

The Value of "New Generation" DDGS in Swine and Layer Diets

Dr. Jerry Shurson
Dept. of Animal Science
University of Minnesota

What is DDGS?

- By-product of the **DRY-MILLING** ethanol industry
 - Corn (maize) DDGS - Midwestern US
 - Wheat DDGS - Canada
 - Sorghum (milo) DDGS - Great Plains US
 - Barley DDGS
 - Rye DDGS
- DDGS is nutritionally **DIFFERENT** than other grain by-products from the beverage or wet-milling industry

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" DDGS (UM)	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 Yield Per Bushel of Corn



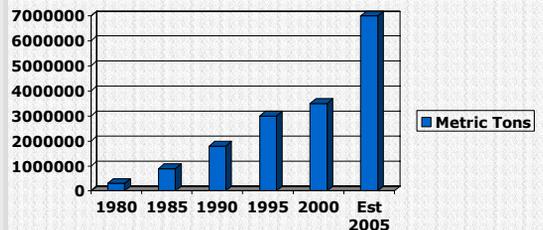
- Ethanol 2.7 gallons
- DDGS 18 lbs
- CO₂ 18 lbs

Slide courtesy of Ms. Kelly Davis, CVEC

Most Fuel Ethanol Production is in the Western U.S. "Corn Belt"

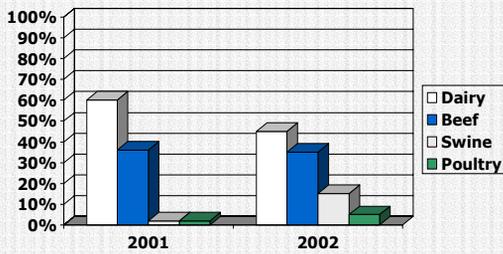


North American DDGS Production



Source: Commodity Specialists Company

Estimated North American DDGS Consumption in 2001 & 2002



Source: Commodity Specialists Company

"New Generation" vs. "Old Generation" DDGS



Comparison of Energy Values of DDGS for Swine (88% DM Basis)

	"New" DDGS Calculated	"New" DDGS Trial avg.	"Old" DDGS Calculated	DDGS NRC (1998)
DE, kcal/kg	3488 Range 3418-3537	3528 Range 2975-4086	3409	3449
ME, kcal/kg	3162 Range 3087-3215	3367 Range 2820-3916	3098	2672

Corn (NRC, 1998): DE (kcal/kg) = 3484
ME (kcal/kg) = 3382

Comparison of Amino Acid Composition of DDGS (88% dry matter basis)

	"New" DDGS	"Old" DDGS	DDGS (NRC, 1998)
Lysine, %	0.75 (17.3)	0.47 (26.5)	0.59
Methionine, %	0.63 (13.6)	0.44 (4.5)	0.48
Threonine, %	0.99 (6.4)	0.86 (7.3)	0.89
Tryptophan, %	0.22 (6.7)	0.17 (19.8)	0.24
Valine, %	1.32 (7.2)	1.22 (2.3)	1.23
Arginine, %	1.06 (9.1)	0.81 (18.7)	1.07
Histidine, %	0.67 (7.8)	0.54 (15.2)	0.65
Leucine, %	3.12 (6.4)	2.61 (12.4)	2.43
Isoleucine, %	0.99 (8.7)	0.88 (9.1)	0.98
Phenylalanine, %	1.29 (6.6)	1.12 (8.1)	1.27

Values in () are CV's among plants

Comparison of Apparent Ileal Digestible Amino Acid Composition of DDGS for Swine (88% dry matter basis)

	"New" DDGS	"Old" DDGS	DDGS (NRC, 1998)
Lysine, %	0.39	0.00	0.27
Methionine, %	0.28	0.21	0.34
Threonine, %	0.55	0.32	0.49
Tryptophan, %	0.13	0.13	0.12
Valine, %	0.81	0.45	0.77
Arginine, %	0.79	0.53	0.77
Histidine, %	0.45	0.26	0.40
Leucine, %	2.26	1.62	1.85
Isoleucine, %	0.63	0.37	0.64
Phenylalanine, %	0.78	0.60	0.96

Comparison of Phosphorus Level and Relative Availability of DDGS for Swine (88% dry matter basis)

	"New" DDGS	"Old" DDGS	DDGS NRC (1998)	Corn NRC (1998)
Total P, %	0.78 Range 0.62-0.87	0.79	0.73	0.25
P Availability, %	90 Range 88-92	No data	77	14
Available P, %	0.70	No data	0.56	0.03

Why is there so much interest in feeding DDGS to swine?

- “New Generation” DDGS is high in digestible nutrients
- Economical partial replacement for:
 - corn
 - soybean meal
 - dicalcium phosphate
- Increasing production and supply
- Unique properties
 - reduce P excretion in manure
 - increase litter size weaned/sow
 - gut health benefits?

