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INTAKE CHARACTERISTICS AND PERFORMANCE OF CONTRASTING GRASS VARIETIES CONTINUOUSLY STOCKED WITH SHEEP

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Abstract

Fifteen intermediate-heading perennial ryegrass (*Lolium perenne)* varieties were grazed by sheep under continuous variable stocking management. Mean daily grass dry matter intake per ewe was positively correlated with liveweight gain per ewe (r = 0.63) and per ha (r = 0.58) over an 8-month grazing season. Daily intake was not correlated with grazing time (r = 0.12) but was positively correlated with instantaneous dry matter intake rate (r = 0.75). Breeding varieties with high intake rate characteristics should allow increases in the contribution of grazed grass to grassland-based livestock farming. There is now a need to identify morphological and chemical characteristics of varieties that are correlated with high intake rate and a need to develop tools, which enable these traits to be identified rapidly in grass breeding programmes.

Keywords: Ryegrass, varieties, sheep, intake, animal performance

Introduction

New herbage varieties are often tested in standard cutting trials, but Orr et al. (2000) showed how the relative performance of perennial ryegrass (*Lolium perenne*) varieties measured under cutting may not be the same as when the swards are grazed. Grazed swards were maintained at a constant sward surface height throughout the grazing season by adjusting stocking rate, so that pasture growth and intake were matched. Grazing yield (GY) was measured as the product of daily grass dry matter intake per ewe (DMI, measured in early, mid and late season) and stocking rate (SR). From an understanding of the components of intake, assessment of the intake potential of new varieties will lead to identification of plant attributes that are important for intake control and to varieties that can give high intake per animal and/or per ha. Here we report relationships between intake and nutritional characteristics of the grass varieties, along with animal performance found in that trial.

Material and Methods

Fifteen (9 diploid and 6 tetraploid, including 2 hybrids with *Lolium multiflorum*) intermediate-heading perennial ryegrass varieties (see Table 1) were sown in September 1997 and grazed by non-pregnant, non-lactating Welsh Mountain ewes that weighed approximately 28 kg live weight at the start of the March to October grazing season in 1998. The swards were fertilised with a total of 200 kg N per ha in 5 equal applications, starting in late March. Sward surface height was maintained within a target range of 4 - 5 cm using a sward stick (Hill Farming Research Organisation, 1986) in a 'put-and-take' system with a minimum of 3 ‘core’ ewes on each of 5 replicate paddocks (0.1 ha) per variety. The number of ewes present on each plot was recorded daily. Grass dry matter intake was measured in May, July and September using Captec^{TM} (FERNZ, New Zealand) n-alkane slow release devices, which delivered C_{32} (dotriacontane) within the rumen at a constant rate over approximately 21 days. The 3 core sheep were dosed and one week after dosing, defined areas (15 m x 2 m) within the pasture were cleared of faeces. Non-core ewes were removed for 48 h and grass snips, designed to be representative of material eaten, were taken. Faeces samples were collected, from within the cleared areas 24 h and 48 h after clearing. Mean daily dry matter intake by the group was calculated from the concentrations of C_{32} and C_{33} (tritriacontane) in grass and faeces and the assayed release rate of C_{32} (Dove and Mayes, 1991). Grazing times (GT) were measured using the IGER automatic behaviour recording system (Rutter et al., 1997) and instantaneous intake rate (IIR, mg DM min^{-1}) was calculated. Grass samples were analysed for digestibility *in vitro* (DOMD), nitrogen (N) and water-soluble carbohydrate (WSC) concentrations.

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Results and Discussion

Results for grass intake (shown as the mean of 3 periods), digestibility, N and WSC concentrations, along with animal performance are shown in Table 1. There were significant differences between the 15 varieties in all the variables, and relationships amongst these are shown in the correlation matrix in Table 2. DMI was not correlated with GT (r = 0.12) but was correlated with IIR (r = 0.75). Animals appeared unable to compensate fully for low IIR by increasing GT (r = -0.50). DMI was correlated with liveweight gain ewe^{-1} (LGewe, r = 0.63) and liveweight gain ha^{-1} (LGha, r = 0.58). The highest liveweight gains over the 8-month grazing season were measured on the two tetraploid hybrid varieties, AberExcel and Storm (Table 1).

Looking at the effects of the nutritional parameters examined on intake, IIR and DMI were more highly correlated with N concentration than with DOMD and, in this rather limited range of materials, WSC had little effect. LGewe and LGha were also both correlated more highly with N concentration than with DOMD. The levels of N recorded were consistent with values reported previously for swards continuously stocked with sheep (Parsons et al., 1991).

