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A. M. Nicol
Lincoln University, New Zealand

M. B. Soper
Lincoln University, New Zealand

A. Stewart
PGG Seeds, New Zealand

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The XX International Grassland Congress took place in Ireland and the UK in June-July 2005.

The main congress took place in Dublin from 26 June to 1 July and was followed by post congress satellite workshops in Aberystwyth, Belfast, Cork, Glasgow and Oxford. The meeting was hosted by the Irish Grassland Association and the British Grassland Society.

Proceedings Editor: D. A. McGilloway

Publisher: Wageningen Academic Publishers, The Netherlands

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Diversity of diet composition decreases with conjoint grazing of cattle with sheep and goats

A.M. Nicol¹, M.B. Soper¹ and A. Stewart²

¹Agriculture and Life Sciences Division, PO Box 84, Lincoln University, New Zealand, Email: nicol@lincoln.ac.nz, ²PGG Seeds, PO Box 3100, Christchurch, New Zealand

Keywords: diet selection, cattle, sheep, goats

Introduction Conjoint or mixed grazing can affect the diet selected by each species (Nicol & Collins, 1990). Diet similarity coefficients are often used to compare *pairs* of diets (Krebs, 1999). However this approach is awkward when a number of contrasts are required in a multifactorial comparison. Species diversity is a descriptor of a *particular* environment. Many models provide an estimate of *species* diversity, the most common of these being a log-normal distribution (Tokeshi, 1996). We tested whether this model could be applied to dietary *components* selected from a pasture, and thus provide a coefficient of dietary diversity for the *individual* diets of cattle, sheep and goats when grazed alone or in mixtures, which could then be statistically compared.

Methods Groups of cattle, sheep and goats grazed alone (CA; SA; GA) or as cattle plus sheep (CS; SC) and cattle plus goats (CG; GC), during a progressive defoliation (4400 to 1550 kg DM/ha) of a ryegrass/white clover pasture during 20 days in summer. Oesophageal extrusa (OE) samples were collected from two of each animal species on most days (n = 116 OE samples). The samples were dissected into six botanical components (grass leaf, grass stem, grass seed head, clover leaf and petiole, clover flower and dead material). The dietary diversity coefficient (k) was estimated for each OE by an iterative minimisation of the sum of the squared deviations of the observed proportion of each component and the predicted proportion (P) of each component from $P_R = 100(1-k)k^{R-1}$, where R = the rank of each component in the observed OE composition. Dietary diversity coefficients were compared by analysis of variance using species (cattle, sheep and goats) and grazing environment (alone or mixed), and their interaction, as fixed effects.

Results and discussion Simple correlations between predicted and observed OE composition ranged from 0.87 to 0.99. The mean k for cattle was significantly greater than that for sheep and goats (Table 1) and the effect of conjoint grazing was to significantly reduce the diversity of the diet.

Table 1 The dietary diversity coefficient (k) and *in vitro* dry matter digestibility of oesophageal extrusa of cattle, sheep and goats grazed alone or conjointly

	Dietary diversity coefficient (k)				<i>In vitro</i> DMD (g DMD/kg DM)			
	Alone	Conjoint	Average	sem	Alone	Conjoint	Average	sem
Cattle	0.582	0.522	0.552 c		613	595	604 c	
Sheep	0.505	0.431	0.468 d	0.025	619	641	630 d	6
Goats	0.504	0.401	0.452 d		617	632	624 d	
Average	0.53 a	0.451 b		0.021	616 a	624 b		5

Values followed by a different letter (a or b in rows, c,d in columns) are significantly different (P<0.01)

Decreased diet diversity was associated with a higher *in vitro* digestibility of OE for sheep and goats, especially when they were conjointly grazed with cattle. This probably reflects their ability (smaller incisor arcade breadth), and opportunity when mixed with cattle (SC and GC), to exploit their dietary preferences. In contrast the reduced diet diversity of CS compared with CA (significant interaction), was associated with a reduction in *in vitro* digestibility, suggesting that the quality of the diet of cattle suffered when they were in competition with sheep.

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