THIS ARTICLE IS SPONSORED BY THE
MINNESOTA DAIRY HEALTH CONFERENCE.

UNIVERSITY OF MINNESOTA

College of Veterinary Medicine

VETERINARY CONTINUING EDUCATION

ST. PAUL, MINNESOTA
UNITED STATES OF MINNESOTA

Measuring, Monitoring, and Managing Reproductive Reproductive Performance of the Dairy Herd

Jerry D. Olson, D.V.M., MS
Diplomate, ACT
Clinical and Population Science
College of Veterinary Medicine
University of Minnesota
St. Paul, MN 55108

Costs of Poor Reproductive Performance in Dairy Herds.

Commonly cited costs for poor reproductive performance of dairy herds include reduced milk production resulting from cows spending greater proportion of time in late lactation at low levels of production, production of fewer calves, increased costs for semen, drugs, and veterinary services, and an increased number of cows culled for either failing to become pregnant or becoming too late in lactation to justify retention in the herd. Most of these costs are insidious and difficult to calculate. Reproductive culling is the most easily identified cost associated with poor reproductive performance of the herd and the easiest to calculate a cost. A 1996 NAHMS study found 26.7% of cows are culled from U.S. dairy herds for reproductive reasons. In addition, some cows which were identified as culls for low production were cows lower producing cows which did not get pregnant early enough in lactation to justify their retention in the herd. If they had conceived in early lactation, they would have remained in the herd for another lactation in spite of lower production. A recent study demonstrated that as days open increases, the risk that cows will be culled for reproductive increases. A benefit of reduced culling reproductive reasons would be that more low producing cows could be removed from the herd as elective culls.

Monitoring Reproductive Performance of the Dairy Herd.

There is an old adage that says, "If you can't measure it, you can't manage it." If key reproductive parameters aren't monitored, they can't be managed. There are five key factors which are essential to measuring and monitoring the reproductive performance of the dairy herd; they are 1) days in milk (DIM) at first service, 2) services per conception, 3) rate of heat detection, 4) rate of fetal attrition, and 5) reproductive culling rate. One of the primary goals of monitoring reproductive performance is to identify undesirable changes in reproductive parameters as early as possible and implement corrective measures as quickly as possible to minimize losses from poor reproductive performance.

Days Open.

Days open for cows on test in Minnesota has increased markedly in the past decade. Summaries of reproductive performance of Minnesota dairy herds enrolled in the DHI program show that days open has increased from 128 days in 1987 to 164 days in 1997, an increase of 38 days.

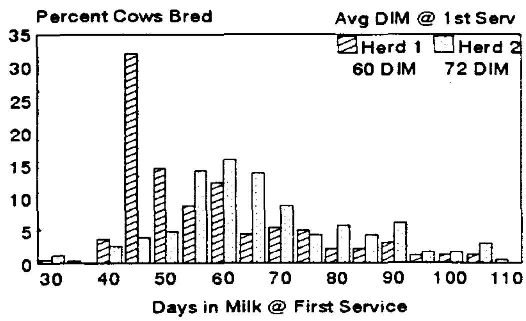
Thirty of the 38 day increase in days open can be accounted for by a change in DIM at first service from 85 to 115 days. During the interval from 1987 to 1997, milk production has increased by 8.6 pounds per cow per day. As days open has increased, the length of lactations has increased and the amount of time spent in later lactation also has also increased. The result is a reduction in the potential amount milk that could have been produced had the cows conceived in a more timely manner.

