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FAECAL NIRS PREDICTIONS OF DIET QUALITY AND LIVEWEIGHT CHANGE IN STEERS GRAZING A SPEARGRASS PASTURE IN S. QLD

R. M. Dixon[A] *and D. B. Coates*[B]

[A]DPI&F, PO Box 6014, Rockhampton, Queensland 4702 Australia
[B]CSIRO Sustainable Ecosystems, PMB, PO, Aitkenvale, Townsville Qld 4814 Australia

Email: rob.dixon@dpi.qld.gov.au

ABSTRACT
The diet selected and liveweight (LW) change of 4 drafts, each comprised of 3 age groups of *Bos indicus* cross steers grazing a native pasture paddock over 4 years in the southern speargrass pasture region, were estimated using faecal near infrared reflectance spectroscopy. Diet non-grass % (mean 10, s.d. 5) was apparently not related to season. Diet crude protein (CP) averaged 8.4% (s.d 2.1) during the summer and 5.8% (s.d 1.2) during the winter. Dry matter digestibility (DMD) averaged 56% (s.d. 3.3) in the summer and 51% (s.d. 2.6) in the winter. Liveweight (LW) gain was influenced by age group: bullocks < yearlings < weaners. A modified F.NIRS calibration could, in 2/3 drafts, satisfactorily predict cumulative LW gain of weaners. The utility of F.NIRS to estimate the diet and productivity of cattle grazing native pastures in the southern speargrass region was demonstrated.

INTRODUCTION
Faecal near infrared reflectance spectroscopy (F.NIRS), which predicts dietary attributes of grazing ruminants from the NIR spectra of the faeces, has been developed to estimate the diet selected by grazing cattle (Lyons and Stuth 1992; Coates 2004; Dixon 2008). A study examined F.NIRS predictions of diet attributes and LW gain in cattle grazing native pasture in southern Queensland.

MATERIALS AND METHODS
Four drafts of 3 age groups (weaners, yearlings and bullocks, 3 per group) of *Bos indicus* cross steers of varied origin grazed a 30 ha native pasture paddock (principally black speargrass *(Heteropogon contortus)*, Burnett blue grass *(Bothriochloa bladhii)* and Indian couch *(B. pertusa)*) at Brian Pastures Research Station, Gayndah, Qld from October 2001 to May 2005. The oldest steers were replaced annually with weaner steers during the mid dry season. The weaner steers in Draft 4 were removed from the paddock from August to October 2004 due to health problems with scouring, and after their return to the paddock their LW gain was low compared to the other steers; consequently LW gain results from these weaner steers were excluded from the experiment. The steers were weighed monthly. Faecal samples obtained monthly at weighing were bulked within age group, and mixed samples were also obtained in the paddock midway between musters. Dried and ground faecal samples were scanned (Foss 6500, NIRSystems Inc., Silver Spring, Md, USA), and the Coates (2004) F.NIRS calibration equations were used to predict diet attributes.

Actual DWG (DWG_{Actual}) of the steers was calculated from the monthly measured LW. F.NIRS predicted DWG was calculated (i) using the Coates (2004) adg1441 calibration ($DWG_{F.NIRS\_A}$), and (ii) using 4 calibrations where each possible combination of 3 drafts of weaners was included with the adg1441 data and used to predict the remaining draft ($DWG_{F.NIRS\_B}$). Predicted cumulative LW of the weaner age group of steers was calculated from the LW at the commencement of the draft and the fortnightly predictions of DWG calculated by each method.

RESULTS AND DISCUSSION
The amounts and distributions of rainfall were generally as expected for the site. The F.NIRS predictions of diet quality did not differ between the steer age groups, consistent with the absence of any effect of age or reproductive status on F.NIRS predictions of diet quality in other experiments (Dixon 2008).

