MEAT & LIVESTOCK AUSTRALIA

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FEEDLOTS

Summary of Bovine Respiratory Disease preventative practices

Bovine Respiratory Disease (BRD) is produced through the complex interaction of pathogens with animal, environmental and management risk factors. A competent immune system is capable of fighting off these pathogens, many of which can be isolated from the upper airways of healthy animals in small numbers. However, under certain conditions interactions between the risk factors reduce immunity, allowing pathogens to invade and proliferate in the respiratory tract which results in disease.

Pathogens

The viruses most commonly associated with BRD in Australia are bovine herpesvirus 1 (BHV 1), bovine viral diarrhoea virus (BVDV or bovine pestivirus), bovine parainfluenza 3 virus (PI3), and bovine respiratory syncytial virus (BRSV). More recently, coronavirus has been identified as a potential viral contributor to BRD in Australia. A number of bacterial species have also been recognised as important to the BRD complex; these include *Mannheimia haemolytica, Pasteurella multocida, and Histophilus somni*. In addition, other bacteria can colonise the respiratory tract opportunistically.

Animal factors

The risk of an animal developing BRD in a feedlot will depend on the type and amount of pathogens in the feedlot environment, its ability to cope with the psychological and physical stressors it encounters and the strength of its immune system (immunocompetence). Researchers across the world are beginning to unravel the genetic factors contributing to BRD and the complexities of the immune system. Just like humans, some cattle have stronger immune systems than others.

Breed can influence BRD incidence as reported by Australian and US studies. In general, British breeds are more likely to develop clinical BRD than *Bos indicus* breeds. Furthermore, Herefords show a predisposition to develop clinical BRD over Angus. The National Bovine Respiratory Disease Initiative (NBRDI, 2014) examined the epidemiology and management of BRD of 35,160 feedlot cattle across 14 feedlot sites in Australia. The study reported that Herefords were twice as likely to be treated for BRD as Angus cattle. Tropical breeds and crosses were less likely to be treated for BRD. Gender has also been implicated in BRD incidence in both US and Australian research, with steers slightly more likely to suffer BRD morbidity and mortality than heifers.

The NBRDI (2014) reported that cattle with initial weights > 400 kg at feedlot induction had reduced BRD incidence compared to cattle of lighter weights. Previous exposure to pathogens can influence BRD incidence. The NBRDI (2014) reported that for cattle with low initial respiratory

Key messages

- Avoid placement of cattle in the feedlot if purchased through saleyards within the previous 12 days. If backgrounding paddocks are available do not place the cattle in the feedlot for at least 28 days, to confer a protective effect against BRD.
- For cattle placed directly in the feedlot, reduce the number of purchase groups per pen.
- Fill pens as quickly as practical, ideally within a day.
- Minimise the distance cattle are transported to the feedlot and the time taken for delivery.
- Practice yard weaning.
- Mass medicate high risk cattle where the other preventative measures have not been possible.
- When constructing new pens or replacing water troughs, provide separate water troughs for each pen.
- Avoid high concentrations of non-protein nitrogen in starter diets.
- Provide dietary vitamin E at the upper range of the National Research Council recommendation of 60 IU/kg DM, but no greater.
- Provide dietary zinc at a basal concentration of 30 mg/kg DM for the duration of the feeding period and provide additional zinc in an organic form at 45 mg/kg DM for the first 28 days, to achieve a total dietary zinc concentration during the adaptation phase of 75 mg/kg DM.
- Vaccinate with modified live BHV-1 vaccine at feedlot entry.
- Give two injections of Bovilis MH at four week intervals before feedlot delivery.
- Give two injections of Pestigard at four week intervals before feedlot delivery.

virus antibody titres, the risk of BRD increased with increasing exposure to respiratory viruses during the first 6 weeks in the feedlot.

Environmental factors

Complex interactions of temperature, wind speed, humidity and rainfall are most likely involved in the development of BRD. Weather which results in large temperature fluctuations, cold stress or heat stress of cattle is believed to increase the incidence of BRD in feedlot cattle. The NBRDI (2014) reported that relative to spring, cattle were 2.4, 2.1 and 1.6 times more likely to be treated for BRD in summer, autumn and winter respectively.

