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Using sheep preference, near infrared reflectance and laboratory tests for predicting voluntary intake from small samples of barley straw

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Breeding cereals with straws having high voluntary DM intakes (VDMI) could maximise the value of straw in ruminant diets without the costs of chemical treatment. We here report our progress in developing low-cost rapid tests that breeders can use to predict the VDMI of small samples of straw.

We chose 42 samples of barley straw representing 13 cultivars grown in 8 years, and measured VDMI (mean = 17.3, SD = 7.29 g/kg body weight) in Awassi sheep. We then performed laboratory tests : gas production (Hohenheim HFT test) at 4, 6, 8, 12, 24, 30, 36, 48, 54, 60, 72, 96 h from straw and its NDF; *in sacco* loss (L) of DM and NDF at 0, 8, 24, 48, 72 h ; energy required for grinding ; N, NDF, ADF ; *in vitro* DMD ; and 4 promising second derivatives of the near infrared spectrum (1236, 1606, 1668, 1680 nm). We also offered straw to sheep in pair-preference tests lasting between 2.5 and 6 minutes. Statistical analysis was by the SAS generalised linear model procedure with type II error.

Findings (see table) : (1) when VDMI was predicted from any one laboratory test by linear regression, residual standard deviation (RSD) varied between 3.02 and 7.29 ; (2) predictions of VDMI using a combination of year effect and any one laboratory test improved the RSD to between 1.53 and 1.95 ; (3) predictions of VDMI were even better using a combination of year effect and sheep preference (RSD = 1.47) ; (4) predictions of VDMI using a combination of year effect, preference and one laboratory test were no better than the latter except for NIRS D2OD at 1236 nm or *in sacco* DML at 8 hours. Using NDF rather than DM for estimating gas production or *in sacco* disappearance (see table), or using the parameters of asymptotic regressions, did not improve predictions.

We conclude that laboratory methods to predict differences in VDMI between cultivars must be used in their proper context. Where one corrects for year to year variation in VDMI, gas production methods lose their predictive ability in favour of *in sacco* methods. Near Infrared Reflectance shows considerable promise, and preference tests, although requiring more time and more straw (eg 1 kg) than laboratory tests, may be accurate enough to contribute to NIRS calibrations for predicting VDMI.

Laboratory test	Variables used to predict voluntary dry matter intake by sheep							
	test alone		year and test		year, sheep preference and test		
	RSD[1]	P^2_{test}	RSD[3]	P_{test}	RSD[4]	$P_{preference}$	P_{test}
DM loss *in sacco*	4.15 to 5.80		1.64 to 1.83		1.38 to 1.47		
after 8 h	4.87	****	1.64	***	1.38	**	*
after 24 h	4.15	****	1.66	***	1.47	*	ns
NDF loss from DM *in sacco*	4.47 to 7.18		1.80 to 1.98		1.39 to 1.44		
Gas production (HFT)	3.49 to 4.96		1.86 to 1.93		1.43 to 1.44		
after 12 h	3.49	****	1.88	=	1.44	***	ns
after 24 h	3.56	****	1.86	*	1.44	***	ns
after 72 h	4.13	****	1.88	=	1.43	***	ns
Gas production from NDF	3.66 to 6.87		1.88 to 1.97		1.44 to 1.44		
Grinding energy (kJ/g)	3.29	****	1.93	ns	1.45	***	ns
Nitrogen	3.02	****	1.59	***	1.42	*	=
Neutral detergent fibre	4.06	****	1.77	**	1.49	**	ns
Acid detergent fibre	3.58	****	1.85	*	1.49	**	ns
In vitro DM digestibility	5.04	****	1.80	*	1.46	**	ns
NIRS (D2OD, 4 points)	4.96 to 7.29		1.53 to 1.95		1.33 to 1.49		
at 1236 nm	4.96	****	1.53	****	1.33	**	**

[1]Residual standard deviation of VDMI (g DM/kg body weight) predicted using the test ; [2]Significance probability : ns, =, *, **, ***, **** denote P>0.1, <0.1, 0.05, 0.01, 0.001, 0.0001 ; [3]RSD of VDMI within year = 1.95 ; [4]RSD of VDMI predicted by preference within year = 1.47