

Filling up on ethanol byproducts

By Don Comis and Ann Perry, Agricultural Research Service USDA

Ethanol production in the US has profoundly changed the scene in corn and livestock country. The high cost of field corn, and its diversion from livestock feed to ethanol production, have created the need to substitute ethanol production coproducts for some corn feed.

Distiller's grains are the residual material from converting grain, such as corn or sorghum, into ethanol. Distiller's grains are either wet (WDG) or dried (DDG). Adding back liquid solubles to distiller's grains makes a coproduct known as "wet distiller's grains with solubles" (WDGS). If dried, that mixture is known as "dried distiller's grains with solubles" (DDGS). There are more than 20 forms of these coproducts, most of which are suitable as feed supplements for cattle, pigs, and poultry.

ARS scientists across the country are testing the coproducts of ethanol and biodiesel production on hundreds of livestock, including beef cattle, dairy cows, pigs, poultry, and fish. They want to see whether and how distiller's grains fit into

feed rations. They're testing the effects on every aspect of raising animals.

Blending distiller's grains into feed could lower costs for livestock producers and provide a market for recycling these ethanol coproducts, which are growing in supply as more and more ethanol is produced.

In the US Midwest alone, ethanol producers generate 10 million tonnes of DDG annually.

Recycling distiller's grains is good for distillers, grain farmers, livestock producers, and the environment. It lowers the costs of ethanol production and helps offset some of the losses of field corn diverted to make ethanol.

The goal is to recycle distiller's grains into as many products as possible, not only nutritious and low-cost livestock and aquaculture feed, but also human food supplements and nutraceuticals as well as nonfood products.

Andy Cole, an animal scientist at the ARS Renewable Energy and Manure

...22▷



Research leader Brian Kerr evaluates piglets' ability to use nutrients in corn coproducts for growth and development. After four weeks of a diet supplemented with dried distiller's grains with solubles (DDGS), the immune response of piglets increased. (Photo: Peggy Greb)

Kotzur Silos

Shaping the future in grain storage and handling

Order before 30 June 2009 to benefit from the recently announced Federal Government Temporary Investment Allowance

Top Quality Storage at Competitive Prices

- Silo range includes transportable and built on site silos from 19 to 4,700 cubic metres.
- Sealed gas tight (guaranteed) for the most cost effective pest control.
- Elevated and on ground storage silos for all farm, industrial and commercial storage.
- Specialists in aeration and drying.
- Sole Australian distributor of the ADC Aeration Manager.
- Celebrating over 50 years of agricultural engineering since established in 1953.
- Australian owned, Australian designed, and Australian made.



"KOTZUR"

Modern Engineering & Construction Co P/L (ABN 16 079 134 802)

60 Commercial Street, Walla Walla. NSW 2659

P: (02) 6029 4700 Fax: (02) 6029 2307 E: mec@kotzur.com Visit us on-line at www.kotzur.com

Management Research Unit in Bushland, Texas, says as new ethanol plants of various sizes open and existing plants change their processing techniques, this affects the type of coproducts produced.

"We've found that coproducts change from plant to plant and within plants," Andy says.

Barley and sorghum

The researchers are also testing barley and sorghum, which could be used for bio-fuel production. Use of these and other alternative grain crops to produce ethanol is just one of many factors that make ethanol and byproducts research so dynamic.

Andy explains that distiller's grains are likely to come from sorghum and corn in the US Southern Plains. "This is one of the differences between Southern Plains and Northern Plains states," Andy says.

"There are more ethanol plants in the Northern Plains, and they have a head start on us. But we have larger feedlots in the south, so management techniques are different here. Also, we feed our cattle steam-flaked corn rather than dry-rolled corn, which is common in the Northern Plains. Steam-flaked corn has more net energy than dry-rolled corn, so adding distiller's grains tends to lower the feed-energy value of steam-flaked-corn-based diets. But with dry-rolled-corn-based diets, distiller's grains probably add to the feed-energy value."

