Broiler industry perspective on the application of NIR-derived energy values for feed grains

Ron MacAlpine

Inghams Enterprises Pty Limited

The value of grain energy (AME) in broiler diets

- Sorghum (13.8 MJ/kg) > Wheat (12.8 MJ/kg) > Barley (11.8 MJ/kg). There is also significant variation within grain type.
- Typical average wheat AME at 11% moisture content is 12.8 MJ/kg.
- Wheat energy on today's ingredient prices has significant value implications in lease cost diet formulations.

  12.8 → 13.3 MJ/kg + $12/tonne wheat

  12.8 → 12.3 MJ/kg - $13/tonne wheat
- How can we capture energy differences in grain and improve the accuracy of diet formulation?
- Are the NIR-predicted grain energy values reliable determinants of final feed performance?

GRDC/Inghams wheat AME trial (2006)

- Three different wheats were compared based on NIR predicted broiler AME. Wheat was the only grain used in the diets (67% - 77%).
- Roache 13.1 MJ/kg 11.2% protein
  Ammrock 12.5 MJ/kg 13.3% protein
  APW (control) 12.8 MJ/kg 12.1% protein

Roache	13.1 MJ/kg	11.2% protein
Ammrock	12.5 MJ/kg	13.3% protein
APW (control)	12.8 MJ/kg	12.1% protein

- The average AME for these wheats (12.8 MJ/kg) was used for all diet formulations. On this basis each diet phase was “isocaloric” and all non-energy nutrient specifications were similar based on actual ingredient values.
- Growth and FCR were measured to verify the reliability of NIR-predicted high or low AME as a determinant of broiler performance, with and without xylanase enzyme.

Wheat AME trial results at 42 days

Treatment	Wheat A.M.E. (MJ/Kg)	Live Weight (Kg)	FCR at 2.8kg (g food/g gain)
Roache	13.1	2.91	1.71
Roache + enzyme	13.1	2.92	1.66
Ammrock	12.5	2.76	1.77
Ammrock + enzyme	12.5	2.77	1.73
APW + enzyme	12.8	2.82	1.69
LSD ($P < 0.05$)		0.05	0.04

- The average calculated diet AME for each treatment was 12.6 MJ/kg (taking the average wheat value as 12.8 MJ/kg, with and without enzyme).
- The difference in FCR performance between the high and low AME wheat diets (3.8%) closely matched the difference in predicted AME contribution from wheat (3.7%).
- The growth advantage of the Roache high AME wheat may have reflected its high AME intake characteristics and/or superior pelleting quality.
- Addition of enzyme improved FCR by 2-3% in both high and low AME wheat diets without narrowing the differences.

Limitations of individual NIR test results for broilers

- Feed enzymes and/or whole grain feeding may or may not diminish some of the energy differences predicted by NIR. A low energy wheat or barley may be inappropriately penalised?
- Normal blending within each grain type from different parts of the supply chain through storage and the feed milling process may also compromise NIR-predicted differences?
- Additivity of AME values in formulations based on two or more different grain types can change performance outcomes from predicted energy values for the individual grains.
- Feed trial results with ingredient-complex diets do not usually indicate large movements in available grain energy from average values.

Trial results with ingredient-complex diets (2009)

Feed source/grain	Average diet AME (MJ/kg)	FCR 0-42 days (adjusted to 12.9 MJ AME & 2.60kg)	
QLD	Sorghum/wheat	12.96	1.59
NSW	Sorghum/wheat	12.77	1.59
VIC	Sorghum/wheat/barley	12.90	1.56
SA	Wheat/barley	12.80	1.59
WA	Wheat/barley	12.70	1.59
TAS	Wheat	12.95	1.56

Average diet AME was based on average ingredient matrix values for wheat, sorghum and barley. Appropriate enzymes were added to all diets.

Application of NIR energy testing capability

- Currently we have clear energy differences between grain types and these are valued and traded accordingly e.g. wheat vs barley for broilers and barley vs sorghum for ruminants.
- There is a need to identify general shifts in grain energy within grain type that could be captured in the supply chain e.g. breeding a new high-energy feed grain variety. Growers could choose to grow high-energy varieties which may be segregated and valued for energy by the end user.
- End users could use NIR to validate and adjust AME values for ‘composite’ grain stocks in the feed mill. This should improve accuracy and efficiency in feed formulation.
- NIR energy tests would be a valuable tool for nutritional research, particularly in the area of additivity in AME for single grain blends and multiple-grain diets with different levels of inclusion.

Trading grains based on NIR-energy

- NIR prediction at the grower delivery point may not achieve the desired purpose. Growers would be penalised or rewarded for unpredictable energy outcomes. Large end users will have difficulty segregating the supply chain to capture energy values from farm to mill.
- Trading grains based on NIR- predicted energy is not likely to advance overall feed grain energy values unless there is an initiative to develop higher energy varieties.
- Traders and growers would have increased price risk in forward selling grain based on NIR-energy which they can't control.
- Major users will end up with "average" grain AME as the supply chain works with multiple growers, traders, forward contracts, storage co-mingling and swaps by storage providers between sites.
- Small end users may be able to capitalise on NIR-energy through a direct alignment with individual growers.

Conclusion

- NIR energy prediction is an effective technical innovation.
- However, there are limitations in reliability of individual batch NIR-energy values where blending and complex broiler diets are used.
- Opportunities for NIR prediction are identified in breeding programs to develop high-energy varieties, end user validation of AME in composite grain stocks and in nutritional research.
- There are substantial challenges to overcome before trading grains based on NIR-energy at the grower/country storage end of the supply chain.