

Northland Pastoral Extension: Popular Summary

Mycotoxins & Respiratory Disease



Summary of Key Findings

- A mycotoxin is a toxic substance produced by a fungus, these fungus can live in symbiotic association with pasture plants.
- Mycotoxicoses are some of the most important diseases of grazing livestock in New Zealand, especially in the warmer northern regions.
- Facial eczema (pythomycototoxicosis) has been extensively studied and several successful control methods now exist. FE is not covered by this paper.
- Ryegrass staggers is due to the endophyte (fungus) lolitrem B in ryegrass.
- Ergovaline, another endophyte found in ryegrass and wild-type tall fescue, can cause hyperthermia or heat stress.
- Paspalum staggers and the infertility caused by zearalenone are other examples of mycotoxicoses.
- New non-toxic endophytes are now inoculated into ryegrass cultivar seeds.
- Pneumonia in lambs can be caused by heat stress and a strong risk factor is panting by sheep which have been driven too hard.

Mycotoxins

Endophytes ("within the plant") are symbiotic fungi living between plant cells, concentrated in the leaf sheath. The natural condition of perennial ryegrass is to be infected with the endophyte *Neotyphodium lolii*. The endophyte protects the plant from invertebrate pests, namely Argentine stem weevil (nationwide) and black beetle (northern region) and therefore encourages pasture persistence. However the endophytes



also produce alkaloid metabolites like lolitrem B, ergovaline, peramine and zearalenone which are called mycotoxins because of the toxic effects they have on insects and grazing livestock. These are in high concentrations during summer months and have therefore become associated with heat stress. New Zealand's agricultural scientists lead the world in the discovery, description and mitigation of endophytes in grasses. They have shown that it is possible to treat grass seed to remove endophytes and have endophyte-free pastures which don't have the same livestock disease potential. However, the plants were vigorously attacked by pests. The next development was growing grasses from seed which has been deliberately infected with endophytes which produce different alkaloids, so insect resistance remains for the plant but without toxicity to animals. These are named AR1 and AR37 endophytes, now available in a number of ryegrass cultivars.



In the beginning

In the mid 1980s, MAF Animal Health Division vets read scientific reports from the United States on "tall fescue toxicosis" in cattle which had similarities to observed hyperthermia in northern herds. They found an association between hyperthermia and the presence of tall fescue on NZ farms. At that stage it was not recognised that the disease was due to a fungal toxin (mycotoxicosis) produced by endophyte fungi growing in wild tall fescue and also in commercial perennial ryegrasses. Work elsewhere identified the problems of ryegrass staggers, heat stress and fescue foot, arising from endophytes in these grasses. The endophytes and their toxins had the useful survival trait for the grasses of protecting them against insect damage, particularly Argentine stem weevil. Intensive searching around the world found different strains of endophyte which produced low lolitrem B and ergovaline levels but maintained the peramine level necessary for insect resistance.

Dairy cow performance on pastures with and without ergovaline and lolitrem B.

An on-farm trial at Te Hana, Northland, measured milk production responses for two groups of 16 cows which were a) on normal ryegrass-based pastures containing wild-type endophytes

producing ergovaline and lolitrem B [+Ev] or b) on pasture free of endophyte or containing a novel endophyte with neither ergovaline or lolitrem B [-Ev]. The trial ran from October to April.

There was no difference in October and November but in December a 25% yield in favour of the -Ev group developed. Substantial differences were maintained until the trial finished.

Authors: RG Keogh, M Blackwell, P Shepherd

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Pasture management

Further trial work in the same area by the same researchers has highlighted the need to keep wild-type endophyte ryegrasses from re-invading the nil-endophyte or novel-endophyte (non-toxic) new pastures. For example, seed-heads on endophyte-free ryegrass are grazed by cows, but those on wild-type ryegrass are not. So removal of seed-heads before seed-set is one strategy that would slow the rate of wild-type ryegrass invasion.

AR1 endophyte

A world-wide search by AgResearch scientists uncovered ryegrasses with endophytes which produce alkaloids that are not toxic to animals. The first of these strains, AR1, went through intensive study of its agronomic, animal safety and animal productivity worth. Sheep and cattle grazing pastures infected with AR1 are free of toxicosis and produce meat and milk





at least as well as animals grazing ryegrass free of any endophyte. AR1 is now available in nearly 20 proprietary ryegrass cultivars and has enjoyed rapid uptake by the farming sector.

AR37 endophyte

The second commercially available new endophyte, AR 37, gives the ryegrass pasture insect resistance not only to Argentine stem weevil and pasture mealy bug, but also to black beetle, root aphid and porina caterpillar. In the upper North Island, black beetle is arguably the major ryegrass pest problem. For reasons not yet entirely clear, AR 37 cultivars also have deeper and more robust root systems.

Zearalenone

Zearalenone is produced by the *Fusarium* spp fungi or moulds and is a powerful estrogenic metabolite which can cause infertility and abortions in sheep, and especially in pigs. It forms on the dead content of pasture which may then be eaten at critical times before and during pregnancy, producing the adverse effects.

Lamb pneumonia

Northland has a problem with higher rates of pneumonia in lambs than other regions, which is a factor in farmers deciding on lower sheep-to-cattle ratios. Heat stress is a major risk factor for pneumonia, and can be observed by farmers and handlers in the behaviour of panting, a cooling mechanism for sheep. It follows that lambs should not be driven hard enough to make them pant. Mustering slowly on cool, cloudy, low humidity and/or windy days is good stockmanship. If the droving distance is long, allow time for lambs to rest.

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The complete research stocktake on Animal Health: Mycotoxins and Respiratory Disease
in Northland is on the Enterprise Northland website: www.enterprisenorthland.co.nz