Seasonal alkaloid concentrations in perennial ryegrass dairy pasture

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ABSTRACT

Total ergovalines and lolitrem B, alkaloids associated with the ryegrass endophyte (*Neotyphodium lolii*), were monitored in dairy pastures across a range of locations in south west Victoria over 12 months during 1999-2000. Concentrations regarded as critical for clinical symptoms of ryegrass staggers and heat stress were restricted to the December-June period, with peaks of total ergovalines (1.8 mg/kg) and lolitrem B (5.1 mg/kg) observed in March 1999 and March 2000 respectively.

KEY WORDS

Endophyte, lolitrem B, ergovaline, ergovalinine, perennial ryegrass, dairy pasture.

INTRODUCTION

The endophyte-infected perennial ryegrass plants in Australian pasture produce alkaloids including ergovaline and lolitrem B; concentration varies between populations within ecotypes (7). The ryegrass endophyte has a significant influence on animal performance. Overt symptoms of ryegrass staggers and heat stress are observed spasmodically but long term affects associated with poor mammary development may occur. Foot *et al*. (4) reported significant increases in lamb mortality when ewes experienced ryegrass staggers as weaners grazed high-endophyte perennial ryegrass, sub. clover pasture. Similarly, dairy cows have had reductions in milk yield (9). The effects of heat stress are likely to be greater in hot, humid situations where conditions do not allow adequate dissipation of accumulated heat (3). From a random survey taken in autumn across 60 dairy farms in SW Victoria, over a third exceeded the critical levels for clinical symptoms. Significant alkaloid concentrations were noted both in extremely old naturalised perennial ryegrass paddocks and in pasture recently renovated with modern cultivars (8). This study assessed the seasonal variation in alkaloid concentrations in the whole plant across a range of environments in SW Victoria.

MATERIALS AND METHODS

Five dairy farms selected from across the region were visited at approximately six week intervals to monitor alkaloid concentrations. On two of these, two paddocks were monitored. Twenty perennial ryegrass plants were randomly sampled and individually packed for determination of endophyte frequency. Three tillers from each plant were cut off below the crown. For determination of alkaloids a bulk sample of perennial ryegrass was similarly harvested at 60 random sites across the paddock. Samples were freeze dried. The presence of endophyte, *N. lolii*, was tested by an enzyme-linked immunosorbant assay (6). Lolitrem B was determined by a method based on Gallagher *et al* (5), modified for herbage with a solid phase extraction clean up. Total ergovalines (ergovaline + ergovalinine) was determined according to Yates and Powell (11).

