



Find a few facts on feed



*from theory
to field*

Over half of UK grain becomes animal feed either directly, or as co-products. CPM explores the research aimed at understanding the needs of this important sector.

By Tom Allen-Stevens

A milling wheat grower refines the agronomy of the crop to deliver the right balance of grain yield and protein. A malting barley grower focuses on delivering a grain of the correct grain nitrogen for the end user. But what about the feed wheat and rapeseed grower?

The UK animal feed sector is the greatest user of UK cereals and oilseeds by a long way, but growers know little about the sector's quality requirements. That's not to say there aren't opportunities to be explored, notes Harley Stoddart of HGCA. "Northern Europe is highly dependent on non-GM protein, but the world is running out of sources of non-GM soymeal. So home-grown sources of protein for animal feed are becoming ever more important."

Significant research

That's why there's a significant body of research currently underway looking at the value of oilseed rape meal and cereal co-products (see panel on p63). Among these is the £2.6 million ENBBIO project — the last of the Defra and industry-funded LINK programme — that's due to conclude in Sept this year.

The project investigates the potential value of distillers dried grains with solubles (DDGS) produced as a co-product of the Vivergo and Ensus bioethanol plants, explains Harley Stoddart. "We've a reasonable amount of information on barley and maize DDGS, but less is known about wheat. But these plants depend as much on the sale of DDGS to the feed industry as they do on bioethanol sales, and UK growers are providing the primary product."

A tonne of wheat will produce about 350kg (400 litres) of ethanol and around the same weight of DDGS, while the 300kg of

carbon dioxide produced can be used in fizzy drinks or other food products, he explains. Currently, just 250,000t of DDGS, a co-product mainly of the brewing and distilling industry, is used in animal feed, but this is set to jump at least fourfold once the bioethanol plants are up to full production.

"That's a sizeable market. The project has focused on ensuring the feed industry can use wheat DDGS with confidence. There's been very strong industry involvement throughout, which is a key plus point, and HGCA are working with cross-sector AHDB colleagues to co-ordinate and disseminate the findings."

The project's research team was starting from a point of little understanding of DDGS for monogastrics or of wheat DDGS from a bioethanol plant, recalls Liz Hudson of ADAS. "DDGS had a reputation of being of variable quality because of variations in the manufacturing process at different distilleries. In the past, they'd mainly been

“We found DDGS really are a valuable source of protein and energy for pigs and poultry.”

fed to ruminants, so we needed to establish not only the digestibility for non-ruminants, but also the inclusion levels.”

In poultry, initially small-scale academic trials were carried out, mainly through University of Nottingham, to establish how broilers and layers performed at different levels of inclusion.

About a third of the wheat taken in by a bioethanol plant is sold on as DDGS.



“What we established early on was that DDGS can be included at quite high levels in diets for monogastric animals with no negative effect on performance. We found they really are a valuable source of protein and energy for pigs and poultry,” notes Liz Hudson.

The protein content of DDGS is around 34% — significantly higher than the 9-10% protein of the wheat feedstock — and they are also high in fibre. The project diets were balanced for standardised digestible amino acids for different species and then included at different levels with performance monitored closely. “We found the wheat DDGS was consistent in quality from day to day.”

No differences

In the broiler trials, both starters (0-14 days) and growers (14-28 days) were studied, with inclusion levels up to 5% and 18%, respectively. “No differences were detected between treatments, and there were no starter to grower interactions in broilers, showing that feeding wheat DDGS during the start phase doesn’t lead to any adaptation during the grower phase,” reports Liz Hudson. A broiler study at SRUC found there were no negative effects of DDGS inclusion on overall growth



Wheat DDGS from bioethanol are set to represent a sizeable market for UK growers, notes Harley Stoddart.

performance, provided diets were formulated correctly.

Layers fed wheat DDGS were examined over four weeks, and likewise, this had no negative effect on performance. “A key concern was whether the diet would lead to dirty shells, but there was no effect on this or egg-shell quality, either,” she adds.

The academic studies led to trials with commercial flocks at Hook2Sisters and Noble Foods. “It’s important to ensure these ▶

Advert removed



Liz Hudson works with a large number of industry partners on the project, and this has been valuable to ensure the research findings have been taken on in practice.

► findings carry through into commercial use. There are also handling and other practical aspects to consider. One of the notable features of this project has been involvement with a large number of industry partners. While that's sometimes been a challenge to coordinate, the two-way link has been really valuable to ensure the research findings have been taken on in practice."

In pigs, work has been undertaken at the University of Illinois, as well as at Nottingham, to assess the apparent ileal

Feed focus at Cereals

A special exhibit focusing on the importance of animal feed will feature on the HGCA stand at next month's Cereals event. As well as information on the research projects, HGCA staff and experts will be on hand to provide insight on growing for the sector.

