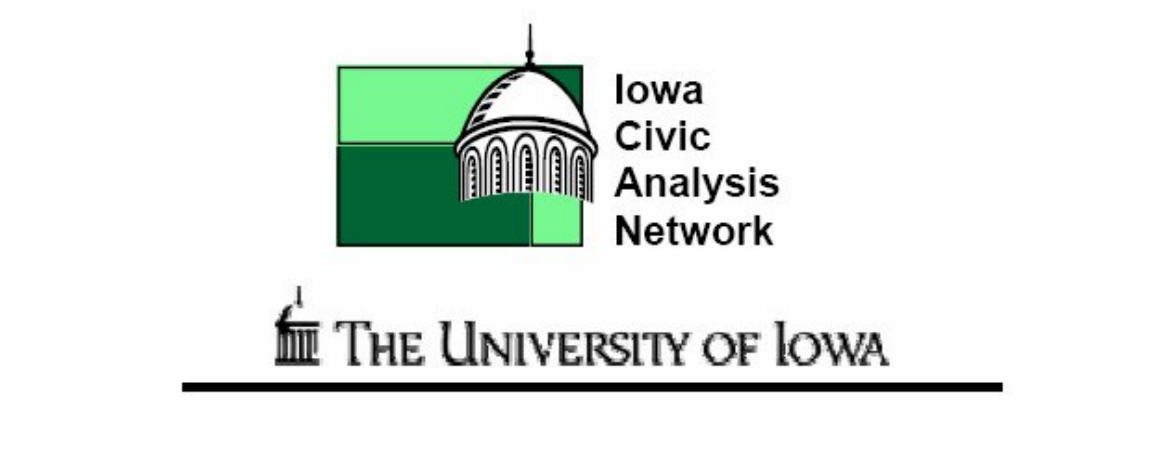

Distillers Dried Grains with Solubles

This I-CAN report provides an overview of Distillers Dried Grains with Solubles (DDGS) and discusses the use of DDGS in feeding livestock, including the nutritional value and economic benefits for different animals.

Overview

Distillers Dried Grains with Solubles (DDGS) is a by-product of the distillery process. Approximately 98% of all DDGS is produced by ethanol fuel plants, with the remaining 2% a product of alcoholic beverage production. Between 3.2 and 3.5 million tons of DDGS are produced each year in the U.S. and Canada, and this number is expected to double in a few years. Some of the DDGS produced in the U.S. and Canada is exported to Mexico and Europe, but over 75% is used as livestock feed in Canada and the U.S. [1] Over 85 % of the DDGS used in Canada and the U.S. is used in diets of ruminants (animals that digest their food in two steps, such as cattle and sheep). Only 1% of the total production of DDGS per year is currently fed to swine.[1]

Production

In ethanol production, one bushel of corn produces approximately 18 pounds of DDGS. Corn ethanol production begins by grinding the corn into flour and adding enzymes and water. The starch of the corn becomes sugar and the resulting substance, called mash, is cooked and sterilized. Yeast is then added and fermentation takes place, after which the ethanol is removed through distillation.[2] The remaining residues are then dried. The

[1] "DDGS Overview." University of Minnesota Department of Animal Science. http://www.ddgs.umn.edu/overview.htm.
[2] "NCGA – Ethanol." National Corn Growers Association. http://www.ncga.com/ethanol/co_products/definition_production.htm.

evaporation process produces condensed distiller's solubles, and the remaining solids are known as the distiller's grains fraction. These two residues are then dried, resulting in distiller's dried solubles and distiller's dried grains, respectively. These two products are blended by the ethanol plant to produce DDGS. DDGS is the only way ethanol by-products are sold to the feed industry. [1]

Economic Value

DDGS is a replacement for corn in animal feeds. However each DDGS formula needs a certain amount of corn (depending on how much DDGS is used). The following is a table showing the value per ton of using a DDGS mix compared to a corn-only mix.[3] Each column shows the amount (lbs.) of ingredients used in each mix. The DDGS Formula is broken up into 3 sub-categories, each having different amounts of DDGS (10, 20 and 30% of mix)

		DDGS Formula		
Ingredient	**Corn Formula**	**10% DDGS**	**20% DDGS**	**30% DDGS**
Corn, lb.	1,463	1,301	1,201	1,101
DDGS, lb.	0	200	400	600
Other ingredients, lb. (constants)**	537	499	399	299
TOTAL, lb. (2,000 lbs.= 1 ton)	2,000	2,000	2,000	2,000
Total Cost, $/ton	109.8	105.3	106.8	108.9
Difference $/ton	-	-4.5	-3	-0.9
Feed Ingredient Prices Used:		Corn: $2.00/bu	DDGS: $85.60/ton	

**Constant ingredients used: SBM 44%, Dicalcium phosphate, limestone, salt, L-lysine HCl, VTM premix

DDGS and Livestock Diets

The Iowa Corn Growers Association (ICGA) has recently compiled research on the dietary benefits of DDGS. Overall, DDGS has more energy per pound than corn. It replaces the starch in corn with fat and fiber, resulting in fewer upset stomachs for livestock.[4] DDGS typically contain 28-30% crude protein, 9-10% oil, 9% fiber, 0.7-0.9% phosphorus, 0.4-0.5% potassium and less than 0.15% calcium. DDGS has different

[3] Shurson, Jerry. "Evaluating Distiller's Dried Grains with Solubles." National Hog Farmer. http://nationalhogfarmer.com/mag/farming_evaluating_distillers_dried/

[4] Schingoethe, David. "Feeding Recommendations – Dairy." Iowa Corn Growers Association. http://www.iowacorn.org/ethanol/ethanol_13.html.

effects on different types of livestock.[5] The following is an overview of the current research findings for different livestock.

