

Faecal NIRS for predicting diet quality in grazing cattle

The problem

The quality of the diet consumed by cattle is one of the main determinants of productivity (reproductive performance, growth rate and carcass quality) but conventional methods of estimating the diet quality of grazing cattle are costly, time consuming and generally unreliable. Because of the importance of diet quality in driving productivity, the ability to make inexpensive and reliable estimates of this trait would greatly enhance research capacity in scope and cost-effectiveness. It would also allow producers to acquire critical information for on-property decision making leading to more efficient production systems and enhanced economic viability, especially in relation to strategic and cost-effective supplementation. New technology based on the analysis of cattle faeces using Near Infrared Reflectance Spectroscopy (NIRS) is breaking fertile ground in the quick, inexpensive and reliable prediction of diet quality of grazing cattle.



The research and development

This technology was developed by the CSIRO in association with the MLA and took over 10 years using in excess of 1200 samples and 300 diets. The focus of the research was to develop the capacity to reliably predict various dietary attributes using faecal NIRS. In the research phase, forage samples representative of what the cattle consume (ie. the diet), and faecal samples from the cattle eating these diets, are analyzed. Matching diet and faecal samples are obtained from pen feeding experiments and from a wide range of grazed pastures. Predictive equations known as calibration equations are computed by relating faecal NIR spectra (measured by scanning the dried and milled faecal samples in a NIR spectroscope) to measured dietary attributes



(laboratory reference values) which are determined by chemical analysis of the matching diet samples. There is a strong correlation between the chemical composition of the diet and the chemical composition of the faeces and this results in calibration equations which can reliably predict dietary attributes from faecal analysis.

NIR used for Faecal Analysis

Initially the dietary attributes being measured were restricted to dietary crude protein, digestibility and dietary grass to non-grass proportions. The range of dietary attributes has been increased and non-dietary attributes have also been included. The full range of attributes for which calibration equations has been developed comprises:

- ***Forage crude protein***
- ***Dietary digestibility***
- ***Roughage Metabolizable Energy***
- ***Dietary grass and non-grass proportions***
- ***Intake of digestible dry matter***
- ***Rate of gain in growing cattle***
- ***Faecal N concentration.***

Technical advantages of the technology

- Collection, processing and analysis of samples is simple
- Analysis is non-destructive and environmentally friendly
- Quick, timely results
- Inexpensive compared with wet chemistry
- All attributes are predicted from a single faecal analysis

Benefits of the technology

- Decision making tool for cost-effective supplementation
- Decision making tool for forward planning (marketing) based on current growth rates
- Enhanced capacity to determine nutritional requirements of grazing cattle for different performance attributes
- Greater understanding of nutritional limitations to productivity in grazing cattle
- Cost-effective resource monitoring technology leading to more effective understanding of the feed resource and resource management
- Greater understanding of the effects of different management inputs and the way they effect performance
- New avenues of research and more cost-effective research

Cost:

The cost of faecal NIRS analysis is \$45 per sample. Wet chemistry determination of phosphorus is available on the same sample for \$25. This price includes the sample containers, postage, sample preparation, results and interpretation.

Example of Faecal NIRS Predictions

Client ID:
Name:
Property:
Address:
Sample date:

Sample Number 2005-1
Paddock: Number 1
Sample date: 9th September 2005

Results

CP%	Faecal N%	Digestibility %	Non grass %	Weight gain ***
4.9%	1.3	48%	3%	- 0.25 kg/day

*** Estimated weight gain without supplement

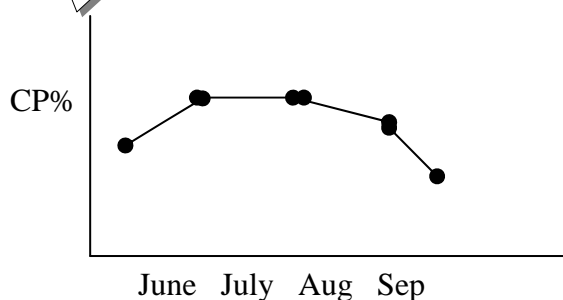
Interpretation

As you can see from the attached graph the diet available to the steers in this paddock has deteriorated somewhat from the sample submitted last month. While the protein levels have dropped below 5% CP, the digestibility of the feed and hence the energy available is still reasonable so you could expect that they will continue to put on weight with some sort of protein supplement.

