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THE VETERINARIAN'S ROLE IN MANAGING REPRODUCTIVE PROGRAMS

Sandra Godden, Steven Stewart, Paul Rapnicki, and Kenn Buelow
University of Minnesota

INTRODUCTION

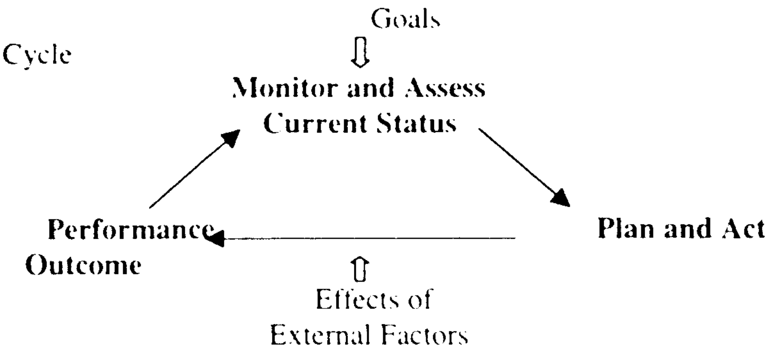
Reproductive efficiency has a major impact on dairy herd production and profitability. The economic benefits of a successful reproductive management program include increased milk yield by returning cows to the earlier, more profitable phase of her lactation, increased numbers of replacement heifers born, reduced costs of reproductive disease, reduced costs from culling, and increased rate of genetic gain (Britt J. 1985; Goodger et al., 1988). Benefits of sound reproductive management are typically optimized if individual cows achieve a calving-to-conception interval of 85-120 DIM.

The veterinarian's role in the herd reproductive management now goes far beyond traditional palpation services. Veterinary service also now calls into use skills in monitoring and herd-level analysis, management consulting, and problem solving. The veterinarian may be involved with many, if not all, of the following activities:

1) Monitoring:
   a) Monitoring current status and recent trends in herd reproductive performance
   b) Monitoring to identify 'exceptions'
2) Assist with the design of a reproductive management program
3) Provide aid in implementing the program
4) Monitor trends to evaluate success of current program and to motivate producer

These activities make up the necessary components of the health management cycle (Figure 1). If a measured parameter does not meet goals, standards, or past performance, then plans are made and action taken to improve performance. Once a result is achieved, both from the influence of the action taken and from external influences, this new status must be measured, beginning the cycle again. *This paper will review the role of the veterinarian within each of these activities and, for each, discuss the issues and options which should be considered.*

Figure 1: Health Management Cycle (from Radostits et al., 1994)



1) MONITORING

1.a Monitoring current status and recent trends in herd performance

Status monitoring simply asks: "is current performance as it should be?" This involves measuring the value of a parameter and comparing that with a goal figure (Fetrow et al., 1997). Trend monitoring involves tracking the trend or change in a parameter over time. This should allow for the rapid detection of recent important changes wherein performance is deteriorating, thus allowing for timely intervention. This should also allow for the evaluation of the nature and magnitude of a positive response to a recent management intervention, thus improving client motivation.

Selecting the appropriate monitoring parameters: *The use of inappropriate parameters can lead to inappropriate inaction (a real problem escapes notice) or inappropriate action (misdiagnosis of a problem resulting in the wrong action taken). Traditional measures of reproductive performance include average age at first breeding, average age at first calving, average calving interval, average days open, average first service conception rate, average services per conception, average annual culling rate and reproductive culls as a percent of the herd. These parameters are subject to several different problems which could lead to misdiagnosis of a herd's real situation. While others offer a more detailed discussion of these potential (Stewart et al., 1994; Fetrow et al., 1997) brief definitions are provided below:*

1) The Dangers of Averages: The use of averages, alone, may result in a failure to indicate groups of extreme outliers who require attention. In small herds, inclusion of these extreme outliers may skew the average that is calculated (effect of Variation).

2) Error of Momentum: The inclusion of historical data in calculating parameters masks or dilutes what the recent performance has been. Momentum also means that a parameter is slow to change over time. As such the parameter will be relatively insensitive at detecting recent changes in herd performance.

