Final Project Summary

The nutritional value of biofuel co-products for poultry

Project number	RD-2009-3622	**Final Project Report**	SR28
Start date	May 2011	**End date**	May 2014
HGCA funding	£37,500	**Total cost**	£94,897.82

What was the challenge/demand for the work?

Distillers' dried grain with solubles (DDGS) is the co-product of bioethanol produced from cereal grains with value as a feedstuff for poultry. There is substantial data about the nutritional value of maize-DDGS, but very little data on wheat-DDGS, particularly from modern biofuel plants. From information available for maize-DDGS, it is clear that wheat-DDGS is likely to be a viable source of metabolisable energy, amino acids and available phosphorus for poultry. This project investigated the nutritional value of wheat-DDGS for broilers and turkey and the efficacy of exogenous enzymes (carbohydrases, protease and phytase) in improving the nutritional value of wheat-DDGS.

How did the project address this?

A total of eight experiments were used to provide data about the value of wheat-DDGS as a feedstuff for broilers and turkeys in the current project. One of the main drawbacks relating to the use of DDGS for poultry is the variation in its chemical composition among sources. Therefore in the first experiment, chemical composition data for 499 samples of wheat- or maize-DDGS were used to develop mathematical models that can be used to predict amino acids composition in both maize- and wheat-DDGS from their crude protein contents. Using a total of six experiments, the metabolisable energy content, amino acids and phosphorus digestibility in wheat-DDGS without or with exogenous enzymes were determined for broilers and turkey. The metabolisable energy and digestible nutrient values of wheat-DDGS determined in the previous experiments were then used to formulate diets to determine the growth performance and gastrointestinal tract characteristics of broilers in response to receiving diets containing wheat-DDGS and exogenous enzymes in the final experiment.

What outputs has the project delivered?

In the first experiment, it was noted that the amino acids contents of maize- and wheat-DDGS can be predicted with reasonable accuracy using the regression equations developed in this study. The results of a validation exercise for the prediction models developed are shown in Figure 1 and 2, and it is notable that the predicted values were close to the actual values.

