

# Fact sheet

## Vaccination for beef cattle in southern Australia

### What are vaccines?

Vaccines are proteins (antigens) that initiate a protective immune response within an animal. In most cases the immune response involves antibodies that can block either the disease agent (bacteria or virus) or its product (toxin) so disease does not occur.

The first time an animal is exposed to an antigen, the response is slow and may not be strong. This is why in natural infection, animals still develop disease, and why many recover from disease over time. The disease triggers an immune response that includes the production of antibodies, which then reduce or nullify the disease.

However, if the disease is severe, death or production losses will already have happened as the immune response is occurring. If an animal does survive, invariably the next time they are faced with the same challenge, their immune system is primed and ready, and the antibody response is much quicker and stronger – resulting in the disease having little or no effect. This is why most animals are considered ‘immune’ to a disease after they have had it.

Vaccination aims to generate this immune response and make animals immune without (in general) giving them the disease or experiencing the effects of the disease.

### Types of vaccines

There are two main types of vaccines:

1. Killed vaccines
2. Live, or modified attenuated live vaccines.

**Killed vaccines** have no ability to cause disease and contain the right protein (antigen) to get a protective immune response. In most cases, two doses (usually at least 3–4 weeks apart) are needed for these vaccines to be effective.

The first dose is referred to as the primary or sensitising dose, and produces a low antibody response over 7–21 days. The second or booster dose produces a more rapid, stronger and longer lasting antibody response so the animal has lots of antibodies in their blood stream ready to nullify the antigens from either the organism or its toxin, hence preventing disease.

For vaccines that require two doses, the timing between doses is important. Most of the information on vaccines comes from the companies that develop them, and their goal is to identify the best protocol to get protection as soon as possible. Recommendations on vaccine packs usually refer to the minimum time between doses.

In reality, if animals have received the first dose some time in their life, and almost certainly in the last six months, a second dose will still act as a booster and result in a strong, prolonged antibody response. However, the animal is not fully immune in the period between the first and second doses, and so animals are at risk of succumbing to a disease if only one dose is given.

Once the booster dose has been given, antibodies will reach their maximum levels within several days, and animals will be immune to the disease (in general).

Over time, the antibody levels in the blood fall, and at some point for most diseases these vaccine-induced antibodies fall below the protective level (see Figure 1). Therefore, while some antibodies are still present, there are not enough to immediately stop disease, and some animals may then get the disease.

Figure 1: Schematic diagram of antibody response following vaccination



For this reason most vaccines require additional, usually, annual boosters. Clostridial vaccines are good examples of vaccines that require two initial doses, and then a follow-up annual booster vaccination to maintain the highest level of immunity.

However, for some diseases, antibody levels stay high for much longer periods, and immunity is considered lifelong and repeat vaccination later in life is not required. The protective immunity to some diseases is mainly through a cellular immune response, rather than antibodies. Examples of where this occurs include *leptospira hardjo* and bovine Johne's disease.

**Live, or modified attenuated live vaccines** are developed from a weakened virus or bacteria, allowing it to replicate in the body and generate an immune response. Due to this process of pathogen replication promoting a protective response, many live or attenuated live vaccines do not require booster shots. While attenuated live vaccines do not usually cause disease, if disease is caused it is usually significantly milder than a strain caught through animal-to-animal transmission.

## Handling vaccines

Handling vaccines correctly is important because vaccines are sensitive to temperature and light. Freezing, overheating or prolonged exposure to sunlight will kill vaccines.

If you are distributing vaccines between September and March, make sure the vaccines are kept on ice and use an esky when marking or weaning cattle.

Given the different vaccination schedules, it's important to read the label and information sheet provided with the vaccine before using it. Check the appropriate timing between shots (if multiple shots are required), the dose and method of administration.

Most vaccines are given as a subcutaneous injection (under the skin), but this does vary. Ultravac® Scourshield®, a scours vaccine in cattle, is given intramuscularly.

## Tips for storing vaccines

The length of time vaccines can be stored depends on sterility to reduce the subsequent growth of organisms in the vaccine.

Open the sealed tube and fix it carefully to the pack and gun to reduce the opportunity for contamination. If the vaccine is then stored as this closed unit, there is likely to be little chance of growth of organisms.