Diet non-grass, consisting of herbaceous dicotyledonous species, averaged 11% (s.d. 5.9) during summer and 9% (s.d. 4.7) during winter. The low diet non-grass was consistent with the observed presence of little native forb or invasive legume species in the pasture. Crude protein (CP) in the diet averaged 8.4% (s.d. 2.1) in summer and 5.8% (s.d. 1.2) in winter. Dry matter digestibility (DMD) averaged 56% (s.d. 3.3) in summer and 51% (s.d. 2.6) in winter. The DMD/CP ratio was generally in the range 8-11 (mean 9.1 s.d. 1.5) during the mid to late dry season, suggesting that the steers may have responded to non-protein N supplement. Faecal N% (FN) was related to diet CP% and diet DMD/CP as follows:

$FN = -0.0049\ (CP)^2 + 0.19\ (CP) + 0.12$ (n 82, R^2 0.87), and

$FN = 0.014\ (DMD/CP)^2 - 0.36\ (DMD/CP) + 3.13$ (n 82, R^2 0.83).

LW gain was markedly influenced by steer age (Table 1), with the LW gain of yearlings and bullocks being only 79% and 71%, respectively, of that of the weaner steers in Drafts 1-3. Lower LW gain with increasing maturity is to be expected.

Table 1. Liveweight (LW) gain of the 3 age groups of steers measured by monthly weighing or cumulative LW predicted using the $DWG_{F.NIRS\_A}$ and $DWG_{F.NIRS\_B}$ calibration equations

Draft	Measured LW gain (kg)			Predicted LW gain (kg)	
	Weaner	Yearling	Bullock	$DWG_{F.NIRS\_A}$	$DWG_{F.NIRS\_B}$
1 (Oct 01-Jun 02	151	100	114	203	154
2 (Jun02-Jun03)	185	164	148	239	192
3 (Jun03-Jun04)	192	153	112	199	146
4 (Jun04-May05)	-[a]	97	47	171	132

[a], LW gain measurements of these weaner steers were excluded due to health difficulties.

The calibration statistics for the $DWG_{F.NIRS\_A}$ and $DWG_{F.NIRS\_B}$ equations were similar. $DWG_{F.NIRS\_A}$ predictions provided a good estimate of the cumulative LW gain for Draft 3 weaner steers, but substantially overestimated cumulative LW gain of Drafts 1 and 2. The $DWG_{F.NIRS\_B}$ predictions provided good estimates of the cumulative LW gain of weaner steers in Drafts 1 and 2, but underestimated cumulative LW gain in Draft 3. Since this latter calibration included information for the specific site, although not for the specific year, it was to be expected that estimates of weaner steer LW change would be improved. The cumulative predicted LW (Y) of the weaner steers using $DWG_{F.NIRS\_A}$ (X_1) was related to the measured LW of the weaner steers as follows:

$Y = 1.17\ X_1 - 37$ (n 30, R^2 0.98), while that predicted using $DWG_{F.NIRS\_B}$ (X_2) was:

$Y = 1.01\ X_2 - 12$ (n 30, R^2 0.96).

The relationship between actual and predicted DWG (R^2 0.35) was not as close as that for measured and cumulative predicted LW, but this is to be expected from the magnitude of the standard error of prediction and because calculation of cumulative LW from a sequence of faecal samples and predictions of DWG will reduce the error associated with the prediction. The large errors in the prediction of cumulative LW of the older age groups was to be expected because the Coates (2004) calibration data set for DWG was based on LW measurements with young, usually weaner cattle, and cognizance of the principle that NIRS calibrations are usually highly specific for the sample set on which they are based.

In conclusion, the experiment demonstrated the utility of F.NIRS to describe the diet selected by grazing cattle and supported the hypothesis that F.NIRS calibrations to satisfactorily predict cumulative LW change can be developed for specific pasture systems.

REFERENCES

Coates, D.B. (2004). Faecal NIRS – Technology for improving nutritional management of grazing cattle. Final Report of Project NAP3.121. Meat and Livestock Australia, Sydney.

Dixon, R.M. (2008). Utilizing faecal NIRS measurements to improve prediction of grower and breeder cattle performance and supplement management. Final Report of Project NBP.302. Meat and Livestock Australia, Sydney.

Lyons, R.K. and Stuth, J.W. (1992). Fecal NIRS equations for predicting diet quality of free-ranging cattle. *J. Range Management* 45, 238-244.