

Concurrent Session 4: Resistant Starch

Resistant starch and animal production

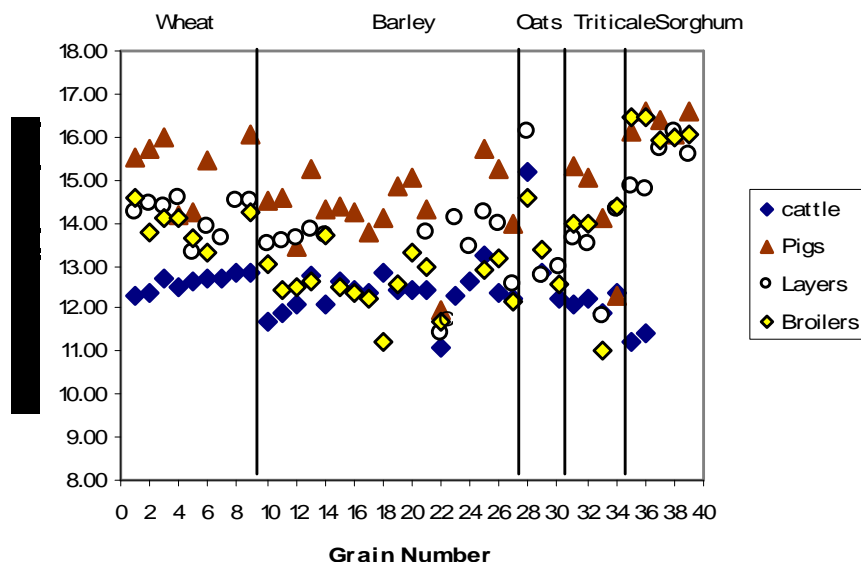
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Background – Cereal grains with their high starch content are fed to livestock predominantly as a source of energy for rapid growth or high milk yield. The capacity of an individual grain sample to provide energy is known to vary widely between and within cereal and animal species. A large research effort, the Premium Grains for Livestock Program, funded jointly by the Australian grains and animal research and development organisations and Ridley Agriproducts, was established in 1996 to define the range in and identify the causes for variation in available energy released during digestion (MJ/kg) and in total available energy intake (MJ/d) for wheat, barley, triticale, oat and sorghum grains fed to sheep, cattle, pigs, broilers and laying hens.

Review – Over 3300 cereal grains with a wide range in chemical and physical characteristics were collected from germplasm archives, plant breeder, farmers and selected because of drought, frost damage or pre-harvest germination. Over 190 grains selected on variation in near infrared spectroscopy scans and *in vitro* fermentation/digestion assays were fed to animals and 40 grain samples were offered across all animal types. The energy from grains made available following digestion was measured in all animal types and voluntary intake was measured in cattle, pigs, broilers and layers. A comprehensive chemical and physical analysis was conducted on all grains. Available energy is expressed as digestible energy for pigs, apparent metabolisable energy for poultry and metabolisable energy for ruminants.

There were large variations across cereal grain species, individual grain samples and animal types in the available energy content (MJ/kg DM, figure). Barley tended to have the lowest values for pigs and poultry and sorghum the highest values, whereas, sorghum had the lowest energy content of all grain species for cattle. Pigs tended to extract more energy from the grains than the other animal species and cattle the least. The smallest within grain species variation was observed for cattle. The extent of the within grain variation depended on the grain species, with the variation being particularly small for pigs offered sorghum. There were low and negative correlations in available energy content of grains between the animal types (e.g. broilers-pigs, 0.19; broilers-cattle, -0.28; pigs-cattle, 0.21). There were also low and negative correlations between available energy content and available energy intake within each animal type (e.g. 0.2 for broilers to -0.1 for pigs) indicating that different characteristics of grains determine digestibility and intake. Similarly, there were low and negative correlations in available energy intake across animal types (e.g. broilers-pigs, -0.15; broilers-cattle, -0.03; pigs-cattle, 0.12).



Conclusions – The combined results suggest that grains with high digestibility in will not necessarily provide high intakes of available energy for the animals examined and that some individual grain samples provide more energy for one animal type than another and vice versa. The differences between grains and animal types is determined primarily by an interaction between the animal digestive system, chemical composition of the grain and accessibility of amylolytic enzymes to starch as influenced by the composition and thickness of endosperm cell walls in wheat, barley and triticale and the protein matrix in sorghum.