Trouble-Shooting Reproduction Issues

Jocelyn Dubuc

Faculté de médecine vétérinaire, Université de Montréal, St-Hyacinthe, QC
Email: jocelyn.dubuc@umontreal.ca

Take Home Messages

- The best metric to quantify the overall herd reproductive performance is the pregnancy rate. In Holstein herds, it should be ≥ 25%.
- When the pregnancy rate is below expectation, the first step is to look at the insemination rate. In Holstein herds, it should be ≥ 61%.
- An insemination rate below expectation is generally associated with a long interval between calving and first insemination, poor heat detection, a nonpregnancy diagnosis that occurs too late or a long interval between a nonpregnancy diagnosis and the subsequent re-insemination.
- If the insemination rate is appropriate, the next step is to look at the conception rate of the herd. In Holstein herds, it should be ≥ 42%.
- If the conception rate is below expectation, it is important to determine if it affects all inseminations or only the first insemination. Common causes affecting all inseminations can include poor hormonal protocol compliance, poor insemination technique and semen handling, elevated milk urea nitrogen, and infectious diseases. Common causes affecting only the first insemination can include a high prevalence of postpartum diseases (hyperketonemia, endometritis, prolonged anovulation) and poor hormonal protocol compliance.

Introduction

Dairy producers know that efficient reproduction management is important to maximize productivity and profitability of their herd. Although the mathematical demonstration of this relationship can be complex, one of the main benefits resulting from efficient reproduction management is the reduction of days open, because they are costly.

On a daily basis, reproduction management can be done by a dairy producer at two different levels. The first level is the individual management of each cow. In other words, the farmer will make decisions regarding a cow in order to optimize specifically her performance. For example, a cow is diagnosed open by a veterinarian at the herd health visit and a strategy to rebreed her will be implemented to maximize her chance of becoming pregnant. It could be based on individual characteristics of this cow such as having or not having a corpus luteum.

The second level involves making decisions at the herd level (or group level). In other words, herd-level strategies will be established to improve the group performance although sometimes some cows might not benefit from it. For example, a cow is diagnosed open by a veterinarian at the herd health visit and she is automatically enrolled in an ovulation synchronization protocol (e.g., Ovsynch) no matter what structures she has on her ovaries. This strategy is implemented on this farm to organize and facilitate farm staff work. Although it depends on what day of their estrous cycle the cows are at, most cows will benefit from this strategy (i.e., have a high chance of conception) but some will not (if they were at a specific time in their cycle when they will not optimally respond to the synchronization protocol).

Although it may seem counter-intuitive, doing all you can to maximize the performance of each individual cow does not always lead to good herd-level performance. In reproduction, maximizing cow-level management generally implies maximizing the chance of conception of each cow. The potential problem with this approach is that sometimes producers might choose to delay insemination in order to obtain a potentially better conception probability. It may seem like a good idea for this cow to wait for the perfect time to breed her and optimize her probability of conception. However, not breeding her for many days will give you zero chance of conception. This will likely result in an increase of days open for this cow. This is probably not a big deal if you only do it for her, but it will soon be costly if you apply this strategy to a certain proportion of cows in your herd.

When troubleshooting reproduction issues in a herd, it is important to use herd-level metrics to focus on problems that affect a large proportion of cows. In other words, if a cow is having a reproduction problem, she will not be the cause of your low pregnancy rate at the herd level. Something else is going on. If we look at it the other way, it can also imply that a herd with an excellent pregnancy rate may have some cows that are still not pregnant at 300 days in milk (DIM).

Although troubleshooting reproduction issues may sometimes seem complex, one should keep in mind that some problems are common in your region and some others are less frequent. Therefore, the first focus of your investigation should be based on common causes instead of focusing on the not-so-frequent causes.

▪ What Metrics to Use to Assess a Herd Reproductive Performance?

The best metric available to quantify the reproductive performance of a herd is the pregnancy rate (PregR). This metric is commonly used on farms and can be computed on a 21-day basis, a monthly basis or a daily basis. Most software programs used for daily management on Canadian farms provide a PregR and their calculation is relatively similar. The PregR refers to the proportion of cows that became pregnant out of all the cows eligible for pregnancy during a certain time period. All cows that have completed the voluntary waiting period and that are not yet pregnant or do not have a ‘do not breed’ status will be computed as eligible cows for pregnancy. Globally, the PregR reflects the speed at which eligible cows become pregnant over time.

If you only have one number to look at to figure out if your herd reproductive performance is good or not, it has to be the PregR because it reflects the overall performance. A good farmer always knows his average bulk tank milk production per cow. The same holds true for somatic cell count. I highly recommend adding the PregR to this list of unavoidable numbers.

