

Use of "New Generation" Corn DDGS in Feeds for Swine, Poultry, and Aquaculture

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Overview – Part 3

- Feeding value and considerations of feeding DDGS to poultry
- Energy, digestible amino acids, and available phosphorus values of "new generation" DDGS for poultry
- Effect of DDGS color on amino acid digestibility and broiler growth performance
- University and field trial results from feeding "new generation" DDGS to laying hens
- University and field trial results from feeding "new generation" DDGS to broilers
- Maximum recommended dietary inclusion rates for "new generation" DDGS
- Use of DDGS in aquaculture

Use of Corn DDGS in Poultry Diets



Historical Use of DDGS in Poultry Diets in the U.S.

- Fed at low inclusion rates in U.S. poultry industry for many years
 - High B vitamin content (solubles)
 - Source of unidentified growth/reproduction factors?
 - Positive effect on palatability
 - Protein source when fed at higher dietary inclusion levels

Unidentified Growth or Hatchability Factors

- Growth response (Couch et al., 1957)
 - 5% DDGS in turkey diets
 - 17-32% improvement in gain
- Feed preference (Alenier & Combs, 1981)
 - 10% DDGS in chicken layer diets
- Reproduction improvement (Manley, 1978)
 - 3% DDGS in turkey breeder hen diets
 - improvement in egg numbers and hatch (late lay)

Use of DDGS in Poultry Diets

- High inclusion rates have also provided good results
 - Favorable results with **25%** DDGS in broiler diets
 - Waldroup et al., 1981
 - **15%** DDGS in layer diets reduces fatty liver incidence
 - Jensen et al., 1974; Jensen, 1987; Akiba et al., 1983
 - **12%** DDGS turkey diets gave similar performance to corn-soybean meal diets
 - Noll, 2002

Nutritional Value of DDGS for Poultry

- Must use high quality DDGS
 - Golden color = high amino acid digestibility
- Excellent energy and available phosphorus source
- Nutritional value higher than previously thought
- Unidentified growth factors?
- Source of xanthophyll
- Effective partial replacement for corn, soybean meal, and dicalcium phosphate

Considerations in Feeding DDGS to Poultry

- Product quality and variability
- Metabolizable energy content
- Amino acid digestibility
- Amino acid balance
- Phosphorus availability
- Diet levels
- Source of xanthophyll
- Cost in relation to other ingredients

DDGS As Protein Supplement

- Limiting amino acids (Parsons et al., 1983)
 - Lysine
 - Tryptophan
 - Arginine (perhaps equally limiting with trp)
- Dietary lysine and energy adjustments are needed with high inclusion rates (>10%) of DDGS
 - growth
 - feed conversion

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.

Amino Acid Content of Corn DDGS (5 Sources)

Amino acid	Range	Average	NRC, 1994
Methionine, %	0.44 – 0.56	0.49	0.60
Cystine, %	0.45 – 0.60	0.52	0.40
Lysine, %	0.64 – 0.83	0.74	0.75
Arginine, %	1.02 – 1.23	1.08	0.98
Tryptophan, %	0.19 – 0.23	0.22	0.19
Threonine, %	0.94 – 1.05	0.98	0.92

Source: Noll and Parsons. 2003. Unpublished data.

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

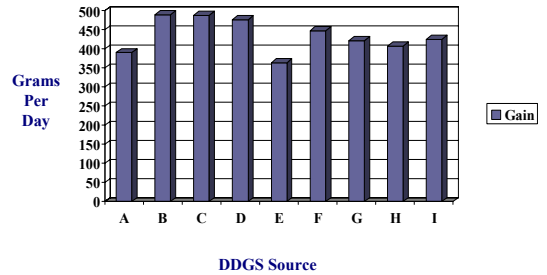
Amino acid	True Dig. Amino Acid, %	Average	Digestibility Coefficient, %	Average
Methionine	0.35 – 0.53	0.43	86 - 90	88
Cystine	0.28 – 0.57	0.40	66 - 85	76
Lysine	0.37 – 0.74	0.53	59 - 83	71
Arginine	0.73 – 1.18	0.93	80 - 90	86
Tryptophan	0.14 – 0.21	0.18	76 - 87	82
Threonine	0.61 – 0.92	0.74	67 - 81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

Source: Noll and Parsons. 2003. Unpublished data.

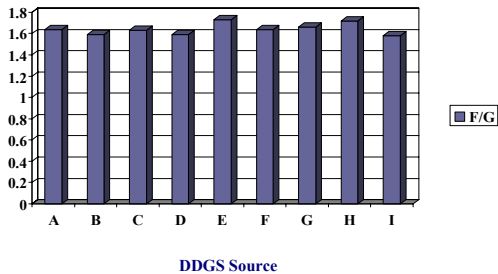
Correlation Between DDGS Color and Amino Acid Digestibility (r^2)

Amino acid	L*	a*	b*
Lysine	.67	NS	.77
Cystine	.67	NS	.74
Threonine	.51	NS	.58

Growth of Chicks Fed Nine Sources of DDGS



Feed Conversion of Chicks Fed Nine Sources of DDGS



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 Trials Feeding "New Generation" DDGS (University of Georgia)

- Hy-line W35 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

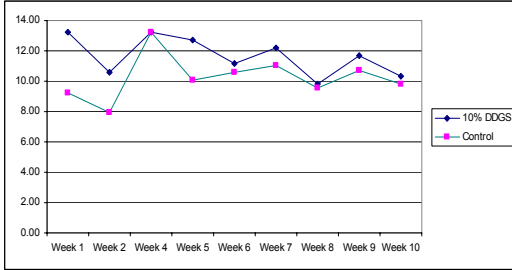
Source: Lumpkins, Batal, and Dale. 2003.