With research cooperators Andy is testing WDGS from sorghum and corn and from blends of both. They're combining sorghum-based distiller's grains with steam-flaked corn in beef cattle finishing diets. They have also done some preliminary experiments at a large commercial dairy to study the feeding value of WDGS for lactating dairy cows.

Andy and his colleagues have tentatively found that WDGS are best used at 10 to 20 per cent of the diet for beef cattle that are fed steam-flaked corn-based diets in the Southern Plains.

They are currently studying safety concerns, such as too much dietary sulfur, which can be fatal to cattle.

DDGS fuel pig growth and health

Tom Weber, an ARS physiologist at the Swine Odor and Manure Management Research Unit in Ames, Iowa, says that rising feed costs and increasing use of corn for biofuel production have pushed pig producers to find new feed supplements for younger pigs.

"Producers had already started using DDGS for older pigs, based on ARS studies of the benefits of supplementing pig feed with high-fibre byproducts such as DDGS. Now we're looking at piglets."

That is why Tom, research leader Brian Kerr, and ARS microbiologist Cherie Ziemer studied the effects of feeding fibrous coproducts to young pigs. The team divided weanling pigs into four groups and fed them either a standard control diet or a diet supplemented with DDGS, soybean hulls, or citrus pulp.

After four weeks, the researchers found that DDGS increased the immune response of piglets, possibly making them more resistant to illness.

"Our study shows that we can feed DDGS successfully to young pigs without altering their growth. And it's clear that these DDGS may result in improved health," Tom says.

Over the past few years, Brian, Tom, and Cherie have conducted about a dozen studies with a herd at Iowa State University. Brian Kerr is now studying energy and amino acid availability in 13 different coproducts of the corn-milling industry.

Tom agrees with Andy about the ever-

changing nature of ethanol coproduct research: "It's quite dynamic. As the processes change, you keep getting different forms of DDGS and other coproducts," Tom says. "We have no lack of coproducts to study."

Tom found that, for adult pigs, they can use up to 40 per cent DDGS mixed with corn and soy-meal feed. For piglets, they use 7.5 per cent, because the piglets tend to grow less with too much fibre.

Cattle feed and human food

Kurt Rosentrater, an agricultural and bioprocess engineer with the ARS North Central Agricultural Research Laboratory at Brookings, South Dakota. His research program is investigating methods of using DDGS as ingredients in cattle feed and human food and as fillers in biodegradable plastics.

He is also examining the role of manufacturing conditions on the products' chemical and physical properties and how these relate to storability and material-handling characteristics.

For example, Kurt sampled distiller's grains coproducts at commercial ethanol plants in South Dakota. He found that they had nearly 30 per cent protein and between 30 and 40 per cent fibre, making them suitable as feed not only for livestock, but also for aquatic animals and pets.

To reach scientists mentioned in this article, contact Don Comis, USDA-ARS Information Staff, Beltsville, Maryland Ph: +1 (301) 504-1625; Fax: +1 (301) 504-1486.

OTHER DDG USES

Human food supplements and nutraceuticals

Phytosterols, lecithin, as well as carotenoid antioxidants, such as lycopene, are some of the ingredients that could be mass produced from distiller's grains and sold as human food supplements.

ARS scientists are also searching many barley types for healthy ingredients that can be gleaned from distiller's grains.

Better fish feed

Barley DDGS with improved nutritional value can be used as a new feed for rainbow trout.

Adding lysine allowed tilapia fish to thrive on feed with 40 per cent DDGS or more. Catfish fed DDGS-containing diets showed more resistance to enteric septicemia, a major fish disease.

Mulch

Distiller's grains can make a mulch that is both an organic fertiliser and a weed-inhibitor.



Animal scientist Andy Cole examines cattle feed containing wet distiller's grains.
(Photo: Peggy Greb)