Tools to Improve Reproductive Performance of Dairy Cattle

Jerry D. Olson, *DVM*
University of Minnesota, College of Veterinary Medicine
Department of Clinical and Population Science
St. Paul, Minnesota

Tools available to improve reproductive performance of dairy herds can be divided into the broad categories of diagnostic and therapeutic. Whether dealing with individual animals or populations of animals, the first step to effectively solving perceived problems is establishing a diagnosis. Practically, diagnosing herd problems resulting in infertility is similar to diagnosing disease in individual animals. Whether making a diagnosis of individual animal or a herd, the specificity of the diagnosis can vary. For example, the diagnosis may be general and targeted to a body system (*ie.*, enteritis) or the diagnosis may be specific (*ie.*, enteritis caused by an enterotoxigenic *E. coli*). As a diagnosis becomes more specific, the probability that therapy will be successful increases. For example, appropriate antimicrobial therapy is more likely to be of value in treating a bacterial enteritis than a viral enteritis.

A general diagnosis of infertility may be considered for the herds with excessive days open. Even when the general diagnosis of infertility is attributed to a low overall conception rate, the specific approach to correcting the infertility will vary depending on whether the cows are infertile, the semen is of poor quality, estrous detection is inaccurate, or insemination technique is suboptimal.

The first step in diagnosing a perceived herd fertility problem is determining if a problem actually exists. Parameters of herd reproductive performance should be compared against a standard or norm performance much as a clinician would compare a patient's hemogram to a normal hemogram for the species. The indices that are useful in evaluating the reproductive status of a herd include: 1) the average age at calving of first lactation cows, 2) the average days from calving to conception, *ie.*, days open, 3) the rate of reproductive culling, 4) the rate of pregnancy wastage (early embryonic death plus abortion), and 5) the proportion of the herd that have actual reproductive problems. The proportion of the herd with actual reproductive problems varies with the definition of infertility. For example, cows that have excessive days in milk but have not been bred or have been bred but not confirmed pregnant are not generally included in reproductive parameters of the herd. Therefore, to effectively evaluate reproductive performance of a herd, it is important to quantify the proportion of animals that are not captured with the common reproductive indices. For herds enrolled in Minnesota DHI program, problem cows are defined as those with more than 120 days in milk and not yet confirmed pregnant. The average percent of problem cows in the total herd for the first quarter of 1992 was 24.53% with a standard deviation of 12.10%. Lemire, *et al.*, defined problem cows as those with more than 150 days in milk and not yet confirmed pregnant or those with more than 90 days in milk and not yet inseminated. With either the Minnesota DHI's or Lemire's definition, the concept of monitoring the proportion of a herd which are problem cows is useful in predicting future reproductive parameters; problem cows will 1) increase the average days from calving to conception if they become pregnant or 2) increase the rate of reproductive culling if they fail to become pregnant or if pregnancy occurs too late to justify retention in the herd. The JMR Index (Martinueau and Cardyn, 1990) is a practical alternative index of reproductive performance for smaller Midwest dairy herds and includes cows which are not included in calculation of DIM at first breeding or the interval of calving to conception. The JMR Index is calculated from the cows that exceed the Voluntary Waiting Period but have not been serviced, diagnosed pregnant, or have been diagnosed open.

In addition to evaluating the means for reproductive indices such as days open, it is useful to know the standard deviation of these parameters. Standard deviation is a measurement of the spread of numbers around an average. When reproductive indices have means with large standard deviations, the measured indices for the herd may vary more from the norm, and yet be acceptable, than when standard deviations are small. By knowing the standard deviation of a reproductive indices, the clinician is better able to define the acceptability of the reproductive performance of a herd. Table 1 is a summary of reproductive indices of herds enrolled in Minnesota DHI (1991) and 87 herds in Quebec and Wisconsin (Lemire, *et al.*, 1991). An interval of acceptability can be constructed around each mean to

Presented at the Minnesota Dairy Conference for Veterinarians, The College of Veterinary Medicine, University of Minnesota, June 3-4, 1992; Dr. James Hanson, Coordinator.

evaluate herds for any given reproductive indices. This interval can be constructed by dividing twice the standard deviation (in Table 1) by the square root of number of cows in the client's herd and adding and subtracting it from the table value. If a herd's mean reproductive indices is not included in the constructed interval, then a problem exists and appropriate corrective measures should be implemented.

