

Interpreting Reproductive Efficiency Indexes



IRM-5

Dairy Integrated Reproductive Management

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Introduction

Reproductive efficiency is the ability of a dairy producer to get cows bred back rapidly after calving with a minimum number of breedings per cow. Inefficient reproduction decreases profit by reducing both the efficiency of milk production and the number of available replacement heifers. Also, there may be increased breeding costs and veterinary fees. Breeding records, summarized as a reproductive efficiency index, provide the best indication of breeding problems. More importantly, indexes can give clues as to what the cause of problems might be.

Reproductive efficiency indexes are also useful to dairy producers who currently do not have problems getting cows pregnant. Trends in these indexes can be used to detect problems as they develop. Steps to correct the problem can be taken before the problem becomes more serious.

The index values for a herd should not be compared only to guidelines contained in this fact sheet, but also to index values for the state and/or county in which the herd is located. The guidelines are goals for optimal efficiency. Regional differences, such as weather, may make goals more difficult to reach for some producers. Consequently, comparing state and county index values to herd values can provide an indication of how good a job a particular producer is doing when compared to neighbors. State and/or county values can usually be obtained from Cooperative Extension Service state specialists or county agents.

The breeding records necessary for calculation of the indexes discussed in this fact sheet are:

1. Date (month, day, and year) of the most recent calving
2. Date of the previous calving for second and later lactation cows
3. Reproductive status (pregnant, open, and bred but too early to detect pregnancy)
4. Number of breedings for all cows, and
5. Date(s) of first breeding and most recent breeding if a cow has been bred more than once.

Indexes of Reproductive Efficiency

Days Open

Days Open measures overall reproductive performance for the previous 12 months. Problems with fertility (Fact Sheet IRM-10) and/or estrous detection (Fact Sheet IRM-6) increase Days Open. Projected Minimum Calving Interval is calculated by adding Days Open to the gestation length for a normal cow. It is interpreted in a manner similar to Days Open.

A small portion of cows with high Days Open usually inflates the herd's average Days Open to a small degree. If Days Open is inflated significantly by a few problem breeding cows, these cows should be culled. The culling policy for reproductive problems in the herd should be examined. Fact Sheet IRM-17 can provide a basis for understanding the costs of keeping problem breeders in the herd too long.

Current Days Open when added to a gestation length for a normal cow will not always be equal to the Calving Interval one to two years from now. Some cows with reproductive problems are culled and never contribute to the Calving Interval. This difference is usually small, unless a significant portion of the herd is culled for reproductive problems.

If most of the cull cows are removed from the herd for reproductive problems, then current Days Open plus gestation length may be larger than future Calving Interval. Of course, a serious problem exists in any herd where most of the cull cows are removed for reproductive problems. The causes of these problems should be determined by examining the indexes of reproductive efficiency as described in this IRM fact sheet.

To calculate Days Open for a herd, list for each cow the number of days from calving to:

1. Conception for pregnant cow
2. Last breeding for cows which are bred but not yet confirmed pregnant, or
3. Current date for open cows. Do not include cows that will be culled due to reproductive problems, but are still in the herd because of high milk production.

Calculate the average Days Open for the herd by adding together the Days Open for each cow and divide the total by the number of cows in the herd.

A guideline for interpreting Days Open is summarized in Table 1. A herd average of 85 days or less for Days Open indicates cows are being bred too early in lactation. Recent research has shown that the level of milk production was decreased significantly in the lactation that followed early postpartum (after calving) breedings.

Most producers are interested in overall efficiency of milk production (commercial herds) and not in obtaining large milk production records on specific cows. Some breeders of registered cattle, however, are interested in obtaining maximal milk production records on individual cows to increase the sale value of these animals or their offspring.

Days Open values between 116 and 145 Days are interpreted differently for these two types of herds. A value for Days Open of 116 to 130 Days indicates a slight problem for commercial herds, but may be adequate for breeders of registered cattle. A value for Days Open of 131 to 145 Days indicates a moderate problem for commercial herds and a slight problem for registered herds. A value for Days Open of over 145 Days indicates a severe problem for all herds.

Table 1. A List of Various Levels for Days Open and a Short Interpretation for Each Level

Level of Days Open ¹	Interpretation
Under 85 Days	Too Low
85 to 115 Days	Optimum For Most Herds
116 to 130 Days	Slight Problem for Most Herds
131 to 145 Days	Moderate to Slight Problem
Over 145 Days	Severe Problem

¹Herds with a seasonal calving pattern should use the highest value for Days Open during the last 12 months.

