Strategies to Increase Pregnancy Rates

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As herds have become larger and milk production has increased, reproductive management has become a greater challenge. Several strategies have been developed based on our current comprehension of development and regression of the corpus luteum, follicular dynamics through the use of ultrasonography, and intensity of estrous behavior with systems of electronic estrus detection such as HeatWatch and pedometers.

We also are having to re-evaluate traditional goals and parameters of reproductive performance. No longer is a calving interval of < 380 days[2] necessarily ideal. Cows with different production levels and calving at different times of the year have different optimal calving intervals. Use of bovine somatotropin can sustain a prolonged profitable lactation with the added benefit that these cows in their lifetime have fewer nonproductive dry periods and risky early postpartum periods. Days open, once recommended to be < 100 days,[2] is a less critical parameter, as is days to first service. Conception rates are higher after 60 days postpartum. This is undoubtedly associated with improved uterine health and body condition, and increased energy balance. If heat detection rate is only 50% and the voluntary waiting period is 65 days, a producer would need to begin heat detection and inseminations at approximately 45 days postpartum to have mean of 65 days to first service.

To achieve a timely first-service conception rate, dairymen must have an efficient method of heat detection. It is difficult to precisely control time to first service based on spontaneous expression and detection of estrous behavior on a herd basis. The most efficient way to reduce days open would be to reduce the number of missed heats and increase the rate of submission of animals for insemination. Effective estrus synchronization is one approach of scheduling animals for insemination and to reduce days open.

Management Factors

Several management factors impinge on the success of all reproductive strategies. Inadequate nutrition, reflected by low body condition scores (< 2.5), leads to postpartum anestrus. Such cows are known to eat less feed, produce less milk, and lose more body weight, resulting in a more negative energy status than cycling cows.[25]

There are several reproductive diseases, including infectious bovine rhinotracheitis (IBR), bovine virus diarrhea (BVD) and leptospirosis that can lead to early embryonic losses and abortions. However, cows can be protected against such losses by regular immunization. Furthermore, basic errors in semen handling and insemination procedures are frequently overlooked. Finally, pregnancy rate, which is a product of estrus detection and conception rate, is reduced during seasonal periods of heat stress. Heat stress reduces plasma estrogen concentrations during proestrus, and with it the intensity of estrous behavior.[8] Conception rates also are reduced during periods of heat stress due to elevations in body temperature that lead to early embryonic death.[17] The effects of heat stress can be ameliorated by the use of fans and sprinklers or misters.

Prostaglandins

The most direct way to reduce days open is to reduce the number of missed heats and to increase the number of animals submitted for insemination. This can be done by short-cycling cows and estrus synchronization. Groups of animals that are in heat facilitate accurate estrus detection because of more active animal-to-animal interaction (sexually active groups). The use of estrus detection aids (chalk, heat mount detectors, teaser animals) further increases the efficiency of detection. Prostaglandin F 2 alpha (PGF) is the natural substance produced by the endometrium of the cow that causes normal regression of the corpus luteum. Injection of PGF mimics the normal process. However, the corpus luteum has to be mature (days 6 to 18) to be able to respond. Heats of animals injected on days 7, 15 and 16 are more precisely synchronized on day 3 after injection of PGF. Most cows injected on days 8 to 14 show heat on days 4 to 7 after injection of PGF.[12] This differential pattern is related to the occurrence of follicular waves during the estrous cycle.[11,23]

When first approved, the recommendation was to inject PGF twice, 11 days apart. This protocol increases

the number of animals with a mature corpus luteum at the time of the second injection. With heifers, injecting PGF twice, 11 days apart, results in an estrous response of 85% under field conditions.[27]

In lactating dairy cows, metabolic and hormonal changes associated with milk production alter follicular development. This is evidenced by a reduction in plasma estradiol and altered patterns of follicular development in lactating cows, compared with non-lactating cows.[4] After the injection of PGF, lactating cows come into heat later than heifers and nonlactating cows. This means that with an 11-day interval between injections, a higher percentage of lactating cows will be at an earlier stage of the estrous cycle—days 1 to 5—a time during which the corpus hemorrhagicum or early corpus luteum is non-responsive to the luteolytic action of PGF. Based on these observations, a 14-day interval is recommended for dairy cows.[5] This complies nicely with weekly herd reproductive health visits.

