

Before these questions can be answered completely it will be necessary to learn a great deal about the fungus itself; for example, we must find out how to grow the fungus in quantity, whether the method of growth affects its toxicity, whether spores are the only, or the most, toxic part, and how we can measure the abundance and toxicity of the fungus in the field. Partial answers to these questions have been obtained and Dr Johns deals with some of them.

1. Is the Liver-damaging Factor in the Fungus the Same as that in Pasture?

Obviously the complete answer to this question must await the isolation and identification of the liver-damaging factor from both pasture and fungus. However, investigations at Ruakura and Wallaceville have failed to show any difference in the chemical and biological properties of the extracts containing the liver-damaging factor from the two sources.

The concentration of the liver-damaging factor in some cultures of the fungus is very much greater than in the most toxic samples of pasture. This has facilitated the work of the chemists and should result in the isolation of the liver-damaging factor sooner than seemed possible when it had to be sought in pasture.

2. Is the Fungus the Cause of Facial Eczema in the Field?

Again the evidence is incomplete. However, the fungus has always been found when sought for on pasture which has produced liver damage. At Manutuke during 1959 it was possible to compare liver damage in grazing lambs with spore counts and beaker tests on the pasture grazed by them. There was a very good general correlation between these three measures of toxicity.

Thus, though it is not yet possible to say that facial eczema never occurs in the absence of the fungus, all the available evidence supports the idea that the fungus does cause facial eczema in the field.

3. What Factors Influence the Abundance of the Fungus?

Much of the work on the effect of weather, pasture species, and litter has been done by branches of the Department of Scientific and Industrial Research and Dr Johns's paper tells how these factors affect the abundance of the fungus.

At Manutuke two paddocks were mowed regularly from October 1958 onward at intervals of one to three weeks according to the growth taking place. The pasture was never allowed to become more than 2 in. high. All the clippings were left on one paddock



In 1941 liver damage was produced in experimental lambs fed fresh-cut pasture and in 1943 similar results were obtained with heat-dried pasture. In the lamb above symptoms were produced in 1958 by feeding it fungal material.

and those collected in the catcher were removed from the other. Another paddock was severely harrowed at weekly intervals from late January to mid March. From early January pasture samples were collected at weekly intervals from these and other paddocks and sent to the Soil Bureau, Taita, where spore counts were made. These were much higher on mowed and harrowed paddocks than on untreated paddocks.

Severe liver damage occurred in nearly all the lambs grazing the mowed paddocks during January and February and 35 per cent of them developed skin lesions. Severe liver damage and skin lesions also occurred after harrowing. Mowing and harrowing both caused a rise in beaker tests. It is presumed that both treatments increased the abundance of the fungus by providing litter on which it could grow.

4. How Can the Fungus be Controlled?

Reports that facial eczema had been prevented by topdressing with copper and cobalt led to the testing of this treatment at Manutuke in the autumn of 1957. Five 1-acre paddocks carrying a similar sward were topdressed as follows: No topdressing; 2 cwt of superphosphate; 2 cwt of superphosphate + 5 lb of copper sulphate; 2 cwt of superphosphate + 5 oz of cobalt sulphate; 2 cwt of superphosphate +

5 lb of copper sulphate + 5 oz of cobalt sulphate. Topdressings were applied on 11 January and each paddock was set stocked with 12 lambs from 14 January to 14 May, when all lambs were killed and their livers examined with the following results:

Treatment	Liver damage		
	None	Slight	Severe
No topdressing	4	7	1
Superphosphate only	2	7	2
Superphosphate + copper	2	8	1
Superphosphate + cobalt	2	9	1
Superphosphate + copper + cobalt	3	7	2

It is thus obvious that topdressing with safe amounts of copper either with or without cobalt cannot be relied on to prevent facial eczema. There is a good deal of field evidence to support this conclusion.

In the following year topdressing with a total of 27 lb of copper sulphate per acre was tested in an effort to confirm the results of an experiment reported by Dr Johns. No liver damage occurred in lambs grazing either the treated or untreated paddocks. The copper concentration in the livers of all the lambs grazing the treated paddock reached a dangerously high level.

In 1959 tests were made at Manutuke with three different fungicides which had proved toxic to the fungus in the laboratory. All appeared to be without effect in the paddock even when applied repeatedly. The use of fungicides is beset by many difficulties. To