3) Error of Lag: Lag occurs when there is a long delay from the time an intervention or management change occurs, and when we can measure the results of that intervention. Obviously we would prefer to use parameters with as little lag as possible so that we can detect changes, both positive and negative, as soon as possible after they occur.

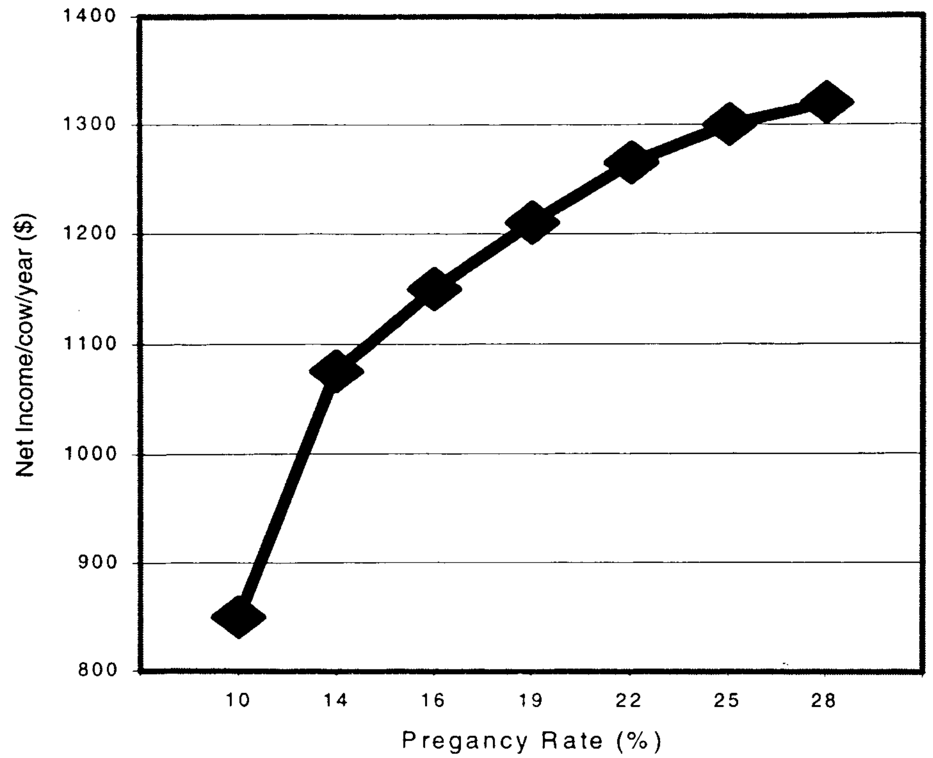
4) Error of Bias: Bias is introduced when animals or events are inappropriately included or excluded from a calculation, distorting the parameter's representation of reality.

Veterinarians should attempt to select parameters that allow for the monitoring of current status and recent trends in herd reproductive performance, while avoiding the errors of momentum, lag, and bias. Annual average days open (calving-to-conception interval) has significant momentum and lag, and is biased by exclusions of unbred cows, unknown or assumed outcomes, do-not-breed cows, and culling. While days open may be a *goal* of a reproductive program, it is less than ideal as a *parameter to monitor* recent performance. However, it is possible for us to break down days open into its separate determinant components, and then successfully use these components to monitor recent performance and recent trends or changes in performance. Days open is determined by the voluntary waiting period (VWP), the heat detection rate (HDR), the conception rate (CR), and pregnancy wastage. The HDR is the proportion of eligible cows which are detected in estrus in a given 21-day interval. The CR is the proportion of cows inseminated during that 21-day interval which become pregnant. Pregnancy rate is defined as the proportion of eligible cows that become pregnant in a given 21-day interval and is determined by the HDR and the CR (PR = HDR x CR). Pregnancy rate is improved by increasing either the HDR or the CR or both. *Rapnicki* (1999) has presented a thorough discussion of how the parameters of VWP, HDR, CR, and PR are defined, calculated, and interpreted to successfully monitor current performance and to monitor trends and recent changes over time (see Paul Rapnicki's paper in these proceedings).