However, if you are not careful when setting up the equipment then the vaccine may become contaminated, and it will need to be discarded within a short period of opening.

Manufacturers provide recommendations for how long opened vaccines can be stored.

## Should I vaccinate?

To make the decision whether to vaccinate or not, you need to consider the:

- cost and impact of disease, including welfare implications
- likelihood of the disease occurring
- cost of vaccine
- efficacy of the vaccine.

Vaccines:

- Are not usually 100% protective, and even with vaccination some animals may succumb to disease. Cattle in poor body condition or under severe stress may not respond as well to vaccines as healthy cattle.
- May not necessarily stop an animal being infected or transmitting the disease. In most cases they stop the outcome of the disease, and they may or may not stop infection.
- May mask a disease being present.

These aren't reasons not to use a vaccine, but they must be understood to get the best value from a vaccine.



## Let's look at two examples

### 1. Blackleg in finishing animals

#### Challenge

A producer is concerned about the potential to lose steers from blackleg. Blackleg usually occurs in well grown animals if they get a bump in the yards or similar injury, which can happen when handling finished animals coming up to sale. The producer vaccinates the calves at marking with 5-in-1 and is wondering if this is sufficient.

#### Action

To get effective protection, the producer needs to give a second booster dose, and this needs to be done at least 7–10 days before the steers are exposed to the risk of blackleg. A single vaccination at marking will only provide a small level of protection 2–3 weeks post marking.

#### Benefit

With 300 calves and a 98% protection from vaccination, it will cost \$150 (\$0.50) for the extra vaccination. If the producer saves an animal every 10 years it will have paid for itself (assuming finished cattle are valued at \$1,500).

### 2. Pinkeye in cattle

#### Challenge

A producer is concerned about pinkeye at weaning because they yard wean their cattle in March and it's sometimes dusty. The producer gives a 7-in-1 at marking and again at weaning, and is wondering if it is okay to give a pinkeye vaccination at the same time at weaning, and if it is worth doing.

Last year the producer had at least six steers out of 150 (4%) rejected by the feedlot from old pinkeye damage, and both the steers and the heifers were affected. The rejected steers were sold for 30c/kg less (a loss of \$120/hd).

#### Action

Piliguard® vaccine is a single dose vaccine but takes 3–6 weeks until vaccinated cattle are immune. In this case, if the main challenge is occurring at weaning, then calves would need to be vaccinated at least three weeks prior to this.

In fact, it is worth vaccinating at marking, to save extra handling, and provide protection when flies are around in late spring/summer as well. It is fine to give animals both 7-in-1 and pinkeye vaccinations at the same time (they are given separately, so each calf would get two vaccinations).

#### Benefit

The single dose will cost approximately \$5/hd (ie. \$1,500 for 300 calves). The loss of the steers was \$720, and it is reasonable to assume that there were similar 'losses' in the heifers, either in terms of marketing or bodyweight, and fertility effects. Company data suggests the vaccine is about 85% protective, so there would still be possibly one or two animals affected even with vaccination.

The net outcome of vaccination in this scenario is about breakeven (a loss of \$276 from a sale value of \$480,000; breakeven at 5% prevalence). The breakeven point if each case of pinkeye cost \$80/hd would be a 7–8% prevalence, and if each case resulted in \$150 loss the breakeven would be about 4%.

Of course, the fact that pinkeye is difficult to treat, and handling animals can spread the disease to other animals, as well as the welfare aspects for the animals affected, means that even at breakeven (or below), vaccination is likely the preferred strategy.

#### In summary

These scenarios emphasise the importance of assessing the likelihood and level of disease in the absence of vaccination, something which is always easy in hindsight but difficult in reality. Where there is any risk of disease, and a vaccine is available, vaccination to prevent or minimise disease will be a cheap and almost always worthwhile investment.

## Vaccines available for cattle

Table 1 includes the main diseases in southern Australia beef herds for which vaccines are available, and some of the main products on the market. The following provides a brief discussion on each of these issues, to highlight when vaccination is most useful, and examples of appropriate programs.

