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GRAZING BEHAVIOUR OF SHEEP DURING SUMMER AND AUTUMN IN RELATION TO FACIAL ECZEMA

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SUMMARY

Defoliation studies have shown that, during summer and autumn, on ryegrass-dominant pastures, sheep ingest little inter-excreta herbage before most of the available urine-patch herbage has been removed. On this type of pasture *Pithomyces chartarum* spore loads are likely to be much higher at urine-patch than at inter-excreta sites. To ensure that ingestion of spores is kept to a minimum, it is therefore necessary to prevent close grazing at urine-patch sites.

Grazing patterns are also affected by the presence of white clover in pastures. Areas containing white clover are grazed in preference to similar areas without the legume. Additionally the herbage present at sites containing white clover is relatively closely grazed. Because *P. chartarum* spore loads are lower than in grass-dominant pastures, the risk involved in grazing grass/clover pastures is also much lower.

INTRODUCTION

Some of the earlier investigations into outbreaks of facial eczema showed that they were most severe on closely-grazed, ryegrass-dominant pastures (Levy and Smallfield, 1942). The finding (Thornton and Percival, 1959) that facial eczema was caused through livestock ingesting a mycotoxin produced by the pasture saprophyte, *Pithomyces chartarum* (Berk. & Curt.), M. B. Ellis, led to attention being focused on a host of interactions involving, amongst others, plant, animal, soil, and environmental factors. Information subsequently obtained showed that, although the fungus could develop on all types of pasture litter, sporulation was often confined, during fine warm weather, to the more sheltered basal litter in grazed pastures (Brook, 1963), and that sheep obtained the spores (toxin) principally through the ingestion of this basal litter (Lancashire and Keogh, 1964, 1968). This explains why outbreaks are likely to be more severe on closely-grazed pastures. However, some of the questions posed by Levy and Smallfield's (1942) findings, in particular why facial eczema outbreaks are more severe on ryegrass-dominant pastures, have remained unanswered or, at best, only partially explained.

To understand the problem further, and its control, it is necessary to be aware of some of the interactions that occur in grazed pastures. The aim of this paper is to present and integrate information on the grazing patterns of sheep, pasture structure and growth, and *P. chartarum* spore distribution patterns, which may help fill some of the blanks in the facial eczema jigsaw, and also be used as a basis for control measures based on pasture management.

PASTURE STRUCTURE AND GROWTH

RYGRASS-DOMINANT PASTURES

During summer and autumn much of the herbage present on sheep-grazed, ryegrass-dominant pastures is associated with either urine-patch or inter-excreta sites.

Increases in yield of live herbage components in such pastures are confined, for most of summer, to urine-patch sites (Table 1).

TABLE 1
Total Herbage and Some Component Yields (g DM/m²) for Spelled Urine-patch and Inter-excreta Areas on Two Sampling Dates

	Urine Patch Areas			Inter-excreta Areas						
	Ryegrass only present			Ryegrass only present			Ryegrass plus White Clover			
	Total	LL	DL	Total	LL	DL	Total	LL	WC	DL
25.2.72	284	154	116	352	130	162	304	48	46	94
14.3.72	416	266	126	380	132	196	390	86	74	126
SE ±	11	7	8	18	10	14	25	6	8	13
	**	**	n.s.	n.s.	n.s.	n.s.	*	**	*	n.s.

Total Total herbage

LL Live ryegrass leaf and sheath

DL Dead ryegrass leaf and sheath

WC Live white clover leaf and petiole

Most of the dead ryegrass leaf and sheath is situated in the base of the pasture (Table 2).

TABLE 2
Dead Ryegrass Leaf and Sheath Yields (g DM/m²), above and below 2 cm, for Spelled Urine-patch and Inter-excreta Sites on 14.3.72

	Urine-patch	Inter-excreta
Above 2 cm	6 ± 1.2	30 ± 3.3
Below 2 cm	120 ± 6	166 ± 2

RYGRASS/WHITE CLOVER PASTURES

Both ryegrass and white clover have contributed to an increased total yield of live components at inter-excreta sites of the mixed association (Table 1).

Grazed pasture containing white clover has a significantly lower quantity of ryegrass litter present than does ryegrass-dominant pasture (Table 3).

TABLE 3

Mean Yields (g DM/m²) of Dead Ryegrass Leaf and Sheath present in Grazed Ryegrass Pastures, with and without White Clover, on 3.4.73

Pasture type	DL Yield
Ryegrass/white clover	66
Ryegrass-dominant—urine-patch	154
Ryegrass-dominant—inter-excreta	172
<i>d</i> 0.01	48

SPORE DISTRIBUTION PATTERNS

For most of summer and autumn, *P. chartarum* spore loads are significantly higher on urine-patch than on inter-excreta dead leaf and sheath (Table 4).

The spore load on dead ryegrass leaf and sheath is also much higher at urine-patch sites than at sites with ryegrass and white clover (Table 5). Later in the season (April onwards) there was insufficient ryegrass litter present at sites containing white clover for an adequate sample.

TABLE 4

Mean *P. chartarum* Spore Loads (Spores $\times 10^{-3}$ per g dry wt) on Dead Ryegrass Leaf and Sheath from Urine-patch and Inter-excreta Sites

	Period	
	17.12.71 to 22.2.72	24.2.72 to 4.5.72
Sampling days	10	15
Urine-patch	60	440
Inter-excreta	0	30

TABLE 5

Mean *P. chartarum* Spore Loads (Spores $\times 10^{-3}$ per g dry wt) on Dead Ryegrass Leaf and Sheath from Urine-patch Sites, and Inter-excreta Sites with and without White Clover

	24.2.72 to 15.3.72 ¹
Urine-patch	460 \pm 60
Inter-excreta ryegrass-dominant	20
Inter-excreta ryegrass/white clover	80 ²

¹Samples taken on 7 dates.