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

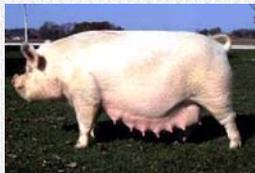
DDGS and Phytase are a Key Part of Manure Phosphorus Management

- Adding 20% DDGS to a corn-soy diet and formulating on an available P basis
 - can reduce manure P by > 12%
- Adding phytase to a corn-soy diet
 - increases P bioavailability from 15% to > 45%
- Lowering dietary P, adding 20% DDGS & phytase
 - can reduce manure P excretion by 40 to 50%

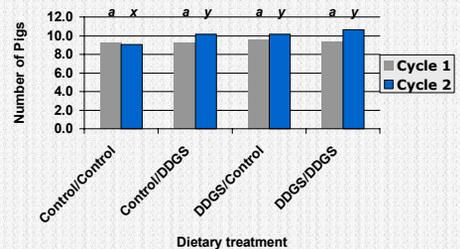
Diet Composition When 18.8% DDGS and Phytase are Added to the Diet

Ingredient	Corn-SBM-1.5 kg Lysine	18.8% DDGS + Phytase
Corn, kg	798.3	636.3
Soybean meal 44%, kg	176.9	159.4
DDGS, kg	0.0	188
Dicalcium phosphate, kg	11.6	0.0
Limestone, kg	7.2	9.8
Salt, kg	3.0	3.0
L-lysine HCl, kg	1.5	1.5
VTM premix, kg	1.5	1.5
Phytase, 500 FTU/kg	0.0	0.5
TOTAL, kg	1000.0	1000.0

Feeding “New Generation” DDGS to Sows

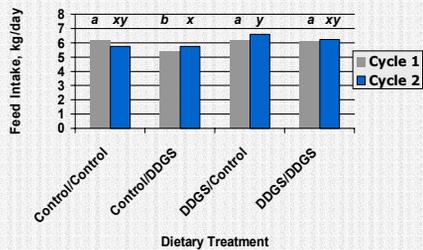


Effect of Feeding 0 or 50% DDGS Gestation Diets and 0 or 20% DDGS Lactation Diets on Pigs Weaned/Litter



*** Different superscripts indicate significant difference (P < .10).

Effect of Dietary Treatment Combination on Sow Lactation ADFI



^,^,^,^ Different superscripts indicate significant difference ($P < .10$).

Does Feeding DDGS Improve Gut Health?

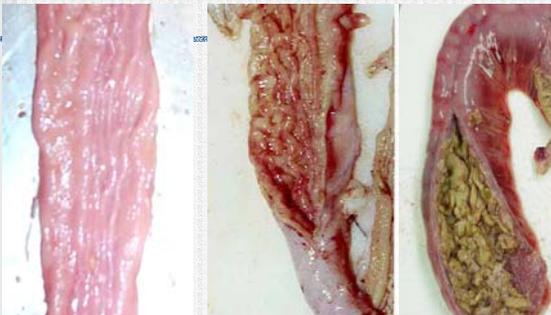
What is Ileitis?

- Porcine Proliferative Enteropathy
- Caused by *Lawsonia intracellularis*
 - Present in 96% of U.S. swine herds (Bane et al., 1997)
 - 28% of pigs affected (NAHMS, 2000)
 - Can be shed in infected pigs for up to 10 weeks
- Animals are infected by oral contact with feces from animals shedding the bacteria
- 7-10 days after infection:
 - Lesions of the intestinal wall begin to form
 - Lesions maximized around 21 days post-infection

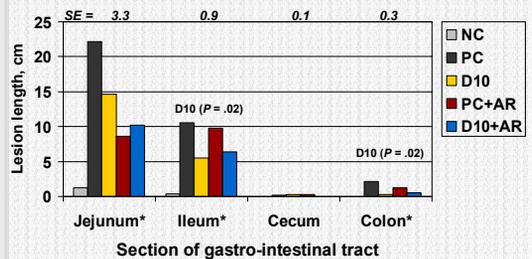


Healthy

Ileitis

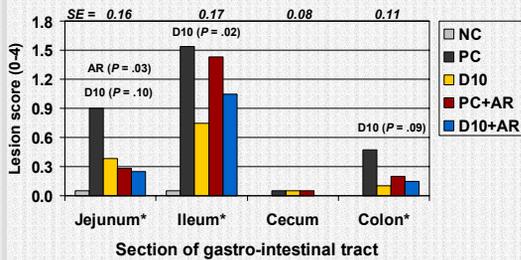


Effect of Dietary Treatment on Lesion Length (21 d Post-Challenge) Experiment 2



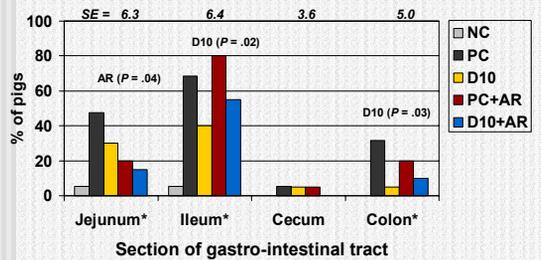
* Effect of disease challenge ($P < .01$).

