

## PHOMOPSIN INTAKE REDUCES WOOL GROWTH IN MATED EWES

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### SUMMARY

The effect upon wool growth of feeding toxic lupin stubble daily for 52 days was measured under animal house conditions in mated ewes. Two hundred ewes were randomly allocated to four groups of 50 receiving no, low, medium or high doses of toxic stubble.

Chronic lupinosis was induced in the groups receiving the medium and high doses of stubble. It resulted in reduced feed intakes, elevation of plasma activities of liver enzymes and an increase in the biological half-life for clearance of bromosulphthalein in the plasma.

Wool growth was decreased in all groups receiving toxic stubble. Both high and low dose groups grew shorter ( $P < 0.001$  and  $P < 0.01$ ) and finer ( $P < 0.001$  and  $P < 0.05$ ) wool, while the medium dose group grew shorter ( $P < 0.01$ ) but not finer wool, than the controls. The wool growth effects in the low dose group occurred in the absence of detectable lupinosis.

### INTRODUCTION

In Western Australia large areas of lupins are grown, and the stubbles of these crops provide valuable summer grazing for sheep in the absence of lupinosis. Lupinosis is a mycotoxicosis resulting from the ingestion of phomopsins (Culvenor et al. 1977), toxins produced on lupin stubbles by the fungus *Phomopsis leptostromiformis* (van Warmelo et al. 1970). It is often a fatal disease, but apart from loss of live weight, production losses associated with milder forms of lupinosis have not been quantified. The aim of this experiment was to investigate the effects of phomopsin intake on wool growth of ewes.

### MATERIALS AND METHODS

#### Sheep

Two hundred five and six year old ewes were mated at the Wongan Hills Research Station in preparation for an accompanying experiment investigating the effect of phomopsins on embryo development. The ewes had received normal summer drenching for internal parasites prior to this. The ewes were transported to the Medina Research Station one week after mating, where they were individually penned in a sheep shed.

#### Diets

While at Wongan Hills the ewes were grazed on summer pastures of subterranean clover (*Trifolium subterranean* L.) and fed a supplement of wheaten chaff and non discoloured lupin seed to hasten acceptance of the diet to be provided in the shed. Feeding within the shed commenced at the rate of 500 g wheaten chaff and 200 g lupin seed per day. This was increased by 100 g lupin seed on day 11. Feed residues were collected and weighed daily to determine feed intake, which is a sensitive indicator of lupinosis (Peterson et al. 1987).

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### Treatments

Phomopsins were fed to the ewes in the form of toxic lupin stubble, which was naturally infected with *P. leptostromiformis*. The stubble had been collected in January 1984, as described by Allen *et al.* (1986).

The animals were randomly allocated to one of four treatment groups. The control group received no lupin stubble, whereas other groups received low, medium and high doses of toxic stubble, 10 g, 20-25 g and 30-50 g toxic stubble/day respectively from the day they entered the shed. The diets were fed for 52 days.

### Measurements

Progression of intoxication was assessed daily by monitoring the daily feed intake. Live weight was measured prior to mating and on days 10, 24 and 47 of treatment. Liver damage was evaluated on days 10, 24, 31 and 47 of treatment by the measurement of plasma activities of aspartate amino transferase (AST), gamma glutamyl transferase (GGT) and glutamate dehydrogenase (GLDH) in 20 animals from each group selected on the basis of their live weight. Liver function was monitored in five animals per group by the determination of the biological half-life for clearance of bromosulphthalein (BSP) from the plasma (Lanigan and Peterson 1979) on days 10, 24, 31, 42 and 47 of treatment. Livers were weight after slaughter on day 54.

Wool growth was measured during the period of stubble intake using dyebands (Chapman and Wheeler 1963). These were applied on day 0, and harvested on day 52. The length of staple grown during the experiment was taken as the mean of three measurements made with a ruler from the cut end to the dyeband on each sample, and the fibre diameter was determined on a CSIRO Fibre Fineness Distribution Analyser machine. The change in mean fibre diameter for each animal was calculated as the difference between the diameter of the fibre at the beginning of the experiment and at the cut end of the harvested sample.

### RESULTS

The feed intakes of the groups are illustrated in Fig. 1.

