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The High-Producing Cow: Queen of Denial?

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Genetic selection of more productive dairy cows during the last 50 years has not come without associated disadvantages; most specifically, reduced reproductive performance. University research indicates milk production per cow has increased 218% while conception rates have declined from 66 to 40% since 1951. Examination of DHIA records from New Mexico reveals milk production per cow increased from 21,156 pounds in 1995 to 22,442 pounds during 1999. During this period, calving interval increased 18 days, days open increased 23 days and services per conception increased from 2.3 inseminations per cow to 2.6. Other researchers have reported similar trends throughout the U.S. and in other countries. However, the aggressive selection of increased milk production is not solely responsible for the demise of reproductive performance in the "modern" dairy cow. Conception rates of virgin heifers have remained at 70 to 80% during the last four decades. So, the question must be asked and answered, "Is the decrease in reproductive performance of dairy cattle due to increased milk production?" There are several managerial strategies currently implemented on dairy operations that have an impact on reproduction.

The stress of negative energy during early lactation may cause abnormal development of follicles. Most dairy operations use a 60-day waiting period prior to breeding. University research suggests that follicular development during early lactation when cows are exposed to adverse conditions, such as negative energy balance, may compromise reproduction. Beam and Butler reported that 42% of postpartum cows (40 days in milk or less) had normal ovulations, while 40% had multiple nonovulatory follicles and 18% formed cysts. The 42% of cows that had normal ovulations is similar to current conception rates on dairy farms. It has been estimated that it generally takes 60 to 80 days for ovarian follicles to reach ovulatory size. If these estimates are correct, a majority of postpartum follicles would be developed during a period of severe negative energy balance (first 60 days after calving).

Concentrations of progesterone, the hormone required for maintenance of pregnancy, may be reduced in the "modern" dairy cow due indirectly to increased milk production. Cows with increased milk yield obviously must increase their dry matter intake. Notable increases in blood flow to the liver are due to increased feed intake. Consequently, progesterone will be cleared from the body more rapidly. Research indicates that cows consuming large amounts of feed had less progesterone than cows consuming moderate amounts of feed. Without sufficient concentrations of progesterone, pregnancy will be jeopardized.

Large herd size. Recently generated USDA statistics reveal that 30% of all dairy cows are on farms with more than 500 cows. Due to the magnitude of large dairy operations, employees with little or no training in reproductive management may be coordinating the reproductive programs on the dairy. With high turnover rates of dairy employees, consistency of common reproduction protocols may be put at risk.

Change in the pattern of estrus, or heat expression. Trimberger (1948) found the duration of heat averaged almost 18 hours in dairy cows observed three times daily. Recently, researchers in Virginia reported the duration of heat averaged 7 hours in dairy cows (n = 2055 observations) continuously observed by a radiotelemetric system (HeatWatch®; Dransfield et al., 1998). Large dairies use timed breeding programs to overcome poor heat detection rates; however, conception rates often remain low. Reproductive performance will not improve with these programs if heat detection and insemination skills are inadequate.

(Please continue on page 4, under Reproductive Performance)

Production Effort Generously Sponsored By MONSANTO

Semen Handling: The Forgotten Link in Reproductive Efficiency

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As dairy herds become larger, labor efficient management strategies such as systematic breeding protocols, once-daily AI, and timed AI are more common. Unfortunately, many dairy managers and AI technicians spend little time critically evaluating semen handling. According to Dr. Phil Senger, Reproductive Physiologist at Washington State University, management of semen handling is crucial to achieving greater reproductive success. Frozen semen must be stored, thawed and handled properly to maintain sperm viability and offer the greatest opportunity to obtain optimal conception rates. It is important to realize that ***every*** successful reproduction program ***begins with proper semen handling***. Don't let semen handling be the "forgotten link" in reproductive efficiency in your herd. This article reviews the 12 steps to successful semen handling for herd owners and managers, herdsman-inseminators, and professional AI technicians.

Step 1: Locate all items necessary to thaw semen and perform AI, including tweezers, water bath and thermometer, AI gun, sheaths, scissors, paper towels, plastic sleeves, and lubricant. Work close to the liquid nitrogen tank, preferably in a clean and dry location. (Be especially careful when transporting the tank and working out of a farm truck, van or servicecart, as tanks are susceptible to damage from rough handling).

