be effective the time of application may have to be calculated very accurately and they may need to be applied at short intervals.

Most fungicides are quite toxic; 1/10 oz of one of those used killed a lamb in less than 24 hours. A total of 7 lb per acre of this fungicide in three applications was ineffective in controlling the fungus. Enough fungicide to kill over 1,000 lambs was applied per acre over a period of two months.

A culture of a soil organism, *Bacillus subtilis*, which had prevented the growth of the fungus in culture was also ineffective in the paddock, as was topdressing with ½ ton of slaked lime per acre and 6 cwt of superphosphate per acre.

At present there is no safe method which can be recommended for controlling the fungus, nor is it easy to visualise any way in which it could be controlled. However, it is being studied intensively in both the laboratory and the field and this should result in a better understanding of the conditions which favour or hinder its growth. Such an improved understanding may indicate a method of control.

5. How Does the Liver React to the Fungus?

For many years the changes in the liver have been studied in natural and experimental cases of facial eczema in sheep, cattle, and guinea pigs. However, until the discovery of the fungus it had never been possible to give graduated doses of the liver-damaging factor to a large group of animals and kill them at short intervals to discover just how the liver reacts. Now that large quantities of fungus cultures are available such experiments can be undertaken. Already one experiment involving over 200 guinea pigs has been conducted and similar experiments with mice, rats, rabbits, and lambs have been started or are planned. Culture material or extracts of it are being given both by mouth and by injection into different sites including the gall bladder and the vein leading to the liver.

These experiments are very important. Until we can measure accurately the effect of a known dose of liver-damaging factor on experimental animals it will not be possible to calculate the effect of measures designed to protect these animals.

In addition to experiments with animals the effect on cultures of living cells is being studied. If successful, this method would enable the toxicity of an extract to be measured quickly, only very small quantities being used.

6. Can Stock be Protected against the Fungus?

Two avenues are being explored, antidotes and vaccines. Antidotal treatment probably has little hope of success as a practical measure. An antidote must usually be given before, with, or immediately after the poison, and with grazing animals this presents obvious difficulties. The discovery of a successful antidote would, however, be of considerable value in aiding our understanding of the disease. Since the discovery of the fungus, vaccination has become a real possibility, as some fungi are known to provoke the formation of antibodies. This question will be thoroughly explored, as vaccination would be a very practical way of controlling the disease.

Conclusion

Though no new way of controlling the disease has yet been found, the discovery of the fungus has opened up many new lines of attack and one or more of these may well prove fruitful.

In the meantime farmers are recommended to use the control measures which, in spite of their obvious disadvantages, have been successful in preventing any outbreak of facial eczema at Ruakura during the past 16 years.

In the Department of Scientific and Industrial Research

Dr Johns

INVESTIGATIONS of the causes of the very severe outbreak of facial eczema in 1938 were believed to have eliminated the possibility of a micro-organism as the culprit and it was considered that by far the most probable cause was a toxin in the pasture herbage induced by abnormal growth conditions. This was believed to be just one more link in the chain of observations that rapidly growing pasture plants can cause serious disorders of livestock. It was considered that facial eczema was in the same category as bloat and staggers in being associated with abnormal growth conditions.

The Plant Chemistry Laboratory, Department of Scientific and Industrial Research, was established in 1938 under Dr J. Melville to study the relationship of problems such as these to the biochemical processes of pasture plants, with special reference to facial eczema.

Regular meetings of facial eczema workers from both the Department of Agriculture and D.S.I.R. were held for several years, but as Dr Melville left the Plant Chemistry Laboratory for war service, and the laboratory was diverted to defence priority work, D.S.I.R.'s participation gradually decreased and ceased altogether in 1945.

The Department of Agriculture continued the work at Wellington and later at Ruakura, hampered both by the lack of supply of toxic grass and a suitable assay procedure for the toxin.

Large-scale Extraction of Toxic Grass

In 1957 a large amount of facial eczema toxic grass was collected at Manutuke and other Hawke's Bay farms. Dr J. F. Filmer offered the D.S.I.R. 5 cwt of dried grass so that they could again participate in the facial eczema research programme. Dr E. P. White at Ruakura had by this time reached the stage where it was possible to produce as a routine small-scale procedure a concentrate containing 1/20,000 of the original weight of grass. After consultation with the Ruakura workers it was decided that, rather than work independently, the Plant Chemistry Division could best help the programme on the isolation