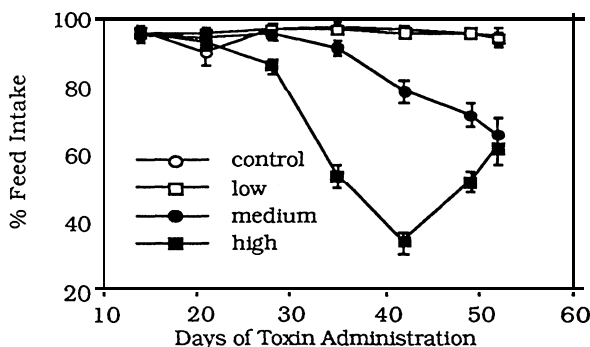


Fig. 1. The effect of different daily doses of toxic lupin stubble on weekly feed intake of ewes

Live weights of the groups reflected the changes in feed intake. The control and low stubble groups maintained live weight during the experiment. The medium stubble group decreased significantly ( $P<0.05$ ) in live weight from  $45.2 \pm 0.75$  kg on day -4 to  $42.9 \pm 0.65$  kg on day 47, while the high stubble group decreased significantly ( $P<0.05$ ) from  $46.0 \pm 0.68$  kg to  $40.0 \pm 0.64$  kg over the same period.

The plasma activities of AST, GGT, and GLDH were significantly ( $P<0.05$ ) elevated and the biological half-lives for plasma clearance of BSP were significantly ( $P<0.05$ ) longer by day 31 in the medium and high stubble groups compared to the control group. Livers from the high stubble group weighed significantly ( $P<0.05$ ) less than those from the control group at the end of the experiment. The low stubble group did not differ from the control group in any of these measurements during the experiment.

Results of the wool measurements are shown in Table 1. All groups that received phomopsins grew significantly shorter wool than the control group. The wool grown by the high stubble group was also significantly shorter than that grown by the other two treatment groups ( $P<0.001$ ). The change in mean fibre diameter from the beginning to the end of the period of toxin administration was significantly different from the control group for the low stubble ( $P<0.05$ ) and high stubble groups ( $P<0.001$ ). The high stubble group was also significantly ( $P<0.01$ ) different to the medium stubble group.

Table 1 The effect of different daily doses of toxic lupin stubble on length of wool grown and change in mean fibre diameter in ewes

| Treatment | Length<br>of wool grown<br>(mm) | Sig.      | Change in mean<br>fibre diameter<br>(microns) | Sig.      |
|-----------|---------------------------------|-----------|-----------------------------------------------|-----------|
| Control   | 12.5 (0.18)                     |           | 0.06 (0.130)                                  |           |
| Low       | 11.6 (0.19)                     | $P<0.001$ | -0.38 (0.136)                                 | $P<0.05$  |
| Medium    | 11.6 (0.16)                     | $P<0.01$  | -0.24 (0.136)                                 | n.s.      |
| High      | 10.7 (0.17)                     | $P<0.001$ | -0.87 (0.126)                                 | $P<0.001$ |

Standard error of the mean in parenthesis

#### DISCUSSION

This paper reports that phomopsins can affect wool growth. The effects seen may be due to direct action of phomopsins upon wool follicles, or indirectly result from the liver damage and inappetence induced by lupinosis, or a combination of both.

Chronic lupinosis was induced in ewes which received the medium and high daily doses of stubble. Depression of feed intake, elevation of plasma activities of AST, GGT and GLDH and impairment of BSP clearance from the plasma in these sheep indicated substantial liver damage due to the phomopsins in the stubble. However, sheep receiving the low dose of stubble developed none of these changes, but did have significantly reduced wool growth. This suggests that there is a direct effect of the phomopsins upon the wool follicles and growth. No explanation can be offered for the inconsistent results recorded in the group receiving a medium dose of stubble.

A reduction in feed intake will result in a decrease in wool growth (Allden 1979; Black 1988). The greater reductions in length and diameter of fibres seen in the high dose group may thus be due to a combination of the direct effects of the phomopsins, together with the reduced feed intake, or due only to the

direct action of the phomopsins which were consumed in larger quantities by this group.

Whether the effect of phomopsins upon wool growth persists was not investigated in this experiment. Field reports indicate a convalescence of at least six weeks before lupinosis-affected sheep recover. Wool growth response to increased nutrition is reported to lag one to three months behind the change in nutrition (Allden 1979), possibly due to the time taken for regressed wool follicles to recommence fibre production (Butler-Hogg 1984). Thus it could be anticipated that lupinosis-affected animals may suffer reduction in wool growth for several months after being taken off toxic stubbles.

In the absence of severe acute lupinosis, sheep may remain on lupin stubbles ingesting small amounts of toxin for some time. The findings of this experiment suggest that this may result in reduced wool production. Whether the effects of lupinosis on wool growth recorded here are significant in terms of annual production, and whether a break in the fibres results from the decrease in fibre diameter, remain to be determined.

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