"The feed industry is quite diverse as it provides products for a whole range of animals," explains Dr Martin Grantley-Smith

of HGCA. "Firstly, you have ruminant and non-ruminant livestock, which have quite different nutritional requirements. On top of that there are pet food, horse feed and feed for fish farms. Growers can target specific feed types by using the right varieties and agronomy, helping boost profitability across the supply chain."

digestibility (AID) and the standardised ileal digestibility (SID) of amino acids — two key measurements needed to assess the value of wheat DDGS — and commercial trials are on-going. Meanwhile, sheep-feeding trials were carried out to determine metabolisable energy (ME) and nitrogen digestibility for ruminants.

With just a few months of the project left, initial results from all the commercial trials look promising, she concludes. "We'll also be assessing the land-use impact of switching protein sources for animal feeds into wheat DDGS and including these findings in the final report."

But cereal co-products are not the only

Broiler studies at SRUC found there were no negative effects of DDGS inclusion on growth performance, which led to commercial-scale trials.



Pig pluses from ENBBIO project

For Lorraine Salmon, feeding wheat DDGS to pigs without establishing its energy and amino acid content first would be like an arable farmer spreading an unknown fertiliser through an unmetred spreader.

"As with any new feed ingredient, you need to know what's in it, and the requirements of every animal and stage of growth is different," she explains. "Often there's an existing analysis you can refer to. But with co-products, it's very dependent on the impact of the manufacturing process."

As a pig nutritionist with Premier Nutrition, she advises on what levels of vitamins and minerals are needed to supplement a feed. She's also been involved with the ENBBIO project, helping to establish the parameters needed, the best way to measure them and how wheat DDGS can be incorporated into monogastric diets.

"You first need to establish a feed's energy content, which is dominated by either starch or oil for a product of cereal or oilseed origin respectively. Then you look at protein, and the balance of the amino acids lysine, methionine, threonine and tryptophan. Fibre content is also important — the right amount for a ruminant can be too much for a pig."

As co-products, wheat DDGS has much of its starch removed, while OSR meal has relatively little oil content. "There's also the quality of the protein to consider — it can be heat damaged and become less available to the animal. The level of damage and resulting nature of the protein is very dependent on the manufacture process and the specific plant. There are anti-nutritional aspects to consider, such as glucosinolates, and processing can hydrolyse these into more toxic products."

The valuable part of the ENBBIO project is that it's established all the parameters needed for wheat DDGS, she points out, and also determined that the product from the bioethanol manufacture process is consistent.

"Wheat DDGS have a reasonable energy level but the digestibility of amino acids are relatively low. Today, they'd feature in pig feeds at around £200/t — considerably more than the original cost of the wheat, although this depends very much on the cost of other ingredients they replace in the formulation, such as OSR and sunflower meal."

The relative value of wheat DDGS is higher in cattle feed, as the crude protein has a higher value, she notes. But with the bioethanol plants



A feed's energy content, balance of the amino acids, and fibre content must be assessed before it can be included in a diet formulation.

in the east of England and majority of beef farms in the West, there's a transport penalty, particularly where the DDGS aren't pelleted.

These are all aspects over which growers have little influence, she accepts. "The best way to improve the quality of any cereal or oilseed destined for animal feed is to manage the crop well, especially as harvest nears. Mycotoxin levels are very important, and how grain is stored has a significant impact on its value in animal feed. The 2012 harvest really showed up the importance of these aspects and put the feed industry to the test in terms of how we could include cereals when formulating diets."

source of protein that could replace soya, according to HGCA's Dr Dhan Bhandari. "Oilseed rape is a high protein crop, but the feed industry has its concerns. Firstly, the nutritional value of OSR meal is not clearly defined. It also contains an anti-nutritional fraction — metabolites such as sinapines and glucosinolates — that could be seen as less attractive properties and currently limit the amount that's included in diet formulations."

So following a research call put out in Sept 2012, a further £1.5 million of new work is underway into animal feed, including two projects looking in more detail at the feed value of OSR meal. A third, separate project assesses how moisture, fusarium and microdochium levels in wheat affect broiler

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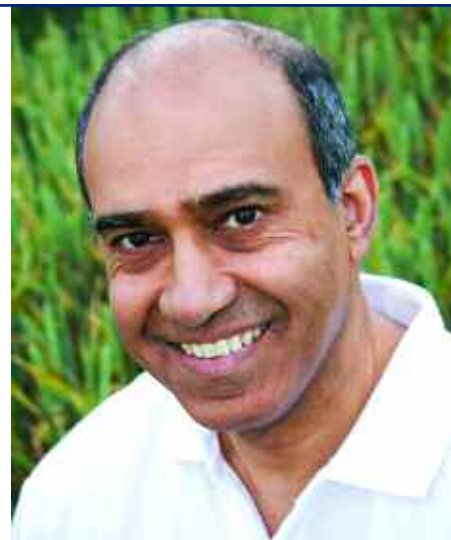
performance (see panel below).

