

Factors Affecting Conception Rate



IRM-10

Dairy Integrated Reproductive Management

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An analysis of dairy herd records to determine the cause of low reproductive efficiency usually leads to the conclusion that problems are centered in one of the following areas: breeding policy (intentionally waiting too long after calving for first service), estrous detection efficiency (missed heats), or conception rate. The challenge is to identify the factors responsible for the problem. Only then can management changes be made to improve reproductive efficiency and herd profitability.

The purpose of this fact sheet is to identify factors that must be considered as possible causes of low conception rates. Discussion is limited to factors which can potentially lower conception rate on a herd-wide basis. Additional causes of conception failure in individual cows are discussed in Fact Sheet IRM-23 on Repeat Breeders.

Calving Conditions

In many herds the search for factors causing low conception rates begins in the calving area. Failure to provide a clean environment and (or) failure to practice good hygiene when examining and assisting cows at calving contributes to retained placentas (Fact Sheet IRM-21) and reproductive tract infections (Fact Sheet IRM-22). These disorders slow the reproductive tract repair processes and can lower conception rates, especially if they do not receive timely and effective treatment.

Post-calving Health and Reproductive Disorders

Calving and post-calving reproductive disorders seriously affect conception rates as illustrated by a study of 22 New York herds (Table 1). Seventy-seven percent of the cows were normal (never treated for a reproductive disorder after calving). Reproductive disorders in the remaining 23% of the cows were an important cause of reduced conception rates in these herds.

It is important to note that all the problem cows in these herds were treated by the veterinarian. In spite of treatment, performance was still lower than that in normal cows. Thus, the key to maximizing conception rates must lie in the **prevention** of disorders, not treatment after they have occurred.

Some evidence indicates cows suffering from metabolic disorders, like milk fever, may have a higher incidence of reproductive disorders and lower conception rates. In a second Cornell study of 33 herds, first service conception rate was lower (38%) in cows treated for milk fever than in cows not suffering from this disorder (47%). Wisconsin researchers reported a higher incidence of cystic ovaries (20%) in cows treated for milk fever than in cows that were not (4%).

To ensure that conception rates will not be limited by health and reproductive disorders, producers should work closely with their veterinarians to develop herd health programs (Fact Sheet IRM-18) that both prevent the occurrence of health problems and effectively treat those disorders which occur.

Table 1. Effect of Calving and Post-Calving Reproductive Disorders on Conception Rate¹

Disorder	Incidence	1st Service Conception Rate²
None	77%	49%
Difficult calving	1 %	43%
Retained placenta	4%	42 %
Uterine infection	14 %	36 %
Cystic ovaries	4%	35 %

¹Braun and Smith, Cornell University 1980.

²Percent of cows that were pregnant after one service.

Estrous Detection Errors

Milk progesterone analysis (Fact Sheet IRM-9) has been used recently to study the reproductive status of cows on the day they were inseminated. Progesterone levels are always low for 5-6 days around the day they are in estrus (heat). Cows are never in true estrus when progesterone is high. Thus, when progesterone levels are high in milk samples obtained on the day of breeding, the cow is not in estrus. An estrous detection error has been made and the cow has no chance of conceiving since ovulation will not occur.

The effect of estrous detection errors in a herd experiencing conception rate problems is illustrated in Table 2. Over 30 percent of the cows were not in estrus on the day they were bred. This obviously was the major cause of low conception rate.

Estrous detection errors were a problem in 30% of 467 Northeast herds that recently participated in a Cornell study. From 10 to 50% of the cows bred in these herds were not in estrus. Estrous detection errors are an individual herd problem and should always be considered as a possible cause of low conception rates.

Timing of Service

For maximum conception rate, cows should be bred at a time that will ensure that healthy, living sperm are present at the site of fertilization when the unfertilized egg arrives. Thus, to accurately "time" the insemination one needs to predict when ovulation will occur. Standing behavior is the most reliable sign for predicting when cows will ovulate and, therefore, when they should be inseminated. This is based on the fact that ovulation occurs 24 to 30 hours after the animal first stands to be mounted.

Thus, estrous detection (Fact Sheets IRM-6 and IRM-7) becomes the single most critical factor in timing the service to maximize conception rate. Frequent and accurate estrous checks are required so the time of the onset of standing estrus can be accurately estimated. Then and only then, can one inseminate at the time when fertilization and pregnancy are most likely to occur.

Other factors which influence the timing of insemination are the amount of time sperm must be in the cow's reproductive tract before they develop the ability to fertilize the egg, transport of the sperm from the uterus to the site of fertilization in the oviduct and the fertile life spans of both the sperm and the egg.

