

***FEEDING VALUE OF DDGS
FOR
POULTRY***

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Considerations in Feeding DDGS to Poultry

- Product quality and variability
- Amino acid digestibility
- *Feeding recommendations for broilers, layers and market turkeys*
 - *Diet levels*
 - *Amino acid balance*
 - *Metabolizable energy content*
 - *Source of xanthophylls*
 - *Phosphorus availability or digestibility*

DDGs in Broiler Chicken Diets

- Early research prior to 1970's
- Levels of 10% (with adjustment of lysine and energy) supported growing performance
- Levels up to 15% in slower growing birds acceptable

DDGs as a Feed Ingredient for Broilers-Current Studies

- Waldroup et al., 1981
 - DDGs level and dietary energy
- Lumpkins et al., 2004
 - High and low density diets
 - DDGs level
 - Isocaloric and Isonitrogenous

***Performance Response of Broiler Chickens (0-42 days)
to DDGS in Diets Adjusted and Not Adjusted for Energy***

DDGS Inclusion Level (%)	BW (g)		Gain/Feed	
	Fixed Energy	Variable Energy	Fixed Energy	Variable Energy
0	1288	1206	.513	.493
5	1237	1227	.518	.505
10	1237	1203	.508	.490
15	1220	1165	.513	.444*
20	1246	1164	.498	.467
25	1247	1096*	.500	.446*

*** Different from control**

DDGs and Broiler Performance

Diet Density & DDGs Level	Gain 18d G	G:F 18d
High, 0%	556a	782a
High, 15%	555a	772a
Low, 0%	523b	712b
Low, 15%	518b	705b

DDGs and Broilers

Level of DDGs	Gain 42d kg	G:F 0-42 d
0	2.31a	566
6	2.29a	554
12	2.29a	565
18	2.24b	554

DDGs – Broiler Diets (Lumpkins et al., 2004)

- Experiment 1 - 0 and 15% DDGs at two dietary energy levels (3200 and 3000 kcal/kg – no difference in performance to 18 d re. DDGs
- Experiment 2 – 0, 6, 12, & 18%
 - BW to 42 days similar to 12%
 - Slight depression in BW at 18%
 - Lowered wts through 16 da

DDGs in Chicken Broiler Diets

- Adjustment for lysine and energy level
- Inclusion level of 15-25% possible
 - Starter diets 6%
 - Grower/Finisher >10%

DDGs and Layer Performance

- Early research
 - Matterson et al. (1966) – 10 to 20% distillers grains with solubles (DDGS) could be fed to laying hens (1/3 of protein)
 - Harms et al. (1969) – 10% DDGS supported equivalent egg production and weight to corn-soy diet
 - Jensen et al. (1974) – 10% DDGS to wheat-soy diet benefited from supplemental Lys for egg production

DDGs in Chicken Layer Diets

- General conclusions
 - Levels of 10 & 20% comparable production to control
 - Levels greater than 20% - reduced egg weight (research levels of 20, 30, and 44%)
 - Amino acid balance?
 - Some field observations of “dirty” eggs but not in research trials

DDGs and Chicken Layer Diets

- Roberson, 2004
 - Hy-line W36
 - Two 9/10 wk trial
 - Level 0, 5, 10, 15% DDGs
- Lumpkins et al (2003)
 - Hy-line W36
 - 22 wk trial
 - Level and diet energy density
- Field trial – Sanfandila (Shurson, 2003)
 - Babcock 300
 - 12 wk trial
 - 10% Norgold DDGs

Laying Hen Study (Roberson, 2004)

- Inconsistent level effects on:
 - Weekly egg production (1 wk of 9 wks)
 - Specific gravity
 - Exp 1 (1 wk of 4)
 - Exp 2 – no effect
- No effect on egg weight
- Yolk color ($P < .05$) in Exp 1 and 2
 - Darker



Roberson Experiment 2 – Yolk Color (9 wks)

DDGS	L*	a*	b*	Roche
0 %	77.9 ^a	2.70 ^d	88.1	8.63 ^b
5 %	75.9 ^b	4.19 ^c	86.7	8.98 ^a
10 %	76.2 ^b	4.74 ^b	87.5	9.02 ^a
15 %	75.9 ^b	6.11 ^a	87.7	9.22 ^a
SE	0.4	0.19	0.6	0.08
Trt, p<	0.004	<0.001	0.352	0.001
Linear, p<	0.007	<0.001	0.846	<0.001

