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# Beef Cattle Vaccination Principles and Recommendations

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## Introduction

Most producers are familiar with the term "risk management" and often associate this term with best management practices that reduce the effects of risk from a business or financial perspective. This term can also be used with regards to animal health. Preventing diseases is essential to controlling production health risks.

Preventing animal health problems involves proper animal husbandry, adequate nutrition (including vitamins and minerals), and the strategic use of vaccinations. Two Utah State University Extension fact sheets *"Common Vitamin and Mineral Deficiencies in Utah"* and "*Reproduction and Immune Impacts from Vitamin or Mineral Deficiencies: Determining if your herd is deficient"* review the importance of vitamins and minerals with regards to animal production and health.

Utah beef operations vary in their production systems. Some producers' cattle are located year round in the same general vicinity, with more availability of facilities (working corrals, chutes, and catches). Other producers utilize seasonal (winter, spring, summer, fall) grazing systems that may find their cattle commuting, sometimes great distances, between pastures. Producers utilizing the latter systems may not have access to their cattle, in terms of access to or availability of working facilities. Strategic delivery of a vaccine takes into account the varied production systems in Utah.

## Basic Immunology

The bovine active immune system involves two arms or pathways. First, there is a cellular arm (cell-mediated immunity) and another arm that produces antibodies (humoral immunity). Both arms are necessary for optimal immune function, and each side relies heavily on the other. The final component to the immune system is the ability to create memory. This memory (anamnestic) response is critical to providing a long duration of immunity. Figure 1 illustrates these two sides of the immune system working together.

The active immune system is not fully functional for several months in newborn calves. Time is required for both arms of the immune system to become active and able to produce cells and antibodies. As a stop gap, calves acquire passive immunity, in the form of antibodies, from their mother's first milk, or colostrum. Colostrum contains high concentrations of immunoglobulins that are absorbed as intact molecules through the gastrointestinal tract during the first few hours of birth. This is the only time that the GI tract will allow the absorption of antibodies. After about 12 hours from birth, the lining of the gut will no longer allow absorption. This is the reason for the recommendation to ensure that calves get up and nurse multiple times during the first few hours after birth.

In the literature and popular press you may come across the term "maternal interference or override" with regards to vaccination timing in young calves. This refers to the interference that these colostrum-based antibodies have on vaccines given to calves at a young age (under approximately 3 months of age). It is thought that these antibodies may have a negative influence on vaccines when they are still circulating in high numbers. To combat the negative influence of maternal interference or override, using the principle of serial or repeated vaccinations (boostering) is recommended.

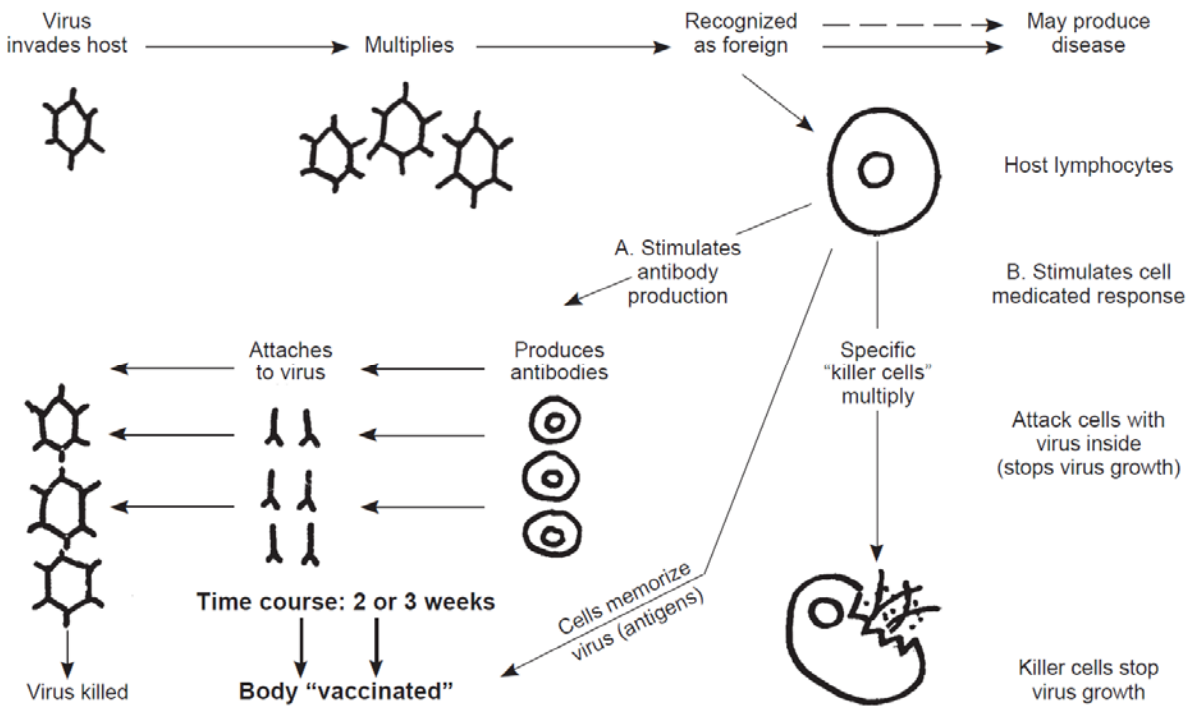


**Figure 1. The sequence of events after a virus invades the host. (Used with permission from Dr. James England.)**

## Attenuated versus Inactivated

Some viral vaccines contain viral fractions that have been prepared in such a way as to still be "alive" and able to replicate in the animal without causing disease. These *attenuated* viruses have been commonly referred to as "modified live." On the other hand, some vaccines contain just the viral fractions (antigens) that elicit or produce an effective immune system response without the need for replication. These inactivated viral vaccines are commonly referred to as "killed" vaccines. Both types stimulate the immune system.