Extended periods of low rainfall can also result in dusty conditions around the feedlot. Feedlot dust can contain viable microbes and endotoxin and has been implicated as a possible contributor to BRD. Repeated exposure to feedlot dust has caused lung damage in sheep and initiated pneumonia in goats and has been associated with an increase in BRD in cattle, with a lag of several days. The relationship between dust levels in feedlots and BRD incidence requires further research in Australia.

Management factors

Pre-feedlot

Pre-feedlot management factors include optimising nutrition, health management, transportation and marketing.

Weaning is a key time for management of potential feeder cattle. Australian research has reported the positive benefits of yard weaning, independently of the effects of vaccination to reduce the incidence of BRD. Yard weaning involves holding weaners in a penned environment with regular handling for 10 days and feeding good quality hay or silage. It is thought that learned feeding behaviour and the establishment of social groups have positive effects on subsequent health and productivity of yard-weaned cattle in the feedlot.

Health management practices applied on farm prior to feedlot entry typically include identification, vaccination, treatments for internal and external parasites, implantation, castration and dehorning. On farm vaccination against BRD pathogens is currently accomplished by the use of four products (See Table 1).

Apart from feedlot experiments used to register these vaccines in Australia, little peer-reviewed research exists on the efficacy of on farm administration of these vaccines. The NBRDI (2014) reported a modest protective effect from on farm vaccination with Pestigard® or Bovilis MH®. MLA is currently funding research to assess the effects of local backgrounding (4 to 12 weeks) with and without vaccination against M. haemolytica and/or BVDV on the incidence of feedlot BRD.

Transportation to marketing or feedlots is a stressful process leading to dehydration and shrink. Transport length and duration and loading position in the truck have been implicated as causative factors of BRD by international research. Australian research has reported lower immune function for six days post-transport after a 72 hour haul for *Bos indicus* steers. The NBRDI (2014) reported that cattle transported for six hours or more within a 24 hour period were at slightly increased risk of BRD compared to cattle transported fewer than six hours.

The marketing of feeder cattle can also have effects on BRD incidence in the feedlot. In general, cattle purchased out of saleyards and placed directly in the feedlot have greater levels of morbidity than cattle sourced directly from the vendor on farm. For saleyard cattle, the timing of purchase influences BRD incidence. Mixing cattle through saleyards was associated with increases of 1.9 and 2.6 times the likelihood of BRD treatment for cattle mixed between 27 and 13 days, and 12 days or fewer before feedlot entry (NBRDI, 2014). Animals not mixed with cattle from other farms prior to 12 days before induction and then exposed to a high level of mixing (≥4 groups of animals mixed) had a 3.7 times greater likelihood of BRD treatment compared to animals mixed at least four weeks before induction with fewer than four groups forming the cohort. It is thought that cattle mixed 28 days or more prior to feedlot induction and then kept in familiar pasture environments might have improved immunity to respiratory viruses (as threshold levels of antibodies have built up due to exposure), and lower stress levels upon feedlot arrival as they have an established social hierarchy.

Table 1: Vaccines available in Australia to decrease BRD incidence

Vaccine	Target	Comments
Bovilis MH® (Coopers)	M.haemolytica	On farm and feedlot use. Killed vaccine. Two subcutaneous injections 3-4 weeks apart. Store at 2-8°C.
Bovilis MH with IBR® (Coopers)	M.haemolytica & BHV-1	On farm and feedlot use. Killed vaccine. Two subcutaneous injections 3-4 weeks apart prior to feedlot entry. Alternative is a priming dose 3-4 weeks prior to feedlot entry and booster at feedlot induction. Store at 2-8°C.
Bovi-shield MH-One® (Zoetis)	M.haemolytica	On farm and feedlot use. Single subcutaneous injection. Onset of immunity within 7 days and duration of immunity 120 days. Where protection is required at weaning, healthy cattle should be vaccinated at least a minimum of 14 days prior to weaning. Calves should be vaccinated at least 7 days prior to transportation, mixing or undergoing conditions leading to stress. Store at 2-8°C.
Pestigard® (Zoetis)	BVDV	On farm use. Two subcutaneous injections should be given 4-6 weeks apart with annual boosters thereafter. Immunity does not develop until at least 14 days after the second dose. Store at 2-8°C.
Rhinogard® (Zoetis)	BHV-1	Feedlot use. Modified live vaccine. Internasal administration.