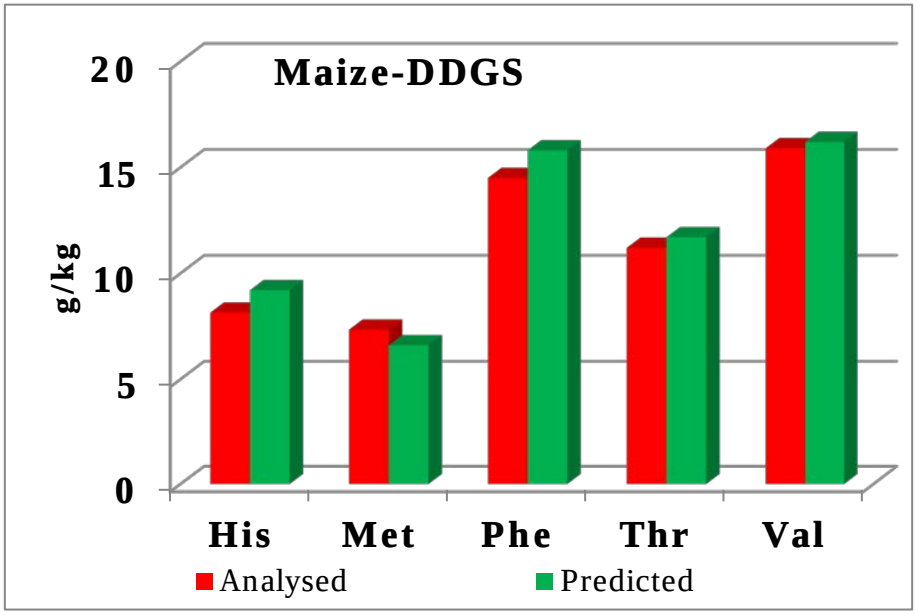

Figure 1

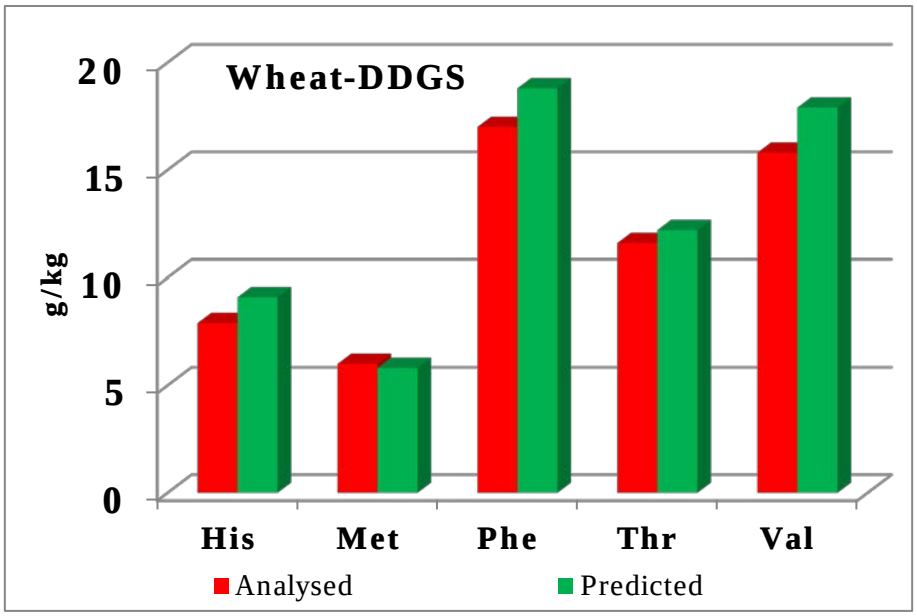

Figure 2

In the following six experiments, it was noted that:

Metabolisable energy:

- The apparent metabolisable energy content in wheat-DDGS without or with an enzyme mixture containing xylanase, amylase and protease activities (XAP) were 15.0 or 15.5 MJ/kg DM, respectively, for broilers or 14.0 or 14.4 MJ/kg DM, respectively, for turkeys.
- Nitrogen corrected-AME without or with XAP were 14.0 or 14.5 MJ/kg DM, respectively, for broilers; or 13.0 and 13.5 MJ/kg DM, respectively, for turkeys.

Amino acids digestibility:

- For broilers, standardised ileal amino acids digestibility (SIAAD) ranged from 43% (Asp) to 84% (Pro) whereas the range was from 54% (Asp) to 93% (Pro) with protease.
- For turkeys, SIAAD ranged from 41% (Thr) to 89% (Pro) without protease; and 56% (Arg) to 88% (Pro) with protease.
- Protease improved SIAAD in wheat-DDGS for broilers and turkeys from 5 to 19 percentage points.

Phosphorus digestibility:

- True phosphorus digestibility of wheat-DDGS measured at the ileal or total tract is greater than 90% for broilers.
- For turkeys, the true phosphorus digestibility ranged is greater than 70% at the ileal and total tract.
- Phytase did not improve phosphorus digestibility in wheat-DDGS for broilers and turkeys.

In a final study, the growth performance and gastrointestinal tract characteristics of broilers receiving diets containing wheat-DDGS and exogenous enzymes was determined. It was noted that:

Growth performance:

- Body weight gain was similar between birds receiving a wheat-SBM diet and those receiving a wheat-SBM diet containing wheat-DDGS from day 1 to 42; however, feed efficiency was superior for birds not receiving wheat-DDGS in their diet from day 1 to 42.
- XAP improved the bodyweight gain and feed efficiency of birds receiving diets marginal in energy (minus 0.63 MJ/kg) and containing wheat-DDGS from day 1 to 42.
- Phytase alone or a combination of phytase and XAP did not improve growth performance of birds.

Gastrointestinal tract characteristics:
The absorptive structure of the jejunum (villi height and crypt depth), intestinal pH and caecal volatile fatty acids production of broilers at 42 days were generally not affected by the inclusion of wheat-DDGS or supplemental enzymes.

Who will benefit from this project and why?

It is expected that the information generated in the current project will encourage the use of wheat-DDGS in diets for broilers and turkeys as a low cost alternative for wheat, soyabean meal and inorganic phosphorus. In turn, an increase in the use of wheat-DDGS for poultry may reduce feed cost and competition between wheat demand for poultry and bioethanol production. It is also expected that the development of a nutrient matrix for exogenous enzymes in wheat-DDGS will help in formulating diets that closely match bird requirements and prevent excessive surfeit. It is also possible that the use of wheat-DDGS as a source of energy and nutrients for poultry will reduce dependency on soyabean import and, as a consequence, improve sustainability.

If the challenge has not been specifically met, state why and how this could be overcome

The objectives set out in the current project were met. Nonetheless, it is advised that similar studies should to be conducted for layers and pigs to generate comprehensive data and improve the opportunity to use wheat-DDGS for poultry and pig in the UK.

How have you benefited from this studentship?

I had the opportunity to provide data that has both economic and environmental value for the UK and beyond. Through knowledge transfer at national and international conferences, I was able to meet experienced professionals and this helped me to gain skills, knowledge and schemes beyond the scope of my PhD project.

Lead partner	SRUC (formerly SAC)
Scientific partners	
Industry partners	Danisco Animal Nutrition; Ensus
Government sponsor	