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Facial eczema in hill country — potential toxicity and effects on ewe performance

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ABSTRACT

The impact of a facial eczema outbreak on ewe performance, and its link to pasture conditions, was assessed within a farmlet experiment that investigated aspects of managing pasture surpluses in hill country. Late disposal of lambs and grazing steep land during periods of high spore numbers increased facial eczema in ewes. These effects can be associated with grazing lower pasture masses. In addition to clinical facial eczema deaths, there was a 2-3% increase in barren ewes and a 5-7% reduction in multiple births for every 100 i.u. increase in serum gamma glutamyl transferase levels.

Pithomyces chartarum spore numbers were highest in easy contoured and north to north-west facing paddocks and in ryegrass dominant microsites. Numbers were least in south to south-west facing paddocks and in pastures dominated by low quality herbage and/or low fertility demanding grass species. The effects of facial eczema may well be reduced, but not necessarily eliminated, if the variability in potential toxicity is understood and wisely managed.

Keywords *Pithomyces chartarum*; ewe performance; topography; vegetation type.

INTRODUCTION

The mycotoxin disease, facial eczema (FE) is estimated to cost between \$20 and \$50 million nationally in lost animal production (Towers, 1986; Thomson, 1986). For sheep, these losses principally centre on increased stock losses and reduced ewe fertility (Smeaton *et al.*, 1985; Towers *et al.*, 1987). There are a range of control measures that can reduce the severity of FE outbreaks which include: the identification and avoidance of toxic pastures; use of fungicides; zinc dosing; and in the longer term, selection for more resistant stock and immunisation (Towers, 1986). However, because of direct costs and high labour requirements, little adoption of these options has occurred on hill country sheep and beef properties (Thomson, 1986).

Growth and sporulation of the causative agent, *Pithomyces chartarum*, is favoured by climatic conditions of the lower altitude, warm, moist regions of the North Island. However, there is considerable microvariation within these areas in spore build-up and pasture toxicity. This is dependant on aspect and pasture condition (di Menna and Bailey, 1973; Keogh, 1986). Such variation is greatest in hill country, and if wisely used, it may well be a low-cost means of reducing FE incidence.

During autumn 1985, climatic conditions at Whatawhata Hill Country Research Station allowed the build-up of *P. chartarum* spores to a level, sufficient to cause FE in breeding ewes. The impact of this outbreak on ewe performance, and its link to

pasture conditions, was assessed within an on-going farmlet trial that centred on managing November-January pasture surpluses (see Sheath *et al.*, 1984).

EXPERIMENTAL

There were 12 self-contained farmlets (5-6 ha) in a 2 x 2 factorial experiment that investigated the effects of:

- (1) Preferential control of pasture density and quality on steep or easy contoured land during November-January.
- (2) Disposal of all lambs in mid January or early March.

Each farmlet contained ewes (48-56 balanced for age and breed — Romney, Romney x Coopworth), lambs (100% weaning) and bulls (4-5). All animals were rotationally grazed in separate groups during summer-winter 1985, in the sequence of lambs-ewes-bulls.

P. chartarum spore numbers increased during 1-13 February, and peaked during 6-15 March. During March, grazing was principally concentrated on land given preferential control during November-January. All ewes were bled on 30 March and blood serum concentration of the liver enzyme, gamma-glutamyl transferase (GGT) was determined (Tower and Stratton, 1978).

Spore counts using the wash method (di Menna and Bailey, 1973) were taken immediately before grazing for all paddocks used during 1-13 February. On 4-5 February, additional counts were made for 8 pairs of easy and steep contoured paddocks. Each

paddock pair was matched for aspect, but contrasted in whether the pasture was previously in controlled or rank condition.

