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# Dag formation

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## ABSTRACT

Dags are a major cost in sheep farming. This paper reports on differences in wool yield and mineral content of faeces associated with dag formation.

Of 600 hoggets on a farm in Inland Canterbury, only three had dag scores greater than 0.5 in mid-March (mean dag score 0.030). After 10 weeks (mean dag score 0.4), 80% of the animals recorded a dag score 0.5 or less and 40 animals (6.7%) had dag scores of 2 or greater.

In two other trials, wool samples showed no differences in wool grease, suint content or yield associated with differences in dagginess of the animals.

Fresh faeces were collected from ewes from the Resistant (R) and Susceptible (S) FEC selection lines at Wallaceville which differ in dag formation. These lines did not differ in faecal dry matter, phosphorus, calcium, magnesium, sodium or potassium content. Lambs from these lines differed significantly in faecal potassium (mean = 13.8 mg/kg, R-S = 2.98 mg/kg ($P<0.001$)) and magnesium (mean = 5.7 g/kg, R-S = -0.82 g/kg ($P<0.05$)) contents.

Faeces from lambs grazing low or high endophyte pasture also differed in potassium (12.8 vs. 15.3 g/kg, SED 1.18) and magnesium (7.6 vs. 6.0 g/kg, SED 0.67) content.

These results point to differences in faeces associated with differing dag forming tendencies and may assist in explaining some of the mechanisms involved in dag formation.

**Keywords:** dags; faeceal potassium; faeceal magnesium; dag formation; wool grease; suient; yield; faeceal minerals.

## INTRODUCTION

Dags are accumulations of faecal material around the tail and crutch of sheep. They are associated with sheep with loose, moist faeces adhering to the wool and can accumulate to form large masses. While the tendency to dagginess in sheep is at least partly under genetic control (Meyer, *et al.,* 1983; Morris *et al.,* 1997), several factors, including intestinal parasites (Larsen e*t al.,* 1994; McEwan *et al.,* 1992), some fungal toxins (Fletcher and Sutherland 1993), low tannin feed and high quality, high moisture content feed have been associated with dag formation. There are no reported studies on the factors involved in the adhesion of dags to wool and the build up of the dag material. Knowledge of these factors could enable the development of innovative methods to prevent dag formation in susceptible sheep under conditions conducive to their accumulation. This project was designed to generate data on which to build this knowledge.

## MATERIALS AND METHODS

### Trial 1. Dag formation

The development of dags on 600 Romney cross hoggets was monitored regularly on a farm in Inland Canterbury for a two-month period in autumn. These animals were dag scored on a 0 (low) to 5 (high) scale (Larsen *et al.,* 1994) at fortnightly intervals from 13 March to 25 May. Photographic references were used to ensure consistency of scoring over time. Records from the farmer indicated that the animals were grazed on high endophyte pasture for the first two weeks and on low endophyte pasture for the remainder of the trial. They were drenched with a "white" drench before the second observation.

### Trial 2. Composition of dag forming faeces

Fresh faeces and wool were collected from "daggy" and "non-daggy" sheep from two flocks where the incidence of dags varied between groups of animals. These samples were analysed for dry matter content, potassium, sodium, magnesium and calcium in the faeces and for grease and suint content and yield of wool.

*a. Wallaceville FEC selection lines*

The first of these flocks was from the lines of sheep at AgResearch, Wallaceville selected on the basis of parasite egg counts in the faeces (FEC) (Morris *et al.,* 1997). Two-tooth ewes (n=23) chosen at random from each of the High and Low selection lines were faecal and wool sampled at weaning in December and their lambs faecal sampled in February. Sheep from the High FEC line (Susceptible to internal parasites) have been shown to have a lower mean dag score than those from the Low FEC line (Resistant).

*b. Grazing trials at AgResearch, Lincoln*

The second set of samples was obtained from an experiment at AgResearch at Lincoln, in which lambs were grazing on pasture with either wild type ryegrass endophyte known to cause increased dag formation or no endophyte. Animals (n=10), chosen at random, were sampled from each of two replicates per treatment.

