Quality and Nutritional Characteristics of Distiller's Dried Grains with Solubles (DDGS)

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What is DDGS?

- By-product of the dry-milling ethanol industry
- Nutrient composition is different between dry-mill, wet-mill and beverage alcohol by-products
 - DDGS fuel ethanol
 - DDGS whiskey distilleries
 - □ Corn gluten feed wet mill
 - □ Corn gluten meal wet mill
 - □ Brewer's dried grains beer manufacturing
- Nutrient content depends on the grain source used
 - Corn (maize) DDGS Midwestern US
 - Wheat DDGS Canada
 - Sorghum (milo) DDGS Great Plains US
 - Barley DDGS

Comparison of Nutrient Composition (Dry Matter Basis) of "New Generation" DDGS to Corn Gluten Feed, Corn Gluten Meal, Corn Germ Meal, and Brewer's Dried Grains

	"New Generation" Corn DDGS	Corn Gluten Feed (NRC)	Corn Gluten Meal (NRC)	Corn Germ Meal (Feedstuffs)	Brewer's Dried Grains (NRC)
Protein, %	30.6	23.9	66.9	22.2	28.8
Fat, %	10.7	3.3	3.2	1.1	7.9
NDF, %	43.6	37.0	9.7	No data	52.9
DE, kcal/kg	4011	3322	4694	No data	2283
ME, kcal/kg	3827	2894	4256	3222	2130
Lys, %	0.83	0.70	1.13	1.00	1.17
Met, %	0.55	0.39	1.59	0.67	0.49
Thr, %	1.13	0.82	2.31	1.22	1.03
Trp, %	0.24	0.08	0.34	0.22	0.28
Ca, %	0.06	0.24	0.06	0.33	0.35
Available P, %	0.80	0.54	0.08	0.17	0.21



Dry-Milling Average Ethanol Yield Per Bushel (25.4 kg) of Corn



Ethanol	10.2 liters
DDGS	8.2 kg
■ CO ₂	8.2 kg

Ethanol Plants in North America - June 16, 2004



U.S. DDGS Production



Source: Steve Markham – Commodity Specialists Company

U.S. DDGS Consumption

Estimate 2001

Estimate 2002





Current and Potential DDGS Export Markets

Current

- 1. Ireland
- 2. Denmark
- 3. United Kingdom
- 4. Spain
- 5. Portugal
- 6. Columbia
- 7. Mexico
- 8. Canada
- 9. Germany
- 10. Costa Rica

Potential

- 1. China
- 2. Brazil
- 3. Philippines
- 4. Japan
- 5. Thailand
- 6. Republic of Korea
- 7. Taiwan
- 8. Vietnam
- 9. Malaysia
- 10. Indonesia

What Are the Challenges?

- 1. DDGS "new" feed ingredient for many customers
 - education and technical service is needed
 (www.ddgs.umn.edu)

2. Inconsistent quality

- nutrient content
- color
- particle size
- 3. No grading system to differentiate quality and price
- 4. **Misrepresenting** quality and nutrient specifications and **blending DDGS** with other ingredients

DDGS Varies Nutrient Content and Digestibility, Color, and Particle Size Among U.S. Sources



Comparison of Nutrient Composition (Dry Matter Basis) of "New Generation" DDGS to Other "DDGS Sources"

	"New Generation" Corn DDGS	Solulac	Badger State Ethanol	ADM - Peoria	Extruded DDGS/Soy (XDS Plus)	AGP Pelleted
Protein, %	31.82	29.32	31.62	30.12	34.44	27.0
Fat, %	11.32	3.52	15.25	8.96	13.33	9.00
Crude fiber, %	6.25	7.90	No data	7.77	7.78	15.10
ADF, %	12.37	11.80	17.91	20.95	14.44	No data
Ash, %	6.93	5.29	4.58	7.30	5.56	4.28
DE, kcal/kg*	4053	3808	No data	3796	No data	No data
ME, kcal/kg*	3781	3577	No data	3560	3749	No data
Lys, %	0.92	0.61	0.90	0.83	1.67	No data
Met, %	0.62	0.54	0.54	0.66	0.61	No data
Thr, %	1.17	1.01	1.04	1.13	2.50	No data
Trp, %	0.25	0.18	0.23	0.25	0.39	No data
Ca, %	0.07	0.12	0.06	0.51	0.22	0.17
P, %	0.77	0.78	0.89	0.68	0.72	0.62

*Calculated energy values for swine

Potential Categories of Distiller's By-Products



Most of the Newer Ethanol Plants in the Midwestern U.S. Produce High Quality, Relatively Consistent Golden Corn DDGS



VeraSun - Aurora, SD CVEC - Benson, MN Al-Corn - Claremont, MN MGP – Lakota, IA



CMEC - Little Falls, MN Agri-Energy - Luverne, MN LSCP

LSCP - Marcus, IA

DENCO – Morris, MN



What Are the Challenges?

5. System to directly **connect customers to suppliers**

Nutrient profile section of www.ddgs.umn.edu

- 6. Flowability
- Relatively low bulk density high freight costs

"Old Generation" vs. "New Generation" DDGS



Corn DDGS Color and Smell are Indicators of Digestibility for Monogastrics

Color varies among sources

- □ ranges from dark to golden (Cromwell et al., 1993)
- golden color of corn DDGS is correlated with higher amino acid digestibility in swine and poultry

Smell varies among sources

- ranges from burnt or smoky to sweet and fermented (Cromwell et al., 1993)
- golden DDGS has a sweet, fermented smell
- □ smell may affect palatability





The Use of DDGS in Swine Diets



Maximum Inclusion Rates of "New Generation" DDGS in Swine Diets (Based Upon University of Minnesota Performance Trials)

- Nursery pigs (> 7 kg)
 Up to 25 %
- Grow-finish pigs
 Up to 20% (higher levels may reduce pork fat quality)
- Gestating sows
 - □ Up to 50%
- Lactating sows
 - □ Up to 20%

Assumptions: no mycotoxins

formulate on a digestible amino acid and available phosphorus basis

The Use of DDGS in Poultry Diets



Recommended Inclusion Rates of DDGS for Poultry

Broilers and Turkeys

- □ 5-10% inclusion rates (Starter/Finisher)
 - Without energy adjustments
- □ > 10%
 - With adjustments for lys, met, thr, trp, and energy
- Chicken Egg Layers
 10% inclusion rate

The Use of DDGS in Dairy Rations



Recommended Feeding Levels of DDGS for Dairy Cows and Replacements

Lactating dairy cows

 Up to 30% DMI under normal feeding conditions
 > 30% DMI if BST is used

 Calves

 Up to 20 % DMI

 Replacement heifers

 Up to 25% DMI



Recommended Feeding Levels of DDGS for Beef Cattle

Creep feeding
Up to 20%

Feedlot cattle

□ Up to 40 % DMI

Receiving/starting cattle

□ Up to 20%

Brood cows

□ Up to 35% of supplement

U of M DDGS Web Site www.ddgs.umn.edu

We have developed a DDGS web site featuring: * nutrient profiles and sample photos of DDGS sources

- * research summaries
 - swine, poultry, dairy, & beef
 - DDGS quality
- * presentations given
- * links to other DDGS related web sites
- * international audiences