

VACCINATING DAIRY COWS: DOES TIMING MATTER?

In recent years there has been a trend towards more vaccination in the dry period. However, it is not clear whether this has immunological or other benefits over spring vaccination. In this article John F Mee* PhD MVM MVB Dip ECBHM FRCVS, Moorepark Research Centre, Teagasc, Amelia R. Woolms DVM MVSc PhD DACVIM DACVM, Department of Pathobiology and Population Medicine, Mississippi State University, USA, and Charles Chavasse BVMS CertDHH MRCVS, investigate the current timings of vaccination in our dairy herds

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Vaccination in the dry period may be more effective for the majority of cows, because of greater nutrient availability (than in the spring) for vaccine response.

This article addresses the question of when is the optimal time to vaccinate dairy cows in our seasonal calving system and what factors influence this decision. The answer has practical and immunological aspects. It is concluded that vaccination should not be carried out within three weeks either side of calving. Vaccination in late lactation or in the dry period presents benefits with regard to labour usage, immune response, and colostral immunity but risks regarding drying off immune suppression and handling heavily pregnant cows. Vaccination in spring presents benefits in synchronising stimulated immunity with breeding period but risks regarding compromised immune response, transient milk yield drop, mistiming of injections, and farmer workload. This mini-review highlighted that studies directly comparing timings of vaccination need to be conducted under Irish management systems to clarify the relative strengths of these pros and cons.

Introduction

How vaccines work

To the immune system of the cow, the vaccine appears to be an infection; therefore, upon vaccination, the immune system begins forming new cells, and new proteins (antibodies) that will prepare the system to clear that same infectious agent faster in the future, which should decrease or prevent disease if the cow is exposed to the same virus or bacteria in the future. In an animal that has been vaccinated previously, this response to vaccination reaches its peak between one to three months after vaccination, although it is still helpful for several more weeks. For some vaccines, the response can provide protection for a full year, or even longer. If an animal has never been vaccinated before, two or three doses of vaccine are usually required, with peak response occurring one to three months after the final dose.

Irish dairy herd vaccinations

The latest National Farm Survey data (2023) show that 79 per cent of dairy farmers vaccinate their herds. However, in recent years there has been a decline in herd vaccine coverage from 86 per cent in 2019 to 79 per cent in 2023. In order of descending usage, dairy farmers vaccinate against leptospirosis, IBR, salmonellosis, BVD, *Clostridium* spp., calf diarrhoea, calf pneumonia, and other. There are currently licensed vaccines available against approximately 20 pathogens of bovines in Ireland: bluetongue virus-3, bovine herpes virus-1, bovine viral diarrhoea virus, *Clostridium* spp., coronavirus, *Coxiella burnetii*, *Cryptosporidium parvum*, *Escherichia coli*, *Histophilus somnus*, *Leptospira Hardjo*, *Mycoplasma* (formerly *Mycoplasma*) *bovis*, rotavirus, parainfluenza-3, respiratory syncytial virus, *Staphylococcus aureus*, coliforms, and coagulase-negative staphylococci. Thus, while herd-level vaccination rates are high, they may be declining. One issue which may contribute to this trend is reduced labour availability. As dairy herds have expanded, availability of skilled labour has become an industry-wide bottleneck, especially to complete herd-level tasks at busy times in the spring. Additionally, with 63 per cent of dairy farmers who vaccinate vaccinating against four or more diseases, some may find it difficult to avoid co-vaccination in the busy spring.

Why do we vaccinate dairy cows when we do?

For vaccination to be successful, the right animals need to be vaccinated at the correct time with a functional vaccine, delivered by the correct route of administration. This all sounds very straightforward but there are many potential points where this could fail. Points of failure could include:

- animals that have a compromised immune system, either due to disease or production stress;
- a vaccine that has been compromised due to a poor cold chain or is incorrectly reconstituted;
- inappropriate administration by the farmer due to a lack of knowledge or the job being rushed.

Traditionally in Ireland, many of the vaccines have been administered to dairy cows in the spring when cows are within roughly 30 to 60 days of calving. At this time, there is an increased chance that some of these cows will be affected by, or recovering from, conditions like endometritis, mastitis, or various abomasal conditions. In addition, cows are approaching peak lactation, so will have increased physiological demands and many will be in negative energy balance. It is also a busy and stressful time for the farmer. There are many tasks to be completed at this time of year including calving, feeding calves, introducing heifers to the milking process, treating sick animals etc. In addition, the second dose of the primary course may be administered late and into the breeding season or not at all, and if synch programmes are used, vaccination may be an additional stress factor in the spring.

As a result, both man and beast are under pressure. It might, therefore, make sense to consider if vaccinations could be moved to another time of year without compromising their efficacy. It has been proposed that vaccination after cows have been dried off in the autumn may be more beneficial and may induce a better response than vaccination in the spring. The farmer has more time to plan and administer vaccines, and the cow, when dried off, is under less

physiological stress and will not be suffering from any periparturient disorders/diseases. However, heavily pregnant cows need to be handled with caution.