More detailed monitoring of spore numbers under specific site conditions was made during 8-11 March 1985. Twelve site types were selected covering a combination of factors: aspect/contour (easy, 5°; north to north-west, 26°; south to south-east 27°); dominant vegetation (ryegrass leaf, legume + weed, other grass leaf, dead + grass stem). Four replicates of these 12 types were measured and blocked on herbage mass (replicate 1, \approx 2.3 t/ha; replicate 2, \approx 1.2 t/ha; replicate 3, \approx 1.8 t/ha; replicate 4, \approx 1.0 t/ha). Five 0.125 m² quadrat areas of pasture were sampled at each site. These were cut to ground level and subsampled for subsequent spore number, species composition determination and dry matter determination. The category *other grass leaf* consisted of sweet vernal (*Anthoxanthum odoratum*), yorkshire fog (*Holcus lanatus*), browntop (*Agrostis capillaris*), rice-grass (*Microaena stipoides*) and danthonia (*Rytidosperma spp.*). Legume leaf was predominantly white clover (*Trifolium repens*). Spore numbers were log transformed for analyses and re-transformed to geometric means for presentation.

RESULTS AND DISCUSSION

Ewe Performance

Farmlets that retained lambs until March and/or concentrated grazing on *controlled* steep land during March had ewes of lighter weight and higher GGT levels at mating (Table 1). Weight differences principally reflected November-January management contrasts. GGT differences were most likely associated with the lower pre- and post-grazing pasture masses resulting from extra lamb grazing demands and/or grazing steep land during March. Grazing into the basal litter layer accentuates toxin ingestion (Campbell, 1970). Associated with these lighter ewe weights and higher GGT levels were greater numbers of cull and barren ewes, and fewer lambs born to ewes lambing. Obviously, the cost-benefit of lamb retention is an important

management consideration for FE prone properties if it means increased grazing pressure and spore ingestion by other stock.

If treatments are ignored, the relationship between individual farmlet mean GGT levels and the percentage of ewes that were present at joining and then culled or barren (CB) was:

$$\text{logit CB} = -3.4 + 0.0058 \text{ GGT} \quad (r^2 = 0.73^{**}, n = 12)$$

While ewe body weight at mating ranged between 51-55 kg and slight confounding can be expected to exist within this relationship, it does provide an adequate between flock estimate of FE effects on CB ewe numbers. Within the range of flock GGT means recorded in this experiment, an increase of 100 iu GGT was associated with a 5-7% unit increase in cull plus barren ewes.

Individual performance of ewes that were present at both joining and lambing was also assessed by logit analysis. The number of surviving ewes that were joined (EJ) and lambed (EL) was significantly affected by both GGT and ewe live weight (LW) (kg) at mating ($P < 0.001$):

$$\text{logit EL/EJ} = 4.09 - 0.0029 \text{ GGT} - 0.01 \text{ LW}$$

This subclinical effect meant that for every 100 iu GGT increase, there was a 2-3% reduction in the number of surviving ewes that lambed.

For ewes that survived and lambed, the relationship between mean farmlet GGT levels and ewes lambing multiples (ELM) per ewe lambing was:

$$\text{logit ELM/EL} = 0.002 - 0.0018 \text{ GGT} \\ (r^2 = 0.61^*, n = 12)$$

On a flock mean basis, this meant that for every 100 iu increase in GGT there was a 4-5% reduction in multiple births.

Logit analyses of individual ewe data indicated that ELM/EL was significantly affected by GGT ($P < 0.001$) but not by ewe live weight at mating:

$$\text{logit ELM/EL} = 0.09 - 0.0028 \text{ GGT}$$

This relationship meant that for every 100 iu increase in individual GGT levels there was an expected 7% reduction in ELM/EL. It is likely that this relationship takes greater account of the impact

TABLE 1 Effect of grazed land type and lamb disposal date on ewe performance

Grazed land type/ lamb disposal date farmlets	Ewe live wt (kg) 2/4/85	Pasture mass (kg DM/ha)		GGT concentration (iu/l)	Proportion culled or barren ¹ (%)	ELM/EL ²
		Pre-grazing	Post-grazing			
Easy/January	55.2	1820	1260	114	7.2	0.46
Easy/March	54.8	1400	890	190	14.3	0.43
Steep/January	52.3	1670	1140	244	16.6	0.36
Steep/March	51.8	1200	870	265	16.0	0.39
SED	0.6	152	102	47	6.3	0.04

¹ Ewes that were culled or died because of severe clinical FE plus surviving barren ewes

² Ewes lambing multiples/ewe lambing.

of high GGT levels (> 500) on individual performance than does the mean flock relationship.

