Dairy Herd Reproductive Records

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Introduction

Reproductive herd health programs have been a very important part of dairy practice for many years. Dairy producers frequently utilize the local veterinary practitioner for palpation and obstetrical services. This is with good reason as theriogenology courses in veterinary school have trained dairy veterinarians very well to examine, diagnose, and treat numerous reproductive conditions in the individual dairy cow.

In addition to these traditional theriogenology services, veterinarians are increasingly becoming involved in management decisions relative to the reproductive performance of the herd. This requires a herd-level approach to implementing reproductive programs and a herd-level analysis approach to assessing the resulting reproductive performance. Because of their extensive training in theriogenology veterinarians are uniquely qualified provide these services and work with producers to develop, implement, and monitor the reproductive performance of dairy herds.

In general, the goal of any dairy's reproductive program is to allow cows in the herd:

- to have minimal difficulties with calving
- to have minimal reproductive pathology post-partum
- to begin normal estrus cycles at an early days in milk
- to be detected in estrus
- to conceive in a timely manner for that animal
- to carry calf to full term
- and to re-freshen again with minimal difficulties

The management of a particular dairy must decide on which specific methods they will use in the attempt to meet these goals. Together the methods that are selected by management will become the reproductive program for that particular dairy.

Dairy producers should work closely with their veterinarians when going through this process of designing a reproductive program that is best suited for their dairy. When participating in this process, the consulting veterinarian will be asked for opinions on many different aspects including: controlled breeding programs, heat detection programs, breeding techniques, record systems, impacts of nutrition and housing, and even on selection of which AI service sires to use. Additionally, veterinarians should be involved with monitoring the performance of natural service, including whether and when cows should be exposed to the bull.

The purpose of monitoring reproductive records is to look for opportunities to improve the level of herd performance either by accomplishing things better or more efficiently. The consulting veterinarian needs to:

- Assess the available information on the reproductive performance of a herd and determine if there are decisions that management can make that will be likely to improve the current situation.
- Evaluate the success to previous management interventions

Some of the parameters that have been used to monitor performance by the dairy industry are yearly overall conception rate, yearly first service conception rate, yearly heat detection rate, average calving interval, average days open. Thanks in part to computers these numbers are readily available to producers and their veterinarians. But how good really are these numbers to help us identify potential problems that we can fix?

One of the biggest problems with computers is that they only give us answers. It is up to a human to do the truly hard part, and that is to make sure we are asking the proper questions.

The questions that the veterinary consultant should be routinely asking when evaluating a herd's reproductive program are:

- What's the current reproductive performance of a herd?
- What's the likely future performance for a herd?
- What management action needs to be made to improve performance?

Only after these questions have been asked, should we begin reviewing reproductive records to look for the answers. If you do not know what the questions are, then it is impossible to know when you are looking at the right answer.

The questions also determine what data we need to collect and analyze to have our best chances at reaching the correct answers. Answering these three questions as accurately as possible will give us an opportunity to improve the reproductive performance of a herd. We must never forget that improving performance and getting closer to the stated goals of the reproductive program is the reason that we are monitoring records in the first place.

If we want to use reproductive records to assess the current performance of a herd and answer the three questions, what parameters should be analyzed? The traditional measures of herd reproductive performance (yearly overall conception rate, yearly first service conception rate, yearly heat detection rate, average calving interval, average days open) have some problems in providing the answers to our questions.

It is critical that practitioners be aware of the potential problems with monitoring parameters. The major pitfalls of the most common reproductive monitoring parameters are well described in the chapter on Reproductive Health Programs for Dairy Herds in the book Bovine Theriogenology.[1] The authors of this chapter have forced many practicing veterinarians to rethink the way they should approach using record systems with their dairy clients.

The average days open is very likely the most widely used parameter to measure the overall reproductive performance in a herd. As an example it is useful to consider the reasons why this particular parameter may not be of much use when attempting to determine the current state reproductive performance.

Calculating Average Days Open

The first step to make the calculation of average days open (Avg DOPN) is to decide which population of animals to include in the calculation.