"So far in the first OSR meal project (3812), samples have been prepared from 22 conventional and hybrid varieties, and these have been analysed for nutritional and anti-nutritional factors, while pig and poultry feeding trials are underway. Initial screening has indicated glucosinolate levels do vary, and that the way in which the rapeseed is crushed also has an influence on this" reports Dhan Bhandari.

This project overlaps with another (3813) led by AFBI, that aims to establish a digestibility coefficient database for OSR meal. "The research team is analysing a large number of samples from more than one growing season and assessing them for digestibility, protein and amino acids. Near infrared reflectance spectroscopy (NIRS) is being used, and the plan is to develop a set of protocols that can be used to assess samples quickly and easily using machines that most feed manufacturers have in their labs," he continues.

A second aspect of this study is to determine the levels of various contaminants, including heavy metals and mycotoxins, and also to develop a similar rapid test for key mycotoxins in DDGS. "The feed industry is keen to know to what extent DDGS may contain these contaminants."

The final project (3805) studies the nutritional value of wheat, using NIRS again to predict how broilers will perform when fed a diet based on particular wheats. "It builds on previous HGCA-funded work and looks



Anti-nutritional properties, currently associated with OSR meal, could limit the amount that's included in diet formulations, says Dhan Bhandari.

to validate the academic findings using commercially raised birds," explains Dhan Bhandari.

"In particular, the project will investigate how post-harvest grain-drying history, fusarium and microdochium levels in wheat affect broiler performance. Growing conditions in 2012 provided excellent samples for work in this area, and these have been analysed and formulated into diets. It should build into a better understanding of how wheat of marginal quality can be used in animal feed," he concludes. ■

Research round-up

HGCA project 3638, Environmental and nutritional benefits of bioethanol co-products (ENBBIO), runs from April 2010 to Sept 2014. It aims to investigate variability and opportunities for distillers dried grains with solubles (DDGS) and quantify their contribution to the overall greenhouse gas balance. Led by ADAS, with scientific partners University of Nottingham, University of Manchester and SRUC, its total cost is £2,629,000, with £120,000 funded by HGCA. Part-funded by Defra, through the Sustainable Livestock Production LINK programme, the project's industry partners are AB Agri, AB Vista Feed Ingredients, Aunir, BPEX, DairyCo, Noble Foods, EBLEX, Ensus, Evonik, Glencore, Hook2Sisters, Marks & Spencer, NEPIC, Premier Nutrition Products, Sciantech Analytical Services, Syngenta Seeds, The Scotch Whisky Research Institute and Tulip.

HGCA project 3813, Expanding the knowledge base to increase the use of

home-grown rapeseed meal and DDGS in diets for pigs and poultry in the UK, runs from April 2013 to April 2016. It aims to develop a digestibility coefficient database and near infrared (NIR) prediction equations for the digestibility of OSR meal in pigs and broiler chickens and assess the safety of wheat DDGS with particular reference to mycotoxins and heavy metals. Led by the Agri-Food and Biosciences Institute (AFBI), with scientific partners Queen's University Belfast and the James Hutton Institute, its total cost is £852,790 of which HGCA is contributing £204,574. Part-funded by DARD, the project's industry partners are Aunir, Cargill, AB Agri, QMS, Pig ReGen, Moy Park and Senova.

HGCA project 3812, Home-grown oilseed rape meal and OSR products as protein sources for pigs and poultry, runs from April 2013 to March 2016. It aims to assess the nutritional value and contamination levels of current OSR

meal varieties and products. Led by SRUC, with scientific partners NIAB and University of Nottingham, its cost is £324,312, funded by HGCA.

HGCA project 3805, Development of an accurate means to predict the nutritive value of wheat for broilers and an investigation of the effect of harvest moisture content of wheat on broiler performance, runs from April 2013 to March 2015. It aims to develop a validated NIRS tool to predict the nutritive value and mycotoxin and microdochium levels of wheat, investigate the effects of moisture content at harvest and drying conditions of wheat on broiler performance, and investigate the effect of fusarium mycotoxin and microdochium level on broiler performance. Led by AFBI, with partner Harper Adams University, its cost is £353,000, with £123,000 funded by HGCA. Industry partners are Moy Park, Aunir and AB Vista.