FACT SHEET: Bovine Viral Diarrhoea

BVD is probably the most important viral disease of the New Zealand cattle industry. An estimated 90% of New Zealand dairy farms have been exposed to the virus, and BVD costs the dairy industry approximately $50 million per year. BVD is a common but complex disease. The costs are often hidden and difficult to calculate, and the effects of the disease often insidious.

- If you are living with BVD, you are probably accepting poor performance as normal.
- Eliminating BVD usually causes expectations of ‘normal’ to rise dramatically!
- Reproductive effects are responsible for the greatest financial losses.
- BVD is mainly spread by persistently infected carrier animals.
- The disease can be diagnosed by testing of blood or bulk milk.
- When infected bulls come into contact with vulnerable herds, the results can be devastating. Bulls that are untested and unvaccinated are a danger to the herd.
- When naïve bulls are introduced to an affected herd and get infected, their semen quality can be reduced for up to 80 days, thus compromising conception rates.
- Several options are available for control. The best include vaccination of the herd and elimination of persistently infected carrier animals.

Transmission

The BVD virus may be transmitted between animals in one of three ways:

1. By direct contact between animals (‘horizontal’ transmission). The virus can be spread in all body fluids, including saliva, tears, nasal discharge, semen, urine and faeces. Nose-to-nose transmission over boundary fences can occur.
2. By contact between an animal and the body fluids of an infected animal no longer present. For example, calf pens can remain infectious for up to 4 days after PI removal if no disinfection is executed.
3. By invasion of the foetus when the virus infects a pregnant cow (‘vertical’ transmission).

Effects

The consequences of viral infection differ, depending on which classes of animals are infected:

Infection of youngstock, bulls or cows. Infection is temporary, death rates are low and animals recover from infection after an average of 2 weeks, with subsequent immunity to the virus. There may be no signs that an animal is infected at all, but when clinical signs are present they can include diarrhoea, reduced weight gain, reduced appetite, rough coat, immunosuppression with increased susceptibility to other diseases such as pneumonia, temporary infertility (cows and bulls), and reduced milk yield (cows). BVD in youngstock can appear similar to gastrointestinal parasitism.

Infection of cows in the breeding season. This is the area in which the virus can have particularly devastating effects when it infects cows that have not acquired immunity, either by vaccination or by natural exposure. Clinical signs depend on the stage of gestation of the cow when she encounters the infection, and are listed below.
1. **Infection prior to insemination or insemination using infected semen.** Reduced conception rates.
2. **Infection between 0—45 days gestation.** Reduced conception rates; increased empty rates. Early embryonic death causing returns to service which in many cases are at irregular intervals.
3. **Infection between 45—125 days gestation.** Abortion, mummification or birth of persistently infected calves (see below).
4. **Infection between 125 days gestation and term.** Calves born with congenital defects, e.g. small eyes, blindness, brain defects. Abortions. Normal-looking calves may be persistently infected or may be born with an active and effective immune response to the virus.

### Persistent Infection

When an animal is infected with the BVD virus, whether or not it shows any of the clinical signs listed above, generally it will mount a response, clear the virus within 2 weeks and become immune to it. The length of this immunity is variable. This is known as ‘transient’ infection. However, when unborn calves are infected in the uterus, between 45 and 180 days gestation as described above, they may be born with a persistent BVD infection. Because they are infected before their immune system is mature, they perceive the virus as ‘self’ and become tolerant to it. They never get rid of the virus or develop immunity, and they act as ‘virus factories’, shedding huge amounts of virus (from all their body fluids, but especially from their nasal secretions) all throughout their lives. PIs are much more efficient at spreading BVD virus than transiently infected animals—most BVD is spread within and between herds by PI carriers. Any non-immune animal that comes into contact with a PI is at risk of contracting the infection.

#### The Persistently Infected or ‘PI’ Animal

PIs are thought to make up about 1% of the New Zealand cattle population. PIs may die before birth. If they survive, they are often unthrifty, poorly grown and stunted, with an increased susceptibility to other diseases such as pneumonia and parasitism.

Sometimes the BVD virus in a PI will mutate. This causes a severe disease in the PI known as mucosal disease. Signs include severe mouth and gastrointestinal ulcers, nasal and eye discharge, weight loss, profuse diarrhoea and eventual death. Mucosal disease is always fatal, and only occurs in PIs, usually at 6-24 months of age.

There is no cure for PIs, and once identified they should be culled immediately before they continue to spread the virus to other cattle.

It is important to remember that sometimes a PI will look perfectly normal, and may survive long enough to breed itself. A PI cow will always give birth to a PI calf. A PI bull can have disastrous consequences on fertility in a naïve herd. Bulls must be tested to make sure they are not PIs. They only need to be tested once in their lifetime.