The broadest definition would include all cows in the herd and be the length of time between the most recent calving and latest insemination or days in milk for un-inseminated and non-pregnant cows. However, is it appropriate to include cows that freshened yesterday? or cows that have left the herd? or cows that management has elected not breed back?

A slightly more narrow definition would be to include just the pregnant and inseminated cows and calculate the length of time between the most recent calving and latest insemination. However, is it appropriate to exclude cows that have never been serviced?

A third method, and the one most commonly used is to include only the pregnant cows and calculate the length of time between the most recent calving and conception for all confirmed pregnant cows. This method excludes the "failures", the animals that never become pregnant. By including only the successes (pregnant cows) and excluding the failures (open culls) we have "biased" the calculated result.

By waiting for a cow to conceive and have a pregnancy confirmed there is significant "lag" time for the cow to be included. By including cows that conceived up to 9 months ago the parameter has "momentum" since it reflects performance of the herd 2 to 9 months ago.

Posing the question of "which cows to include in the Average Days Open calculation" points out that in fact there are many different definitions that could be used and unfortunately there is no standard calculation method for Average Days Open. The best advice that a veterinarian can get about approaching reproductive parameters is to approach the numbers with a healthy skepticism and make an effort to fully understand how the calculation was made.

Another issue is the problem of using averages in monitoring. Average days open does not describe the spread of the distribution and it does not point out individual animals that have an extremely high or low days open. There are enough inherent difficulties in calculating and subsequently interpreting average days open that depending too much on this single number may mask serious current reproductive inefficiency in a herd.

However, the average days open of a herd in general does reflect the past reproductive performance of the herd, and recent or current reproductive performance will affect the average days open in the future. Days open is also a parameter that is readily available and because of this we will probably continue to use it as an assessment of HISTORICAL reproductive performance but to improve performance today, veterinarians should select more current measures of the reproductive program.

Question 1: What is the current reproductive performance of a herd?

To get an assessment of the current performance of a herd, a good approach to take is to evaluate the components that will ultimately result in days open. These components are:

1. The farm policy on the Voluntary Waiting Period.
2. The Heat Detection Rate of the herd.
3. The Conception Rate of the herd.

Monitoring the current status of these three components will allow the veterinarian to look for current problems that in will affect the future average days open of the herd. The value of identifying current problems is that management is given the opportunity actually step in and implement a change at the same time the problem is occurring.

Evaluating the Voluntary Waiting Period

The definition of the Voluntary Waiting Period (VWP) is the length of time, chosen by management, to wait after calving before starting to inseminate.

First, the veterinarian should ask the dairy producer what is their stated policy. Typically producers will state between 45 and 60 days in milk. Knowing the producers stated policy the veterinarian should then ask the questions:

- When are the first inseminations actually occurring?
- Is this consistent with the stated policy?

A scatter graph of days at first breeding by days since freshening is a useful way to assess the data in a herd and answer these two questions.

Herd size = 660 milking cows
BRED1 = Days in milk at first breeding
DSFSH = Days Since Freshening