Finishing Beef Cattle
Finishing beef cattle are cattle raised for meat consumption. Research compiled by the ICGA shows that cattle seem to enjoy eating DDGS. There is no decrease in the value of the carcass if the cattle's diet consists of 10-20% DDGS.

Dairy Cattle
DDGS is an excellent source of energy and protein for dairy diets. Dairy cows fed DDGS are at least as productive (and sometimes more productive) as dairy cows fed diets of soybean meal. It is recommended that DDGS constitutes a maximum of 20% of a dairy cow's dry diet. If DDGS is more than 20% of the dry diet, it may lead to a decrease in milk production and excess protein and phosphorus.[4]

Dairy Beef (Holstein Steer)
For Holstein steers ranging from 425 to 700 pounds, DDGS can be up to 40% of the dry diet without negatively impacting weight gain, feed intake or carcass value. At $2.25/bu of corn and $85/ton of DDGS, feed cost of weight gain can decline as much as 6% using DDGS. As long as DDGS is under $100/ton, feeding DDGS to growing and finishing Holsteins can increase profits.

Poultry
Used as a limited supplement, DDGS can contribute useful amounts of protein, energy, amino acids and phosphorus to poultry diets. DDGS should, at the most, make up 10% of the diet for broilers (chickens raised for meat) and turkeys and 15% of the diet for chicken layers (chickens raised for eggs).[6]

Sheep
DDGS is acceptable for sheep diets because of the low levels of copper. DDGS should be a maximum of 10 % of the diet for lamb. Higher levels of DDGS can be more economical but may reduce the overall food consumption and value of the lamb. For ewe (female sheep) diets, DDGS is a better complement with low quality roughages than with alfalfa hay.[7]

Swine
DDGS should be at a maximum of 15% for nursery pigs, 20% for grow-finish pigs (pigs raised for meat), 10% for lactating pigs and 50% for gestating pigs (pigs that serve to give birth). High levels of DDGS in the diet can increase the litter size for sows when compared with corn and soybean meal diets. The addition of DDGS also may reduce

---

[5] Trenkle, Allen. "The Nutritional Value of Coproducts from Dry Mill Ethanol Plants." Iowa Corn Growers Association. http://www.iowacorn.org/forms/Coproducts_paper.pdf.
[6] Noll, Sally. "Feeding Recommendations – Poultry." Iowa Corn Growers Association. http://www.iowacorn.org/ethanol/ethanol_13.html.
[7] Morrical, Dan. "Feeding Recommendations – Sheep." Iowa Corn Growers Association. http://www.iowacorn.org/ethanol/ethanol_13.html.

stomach illness for swine. This is due to DDGS's relatively high available phosphorus content (0.66%) compared to other grains and grain co-products. This high available phosphorus level enables nutritionists to use less supplemental inorganic phosphate (e.g. dicalcium phosphate) to reduce diet cost while meeting the pigs' phosphorus needs. Pigs digest the level of phosphorus in DDGS better than the level of phosphorus in corn and soybean meal, resulting in less phosphorus supplementation and a reduction of phosphorus levels in manure. Swine manure levels of ammonia, hydrogen sulfide and odor emissions are no different with a diet of DDGS than with a normal corn and soybean meal diet.[8]

Summary

Overall, a diet including DDGS is cheaper for the farmer than standard livestock diets, such as corn and/or soybean meal. This does not mean that DDGS should be used as a direct substitute for a standard diet. Levels higher than recommended for different livestock may have adverse affects, such as decrease in overall consumption, decrease in value, excess protein and phosphorus, and a decrease in dairy milk production. When used at proper amounts, however, livestock can benefit from a diet containing DDGS because of the increase in energy and fewer upset stomachs. The following table summarizes the maximum levels of DDGS recommended for different livestock.

Livestock	**Maximum amount of DDGS**
Beef cattle	10-20%
Dairy cattle	20%
Holstein steer	40%
Poultry	
Broilers, turkeys	10%
Chicken layers	15%
Sheep	10%
Swine	
Nursery pigs	15%
Grow-finish pigs	20%
Lactating pigs	10%
Gestating pigs	50%

This report was prepared in September, 2007 by the Iowa Civic Analysis Network (I-CAN), a non-partisan public policy undergraduate research group at the University of Iowa. For additional research on this or other issues, please visit our website at http://www.uiowa.edu/~ican or contact us at studorg-i-can@uiowa.edu.

[8] Shurson, Jerry. "Feeding Recommendations – Swine." Iowa Corn Growers Association. http://www.iowacorn.org/ethanol/ethanol_13.html.