NIR: A KEY COMPONENT OF THE PREMIUM GRAINS FOR LIVESTOCK PROJECT

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The NIR technique has been used extensively over many years for the routine monitoring of grain quality, particularly moisture and protein content. However, because most Australian grain is intended for human food production, the determinants of grain quality for livestock feed, apart from protein, have been largely ignored. However the increasing use of grain for feeding to pigs, poultry, beef cattle and dairy cows has led to an important national research project entitled "Premium Grains for Livestock". Two of the objectives of this project are to determine the compositional and functional characteristics of grains which influence their nutritional quality for the various classes of livestock, and to adopt rapid and objective analytical tests for these quality criteria.

NIR has been used in this project firstly to identify a set of grain samples from a large population of breeders' lines which showed a wide spectral variation, and hence a potentially wide variation in nutritional value. The selected samples were not only subjected to an extensive array of chemical, physical and *in vitro* analyses, but also were grown out to produce sufficient quantities of grain to feed to animals in *in vivo* studies. Additional grains were also strategically selected from farms in order to include the effect of weather damage, such as rain, drought and frost.

In the first three years of this project, NIR calibrations have been derived or attempted, on both ground and whole grains, for a range of chemical, *in vivo*, *in sacco* and *in vitro* assays. These include protein, fat, acid detergent fibre, neutral detergent fibre, starch, and (in the case of ruminants) *in vivo* dry matter digestibility (DMD), pepsin-cellulase dry matter disappearance, *in sacco* DMD and *in vitro* assays to simulate starch digestion in the rumen and small intestine. Other workers are involved in deriving or refining NIR calibrations for digestible energy (pigs) and apparent metabolisable energy (poultry).

Results so far indicate high calibration accuracy for chemical components (SECV 0.3 to 2.6%) and very promising statistics for *in vivo* DMD (SECV 1.8, R^2 0.93, SD 7.0, range 61.9 to 92.3, n=60). There appears to be some potential for NIR to estimate some *in vitro* properties, depending upon the accuracy of reference methods and appropriate sample populations.

The project has been extended for a further three years, and so far *in vivo* DMD has been measured on an additional 14 grains using sheep, and of these, 3 using cattle. This is a laborious and expensive process, but is necessary to extend the range of grains with *in vivo* DMD values and so increase the robustness of the various NIR calibrations, with the aim of implementing uniform testing procedures for nutritional value of grains throughout Australia.