Effect of Dietary Treatment on Lesion Severity (21 d Post-Challenge) Experiment 2



* Effect of disease challenge ($P < .01$).

Effect of Dietary Treatment on Lesion Prevalence (21 d Post-Challenge) Experiment 2



* Effect of disease challenge ($P < .01$).

Quick Calculation of DDGS Value in Swine Diets

Thumb rule:

Additions/2000 lbs diet

+ 200 lbs DDGS x _____ \$/lb = \$ _____
 + 3 lbs limestone x _____ \$/lb = \$ _____
 TOTAL ADDITIONS (A) \$ _____

Subtractions/2000 lbs diet

- 177 lbs corn x _____ \$/lb = \$ _____
 - 20 lbs SBM (44%) x _____ \$/lb = \$ _____
 - 6 lbs dical. phos. x _____ \$/lb = \$ _____
 TOTAL SUBTRACTIONS (S) \$ _____

(S - A) = Feed cost savings/ton by adding 10% DDGS to the diet

Feeding "New Generation" to Laying Hens



Comparison of Energy Values of DDGS for Poultry (88% DM Basis)

	"New Generation" DDGS	NRC (1994)
AME, kcal/kg	2260 Range 2090-2418	2480
TME, kcal/kg	2850 Range 2650 - 3082	3097

Source: Noll and Parsons. 2003. Unpublished data.

True Digestible Amino Acid Levels of Corn DDGS for Poultry (5 Sources)

Amino acid	True Dig. Amino Acid, %	Average	Digestibility Coefficient, %	Average
Methionine	0.35 - 0.53	0.43	86 - 90	88
Cystine	0.28 - 0.57	0.40	66 - 85	76
Lysine	0.37 - 0.74	0.53	59 - 83	71
Arginine	0.73 - 1.18	0.93	80 - 90	86
Tryptophan	0.14 - 0.21	0.18	76 - 87	82
Threonine	0.61 - 0.92	0.74	67 - 81	75

Source: Noll and Parsons. 2003. Unpublished data.

Comparison of Phosphorus Level and Relative Availability of DDGS for Poultry (88% dry matter basis)

	"New Generation" DDGS	NRC (1994)
Total P, %	0.74	0.72
P Availability, %	61 Range 54 - 68	54
Available P, %	0.45	0.39

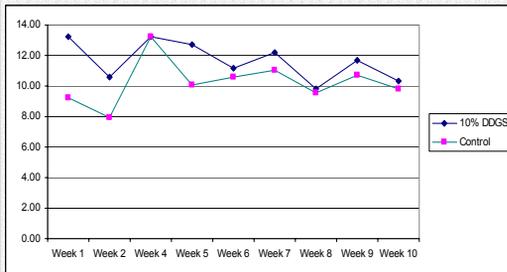
Source: 2003 Lumpkins, Dale, and Batal, University of Georgia. Abstract.

Results from Recent Layer "New Generation" DDGS Trials - University of Georgia

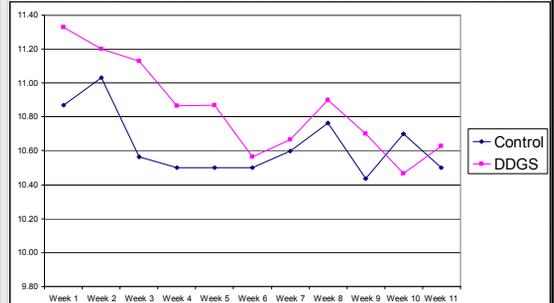
- Laying hens (21 to 43 weeks of age) fed diets containing:
 - 0% DDGS – 2800 kcal ME/kg
 - 15% DDGS – 2800 kcal ME/kg
 - 0% DDGS – 2870 kcal ME/kg
 - 15% DDGS – 2870 kcal ME/kg
- No differences in egg production except when low energy, 15% DDGS diet was fed (reduction)
- No differences in egg weight, specific gravity, Haugh units, yolk color, or shell breaking strength

Source: Lumpkins, Batal, and Dale. 2003.

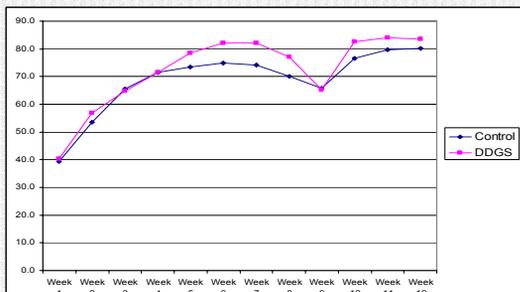
Xanthophyll Content of Control and DDGS Diets During a 12-Wk Layer Trial - Jalisco Mexico



Differences in Yolk Color (Roche Units) in Eggs Produced by Layers Fed Control and DDGS Diets – Jalisco Mexico



Average Percentage of Production by Week for Layers Fed Control and DDGS Diets – Jalisco Mexico



Recommended Inclusion Rates of DDGS for Poultry

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

U of M DDGS Web Site

www.ddgs.umn.edu

We have developed a DDGS web site featuring:

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