²Insufficient DL present at white clover sites to obtain samples after grazing on 15.3.72.

GRAZING PATTERNS

The results presented in this section relate to pastures that were periodically grazed with sheep during summer and autumn. Similar grazing patterns have been recorded on set-stocked, ryegrass-dominant pastures (Keogh, 1973a).

The methods used to determine grazing patterns consisted mainly of some form of herbage sampling or recording made at regular intervals during grazings, and at fixed (pre-determined) sites for various classes of herbage. This information was supplemented, where necessary, by photographic records and dietary samples obtained from oesophageal-fistulated sheep.

During grazings on ryegrass-dominant pastures, sheep initially defoliate urine-patch, in preference to inter-excreta, herbage (Table 6). In fact, sheep consume little inter-excreta herbage before most of the available urine-patch herbage has been removed (Keogh, 1973b).

Inter-excreta areas containing white clover are grazed in preference to similar areas which are without the legume (Table 7).

TABLE 6

Changes in Mean Height (cm) of Herbage at Urine-patch and Inter-excreta Sites during Grazing 20-24.4.72 (250 ewes/ha)

Days from Start of Grazing	Urine-patch	Inter-excreta
0	13.3	8.2
1	3.7	8.1
2.5	3.1	7.9
4	2.6	4.5
d 0.05	1.0	1.8

TABLE 7
Changes in Mean Height (cm) of Herbage at Ryegrass-dominant and Ryegrass/White Clover Sites during Grazing 12-17.4.72 (250 ewes/ha)

<i>Days from Start of Grazing</i>	<i>Ryegrass-dominant</i>		<i>Ryegrass/White Clover</i>
	<i>Urine-patch</i>	<i>Inter-excreta</i>	
0	21.7	9.3	6.9
1	6.5	8.8	2.9
2	5.6	8.7	2.2
3	4.5	7.8	1.8
4	3.3	6.3	1.6
5	3.2	5.6	1.6
<i>d 0.05</i>	2.1	1.5	0.8

The presence of white clover also affects the extent of defoliation by sheep (Table 8). The herbage present at sites containing white clover is grazed much closer to the soil surface than is herbage at either urine-patch or inter-excreta sites.

TABLE 8
Mean Height (cm) of Herbage residues at Ryegrass-dominant and Ryegrass/White Clover Sites within Three Grazed Pastures, 8.2.72

<i>Ryegrass-dominant Sites</i>	<i>Ryegrass/White Clover Sites</i>	<i>d 0.01</i>
<i>Urine-patch</i>	<i>Inter-excreta</i>	
3.01	4.53	0.3

DISCUSSION

The grazing pattern (frequency and intensity of defoliation) of sheep under dry summer and autumn conditions is strongly influenced by the presence of both white-clover and urine-patch herbage. Urine-patch herbage is grazed in preference to other material present in ryegrass-dominant pastures and this occurs under both set-stocking and rotational grazing. Under set-stocking, urine-patch herbage is grazed more frequently and intensively than inter-excreta herbage (Keogh, 1973a), whilst under rotational grazing most of the urine-patch herbage is grazed before sheep start ingesting inter-excreta herbage.

If the amount of herbage removed from inter-excreta areas on grass-dominant pastures at any grazing is small compared with that available, there will be a gradual increase in the proportion of mature and dead herbage compared with expanding leaf material. At subsequent grazings, the inter-excreta herbage will be

even less acceptable to animals and the grazing patterns likely to be even more clearly defined. The inevitable outcome is that sheep overgraze urine-patch herbage and undergraze inter-excreta herbage. In such a situation with *P. chartarum* spore loads much higher at urine-patch sites, it is obvious that most of the ingested spores will also be obtained from these sites.

The pattern of events outlined above can be expected on pastures that are, or become, ryegrass dominant during the summer, and is advanced as one of the reasons outbreaks of facial eczema are more severe on ryegrass-dominant pastures. To ensure that ingestion of spores by sheep grazing ryegrass-dominant pastures is kept to a minimum, it is necessary to prevent over-grazing at urine-patch sites.

In contrast to the situation in ryegrass-dominant pastures, inter-excreta areas of pasture containing ryegrass plus white clover are readily grazed by sheep. In the process both ryegrass and white clover are harvested and as the herbage is grazed close to ground level (Table 8) some potential ryegrass litter is also likely to be removed. With less ryegrass litter, and that supporting a relatively low *P. chartarum* spore load, ingestion of spores from white clover-based pasture, notwithstanding the close grazing, is also likely to be low.

It is obvious, from Levy and Smallfield's (1942) findings, that the risk of facial eczema is much lower for animals grazing ryegrass pastures with, than without, white clover. This is due, in part, to the effects that the presence of white clover has on the growth, structure, and botanical composition of pasture, the pattern of saprophyte development and the grazing pattern of sheep, and interactions amongst these and other factors.

If all these factors are considered, it is obvious that, in terms of facial eczema control, practices leading to the development of ryegrass dominance during the summer should be avoided. As a corollary to this, the value of having (and maintaining) white clover uniformly distributed throughout a pasture should also be obvious.

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