Systematic Breeding Programs for the Dairy Herd

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TAKE HOME MESSAGES

- Two programs for controlling the estrous cycles of dairy cows are described and compared.
- These methods reduce the time required for estrus detection and allow timed AI.
- Although the average costs of the hormones to control the estrous cycles range from $30-46 per pregnancy, when compared to breeding with a "jumper" bull, the added benefits of AI outweigh the costs.

INTRODUCTION

As dairy herds expand, having adequate labor to pay attention to the important details of heat detection and artificial insemination (AI) becomes a larger problem. The time available to observe the cows in estrus often becomes inadequate to detect cows in estrus accurately. Furthermore, it is often more difficult to detect cows in estrus when they are constantly on slippery concrete surfaces often found in large herds. Consequently, some large dairy herds have turned away from AI and are letting genetically unproven "jumper" bulls run with the dairy herd. Although at first this may seem like an easy solution, this approach has many disadvantages.

One important disadvantage is the loss in genetic value in the offspring. The bulls that are used for AI have been heavily selected for milk production and type characteristics. The daughters of the average "jumper" bull will, on average produce much less milk and have poorer type traits. Even if one uses an exceptional "jumper" bull, one that has a pedigree similar to those bulls that will be progeny tested through AI, the average daughter will produce 2,000 lbs. less milk and will classify 1-2 points less. This is because only the top 10-15 percent of the bulls that are progeny-tested are good enough to be used in AI routinely. The loss of intense selection that AI offers jeopardizes the tremendous progress that has been made in dairy cattle productivity. One must also calculate the feed cost for the "jumper" bull, often in excess of $1,000 per year. One should also include the losses due not knowing when to dry cows up to give them a 60 day dry period before they calve. These bulls will also spread sexually transmitted diseases from one cow to the entire herd and could thereby cause many reproductive problems. The last important consideration that cannot be calculated is the possibility for injury with the "jumper" bull. The behavior of bulls is unpredictable and the cost of injury or even worse, the loss of a human life should be a major deterrent. The barns used for dairy herds are built to handle cows and not large aggressive bulls.

If labor is inadequate for accurate heat detection, there are several good methods available to control the estrous cycle and allow dairy farmers to minimize time spent on estrus detection and to schedule AI at convenient times. For dairy cows, two effective protocols are becoming more common (Figure 1). The first is a sequential combination of gonadotropin releasing hormone (GnRH), prostaglandin F_{2a} (PGF_{2a}) and GnRH injections referred to as Ovsynch. The second is a series of PGF_{2a} injections followed by timed AI that is referred to as Targeted Breeding™.

TARGETED BREEDINGÔ

Until recently, most estrous synchronization of dairy cows was performed using PGF_{2a} or analogues (Lutalyse or Estrumate). These compounds cause the regression of the corpus luteum (CL), the expression of estrous behavior and ovulation of a follicle 2-5 days after administration. In order for PGF_{2a} to act on a cow, she must have a functional CL on an ovary. The exact time from PGF_{2a} administration until estrus depends on the population of follicles on the ovary. If there are no large follicles on the ovary, it will take more time for them to develop. Since all cows will not be in the same stage of the estrous cycle when injected with PGF_{2a}, they will show estrus at different times after injection of PGF_{2a}. The Targeted Breeding™ (Pharmacia-Upjohn, Kalamazoo, MI) scheme uses additional synchronization doses of PGF_{2a} to produce cows that are in the middle of the estrous cycles that all have dominant CLs (2 weeks after estrus). Cows at this stage give the most consistent response to a subsequent injection of PGF_{2a}.

The exact procedure is to administer the first injection (the set-up) of PGF_{2a} after a certain voluntary waiting period (see figure). A suggested time is about 2 weeks before one would breed the cow for the first time. For convenience, the first injection can be given to all cows that will be synchronized on one day of the week. Two weeks later, these cows are given the first breeding administration of PGF_{2a}. Cows are watched for estrus for the next 2-5 days and those in estrus are bred. Those not observed in estrus are given an additional injection of PGF_{2a} two weeks later. These cows are observed 2-5 days after the injection and those in estrus are bred. Those not detected in estrus can be given a fourth PGF_{2a} injection and the cycle can be carried on. Rather than continue to give PGF_{2a} shots, the Targeted Breeding™ protocol includes timed AI 80 hours after the third injection of PGF_{2a}. Pregnancy rates by timed AI following the third injection of PGF_{2a} are usually about 20 percent. Therefore, estrous detection after each injection of PGF_{2a} will yield the highest pregnancy rates with this scheme.

One recent study tested the effect of reducing the 14-day intervals between injections to 11 days to reduce the time required for this procedure. However, with first calf heifers, the shorter interval was not as effective (20 percent lower conception rate). Apparently the longer internal is necessary, perhaps so that the developing follicles are at the proper stage. In addition, administering a "setup" injection of PGF_{2a} is more effective than detecting a CL by rectal palpation before giving the PGF_{2a} dose for AI. It synchronizes the cows so they are more consistently responsive to the second PGF_{2a} injection.