Step 2: Check the water bath temperature using a thermometer. (Also, ask your AI salesperson to check the accuracy of your thermometer with a mercury thermometer at least every two months). Most semen packaged in .5- or .25-mL straws should be thawed in water at 95 degrees Fahrenheit. Research has shown that warm water thawing of semen straws results in greater sperm survival as compared to ice water and air thawing. Generally, ice water and air thawing occurs too slowly, exposing sperm to extended thawing which allows ample time for sperm to be damaged. Warm water thawing rapidly transforms sperm, thus minimizing the time in which sperm may be injured. Although a few AI organizations recommend "pocket thawing," this method should be used ***only*** for semen processed and packaged by their system.

Step 3: Keep an accurate semen inventory including storage location. This will help you determine the location of the semen to be used without opening the semen tank, thereby avoiding a) unnecessary searching and exposure of semen to high temperatures within the neck of the tank, and b) excessive loss of liquid nitrogen. (Although new tanks may have a six-month liquid nitrogen holding time, check the liquid nitrogen level regularly. When necessary, have the tank filled with liquid nitrogen.)

Step 4: Work at or below the frost line in the neck of the tank to minimize the possibility of premature thawing of semen straws. After locating and grasping the desired cane, remove the straw with tweezers. Quickly transfer the straw to the water bath, while gently lowering the cane back into the canister, and the canister back into storage position. When thawing more than 1 straw simultaneously, do not allow straws to touch in the water bath. Research at Washington State University has shown that re-freezing occurs in straws that touch in the water bath, causing sperm injury (as seen by decreased motility) or death. The same research showed no effect on sperm motility when up to 10 straws were thawed simultaneously and not allowed to touch. A general recommendation is to thaw no more straws than can be deposited in cattle within 10 to 15 minutes. University of Idaho research investigating the effect of simultaneous straw thawing on conception rates in dairy cattle is nearly finished.

Step 5: Semen should be thawed for a minimum of 45 seconds. Use a watch or clock to monitor the time. The AI gun(s) and sheath(s) should be warmed at this time.

Step 6: Remove the straw from the water bath and dry thoroughly with a paper towel. Water will kill sperm. Cut the crimped end of the straw at a right angle, keeping the straw covered by paper towels during the process.

Step 7: As you load the straw into the gun, very quickly check to make sure you have selected the right bull. This step is merely for record-keeping purposes as the semen must be used. Some inseminators prefer to load the straw directly into the sheath. Whether you load the straw into the gun or the sheath, remember to keep the AI gun and sheath warm at all times to prevent cold shock of sperm.

Step 8: Pull the sheath over the gun and secure it with an o-ring or by twisting the sheath on the raised spiral. Be certain the straw is seated squarely in the sheath. Make sure you use sheaths made specifically for your AI gun.

Step 9: Place the AI gun close to your body to keep it warm. Pull on a sleeve, get a little bit of lubricant, a few paper towels, and quickly make your way to the cow.

Step 10: Practice good hygiene. Insert your arm into the rectum of the cow without removing manure. Utilize a paper towel to clean the cow's vulva prior to insertion of the AI gun. Gently insert the AI gun, thread through the cervix, and slowly deposit semen in the body of the uterus. If the cow moves while you are depositing semen, stop and check the location of the end of the AI gun. If necessary, reposition the AI gun and resume semen deposition. Discard waste (sleeve, sheath, straw and towels) properly.

Step 11: Keep accurate records including 1) date and time of AI, 2) cow, bull, and technician identification, and 3) type of heat signs observed.

Step 12: Conduct pregnancy examinations prior to 40 days after AI. Evaluate the success of each AI technician.

Attacking Summertime Breeding Problems

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Many think of summer as a carefree time to enjoy outdoor activities, but getting cows pregnant in the summer is no picnic for most dairy producers. With rising temperatures, cows become less active and harder to detect in estrus. When cows aren't observed in estrus and bred, they can't become pregnant. One way to overcome the challenge of finding cows in estrus is to implement an estrous synchronization program. By developing a system to breed all cows within a defined time frame after they calve, you can increase the number of cows pregnant by the end of summer.