Other important metrics in reproduction management are the insemination rate (InseR) and conception rate (ConcR). The InseR refers to the proportion of cows that were inseminated out of all the cows eligible for pregnancy during a certain time period. This metric reflects the speed or intensity of insemination within the population of eligible cows. The ConcR refers to the proportion of cows that became pregnant out of the all the ones that were inseminated during a certain time period. It reflects the proportion of success at insemination. To investigate further, the ConcR can be stratified to look at conception rate at the first insemination (ConcR1st) or at the second insemination or more (ConcR2+).

▪ Investigation Steps

The purpose of the current manuscript is to provide some guidelines to investigate reproductive performance in a herd. To help you when troubleshooting your herd, I have some suggestions of questions to look at. This approach is designed to help identify the common causes of reproductive problems and not to summarize all the potential causes. These questions should help you figure out the main bottlenecks in your herd and give you some insights on potential solutions. Make sure to discuss with your veterinarian and other advisors to validate that this approach is relevant for your herd. It may need to be adjusted based on your location in the country. Many numerical objectives will be presented over the next pages; these targets are based on what research suggests or on what the best herds can generally achieve. Keep in mind that these numbers are only suggestions and are based on Holstein herds.

Question 1: Is your PregR ≥ 25%?

The PregR is the overall reproductive performance metric, so it is the one to look at first. Based on currently available data in Québec, the median PregR rate was 18% in 2018. It must be similar in the rest of Canada because it has been in previous years. The median PregR has been increasing steadily in Québec and Canada over the last decade. Top herds will generally have PregR between 30 and 35%.

If your herd's PregR is below 25%, it means that there are opportunities for improvement. Two main metrics can guide you to identify the bottlenecks in your herd: InseR and ConcR. The first one informs you on the intensity of insemination whereas the second one informs you on the success of these inseminations. Because cows need to be inseminated to become pregnant, it is logical to look into InseR first.

Question 2: Is the InseR ≥ 61%?

If your herd's InseR is below 61%, it means that the intensity of insemination in eligible cows could be improved. Based on currently available data in Québec, the median InseR rate was 45% in 2018. It must be similar in the rest of Canada because it has been in previous years. The median InseR has been increasing steadily in Canada over the two last decades; this increase is largely responsible for the PregR increase over the same time period. Top herds will generally have InseR of 70% or more.

Four key points to get a high InseR include:

- Early insemination after the end of the voluntary waiting period
- Good heat detection
- Early identification of nonpregnant cows after last insemination
- Short interval between diagnosis of nonpregnancy and subsequent insemination

The first key point ensures that no time is lost at the end of the voluntary waiting period. The three other key points ensure that cows that did not become pregnant at the insemination will be identified early and re-inseminated quickly.

Question 3: Is the average days in milk at first insemination ≤ 66 days?

This question helps to figure out if cows are bred early enough after the end of the voluntary waiting period. Similar to any plot graph interpretation, two important things need to be investigated while looking at the graph: 1) the average (or central tendency), and 2) the dispersion of the dots. Ideally, the average of this metric would be low and the dispersion of cows would be homogenous (similar between cows). If it is heterogenous (largely different) between cows, it may imply that the potential gain could come from avoiding to have a certain proportion of cows that are inseminated late or very late.

In Québec, the average DIM at first insemination is 72. Top herds will manage to have all of their cows inseminated within 21 days (a cow cycle) after the end of the voluntary waiting period. For instance, a herd with a 50-day voluntary waiting period would imply that all the cows are bred for the first time no later than 71 DIM, which would likely lead to an average of 60 DIM at first insemination.

The following plot graph (Figure 1) is an example of an opportunity for improvement in a herd. Two problems can be observed. The first one is that all cows are inseminated for the first time after 80 DIM, which can be considered late. The second one is that 53% of cows (8/15) are inseminated after 100 DIM, which is considered very late. Some solutions could be: 1) find ways to avoid cows being inseminated for the first time after 100 DIM (the use of ovulation or estrus synchronization protocols could help, and 2) start inseminating all cows as soon as 50 DIM to reduce the proportion of cows being inseminated late or very late.