OVSYNCH PROTOCOL

This protocol uses sequential injections of GnRH, PGF_{2a}, and GnRH prior to timed AI. GnRH causes the pituitary to release luteinizing hormone (LH) that acts to transform a large follicle containing an unfertilized egg into a CL. In the past, GnRH was used to treat ovarian follicular cysts. Recently, GnRH was incorporated into synchronization programs. GnRH was used 6-7 days prior to PGF_{2a} because it increased the percentage of cows that were synchronized in response to PGF_{2a}. Usually the GnRH analogues Cystorelin, Factrel, or Fertagyl are used. The most frequently used combination of GnRH and PGF_{2a} is referred to as the Ovsynch procedure. It is called Ovsynch because it controls ovulation and so timed AI without estrus detection can be performed successfully.

To synchronize cows using the Ovsynch procedure, after the voluntary waiting period, the first injection of GnRH is given to all cows without any knowledge of the stage of the estrous cycle. Depending on the stage, GnRH will either luteinize or ovulate the largest follicle in about 85 percent of all cows, forming a CL. After a 7 day waiting period, PGF_{2a} is given. Administration of PGF_{2a} will regress the CL induced by GnRH. A new dominant follicle grows and is available for ovulation by the second GnRH injection. This injection is given 36-48 hours after the PGF_{2a} injection. The cows are inseminated 16-20 hours after this GnRH injection, without watching for estrus. Rather than give the last injection of GnRH, some have simply watched cows for estrus 2-5 days after the PGF_{2a} injection. Although it is less convenient, it saves the cost of the last GnRH injection.

If cows do not conceive with the Ovsynch program after the initial timed insemination, they should be in estrus in 21 days. One can watch carefully to detect estrus during this time. If the cows do not conceive and do not show estrus 21 days after insemination, the cows can be given an injection of PGF_{2a} 35 days after the initial insemination to shorten the time to the next insemination and to time AI.

COMPARISONS OF THE TWO PROGRAMS

The Targeted Breeding™ program and the Ovsynch program result in similar pregnancy rates in cows. Research at the University of Wisconsin showed that pregnancy rates were about 38 percent. However, pregnancy rates of heifers on the Targeted Breeding™ program were much higher (74 percent) than pregnancy rates of heifers on the Ovsynch program (35 percent). Heifers do not respond to first GnRH injection to synchronize luteal function as well as cows. Cows bred with the Ovsynch program more than 76 days after calving had 17 percent higher pregnancy rates than cows bred between 60 and 75 days after calving. This suggests that the voluntary waiting period for the Ovsynch program should be at least 70 days.

COSTS OF EACH PROCEDURE

A survey of Virginia dairy veterinarians showed that the average drug and labor cost of a pregnancy with the Targeted Breeding™ program, assuming a 40 percent estrus detection rate and 40 percent pregnancy rate, was about \$30. If estrus detection rate improved to 70 percent, the average cost was reduced to \$21. Using the Ovsynch program and assuming a 40 percent pregnancy rate, the mean drug and labor cost was \$46 per pregnancy.

As the size of dairy herds increase and labor becomes more expensive, one can use systematic breeding programs to reduce the amount of time required for estrus detection and one can schedule AI. Systematic breeding makes insemination easier and more feasible in large herds. Of course, with these advantages come the cost of the hormones used to synchronize the estrus cycles. The extra value of the offspring, the reduction in reproductive disease transmission, and the increased safety make systematic insemination a better option than using a “jumper” bull.

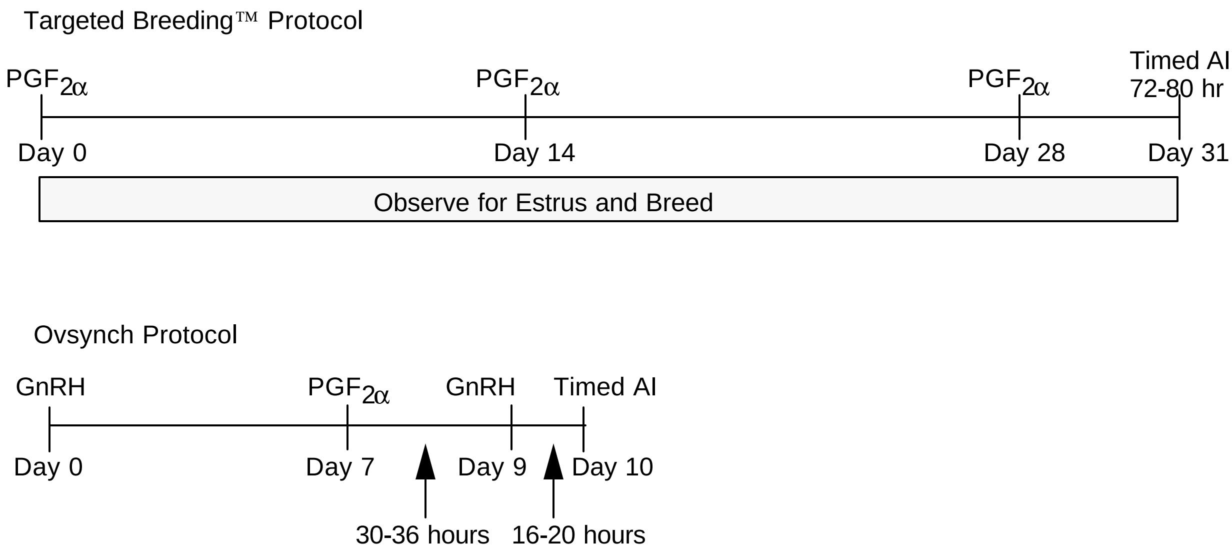

Figure 1. Two protocols used to control estrus in dairy cattle.