Researchers have found that heat synchronization programs such as OvSynch work best when cows are in a certain stage of the estrous cycle, day 5 to 12 after estrus. A technique called presynchronization, referred to as PreSynch, has been developed to group cows in the ideal stage of the cycle. To PreSynch cows, two injections of PGF_{2a} are given at two week intervals prior to initiating OvSynch (Figure 1). By using presynchronization prior to the end of the voluntary waiting period, cows can be grouped so they respond optimally to synchronization programs without extending the time to insemination. An example, combining PreSynch with OvSynch and a voluntary waiting period of 70 days, is illustrated in Figure 1.

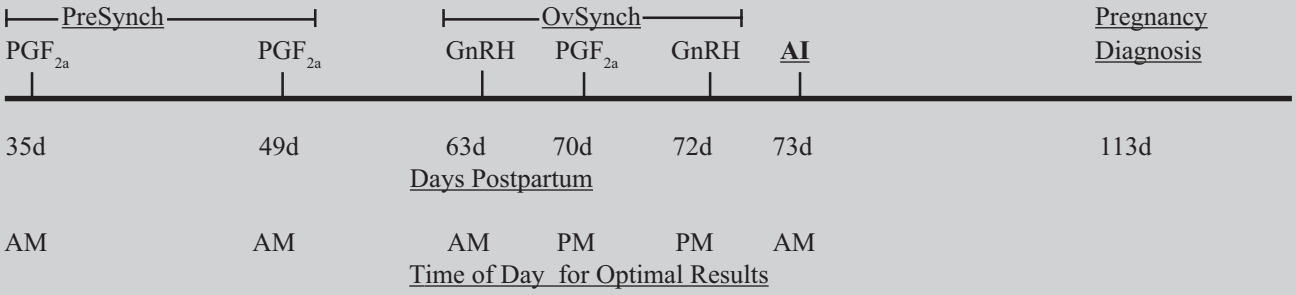
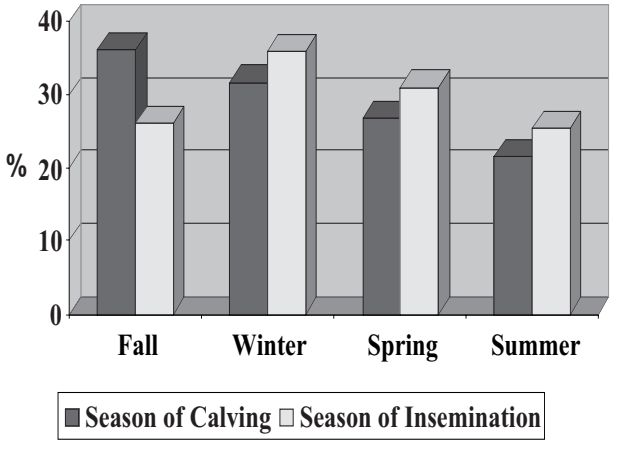


Figure 1: Example time line for coordinating PreSynch and OvSynch with a 70-day voluntary waiting period

How well do these programs work during the summer? We recently completed several year round trials using variations of PreSynch and OvSynch. Figure 2 illustrates the effect of season of calving and insemination on first cycle pregnancy rates. In this particular trial, a 60-day voluntary waiting period was used. Although numerically it appears that first cycle pregnancy rates were lower in the summer, statistically season of insemination was not significant. Season of calving did impact first cycle pregnancy rates, with summer calving cows having reduced first cycle pregnancy rates. Thus programs that allow for timed AI can over come some of the negative impacts heat stress has on reproduction during the summer. The fact that season of calving influences first cycle pregnancy rates indicates we may need to improve the environment in which our dry cows are kept during the summer.

Figure 2: First cycle pregnancy rates based on season of calving or insemination.



Many producers use synchronization programs only on problem cows. Using synchronization programs for all cows during the summer can overcome the difficulties of finding cows in estrus when the temperature soars. Advantages gained by synchronizing all cows for their first cycle insemination are maintained for many cycles. In figure 3, a survival curve is used to illustrate how programming first insemination can impact the number of cows open. In this example, a heat detection rate of 50% was used with a conception rate of 30%. The voluntary waiting period was 60 days. In the group **Synch**, an estrous synchronization program was initiated so that all cows were inseminated between 60 and 66 days postpartum. A reduced conception rate of 25% was used on this group for the first cycle, although many times conception rates don't differ. After the first cycle only visual heat detection was used. In the **Detection** group, only visual heat detection was used to find cows in estrus.