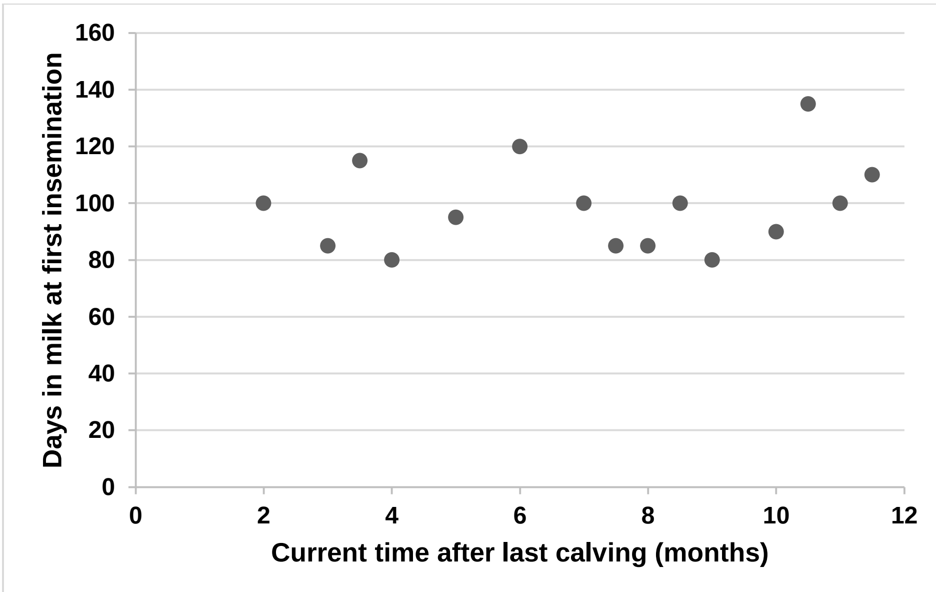

Figure 1. Plot graph of days in milk at first insemination of a herd (each dot represents a cow)

Question 4: Is the average interval between inseminations ≤ 36 days?

This question helps to figure out if cows that are not pregnant after the insemination will be identified early enough to minimize unproductive days. Again, the plot graph (Figure 2) can be looked at to investigate the average and the dispersion. All dots before 30 days after insemination generally reflect the intensity of heat detection by farm staff. After 30 days, the dots reflect the intensity to diagnose open cows and re-inseminate them in a timely fashion.

In Québec, the average interval between inseminations is 42 days. Top herds are generally able to get this interval to 30 days or less.

Figure 2 shows a herd with some opportunities for improvement. Only 23% of the cows (7/30) were re-inseminated before 30 days, likely by heat detection. This might be improved by promoting heat detection through the use of activity monitors or pedometers for instance. The dispersion of dots is quite large (up to almost 70 days), which could reflect that cows are not diagnosed open early (number of days after insemination at which cows are examined by veterinarian) or frequently (frequency of veterinary visits). It could also reflect that cows are diagnosed open early but there is a long delay between this exam and the subsequent re-insemination. Such a situation could be caused by a farmer who wants to wait for the next heat or by prostaglandin injections that did not result in cows being seen in estrus over the next couple of days. The use of ovulation synchronization protocols in such cases might be useful.

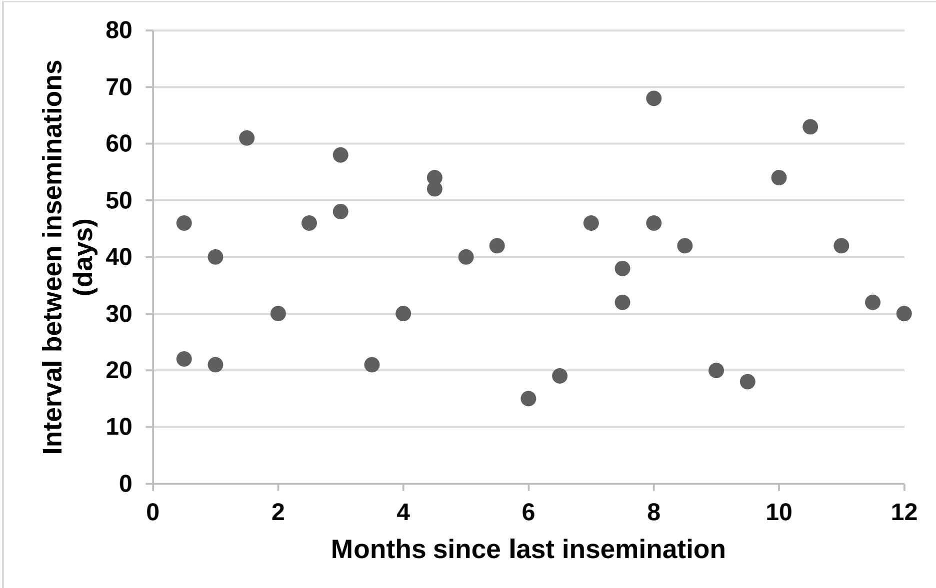

Figure 2. Plot graph of interval between inseminations of a herd (each dot represents a cow)

In summary, for a herd that has a PregR below 25%, the last questions were designed to identify if the InseR is low and what may cause such a situation. In cases where the InseR is ≥ 61%, the intensity of insemination is high; thus, it is likely that the problem comes from a low ConcR.

