



University of Kentucky  
UKnowledge

---

International Grassland Congress Proceedings

21st International Grassland Congress / 8th  
International Rangeland Congress

---

## Utilisation of Near Infrared Spectroscopy to Optimise Productivity of Grazing Animals in the Western Australian Rangelands

Peter McCafferty  
*Chemistry Centre, Australia*

Gaye Krebs  
*Curtin University of Technology, Australia*

Kevin Ho  
*Chemistry Centre, Australia*

Ken Dods  
*Chemistry Centre, Australia*

Kumara Mahipala  
*Curtin University of Technology, Australia*

Follow this and additional works at: <https://uknowledge.uky.edu/igc>



Part of the [Plant Sciences Commons](#), and the [Soil Science Commons](#)

This document is available at <https://uknowledge.uky.edu/igc/21/9-1/42>

The 21st International Grassland Congress / 8th International Rangeland Congress took place in Hohhot, China from June 29 through July 5, 2008.

Proceedings edited by Organizing Committee of 2008 IGC/IRC Conference

Published by Guangdong People's Publishing House

---

This Event is brought to you for free and open access by the Plant and Soil Sciences at UKnowledge. It has been accepted for inclusion in International Grassland Congress Proceedings by an authorized administrator of UKnowledge. For more information, please contact [UKnowledge@lsv.uky.edu](mailto:UKnowledge@lsv.uky.edu).

## Utilisation of near Infrared spectroscopy to optimise productivity of grazing animals in the Western Australian rangelands

Peter McCafferty<sup>1,3</sup>, Gaye Krebs<sup>2,3</sup>, Kevin Ho<sup>1,3</sup>, Ken Dods<sup>1,3</sup>, Kumara Mahipala P.<sup>2,3</sup>

<sup>1</sup> Chemistry Centre (WA) 125 Hay Street East Perth, Western Australia 6004. E-mail: pmccafferty@ccwa.wa.gov.au. Corresponding author.

<sup>2</sup> Curtin University of Technology, PMB 1, Northam Western Australia 6401.

<sup>3</sup> Rural Industries Development Corporation (RIRDC), PO Box 4776 Barton ACT Australia 2604

**Key words** : NIRS, sheep, diet quality, rangelands.

**Introduction** The use of Near Infrared Spectroscopy (NIRS) to assess the quality of animal feed (dry matter, crude protein, NDF and ADF) is a well established technique and its usefulness as a predictive tool may match or exceed that of traditional wet chemistry (1, 2). More recently faecal NIRS (f NIRS) has been developed to measure various dietary indicators in ruminants (3, 4, 5). Up until now it has not been possible to calibrate the technique for universal feeds, with relevant calibrations being developed for a limited number of browse and grass species. It has been necessary to recalibrate the technique for each pasture type. However, our f NIRS calibrations are able to predict the nutritional attributes of mixed diets and therefore will have more generic application.

**Materials and methods** The diets investigated in this study involved a variety of mixed rations containing both browse (with variable levels of tannins and salt) and grass species. These diets were fed to penned sheep, with various dietary parameters measured including crude protein, crude protein digestibility and organic matter digestibility. All f NIRS calibrations were carried out on a Foss 6500 NIR instrument, utilising a spinning cup sample holder (Foss Instruments, Denmark). Chemical measurements were carried out to NATA accredited methods. The metabolisable energy content of the diets was determined using the gas fermentation technique (6). The ability to predict dietary parameters from f NIRS is shown in Table 1.

**Table 1** Predictability of dietary parameters using f NIRS.

| Dietary parameter            | r <sup>2</sup> | Slope | Standard error of prediction |
|------------------------------|----------------|-------|------------------------------|
| Crude protein                | 0.92           | 0.994 | 0.666                        |
| Crude protein digestibility  | 0.94           | 0.993 | 3.92                         |
| Metabolisable energy         | 0.92           | 0.960 | 0.352                        |
| Organic matter digestibility | 0.81           | 0.952 | 2.58                         |
| Total phenolics content      | 0.93           | 1.02  | 0.353                        |
| Total tannins content        | 0.99           | 0.932 | 0.321                        |

**Results** The predictability of the dietary parameters was high compared with the classically determined parameters. The results of this study indicate that universal f NIRS calibrations can be developed, overcoming the current requirement of costly and time consuming calibrations for individual species.

**Conclusions** This research will provide producers in the rangelands with a much needed tool as it is in these environments that dietary variability due to temporal and spatial conditions and selectivity by the animal can be great. Knowing the nutritional status of grazing animals will allow the producer to make informed management decisions regarding stock rotation, animal sale and purchase timing, grazing rates, supplementary feeding and the subsequent environmental impact of these decisions.

### References

- Norris, K. H., Barnes, R. F., Moore, J. E., Shenk, J. S. (1976). Predicting forage quality by infrared reflectance spectroscopy. *J. Anim. Sci.* 43, 889-897.
- Barton, K. E. and Windhas, W. R. (1988). Determination of acid detergent fibre and crude protein by near infrared spectroscopy: collaborative study. *J. Assoc. Off. Anal. Chem.* 71, 1162-1167.
- Leite, E. R. and Stuth, J. W. (1995). Faecal NIRS equations to assess diet quality of free ranging goats. *Small Ruminant Research* 15, 223-230.
- Coates, D. B. and Dixon, R. M. (2007). Faecal near infrared reflectance spectroscopy (f NIRS) measurements of non-grass proportions in the diet of cattle grazing tropical rangelands. *The Rangelands J.*, 29, 51-63.
- McCafferty, P. B., Krebs, G. and Ho, K. (2006). Utilising NIRS and DNA Technologies to Manage Rangeland Sustainability. *Proceedings of Interact 2006, Perth, WA*.
- Makkar, H. P. S. (2003). Quantification of tannins in tree and shrub foliage. *Kluwer Academic Publishers: The Netherlands*.