Feedlot

Feedlot management factors influencing BRD incidence include pen conditions, health management, handling and nutrition.

Management of pen conditions is very important to set cattle up for the feeding period. Poor planning or management could predispose cattle to BRD. Decreasing the number of purchase groups per pen and filling time (time to complete a pen) have been reported to reduce BRD incidence. The NBRDI (2014) reported that pens taking longer than one day to fill were associated with a 1.9 times greater risk of BRD incidence compared to pens closed within one day. As previously mentioned, the source and the timing of mixing of cattle prior to feedlot entry can also affect health outcomes. Positioning of water troughs is important. The NBRDI (2014) reported that cattle that drank from shared fence line water troughs had a risk of BRD incidence three times greater than cattle that drank from isolated pen water troughs. Industry minimum standards for bunk space and density should be followed. The effect of the interval between arrival and induction time and pen surface management (dust control, manure cleaning) on BRD incidence are untested and require further research in Australian feedlots.

Health management practices applied at feedlot arrival typically include identification, vaccination, implantation, treatment for external and internal parasites and in rare cases, dehorning and castration. At feedlot entry, vaccination for respiratory pathogens is achieved through the use or combination of a number of different products (See Table 1). There have been no peer-reviewed published studies to support the efficacy of Bovilis MH® or Bovi-shield MH-One® administered at feedlot arrival. Registration data and field observations from consulting veterinarians support the effectiveness of Rhinogard® in prevention of infectious bovine rhinotracheitis (IBR) caused by BHV-1. There is a need to conduct formal scientific research to demonstrate the efficacy of vaccination strategies at feedlot arrival in commercial feedlots across Australia.

Robust studies with large sample sizes from North America have shown that implantation of cattle with hormonal growth promotants does not increase the risk of BRD. Australian feedlot research has found no benefit to health and growth rate from the injection of vitamins A, D and E at feedlot entry (Cusack et al., 2008; NBRDI 2014). Small pen studies examining the effect of trace mineral injections (copper, zinc, selenium and manganese) on BRD incidence have reported variable responses to the practice. Large commercial studies are required to clarify the effect of injectable trace minerals on BRD incidence.

In special cases, the consulting veterinarian may prescribe mass antibiotic medication (metaphylaxis) at arrival for high risk cattle via injection of oxytetracycline, tilmicosin (Micotil®), or tulthromycin (Draxxin®). Australian and North American research has shown mass medication with tilmicosin or tulthromycin is highly effective for reducing BRD incidence. Metaphylaxis with oxytetracycline was not effective in an Australian study (Cusack, 2004). Additionally, mass medication via in-feed application of chlortetracyline (CTC) is judiciously applied for short durations by some veterinarians to control BRD outbreaks. Data from the United States and Canada reports inconsistent responses from the use of in-feed CTC to reduce the incidence of BRD. Further research on the efficacy of CTC in Australian feedlots is required. Feedlots utilising oxytetracycline and chlortetracycline must adhere to the 90 day Provisional Russian Export Slaughter Interval for cattle destined for this market.

In recent years, there has been increasing focus on the effect of animals persistently infected (PI) with BVDV on the incidence of BRD in feedlots. The NBRDI (2014) identified 0.23% of animals in Australian feedlots as being BVDV-PI. These animals were 1.9 times more likely to be treated for BRD compared to animals that were not BVDV-PI. However, there was no indication that BVDV-PI animals could increase the incidence of BRD in cattle in the same or adjoining pens. Unpublished data from feedlot veterinarians in Australia suggests that BVDV-PI animals can increase BRD treatment incidence by 2.3 times in their pen, with no effect on adjoining pens. They concluded that detection and removal of BVDV-PI animals would only be profitable if the incidence of BRD exceeds 10% of feedlot occupancy on a monthly basis. Further research is also required to determine the effect of staffing levels and concurrent disease on BRD incidence.

