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BLOOD AND FAECAL PARAMETERS OF MERINO EWES GRAZING MITCHELL GRASS PASTURES WHEN SUPPLEMENTED WITH UREA, PHOSPHORUS AND VITAMINS

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Summary

Merino ewes grazing in the semi-arid zone of North-West Queensland were supplemented with nitrogen (N) and/or phosphorus (P).

Faecal N and P values in unsupplemented ewes ranged from 0.77 to 2.23 per cent and 0.8 to 1.07 per cent respectively. These indices were related ($r = 0.86$) and showed marked seasonal trends.

Overall blood inorganic phosphorus levels ranged from 3.5 to 10.3 mg/ 100 ml, but were of no value as an index of P intake.

Faecal ash was variable (18.6 to 49.7 per cent) and probably due to soil ingestion.

Vitamins A, D and E administered during mating resulted in high levels of plasma vitamin A acetate 21 days after injection.

I. INTRODUCTION

In the study by Gartner, Granzien and Murray (1968) on blood constituents from sheep grazing Mitchell grass (*Astrebla* spp) pastures in North-West Queensland, faecal nitrogen (N) and phosphorus (P) analyses were done but not reported. On the bases of these results, and assuming the applicability of the equation by Moir (1960 a) to estimate pasture N from faecal N, these pastures contained a minimum of about 1.12 per cent N. As the N content of a subtropical pasture needs to be 1.15 per cent to ensure a zero N balance (Milford and Haydock 1965), and since voluntary intake is depressed when N is below this level (Minson 197 1), it was considered that N supplementation may be necessary, particularly for pregnant ewes. Further, using Moir's (1960 b) equation, faecal P levels in these sheep indicated pasture P ‘levels as low as 0.15 per cent.

Although Gartner and Johnston (1969) suggested that vitamin A reserves were adequate in adult sheep, the role of high circulating levels of vitamins on reproductive performance had not been exarnined previously. The effects of N and/or P and vitamins A, D and E supplementation on liveweight, reproduction and wool growth are given in the paper by Entwistle (1972). This paper reports changes in faecal and blood parameters.

II. MATERIALS AND METHODS

Details of the environment, the sheep and their management together with an outline of some of the measurements made are described by Entwistle (1972).

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(a) ***Treatments***

Each group contained 40 maiden (1½ year) and 40 mature (3% year) ewes allocated by stratified randomisation on Iiveweight to the following treatments:-

(i) Control group.

(ii) N supplemented group: Urea was fed in a liquid mixture of molasses and water and urea intakes ranged from 1.8 to 8.8 g/head/day.

(*iii*) P supplemented group: P in the form of NaH_2PO_4 was added to the drinking water. Supplementation was interrupted for 7 days in August and 5 days in October. As P intake depended on water intake, it ranged from 2.5-5.0 g/head/day for most of the experiment.

(iv) N plus P supplemented group as for 2 and 3.

Each treatment group was allocated at random to a 130 ha paddock and rotated through the paddocks at 4 weekly intervals.

Half of the sheep exhibiting oestrus during the mating period were treated I/M with 10 ml of a multivitamin preparation* containing 500,000 I.U. vitamin A, 250,000 I.U. vitamin D and 200 I.U. vitamin E.

(b) ***Sampling procedures***

(i) N and P

Blood inorganic phosphorus (BIP) levels were determined in blood samples collected from 12 ewes of each age group and treatment at 4 weekly intervals, and faecal ash, N and P analyses at similar intervals in 6 of each of the 12 ewes.

(ii) Plasma vitamin A

Plasma for vitamin A estimation was taken from 6 mature ewes in the control group which received vitamin A, and from 6 untreated ewes. Samples were collected at 0, 7, 14 and 2 1 days after administration of vitamins.