If they are not supplemented, it is more likely they will lose weight until there is a significant fall of rain.

The description of the dry lick you said you were feeding will provide these steers with enough nitrogen to stimulate the rumen to allow them to eat enough grass to put on about 0.3 kgs per head per day provided you can get them to eat at least 120 grams of the lick per head per day. This would equate to intake of urea of about 30 grams per head per day which is safe provided they build up to this level gradually and you can ensure a consistent intake of the lick.

From your comments on the estimated pasture yield there should be plenty of grass in the paddock to support these steers through to the end of the year based on the estimated intake of pasture. Of course, this situation will need to be reviewed depending on the weather.

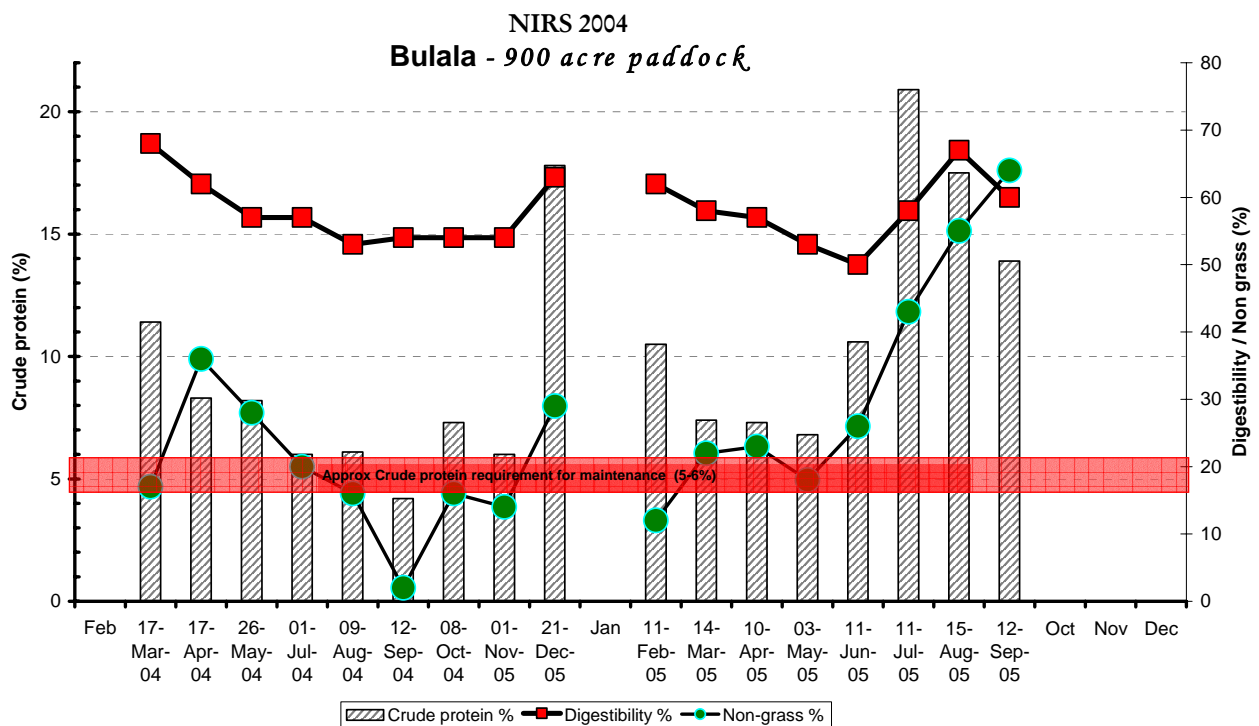


Profiling Paddocks using Faecal NIRS

It is possible to build up an excellent bank of data relevant to a particular paddock when repeated results for forage crude protein and non-grass digestibility have been obtained. The following shows results for a single paddock from March 04 to September 05. The red band in the centre represents approximate crude protein requirement for maintenance. Monthly rainfall could also be plotted on such a chart.

This tool allows producers to optimize pasture utilization according to desired animal performance and gives a clear indication of when supplementation may or may not be justified.

Example of Graph obtained from repeated sampling in paddock.



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