Risco et al. (1998a) showed that increasing the HDR, and subsequently the PR, resulted in a greater net income per cow. This was produced through lowering the mean calving interval that resulted in increased pounds of milk per cow per year, and lower replacement rates (Table 1). The financial impact of improving the PR depends on where you start and how much of a change is made. The lower a dairy's pregnancy rates the greater the economic benefit that comes with each 1% increase in pregnancy rate. For instance, increasing the PR from 12% to 13% would yield an addition net income of approximately $77/cow/year. However increasing the PR from 18% to 19% or from 26% to 27% would only increase net income approximately $23/cow/year and $4/cow/year, respectively (Figure 2) (Risco et al., 1998a). Producers already maintaining high pregnancy rates (>25%) need to consider if additional resources should be applied to further improving reproductive efficiency, or if the same resources would be better spent on other management issues.

Table 1. Effect of heat detection rate (HDR) and pregnancy rate (PR) on net income per cow[a]

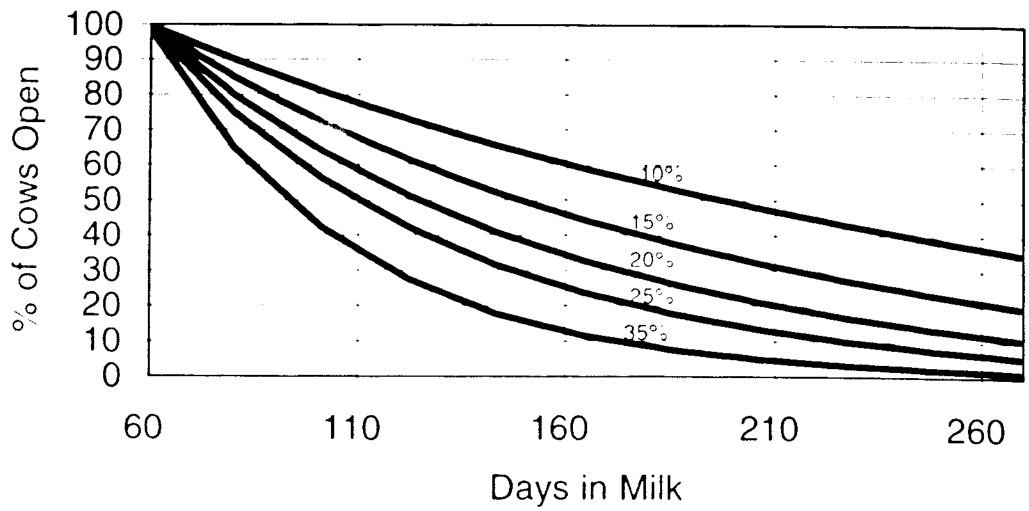
HDR (%)	PR (%)	Mean CI[b] (days)	Milk/Cow/ year (lbs)	Replacement Rate (%)	Replacement Cost ($)	Net Income/ cow/year ($)
34	11	414	20,607	44	597	837
43	14	406	21,110	38	514	1070
51	16	399	21,455	34	461	1141
60	19	391	21,810	32	426	1211
70	22	384	21,953	29	393	1265
80	26	377	22,116	28	374	1296
90	29	372	22,153	27	358	1322



[a]Assumptions: Calculations based on a conception rate (CR) of 32% and no seasonality of milk production and CR. Net milk price = $13/100 lb; Feed cost for lactating cows = $0.08/lb DM intake; Feed cost for dry cows = $1.00/cow/day; Cost of first-calf heifer replacement = $1200; Salvage price for culled cows = $0.35/lb.
[b] Calving interval. (Adapted from Risco et al., 1998a).

Figure 2. Relationship between pregnancy rate and net income per cow per year. (Riscow et al., 1998a)

Figure 3 shows the relationship between a herd's pregnancy rate and the percent of cows open in a herd with a 60-day VWP. The median days open for herds with either a 10% or a 15%



pregnancy rate are approximately 200 and 145 days, respectively. Of concern is the fact that approximately 50% and 35% of cows, respectively, are still open at 200 days in milk. If we assume 100 eligible cows in each herd, then the herd with a 10% pregnancy rate has approximately 15 more cows open at 200 days than does the herd with a 15% pregnancy rate. There is nothing biologically or pathologically wrong with the majority of these 15 cows. However, their risk of becoming reproductive culls has increased markedly. Reproductive culls contribute significantly to the cost of impaired reproductive performance.

