Reproductive Performance in Some Minnesota Dairy Herds

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Introduction

It is a considerable time since a detailed report of reproductive performance in Minnesota dairy herds was published (Zemjanis et al 1969). Since that time, new products and technologies have been introduced which result in an increase in the options available for the herd manager who seeks to improve reproductive performance and control in dairy herds. New therapies which have become available for reproductive disease have been shown to be successful in controlled studies. It is therefore time that a new look is taken at reproductive performance in Minnesota herds to determine if improvements have occurred. Another and perhaps more important reason to determine current performance levels is to identify the areas in the reproductive management system where improvements can continue to be made. It is hoped that information presented in this paper may provide some basis for comparison when veterinarians are evaluating the reproductive performance of herds which they serve.

Materials and Methods

Operation of the Minnesota DairyCHAMP data laboratory has allowed the collection of information on a number of herds in Minnesota and nearby Wisconsin as a matter of course, as a result of the operation of the program to provide support to veterinarians supplying reproductive herd health program services to these farms. Information collected for the year from July 1st 1984 to June 30th 1985 has been analyzed. This provides a measure of the levels of performance achieved in the 21 dairy herds which had complete information available for analysis in the year. Information on key indices of reproductive performance have been extracted from the Annual DairyCHAMP reports and have been summarized in this paper. The values reported are herd mean indices.

It is worth noting that the information presented in this paper was extracted from DairyCHAMP Annual and Monthly Reports in approximately ½ day. The analysis of herd records was done as a part of the routine operation of the DairyCHAMP data laboratory.

Records Required for an Evaluation of Reproductive Performance

Ideally the records required to allow thorough reproductive analysis and monitoring in a dairy herd should include the cow's identification, age or birth date and lactation number. The sire and dam of each cow should be listed and a vaccination history for each animal. Calvings and the ease of calving should be recorded, including the date of occurrence, the number, sex and identity of calves and any assistance which is given. Peripartum diseases and treatments should be noted. All heats should be recorded and the reason for not breeding cows when service is withheld. Services should be recorded, including whether natural or artificial, the sire identification and the inseminator for artificial services, along with breeding dates.

Any discharge from the reproductive tract, their nature and the date of occurrence should be recorded. All diseases and injuries which are diagnosed and treatments—including therapeutic, preventive and managemental treatments such as estrus synchronization.

The dates of reproductive examination and uterine and ovarian findings should go into the cows' records, especially the diagnosis of pregnancy. The status of cows can also be useful in making management easier for the farmer, e.g., whether the cow is pregnant, calved and not bred or bred and not diagnosed pregnant. Information on whether a cow is dry or lactating is also essential to aid in formulating a prognosis and recommended course of action for a cow. For example, if a cow is open and dry she should be culled unless exceptional in some way. If the cows are run in groups, the group affiliation should also be recorded. The final information on any cow's record should be the method, date and reason for disposal.

For the farms included in the analyses which are reported here the potential to record most of this information exists. However the information recorded is somewhat variable in the degree of detail. Certain information has been recorded with a high degree of accuracy including calving dates, reproductive problems in the peripartum period, service dates and the examination results, and diagnosis and treatments by veterinarians which occurred at regular reproductive health visits every 2 or 4 weeks.

Performance Related Reproductive Indices

Important measures of herd reproductive efficiency which are related to productivity are the calving interval, the proportion of the herd calving and not calving in a year, and

the culling rate. These indices are related to the amount of milk produced and to the number of replacement animals or animals for sale which are available and required in herds.

The calving interval is a production related index, but it has several weaknesses when used as an index of herd fertility. The calculation of the calving interval requires that either all cows in the population have re-calved and the retrospective calving interval is studied or that a population is defined and the subsequent calving interval is calculated after all cows in the population recalve. The former method ensures that records will be slow in reflecting any positive changes in herd performance because the index is looking backwards from a point in time, whereas the latter method must wait for calculation until all cows recalve. An alternative index which reflects the same factors in reproductive performance is the calving to conception interval which has the advantage of being able to be calculated as soon as cows in the population conceive. A disadvantage is that if cows don't conceive they are excluded from the analysis of the index and may thus cause bias in the result. Calving to conception interval differs from calving interval by a small amount due to prenatal loss and abortion, but in studies conducted by the author the two indices remain extremely highly correlated.

A factor requiring consideration when evaluating a herd's performance, is the proportion of the herd which is excluded from analysis in the population being evaluated. If the analysis being undertaken is of the reproductive performance of all cows calving in a year, then some account needs to be taken of the cows which are (or were) in the herd but which did not calve in the year being considered.

The proportion of the herd calving in the year was calculated as the number of calvings divided by the average herd size. The proportion of the herd which did not calve in the year was calculated as the number of cows in the herd which were present in the herd for the full year under review and did not calve in the year, divided by the average herd size.

Calving (or calving to conception) intervals, the proportion of the herd calving and culling rates reflect the final outcome of the factors influencing herd fertility. While they do relate to productivity, they do not aid the identification of problems causing inadequate performance.