Ideally, PIs should be identified and removed from the herd.

### Behaviour of BVD in the Herd

BVD behaves differently in dairy and beef herds, due to their different natures.

In dairy herds, the disease waxes and wanes. A PI carrier is born, and the herd’s immunity declines as the calf is raised away from the main herd. When that PI rejoins the now naïve herd as a replacement, widespread BVD infection occurs. The pattern is a regular cycle of infection every few years.

In beef herds, younger and older animals are kept together, and so PI carriers remain in constant contact with all age groups of the breeding herd — cows, replacements and bulls. The disease remains active and spreading all the time, and losses are ongoing.

### Diagnosis

Individual cows can be blood tested (or tissue tested) to see if they have been exposed to the virus and have mounted an immune response (*antibody test*), or to see whether the virus is present (*antigen test*). Animals that have been exposed to the virus and that have recovered will be antibody positive. PIs will usually be antibody negative, due to their lack of immune response, but antigen positive due to their inability to clear the virus. Transiently infected animals may be antigen positive due to temporarily circulating virus, and should be retested in 4 weeks, by which time they should be antigen negative but antibody positive, thus distinguishing them from the PIs. Blood samples can be pooled, which makes testing more economical.

Note that if a pregnant bought-in cow tests negative for antigen, it is still necessary to test her calf—she may be carrying a PI calf while being antigen negative herself—the ‘Trojan Cow’.

Bulk milk samples can be tested for *antibody*, to assess the level of exposure of the herd to the BVD virus, or for *antigen*, to see if a PI is present in the herd (N.B. for this to be reliable, milk from every cow must be going into the vat).
Options for Control

There is no treatment for BVD, but control is vital. There are a number of options for controlling the virus, ranging from very poor to very good, as listed below.

1. Do nothing

When the herd is exposed to the BVD virus, some cows will suffer from the disease and then become immune, but immunity is unpredictable and some cows will remain susceptible. This is a poor option with negative financial benefits.

2. Closed herd and biosecurity

Each cow, bull and replacement in the herd is individually blood sampled, and PIs are identified and culled. Then absolute biosecurity is maintained to prevent BVD virus getting onto the farm. The disadvantages of this option are that the herd becomes unprotected, since no immunity is generated either by vaccination or by natural exposure, and biosecurity can be very difficult to maintain, leading to great potential for disaster. Common routes of BVD entry include bought-in stock, contact ‘over the fence’ with neighbouring stock, stock brought home from grazing and PI bulls, but BVD has occurred in apparently ‘closed’ herds.

3. Vaccinate only the heifers/replacements prior to breeding

As long as the vaccinated animals receive a booster injection every year, this method will eliminate disease in the long term. However, in the short to medium term, many of the older members of the herd are left naïve and unprotected. PIs will not respond to the vaccine, although their non-PI herdmates will, and so a vaccinated PI carrier will continue to shed virus. This may cause losses in animals that haven’t responded well to the vaccination producing insufficient immune protection to avoid natural infection.

4. Vaccinate the whole herd, including replacements, prior to breeding

This protects all members of the herd, breaking the cycle of infection before exposure by making sure that most herd members are immune before mating starts. Herd members are protected from disease, reproductive losses are minimized and the chances of further PI carriers being born is greatly reduced. Annual booster vaccines are required.

5. Vaccinate the whole herd, including replacements, prior to breeding, and find and cull all PIs

Because the PIs do not respond to the vaccine, they will always produce PI offspring and so maintain BVD in the herd despite whole herd vaccination. In this option, each member of the herd is blood tested to identify, and then remove, any PIs. This option provides rapid and ongoing BVD control and also prevents the birth of any more carrier PI animals. This method is the gold standard. It is reliable and has maximum financial benefits.

Vaccination Programme

Heifers and bought-in replacements are vaccinated prior to their entry to the main herd. The primary vaccine course for all animals is two injections three weeks apart. Heifers should be older than three months when first vaccinated, and should have their booster at least two weeks before their first service. After this, annual boosters are required to maintain immunity.

The main herd has an annual booster vaccine several weeks before the planned start of mating. If the main herd is being vaccinated for the very first time, two injections, three weeks apart, will be required. The second injection should be given at least two weeks before the planned start of mating.

Bulls must not be forgotten. They are prime candidates for bringing BVD onto a farm. They must be blood tested to check if they are PIs, and should have a certificate to prove this. If proven negative, they should be vaccinated as above, and their immunity maintained by annual vaccine boosters.