The targeted breeding program (Figure 1) is based on PGF injections given at 14-day intervals on a specifically scheduled day of the week. Seventeen days prior to the end of their voluntary waiting period, cows are injected with PGF. The purpose of this "set-up" injection is to ensure that cows will respond uniformly to the "breeding" injection 14 days later. No cows are inseminated upon detected heats from the set-up injection. After the second (breeding) injection, cows detected in heat will be inseminated. All cows not detected in heat are again injected with PGF 14 days later. With this system, over 90% of the cows should be inseminated following 2 injections 14 days apart.

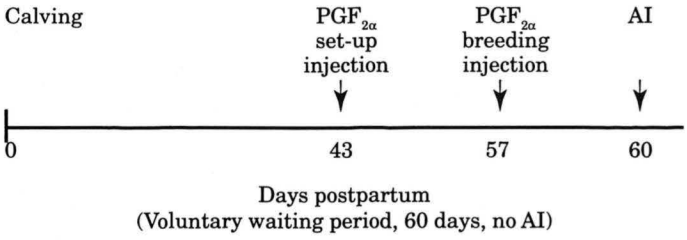

Figure 1. Targeted breeding program.

If heat detection rates fall below 50%, method of heat detection and the anestrous state of the cows should be evaluated. New cows approaching the end of their voluntary waiting period (VWP) receive their first PGF injection on the same schedule and the same day of the week. Cows are re-inseminated if seen in heat 21 days later. Cows are examined for pregnancy 6 weeks after insemination. If diagnosed open, they re-enter the pool of cows to be treated with PGF. For the system to work, employees must pay attention to details of heat detection and insemination. Problems are likely to arise if the groups are too large for the abilities of the people, or capacity of the facilities, for injection, observations, and inseminations.

Syncro-Mate-B

The Syncro-Mate-B system (Figure 2) is approved for use in beef cattle and dairy heifers, but not for lactating dairy cows. Syncro-Mate-B allows producers to avoid heat detection and use timed insemination with acceptable results.[13] Cows with high progesterone concentrations before injection of PGF to synchronize estrus have a higher estrus detection rate.[19] and conception rate.[6] However, treatment with a progestagen during the nonluteal phase of the estrous cycle causes a lower pregnancy rate due to the development of persistent follicles with poorer oocyte quality.[20,33] In contrast, treatment during the luteal phase leads to greater turnover of follicles and a higher subsequent pregnancy rate. Estrus can be re-synchronized with progesterone treatment in the late luteal phase of animals that did not conceive after an initial insemination, without jeopardizing an ongoing pregnancy in those that did conceive.[27]

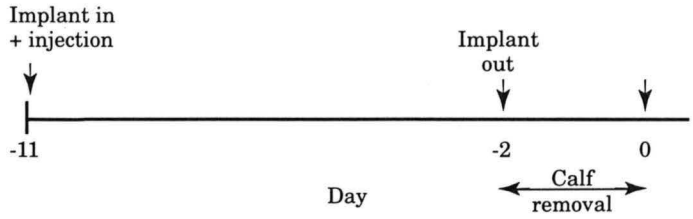

Figure 2. Syncro-Mate B protocol
Ear implant: 6 mg Norgestomet
Injection: 3 mg Norgestomet +
5 mg Estradiol valerate

Synchronization of Ovulation

While estrus is a variable period of time during which a cow will stand for mounting by a bull or by another cow, ovulation is a specific event in response to a pre-ovulatory surge of luteinizing hormone (LH) ~30 hours earlier. The reason for estrus detection is simply to determine the time for insemination. The most common denominator of poor reproductive performance is a low estrus detection rate. Pregnancy rate is the product of estrus detection rate and conception rate (PR = EDR x CR). Pregnancy rate is defined as the number of pregnant cows divided by the number of cows in the breeding herd. Conception rate is defined as the number of pregnant cows divided by the number of cows inseminated.

Estrous behavior is not detected with sufficient accuracy, nor is estrus synchronization precise enough to achieve an acceptable conception rate, based on timed insemination when using PGF alone. Treatment with PGF

only regulates the life span of the corpus luteum and requires estrus detection over a period of 5 days.[10] There is a lack of precision between the time of the PGF injection and the time of ovulation, relative to insemination.

