



Nitrate and nitrite poisoning of livestock

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Nitrate accumulation in plants is a potential danger to grazing animals. It can cause two different disorders - nitrate poisoning and nitrite poisoning. Nitrates may cause inflammation of the gut when eaten in large quantities, but their main importance is as a source of nitrite. Nitrites cause respiratory distress due to interference with oxygenation of blood; death may follow. Pigs are the species most susceptible to nitrite poisoning, followed by cattle, sheep and horses.

Plants absorb nitrogen from the soil in the form of nitrates, which are then converted into proteins and other nitrogen-containing substances. Normally plants contain relatively small amounts of nitrate as such, because the conversions take place fairly rapidly inside the leaf. However, during periods of drought the amount of nitrate in the soil can increase greatly because of lack of leaching, reduced uptake by plants, and decomposition of organic matter. After the drought breaks nitrate uptake by plants may be high. While high concentrations of nitrate are not toxic to plants, animals grazing on such plants may suffer from poisoning. Major outbreaks of nitrate and nitrite poisoning have occurred after prolonged dry periods in Victoria.

Apart from high natural availability of soil nitrogen, various other factors promote high concentrations of nitrate in plants. These include moisture stress, decreased light (cloudiness, short day length), and low temperatures. The use of nitrogenous fertilisers, and spraying plants with hormone-type herbicides (such as 2,4-D) can also cause a build-up of nitrate levels in plants.

Many weeds, crop and pasture plants have been reported as capable of causing nitrate and/or nitrite poisoning. Capeweed, variegated thistle, and pigweed (*Portulaca oleracea*) are well-known accumulators of nitrate. Many of the major crop plants have been implicated, including maize, rape, soybean, linseed, sorghum, millet, wheat, oats and barley. Lucerne, subterranean clover, and Tama ryegrass have also been reported to be capable of accumulating large amounts of nitrate in their leaves and stems.

Nitrate poisoning

Nitrate in the diet of ruminants is normally broken down by microbial action in the rumen, first to nitrite and then to ammonia. Ruminants can tolerate fairly high levels of nitrate in their diet if the intake is spread over the whole of the feeding day and if their diet is also high in readily available carbohydrate, which is needed to fuel the microbial activity in the rumen. If these conditions are not met, the nitrate can accumulate, resulting in poisoning.

Signs of nitrate poisoning

Nitrates have a direct caustic action on the lining of the gut. The main signs are diarrhoea, salivation and abdominal pain.

Nitrite poisoning

If an animal's nitrate intake is too high, or if conditions are not right for the conversion of nitrite to ammonia in the rumen, nitrite will accumulate and may be absorbed into the blood.

Nitrite may also be absorbed direct from fodder such as hay if it becomes wet or mouldy. Microbes on the fodder convert nitrate to nitrite under these conditions.

Nitrite reduces the ability of the blood to transport oxygen throughout the body of the animal. If the nitrite level is high enough, death can occur through oxygen starvation.

Non-ruminants, such as horses and pigs, have no mechanism for converting nitrate to nitrite in their digestive tracts and so are not in danger of getting nitrite poisoning from an excessive intake of nitrate. They are, however, highly susceptible to oral intake of nitrite (for example, in mouldy hay) because they cannot convert the nitrite to ammonia.

Signs of nitrite poisoning

Difficulty in breathing, with gasping, rapid breaths is the most obvious sign. Affected animals are weak and tremble and will stagger. Severely affected animals will go down, convulse and die. In some nitrite poisonings of cattle the main problem is abortion occurring a few days after exposure.

The blood has a dark brown appearance which is obvious at post mortem. However, the blood returns to its normal colour a few hours after death. Pin-point haemorrhages may be present in the heart and trachea along with general congestion of the blood vessels.

Diagnosis of nitrite poisoning

Analysis of plant material from the pasture on which animals suspected of suffering from nitrite poisoning have been grazing, may be a useful guide to diagnosis, but it should never be used as the sole criterion.

Laboratory analysis may be used to determine the amount of nitrite in plant herbage. Plants containing more than 1.5% nitrate (expressed as potassium nitrate) on a dry weight basis are considered to be potentially dangerous. The accuracy of the testing depends on the thoroughness of sampling; plants growing near each other can have large variations in their nitrate content. There can also be different concentrations of nitrate in different parts of the same plant.

The animal provides the most positive means of diagnosis after a problem has occurred. As well as looking for the signs described earlier, blood and rumen contents can be collected for analysis of nitrite levels, specimens must be collected within one to two hours of death to be of any value. The samples should be kept cool and sent to the laboratory as soon as possible.

Prevention of nitrate and nitrite poisoning

The best policy is to prevent poisoning. Animals can usually cope with grazing pastures that are high in nitrate providing intake is controlled. In practical terms, this means not grazing hungry stock on forages that are

potentially dangerous, such as lush capeweed, or fodder crops such as oats or millet. Holding paddocks around shearing sheds often contain lush capeweed because of the high fertility of the soil and infrequent heavy grazing. In these areas where grazing management is fairly intense (or on dairy farms) animals should be initially given access to safe pastures. When their appetite has been reduced they can, if it is necessary, be moved to high risk pastures later in the day. They are then less likely to gorge themselves on the high-nitrate fodder.

Hay that is known to be safe could also be fed to hungry stock to reduce their appetite before they are given access to high-risk fodder.

When nitrate or nitrite poisoning is suspected, animals should be removed from the suspect paddock and placed onto feed containing less toxic herbage. Hay or some other low-nitrate herbage should also be fed so as to dilute the nitrate and/or nitrite in the stomach. If capeweed is the dominant species on your property (this often occurs following drought years), consideration should be given to the methods of eliminating it or reducing it, at least from some paddocks.

Be careful of feeding stock on fodder crops, particularly if the crop has been fertilised with nitrogen.

Treatment of nitrite poisoning

Urgent veterinary attention is required. Methylene blue (1% solution) is the specific treatment and is given intravenously by a veterinarian. Repeated treatments are often needed.

If you suspect nitrate or nitrite poisoning, seek immediate veterinary advice.

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