Actual Calving Interval

Actual Calving Interval is an indication of reproductive performance from 9 months to 2 years prior to the current date. This measure only reflects reproductive successes, however, and does not take into account reproductive failures. Cows that are culled for reproductive problems can be considered failures.

Actual Calving Interval is figured by calculating the number of months between the most recent calving and the previous calving for each cow in second or later lactation. A Calving Interval is not calculated for first-calf heifers. The Calving Interval for each cow is then added together and the total is divided by the number of cows in second or later lactation.

Actual Calving Interval should be interpreted according to the guidelines in Table 2. Producers with a herd having an Actual Calving Interval of under 11.7 months and a Days Open of under 85 Days should breed cows later in lactation for their first service to increase Days Open to 85-115 Days. Recent research indicates that milk production of herds with an Actual Calving Interval of under 11.7 months is significantly less than milk production of herds with a Calving Interval of 11.8-13.0 months.

Similar to Days Open, Calving Intervals for commercial herds are interpreted differently than Calving Intervals for herds with registered cattle. An Actual Calving Interval of 13-13.5 months should be considered a slight to moderate problem for commercial but may be adequate for registered herds. An Actual Calving Interval of 13.6 to 14.0 months is considered a moderate problem for commercial herds and a slight to moderate problem for registered herds. An Actual Calving Interval of over 14.0 months is indicative of a severe problem in all herds.

Table 2. A List of Actual Calving Intervals and a Brief Interpretation for Each Interval.

Calving Interval (Months)	Interpretation
Under 11.7	Too Low
11.8 -13.0	Optimum for Most Herds
13.0 -13.5	Slight Problem for Most Herds
13.6 -14.0	Moderate to Slight Problem
Over 14.0	Severe Problem

Days in Milk at First Service (DFS)

The average DFS for a herd is influenced by a management decision of when first breeding will occur postpartum. This earliest number of days decided upon by management (DFS Goal) varies greatly between herds. Some cows can be safely bred as early as 40 days postpartum; however, highest fertility levels usually are not reached until 60 days. Many producers breed cows at their first estrus after 45 days postpartum. These producers avoid many fertility problems by having their veterinarian palpate all cows prior to 45 days postpartum to diagnose reproductive problems such as severe uterine infections (metritis; Fact Sheet IRM-22). Breeding of cows with metritis can then be delayed until the uterine infection is eliminated and the uterus is healthy. The average DFS for a herd is influenced by when the ovaries of a cow begin to function again postpartum and the number of unobserved estrous periods.

The average DFS for a herd is figured as follows:

1. Calculate the number of days from calving until first service for all cows inseminated.
2. Calculate the average DFS for the herd by adding together the DFS for each cow and dividing the total by the number of cows inseminated.

After determining the earliest number of days postpartum that a cow can be bred in a herd (DFS Goal), the average DFS for a herd should be interpreted according to the guidelines in Table 3. Problems in herds with average DFS minus DFS Goal over 18 days can be due to cows being anestrus and/or unobserved estrous periods. A method for determining the cause of the problem is described in Fact Sheet IRM-7.

Table 3. The Relationship of Average Days to First Service (DFS) and DFS Goal to Reproductive Efficiency.

Average DFS Minus DFS Goal	Interpretation
Under 18 Days	No Problem
19 to 26 Days	Moderate Problem ¹
Over 26 Days	Severe Problem ¹

¹The cause of the problem may be due to cows being anestrus and/or to estrous periods being missed.

Services Per Conception (S/Conc)

Average S/Conc for a herd is a measure of fertility in cows which were reproductive successes and have become pregnant. Breedings for cull cows and repeat breeder cows (Fact Sheet IRM-23) not diagnosed pregnant are not included in this index.

Average S/Conc can be figured as follows:

1. Count the total number of breedings (this lactation) for each pregnant cow,
2. Add the numbers together,
3. Calculate the average S/Conc by dividing the total number of breedings by the number of pregnant cows.

Average S/Conc should be interpreted according to the guidelines in Table 4. Poor levels of fertility may be due to inaccurate estrous detection (Fact Sheet IRM-6). Accurate estrous detection may be confirmed by milk progesterone analysis (Fact Sheet IRM-9). Improper techniques for artificial insemination (Fact Sheet IRM-12) may also lead to S/Conc greater than 2.0. An examination of techniques used in artificial insemination or a refresher course could be beneficial.

Table 4. The Relationship Between Services Per Conception (S/Conc) and Level of Fertility.

