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USING PLANT WAX ALKANES TO QUANTIFY THE INTAKE OF PLANT PARTS BY GRAZING ANIMALS

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The cuticular wax of most plants contains saturated, long-chain hydrocarbons (n-alkanes, C_{25}-C_{35}) which, in combination with dosed, even-chain alkanes, can be used to estimate herbage intake (Mayes et al. 1986; Dove and Mayes 1991). We aimed to investigate whether this approach could be extended to the estimation of the intake of plant parts from a sward.

Eight one-hectare plots of annual pasture (*Lolium rigidum/Vulpia bromoides*) were grazed by 18-month old Merino wethers, commencing in late November. In mid-October, half the plots had been sprayed with the herbicide glyphosate (180 g/ha), which delays the loss of soluble carbohydrate from the plant (particularly from stem) during senescence. Our hypothesis was that the resultant higher nutritive value of sprayed herbage should result in greater intakes, especially of stem. Forty days after spraying (20d after grazing commenced), we estimated pasture intake in 10 animals per plot, by dosing for 12 days with 80 mg/d C_{32} alkane and collecting rectal samples of faeces over the last six days. Intakes were calculated from the dose rate and the herbage and faecal concentrations of C_{31} and C_{32} alkanes.

Herbage consumed from the sprayed plots had a higher digestibility of OM than that consumed from the control plots (0.655 v. 0.493; $P<0.001$), and the intakes of both OM (sprayed 1070; control 774 g/d) and digestible OM (sprayed 701; control 382 g/d) were significantly higher ($P<0.001$). We also harvested samples of sprayed and unsprayed herbage, sorted them into the four fractions of leaf blade, leaf sheath, stem and ear and fed the fractions in paired preference tests to housed sheep. These animals preferred sprayed leaf to unsprayed leaf, but showed a marked preference for sprayed stem over either unsprayed stem or sprayed leaf. We therefore sought a means of estimating diet selection in the grazing animals. Analyses indicated that the alkane concentrations of the plant fractions were different and that, unlike the other fractions, the ear fraction also contained n-alkenes (see table). Based on these analyses, a least squares optimisation procedure was used to estimate what combination of consumed plant fractions best explained the faecal alkane and alkene concentrations.

	Leaf blade	Leaf sheath	Stem	Ear
		(mg/kg OM)		
C_{27} alkane (alkene)	170.1	60.5	18.6	154.6 (81.6)
C_{29} alkane (alkene)	366.1	259.4	84.3	197.1 (197.8)
C_{31} alkane (alkene)	488.0	417.5	160.3	189.6 (40.3)
C_{33} alkane	140.8	48.5	19.9	22.3

In both pasture treatments, there were non-limiting quantities of all plant fractions, but consumption patterns differed. In animals grazing unsprayed pasture, leaf blade and sheath made up 0.635 (491 g OM/d) of the total intake, with the ear fraction making up the remainder (283 g OM/d). No stem was consumed. In marked contrast, stem was the major intake fraction from the sprayed plots (0.790 or 844 g OM/d) with the ear fraction contributing 0.205 (219 g OM/d). Leaf blade plus sheath comprised only 0.009, or 9 g OM/d. These results were consistent with the preference rankings observed indoors, and with the underlying accumulation of carbohydrate in stem tissue. They also demonstrate that plant alkane concentrations can be used not only to estimate total intake, but also to apportion the total intake into plant parts, based on the alkane concentrations in each part.

DOVE, H. and MAYES, R.W. (1991). Aust. J. Agric. Res. 42: 913.
MAYES, R.W., LAMB, C.S. and COLGROVE, P.M. (1986). J. agric. Sci., Camb. 107: 161.

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