### Statistical analysis

*Trial 1. Dag formation*

The data were reduced to mean and standard error for each sampling time. In addition, a frequency distribution was produced for each sampling time.

*Trial 2. Composition of dag forming faeces*

a. Wallaceville FEC selection lines

The data from both these sets of samples were analysed after transformation to natural logarithms.

The statistical model fitted to data from the samples from the ewes consisted of: Selection line, age of ewe, number of lambs born, with breeding value for dag score used as a covariate. The breeding values for dag score were obtained from an animal-model restricted maximum likelihood (REML) program, with a full pedigree relationship matrix back to the foundation animals in 1979. The REML program included fixed effects for such factors as age of dam, birth type and contemporary group (year x sex x date) (Johnson and Thompson 1995). The dag score used was recorded after weaning on a 0 to 4 scale (0 = least breech soiling), in January (4 months of age) and March/April.

For the data for samples from lambs the model fitted consisted of: Selection line, age of dam, birth type (single or twin), with date of birth and dag score within line used as covariates.

b. Grazing trials, AgResearch, Lincoln

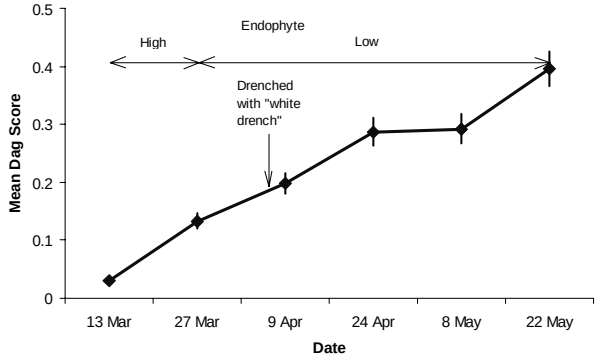
The data were analysed by analysis of variance with two replicates of ten samples per treatment. Initial examination indicated that it was necessary to transform the dag score data to logarithms.

## RESULTS

### Trial 1. Dag Formation

At the initial sampling time (mean dag score 0.03) only three animals had dag scores greater than 0.5 and the highest dag score recorded was 2. Assuming the dag score scale is linear, the increase in average dag score over the following 10 weeks was linear ($R^2$=0.97) (Figure 1).

**FIGURE 1:** Development of dags in 600 hoggets (Trial 1). Mean and standard error for each occasion.

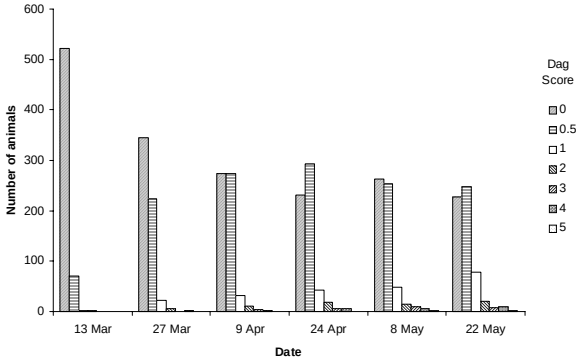



The proportions of animals with low dag scores decreased while those with high scores increased. The small number of animals that started to accumulate dags early continued to do so. The remaining animals remained dag free, or nearly so, throughout the trial (Figure 2).

At the end of the trial (mean dag score 0.4), 80% of the animals were recorded with a dag score 0.5 or less and 19 animals (3.2%) were given dags scores of 3 or greater.

The development of dags in the 10 animals which recorded high dag scores (4 or greater) at the end of the trial was, in general, close to linear (assuming the photographic standards are linear), although on a few animals, dag scores appeared to decrease between successive occasions.

**FIGURE 2.** Frequency distributions of dag scores in 600 hoggets over the observation period (Trial 1).




### Trial 2. Composition of dag forming faeces

*Wallaceville FEC selection lines*

Ewes:

There were no differences associated with dagginess between lines in any of the chemical components measured. The only significant effects were the age of the ewes on faecal potassium and wool grease content. Mean values are given in Table 1.

