Dairy Herd Reproductive Performance Parameters Relevant to North American Production and Marketing Systems

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Introduction

In order for maximum lifetime milk production and breeding efficiency to be attained, dairy herds must attain an average intercalving interval of between 12-13 months (1, 2). The attainment of that goal is dependent upon many factors such as adequate nutrition, proper estrus detection, a decision to begin serving cows 60 to 70 days postpartum, use of good quality semen, a correct and efficient record keeping system and a suitable working relationship between the dairy herd manager and his veterinarian. The objective of this presentation is to describe some reproductive performance parameters which can be used to assess the level of reproductive management in a dairy herd. An attempt will also be made to describe how some reproductive performance diagnostic indices can be used as an indicator of the areas of management which are causing reproductive problems in herds.

Herd Reproductive Performance Parameters

It has been suggested that the mean calving to conception interval is the most useful overall estimate of reproductive performance in herds where calving occurs on a year round basis (3). The calving to conception interval is calculated on the basis of cows diagnosed pregnant as a result of a veterinary examination and therefore is a more accurate indicator of current reproductive performance than the intercalving interval. An intercalving interval calculated for cows which have recently calved, is a measure of the level of reproductive management in the herd during the previous lactation. For a number of reasons, this intercalving interval may vary from that which would be expected by adding 280 days (gestation length) to the present calving to conception interval. First, intercalving intervals are only available for cows which recalve, therefore, disposal of pregnant cows, death before recalving and abortions will alter the interval in comparison with the calving to conception interval. Second, if reproductive performance is changing, perhaps due to a management change, then substantial discrepancies can develop between these two indicators.

The calving to conception interval must be evaluated in light of the proportion of the herd culled because of poor reproductive performance (3, 4). It has been suggested that not more than 10% of the lactating herd should be sold each year because of failure to become pregnant (5). If a dairy herd has an average calving to conception interval of 90-110 days, this is an indication of good reproductive herd management unless the percent culled for reproductive reasons is greater than ten percent. A higher than average reproductive cull rate indicates that the herd manager is merely disposing of a large number of open cows to cover up for inadequate reproductive management practices. In this case, the herd manager must sacrifice culling selection based on production characteristics, type traits or udder health considerations in order to maintain an adequate calving to conception interval. This will not contribute to optimum overall herd productivity.

Since the objective of most herd health programs is to optimize production efficiency in economic terms, biological targets must be carefully chosen to relate close to the economic situation. Therefore, optimum reproductive performance targets may vary from one herd to the next, and from one year to the next depending on alterations in management such as changes to the nutritional program or changes in farm personnel.

Diagnostic Indicators of Management Factors Responsible for Herd Reproductive Performance

Indicators of Estrus Detection Ability and Postpartum Cyclicity

Estrus detection has been emphasized as a major determinant of reproductive performance (6, 7 8). It has been stated that, on average, herd conception rates are not extremely variable and the ability to influence this rate is limited (8). Therefore, dairymen lose more days due to missed heat periods than to conception failures. Pellisier (9), reporting on breeding efficiency problems in large California dairy herds, indicated that poor estrus detection

was the major contributing factor in delayed conception. Despite this fact, artificial insemination units have chosen to stress the indices, services per conception and conception rate as indicators of reproductive performance, which has resulted in dairymen placing disproportionate emphasis on these indices.

Many indicators of estrus detection ability in dairy herds have been recommended. One such indicator is the average interval from calving to first observed estrus. Williamson (4), reporting on a four year study of 59 Australian herds, stated that the average interval from calving to first estrus in these herds ranged from 40.5 to 59.1 days. This figure can be calculated easily in herds with adequate records by randomly selecting a group of cows from the herd and calculating the number of days from calving until they were first seen in heat.

Another index of estrus detection ability is the percent of cows seen in heat by 60 days postpartum. It has been suggested that in well managed herds, over 80% of the herd should have been recorded in estrus at least once prior to 60 days postpartum (4).

The aforementioned indices of estrus can be influenced by factors other than the herd manager's ability to detect estrus and properly record such observed estrus behaviour. Dry period and postpartum nutritional management may also influence these indices. Milk yield in normal cows reaches its peak prior to the time of maximum dry matter intake, resulting in an energy deficit observable as rapid weight loss (10, 11, 12). The amount of body weight loss directly affects the time to resumption of estrus cycles, the progesterone profiles post-estrus and conception rates (12). Therefore body condition scores would appear to be a practical method of assessing the nutritional status of a herd at different stages of lactation. This information could then be related to the aforementioned estrus detection parameters. Even the most diligent estrus detection efforts will fail to detect heat in cows which are not being provided sufficient energy to show positive estrous behaviour. Therefore, if the percent observed in estrus by 60 days postpartum is too low, or the mean interval to the first observed estrus is too long, this may be due to a failure of estrus to occur (true anestrus) or failure of the cow to show estrous behaviour (true subestrus) rather than a failure of the dairyman to observe and record estrus.