Table 2. The Effect of Estrous Detection Errors on Conception Rate

Status	Milk Progesterone	Number Bred	Conception Rate
Not in estrus	High	25	0
In or near estrus	Low	49	61%
Total	—	74	41%

R.D. Smith. Proceedings of National Invitational Dairy Cattle Reproduction Workshop, 1982.

- Sperm must be in the cow's reproductive tract for about 6 hours before they acquire the ability to fertilize the egg.
- Fertilization fails to occur when cows are bred too early or too late because sufficient numbers of sperm are not transported to the oviduct. Sperm transport is controlled by a delicate balance of hormones that is optimum only during estrus and shortly thereafter.
- Sperm cells remain alive in the cow's reproductive tract for 18-24 hours. The fertile life of the egg is 10-12 hours, but the most fertile period is the first few hours after ovulation.

When all these complicated, but critical time relationships are considered, the conclusion is that for maximum conception rates cows should be inseminated at 10-20 hours after the beginning of standing estrus. The key to success is developing an accurate estrous detection program that allows accurate prediction of when the cow started to stand.

Inaccurate Estrous Detection

One factor that can result in poorly timed insemination and low conception rates is inaccurate estrous detection. This problem usually occurs in herds that breed a large number of cows on the basis of secondary signs of estrus. The result is that many cows are near estrus but bred too early or too late in relation to the time of ovulation. The relationship between estrous signs and conception rate in one herd experiencing conception problems is shown in Table 3.

Obviously, in today's dairy herds it will not be possible to observe standing behavior in every cow. To keep the reproductive time clock on schedule, some cows must be bred based on secondary signs alone. Research at Kansas State University suggests that mounting activity is the most accurate secondary sign (46% conception rate vs 50% when standing behavior was observed). Other secondary signs yield a 34% conception rate. Using multiple secondary signs when standing behavior is not observed maximizes conception rates.

Semen Quality

To maximize conception rate, high quality semen must be placed in the cow's reproductive tract. Semen quality at the time of breeding is dependent on the quality of semen at the time it was purchased, storage conditions on the farm, thawing procedures and handling techniques (Fact Sheet IRM-11).

When semen is purchased from reputable AI organizations, quality at the time of purchase is usually assured by strict quality control procedures employed by the seller. However, semen purchased from other sources may be of lower quality due to improper handling and (or) storage and should be considered a possible cause of low conception rates.

When conception rates are lower than expected, owner-inseminators should review on-farm storage conditions, handling procedures and thawing techniques. Short-cuts or bad habits can damage semen and lower its fertility. Farmers who use professional AI technicians from reputable AI organizations usually have fewer concerns about semen quality being a major cause of low conception rates.

Insemination Technique

Faulty insemination technique (Fact Sheet IRM-12) is a major factor causing low conception rate in many herds. Correct semen placement is critical. Minnesota research indicates that the major difference between artificial insemination (AI) technicians with high conception rates and those with low rates was semen placement. Only 30% of low conception technicians deposit semen in the body of the uterus. Eighty-six percent of the technicians with high conception rates deposit semen correctly.

Table 3. The Relationship Between Estrous Signs and Conception Rate

Estrous Signs	Milk Progesterone Level	No. Cows Bred	Conception Rate
Standing	Low (in or near estrus)	163	55%
Not standing	Low (in or near estrus)	193	37%
Total	—	356	45%

Bull Fertility

Two elements must be considered when bull fertility is studied as a factor that influences conception rate: 1) the actual fertility of the bull and 2) the skill of the inseminator.

The fertility of bulls in an AI study may vary by as much as 20%. However, the majority of bulls differ by less than 10%. Therefore, the choice of AI sires usually is not a major factor in causing low conception rates, unless only the lowest fertility bulls were being selected for use. However, inseminator skill and timing of the insemination may complicate the picture in some herds.

Research shows that fertility differences among bulls can be influenced by the skill of the inseminator. Highly skilled inseminators obtain good results from bulls with a wide range of fertility. Less skilled inseminators obtain acceptable results only when high fertility bulls are used. Their results with lower fertility bulls are much lower than those obtained by highly skilled inseminators.

Research in New Zealand suggests that timing of AI may be much more critical for bulls of low fertility than for those of high fertility.

In contrast to AI, much wider variations in fertility are encountered when natural service is used. On occasion young bulls used to service heifers or cows on a "clean-up" basis are infertile and a primary cause of low conception rate.

Interval from Calving to Breeding

The results of research conducted in many states has shown that conception rates are reduced in cows bred before 50 days after calving. Conception rates increase slightly, (but only slightly) after 50 days as illustrated in data collected in Northeast dairy herds during a recent study (Table 4).