S/Conc	Fertility Level
Under 1.75	Good level
1.76-2.00	Adequate Level
2.01-2.30	Moderate Problem
Over 2.30	Severe Problem

Interpreting Indexes of Reproductive Efficiency

Compare Actual Calving Interval to Projected Minimum Calving Interval (Days Open)

This comparison can indicate whether overall reproductive efficiency during the last nine months is better, the same, or worse than the herd reproductive efficiency during the previous year. To compare Days Open to Actual Calving Interval (CI), a Projected Minimum Calving Interval (PMCI) is calculated. Average Days Open is added to the gestation length, in days, for the most common breed in a herd (Ayrshire, 278 days; Brown Swiss, 290 days; Guernsey, 284 days; Holstein, 279 days; and Jersey, 279 days). This total is then divided by 30.25 days/month. For example, PMCI for a Holstein herd averaging 123 Days Open would be calculated:

$$\frac{123 \text{ days} + 279 \text{ days}}{30.25 \text{ days/month}} = 13.3 \text{ months for PMCI.}$$

Comparisons of CI and PMCI should be interpreted according to the guidelines in Table 5. Herd reproductive management does not need to be changed with improving reproductive efficiency, unless the number of missed estrous periods or repeat breeders still requires improvement. For herds with an unchanging level of reproductive efficiency, the effectiveness of reproductive management procedures should be evaluated if the value for Days Open indicates a problem exists. If overall reproductive efficiency has gotten worse during the last nine months, the effectiveness of management procedures concerning reproduction should be evaluated.

Table 5. The Relationship of Actual Calving Interval (CI) and Projected Minimum Calving Interval (PMCI) to Level of Reproductive Efficiency.

Comparison of CI and PMCI	Level of Reproductive Efficiency
CI Greater than PMCI	Improving
CI Similar to PMCI	Staying Same
CI Less the PMCI	Growing Worse

Calculate Estrous Detection Efficiency

Estrous detection efficiency can be expressed as the percentage of Heats Detected (total estrous periods when a cow was detected in estrus). The percentage of Heats Detected can be estimated by first calculating an average breeding interval for the herd and then comparing the breeding interval to Table 6. Breeding interval is the average number of days between first breeding and the insemination resulting in pregnancy. Average breeding interval, can be calculated by the following formula:

$$\text{Breeding Interval} = \frac{\text{Average Days Open}-\text{DFS}}{(\text{S}/\text{Cone}-1)}$$

An example for a herd with an average Days Open of 140, an average DFS of 2.6 would be:

$$\text{Breeding Interval} = \frac{140-75}{(2.6-1)} = 41 \text{ days}$$

Comparing the breeding interval to Table 6, 41 days corresponds to 50% of Heats Detected.

A guideline for interpreting percentage of Heats Detected is summarized in Table 7. Producers with severe problems should improve their estrous detection program (Fact Sheet IRM-6). Moderate problems may be caused by not observing estrus in certain cows. Examining records of individual cows may be useful. Anestrous cows or cows with feet and leg problems may be difficult to observe in estrus.

Table 6. An Estimation of Percentage of Heats Detected Based on Breeding Interval.

Breeding Interval (Days)	% Heats Detected
23	90
26	80
30	70
35	60
41	50
50	40
60	30

Source: Grusenmeyer, D., et al., *Evaluating Dairy Herd Reproductive Status Using DHI Records*. Washington State University, Western Regional Extension Publication, WREP 0067, 1983.

Table 7. The Relationship of Percentage Heats Detected to Estrous Detection Efficiency.

Percent Heats Detected	Level of Estrous Detection Efficiency
Under 50%	Severe Problem
50-65%	Moderate Problem
66-80%	Adequate Efficiency
Over 80%	Excellent Efficiency'

'Herds that also have a poor level of fertility (S/Conc over 2.0) should use milk progesterone analysis to determine the accuracy of heats detected.

Some herds may have excellent estrous detection efficiency yet have poor fertility (S/Conc over 2.0), suggesting a problem in estrous detection accuracy. (Cows are thought to be in estrus when they are not.) Progesterone analysis of milk samples collected on the day of breeding can be used to determine accuracy of estrous detection (Fact Sheet IRM-9).

Summary

Inefficient reproduction is costly and can be caused by different problems. Records, summarized into indexes of reproductive efficiency, are valuable tools because they can be used to identify causes of breeding problems. Indexes can also be used to spot developing problems before they become more serious. Profits can be increased significantly by most producers if breeding problems are solved.

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