Figure 3. Relationship between herd pregnancy rate and the percent of cows open (Stewart, S. 1999: Modified from Ferguson and Galligan, 1993). Assumes herds have a 60-day VWP and pregnancy rates of 10%, 15%, 20%, 25% and 35%, respectively.

Monitoring Reproductive Disease: *In addition to monitoring VWP, CR, HDR, and PR, there are also benefits in monitoring the incidence of reproductive disease. The incidence of retained placenta, metritis, dystocia, stillbirth, and cystic ovarian disease may be useful as indicators of dry cow, transition, and fresh cow feeding program management, calving area hygiene, and calving supervision. Abnormally high abortion rates may also indicate that investigation and action is warranted. Fetrow et al. (1997) recommended that no reproductive disease should have an incidence higher than 10% of cows per lactation.*

Monitoring Nutritional Management: Good transition and fresh-cow nutrition is necessary to minimize the risk for developing a number of metabolic diseases such as milk fever, retained fetal membranes, metritis, mastitis, ketosis, fatty liver infiltration, displaced abomasum, and ruminal acidosis. These diseases may result in lowered estrus display, lowered conception rates, and prolonged days open. Additionally, it is well documented that excessive cumulative negative energy balance between calving and 45 days postpartum will result in delayed days to first ovulation and lower first service conception rates. Butler and Smith (1989) reported that a significantly lower first service conception rates (17%) in cows which lost greater than 1.0 unit of body condition following calving, as compared to cows which lost less than 0.5 or 5-1.0 unit of body condition (65% and 53% C.R., respectively). Sound nutritional management, monitoring of dry matter intakes, cow comfort, air quality and temperature, and routine body condition scoring can indicate help minimize problems which may contribute to impaired reproductive performance.

Monitoring Culling Rates for Reproductive Failure: *Fetrow et al. (1997) suggested that no more than 8% of cows should be culled for reproductive failure per lactation. Higher culling rates may suggest impaired reproductive management or an attempt to cull, rather than manage, one's way to an unrealistic goal for overall reproductive. However, culling information should be interpreted with caution. It is well understood that the reasons for culling reported by producers may not always represent the true reason for departure (Fetrow, 1988; Kelton and Lissemore, 1997). For example, if the manager decides, after 3 unsuccessful inseminations, to stop breeding a low-producing cow that is 200 days in milk with a chronic high somatic cell count, is she truly a reproductive cull? Despite these concerns in classification, if culling for reproductive purposes seems high, this may warrant a discussion of the real reasons for culling on an individual-animal basis.*

Recording and analyzing the data: *Monitoring current reproductive status and recent trends requires that the producer collect and record all pertinent reproductive event data including calving dates, disease events, heat dates, breeding dates, pregnancy outcomes, abortion events,* *and culling information. It is perhaps the first job of the veterinarian to educate the producer as to the importance of monitoring as the critical first step in a successful reproductive management program, motivating them to record the necessary data. The processes of recording this information and then of manipulating the data for the purpose of calculating and then reviewing the desired parameters has been made rapid and efficient through the use of on-farm computer software programs.*

1.b Monitoring to Identify 'Exceptions'

The veterinarian can benefit the producer not only by monitoring general herd status and trends, but also by monitoring to identify those individual cows whose performance is substandard and for which action can be taken. Table 2 shows the hypothetical breakdown of a 100-cow herd by reproductive status. The cows that are best in a position to benefit from some intervention are those in categories 3 and 4.

Table 2. Common distribution of cows by reproductive status in a hypothetical 100-cow dairy (Fetrow et al., 1997)

Group	Reproductive Status	Cows (n)
1	Do-not-breed	3
2	Fresh: (DIM < VWP)	15
3	Open, not yet bred	10
4	Bred, not yet confirmed pregnant	15
5	Pregnant, milking	42
6	Pregnant, dry	15
	Total	100

Monitoring for exceptions may be accomplished efficiently through the use of computerized records, and may be presented in the form of counts, graphic distributions, or action lists (Fetrow et al., 1997). Monitoring for exceptions may serve two purposes on the dairy. First, once these exceptions are identified action can be taken to manage these individual animals. For instance, by routinely generating a list of cows bred greater than 35 days, the veterinarian can proceed with the action of palpating for the purpose of finding open cows, that they may be returned to the group of cows eligible to breed as soon as possible. By routinely creating a list of cows past the VWP and not yet bred, the veterinarian and producer can act by placing these animals in a previously designed program designed ultimately to get semen into these cows.

