

Nitrate Poisoning of Ruminants



What is nitrate poisoning?

Nitrate poisoning occurs when stock graze plants that have high levels of nitrate in the leaf. When plants are growing rapidly, they absorb a large proportion of soil nitrogen (N) as nitrate (NO_3). Normally plants convert that nitrate into other forms of N (ammonium and simple amino acids) in the roots and these are then transported around the plant. Under some conditions, nitrate uptake from the soil exceeds the capacity of the nitrate conversion process in the roots. This leads to a situation where nitrate is continuing to be absorbed by the roots, which fails to be converted into other forms of N, thus nitrate is transported to the leaves and stems. This leads to elevated levels of nitrate in the plant leaves and potentially in turn nitrate poisoning. The ingested nitrate converts to nitrite in the rumen and this enters the blood stream. Nitrite in the blood stream greatly reduces its oxygen carrying capacity and this leads to the animal dying. Nitrate poisoning is generally very quick, therefore relying on visual symptoms to diagnose it is not generally an option. Death can occur within an hour of eating fodder high in nitrates. Pastures can be tested to get an actual nitrate level. Anything above 2.0g/kgDM is considered a risk.

Conditions likely to lead to high nitrate levels in plants

- **Just after an extended dry spell.** Once the dry spell is broken with rain, there is often rapid plant growth and the resulting rapid absorption of nitrate.
 - **Overcast, moist conditions with warm soil temperatures.** Photosynthesis converts nitrates into products that the plant uses to grow. Overcast conditions slow the rate of photosynthesis, however the warm conditions drive the continued uptake of nitrate and the subsequent "overflow" of nitrate from the roots into the leaves and shoots.
 - **The high use of nitrogen fertilisers.** However, be aware that nitrate poisoning can, and often does, occur in the absence of N fertiliser application.
 - **New grasses or greenfeed crops in cultivated ground, particularly after a dry spell.** Recently cultivated soil releases organic nitrogen into nitrate; this is rapidly absorbed once the crops "come away" in the autumn at the end of the dry spell.
 - **Some plant species seem to be prone to accumulating high levels of nitrate.** Particularly, greenfeed rape, turnips, kale, choulmoulier, swedes, vigorous ryegrass, cereal greenfeed crops and fresh grasses.
 - **Autumn re-growth of ryegrass seed crops.** Irrigation and high nitrogen use can result in very vigorous growth which could cause nitrate poisoning.
 - **Wilted, diseased or herbicide affected plants.** These situations rarely cause nitrate poisoning, however it can happen.
- Since there are many factors causing nitrate poisoning, it is not practical to estimate the nitrate level of a particular crop or paddock. Therefore, a nitrate test must be done if you suspect a crop may be high in nitrates.

Testing the plant nitrate status

A very simple test called the Merckoquant nitrate test strip is available from your vet. Testing the herbage with these strips is relatively simple; a plant is pulled from the ground at the base of the stem, cleaned off with a knife, the stem cut and a drop of sap dripped onto the reaction pad at the end of the strip. The time it takes for the strip to change colour to a deep purple is a measure of the nitrate status. A rough guide for a crop to be safe, is the colour change must generally take longer than 20 seconds.

What can farmers do to prevent nitrate poisoning?

- **Introduce stock slowly to the crop.** The first feed should only be for an hour, and then taken off. Stock generally take 2 weeks to adjust to grazing brassica crops.
 - **Feed high carbohydrate feeds as well.** It is important for animals not to go on to crops that may be high in nitrates when they are hungry. Feeding carbohydrates such as hay, can dilute the level of nitrates consumed.
 - **Do not apply nitrogen fertiliser to a brassicas within 6 weeks of grazing.**
 - **Cutting and wilting feed.** Anecdotal testimony suggests that cutting before feeding can also help, however there is *no solid evidence to support or refute this claim*. Beware of re-growth under the mown crop.

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