**Clostridial** vaccinations are relatively cheap. They require two vaccinations at a minimum of four weeks apart to provide strong immunity. A single shot at calf marking provides only short-term protection and it's not until the second dose is given that calves/cattle can be considered protected. Black disease almost always occurs when liver fluke is present, so if cattle have liver fluke then keeping cattle properly vaccinated is important.

In general, where there is any risk of clostridial diseases, proper vaccination is extremely cost effective and worthwhile. Bulls should be vaccinated at least annually (after their initial two doses).

**Leptospirosis** can not only cause abortion in cattle but can infect people working with animals. An effective 'lepto' vaccination will help protect those working around cattle, as well as the cattle themselves. In general, lepto vaccine is given in conjunction with clostridial vaccine (as 7-in-1). However, if you have already been using 5-in-1 across your herd, and you want to start a lepto program, you can give at least one of the initial two doses as a lepto only vaccine.

**Pinkeye** vaccination should be considered for beef enterprises where pinkeye occurs, especially given the challenges with treating affected animals. Only a single vaccine dose is required 3–6 weeks prior to the challenge. Where prolonged challenge occurs, a booster vaccination after five months will provide good pinkeye control.

**Pestivirus** vaccination is one way to control bovine viral diarrhoea virus (BVDV). An effective vaccination program (an initial two doses with annual boosters) will minimise the impact of BVDV but once commenced, it is likely to be an ongoing commitment in the herd. Therefore, discuss your herd status and the use of Pestigard® in your herd with your veterinarian.

**Calf scours** is another complex disease with a number of different organisms potentially being responsible. However, vaccination is usually effective at decreasing scours, even though the vaccines do not cover all the potential pathogens. Cows need to be vaccinated pre-calving to ensure adequate colostral antibody levels to protect young calves.

**Bovine respiratory disease (BRD)** is mostly an issue in feedlot cattle and is uncommon in beef cattle at pasture but may occur at weaning, especially if yard weaning. For producers selling animals to feedlots, or have received feedback from abattoirs about pleurisy and lung lesions in pasture fed cattle, consideration should be given to vaccinating animals prior to being sent. Some feedlots offer premiums for vaccinated cattle.

**Vibriosis** can result in poor reproductive rates. It can be controlled by making sure bulls are properly vaccinated. Bulls should receive two doses of vaccine prior to their first use, followed by annual booster vaccinations. Vaccination of heifers and cows may be required where bull control is problematic or where herds are found to be infected.

**Bovine ephemeral fever** (BEF or three-day sickness) is a viral disease in cattle, transmitted primarily by mosquitos. It is common in central and coastal regions of northern NSW and vaccination is the only means of preventing the disease with two initial doses required.

**Botulism** is usually a problem in northern beef herds, but occasional problems can occur in southern beef herds. Vaccination is an option if your herd is at risk to botulism.

**Bovine Johne's disease (BJD)** vaccine is most likely to be used in dairy herds. The current vaccine (Silirum®) provides good protection against BJD, and assists in control by reducing shedding of BJD organisms for infected cattle.

While Silirum® is a killed vaccine, it only requires a single dose for lifetime immunity so booster dose(s) are not required. As young calves are the most susceptible to infection, it is important on endemic properties that calves being retained as breeders are vaccinated as young as practical, which usually means at marking. If you have BJD and are considering vaccination, you will need to discuss your program with your veterinarian, and ensure it is permitted in your herd. Vaccinated cattle must be permanently identified using a three-hole ear punch.

**Tick fever** is a group of three separate diseases transmitted by cattle ticks. It is localised to the cattle tick endemic area of northern Australia. Producers who want to move cattle, especially bulls, north of the 'tick line' should consider vaccination against tick fever. Cattle should be vaccinated at least eight weeks prior to movement into the tick endemic parts of northern Australia to allow time for protective immunity.