Effect of Dietary DDGS Level and Energy Density of Layer Diets on % Egg Production 22-42 wks

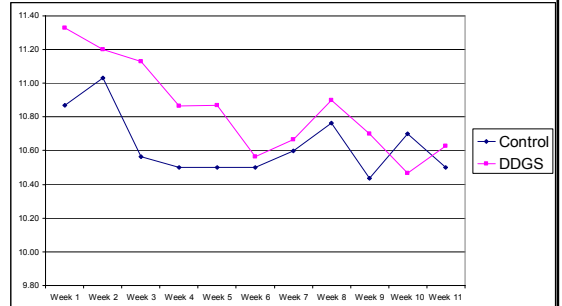
Energy Density	DDGs Level (%)	
	0	15
High (2870 Kcal/kg)	90.2	89.7
Low (2800 Kcal/kg)	89.2	87.6

Source: Lumpkins et al., 2003

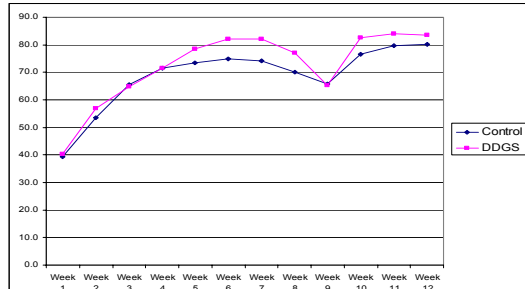
Xanthophyll Content of Control and DDGS Diets During a 12-Wk Layer Trial - Jalisco Mexico



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



Egg Production and Quality When Laying Hens Were Fed Diets Containing 10% DDGS (Jalisco, Mexico Field Trial)

Performance	Control	DDGS	P value
% Egg Production	68.7	72.4	.02
% First Class Eggs	66.2	68.9	.10
Egg Wt./Hen/Wk, kg	.31	.32	.11
% Dirty Eggs	1.4	2.2	.002
Egg Yolk Color	10.6	10.8	.02

Results from Recent Broiler DDGS Trials

- Broiler chicks (0 to 18 days) fed diets containing:
 - 0% DDGS - 3000 kcal ME/kg
 - 15% DDGS - 3000 kcal ME/kg
 - 0% DDGS - 3200 kcal ME/kg
 - 15% DDGS - 3200 kcal ME/kg
- ADG and G/F higher for 3200 kcal ME diets
- No difference in performance between 0% or 15% DDGS within dietary energy level

Source: Lumpkins, Batal, and Dale. 2003.

Results from Recent Broiler DDGS Trials

- Broiler chicks (0 to 42 days) fed isocaloric and isonitrogenous diets containing:
 - 0% DDGS
 - 6% DDGS
 - 12% DDGS
 - 18% DDGS
- No difference in ADG and G/F when 0, 6, or 12% DDGS diets were fed
- ADG was reduced for chicks fed 18% DDGS
- No difference in carcass yields

Source: Lumpkins, Batal, and Dale. 2003.

Effect of Feeding Increasing Levels of DDGs to Broilers on Body Weight and Feed/Gain after a 6-Week Feeding Period

Dietary Level of DDGS	Body Wt. 42d, Kg	Feed/Gain
0	1.47	1.57
6	1.47	1.56
12	1.45	1.57
18	1.43	1.59

Lumpkins et al., 2003

DDGS Broiler Trial – CP Taiwan



Tongshan Farm



Growth Performance of Broilers Fed 0 or 10% DDGS (day 15-39) at CP-Taiwan

Measurement	Control	10% DDGS
Initial Number of Birds	450	450
Final Number of Birds	441	439
% Livability	98.0	97.6
Day 15 Body Wt., g/bird	392	395
Day 28 Body Wt., g/bird	1246	1232
Day 39 Body Wt., g/bird	1988	1981
Day 15-28 ADFI, g/bird	986	978
Day 28-39 ADFI, g/bird	1860	1865
Day 15-39 ADFI, g/bird	2846	2843
Feed/Gain, Day 15-39	1.78	1.79

Recommended Inclusion Rates of DDGS for Poultry

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

DDGS Use in Aquaculture

- Very little research has been conducted on feeding DDGS to fish.
 - University of Kentucky (1992)
 - A diet containing all plant protein sources (DDGS and soybean meal) can completely replace all of the fish meal in catfish diets.
 - D'Abramo (1993)
 - Up to 4% DDGS can be used effectively in freshwater prawn feeds

DDGS Use in Aquaculture

- Hughes Tunison Laboratory of Fish Nutrition (1986)
 - Up to 8% DDGS can be used effectively in lake trout diets.
- Feeding DDGS has no effect on organoleptic properties of meat quality in all of the studies conducted.

Recommendations for DDGS Use in Aquaculture

Species/type	DDGS Inclusion Rate
Catfish	Up to 20%
Trout	Up to 8%
Salmon	Up to 8%
Freshwater prawns	Up to 6%
Shrimp	Up to 5%
Tilapia	Up to 10%

Source: Feed Co-products Handbook

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