Label = Number of cows at that data point

Producers Stated Voluntary Waiting Period = 45 Days in Milk

```
Command  : GRAPH BRED1 BY DSFSH FOR LACT>0 DSFSH<366\TZB

     150 |                              1
     146 |                                    1
     142 |
     138 |
     135 |                                 1                          1
     131 |
     127 |                                                      1
     123 |                                       1    1
     120 |                                 1                     1
     116 |                                                       1
     112 |                                  1            3
     108 |                        1                     1   1       1      1
     105 |                           1          1         2        1           1
     101 |                                           1   1
      97 |                                              1                      1
      93 |                           1              1      112 1111      21
      90 |                                2              4   12 2  1   1       5
      86 |                                            1       1      1        1  1
B     82 |                     11  1 21  1 111      2  1      1  1 1         1
R     78 |                1 2 1141 111132 3 11  3 1 11   1  1  1   1 1  1  1
E     75 |                  1 1  2 2   1  3 1 1 1       21 11 1     11 1      1
D     71 |                             1                  1   11  1 113
1     67 |                11      1      1    1 2   1  2 21  11 1    1 1221  2
      63 |             2   1   1   1  2 2  1       12 1 1  2 1 11 1  1 11
      60 |             12  211 2221 1   2132125  222 111121 131223 1113
      56 |           313331  15213222211 1 112  11232 41 2241 521111 1111121
      52 |          23123 1  122322131211   713121 3219133212611 34113231 1
      48 |          122 2521113442 111 21 22 12 23311 1131       3413 2 11
      45 |-----------21--11--2111 1 2112 12211 1 1    1 1   21  1  1   11-----------
      41 |            11          1    1    1 1
      37 |                           1         1
      33 |
      30 |                                                1
      26 |
      22 |                1                                        1
      18 |
      15 |                                                1
      11 |
       7 |
       3 |                                                   1
       0 |999999499999564312231321 41214 2 1112 111122312112    1   1 1
         +-------------------------------+---------------------------------
          2       47       92      138      183      228      274      319      365
                                    DSFSH
```

The distribution of data points on this scatter graphs demonstrates that the producer is relatively consistent in following the stated VWP policy of 45 days, but some have been bred before 45 days. More detailed information on these cows should be reviewed to determine why, often these are cows that had aborted and management decided to breed them back as quickly as possible. We also get an impression that heat detection is pretty good from this graph because most animals are inseminated for the first time prior to 90 days in milk

Evaluating Heat Detection Rates

Improving heat detection rates has received much attention by the dairy industry lately. Heat detection rate generally would closely reflect the submission rate for AI breeding.

The definition of Heat Detection Rate is the percentage of cows eligible for heat, in a given time frame, which are actually detected in heat.

The voluntary waiting period obviously influences when cows are determined to be "eligible" and for dairy reproduction it is reasonable to set the time frame we are monitoring arbitrarily at 21 days.

The herd heat detection rate is a very important "rate" for every dairy producer to know. It is used to monitor how well eligible cows are submitted for AI breeding. Just as with the average days open calculation, there is no standard method within the dairy industry form making a heat detection rate calculation. Since it is such an important and common monitor, it is crucial that veterinarians and other consultants be consistent in how the calculation is made, at least for herds they are working with. The entire industry would benefit if there were a standard definition.

So, what is the correct way this parameter should be calculated? As a start, it is important to use statistical terminology correctly.

The statistical definition of rate is count of something per unit of time.

For example, some common rates we use every day are

Miles per hour
Pounds per minute

Following this logic, a true heat detection rate would be the number of be cows detected in heat per 21 days.

However, this would have two effects

Unlimited rates (for example 400 heats detected per 21 days)
This method would also prevent us from comparing herds.

To avoid these two effects when monitoring heat detection rates, the statistical definition rules about rates can be bent a little.

If we assume all cows cycle exactly once per 21 days, a cow would be "at risk" to be seen in heat once every 21 days. Another way to think of this would be that we are calculating the number of heats detected per 100 eligible cows, which means we are dealing with a proportion (a percentage).

For example, if we have 100 open cows eligible to be seen in heat, if 35 seen in heat in the next 21 days, this would calculate to be a 35% heat detection rate. This "rate" corresponds to the probability of observing a cow in heat.

We want to not only know how has the heat detection rate been for the last year, we also want to be able to answer the question, how has the heat detection rate been lately?

```
Command  : BREDSUM FOR LACT>0\E
```

