Using plant wax alkanes to estimate phosphorus intake and faecal excretion in grazing ewes

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Estimating the phosphorus (P) requirements of grazing sheep requires a knowledge of the P concentration in consumed herbage, the herbage intake of individual animals and their daily P excretion (1). We used plant cuticular wax alkanes to estimate these in young Merino ewes (35-40 kg weight) grazing improved pastures near Wagga Wagga, NSW (2). Measurements of the amount and botanical composition of the pasture on offer (grass, clover, weed species and dead material), the diet composition of individual sheep and their faecal outputs were made in winter and spring 1995, and in summer 1996, one week after animals had been dosed orally with a controlled-release device releasing a known daily rumen dose of C32 and C36 alkanes. Rectal grab-samples were taken from each sheep twice-daily on each of three consecutive days, and bulked across days. Methods for estimating alkane concentrations in the above plant fractions and in faecal samples, and for calculating diet composition, herbage intake and faecal output from these concentrations, have been described elsewhere (2). The P concentrations in herbage and faecal samples were estimated by the method of Murphy and Riley (3), after Kjeldahl digestion.

Herbage P intakes ranged from 2.5-8 g/d in winter and spring and from 0.5-4 g/d in summer. When examined across seasons, faecal P excretion (FP, g/d) was linearly related to P intake (IP, g/d): FP = 0.552 (±0.0529)IP - 1.014 (±0.2100) ($P<0.001$, $r^2 = 0.615$). Expressions relating FP and IP were then estimated separately for each of the three seasons; equations for winter and spring were not significantly different and were pooled. The equation for summer was significantly different from both the overall equation and the pooled equation for winter/spring (both $P<0.01$), as follows: Winter/spring: FP = 0.29 (±0.084)IP - 2.38 (±0.394); $P<0.001$, $r^2 = 0.712$. Summer: FP = -0.05 (±0.104)IP - 1.73 (±0.194); $P<0.001$, $r^2 = 0.880$

The coefficent of the winter/spring equation suggests an apparent P absorption of 0.71 during gut passage (1-0.29), similar to the value of 0.70 used in the Australian feeding standards (1) for the true absorption of P in sheep. However, care must be exercised in interpreting this result, since these animals were in positive P balance and it is likely that there was also urinary P excretion (4). The coefficient of the summer equation does not differ significantly from zero, implying an apparent absorption coefficient of 1.0 at these lower P intakes. However, recently published data suggest that true absorption is unlikely to have exceeded 0.8-0.85 (4). Extrapolation of the summer equation to zero P intake implies an endogenous faecal P loss of 1.73 g/d or about 45-50 mg P/kg live weight, over twice that used in the Australian standards (1). This result is confounded with possible effects of pasture intake on P losses (4), but requires further study.

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