The second purpose behind monitoring for exceptions is that it may serve to point out a systematic failure in the current herd reproductive management program. For example a scatter graph could be created showing the DIM when cows were first bred (vertical axis) plotted against the days since freshening (horizontal axis). The graph includes all living cows in the herd as well as any cow that was culled or died within the last year. Using a hypothetical herd, one might learn from this graph that the minimum VWP for some individual cows (exceptions) was as low as 35 DIM even though the general VWP is between 50-60 days. It might also be noted, even though the stated the goal for DIM at first breeding is about 70 days, that most of the herd is bred for the first time after this goal (e.g. 100 days or more). Review of this type of information might serve to generate discussion and an investigation with the producer as to why cows are being bred too soon or too late. The result of this process might be a change in herd policy and the design and implementation of a herd-level routine reproductive management program designed to correct the problem.

2) ASSIST WITH THE DESIGN OF A REPRODUCTIVE MANAGEMENT PROGRAM

The herd veterinarian should understand the goals, skills, and resource limitations of an individual producer. As such, the veterinarian is in a position to recommend practical cost-effective reproductive management programs that are uniquely tailored to meet the goals and requirements of that particular producer. What works well in one herd may not be successful in another. Keeping in mind that the end goal is to improve pregnancy rate, two important areas where the veterinarian can have a positive influence is in identifying the exceptions (individual animals requiring some kind of management intervention) and by recommending and helping develop a program to improve pregnancy rates.

2.a Identifying the 'Exceptions'

One of the most useful things we can do for our producers is to regularly identify cows with "semen deficiency". This group of cows includes all cows eligible to inseminate (past the VWP) and either not yet inseminated or determined to be open from a previous insemination. Once identified, these animals may be included back into the routine herd breeding policy (e.g. added to the list to receive prostaglandin injection on the next 'prostaglandin day') or action may be taken on a cow-to-cow basis.

2.b Improving Heat Detection

Parameters we can manipulate to influence reproductive performance include VWP, HDR and CR. Of these, we have a much greater ability to change HDR than we do CR. Thus, manipulating HDR will have the greatest potential overall impact on reproductive performance. The best program for achieving a higher HDR depends on the skills and resources of each individual producer. A variety of technologies and programs have been developed which are designed to improve PR by improving the HDR and accuracy of heat detection.

Heat Detection Aids: In addition to the traditional method of observing animals for signs of estrus activity, several other heat detection tools are available. These include Kmar patches, tail paint or chalk, electronic pedometers, electronic patches, androgenized (teaser) heifers, and use of natural service bulls. The considerations for using natural service bulls will be discussed in another paper and so will not be discussed here (See Dr. Kenn Buelow's paper in these proceedings). Most of these methods are designed to increase the efficiency and accuracy of heat detection and, for some, reduce or eliminate the amount of time and labor spent observing animals for estrus activity. This may be particularly attractive in larger herds, and in herds wherein staff lack heat detection skills or lack adequate time for traditional heat detection by observing animals.

Estrous Synchronization programs and Timed Insemination Programs: A variety of programmed breeding programs, which use hormone injections, have been developed which offer several advantages over traditional heat detection programs. Producers may consider including one of these programs in the herd reproductive management program in one of two basic ways. The greatest potential improvement in pregnancy rate may occur by increasing the proportion of cows that are inseminated during the first estrous cycle upon reaching the voluntary waiting period, from the average of 35-40% of cows that are currently being detected to a heat detection rate of 100% of the cows. A herd might use estrous synchronization for the first insemination for all animals that reached the VWP and then use conventional heat detection for all subsequent inseminations. A second way in which producers may choose to use estrous synchronization or timed insemination programs is as follows: Conventional estrus detection and breeding may be used for the first 21 days or so after the VWP. A programmed breeding program will then only be used for individual "exception" cows which are detected to be beyond a certain number of DIM and not yet inseminated. Thus, the program would ensure that no cow goes beyond a certain number of days without being inseminated. A brief review of the various estrous synchronization programs and timed artificial insemination (TAI) programs are presented below:

Estrous synchronization programs with heat detection: Numerous programs have been designed based on the luteolytic action of prostaglandin ($PGF_{2\alpha}$ or its analogues). After reviewing several different schedules, Ferguson and Galligan (1993) concluded that $PGF_{2\alpha}$ was used most efficiently when used on a 14-day application program with selection based on the VWP and reproductive status. Injected cows are observed and inseminated if estrus is observed in the 1-7 days post-injection. If not inseminated, cows are scheduled for a second injection at the next scheduled application (14-day injection interval). If a poor response rate follows the first $PGF_{2\alpha}$ treatment (i.e. more than 50% of the treatment group do not show estrus) then sources of program failure should be investigated. Causes of program failure could include anestrus cows due to inadequate nutrition, poor display of estrus due to lame cows, poor footing conditions, housing, or environmental temperature, or poor estrus detection by the producer (Hurnik et al., 1975; De Silva et al., 1981; Staples et al., 1990; Vailes and Britt, 1990).

Protocols using $PGF_{2\alpha}$ injections have several advantages over traditional methods of simply observing cows for signs of estrus. First, they shorten the inter-estrus interval, ensuring that almost all cows should receive their first insemination within 21 days of passing the VWP. Also, by synchronizing the estrus periods of a group of cows within a 7-day period, these programs improve the display of heat by cows in estrus and allow producers to plan for and focus heat detection activities during a 2 to 6 day window every 2 weeks. Conception rates are not different in cows synchronized using $PGF_{2\alpha}$ and then bred on signs of estrus, as compared to cows bred on a natural heat (Moody and Lauderdale, 1977; Seguin, 1978). After considering numerous and varied assumptions involving ovulation rates, conception rates, losses associated with an extra day not pregnant, semen costs, and $PGF_{2\alpha}$ costs, Fetrow and Blanchard (1987) concluded that, in almost all cases, it is more profitable to use $PGF_{2\alpha}$ to induce estrus in dairy cows than it was not to use $PGF_{2\alpha}$ and breed on natural heats.

One disadvantage of the $PGF_{2\alpha}$ programs is that the synchrony of estrus and ovulation is not tight enough to allow for timed artificial insemination (TAI) (Stevenson et al., 1987). Thus, $PGF_{2\alpha}$ estrous synchronization programs still require that estrus detection be performed after the injections have been given. After considering a variety of assumptions involved with using $PGF_{2\alpha}$ to synchronize estrus, Fetrow and Blanchard (1987) concluded that, under most circumstances, it is more profitable to have the cow bred on detected estrus rather than using timed insemination.

Estrous synchronization programs with timed artificial insemination (TAI): The last few years have seen the development of other estrus synchronization protocols which use injections of gonadotropin-releasing hormone (GnRH) in combination with a $PGF_{2\alpha}$ treatment so as to result in the synchronizing of follicular growth with luteolysis, thus allowing for timed artificial insemination (TAI). Eligible cows are injected with GnRH, or one of its analogues, followed by $PGF_{2\alpha}$ treatment 7 days later. A second injection of GnRH is given 48 hours after the $PGF_{2\alpha}$ injection. Animals are artificially inseminated approximately 16 to 20 hours after the second GnRH injection (10 to 14 hours prior to ovulation). Pregnancy rates (conception rates) for the Ovsynch^R program have been reported to average between 30 and 35% (Pursley et al., 1997a; Pursley et al., 1997b; Thatcher et al., 1998).

It should be noted that 10% of cows will express estrus within the first 36 hours after the $PGF_{2\alpha}$ injection. These cows should be inseminated at detected estrus and do not need to receive the second GnRH injection. (Risco et al., 1998b). Within a few hours of receiving the second injection of GnRH, however, cows cease to display estrus as serum progesterone levels begin to rise. The result is that fewer cows will "feel" like cows that are in estrus to the inseminator. The veterinarian should prepare the producer and/or inseminator for these expected observations. It should also be noted that the Ovsynch^R program is not effective at synchronizing ovulation in heifers (Pursley et al., 1997b).

