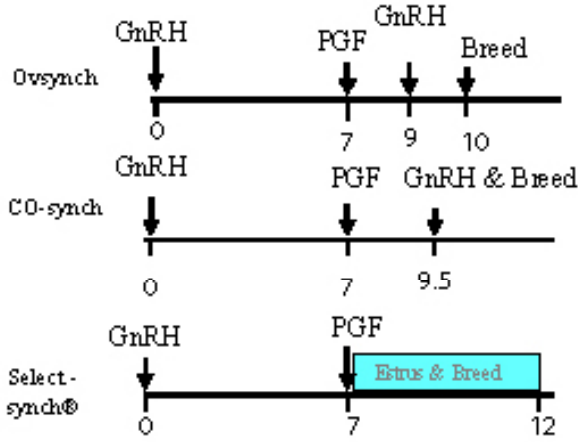


Figure 3. Timelines for GnRH based synchronization systems

Example of Schedule for Ovsynch

May 5 – Inject GnRH

May 12 – Inject PGF

May 14 (pm) – Inject GnRH

May 15(am) – Breed cows

Finally, these systems do not work well in virgin heifers. The GnRH systems should only be used on mature cows. It appears that heifers have a different pattern of follicular waves which lowers the effectiveness of GnRH in young females.

Example of Schedule for CO-Synch

May 5 – Inject GnRH

May 12 (pm) – Inject PGF

May 15(am) – Breed cows and inject GnRH

Cost of GnRH Systems

The pharmaceutical cost of these systems has moderated in the past few years due to several companies producing these products and the willingness of veterinarians to promote these systems as a reproductive management tool. A 100μg dose of GnRH will cost from $3.50 to $6.00 and a single dose of prostaglandin F2? is $2.00 to $3.50. Within this range of prices, pharmaceuticals for OvSynch or CO-Synch will cost $9.00 to $15.50 (average $10 to $12/cow) and Select-Synch will cost $5.50 to $9.50 (average $6 to $7) per cow. Remember, cost of the pharmaceuticals will vary with the number of cows synchronized as larger herds or groups of producers may be able to get a volume discount.

Other costs for the AI program include semen, AI supplies, inseminator fees, and labor. These costs will vary considerably from farm to farm depending on facilities, number of cows, location, and bulls selected.

Results with GnRH Systems in VA

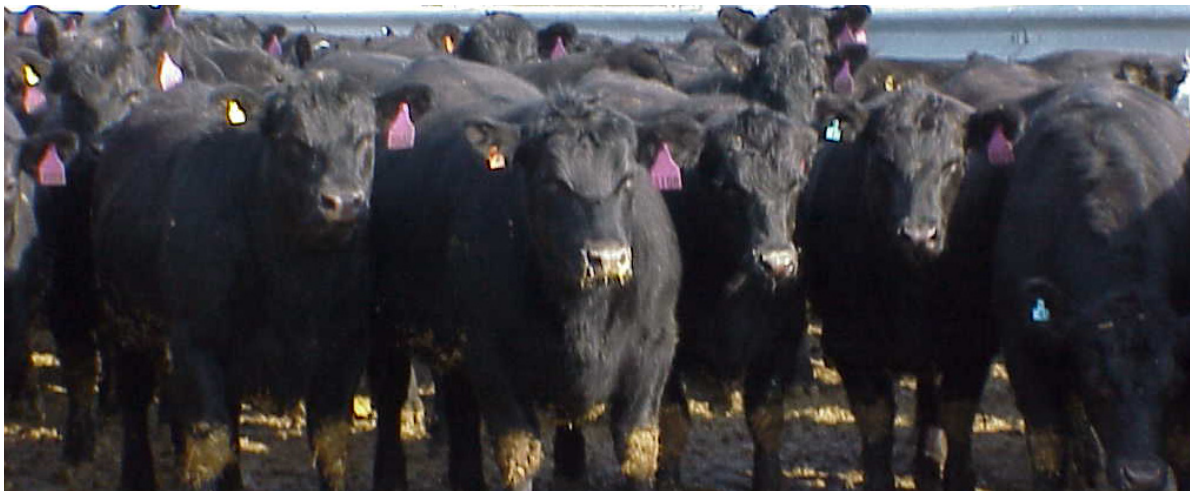
From 1999 to 2001, Extension specialists, agents, and veterinarians conducted trials with the GnRH synchronization systems in over 1000 cows in Virginia (Table 1). Some of these cows were given older synchronization systems like Syncro-Mate-B® or two shots of Lutalyse®. A few of the non-GnRH systems are not shown because there were too few cows in the system or only one farm used the system, so the results were not meaningful. In all cases, the GnRH systems out performed the older systems in cows nursing calves by increasing AI pregnancy rates to a single insemination.