(Please continue on page 4, under Summertime Breeding)

(Reproductive Performance, continued from page 1)

Utilization of more first lactation cows in expansion herds. According to DHIA records, first lactation cows account for between 30 and 38% of all milking cows. Negative energy balance associated with high producing cows during early lactation is more detrimental to first lactation cows as compared to older cows. Negative energy balance increases the days to first ovulation and first heat in cattle.

Inbreeding: Since 1970 inbreeding in Holsteins has increased from less than 1% to almost 5%. It is estimated that inbreeding will reach 10% by 2020 (Hansen, 2000).

There are several approaches to improving reproductive performance of high-producing cows. Because management schemes commonly implemented on large dairies may negatively impact reproductive performance, a first step to improving reproductive performance is to continually examine the following components of the breeding program as well as re-evaluate all matters which support general cow health.

1) Appropriate training and continued education of personnel involved in observing and breeding cows.

2) Insure proper semen handling and insemination techniques. (Refer to Joseph Dalton's article on Semen Handling, page 2 of this newsletter)

3) Consider the economics of observing heat more frequently in the herd and breeding 6 to 8 hours after observing heat (Lucy, 2001). Breeding cows earlier than 60 days after calving should be considered if cows are in good body condition.

4) Use of reproductive drugs (i.e., PGF_{2a} and GnRH) in synchronization protocols with more frequent heat detection efforts should be considered. However, the use of these programs in the place of good management schemes will not have a positive return on investment.

5) Increase cow comfort by decreasing the time in the milking parlor and holding pen, and increasing time spent eating or resting can have a positive impact on reproductive performance. Likewise, cow health must be optimized in order to obtain acceptable performance. Metabolic and reproductive disorders during early lactation will not only decrease milk production but compromise fertility. Implement preventative transition programs to care for cows prior to and after calving, especially first lactation cows, will help boost reproductive parameters.

Increased milk yield is not solely responsible for the decline in reproductive performance in high producing dairy cows during the last 50 years. Management schemes commonly implemented on large dairies must also be evaluated and possibly revised to improve performance. Proper training of employees involved in the dairy's reproduction program can accomplish much toward successful reproduction. Similarly, stressors such as negative energy balance and transition cow problems must be minimized in order to increase pregnancy rates on dairy farms. Do not let the Queen of Denial decide the productivity of your dairy.

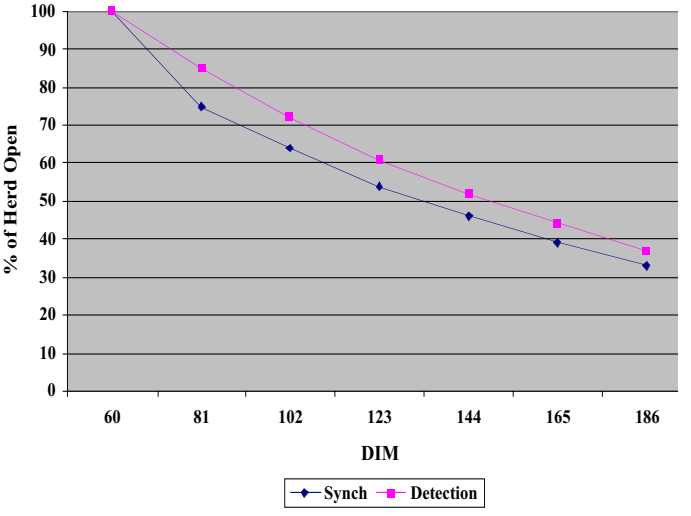
(Summer Breeding, continued from page 3)

Additional cooling for all groups of dry cows throughout the summer may reduce the negative impact of season of calving.

At 60 days-in-milk all cows were open in both groups. During the first cycle (60 to 81 days in milk) 25 cows became pregnant in the **Synch** group, while only 15 became pregnant in the **Detection** group. After 6 full cycles there was still an advantage for the Synch group despite no further intervention. Using synchronization programs to program first inseminations provides long lasting benefits. More cows become pregnant sooner.

Finding cows in estrus continues to be the biggest challenge to most reproductive programs. Implementing reproductive programs that manipulate the estrous cycle so cows can be inseminated at a defined time can improve reproductive performance even in the summer.

Figure 3: Impact of synchronization program for the first cycle with estrous detection thereafter compared to only estrous detection.



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