WHERE ANGELS FEAR TO TREAD: A COMPARISON OF NIR INSTRUMENTS FOR ESTIMATING GRAIN QUALITY FOR LIVESTOCK

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"For fools rush in where angels fear to tread". Alexander Pope (1688-1744).

The "Premium Grains for Livestock Program" (PGLP) is a national research effort funded by the Grains Research and Development Corporation and several other bodies. A major part of this research is the development of rapid tests to estimate grain quality for livestock.

NIR clearly has a major role in this work. Calibrations have been derived or attempted on over 100 grains, either whole or ground, for 52 different chemical and physical properties, several *in vitro* or *in sacco* tests, and *in vivo* dry matter digestibility (DMD) and hence metabolisable energy (ruminants). Similar measurements have also been made with pigs and poultry. This represents one of the largest studies of its type ever conducted.

These calibrations were developed on either a Foss-NIRSystems model 6500 or 5000 spectrometer. However, the grains and livestock industries want the appropriate NIR tests to be available at the point of delivery of grains (eg. a feed mill or silo). These locations generally have simpler, cheaper (and often older) instruments, using various software packages, and the transfer of calibrations in such cases presents a challenge. Can it be done?

At the risk of exemplifying Pope's famous quotation, and raising the hackles of some instrument manufacturers, a recent study compared NIR calibration statistics for seven measurements on nine different NIR instruments using the same set of whole grain samples from the PGLP. The instruments tested were three scanning monochromators (one in reflectance mode, two in transmission mode), two diode array spectrometers, two filter instruments and two FT-NIR instruments. These instruments differed in terms of their optical configuration, spectral range, sample presentation and software. All samples were scanned using each instrument's software then converted to WINISI format for subsequent calibration. The parameters were *in vivo* DMD% (sheep), starch, crude protein (CP), lysine, insoluble non-starch polysaccharides (NSP), crude fibre (CF) and neutral detergent fibre (NDF).

This study is not complete, but results for one parameter are shown in Table 1. Caution is needed in interpreting these values. The trends are not the same across all parameters. Use of one calibration software package with optical data from all instruments may not always give optimum results. There are also factors to consider other than raw differences in calibration statistics when deciding if a given type of instrument is suitable for the job.

Table 1. Calibration statistics among NIR instruments for in vivo DMD% on whole grain (n=82)

Statistic	Mono R	Mono T1	Mono T2	DA 1	DA 2	Filter 1	FT-NIR 1
SECV	2.10	2.59	2.71	2.60	2.92	3.03	2.64
1-VR	0.89	0.83	0.82	0.83	0.79	0.77	0.83

SECV = standard error of cross-validation; 1-VR = 1–variance ratio (r^2 in cross-validation)