The assessment of whether estrus is occurring must depend on rectal palpation findings or progesterone profiles. When cows are examined at 60 or more days postpartum and 75% have corpora lutea while others have follicles or corpora hemorrhagica and only a few have inactive ovaries, it is likely that members of the herd are cycling normally, indicating that inadequate estrus detection and recording, not anestrus, is the problem (4). With the advent of rapid enzyme linked immune assay techniques it is now possible to obtain progesterone concentration status information on a large number of cows very rapidly. This information could be used to augment or in place of palpation findings.

There are several indices of estrus detection ability which are not confounded by nutritional or pathological factors. The estrus detection rate is one of these and is described as [21 ÷ (mean interestral interval)] X 100. Ideally a rate of 80% or more should be expected. However, 50-60% is commonly seen.

Another indicator of estrus detection ability is the proportion of cows presented for pregnancy diagnosis that are pregnant (4). Non-pregnant cows that the farm manager puts forth for pregnancy diagnosis must have had one or two heats that were not observed by the farm manager. At least 80 to 90% of cows presented for pregnancy diagnosis should be pregnant in a herd where adequate heat detection takes place. Cows which fail to conceive should have been seen in estrus and therefore rebred or presented as problem breeders rather than pregnancy diagnosis cases.

Another index of estrus detection ability which is very useful in large herds where all heats are recorded, is the ratio of single (18 to 24 day) to double (38 to 46 day) interestral intervals. If the single to double interestral interval ratio is 5:1 or greater, estrus detection is satisfactory (4). This index is not confounded by nutritional or pathologic factors causing delayed return to estrus, but rather is a specific index of estrus detection ability.

Interval to First Service

Another factor affecting the average interval from calving to conception is the average interval from calving to first service (13, 14, 15). It has been reported that although early postpartum breeding results in more services per conception, it is also strongly correlated with a decrease in the calving to conception interval with no detriment to future reproductive performance (13, 14, 15, 16). Therefore, the cost of an increased number of services required due to early breeding, can be more than offset by the improved productivity associated with a reduction in the intercalving interval in most commercial dairy herds (13, 14).

A conscious decision by dairymen to defer first service in cows that are detected in estrus often results in an increase in the calving to conception interval. This situation is most often seen in registered dairy cattle herds in which the farm manager delays first service to achieve higher 305 day lactation records. This practice is supported by research which indicates that a group of cows bred at their first detected estrus subsequent to 80 days postpartum, produced more fat corrected milk in a 305 day lactation and during the first 150 days of their subsequent lactation compared to cows bred at first detected estrus subsequent to 50 days postpartum (16). This would result in better ROP or DHIA production records, which at present is an important factor in determination of cows selected as dams of A.I. sires or as embryo donors for export and domestic markets. However, the same research indicates that average daily milk production from the beginning of the lactation to day 150 of

the subsequent lactation including the dry period, was the same for both early and late bred groups (16). This would suggest there is no financial benefit to commercial dairymen as a result of deferred services.

Conception Rate

The calving to conception interval is also influenced by the conception rate, that is, the success of breeding. Conception rate is influenced by the bull, the cow and certain management factors. Good conception rates are associated with good semen quality, proper insemination technique, adequate nutrition in the cow herd, correct timing of insemination in relation to both calving and estrus and a healthy uterine environment at the time of insemination. The first service conception rate is the least biased estimate of fertility because it is not unduly influenced by one cow having a large number of services (4). While many A.I. units report first service conception rates of $> 60\%$, it should be remembered that these rates are calculated on the basis of 60-90 day non-return to service. This method of calculation ignores those cows which returned to estrus and received a natural service by a clean up bull or were not serviced again as a result of a decision to cull them. Therefore, first service conception rates of approximately 50% based on actual diagnosis of pregnancy by rectal palpation may be a more realistic goal, particularly with the advent of more farmer performed insemination. Discrepancies in conception rates achieved by different inseminators within the same herd may be useful in detecting problems in semen handling or insemination technique.

Effect of Postpartum Reproductive Abnormalities on Reproductive Performance

The occurrence of reproductive diseases may have a significant impact on the reproductive performance and ultimately the milk production of a dairy herd.