Date	Ht Elig	Heat	Pct	Pg Elig	Preg	Pct	25 %	50 %	75 %	100 %
11/ 3/98	136	83	61	136	29	21	P		H	
11/24/98	146	67	45	146	27	18	P	H		
12/15/98	154	79	51	154	31	20	P	H		
1/ 5/99	153	88	57	153	31	20	P		H	
1/26/99	150	85	56	149	36	24	P	H		
2/16/99	146	79	54	145	31	21	P	H		
3/ 9/99	131	75	57	130	31	23	P	H		
3/30/99	127	69	54	127	24	18	P	H		
4/20/99	146	93	63	142	35	24	P		H	
5/11/99	149	83	55	145	25	17	P	H		
6/ 1/99	143	95	66	138	16	11	P			H
6/22/99	138	96	69	134	12	8	P			H
7/13/99	147	91	61	145	14	9	P		H	
8/ 3/99	162	100	61	162	20	12	P		H	
8/24/99	174	109	62	171	30	17	P		H	
9/14/99	181	123	67	180	48	26		P	H	
10/ 5/99	144	93	64	0	0	0	Unknown Preg status			
10/26/99	111	87	78	0	0	0	Unknown Preg status			
Total	2383	1415	59	2357	440	18	P		H	

In this herd the average heat detection rate for the past year is 59% percent. This particular herd implemented some management changes in their heat detection program at the end of March 1999. This report suggests that the new program has resulted in a 5 to 10% increase in the heat detection rate.

A review of Minnesota DHI data from 1998 showed the average heat detection rate to be about 35%.

Evaluating Conception Rate

The definition of Conception Rate is the percent of services with known outcomes, occurring in a given time frame, which result in a pregnancy.

Traditionally, veterinarians and other consultants have spent a significant amount of effort trying to improve herd conception rates. Many articles have been written stating that it important for a herd goal for services per conception rate to be 1.8, this corresponds to a conception rate of 56%. If we monitor the conception rates using all breedings with a known outcome, very few herds can achieve a herd level conception rate of 56%.

Just as with making the days open calculation, it is important to understand which animals are being included in the conception rate calculation.

It is also to always keep in mind that the ultimate goal of the reproductive program is to get cows pregnant. Conception rate is a factor is this, but it is not the end goal itself.

The 1998 Minnesota DHI data showed that the average conception rate is approximately 35% in Minnesota.

There are numerous options within the Dairy COMP 305 BREDSUM module to analyze conception rates in a herd. This is because there are many different questions one might want to ask to evaluate conception rate in a herd.

Conception Rate by Time Bred will allow us to answer the question: "What is the first service conception rate?"

```
Command  : BREDSUM FOR LACT>0\B

Summarized By Times Bred from 10/12/98 through 10/12/99
Bred Number     %Preg #Preg #Open Other Total %Tot  SPC
============== ===== ===== ===== ===== ===== ==== ====
             1    31   221   472    18   711   35  3.1
             2    25   119   342     7   468   23  3.9
             3    25    77   224    12   313   15  3.9
             4    26    53   144     9   206   10  3.7
             5    24    29    88     5   122    6  4.0
             6    21    14    50     4    68    3  4.6
             7    15     6    33     5    44    2  6.5
             8     5     1    18     4    23    1 19.0
        OTHERS    18     5    22     4    31    1  5.4
============== ===== ===== ===== ===== ===== ==== ====
        TOTALS    27   525  1393    68  1986  100  3.7
397 non-AI breedings were omitted
```

In this report the conception rate is reported in the column labeled "% Preg". This report shows that the first service conception rate for the time period of October 1998 to October 1999 was 31%.

On-farm Dairy COMP 305 and SCOUT programs allow the producer to record a breeding code at the time of insemination. This report can be used to answer the questions: What is the conception rate for the reasons that the producer has submitted cows for breeding?

Determining *why* cows are being bred allows the veterinarian to gain a deeper understanding of the breeding policies of the herd. The breeding codes available within the Dairy COMP 305 and SCOUT programs are defined by the user. This is another opportunity for the veterinarian to be involved in the management decisions of the dairy.

```
Command  : BREDSUM FOR LACT>0\O

Summarized By Breeding Code from 10/12/98 through 10/12/99
Breeding Code  %Preg #Preg #Open Other Total %Tot  SPC
============== ===== ===== ===== ===== ===== ==== ====
Chalk/Paint       16   102   519    80   701   32  6.1
Standing Heat     31   302   653   107  1062   49  3.2
Timed Breeding    14    22   131    19   172    8  7.0
ET (Dux)          48    83    87    10   180    8  2.0
OTHERS            84    16     3     1    20    0  1.2
============== ===== ===== ===== ===== ===== ==== ====
TOTALS            27   525  1393   217  2135  100  3.7
397 non-AI breedings were omitted
```