Question 5: Is the overall ConcR ≥ 42%?

If your herd's ConcR is below 42%, it means that the success of the insemination could be improved. Current Québec data suggest that the median ConcR was 38% in 2018. It must be similar in the rest of Canada. Although it has been slowly increasing over the last decade, the magnitude of this increase remains small compared to the InseR increase over the same period of time. Top herds will generally have ConcR at 45% or more.

Question 6: Is ConcR1st similar to ConcR2+?

If the overall ConcR is low, you must figure out if it is because it affects only the first insemination or if it affects all inseminations. When it affects all inseminations, the causes involved are likely to be different from a situation where the decrease in ConcR is only attributable to a decrease of ConcR1st.

When ConcR is Low for All Inseminations

If your overall ConcR is low and ConcR1st is similar to ConcR2+, various common causes can be involved. In herds where a lot of ovulation synchronization protocols are used, poor compliance with injection schedule might be an issue. Farmers need to keep in mind that compliance implies that the right cow gets the right product at the right dose at the right moment. It may seem easy to do but here are some examples of inappropriate compliance:

- Cow 42 got the injection instead of cow 22 (tag reading problem)
- Cow 54 got a 1-mL dose of a product that requires a 2-mL dose
- Cow 61 got the wrong product by mistake
- Cow 19 was not found this morning in the pen so she got her dose tonight instead

Herds with good compliance generally have ≥ 95% of their injections given correctly. In a herd using a protocol involving up to six injections (e.g., Double-Ovsynch), it is possible that only 70% of the cows got the ovulation synchronization protocol as initially planned (5% errors × 6 injections = 30% incorrect protocols). This could reduce the ConcR significantly.

Other causes to consider in such situations are poor insemination technique and semen management. It may seem easy to inseminate cows but it is hard for an advisor to know what is really done on a farm. Collecting data about individual ConcR of breeders may help to identify a breeder who struggles with his technique. However, caution should be taken when interpreting these data. For instance, if two breeders work on the same farm and each one selects which cows they prefer to inseminate, this may lead to a selection bias. In other words, one could only select the best cows (best heat) whereas the other breeder might end up with the cows that are not in such good heat. In such case, the farmer should probably not expect a similar ConcR from both breeders.

If all breeders have the same low ConcR, the ConcR may be related to poor semen storage (inappropriate temperature), poor semen handling and thawing (inadequate cleanliness of equipment and inappropriate temperature of bath), or extended time between semen preparation and insemination (ideally less than 10 minutes if kept at body temperature). Sometimes, the problem may be that semen handling is fine but it takes a long time between the first and the last cows bred, such as in a freestall barn with no headlocks in which the breeder keeps trying to catch cows without assistance. Therefore, do not thaw too many semen straws at a time; the number allowed will depend on how fast the cows can be bred.

Although it remains controversial for some, data suggest that high milk urea nitrogen (MUN) could be involved in low ConcR. The explanation would be from a variation in uterine pH, which could interfere with embryo development and survival. Research data showed that cows with MUN ≥ 18-20 mg/dL are at greater risk of embryo loss (Raboisson et al., 2017). Such a situation could occur when the ration is improperly balanced for degradable protein and non-fibre carbohydrates.

Infectious problems such as infectious bovine rhinotracheitis (IBR) virus, bovine viral diarrhea (BVD) virus, and some other infectious agents can also cause a decrease in reproductive performance of a herd. If herds are vaccinated with an appropriate vaccination schedule and adequate compliance, this situation becomes less likely.