Days Open is controlled by three factors, DIM at first service, the fertility of cows and the efficiency of heat detection, and is frequently used to collectively monitor these control factors. When the days open for the herd meets goals, it is usually not necessary to evaluate the individual factors contributing to days open. When days open exceeds the herd goals, than the control factor causing the increase in days open should be identified and corrected if possible. When days open are used to measure reproductive performance of the herd, it is important to understand how it is calculated. It is the interval from calving to conception in pregnant cows. However, it can be the days in milk for cows that have not been bred and it can be either the interval from calving to insemination for cows that have been bred but the outcome of the breeding has not yet been determined or it can be the DIM milk for these cows. Minnesota DHI tends to be optimistic in calculating days open by assuming that cows which have been bred have conceived at the last service and uses the interval from calving to last service for determining days open. In contrast, the DairyComp program tends to be pessimistic by using current DIM for cows which have been bred but for the outcome of the last breeding has not been determined. Days open can be used to evaluate cows in various reproductive categories in the herd. Little can be done to change the days open for cows which are either pregnant and lactating or pregnant dry cows. However, the days open for cows that have not been bred and cows that have been bred but the outcome of the breeding has not been determined may change may change days open for this category of cows depending outcome of the breeding and efficiency of estrus detection, it is more important to monitor the days open of these cows. Days open can also be affected by the reproductive culling rate. If the cows that either fail to conceive or conceive too late in lactation to justify to their retention in the herd and are culled, the accumulated days open for these cows will be removed the from the calculation of days open and days open may not reflect the true reproductive performance of the herd. While averages are one type of measure of central tendency that can be used to describe days open, it is important to also have some measure of distribution about the mean. When the average days open for a herd has exceeded the goal for the herd, one commonly used means of reducing the average days open was to reduced the voluntary waiting period. The only parameter that may have been improved was average days open. If one looks at the distribution of days open, there may be cows that conceived both too early and too late in lactation. The ideal is to have a tighten distribution of days open around the average.

Days in Milk at First Service

Days in milk at first service is affected by three factors; the voluntary or elective waiting period, the rate of heat detection, and the proportion of cows cycling. Frequently the voluntary waiting period has been lowered to 45 or 50 DIM in an attempt to reduce the average days open for the herd. The problem with this strategy is that the calving interval will be less than 11 months for cows conceiving at less than 55 DIM. With a 60 day dry period, these cows will spend less 82% of the calving interval in lactation and average milk production per will be less than that for cows with a 12 month calving interval. A better strategy for breeding cows would be to raise the voluntary waiting period and reduce the spread in the distribution of the days in milk at first service. The two parameters necessary to monitor DIM at first service are the average and distribution of first services. Figure 1 demonstrates two herds with similar averages for DIM at first service but quite different distributions of first services. Herd 1 has a skewed distribution of days in milk at first service with a high proportion of the breedings occurring shortly after the voluntary breeding period. This is the result of a controlled breeding program with a voluntary waiting period of 45 days. If conception rate were reasonable in this herd at first service, a high proportion of this herd would have a calving interval of less than 11 months! This short a calving interval cows conceiving at first service may not be optimal for production. Herd 2 has a more normal distribution of first services. However, with a controlled breeding program the distribution of days in milk at first service could tightened-up closer to the mean.

Distribution of First Services

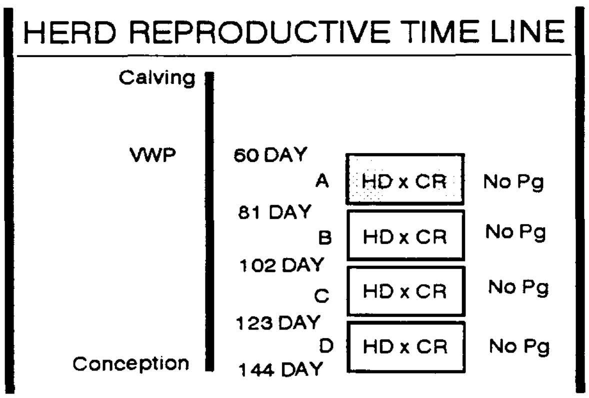


Fertility of the Herd

Fertility of the herd can be monitored by measuring by first service conception rate and services per conception. Conception rate is influenced by a number of factors and is one of the first reproductive parameters to change when fertility changes. Because conception rate is a critical control factor for days open and can change rapidly, it is important to have a system that is current for monitoring this parameter. Even with a system that is current, conception rate still lags 45 to 60 days from the time when the breedings occurred to when the outcome of the breedings are known. Either hand or computer generated Q-sum graphs are an excellent means of monitoring fertility. The graphic format provides an easily interpreted means of identifying changes in conception rate. Monthly tabulations of the total number of breedings and number of new pregnancies are also useful in monitoring fertility. In addition to determining the current status of fertility, it often valuable to have the capabilities of evaluating conception by month of the year, service number, technician, sire, lactation number, days in milk, and day of the week of the breeding.