**TABLE 1:** Mean dry matter and mineral content of faeces, and grease content, suint content and yield of wool of ewes from the FEC selection lines samples at Wallaceville in December 1997 (Trial 2a).

| | No. of records | Mean | Residual SD | Significant age Effect |
|---|---|---|---|---|
| Faeces | | | | |
| Dry matter (%) | 40 | 16.7 | 4.76 | ns |
| Phosphorus(g/kg) | 37 | 2.91 | 1.14 | ns |
| Calcium (g/kg) | 40 | 4.19 | 1.75 | ns |
| Magnesium(g/kg) | 34 | 6.17 | 1.70 | ns |
| Sodium (g/kg) | 40 | 4.23 | 3.47 | ns |
| Potassium (g/kg) | 40 | 14.0 | 6.20 | ** |
| Wool | | | | |
| Grease (%) | 46 | 4.87 | 1.39 | ** |
| Suint (%) | 46 | 4.10 | 1.86 | ns |
| Yield (%) | 46 | 83.23 | 5.47 | ns |

Lambs:

The only significant differences between selection lines were in faecal potassium (High Dag line minus Low Dag line = 2.98 ± 1.12 g/kg (P≤0.001) and magnesium (High Dag line minus Low Dag line = -0.82 ± 0.32 g/kg (P≤0.05). The only other significant effects were of birth type on faecal dry matter (P≤0.05) and calcium (P≤0.05). Mean values are given in Table 2. The effects of dag score as a covariate on % faecal dry matter and faecal potassium were both significant (P≤0.01).

*Grazing trials at AgResearch, Lincoln*

The dag scores were significantly different between the two grazing treatments (Table 3). Of the chemical components analysed, the only two significant differences between treatments in this trial were in the potassium and magnesium content of the faecal dry matter. There have been no analyses of the potassium content of the pastures in this trial, but in earlier trials the presence of wild endophyte strains has been associated with higher magnesium

**TABLE 2:** Mean dry matter and mineral content of faeces, and grease content, suint content and yield of wool of lambs from the FEC selection lines sampled at Wallaceville in February 1998 (Trial 2a).

| | | No. of records | Mean | Residual SD | Significant effects |
|---|---|---|---|---|---|
| Faeces | | | | | |
| Dry matter | (%) | 61 | 15.7 | 3.50 | Birth type (*) |
| Phosphorus | (g/kg) | 62 | 4.16 | 1.88 | |
| Calcium | (g/kg) | 61 | 6.63 | 3.77 | Birth type (**) |
| Magnesium | (g/kg) | 61 | 5.71 | 1.10 | Selection line (* logs) |
| Sodium | (g/kg) | 61 | 9.07 | 5.22 | |
| Potassium | (g/kg) | 61 | 13.79 | 3.77 | Selection line (***) |

**TABLE 3:** Concentration of potassium and magnesium in the dry matter of faecal samples from lambs grazing on pasture differing in ryegrass endophyte. Dag score used as a covariate of mineral content (Trial 2b).

| | Endophyte type | | SED | Sig. |
|---|---|---|---|---|
| | None | Wild | | |
| Dag score | | | | |
| (Log transformed) | 0.219 | 0.539 | 0.1569 | * |
| (Back transformed) | 0.245 | 0.714 | | |
| Faecal composition (g/kg DM) | | | | |
| Potassium | 12.76 | 15.27 | 1.183 | * |
| Magnesium | 7.58 | 6.02 | 0.667 | * |

content than in pasture lacking endophyte (L.R. Fletcher; personal communication).

## DISCUSSION

In this trial dag formation was restricted to a relatively small number of animals in the mob. These animals showed dag formation at early sampling times and the development of those dags was, on average, linear with time.

There do not appear to be any reports in the literature of the chemical composition of sheep faeces associated with differences in formation of dags. In two of the three sets of faecal samples (Tables 2 and 3) there were significant differences associated with differences in propensity to dag formation. In both cases, increased dagginess was associated with increased potassium and decreased magnesium concentrations in the faecal dry matter. This would suggest that there were changes in mineral absorption associated with the tendency to form dags.