Table 1. Reproductive Indices of Dairy Herds.

	1991 MN DHI Herd Average	Mean 87 Herds Lemire, 1991	S.D. of 87 Herds Lemire, 1991
Herd Size		41.6	14.9
Days to Conception	135	118	16.7
1st Service Conception Rate		50.6	13.8
Overall Conception Rate	54	54.6	11.0
Services per Conception	1.85	1.89	0.38
Days to First Service	89	81.0	12.6
Heat Detection Rate, %	39	56.6	24.7
Actual Calving Interval, mo.	13.6	13	0.67
Reproductive Cull Rate, %		13.1	0.54
Percent Problem Cows	24.5	10.8	6.9

Appropriate corrective measures can not be implemented unless one understands various factors which affect reproductive indices. Such factors are referred to as control points. For example, days open is a useful indices used to evaluate reproductive performance of the herd. However, days open cannot be reduced directly but must be changed through altering its control points. The primary control points for days open are: 1) days in milk (DIM) at first service, 2) fertility of the herd, and 3) efficiency of heat detection. Days open may also have secondary control points which affect DIM. For example, DIM at first service has the control points of: 1) a voluntary waiting period, 2) the percent of cows cycling, and 3) efficiency of heat detection. The challenge to the clinician is to establish the cause of the extended days open, and correct the extended days open by altering one or more of the control points.

Conception rate, defined as the percent of total services that produce pregnancies, is a parameter used to measure fertility. Conception rate is the product of: 1) accuracy of heat detection, 2) semen fertility, 3) cow fertility, and 4) inseminator technique. Electronic spreadsheets, such as LOTUS 1-2-3 or QUATTRO, are tools to aid in evaluating the accuracy of heat detection. Good fertility can not be expected when non-estrous cows are inseminated. The clinician can review criteria for heat detection with the dairyman but the dairyman is often more receptive to improving the accuracy of heat detection when there is concrete evidence that reproductive performance is abnormal due to inaccurate heat detection. The primary premise for a diagnosis of inaccurate heat detection is cows returning to estrus at an interval <18 or between 26 and 35 days. Analysis of breeding records can be of value in determining the fertility of breedings that occur at 18 to 25 day intervals compared to fertility of breedings that occur at any other interval within 35 days of a previous service. Electronic spreadsheets can be helpful in calculating breeding intervals and conception rates and in predicting which breedings are spurious. The data which should be captured from farm records are: 1) identification of the cow bred, 2) date of the breeding, 3) inseminator, 4) outcome of the breeding (Table 2). Once data have been entered, sorts can be done by cows and intervals between breedings can be calculated. As an example, in one herd pregnancy occurred in 33 of 70 (47.1%) breedings for breeding intervals which were between 18 and 25 days; in contrast, only 11 pregnancies in 60 (18.3%) breedings occurred when breeding intervals were <18 or between 26 and 35 days.

Table 2. Spreadsheet for Evaluating Pregnancy

Cow ID	Date	Tech	Outcome	Interval
Kitty	1/9/92	P	0	
Della	1/11/92	P	1	
Megan	1/11/92	P	0	
Maria	1/14/92	P	0	
Bunny	1/15/92	P	1	
Grace	1/18/92	J	0	
Jade	1/18/92	B	0	
Stella	1/19/92	P	0	
Angel	1/24/92	P	0	
Bailey	1/29/92	P	1	
Maria	1/30/92	M	0	

Systems which graphically monitor herd reproductive indices over time are useful diagnostic tools to create a visual image of changes or trends in reproductive performance. These can vary from sophisticated electronic spreadsheets with graphic capabilities such as Fetrow's Monitors to simple manually generated graphs in which reproductive indices are taken from monthly DHI Herd Summaries and hand entered on graph paper. Either system has two distinct advantages: 1) they create an image which conveys a strong visual impact of trends or changes in herd reproductive performance over time, 2) they create a focal point for the veterinarian and dairyman to re-evaluate current reproductive management, discuss reproductive problems of the herd, and consider potential solutions. Although graphing such reproductive indices as calving interval may display trends, the most useful indices to graph are the control points for reproductive performance of the herd such as DIM at first breeding, conception rate, and efficiency of heat detection.