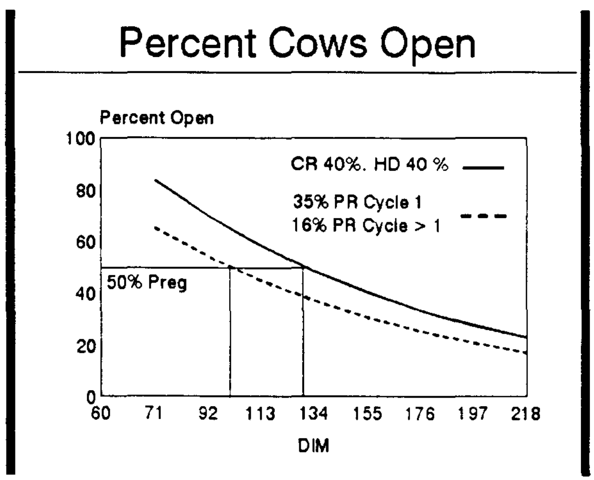
Heat Detection Rate

Heat detection rate is a calculated value based on the intervals between observed heats or breedings. The heat detection rate is based on the assumption that cows have heats every 21 days and that as the interval between observed heats or breedings increases, the efficiency heat detection decreases. The potential problem with calculating efficiency of heat detection on this basis is that the efficiency can be artificially inflated when accuracy of heat detection is poor and breedings occur when cows are not in heat. I have seen a herd with a heat detection rate based on this calculation that exceeded 100% when pedometers were used for heat detections! The proportion of cows that are open of the cows presented for pregnancy diagnosis is frequently assumed to be a measure of fertility. It is really an indication of the efficiency of heat detection. With a high level of heat detection efficiency, few open cows would be presented for pregnancy diagnosis.

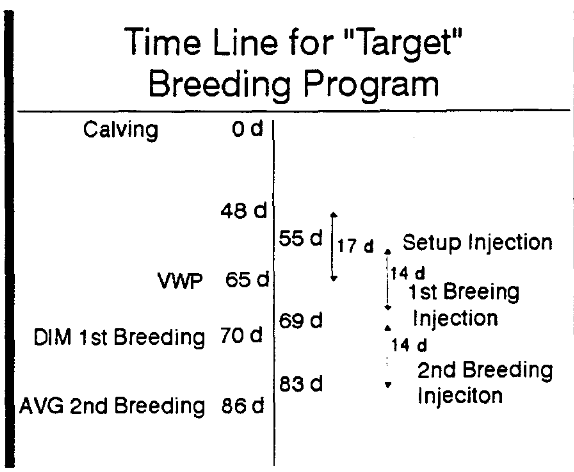


Reproduction Time Line

The reproductive time line begins at calving and ends with conception. The time line can be broken down into two basic components; the interval from calving to the end of the voluntary waiting period and the interval from the end of the voluntary waiting period to conception. This interval consists of a series of 21 day estrous cycles. Within each estrous cycle, the estrous detection rate determines the number of cows that will be bred and the conception rate determines the proportion of cows detected in heat and bred that will become pregnant. Pregnancy rate is the proportion of cows that become pregnant out of the eligible population of open cows within each 21 day window of time representing one estrous cycle. Pregnancy rate is determined by multiplying heat detection rate by conception rate for a 21 days window of time. For most herds in the Midwest, the rates of heat detection and conception are usually between 40% and 50%. For example, if the rate heat detection were 42% and the conception rate were 47%, the pregnancy rate would be 20% (42% x 47% = 20%). Unfortunately, it appears that the average pregnancy rate for DHI herds is about 16%. This means that it takes 4 estrous cycles or more than 80 days to get 50% of the cows pregnant and implies that 22% of cows that are reproductively sound will still be open at 200 DIM. The first estrous cycle after the voluntary waiting period presents a unique opportunity to improve reproductive performance of most herds through the use of controlled breeding programs. Since all cows are open at the end of the voluntary waiting period, controlled breeding programs can be used to synchronize estrus and increase the number of cows detected in heat or bred by appointment in the first estrous cycle following the end of the voluntary waiting period. A reasonable goal for pregnancy rate in the first estrous cycle is 35%. Figure 3 illustrates the marked effect that a successful controlled breeding program can have on reducing the average DIM and percentage of cows that are open more than 200 DIM. With this approach, 50% of the cows become pregnant in 2.5 estrous cycles instead of 4 cycles and 23% cows are open at 200 DIM instead of 29%, thus reducing the number of reproductive culls.