When ConcR is Low Only for the First Insemination

If the overall ConcR is low because the ConcR1st is low, it is important to target causes that are probably linked with the postpartum management of the herd. For instance, a herd with a high proportion of cows affected by an excessive negative energy balance status would likely have a high proportion of cows with hyperketonemia (subclinical ketosis), prolonged anovulation (cows not cycling), and uterine disease (endometritis). A surveillance strategy for these diseases could be implemented to quantify if the proportion of affected cows is high or not. Here are some ways to perform such surveillance with the support of your veterinarian. To have a representative sample, 12–20 cows should be sampled (Oetzel, 2004):

- Testing blood samples to quantify beta-hydroxybutyrate (BHBA) within the first two weeks in milk. Less than 15% of cows should have blood BHBA ≥ 1.2 mmol/L (Dubuc and Denis-Robichaud, 2017).
- Testing blood samples to quantify non-esterified fatty acids (NEFA) within the last week before calving. Less than 15% of cows should have blood NEFA ≥ 0.27 mmol/L (Ospina et al., 2013).
- Testing cows for clinical (metricheck device) and subclinical endometritis (esterase testing) at 30 DIM. There should be less than 10% of cows with clinical endometritis and less than 20% of cows with subclinical endometritis (Dubuc and Denis-Robichaud, 2017).

- Testing cows for prolonged anovulation (absence of a corpus luteum) at 30 and 45 DIM (ideally two exams at an interval of two weeks). Less than 21% of cows should be anovular at both exams (Dubuc and Denis-Robichaud, 2017).

In addition to postpartum diseases, it is not uncommon that poor compliance to the ovulation synchronization protocol is involved in such situations, especially when a lot of protocols are used for the first insemination but not many after that.

Conclusions

In summary, if the herd's PregR is below 25%, examine the InseR. Common causes of low InseR (below 61%) are generally associated with a long interval between calving and first insemination, poor heat detection, a nonpregnancy diagnosis that occurs too late or a long interval between nonpregnancy diagnosis and subsequent re-insemination. If the InseR is appropriate, the next step is to validate if the ConcR is low (below 42%). In such a situation, identify if it is the case for all inseminations or only the first insemination. Causes affecting all inseminations will likely involve poor hormonal protocol compliance, poor insemination technique and semen management, elevated milk urea nitrogen or infectious diseases. Causes affecting only the first insemination will likely include a high prevalence of postpartum diseases such as hyperketonemia, endometritis and prolonged anovulation. When troubleshooting a reproductive problem in a herd, it is important to consider common causes before less frequent causes are considered.

References

Dubuc, J. and J. Denis-Robichaud. 2017. A dairy herd-level study of postpartum diseases and their association with reproductive performance and culling. J. Dairy Sci. 100:3068–3078.

Oetzel, G.R. 2004. Monitoring and testing dairy herds for metabolic disease. Vet. Clinics of North America, Food Animal Practice 20:651–674.

Ospina, P.A., J.A. McArt, T.R. Overton, T. Stokol, and D.V. Nydam. 2013. Using nonesterified fatty acids and β-hydroxybutyrate concentrations during the transition period for herd-level monitoring of increased risk of disease and decreased reproductive and milking performance. Vet. Clinics of North America: Food Animal Practice 29:387–412.

Raboisson, D., A. Albaaj, G. Nonne, and G. Foucras. 2017. High urea and pregnancy or conception in dairy cows: A meta-analysis to define the appropriate urea threshold. J. Dairy Sci. 100:7581–7587.

Select Sires Inc. Generations

ProfitMAX™

GENETIC STRATEGIES TO MAXIMIZE PROFIT
Stratégies d'élevage pour maximiser vos profits

INCREASE YOUR HERD'S PROFITABILITY

ProfitMAX is a complete program offering the expertise of Select Sires' reproductive and genetic specialists. A genetic audit of your dairy's reproductive records, cow and heifer inventories, and evaluation of each animal's genetic value are considered using the Optimal Genetic Pathways calculator. We will work with you to help determine the best possible genetic pairings to maximize profits in the next generation to meet your goals so your dairy not only survives, but thrives well into the future!

AUGMENTE LA PROFITABILITÉ de votre troupeau

ProfitMAX est un programme complet vous offrant une expertise en génétique et reproduction de la part de nos spécialistes. Une stratégie d'élevage sera construite pour vous en étant basée sur les performances de votre troupeau, l'nventaires de vos vaches et de vos génisses et les évaluations génétiques de chaque animal en utilisant le calculateur OGP. Nous travaillerons avec vous pour vous fournir les meilleurs options d'accouplements de la génération future, non seulement pour maximiser vos profits, mais également pour que votre entreprise soit prospère au fil des années!

Identify areas to increase profitability
Identifier les secteurs où optimiser le profit

Set long term goals for your business
Mettre en place des objectifs à long terme

Determine proper herd inventories
Déterminer l'inventaire approprié du troupeau

Create elite replacements from your best genetics
Créer des sujets élites de remplacement provenant de votre meilleure génétique

Increase profits from lower-value genetics
Augmenter le profit de votre génétique la plus faible

Improve short-term cash flow
Améliorer votre capital à court terme