Table 4. The Effect of Days to First Service on Conception Rate

Interval to 1st Service (days)	Conception Rate
31- 50	4%
51- 60	51%
61- 70	54%
71- 80	57%
81- 90	58%
91-100	57%
Greater than 100	58%

T.J. Reimers and R.D. Smith, Cornell University, 1984.

Level of Milk Production and Nutrition

Many studies on the relationship between level of production and fertility in dairy cattle have been reported. Some suggested that the higher producing cows in a herd have lower conception rates. Other studies indicated that level of production had no effect on conception rate. The antagonism between milk production and conception rate was most extreme in a New York field study of 125 Holstein herds (Table 5).

In a more recent study of 22 New York Holstein herds, conception rate to first service decreased from 61% in cows that averaged 40# of milk per day during the first 60 days of lactation to 25% in cows producing 100# or more of milk per day. These field studies indicated that conception rates are lower, especially at first service, in high producing cows.

In contrast, data collected in research herds in Kansas and North Carolina indicated that fertility is not impaired in high producing cows.

It appears that conception rates are lower in high producing cows in some herds, but not in others. Therefore, it seems reasonable to conclude that excellent nutritional and reproductive management may effectively compensate for any negative effect that high milk production has on reproduction.

Environment

Low conception rates are observed when temperatures and humidity are high. The effect is extreme in the Southern U.S. where it is not unusual for conception rates to be as low as 10-20% during the summer. Heat stress (Fact Sheet IRM-15) on the day of breeding and the day after seems to be the cause of the conception failures which are due to fertilization failure or damage to the embryo during its very early stages of development.

Research recently conducted in Virginia suggests that lower conception rates are associated with both high and low temperatures. Studies in New York herds suggest that conception rate is lower for a period of approximately one month during the summer. The effect is usually observed in August, but sometimes in July or September. No reduction was observed during the winter in the New York herds that were studied.

To minimize the environmental effects on fertility, producers should reduce heat stress during summer by providing shade if cows are outside. Many farmers keep cows inside during the hottest part of summer days and use fans to provide a good air flow through the barn.

During winter extra attention must be given to semen handling procedures. "Cold Shock," cooling semen after it has been warmed, damages sperm and reduces conception rate. Extra care must be taken to prevent this problem during the cold winter months, especially in herds housed in free stalls.

Table 5. The Relationship Between Milk Production and Conception Rate in Holstein Herds in New York

305-day ME Milk Production	Conception Rate			
	First Service	Second Service	Third Service	All 3 Services
14,425	54	49	55	91
16,218	50	49	53	89
18,757	40	46	50	85

Spalding, Foote and Everett. J. Dairy Science 58:718-723, 1975

Age

Conception rate is generally lower in older cows. In a Virginia study conception rate remained constant (50%) during the first 3 lactations. Conception rates were 10% higher in virgin heifers and 10% lower in 4th lactation and older cows.

Genetics

Extensive research at Iowa State University has recently confirmed earlier reports that reproductive traits have very low heritability. The same study indicated that as production increased, so did days to first and last breeding, days open and conception rate. However, the effect was small; one additional day open for each 200 to 400 pound genetic increase in milk yield. The bottom line is that producers should continue to emphasize selection for milk production in order to maximize profit. Then reproductive and nutritional management must improve to ensure that reproductive performance is not impaired in high producing cows. Genetic selection for improved reproduction cannot be justified economically.

The Bottom Line

Troubleshooting conception rate problems in dairy herds is not an easy task because there are so many potential problem areas. The situation is made worse by the fact that in most herds, low conception rate is not due to a major problem in one area, but rather to minor problems in several areas. The end result is a lower than desirable conception rate as illustrated in Table 6.

Arbitrary figures for the efficiency of factors affecting conception rate are used in Table 6, but they are well within the range of experiences on dairy farms. Conception rate is estimated by multiplying the percent efficiency for each of the factors. First, note that when efficiencies are all 90% or higher, the maximum conception rate that can be expected is 65-70%. Thus when evaluating conception rate and setting goals, be realistic. It is extremely difficult in the long run to get more than 70 pregnancies out of every 100 straws of semen that are used. Conception rates of 60 to 70% using AI are excellent.

Second, notice that relatively small changes in the efficiencies of individual factors can have a major impact on overall conception rate. Achieving and maintaining high conception rates require attention to detail and doing many little things right all the time.

Table 6. Cumulative Effect of Fertility Factors on Conception Rate.

Cow Fertility	X	Estrous Detection Accuracy	X	Semen Fertility	X	AI Technique	=	Conception Rate
90		95		95		90		73
90		90		90		90		66
85		85		90		90		58
80		90		90		80		52
75		80		90		85		46

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