**Table 1: Common cattle vaccines**

Disease	Product	Manufacturer	Vaccine type	Dose rate	Program*	Cost/dose†
Clostridial 5-in-1	Ultravac 5-in-1	Zoetis	Toxoid, killed cellular	2 ml s/c	Two doses at least four weeks apart, annual boosters	\$0.50
	Websters 5-in-1	Virbac		2 ml s/c		
	Tasvax 5-in-1	Coopers		4 ml s/c		
Clostridial plus Lepto (7 in1)	Ultravac 7-in-1	Zoetis	Toxoid, killed cellular	2.5 ml s/c	Two doses at least four weeks apart, annual boosters	\$2.35
	Websters 7-in-1	Virbac		4 ml s/c		
Lepto	Leptoshield	Zoetis	Killed cell	2 ml s/c	Two doses at least four weeks apart, annual boosters	\$1.70
Pink eye	Bovilis piliguard	Coopers	Killed cell	2 ml s/c or im	Single dose	\$5
Bovine viral diarrhoea virus (pestivirus)	Pestigard	Zoetis	Killed cell	2 ml s/c	Two doses 4–6 weeks apart, annual boosters	\$4.60
Calf scours	Ultravac	Zoetis	Killed cell	2 ml im	Two doses 3–9 weeks apart, annual boosters	\$4.50
	Scourshield	Coopers		Toxoid, killed cell		
	Rotovec corona					
Bovine respiratory disease (MH +/- IBR)	Bovilis MH+IBR	Coopers	Killed cell	2 ml s/c	Two doses 14–180 days apart	\$8.50
	Bovi-shield MH One	Zoetis	Killed cell	2 ml s/c or im	Single dose	\$5.50
Vibriosis	Vibrovax	Zoetis	Killed cell	5 ml s/c (bulls)	Two doses 4–6 weeks apart, annual boosters	\$9
Bovine ephemeral fever	Ultravac BEF	Zoetis	Killed cell	2 ml s/c	Two doses two weeks, six months apart, annual boosters	\$8–\$10
Botulism	Longrange Botulinum	Zoetis	Toxoid	2.5 ml s/c	Two doses 4–6 weeks apart, annual boosters	\$1.50
	Singvac one year	Virbac	Toxoid	2 ml s/c	Single initial dose, annual booster	\$1.30
	Singvac three year	Virbac	Toxoid	2 ml s/c	Single initial dose, booster every three years	\$2.45
Bovine Johne's disease	Silirum	Zoetis	Killed cell	1 ml s/c	Single dose for life	\$20

\* Recommended by manufacturer

† Approximate cost, Nov 2020

## Vaccination programs for a beef cattle herd (southern Australia)

### When to vaccinate?

From the information above, the approach to vaccination for most beef producers should be relatively straightforward. It is a matter of assessing the likely occurrence of a disease, and in most cases, if a disease is likely to occur (even occasionally) then vaccination will be worthwhile.

The higher the rainfall, the more common disease problems occur (botulism and tetanus may be exceptions).

It is also important to understand when to vaccinate.

### Calf marking

Calves should receive a 5-in-1 or 7-in-1 vaccination and pink eye vaccination should be considered. Booster 5-in-1 or 7-in-1 shots should ideally be given 4–6 weeks later, and certainly **at weaning** if not done before.

### Heifers prior to joining

Heifers should receive their second dose of Pestigard® if bovine viral diarrhoea virus control is required, and this needs to be at least two weeks prior to joining, and have a booster dose with either 7-in-1 or Leptosshield® if effective leptovaccination is required.

For **heifers** and **cows** (assuming they have already been vaccinated as calves), a **pre-calving** 5-in-1 or 7-in-1 booster vaccination and a calf scours vaccine should be considered. Remember, the pre-calving vaccination has to occur at least two weeks prior to calving to give time for antibody production and incorporation in the colostrum, but it can be given well before that and still give effective colostral levels.

Depending on the timing, booster administration when cows are yarded at weaning or pregnancy testing is likely to be an efficient way of booster vaccination, depending on when that occurs in relation to calving.

### Bulls

Bulls should receive their initial two doses of the vibriosis vaccine prior to first use. Annual boosters of 5-in-1 or 7-in-1 and vibriosis vaccine should be administered.

## Further reading

[mbfp.mla.com.au/herd-health-and-welfare/tool-62-cattle-disease-vaccines-and-strategies/](http://mbfp.mla.com.au/herd-health-and-welfare/tool-62-cattle-disease-vaccines-and-strategies/)

[coopersanimalhealth.com.au/GetPdf?fileName=Static%2FPiliguard%20Product%20Guide.pdf](http://coopersanimalhealth.com.au/GetPdf?fileName=Static%2FPiliguard%20Product%20Guide.pdf)

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