We also may what to ask the question "what is the conception rates of the different AI technicians for a dairy?" Technician information can be captured at the time of breeding and can be analyzed with BREDSUM. In addition, we may want to look at how the technicians are doing for a specific time frame. In this example, we are looking at the conception rates for the various technicians over the last 180 days.

```
Command  : BREDSUM FOR LACT>0\TD180

Summarized By Technician from  5/20/99 through 10/12/99
Technician     %Preg #Preg #Open Other Total %Tot  SPC
============== ===== ===== ===== ===== ===== ==== ====
Carla              3     1    26     5    32    2 27.0
Bo                 0     0     0     1     1    0
Sander            22    30   104    33   167   15  4.5
Rick             100     2     0     0     2    0  1.0
Mark              20    65   257    55   377   34  5.0
Sarah             28     4    10     2    16    1  3.5
Marty             15    45   242    56   343   31  6.4
Todd              19    13    54    11    78    7  5.2
OTHERS            35    25    46     8    79    7  2.8
============== ===== ===== ===== ===== ===== ==== ====
TOTALS            20   185   739   171  1095  100  5.0
113 non-AI breedings were omitted
```

Pregnancy Rate Analysis

Recently the term "Pregnancy Rate" has become a routine reproductive parameter many dairies have been looking at with their veterinarian to evaluate a herds reproductive program. The concept behind looking at pregnancy rate is good because it emphasizes how the interaction between heat detection and conception impacts the reproductive performance of a dairy.

The herd pregnancy rate is a very important "rate" for every dairy producer to know. It allows us to monitor how well we are achieving are goal of getting eligible cows pregnant. To allow us to compare herds, the entire dairy industry would benefit if there was a standard definition. But at this time, just as with average days open and heat detection rate the same term "pregnancy rate" may be defined very differently by different people.

The typical formula used is: Preg Rate = Heat Detection Rate X Conception Rate
The same statistical principles about rate that were reviewed for heat detection rates also apply to pregnancy rate.

If we assume all cows cycle exactly once per 21 days, then we can consider that an open cow is "at risk" to becoming pregnant once every cycle or once every 21 days. As soon as she becomes pregnant, she is no longer considered to be "at risk".

To help understand how pregnancy rate should be calculated, it is useful to understand how to calculate pregnancy rate for a theoretical breeding program in which all visual heat detection is stopped and all cows are synchronized and bred by appointment.

Start the program with 100 cows eligible to become pregnant, we synchronize all 100 cows so all cows are inseminated. Therefore, our heat detection rate on these 100 cows is 100%.

We then pregnancy check all the cows 35 days after insemination, and we find that 30 cows are pregnant. Therefore, our conception rate for our synchronization program was 30%.

Since the formula for pregnancy rate = Heat Detection Rate x Conception Rate, it is tempting to state that our pregnancy rate on this program was 30%. This would be incorrect.

Why? Because it took two 21 day cycles for us to get the 30 pregnancies!

On the first 21 day cycle, there were 100 cows eligible to become pregnant and 30 got pregnant. On the second 21 day cycle, there were 70 cows eligible to become pregnant but no cows became pregnant from that group.

To correctly calculate the pregnancy rate we need to consider both 21 day periods.

$$\frac{\text{(30 pregnant)} + \text{(0 pregnant)}}{\text{(100 eligible to become preg)} + \text{(70 eligible to become preg)}} = 18\%$$

If you understand this example, you can understand how the "21 day heat trial" report in Dairy COMP 305 calculates the herd pregnancy rate.