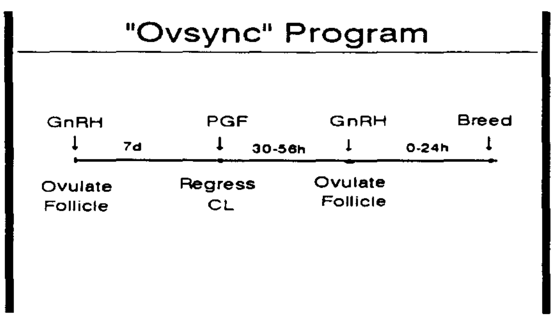
Controlled Breeding Programs



The first estrous cycle of the herd following the voluntary waiting period is unique from all subsequent estrous cycles. It the only estrous cycle in which all cows are eligible for estrous synchronization if the voluntary waiting period is adhered to. It is the estrous cycle that has the potential of more total pregnancies than any subsequent cycle. In fact, the potential pregnancy rate of the first estrous cycle approaches twice that of any subsequent cycle if an estrous synchronization program is used on all eligible cows following the voluntary waiting period. The programs with the potential for the highest pregnancy rates are the "Target Breeding" program and the "Ovsynch" program

Target Breeding Program

A variation of the two-injection prostaglandin synchronization that has been developed to synchronize estrus in the first estrous cycle following the voluntary waiting period is the "Target Breeding" program. The first or set-up injection is given 17 days before the end of the voluntary waiting period. Cows should not be bred after the set-up injection of prostaglandin. The second prostaglandin injection (first breeding injection) is given 14 days later and cows are observed for estrus and bred. The goal for heat detection following the first breeding injection is to detect and breed 70% of the cows. If no heat is detected after the first breeding injection, a third injection (second breeding injection) is given 14 days later. Cows are observed for estrus up to 80 hours following this injection. If no standing estrus is observed, then cows are inseminated by appointment at 80 hours following this prostaglandin injection. This program can be easily monitored by creating a list of cows the enter each synchronization cycle and calculating the proportion of cows observed in heat the pregnancy rate for the group.



Ovsynch Program

The Ovsync programs consists of a series of injections of GnRH, luteolytic prostaglandin and GnRH followed by an appointment insemination. All cows that are 10 days or less before the end of the voluntary waiting period are treated with GnRH. Seven days later cows are treated with an injection of a luteolytic prostaglandin. A second injection of GnRH is given 48 hours after the prostaglandin injection and cows are inseminated without estrous detection at on appointed interval after the second GnRH treatment. Although the pregnancy rate at 30 days post-insemination as determined by ultrasound has usually been the greatest for cows bred 16 to 18

hours after the second GnRH treatment, the rate of fetal attrition by 50 days post-insemination increased as the interval between the second GnRH injection and insemination increased. Hence, the pregnancy rate at 50 days post-insemination was similar for cows bred at the time of the second GnRH treatment compared to cows bred at various intervals after the second treatment of GnRH. The second observation on the "Ovsynch" program is that cows bred after 75 days in milk have higher conception rates than cows bred at less than 75 days in milk. With ability to control the distribution of days in milk at the time of first breeding with the "Ovsynch" program, it seems logical synchronized cows to be bred between 75 and 82 days in milk and take advantage of the improvement in conception rate. Two factors that can reduce pregnancy rate with the "Ovsynch" program are preparation of more than 2 insemination guns at a time and inseminator fatigue when several cows are inseminated in a short period of time.
The cost of drugs per synchronized female is more costly for "Ovsynch" program than for the "Target" breeding program. However, as recent paper suggested, the more appropriate to compare programs in on basis of the cost per pregnancy out of the total number of synchronized animals.

Conclusions:

1. Days open has increased over the last decade in US dairy herds as a result of an increase in DIM at first service and lower fertility of cows. Two consequences of increased days open are a reduction in the potential amount of milk that cows could have produced with fewer days open and more cows becoming reproductive culls as a result of either failing to become pregnant or becoming pregnant too late in lactation to justify an extended dry period.

2. To effectively manage reproductive performance of the dairy, appropriate monitoring tools need to be implemented to measure important reproductive parameters. Monitoring reproductive performance implies that a program is in place to be able to detect trends or changes in reproductive performance of the herd. Monitoring is also important to evaluate the effectiveness of controlled breeding programs.

3. Controlled breeding programs provide the dairy managers with a tool to improve reproductive performance of dairy herds. Controlled breeding programs can reduce the distribution for the days-in-milk at the time of first breeding following the voluntary waiting period and increase the pregnancy rate in the first estrous cycle following the end of the voluntary waiting period.