(c) Chemical methods

BIP was determined by the method of Moir (1954); faecal ash at 650°C for 4 hours; faecal N by the micro-Kjeldahl technique; faecal P in the Kjeldahl digest using a colourimetric method based on the reduction of phospho-molybdate. Plasma vitamin A alcohol and acetate were determined essentially by the methods outlined by Strohecker and Henning (1966).

(d) ***Statistical methods***

In the analyses of biochemical data, an analysis was done at each sampling date using within animals MSS as error. A separate analysis for each group was done where age was taken out as one factor and tested against within animals MSS. Time was taken out as a sub-plot treatment in a split-plot design.

III. RESULTS

Malfunction of the mechanical dispenser metering the concentrated NaH_2PO_4 to the water troughs resulted in the death of 22 ewes on August 11, 1969 and a further 4 on September 9, 1969, presumably from P intoxication. These were replaced by ewes of the same age.

In both figures the values are given as means at each sampling date. Significant differences between the main effects only, i.e. P and N supplementation, are given.

* Rovisol — Roche Products (Australia)

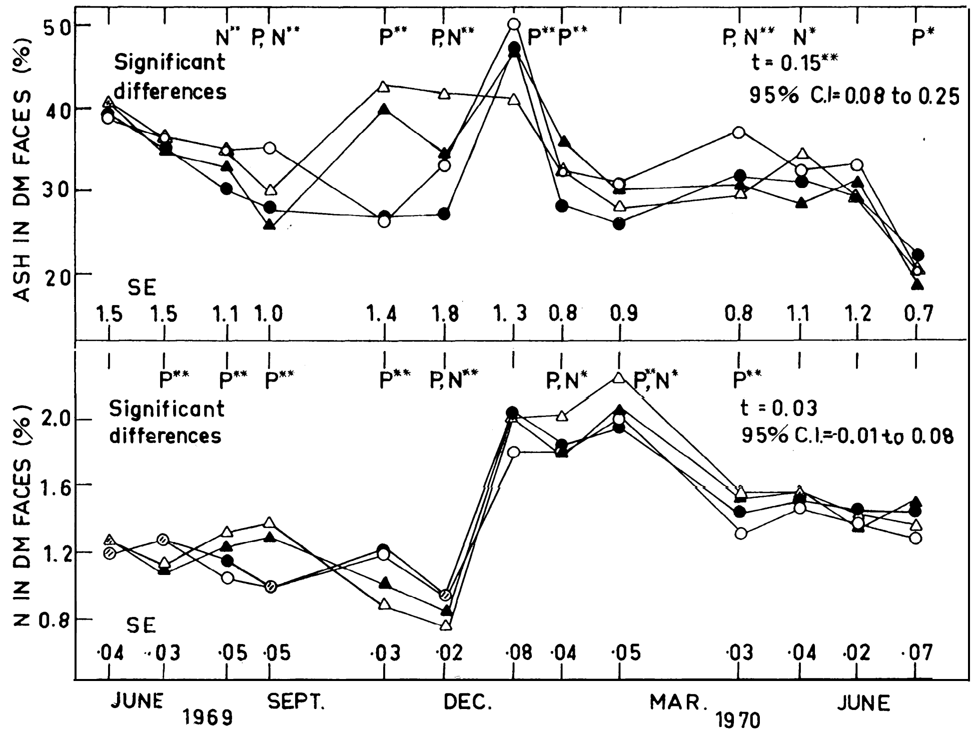

Fig. 1. — Ash and nitrogen (N) in dry matter faeces of Merino ewes grazing Mitchell grass pastures when supplemented with N and phosphorus (P). ○———○, control; ●———●, N as urea; △———△, P as NaH_2PO_4; ▲———▲, N plus P. t = repeatibility. C.I. = confidence intervals. Significant differences for N represent the differences between 2 groups receiving N *v*. 2 groups not receiving N; similarly for P.