In the Wallaceville selection lines sampled in this trial, increased resistance to parasite infection has been shown to be associated with greater numbers of inflammatory-type cells in the mucosa of the small intestine (Bisset *et al.,* 1996), as well as an increased tendency to form dags (Morris *et al.,* 1997). An increase in such inflammatory-type cells has also been noted when increased dagginess results from parasite infection in adult Merino ewes (Larsen *et al.,* 1994). This response to parasite challenge may decrease the efficiency of absorption of potassium (and possibly other nutrients), resulting in the higher concentrations of potassium in the faeces observed in lambs in this trial. The decreases in faecal magnesium may result from the known competitive inhibition of its absorption by increased concentrations of potassium in the digesta (Grace 1988). Increased rate of digesta passage in daggy sheep may also decrease potassium absorption.

It is interesting to conjecture whether a similar mechanism was responsible for the differences observed when the increases in dag formation resulted from the presence of ryegrass endophyte. The diet of sheep has been shown to markedly affect the efficiency of absorption of minerals (Waghorn *et al.,* 1990). Although no data are available on the potassium content of pastures similar to those used in this trial, differences have been observed previously in their magnesium concentration (L. R. Fletcher; personal communication). However, the differences in magnesium concentration of the faeces were the reverse of those previously observed in the pasture. The observed differences in faecal magnesium may have resulted from differences in dietary concentrations of potassium of animals grazing pasture with or without the endophyte. They may also have resulted from differences in potassium absorption caused by the effects of the endophyte alkaloids on the gut.

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## REFERENCES

Bisset, S.A.; Vlassoff, A.; Douch, P.G.C.; Jonas, W.E.; West, C.J.; Green, R.S. (1996). Nematode burdens and immunological responses following natural challenge in Romney lambs selectively bred for low or high faecal worm egg count. *Veterinary Parasitology.* **61:** 249-263.

Fletcher L. R.; Sutherland, B.L. (1993). Grazing ryegrass/endophyte associations and their effects on animal health and performance. Flystrike and faecal contamination in lambs grazing endophyte infected pasture. *Proceedings of the Second International Symposium on Acremonium/Grass Interactions.* 115-124.

Grace, N.D. (1988). Effect of varying sodium and potassium intakes on sodium, potassium, and magnesium contents of the ruminoreticulum and apparent absorption of magnesium in non-lactating dairy cattle. *New Zealand Journal of Agricultural Research.* **31:** 401-407.

Johnson, D.L.; Thompson, R. (1995). Restricted maximum likelihood estimation of variance components for univariate animal models using sparse matrix techniques and average information. *Journal of Dairy Science* **78:** 449 - 456.

Larsen, J.W.A; Anderson, N.; Vizard, A.L.; Anderson, G.A.; Hoste, H. (1994). Diarrhoea in Merino ewes during winter: association with trichostrongylid larvae. *Australian Veterinary Journal.* **71:** 365-372.

McEwan J.C.; Mason, P.; Baker, R.L.; Clarke, J.N.; Hickey, S.M.; Turner, K. (1992). Effect of selection for productive traits on parasite resistance in sheep. *Proceedings of the New Zealand Society of Animal Production.* **52:** 53-56.

Meyer, H.H.; Harvey, T.G.; Smeaton, J.E. (1983). Genetic variation in the incidence of daggy sheep - an indicator of genetic resistance to parasites? *Proceedings of the New Zealand Society of Animal Production.* **43:** 87-89.

Morris, C. A.; Vlassoff, A.; Bisset, S.A.; Baker, R.L.; West, C.J.; Hurford, A.P. (1997). Responses of Romney sheep to selection for resistance or susceptibility to nematode infection. *Animal Science.* **64:** 319-329.

Waghorn, G.C.; Shelton, I.D.; Sinclair, B.R. (1990). Distribution of elements between solid and supernatant fractions of digesta in sheep given six diets. *New Zealand Journal of Agricultural Research.* **33:** 259-269.