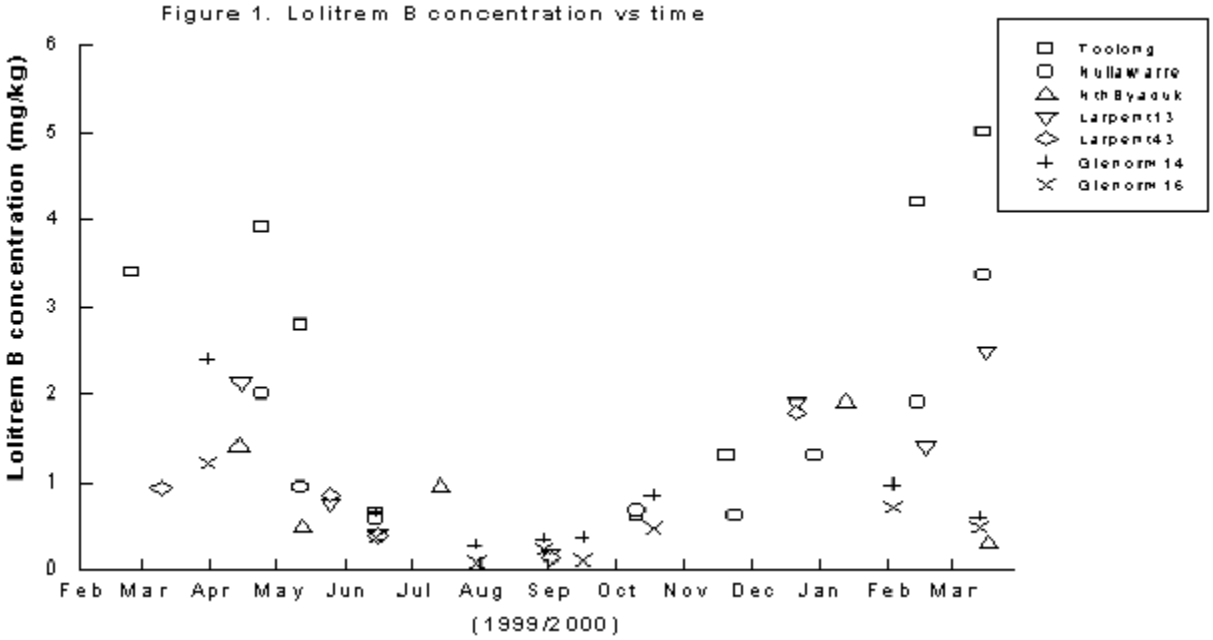
RESULTS AND DISCUSSION

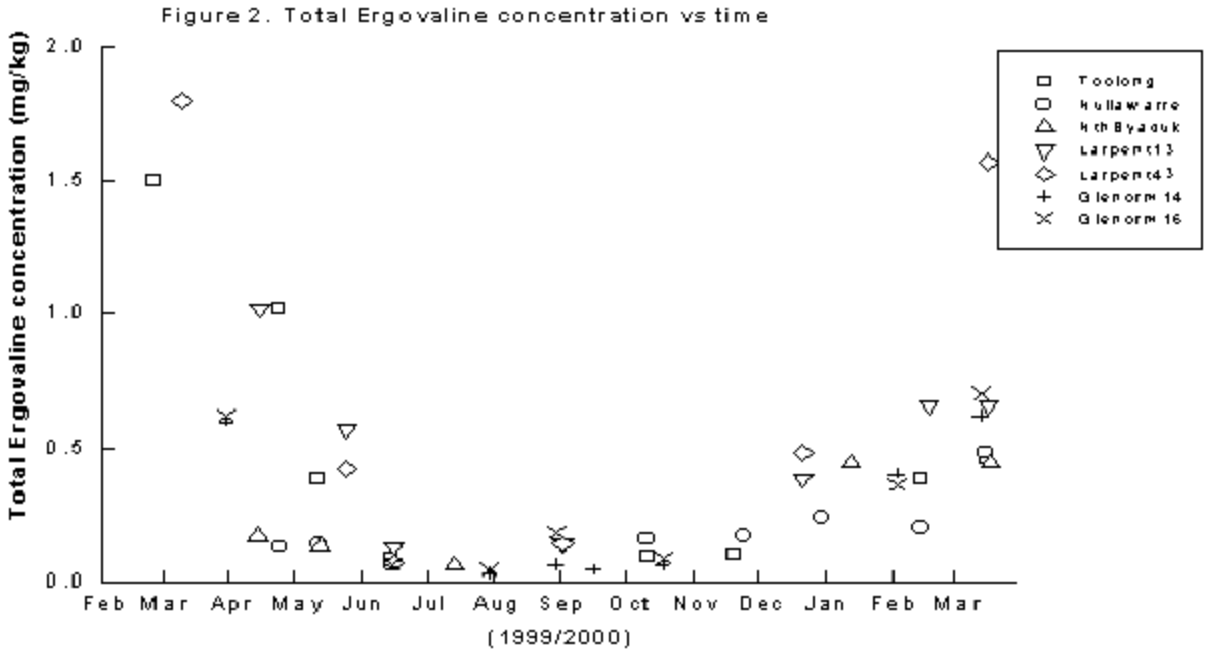
The results of the serial sampling of alkaloids in 7 pastures described below (Table 1) are shown in Figures 1 and 2. All pastures exceeded the ergovaline concentration considered critical (1) for clinical symptoms (0.4 mg/kg). All but one (Glenormiston 16) exceeded the critical concentration for lolitrem B (1.8 mg/kg). Total ergovalines concentration rarely exceeded 0.2 mg/kg between June and November, inclusive. Peak values occurred in March-April. Similarly for lolitrem B, the concentration only exceeded 1.0 mg/kg between November and May. The data confirm that ergovaline and lolitrem B concentrations may vary widely over the season but are likely to peak in the December-May period (2,10).

Table 1. Details of paddocks serially sampled, 1999-2000.

Location	Pasture age (years)	Endophyte frequency (%)	Perennial ryegrass ground cover, April 1999 (%)	Cultivar of perennial ryegrass sown
Larpent 13	1	nd	45	Vedette, Samson
Larpent 43	3	70	50	Banks, Vedette#, Samson#
Glenormiston 14	5	95	40	Ellett
Glenormiston 16	2	95	60	Ellett, Yatsyn 1
Toolong	>50	100	50	Unknown
Nullawarre*	2	85	45	Yatsyn 1
North Byaduk	15	70	50	Unknown

* irrigated nd, not determined # subsequently oversown





CONCLUSION

There is limited information to assist farmers manage ergovaline and lolitrem B. For farmers to maximise animal production from pasture, research is needed on how to effectively establish and protect from contamination, new pasture sown with perennial ryegrass cultivars inoculated with select (low alkaloid) endophyte. Farmers relying on old pasture may reduce the impact of alkaloids by making better provision for vulnerable livestock over the critical period either through pasture management/grazing management strategies, alternative feeds, feed additives or manipulation of rumen flora. Research has yet to define and evaluate such practices.

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