Command : BREDSUM FOR LACT>0\E

Date	Ht Elig	Heat	Pct	Pg Elig	Preg	Pct	25 %	50 %	75 %	100 %
11/ 3/98	136	83	61	136	29	21	P	H		
11/24/98	146	67	45	146	27	18	P	H		
12/15/98	154	79	51	154	31	20	P	H		
1/ 5/99	153	88	57	153	31	20	P	H		
1/26/99	150	85	56	149	36	24	P	H		
2/16/99	146	79	54	145	31	21	P	H		
3/ 9/99	131	75	57	130	31	23	P	H		
3/30/99	127	69	54	127	24	18	P	H		
4/20/99	146	93	63	142	35	24	P	H		
5/11/99	149	83	55	145	25	17	P	H		
6/ 1/99	143	95	66	138	16	11	P		H	
6/22/99	138	96	69	134	12	8	P		H	
7/13/99	147	91	61	145	14	9	P	H		
8/ 3/99	162	100	61	162	20	12	P	H		
8/24/99	174	109	62	171	30	17	P	H		
9/14/99	181	123	67	180	48	26	P	H		
10/ 5/99	144	93	64	0	0	0	Unknown Preg status			
10/26/99	111	87	78	0	0	0	Unknown Preg status			
Total	2383	1415	59	2357	440	18	P	H		

In reviewing the 21 day heat trial report in Dairy COMP 305 typically we see Pregnancy Rates in the range of 12% to 14%. In herds with "good" reproductive performance we will see pregnancy rates in the range of 18% to 22%. Very few herds have been able to maintain a yearly pregnancy rate of 25%.

Reviewing the Bredsum 21 day heat trial on a routine basis will allow the veterinarian to begin to answer the question: What is the current reproductive performance in the herd? If the recent pregnancy rate is poor, then the record analysis can easily be expanded to look at the factors the influence pregnancy rate, which are the Heat Detection Rate and the Conception Rate.

Question 2: What's the likely future performance for a herd?

After reviewing the recent trends in pregnancy rate, heat detection rate and conception rate, the veterinarian can then begin to work with the producer to attempt to predict the likely future performance of the herd. While past performance does not necessarily guarantee future performance, it can be a good place to start.

The veterinarian and producer should consider if there are any anticipated changes that are going to affect reproductive performance in the future. For example, if it is June and an extremely hot summer is likely, management should address the problems of heat stress and look for way to minimize the negative effects. Another scenario is that perhaps the farm is going to have a labor shortage problem for the next 4 months and this is going to affect the ability of the dairy to devote time and personnel to do visual heat detection. Rather than watch heat detection rates fall during the next 4 months, perhaps some consideration should be given to implementing some type of synchronized breeding program.

Question 3: What management action needs to be made to improve performance?

This is a question that should be asked by a veterinarian during every herd health visit. There are two relatively simple reports that can be generated during a herd visit to immediately have a positive impact on the reproductive performance of any dairy.

The first report to generate is a list of all the cows that have been inseminated more that 35 days ago, that still have an unknown outcome from that breeding. This a list of cows that should be palpated to determine not which cows are pregnant (because these cows were already pregnant before the palpation) but much more importantly to determine which cows are open (because these cows need management attention to become pregnant).

The second report to then generate is a list of all the cows that are past the stated voluntary waiting period and open. The only way this population of cows will even have a chance at becoming pregnant is to detect them in heat and inseminate them. The veterinarian should take this opportunity to review the herds reproductive program and policies and assist management to develop the most efficient program possible to detect these cows in heat and to inseminate them.

Summary

There are significant economic advantages for a dairy to develop an effective reproductive program. Dairy veterinarians are increasingly becoming involved in the reproductive management programs of their client herds. Routine analysis of herd reproductive records is necessary to assist the veterinarian in identifying general areas of management where interventions are possible to improve the current reproductive performance of the dairy.

The questions that the veterinary consultant should be routinely asking when evaluating a herd's reproductive program are:

- What's the current reproductive performance of a herd?
- What's the likely future performance for a herd?
- What management action needs to be made to improve performance?

References

1. Fetrow, J., Stewart, S., Eicker, S. Reproductive Health Programs for Dairy Herds: Analysis of Records for Assessment of Reproductive Performance. *In* Current Therapy in Large Animal Theriogenology, ed. R.S. Youngquist. Philadelphia, Pensylvania: W.B. Saunders Company