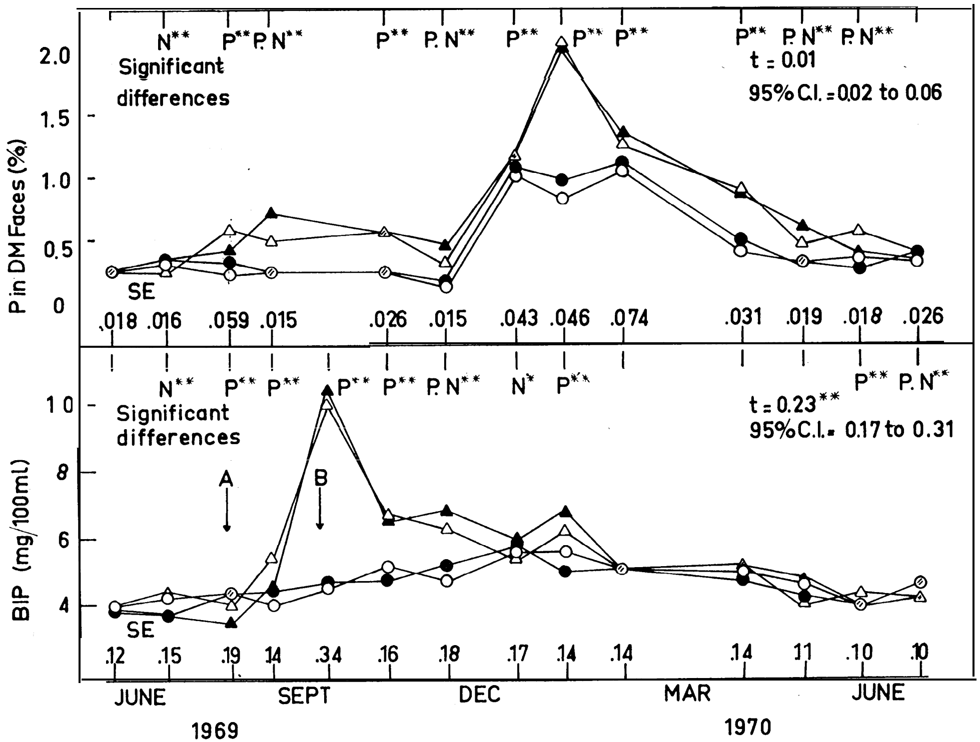

Fig. 2. — Blood inorganic phosphorus and phosphorus (P) in DM faeces of Merino ewes grazing Mitchell grass pastures when supplemented with nitrogen (N) and P. ○——○, control; ●——●, N as urea; △——△, P as NaH_2PO_4; ▲——▲, N plus P. A, 22 ewes died — B, 4 ewes died (presumably due to P toxicity). t = repeatability. C.I. = confidence intervals. Significant differences for N represent the differences between 2 groups receiving N *v.* 2 groups not receiving N; similarly for P.

(a) *Ash in faeces*

There was no consistent trend in the ranking of faecal ash values between treatments or paddocks (Figure 1). Extreme values varied by a factor of 2.7 and there were definite trends with time. For the first 6 months ash was significantly higher ($P < 0.01$) in the faeces from the mature ewes. In general, the ash from sheep receiving P was lower ($P < 0.05$) than that of sheep not receiving P, whereas ash from sheep receiving N was always less ($P < 0.05$) than that of sheep not fed N.

(b) *N in faeces*

Less variation in faecal N was recorded between treatments compared with changes with time (Figure 1). Minimum values of 0.77 per cent were found in November compared with a maximum of 2.23 per cent in February. There was no consistent trend in any of the significant differences between treatments. or ages.

(c) *P in faeces*

With the exception of the first two and the last sampling dates, levels of faecal P (Figure 2) were significantly higher in sheep receiving P. In those ewes not receiving P, the increase in values in summer followed a similar pattern to the increase in N at the same period, and the overall correlation coefficients of faecal N and P in these 2 groups were significant ($P < 0.01$) and similar (0.84 and 0.88). On 4 occasions, faecal P was significantly lower in maiden ewes.