For Minnesota dairies enrolled in DHI, the average efficiency of heat detection is less than 40%. Of the control points for days open, Minnesota dairy farmers could benefit the most by improving efficiency of heat detection. Many factors affect the display of estrus in cattle. One important factor affecting both number of mounts per estrus and the duration of estrus activity is the number of cows in estrus at the same time. Hurnik, *et al.*, observed that the number of mounts per cow increased from an average of 11.2 with one cow in estrus to 52.6 with three cows in estrus at the same time. Detected duration of true estrus was 7.5, 7.8, and 10.1 h when one, two, or three cows were in estrus within a group, respectively. The practitioner has two tools to increase the number of cows in estrus at the same time. The first tool is controlled breeding programs which utilize luteolytic prostaglandins. Controlled breeding programs come in a variety of forms but one decided benefit from these programs is that they increase the probability that multiple cows will be in estrus at one time. The net benefits are 1) the dairy farmer anticipates that the cows will be coming into estrus and observe more closely following treatment, 2) there will be an increase in the number of mounts during estrus with multiple cows in estrus, and 3) the duration of estrus activity may be increased when multiple cows are in estrus. Another tool available to practitioners and dairy farmers to improve heat detection are testosterone treated animals. Freemartin heifers can be androgenized by placing four Synovex-H implants in each ear. In a recent trial, androgenized heifers accounted for 57.6% of the mounts of estrous cows when only one cow was in heat. As the number of cows in estrus increased, androgenized heifers accounted for a lesser proportion of the mounts of estrous cows. Androgenized heifers are usually the nidus of the sexually active group within the herd. In smaller herds where it is unlikely that two or more cows will be estrus at any one time, androgenized heifers can fulfill a very useful function in increasing estrous behavior and thus facilitating estrous detection.

Luteolytic prostaglandins have been used as a therapeutic tool on a herd basis to either improve fertility of postpartum cows or in controlled breeding programs. Controlled breeding programs, in general, have either been based on intensive palpation, identification and treatment of cows with corpus luteum with luteolytic prostaglandin or routinely scheduled treatment, usually on a weekly basis, of postpartum cows with luteolytic prostaglandin that have gone beyond the voluntary waiting period but have not yet been bred. Belschner, 1986, reported a 16.8 day reduction in days open, 0.55 less services per conception, and an improvement in first service conception rate in an evaluation of the former category of controlled breeding program.

Reproductive performance of the dairy herd can most effectively be addressed when specific causes of poor reproductive performance are identified and the appropriate control points for those reproductive indices are addressed.

Selected Bibliography

Belschner, A. 1986. A breeding program for dairy cattle. *Agri-Practice* 7(5); Hurnik, J.F., G.J. King and H.A. Robertson. 1974. Estrous and related behavior in postpartum Holstein cows. *Applied Animal Ethology* 2:55-68; Lemire, G.E., P.S. Stalheim, M.R. Lemire, L. Verdon, M. Tiemann, and T.R. Bruning. 1991. Monitoring reproductive performance of small dairy herds in veterinary practice. *Can Vet J* 32:551-557; Martineau, R. and P. Cardyn. 1990. JMR a current reproductive monitor. *Proc of the Annual Mtg of SFT*, Toronto, Canada, pp 33-44; Mortimer, R.G., M.D. Salman, M. Gutierrez, and J.D. Olson. 1990. Effects of androgenized dairy heifers with ear implants containing testosterone and estrogen on detection of estrus. *J Dairy Sci* 73:1773-1778.