Summary – Roberson, 2004

- Corn DDGS can be fed as high as 15% in layer diets using 1250 kcal/lb ME for DDGS without affecting egg production or shell quality
- Yolk color darkened quickly with 10+% DDGS and within 2 mo with 5% DDGS compared to corn-SBM diet

DDGS and Layer Performance (Lumpkins, et al. 2003)

- Treatments
 - 0 or 15% DDGs
 - Energy density (2870 vs 2800 kcal/kg)
- Interaction of DDGs level & diet energy
- Low energy & 15% DDGs slight depression in egg production (lower protein?)
- No differences in any other egg characteristics

DDGs and Layer Diets

Egg Production (%) 22-42 wks

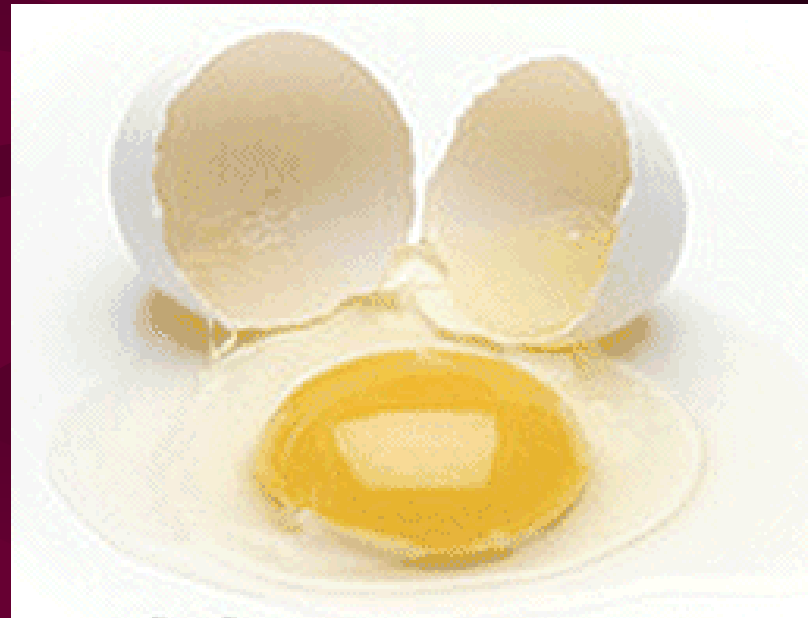
Diet Density	DDGs Level (%)	
	0	15
High	90.2	89.7
Low	89.2	87.6

Sanfandila Field Trial

Performance	Control	Norgold DDGS	P value
EP,%	68.7	72.4	.02
First class EP,%	66.2	68.9	.10
EW/hen/wk, kg	.31	.32	.11
Cull eggs,% of total	2.2	3.5	
Dirty Eggs	1.4	2.2	.002
Yolk color	10.6	10.8	.02

DDGs and Xanthophylls

- Corn 15-25 mg/kg
- Corn Gluten Meal
130-170 mg/kg
- DDGs 15-20 mg/kg
 - SBM replacement in diet



DDGs in Chicken Layer Diets

- Possible source of xanthophyll
- Inclusion level of 15-20%
 - 15% acceptable performance

DDGs in Market Turkey Diets

- Early research prior to 1970's – turkey poults to 8 wks
- Levels of 10% similar or improved growth
- Levels of 20% increased feed/gain



Current Market Turkey Research

- Roberson, 2003
 - Hen turkeys – grow/finish diets
 - Isocaloric; digestible amino acids
- Noll ongoing – 4 experiments
 - Tom turkeys – grow/finish diets (5-19 wks)
 - Formulation - isocaloric; digestible amino acids

DDGs and Turkey Hen Diets

DDGs %	BW 105 da, kg	F/G 75-105 da
Exp. 1		
0	8.53*	2.99
9	8.41	3.07
18	8.23	3.21
27	8.16	3.21
Exp. 2		
0	8.51	3.44
7	8.46	3.54
10	8.50	3.46