Risco et al., (1998c) used data from a different study (*from* de la Sota et al., 1998) to estimate that use of the Ovsynch^R program yielded an increase in net revenue of $117.93/cow, as compared to cows which received a single injection of PGF, followed by insemination upon detection of signs of estrus. However, using an indirect modeling program, Risco et al., (1998c) estimated that the increase in net revenue was only $17.24/cow. Although more research is required to evaluate the economic differences between various programs, these limited findings suggest that the Ovsynch[R] program may be a profitable alternative for managing large commercial dairy herds in which heat detection rates are less than optimal.

Newer estrous synchronization programs, not yet extensively evaluated, continue to be developed which are typically variations on the Ovsynch[R] program:

Presynch Program: Thatcher observed that cows which were between days five and twelve of the estrous cycle when the Ovsynch[R] program treatment was initiated, had higher pregnancy rates than did cows at other stages of the estrous cycle. By placing two injections of $PGF_{2\alpha}$ 26 and 14 days prior to the first injection of the GnRH in the Ovsynch[R] program, the majority of cows were between days 5 and 12 of the estrous cycle at the time of the first GnRH injection. Thatcher et al. (1998) reported that the pregnancy rate for 260 cows treated with this "Presynch" program was 46.9%, as compared to 37.7% for 274 cows treated with the Ovsynch[R] program.

Modified Target Breeding Program: Pharmacia and Upjohn have developed an estrous synchronization program which is initiated by a $PGF_{2\alpha}$ injection followed by an injection of GnRH 14 days later. Seven days after the GnRH injection a second injection of $PGF_{2\alpha}$ is given. This is followed by a 72 to 80 hour period during which cows are bred based on observed signs of heat. All cows not already inseminated receive a timed artificial insemination following this 72-80 hour observation period (Ogburn, W. 1999. Personal communication). This program offers the flexibility to allow for a second injection of GnRH 48 hours after the second $PGF_{2\alpha}$ injection, for the producer who prefers an exclusive TAI program with no heat detection involved.

2.c Considerations in planning, using, and evaluating estrous synchronization and controlled breeding programs

Monitoring success: With traditional breeding programs which emphasize heat detection, one measure of success has been the palpation pregnancy rate (e.g. deemed successful when 85% or more of cows presented for pregnancy diagnosis are pregnant). However, with controlled breeding programs that don't use heat detection, this measure of success is no longer applicable. More cows will be inseminated and become pregnant earlier in lactation. However, more cows will be presented for veterinary palpation, and greater than 50-60% of these animals will likely be diagnosed as being open. This may, at first, appear to the producer as though the program has failed when, in fact, these results should be expected. The producer needs to have a good understanding of these expectations prior to the program's initiation. Different monitoring parameters, such as pregnancy rate (discussed previously), will need to be used to monitor success in these types of programs.

How to follow-up and re-inseminate open cows? Although the Ovsynch[R] program is very successful in getting cows inseminated for the first time, the producer and veterinarian planning the program must consider how open cows are going to be identified and re-bred. This is often not well thought out before many controlled breeding programs are initiated. If open cows are not to be resynchronized, then they will need to be placed back into a more traditional breeding program, with or without the use of prostaglandin, which requires heat detection. If the producer is a poor heat detector and/or is not aware that heat detection activities will need to maintained for these open cows, then they may fall through the cracks, resulting in frustration and an apparent 'failure' of the program. Thus, the veterinarian and producer will need to have discussed and decided upon the plan to be implemented for those cows found open following initial breeding.