Recent research suggests that attenuated and inactivated vaccines can stimulate both arms of the immune system. There are some advantages to attenuated vaccine preparations with regards to maternal influence. Because they replicate within the calf, they are generally considered better at overcoming the maternal influence left over from ingestion of colostrum.

In some rare documented cases, replication by the attenuated IBR virus can cause abortion. Cattle that have been vaccinated with attenuated IBR fractions within the past year with the same vaccine seem to be immune to vaccine-induced reproductive failure. Inactivated vaccines on the other hand do not contain the same label precautions that attenuated do and can be delivered safely to calves nursing pregnant mothers and can be effective in overriding maternal influence if repeat boosters are given per label instructions.

## Common Diseases

Some diseases are commonly found in your area whereas others may not be. Consult your local veterinarian for specific area recommendations. For the most part, however, it is commonly recommended that vaccines be used to prevent the upper respiratory disease complex and for the prevention of clostridial diseases. Table 1 lists the diseases commonly vaccinated for in Utah.

## Calves versus Cows

Calves need to experience a series of inoculations in order for their immune systems to be fully primed. These boosters need to be given according to manufacturer's recommendations and vary for each product/vaccine used. There are, however, some general guiding principles that apply across the board. To overcome maternal influence in systems where calves can be conveniently worked multiple times, booster inactivated (killed) viral vaccines approximately 1 month after the initial dose. For production systems that

**Table 1. Common vaccines used in Utah for cow-calf producers.**

| Disease | Common Vaccine Reference | Requirement | Notes |
|---|---|---|---|
| Bovine Respiratory Disease (BRD) | IBR (infectious bovine rhinotracheitis)<br>$PI_3$ (parainfluenza-3)<br>BVD (bovine viral diarrhea)<br>BRSV (bovine respiratory syncytial virus) | Annual | 30 days prior to breeding |
| Clostridial Disease | 7 or 8 way *Clostridial spp.* vaccine | Annual | Spring prior to branding and castration, prior to confinement |
| Brucellosis | RB51 | Required by law for females | Once between 4 – 12 months of age |
| Bacterial Pneumonia (shipping fever) | *Pasteurella multocida*<br>*Mannheimia haemolytica*<br>*Histophilus somni* | Optional | 30 days prior to weaning, exhibition, or confinement |
| Trichomoniasis | *Tritrichomonas foetus* Trich vaccine | Optional | Prior to breeding |
| Leptospirosis | 5-way Lepto | Optional | 30 days prior to breeding |
| Vibriosis | Vibrio | Optional | 30 days prior to breeding |
| Pinkeye | *Moraxcilla bovis* | Optional | Prior to insect season or as needed |

do not allow for repeat handling of calves, attenuated (modified live) products are recommended. With all injectable products, be sure to read and follow label instructions.

In Utah, our larger cow-calf operations graze on summer public lands with turnout dates historically around the first to middle of June. Bulls and cow-calf pairs are turned out together and spend the entire grazing season on these, often remote, allotments. In this scenario, the calves and cattle should be vaccinated 30 days prior to turnout to ensure optimum immunity during the breeding season. Producers commonly provide these vaccines during branding. In these production systems the calving interval (period) might be quite long because bulls were not removed the previous year when they were on allotment. At branding, producers might find calves that range between one and several months of age. In this scenario, where a booster is not possible, using an attenuated (modified live) vaccine will provide a greater measure of protection for the calves.

Cows and replacement heifers should be vaccinated prior to the start of the breeding season with the upper respiratory vaccines to optimize protection against some of the viruses that can cause reproductive problems. These include IBR and BVD. Bovine viral diarrhea can cause fetal infections if the pregnant cow is exposed to the virus during the first few months of gestation. To prevent this, choose a vaccine that provides a label claim for reducing fetal infections and the subsequent development of “persistently infected” BVD calves.

These vaccines are commonly referred to as fetal protective. Using vaccines with labeled claims of one year duration of immunity will provided the most complete protection.

## Pre-conditioning (weaning) Health Programs

There is good evidence that suggests calves having had a set of shots prior to weaning perform better in the background and finishing phases. Additionally, historical data show there is a financial incentive when calves participate in a health program. In order for these programs to work, they need to be recognized and documented. You might be familiar with the names of a few of these programs such as Select VAC or VAC-45. The concept is to use and standardize vaccines (along

with other health products) prior to the stressful time of weaning and confinement to optimize immunity.

If you choose to participate in one of these programs, the program will dictate what vaccines you can use and when to give them. Make sure your operational management system will accommodate the standard protocol being considered and that you have the ability to document and verify participation. If you choose retained ownership, research suggests an increase in carcass quality (marbling) and weight at harvest in preconditioned calves, because of a lowered incidence of bovine respiratory disease.

## Summary

The immune systems of beef cattle require vaccinations to provide optimum protection against diseases. Management systems in Utah might preclude or favor certain vaccine strategies versus other systems commonly seen elsewhere. Due to the majority of our grazing lands being public, cattle herds often graze (alone or in common) on remote range. This system complicates the opportunity to administer vaccines. Branding and fall pregnancy checking are two times of the year, usually in late spring and fall respectively, that vaccines are given. In these systems, where a monthly booster is not practical, attenuated (modified live) vaccines might provide a better chance at overcoming some of the challenges to mounting effective immunity against many common cattle diseases. Caution should be used when administering attenuated vaccines to calves nursing pregnant animals or in cows that are pregnant when certain label requirements are not met. Most production systems are unique. Consult with your regular herd veterinarian to determine what common diseases are seen in your area and for assistance in designing a vaccination schedule for your herd.

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