Low stress cattle handling has been suggested as a way of reducing BRD incidence in Australian feedlots. Such practices may include pen acclimation or exercising cattle at different times of the feeding period. Meat & Livestock Australia is currently carrying out research on the effect of pen acclimation on BRD incidence in Australian feedlots. At certain times in the feeding period, portions of pens or whole pens may be mixed to maximise pen space utilisation, facilitate hospital returns or for sorting purposes. The effects of such practices on BRD incidence are largely unknown but research data from the US reports elevated levels of stress markers in the bloodstream of cattle continuously mixed at two week intervals. The establishment of a stable social hierarchy might be important for lowering stress for feedlot cattle.

Nutrition is an important consideration in BRD prevention. Variations in dietary protein, energy, minerals and vitamins have all been suggested as possible contributors to BRD incidence. In general, high levels of non-protein nitrogen and fermented feeds such as silage in starting diets are associated with an increased risk of BRD, based on North American research. High levels of dietary energy have also been associated with BRD incidence. In a summary of available research data, US researchers reported a slight increase in BRD morbidity from diets with decreasing roughage content from zero to 75% concentrate. However, the lower BRD morbidity with higher roughage diets did not offset the financial loss due to lower growth rate and higher feed intake. Often there is a perceived link between ruminal acidosis in the starting period and BRD incidence. Further research is required to define the relationship between ruminal acidosis (eg. grain quantity, source, processing intensity, bunk management strategy) and BRD incidence in Australian feedlots.

Vitamins and trace minerals have key roles in immune system function. A meta-analysis of Vitamin E requirements by Cusack et al. (2009) concluded that vitamin E should be fed within the National Research Council (1996) recommended ranges, and that higher dietary inclusion rates (> 60 IU/kg DM) do not consistently reduce BRD and are not profitable. Increased levels of trace minerals (eg zinc, copper, manganese, cobalt) are often fed in starting diets to compensate for decreased feed intake, any incoming deficiencies and to improve immune function. Additionally, 'organic' minerals are marketed to feedlots as a more bioavailable form compared to cheaper inorganic forms (eg sulphates of zinc and copper). A review of the published literature from North American studies makes the following conclusions: in general, dietary organic sources of copper do not enhance immunity, health or production compared with inorganic sources and expenditure on these is therefore not justified; it is unclear if organic sources of manganese or cobalt improve immunity, health or production (in isolation from the effects of zinc in these research experiments) compared with inorganic sources of these minerals, and expenditure on these is therefore not justified; and organic zinc does not consistently improve feedlot production but can enhance immunity, potentially reducing BRD morbidity during the early feeding period. It is recommended that feedlots supplement stressed cattle during the first 28 days with 75 mg/kg DM zinc in line with NRC (1996) recommendations, with 30 mg/kg DM from zinc sulphate and 45 mg/kg from organic zinc sources. When considering using inorganic mineral forms, it is recommended feedlots utilise sulphates rather than oxide forms as they have greater bioavailability.

Dietary feed additives such as Saccharin-based sweeteners (Sucram) and yeast products have been marketed as a mechanism to decrease BRD morbidity and mortality. Sucram had no effect on the incidence of BRD in two experiments in Texas. Research with yeast-based products has been variable and requires further investigation in large pen studies.

Other strategies to improve the mineral status of animals at arrival include the use of electrolytes, and molasses-based supplements. The effect of electrolytes in water on arrival has not been tested in a formal research setting. An Australian study in 2014 found that feeding of a molasses-urea supplement to cattle in starter pens had no effect on BRD morbidity or mortality.

More information

For further information on the preventative practices for BRD, refer to:

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