In making these changes:

- the response to vaccination must be as good as, or better than, administration in the spring;
- there should not be any additional costs incurred; and,
- vaccine manufacturer instructions should be followed.

Vaccinations of relevance here include for IBR, BVD, Lepto, salmonella, and the scour vaccines. So, what does the science say about timing of vaccination for dairy cows?

Don't vaccinate in the transition period

Research has shown that the immune response of the cow in the transition period (three weeks before to three weeks after calving) can be dysfunctional due to the periparturient hormonal and metabolic changes. Immune cells may have weak responses to infectious agents, making those cows more susceptible to infectious and metabolic diseases such as mastitis and metritis (Abuelo *et al*, 2023; LeBlanc, 2020). Vaccinating within a month of calving (compared to two months pre-) has also been associated with a detrimental effect on subsequent fertility in one study (Kuhn *et al*, 2025). More recent research suggests that the story is not simply one of depressed immunity, but rather, in some cases, too much inflammation (Bradford *et al*, 2020). From either perspective, the available data indicate that it is best to wait until at least a month pre- or post-calving to vaccinate cows.

What about spring vaccination?

Vaccinating cows at 30 to 60 days post-calving is rational. The immune response to a vaccine takes weeks to reach its high point. Hence, a vaccine should be given one to three months before maximum protection is desired. In a system where cows are vaccinated at 30 to 60 days into lactation in the spring, that puts maximum benefit of the vaccine at two to five months post-calving. At that time, the greatest infection risk is often pathogens that threaten the new pregnancy such as BVDv, leptospira and BHV-1. However, an additional factor to consider is the nutritional demand of lactation: negative energy balance. With peak of lactation occurring approximately two months post-calving, vaccinating a cow at one to two months post-calving means the cow's body is being asked to make new immune cells and antibodies at the same time she is being asked to make more milk. In addition, transient milk yield drops may also be expected in the spring post-vaccination.

So, are there benefits in dry period vaccination?

The available data also make a good case for vaccinating in the dry period. Due to immune dysregulation many periparturient stress-induced diseases recrudesce and threats are greatest during the transition period. Hence, vaccines given in the dry period are likely to provide protection for this high-risk period. Additionally, vaccination in the dry period may be more effective for the majority of cows, because of greater nutrient availability (than in the spring) for vaccine response. A final point regarding vaccination in the dry period is related to the calf. Boosting the immune system of the cow with a vaccine one to two months before calving is the best time to improve antibody

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concentrations in the colostrum for her calf (Pinheiro *et al*, 2022; Meyer *et al*, 2023). Regarding the specific timing of pre-calving vaccination, cows exhibit upregulated systemic inflammation and depressed immune function in the early dry period. Hence, the latest research shows that vaccinating two weeks pre-dry off (rather than at dry off) reduces inflammatory responses but also milk yield (by five to 10 per cent) then, but improves yield in the subsequent lactation (Gao *et al*, 2026).

We need more research

While the points made here are based on research describing the immune response of cows at different times in the production cycle, it must be pointed out that research directly comparing immune responses by cows vaccinated in the first 30 days of the dry period, to responses by cows, in the same environment, but vaccinated 30 to 60 days into lactation, is currently lacking. This is an evidence gap of particular importance in Ireland given our seasonal calving system.

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READER QUESTIONS AND ANSWERS

1. IN AN ANIMAL THAT HAS BEEN PREVIOUSLY VACCINATED, THE IMMUNE RESPONSE TO A DOSE OF VACCINE IS GREATEST AT:

- A. One to two weeks after vaccination
- B. One to three months after vaccination
- C. Six to eight months after vaccination
- D. Not until 12 months after vaccination

2. IN AN ANIMAL THAT HAS NEVER BEEN VACCINATED, THE IMMUNE RESPONSE IS GREATEST:

- A. At one to two weeks after the first dose of vaccine
- B. At one to three months after the first dose of vaccine
- C. At one to two weeks after the second dose of vaccine
- D. At one to three months after the second dose of vaccine

3. IN A COW PREVIOUSLY VACCINATED, A VACCINE GIVEN AT 30 TO 60 DAYS POST-CALVING IS LIKELY TO PROVIDE THE STRONGEST BENEFIT AT:

- A. One to two months post-breeding
- B. At mid-lactation
- C. At dry-off
- D. At calving

4. THE BEST TIME TO VACCINATE A COW TO INCREASE THE CONCENTRATION OF ANTIBODIES IN HER COLOSTRUM IS:

- A. At calving
- B. At peak of lactation
- C. One to two months before calving
- D. Within one week of calving

5. A VACCINE MAY CONTAIN:

- A. Weakened or dead viruses
- B. Weakened or dead bacteria
- C. A portion of a bacterium
- D. All of the above

ANSWERS: 1B; 2D; 3A; 4C; 5D.