CO-Synch and Ovsynch were the most consistent systems. Herds with low pregnancy rates, in the CO-Synch and Ovsynch groups, resulted from problems with body condition of cows or semen handling. However, these low pregnancy rate herds were included in the average and presented as a reminder of other factors that affect AI pregnancy rates. In contrast, poor performance with Synchro-Mate-B is a result of its ineffectiveness in cows late in the estrous cycle.

Table 1. Results from On-Farm Synchronization Trials in Virginia 1999-2001*

System	Number of Cows Synchronized	Average % Pregnant to Single AI	Range in % Pregnant to Single AI
Syncro-Mate-B	78	48.7	37.5 – 56.5
CO-Synch 64	299	49.8	43.6 – 58.8
Ovsynch	291	55.3	40.0 – 65.1
Select-Synch	97	62.9	52.9 – 71.0

*Note Select-Synch and Syncro-Mate-B cows were bred 12 hours after heat.
Hall and Whittier, 2001



Estrus synchronization and AI can increase uniformity of calf colors.

Another advantage of the GnRH systems is a reduction in the length of the calving season. Producers with cows in good body condition report that 75% to 90% of the cows calve in the first 30 days of the calving season after GnRH synchronization. Many of the cows that did not conceive to AI became pregnant to their first service by the clean-up bull. Also, producers report overall pregnancy rates of 85% to 98% in a 60 day breeding season.

Recently, research at Virginia Tech and Colorado State University demonstrated that reducing the dose of GnRH to 50μg did not alter pregnancy rates (Table 2). However, producers must be careful to accurately and completely deliver this small dose into the cow. Smaller gauge needles and reduced syringe size are required to accurately administer the 50μg dose. Extreme care needs to be taken with the 50μg dose so producers don't reduce pharmaceutical cost only to compromise pregnancy rates. This research also indicates that using the 100μg dose may compensate for injection errors.

For more information about GnRH-based synchronization systems, talk to your AI breeding representative, veterinarian, or Extension animal science agent about these systems.

Summary

Gonadotropin Releasing Hormone (GnRH) based synchronization systems are effective in synchronizing ovulation in beef cows. Pregnancy rates to artificial insemination with these systems average 50 to 60%. Although these systems require cows to be handled 3 to 4 times, they minimize or eliminate heat detection. Artificial insemination of large numbers of cows can occur over a 1 to 3 day period. These GnRH-based synchronization systems make artificial insemination of beef cows more practical and economically feasible for commercial producers. In addition, use of the synchronization systems increases the number of cows calving in the first 30-40 days of the calving season.

References

Geary, T.W. and J.C. Whittier. 1998. Effects of a timed insemination following synchronization of ovulation using the Ovsynch or Co-Synch protocol in beef cows. The Professional Animal Scientist 14:217-220.

Foster, H., J.C. Whittier, P.D. Burns, J. Breummer, T. Field, and T.W. Geary. 2001. Half dose GnRH does not affect pregnancy rates with the Co-Synch synchronization protocol. J. Anim. Sci. 79(Suppl. 2):132.

Geary, T.W., J.C. Whittier, E.R. Downing, D.G. LeFever, R.W. Silcox, M.D. Holland, T.M. Nett, and G.D. Niswender. 1988. Pregnancy rates of postpartum beef cows that were synchronized using Syncro- Mate-B® or the Ovsynch protocol. J. Anim. Sci. 76:1523-1527.

Whittier, W.D., J. B. Hall, Amanda Britt, Mark Cline. 2002. Effect of dose GnRH used in the Ovsynch system on AI pregnancy rates in beef cows. Annual Meeting of the American Association of Bovine Practitioners, Madison, Wisconsin.

Disclaimer

Commercial products are named in this publication for informational purposes only. Virginia Cooperative Extension does not endorse these products and does not intend discrimination against other products which also may be suitable.

Table 2. Effect of reduced dosage of GnRH in the OV-Synch or CO-Synch system on pregnancy rates in postpartum cows

Dose of GnRH		**Percentage (proportion) of Cows Pregnant by Research Location**	
First injection	Second Injection	Virginia – OV-Synch (860 cows)	Colorado – CO-Synch (404 cows)
50 μg	50 μg	51.5 % (119/231)	50.7 %
50 μg	100 μg	50.5 % (97/192)	49.3 %
100 μg	50 μg	51.0 % (98/192)	50.3 %
100μg	100μg	51.4% (126/245)	44.6%

Foster et al., 2001; Whittier et al., 2002