A survey of nitrate levels in failed cereal and canola crops during spring/summer 2019 in NSW

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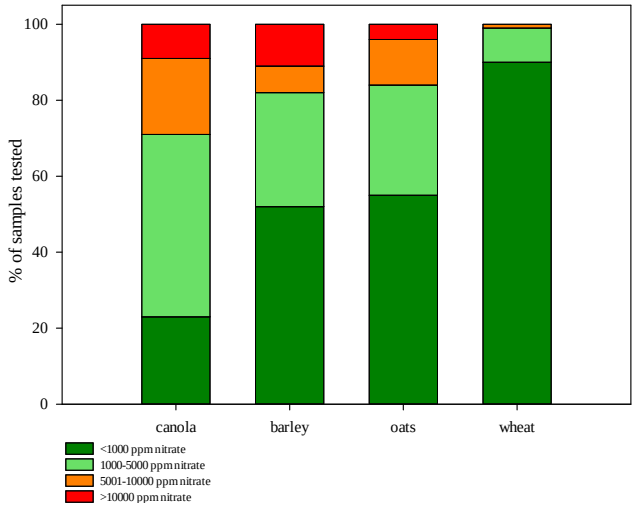
In 2019 Australia had the lowest rainfall on record with 40% below average precipitation, and NSW recorded its driest year on record with widespread crop failures(BOM 2020). Many growers salvaged crops for hay and silage or grazed the failed crops directly to offset losses on cereal and canola crops. Data on the relative danger of nitrate in failed crops has been lacking.

Nitrates can be toxic to ruminants with converted nitrite binding irreversibly with haemoglobin forming methaemoglobin that can cause animals to die from respiratory distress. An animal's ability to tolerate high nitrate can be variable depending on the species, available dietary carbohydrate, and prior exposure to diets with high nitrates (Sidhu, 2011).

During periods of drought, nitrate levels can accumulate in soil due to breakdown of organic matter and a lack of leaching and plant growth (Bolan, 2003). Higher accumulation during springtime can also be exacerbated by additional application of nitrogen fertiliser late in the season, or from earlier applications which were not effectively utilised by the plant (Foyer, 1998). Plants normally acquire nitrogen through uptake of nitrate from root systems, and will efficiently take up excess concentrations when available, especially following rain events in the wake of extended dry periods. Conversion of nitrate to amino acids and proteins can be stifled as the plant becomes stressed due to lack of moisture (Sidhu, 2011).

The concentration of nitrate was measured in samples received by the NSW DPI Feed Quality Service between 01/09/19 to 19/12/19. A total of 44 barley, 49 oaten, 617 canola, and 136 wheaten samples were measured for nitrate (as NO_3 ppm DM) using Flow Injection Analysis (FIA). Briefly 0.20g dried/ground sample is extracted in 25mL deionised water on a reciprocal shaker for 30 minutes, and then filtered prior to analysis on the a Lachat 8500 instrument (Haybridge, 2007). Results are illustrated in the graph below. Values under 5000 ppm are considered safe to feed, between 5,000-10,000ppm feed must be managed, and above 10,000ppm livestock deaths are likely to occur (Kahn, 2005). These samples represented silages, hays and standing forage crops.

Table 1. Nitrate concentration of 2019 drought stressed crops.



29% of canola samples had greater than 5,000 ppm nitrate, with 9% above 10,000ppm, Wheaten hay represented the safest feed with only 1% of samples above 5,000ppm nitrate, followed by oats, barley and then canola.

NSW Local Land Services (LLS) Livestock Officers reported sorghum and millet caused the most stock losses recording concentrations in the range of 15,000-50,000 ppm. In one instance a farmer lost 150 cattle on standing sorghum. There were some confirmed losses from consumption of canola, however there were no reported deaths from consumption of any cereal crops. This work confirms drought stressed canola and barley represent a significant risk for nitrate poisoning with other cereal crops posing a much lower risk. Laboratory testing, providing adequate carbohydrate, and monitoring animals health during consumption are critical factors in managing risk when feeding drought stressed forage.

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