Research at the University of Wisconsin and the University of Florida has led to the development of a timed artificial insemination (TAI) program without the need for detection of estrus in lactating dairy cows.[14,21] Injection of gonadotropin-releasing hormone (GnRH) can induce ovulation of a dominant follicle and, when used after synchronization of follicular growth and regression of the corpus luteum, should program ovulation to permit successful insemination at a predetermined time.[22] This program is called OvSynch and its protocol is shown in Figure 3.[35]

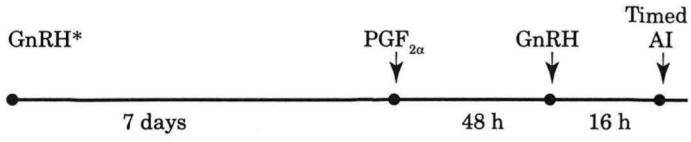

Figure 3. OvSynch / TAI protocol
GnRH (Cystorelin, Factrel) 100 μg IM
$PGF_{2\alpha}$ (Lutalyse) 25 mg IM
* Treatment may be started on any day of the cycle

The OvSynch protocol can be used successfully in beef cows.[7] The program is capable of inducing estrous cycles in a large percentage of anestrous cows and allows timed insemination. It yields a higher pregnancy rate than does Syncro-Mate-B treatment of late-calving cows and cows that have adequate body condition at the beginning of the breeding season.

The first injection of GnRH induces release of LH and follicle stimulating hormone (FSH) which will cause ovulation or luteinization of a dominant follicle and initiate a new follicular wave. When injection occurs during a period when a new follicular wave is just beginning, there is no dominant follicle and neither ovulation nor luteinization will take place. Seven days later, PGF injected intramuscularly causes regression of all corpora lutea. If a corpus luteum resulted in response to the initial injection of GnRH, the 7-day interval usually proved sufficient time for the corpus luteum to mature and be responsive to PGF. A second injection of GnRH 48 hours later should trigger LH release and ovulation of a dominant follicle. GnRH will induce ovulation in about 30 hours. Cows are inseminated approximately 16 hours before ovulation.

Heifers assigned to an OvSynch/TAI treatment had similar pregnancy rates but lower conception rates when compared with heifers inseminated at detectable estrus.[16,21] OvSynch is not recommended for use in heifers unless estrus detection is impossible.

Factors that Affect OvSynch/TAI

Cows at approximately day 14 to 15 of their estrous cycle (~10%) at the time of the first GnRH injection frequently fail to produce a new (accessory) corpus luteum in response to GnRH. As a result, at the time of the injection of PGF 7 days later, they are in heat and should be inseminated.

Cows not cycling due to inactive ovaries do not respond to GnRH treatment and should not be included in an OvSynch/TAI program.[2,8] By extending the voluntary waiting period, e.g. to 75 days, a greater percentage of the cows will be cycling and capable of response to the treatment.[14]

An extended reproductive management program for dairy cows, including synchronization of ovulation and timed insemination, is presented in Figure 4. During the first 10 days postpartum the cows are intensively monitored and treated when indicated.[26] Starting around 5 weeks postpartum cows receive, in essence, 2 set-up injections of PGF 14 days apart. This occurs before the beginning of the OvSynch/TAI program at the end of the voluntary waiting period (70 days).

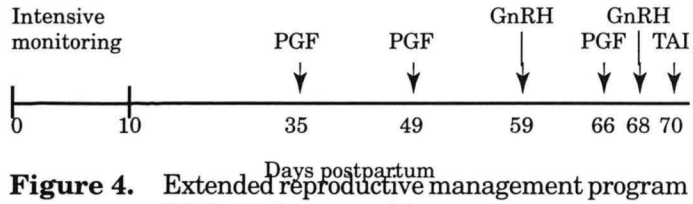

Figure 4. Extended reproductive management program
VWP 70 days; weekly groups
PGF (Lutalyse, 25 mg IM)
GnRH (Cystorelin, Factrel, 100 μg IM)

Cows are not palpated at the usual 3 to 4 weeks postpartum to assess uterine involution and resumption of cycling. The occasional pyometra is treated by the set-up injections of PGF. All cows are palpated at the time of the first GnRH injection. Cows with uterine, oviductal, and ovarian adhesions are identified at this time and generally eliminated from the breeding program. Cows with ovarian cysts are noted but are automatically treated with the GnRH and PGF as part of the OvSynch protocol. Non-pregnant cows are identified at 6 weeks and are re-assigned immediately to the timed AI program, unless previously undetected abnormalities of the reproductive tract are diagnosed.

Economic Comparison

Comparison of the Ovsynch/TAI program with a PGF program, in which only cows with a palpable corpus luteum were injected with PGF, revealed an eco-

nomic advantage of $24.19 per pregnancy for the Ovsynch/TAI program.[1]

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