Relationships among dystocia, retained placenta, metritis and cystic ovarian disease have been established (17, 18, 19, 20, 21). In one study, cows experiencing dystocia were at an increased risk of also experiencing retained placenta and metritis, and regardless of the occurrence of dystocia, cows that had a retained placenta were at an increased risk of developing metritis (18). As well, cows that had experienced retained fetal membranes were at an increased risk of developing cystic ovarian degeneration (18). The effects of retained placenta, uterine infections and cystic ovarian degeneration on subsequent reproductive performance parameters have been investigated (22, 20). In general, cows experiencing these problems may require costly therapy and contribute to an increase in the average calving to conception interval in dairy herds. At the individual herd level, knowledge of the incidence of these reproductive abnormalities may assist the veterinarian in objectively determining the most important management factors which have contributed to decreased reproductive performance in a particular dairy herd.

Average Age at First Calving

The average age at first calving should be less than 28 months. If heifers calve at approximately 2 years of age in good body condition, this is an indication that nutritional and reproductive management of replacement animals is adequate. This is an area of dairy herd health management programs that should not be overlooked as an adequate number of replacements are necessary to allow culling of cows from the milking herd that are no longer economical productive units.

Relationship of Culling for Reproductive Failure to Dairy Herd Productivity

Any culling program should be aimed at increasing average production of the individuals in the herd, decreasing mastitis incidence and improving type traits in the individuals comprising the herd. In order to obtain these objectives, the involuntary removal of cows necessitated by infertility must be kept to a minimum. It has been stated that in a commercial dairy herd not more than 10% of the herd should be culled annually due to reproductive failure (5).

Dutch researchers, during a study of the records of 61 commercial dairy herds from 1974 to 1977, found that the number of cows culled for all reasons ranged from 25-30% of cows beginning a lactation during that period (23). Approximately 7% were culled due to reproductive failure, and most of these cows were culled near the end of the lactation. It was stated that the incidence of culling for reproductive reasons was significantly reduced in a group of 30 herds on a veterinary supervised herd health program when compared to 31 control herds (23).

Dijkhuizen et. al. (24) calculated critical production levels (at various stages of lactation) below which it is not profitable to inseminate open cows, and therefore a decision must be made to cull them. Some attempt must be made to determine these breakeven points in individual dairy operations so that time, energy and semen costs will not be expended on nonprofitable services in cows that should be removed from the herd.

The Influence of Microcomputer Technology and Dairy Herd Management Software Programs on Awareness of Herd Reproductive Performance Parameters

In many herd health management programs, the data necessary to calculate herd reproductive performance parameters is recorded on individual cow paper records. It requires a great deal of effort to retrieve, analyze, and compile this data into a meaningful report on herd parameters. If an on-farm microcomputer or veterinary practice microcomputer providing a bureau service were used to store and analyse this type of information, the data

would be more fully utilized, and hence made available to indicate problem areas. The information could subsequently assist in identifying reasons and planning strategies for correcting these problems (25). There are many dairy herd management software packages marketed at present. However a recent software assessment study revealed that many of the available systems are lacking in areas such as user friendliness, accuracy and user support once they have been installed on a farm or in a veterinary practice (25). However, a field trial investigating the utility of a dairy herd management system which emphasized dairy herd health and fertility analysis indicated that farmers and veterinarians felt that the computer could be a useful management tool (26).

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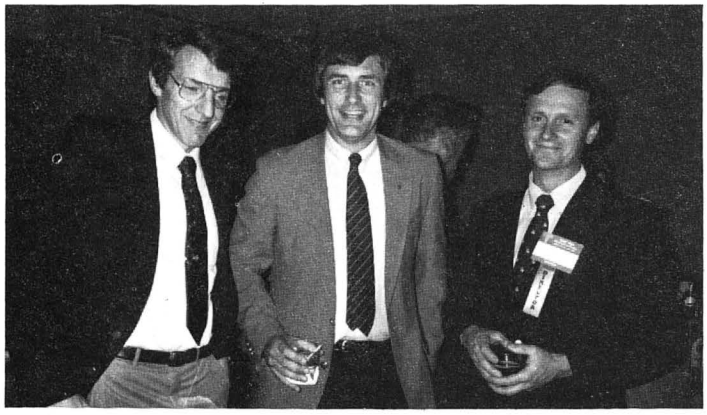
Questions & Answers:

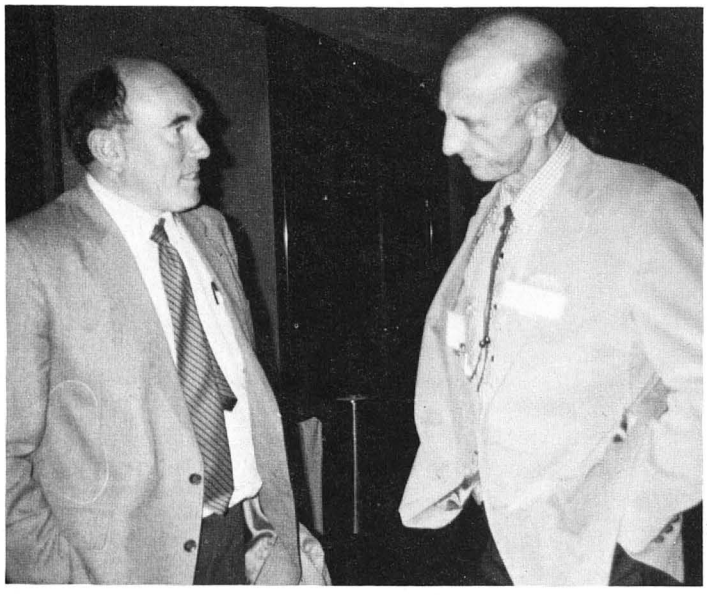
Question: How do you get adequate culling information or reasons for culling?

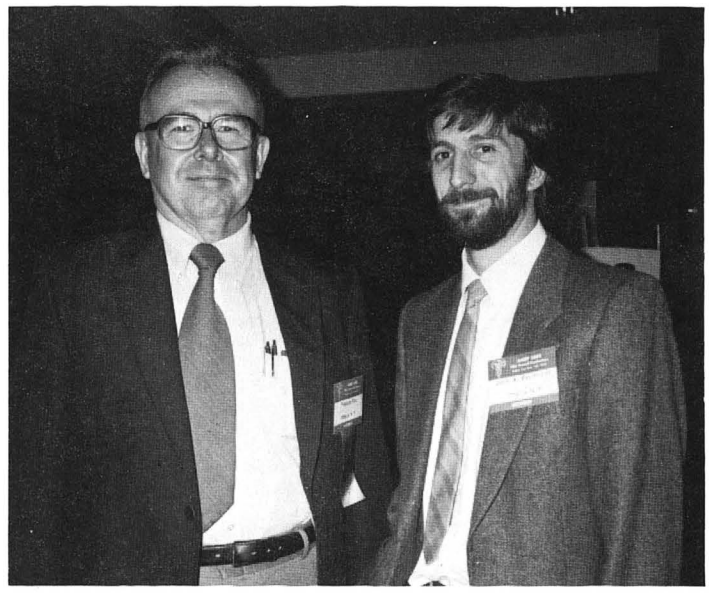
Dr. Etherington: The questioner is saying that when he culls for reproductive reasons, there are usually problems as was the case with the one record that I put up there. She had a bad leg and the decision was to move her on. There was another slide of the Dutch work which indicated that the average days to culling was listed there for the different reasons. Reproduction was the greatest, average days to culling for reproductive reasons are 304 days. And they also stated that they calculated a centrality figure for the reason. And in the reproductive culled cows, far more often did they have other reasons listed with them than for any other reason for culling. They are culled for mastitis quite often. There was no other reason listed. They are culled for foot problems. Sometimes there is no other reason listed. When they were culled for reproductive reasons it said reproduction, she's open, and had bad feet. Reproduction and three teater etc. So it's difficult for sure. We had the same problem in that large herd in culling for reproductive reasons. The only way that I get around it because I'm trying to get somebody aware that they are culling too many for reproductive seasons, is to put more attention on that area. If they're open beyond 250 days and have not conceived and there's no other reason, that's reproduction. So it's difficult, that's a good question. At least if they go and some reason is put on, it's better than no reason at all. Do you have any comment on that Leon?

Dr. Leon Weaver: Yes, I would just make two brief comments. I have found in reproduction, it's useful, as Wayne suggested, to give a precise definition of what infertility is. And I'm not saying this is a good definition, but it's precise. We have told the dairymen that any cow that has not conceived at 150 days, whenever she is culled, was a reproductive failure. So if she's 150 days in milk and hasn't conceived by

at least the 150th day, that's a reproductive failure. Now a cow was culled before 150 days in milk could be a reproductive failure if she had adhesions or something marked on her record. In terms of getting good data, we really stress under culling. We have two categories. One is "other" and the other is "unknown". And that's not apparent what the difference is, but other means it wasn't one of the specific things above but it was something else—cow broke her leg . . . we didn't have a category for it. She had a known reason and it wasn't on the list. "Unknown" means just that. This cow was culled and I don't know the reason why. If you don't have an "unknown" as a specific category, everything gets lumped into low production. So what we tried to do is give them precise definitions and the only one I'm very comfortable with is the one in reproduction. And then by interview process on a regular basis, look at the unknown category and interview the owner and see if you can come up with a reason and maybe once a month is a good time.







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Performance Evaluation as an Integral Part of the Herd Health Program – *Leon Weaver*

Tape 12 –
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