(d) *BIP*

The highest BIP levels were recorded in October (Figure 2), 3 days after the supply of P was temporarily discontinued, and not in August when a number of sheep died. In fact the BIP values then were significantly higher in the 2 groups not receiving P. In general, BIP levels were significantly higher in maiden ewes.

The correlation coefficients of BIP and faecal P were significant ($P < 0.01$) in all groups, but the *r* values ranging from 0.41 to 0.53 were of a low order.

(e) *Plasma vitamin A*

The mean vitamin A alcohol levels on day 0 were 35 $\pm$ SE 2.6 and 34 $\pm$ 2.3 μg/ 100 ml respectively for control ewes and ewes about to receive vitamins. The effect of treatment was little change in the alcohol level, but a predominance of the previously undetected acetate form. Respective levels of the acetate and alcohol forms 7, 14 and 21 days after injection were: 1,230 $\pm$ 247 and 43 $\pm$ 7.8; 384 $\pm$ 137 and 25 $\pm$ 4.3; 105 $\pm$ 55 and 29 $\pm$ 4.4. At these periods the alcohol levels of the untreated ewes were 3 1 $\pm$ 2.5, 29 $\pm$ 1.9 and 35 $\pm$ 1.9, again with no detectable level of acetate.

IV. DISCUSSION

The marked variation in faecal ash content in grazing sheep supports the findings of Corbett and Farrell (1970). Our high ash figures in January could be due to high pasture digestibilities as indicated by high faecal N values. However, high N levels and therefore digestibilities are still evident for the next 2 sampling dates whereas ash values declined markedly in these periods. Thus the most likely explanation for the high ash values is soil contamination of the pastures ingested.

The low faecal N values in June-December indicated very low digestibilities. The lowest faecal N content on an organic matter basis was 1.3 per cent, and Topps (1969) maintained that grazing cattle with less than 1.7 per cent N in faeces are eating insufficient nutrient for maintenance of body tissue. Although N supplementation did not affect liveweight in our sheep, there was a response to wool growth (Entwistle 1972).

The range of faecal P found in our sheep not supplemented with P (0.18 — 1.07 per cent) was narrower than that found by Bromfield (1961) (0.18 — 1.70 per cent) in sheep grazing natural Danthonia pastures and improved subterranean clover.

Although BIP values on occasion were below the level of 4 mg/ 100 ml considered low by the National Research Council (1964), it is recognised (O'Moore 1952; Moir 1966) that at least in cattle BIP may not always be the best index of P status. In our experiment, BIP was no index of P intake.

The data for BIP and faecal P in mid August showed no elevation associated with P intoxication, whereas BIP rose to over 10 mg/ 100 ml almost 8 weeks later. The explanation may lie in a breakdown in endocrine control, for when these high BIP levels were found, P supplementation had been discontinued for 3 days. The previous high intakes of P may have depressed parathyroid hormone activity and P would then have been stored in bone, faecal levels not being particularly high at this stage. Sudden cessation of supplementation would then result in an over reaction of the parathyroid with resultant release of P from the depots in bone.

Forage containing below 0.16 per cent P is usually considered deficient for ewes during gestation, and 0.2 per cent as borderline during lactation (National Research Council, 1964). Weston and Moir (1969) found that on occasions the major plant species in the Mitchell grass downs area had P levels lower than these. From the regression equation of Moir (1960 b) our lowest faecal P figures suggest that ingested material had a concentration down to 0.15 per cent. Despite these indications that P may be limiting at least in certain seasons, we had no productive response to P supplementation (Entwistle 1972).

Carpenter (1964) reviewed the literature on the availability of injected water-dispersed vitamin A. In general this preparation and route gives the most sustained increase in plasma levels. However, no distinction has been made between the acetate and alcohol forms to enable a comparison with our results.

V. ACKNOWLEDGMENTS

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