Increased barrenness and reduced multiple births resulting from FE have been reported from other experiments (Moore *et al.*, 1983; Smeaton *et al.*, 1985; Towers, 1986; Towers *et al.*, 1987). In this experiment there were the obvious clinical losses (5-9% cull), plus the "unseen" costs of a 2-3% increase in barrenness and a reduction of 5-7 multiple births per 100 ewes lambing for every 100 iu GGT increase recorded.

Spore Counts

When paddocks grazed during 1-13 February were grouped on the basis of contour and state of previous pasture control, there was an indication that spore numbers were lower where rank pasture conditions had prevailed (Table 2). This trend was substantiated by a paired paddock comparisons made on 4-5 February ($P < 0.01$). At the time of sampling, previously rank pasture had low proportions of grass leaf, but high levels of senescent grass stem. In addition, the highest numbers of spores were regularly found in pasture on easy contoured, controlled paddocks that are typically the most improved in terms of soil fertility and ryegrass content.

During the second and major surge in spore numbers (8-11 March) spore numbers in 12 defined micro-site types were compared (Table 3). Considering main factor comparisons, spore numbers were least on cooler south to south-east

facing slopes compared with either north to north-west facing hillsides or easy contoured paddocks. This is in agreement with the survey monitoring of di Menna and Bailey (1983).

In terms of pasture type, highest numbers were found at sites most dominant in ryegrass; and least at sites dominated by low fertility demanding grasses (e.g. browntop and danthonia). Whether these differences are direct species effects, or reflect the site conditions (moisture, soil fertility) that determine their abundance, is uncertain. Nevertheless, the practical outcome of these spore counts was the indication that ryegrass dominant pastures on easy contoured land are highly FE prone, particularly if leafy pastures become desiccated during dry conditions leading up to periods of FE outbreak. Considering *P. chartarum* is a saprophytic fungus, it seems contradictory that areas dominated by dead leaf and grass stem should have lower spore numbers. Obviously, site conditions or the material itself does not lead to rapid litter decomposition and hence spore build-up.

CONCLUSION

Losses due to the moderate (150-250 flock mean GGT) FE outbreak reported in this paper amounted to approximately 12% more cull and dry ewes and 14% less multiple lamb births. These losses could have been reduced, but not necessarily eliminated, if variability in potential toxicity that is present in hill country, was wisely used. Grazing south and south-east facing hills and pasture types dominated by low

TABLE 2 Effect of paddock type on number of *P. chartarum* spores (,000)

Contour/ pasture condition	Grouped paddock spore nos. (1-13 Feb)	Paired paddock spore nos. (4-5 Feb)	Pre-graze mass Feb (kg DM/ha)	Pasture composition ² (% dry wt)
Easy/control	20 (19) ¹	24	2.3	37, 7, 16, 16, 24
Steep/control	29 (23)	14	1.9	
Easy/rank	11 (5)	6	2.0	12, 39, 11, 8, 30
Steep/rank	14 (5)	7	1.9	
Least significant ratio	—	2.1	—	—

¹ Number of paddocks making up mean

² % composition: green grass leaf, grass stem, legume, weed, dead leaf.

TABLE 3 *P. chartarum* spore numbers (,000) for contrasting topographic and pasture types; and composition (% dry wt) of the pasture types.

Dominant pasture type	Spore numbers			Ryegrass leaf	Pasture composition		
	Easy contour	N-NW hill aspect	S-SE hill aspect		Legume and weeds	Low fertility grasses	Dead leaf and stem
Ryegrass	220	220	72	40	11	7	42
Legume and flat weeds	99	180	73	17	44	5	34
Low fertility grasses	120	67	40	5	6	32	12
Dead leaf and grass stem	60	110	42	10	9	12	69
Least significant ratio		2.5					

quality feed and/or low fertility demanding grasses would have reduced exposure to toxic spores. The proviso being however, that they were not of low pasture mass. Certainly grazing of low pasture mass paddocks facing north and north-west and easy contour paddocks dominated by desiccated ryegrass leaf should have been avoided. Based on field observations of FE incidence, Cunningham (1947) would have made similar recommendations. When do we ever learn?

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