TOWARDS A NEW METHODOLOGY FOR ASSESSMENT OF PASTURE QUALITY

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Annual pastures are the main source of feed for sheep and cattle in the Mediterranean climatic zones of Australia. If farmers knew the quality of their pasture they could improve animal and farm performance by utilizing the available pastures better and decreasing supplementary feeding, especially at high stocking rates. Many authors have reported moderate to strong correlations between the characteristics of light reflected by pastures and characteristics such as content of protein and energy and amount of fibre (Edirisinghe *et al*. 2004; Mutanga *et al*. 2005; Schut *et al*. 2005). This paper aims to develop a simple model to describe the seasonality of the *in-vitro* digestibility of dry matter of pastures in W.A. and to evaluate the range of spectral responses that can be expected within a growing season.

A total of 482 samples from pastures, collected by various workers in DAWA and CSIRO in 11 seasons on 14 sites in the south-west of Western Australia, were used to develop a simple seasonality model for dry-matter digestibility. Pasture samples were divided into grass, clover or other plant species. The daily mean temperature sum (Tsum) above a base temperature of 5°C from 21 June onwards was used as the independent x-variable. The model fits a constant digestibility in the vegetative (v) and senesced (s) growth stages. It explained 89, 86 and 77% of the variation for grass, clover and other species. The digestibility was 73, 77 and 75% in the vegetative growth stage and 49, 50 and 52% in the senesced stage for grass, clover and other species respectively. Remarkably, the rates of decline in digestibility of grass, clover and other species were similar with 0.028, 0.027 and 0.031% decline in digestibility per degree of temperature. A single model for all annual pastures explained 81% of the variation with an RMSE of 3.7 % units for digestibility.

Table 1. Number of records (N), sites and seasons and R^2 and root mean squared error of the regressions of the model where digestibility = max (min(v, a – b × Tsum), s)

Pasture type	N	Sites	Seasons	R^2	RMSE
Grass	67	7	7	0.89	3.2
Clover	182	9	6	0.86	3.1
Other	233	12	11	0.77	4.1
All	482	14	11	0.81	3.7

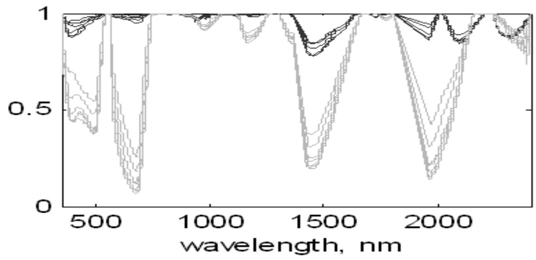

Figure 1. Continuum removed reflectance spectrum of green (grey) and senesced pasture (black) with varying amounts of biomass

The accuracy of this quality model, extended to other quality characteristics such as content, fibre and nutrient content, and the potential of remote sensing for measuring pasture quality will be evaluated in field experiments in 2006 and 2007 in short and long season climatic zones. In these experiments the supply rates of N, K and P or S will be varied: 1) to guarantee a wide range in pasture quality values, 2) to assess the effects of nutrient deficiency on pasture quality, and 3) to unravel the interactions of biomass, growth stage and nutrient deficiency on crop reflectance. Reflectance spectra and pasture quality samples will be collected throughout the year. These experimental data will allow an evaluation of the accuracy of models relating reflectance spectra to pasture quality, under specific N, K and P or S deficiencies. A hand-held radiometer will be used for the measurement of reflectance spectra. The spectra in Figure 1 indicate that a large range in spectral responses within a season can be expected. Specific features can be used to quantify the amounts of ground coverage and the biomass for vegetative and senesced plant material. Based on these promising results, we propose a methodology for measuring pasture quality that combines the strength of remote sensing technology for comparative measurements within a spatial context with benchmarks derived from a simple model describing seasonality.

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