* Significant Linear Component

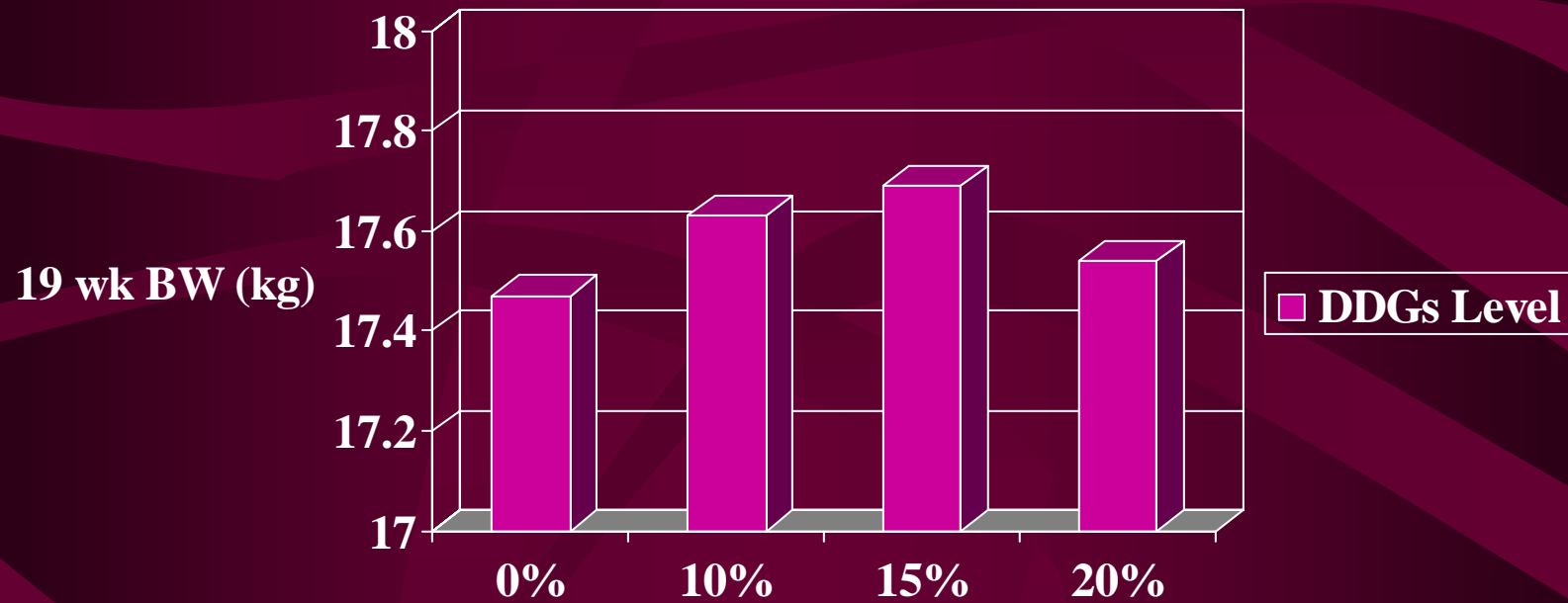
From: Roberson, 2003

Market Tom Trials-Grow/Finish Diets (University of Minnesota)

Trial*	Trt	DDGs,%	BW, kg	F/G
1	Control	0	18.9	2.44
	DDGs	12-8	19.0	2.48
2	Control	0	19.2	2.64
	DDGs	11-8	19.2	2.65
3	Control	0	18.4	2.67
	DDGS	10	18.3	2.63

*Trial weeks of age; 1=5-19 wks; 2=8-19 wks; 3=11-19 wks

Market Tom Trials-Level of Inclusion UM Trial 4



Amino acid balance

- Lysine – 1st limiting
 - Supplementation with lysine
- Tryptophan and arginine
 - Tryptophan supplementation (expensive)
 - No commercial arginine supplement

Ingredient Amino Acids (% of Protein)