Although they have not been well studied, a couple of alternatives are available for re-synchronizing open cows to the controlled breeding program, allowing for re-insemination without the need for heat detection. One alternative is to identify open cows at approximately 32 days post-breeding, either by veterinary palpation or ultrasound exam, and then resynchronize them to the Ovsynch^R program, starting with the first GnRH shot on day 32 post-breeding. If it is not practical to accurately determine pregnancy status this early, then an alternative plan might be to inject all bred cows 32 days post-breeding with the first GnRH injection. Then, only those cows found to be open by veterinary palpation during the following 7-day period would proceed to be injected with the 7-day $PGF_{2\alpha}$ injection on day 39, the second GnRH injection 48 hours later, and finally be time bred 16-20 hours after the second GnRH injection. Spreadsheet analysis compared this latter scenario to the scenario of waiting to palpate for pregnancy at 39 days post-breeding before re-initiating the Ovsynch program on only the open cows (Godden and Stewart, 1999: unpublished). After varying the costs of GnRH, anticipated pregnancy rates, and the cost of an additional day open, spreadsheet analysis indicated that it was almost always economically preferred to begin the resynchronization process for all cows at 32 days post-breeding, and then later identify and exclude the pregnant cows, as compared to waiting a further 7 days to identify and then exclude the pregnant cows from the first GnRH injection. Breakeven analysis showed that the cost of an additional day open had to drop to below \$0.32/day in order for producers to save money by waiting the additional 7 days before re-initiating the Ovsynch program in only the open cows. While this spreadsheet was reasonably simple to generate it was a very useful tool in yielding information to help with decision making. Veterinarians can develop and use similar tools to compare options and address 'what if' scenarios relating to many herd management issues.

What program is the herd currently using? Veterinarians should be aware that producers may be using a multitude of variations of controlled breeding programs. For example, a producer who claims to be using the Ovsynch^R program may in fact be using the protocol: 1) on all animals for all inseminations, 2) only for first inseminations, 3) only on the occasional repeat breeder cow, or 4) They may be using traditional methods of heat detection and insemination early on after passing the VWP and then using the Ovsynch^R program as a safety-net to catch any cows which reach a certain days in milk without having been inseminated (i.e. as a way to manage the "exceptions"). Veterinarians should understand how a program is being used before trying to evaluate whether or not it has been successful.

3) PROVIDE AID IN IMPLEMENTING THE PROGRAM

Once a heat detection and/or estrus synchronization programs has been designed the job has only just begun. These programs must be easy to implement and maintain or producers will stop using them. Lists of cows eligible for breeding, eligible for injections of $PGF_{2\alpha}$ and/ or GnRH, and eligible to palpate for pregnancy must be easily generated on a weekly or biweekly basis, as needed. Records must be maintained documenting which cows received injections or were inseminated, and the outcome of each insemination (pregnant or open). Cows found to be open to a previous insemination must be added back to the list of cows eligible to inseminate. And finally, records must be maintained which will allow monitoring of the success of the program. All of this must be done in an accurate, simple, and quick (labor efficient) manner. Fortunately, herd management software programs are available which can help to facilitate this process including scheduling tasks, creating lists of animals eligible for heat detection, hormone injections, or insemination, allowing rapid batch entry of events to cow records (e.g. hormone injections), and allowing rapid and timely assessment of the parameters used to monitor the performance of the reproductive management program. The veterinarian who is familiar with these programs can be extremely helpful by assisting the producer in determining the criteria for including cows on the various lists, by helping to create a regular schedule for events, and by training the producer and personnel on how to carry out the various required tasks including generating lists, heat detecting, injecting cows, semen handling, insemination technique, and recording injection or insemination events.

4) MONITOR TRENDS TO EVALUATE SUCCESS OF THE CURRENT PROGRAM AND TO MOTIVATE THE PRODUCER

With this step the herd management cycle has come full circle (Figure 1). Regular review of changes and trends in herd performance parameters (previously discussed) is necessary to determine whether the reproductive management program in place has been successful, and whether further improvement would benefit the producer. Your continued interest in herd performance and the careful selection of monitoring parameters which allow for timely and accurate feedback will help to motivate the producer further.

SUMMARY

Veterinary service for managing reproductive management programs in dairy herds has progressed beyond traditional palpation services, now requiring additional skills in monitoring and herd-level analysis, management consulting, and problem solving. Specific activities include the monitoring of current status and recent trends in herd reproductive performance, monitoring to identify 'exceptions', consulting in the design of reproductive management programs, aiding in the implementation of those programs, and following up changes with continued monitoring of performance and trends over time, both to evaluate the success of current program and to motivate the producer.

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