Both IIR and DMI were correlated with grazing yield (r = 0.63 and r = 0.80 respectively). Breeding varieties with high intake rate characteristics could make a major contribution to increasing efficiency of livestock systems based on grazed grass. There is now a need to identify morphological and chemical characteristics of varieties, which are correlated with high intake rate, and a need to develop tools to enable these traits to be identified rapidly in grass breeding and evaluation programmes.

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Table 1 - Instantaneous intake rate (IIR, mg DM min^{-1}), grazing time (min 24 h^{-1}), daily grass intake (DMI, g DM ewe^{-1}); digestibility (DOMD, %DOM in DM), nitrogen (% N in DM) and water soluble carbohydrate (% WSC in DM) in grass snips; stocking rate (SR, ewes ha^{-1}), annual grazing yield (GY, t DM ha^{-1}) and liveweight gain (kg) over the season ewe^{-1} (LGewe) and ha^{-1} (LGha) for sheep continuously stocked on diploid (*d*), tetraploid (*t*) and tetraploid hybrid (*th*) grass varieties.

	IIR	**GT**	**DMI**	**DOMD**	**N**	**WSC**	**SR**	**GY**	**LGewe**	**LGha**
Glen (*d*)	1383	570	774	69.3	4.2	11.3	57.3	11.2	5.1	314
AberExcel (*th*)	1337	702	928	70.5	4.7	10.0	47.1	10.7	13.7	645
Fetione (*t*)	1318	642	763	70.1	4.2	12.0	54.8	10.3	6.3	345
Twins (*t*)	1268	686	870	69.9	4.1	12.7	60.2	13.0	8.0	483
Fennema (*d*)	1255	634	748	67.7	4.1	9.8	52.9	9.5	6.0	319
Storm (*th*)	1196	694	816	70.1	4.4	11.0	50.8	10.2	12.8	639
Spelga (*d*)	1188	700	822	67.7	4.0	10.4	56.1	11.2	7.3	411
AberElan (*d*)	1168	629	726	68.3	3.8	10.2	52.5	9.2	6.1	317
AberDove (*d*)	1074	626	626	69.6	4.0	13.8	55.4	8.4	4.5	249
Agri (*d*)	1060	697	731	68.5	4.1	10.6	64.2	11.3	4.9	319
Aubisque (*t*)	1041	692	719	70.7	4.2	12.8	61.5	10.6	9.6	594
AberSilo (*d*)	1015	737	740	69.7	3.9	11.6	60.0	10.3	3.8	220
Morgana (*d*)	981	711	722	67.7	4.0	10.0	57.0	10.1	6.3	350
Rosalin (*t*)	922	713	651	69.0	4.2	11.2	59.7	9.6	4.0	240
Belramo (*d*)	852	714	605	67.3	3.8	10.5	59.3	8.5	3.5	212
s.e.m	112	32.7	49.8	0.41	0.10	0.42	2.43	0.83	1.33	79.0
F prob	0.035	0.044	0.002	<0.001	<0.001	<0.001	<0.001	0.032	<0.001	<0.001
Mean	**1137**	**676**	**749**	**69.1**	**4.1**	**11.2**	**56.6**	**10.3**	**6.8**	**377**

Table 2 - Correlation matrix showing relationships between intake rate (IIR, mg DM min^{-1}), daily grass intake (DMI, g DM ewe^{-1}), grazing time (GT, min 24 h^{-1}); DOMD (%DOM in DM), N (% in DM) and WSC (% in DM) in grass snips; annual grazing yield (GY, t DM ha^{-1}) and live weight gain (kg) over the season ewe^{-1} (LGewe) and ha^{-1} (LGha) for sheep continuously stocked on 15 intermediate-heading grass varieties (d.f. = 73).

IIR	**IIR**									
GT	-0.50	**GT**								
DMI	0.75	0.12	**DMI**							
DOMD	0.25	-0.02	0.27	**DOMD**						
N	0.43	0.01	0.48	0.59	**N**					
WSC	-0.10	0.02	-0.11	0.42	-0.29	**WSC**				
SR	-0.07	0.02	-0.13	-0.05	-0.10	0.04	**SR**			
GY	0.63	0.11	0.80	0.21	0.38	-0.08	0.46	**GY**		
LGewe	0.49	-0.02	0.63	0.41	0.57	-0.08	-0.26	0.39	**LGewe**	
LGha	0.48	-0.05	0.58	0.41	0.55	-0.07	-0.02	0.50	0.96	**LGha**

r >0.23, P<0.05; r >0.30, P<0.01; r >0.38, P<0.001