Diagnostic Reproductive Indices

Some indices are indicative of biological or managemental performance in areas of the reproductive process. Calving interval depends on a farmer waiting for a certain period after calving, detecting the cow in heat, then breeding the cow until she conceives. The gestation length is relatively standard unless there is a high incidence of abortions or induced calvings. Herd calving intervals can be influenced by culling, since if all poor performers are culled, calving intervals may be kept low—thus making a reproductive problem. The underlying reproductive problem would be indicated only by a high culling rate of open cows.

To document performance and identify problems beyond the level of excessive calving interval or excessive culling, other indices can be derived from records if adequate information is available. In analyzing records, a defined population should be used—for example, unless it is stated otherwise, all cows calving in the defined year is the base population used in this study. All records from the total population have been included and not the records of only those cows remaining in the herd. If analyses are done only on the records of cows which remain in the herd, biases will undoubtedly occur since the group which remains will be a selection of the better performing cows. Thus if cull cow records are removed before analysis then performance will almost certainly **appear** better than it really was.

The **calving to service interval** separates pre-breeding from post-breeding factors in reproductive efficiency. It is influenced by the occurrence and observation of estrus, the maintenance of records and the farmer's policy regarding breeding cows at observed heats. If calving to service intervals are short (65 day herd average or less) then it is likely that the occurrence of estrus, its observation and the breeding management policy are compatible with efficient reproduction. Attention can therefore be shifted to factors operating at or after breeding. If intervals to breeding are long then the occurrence, observation and recording of estrus need to be investigated.

Indices of the occurrence of estrus are the **estrus detection rate** which is defined as—

$$\frac{21}{\text{Average interval between heats}} \times 100 \text{ .}$$

An index of the occurrence and detection of heat is **the proportion of cows in heat by 60 days after calving.**

The influence of a farmer's decision to delay breeding can be documented as the mean interval from a heat detected at a time when service would be reasonable (>50 days postpartum) until service is given. This delay is due to policy and has been called **deferral interval** by the author.

If intervals to service are satisfactory, but intervals to conception are still long, this indicates a problem in conception rate or a failure to observe estrus or to rebreed previously bred cows. Estrus detection problems after breeding will be revealed by low proportions of cows pregnant at pregnancy diagnosis. They will however be cycling and normal at pregnancy diagnosis.

Conception rate (or really **diagnosed pregnancy rate**) is influenced by cow, male and management factors. Cow factors may include inadequate rations which are generally associated with low milk production and excessive changes in bodyweight. Infectious diseases may be implicated and histories should be checked regarding vaccination status and other signs of disease to guide diagnostic efforts if conception rates are low. Analysis by group and age may help to define problems. Infectious problems may be associated with genital discharges. Nutritional problems are frequently

seen as low conception rates associated in the herd with anestrus in other cows which have inactive ovaries.

Bull factors include the variation in fertility which occurs between individual sires and artificial inseminators, semen handling variations, artificial service technique, and semen batches. Low performance when analyzed by one of these variables, may indicate a problem due to one of these factors, however, for a 5% difference in conception rate to be significant, more than 200 services per bull are needed. First service conception rate gives the least biased estimate of bull factors. If many services are given to a few cows, then overall conception rates may be depressed due to problems in a few cows, but such biases are excluded from first service conception rates.

Some management factors influencing conception rate are the interval from calving to service and the interval from estrus detection to service. Farmers sometimes complaining of poor conception rates may be explained solely by early breeding at interval after calving at which conception rates are expected to be low. Heat detection, breeding technique and herd nutrition are also management factors, which may be observed as signs which must be distinguished from sire to cow effects which also may cause depressed conception rates. The number of **services per conception** required for cows conceiving is another measure of conception efficiency.

A key index of herd fertility is the **age at first calving.** The ideal age at first calving is commonly accepted as being 24 months. A prolonged interval to first calving can have a depressing effect on the overall reproductive efficiency of a herd. Many herds have prolonged mean intervals to first calving but few have sufficient records to enable the reasons to be determined. A study of heifer growth and reproductive performance in some Minnesota herds is currently in progress and although funding has been discontinued by the Research Committee of the Veterinary College for this project it is hoped that the project can continue long enough to provide some baseline information on heifer growth in some Minnesota herds including information on the age at first calving. Only a few DairyCHAMP herds whose information is used in this study currently utilize the heifer monitoring program.

The **pregnancy loss rate** (the proportion of the herd which is diagnosed pregnant and then is found to be non-pregnant at subsequent examination) is a reproductive index which may reveal a subclinical problem of prenatal death that would otherwise go undetected by a farmer. Investigation of such a problem needs to proceed in much the same way as for any abortion investigation.

Results and Discussion

The mean size of the herds included in the study of reproductive parameters in 1984/5 was 56 cows with the herds' size range being from 27.3 to 191.0 cows.

The mean of the herd mean calving to conception intervals for the herds studied was 107 days with a range of from 91.2 days to 137.1 days. The mean of the modal calving to conception intervals was 99.8 days. The range in the modes was from 81 to 131 days. Ideal calving to conception intervals are around 85 days for individual cows but herd means of around 90 days are ideal due to the skewed nature of the interval. Modal calving to conception intervals of 85 days are a suitable performance target.

The overall culling rate from the herds was 27.7%, with a range of from 15.3% to 51.2% of the mean herd size. Culling policy can influence the value of reproductive parameters in herds, especially calving and calving to conception intervals if all of the cows which have difficulty in conceiving are culled.

The number of calvings in the year generally exceeded the mean herd size with the average number being 9.6% greater than the average herd size and the proportion of cows calving ranging from 72.1% to 126.9% of the mean herd size. This index is influenced by the numbers of heifers calving into the herd and also by the number of cows which calve twice in the year being reviewed.

The proportion of the herd which did not calve in the year averaged 10.2% with a range of from 0% to 24.9%. Since these cows are not included in the analyses of performance they may represent a major source of bias in the reproductive indices of some herds for the year under review. The proportion of cows which do not calve in any single year in a herd should be less than 10% of the herd based on the fact that this was the average performance achieved in the DairyCHAMP herds.

The calving to service interval is an index of reproductive performance which provides a useful starting point for evaluating specific areas of herd reproductive performance. The mean calving to first service interval in the Dairy-CHAMP herds was 79.9 days with herd average intervals ranging from 68.2 to 113 days. The median interval to first service for herds was 75.1 days with a range from 59 to 103 days. These intervals seem somewhat long if the intention is to achieve a 12 month mean calving interval, given expected conception rates in North American herds.

Estrus detection may influence the calving to service interval considerably. The mean estrus detection rate for the herds was 64.6% with a range of from 46.9% to 85.4%. The target level of performance for this index is 85%. A measure of the occurrence and detection of estrus is the proportion of cows which are seen to be in heat by 60 days after calving. The mean proportion showing heat by 60 days after calving averaged only 48.3% of cows in the herds. The range in this index is great, being from 11.1% to 87.5% of cows detected by 60 days. The wide range in performance in this index is due in large part to the fact that in many herds, prebreeding heats are not recorded. This means that many of the farmers in these herds are paying to have cows examined unnecessarily because they don't record heats. Recording of pre-breeding heats helps to establish that normal cycling is occurring without the expense of veterinary palpation if the farmer is diligent at observing heats. If cows are not cycling

normally then recording of all pre-breeding heats will help to identify the problem.

Deferral of service occurred in 11.8% of intervals following calving. The mean deferral length for all herds was 27.9 days. This was calculated to extend intervals from calving to conception for cows conceiving by an average of 4.6 days. This represents the saving in calving interval which could be made simply by convincing farmers to breed at all heats which they detect and note already at more than 50 days after calving.

The proportion of cows which are detected to be pregnant when presented for pregnancy diagnosis is a measure of estrus detection efficiency after service. In the herds studied the proportion of cows which were found pregnant at pregnancy diagnosis was 72.9%. This index of estrus detection after breeding is higher than would be expected given the proportion of cows seen in heat by 60 days and the estrus detection rates reported above. This is explained in part by the failure to record all prebreeding heats by some farmers.

The first service conception rate for cows receiving first services in the year of analysis was 45.8%. Individual herd first service conception rates ranged from 17.2 to 66.7%. The conception rate to all subsequent service numbers averaged 43.1% with a range from 19.6 to 90%. The range of services required per conception for cows which conceived which was observed in the subject herds was from 1.4 to 3.0 with a mean of 2.0.

The pregnancy loss rate ranged from 0% of the average herd size for 6 herds to a high of 19.1% in one herd. The mean abortion rate expressed as a percentage of average herd size was 6.1%. In the analysis abortions were divided into those occurring at less than 4 months, 4 to 7 months and greater than 7 months. The proportions of abortions in these gestation categories were 66%, 17% and 17% respectively.

Conclusion

The reproductive performance of herds participating in DairyCHAMP in the 1984/5 year varied considerably. In no area of performance did the average performance of the participating herds meet commonly cited performance targets. Median intervals to conception are somewhat extended at close to 100 days, with the mean being 107 days. One way of reducing these intervals somewhat would appear to be to simply improve estrus detection to allow cows to be bred earlier. Deferral of service should also be discouraged because this practice contributed 4.6 days to mean calving intervals in the herds studied.

Methods to improve herd conception rates would contribute to improved herd reproductive performance. Conception rates observed are similar to those reported from other parts of the USA and from previous studies in Minnesota. Heat detection rates are better than the 45% reported for Minnesota DHIA herds, but could be improved further. There seems to be a need to convince farmers to watch for and record all post calving heats.

This paper provides a source of information on observed reproductive performance in some Minnesota herds subjected to systematic examination and monitoring. The information for the herds has been collected, stored and analyzed in a consistent and defined way using the DairyCHAMP Computerized Health And Management System for dairy herds.

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