AA	SBM	Corn	MBM	Canola	DDGS
M+C	2.9	4.6	2.6	4.5	3.7
Lys	6.2	3.0	5.1	5.6	2.8
Iso	4.5	3.2	3.0	3.9	3.7
Arg	7.3	5.0	6.4	6.0	3.6
Try	1.6	0.9	0.5	1.3	0.7
Thr	4.0	3.5	3.4	4.4	3.4
Val	4.7	4.8	4.6	5.1	4.8

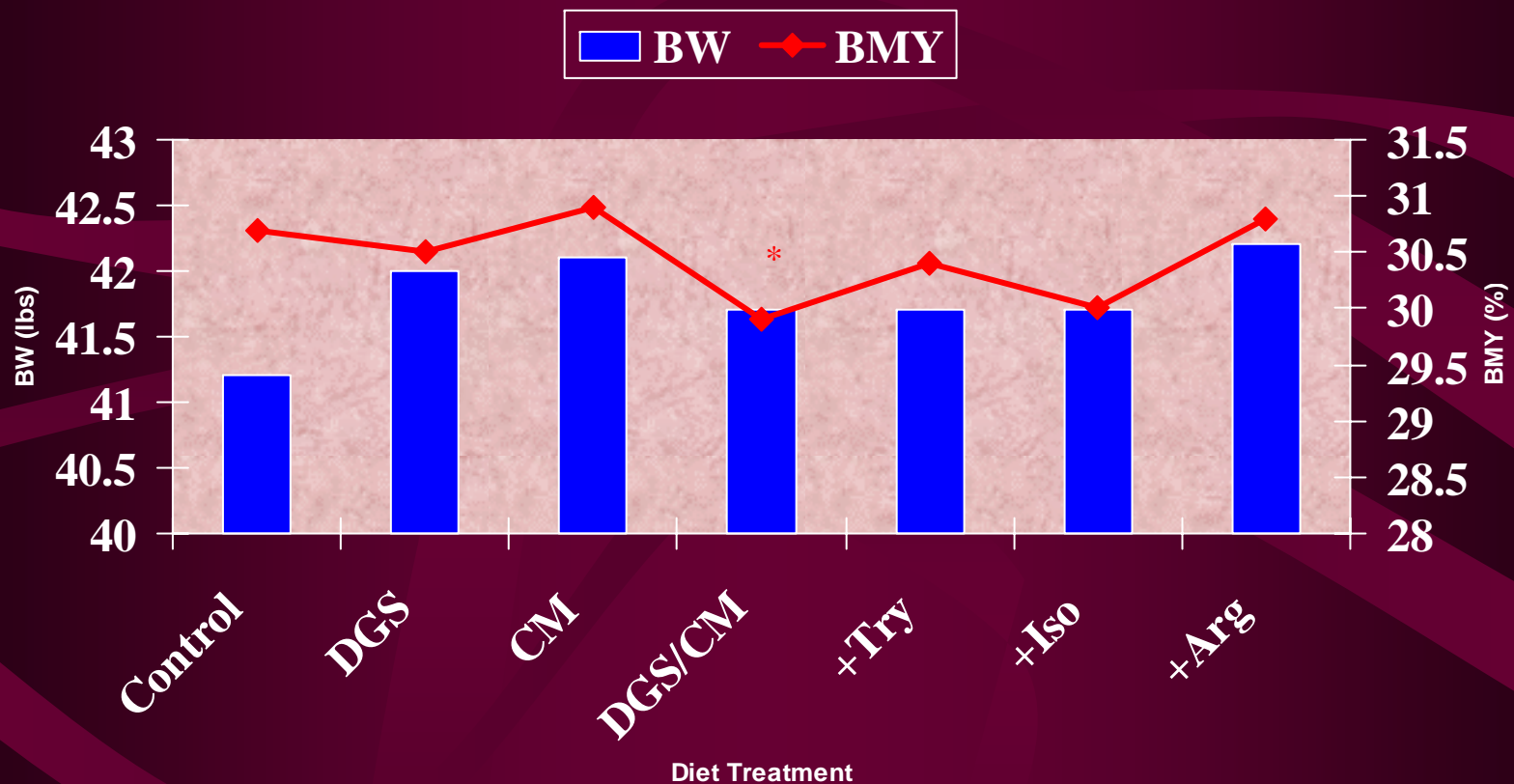
Study #1. Limiting nature of tryptophan and arginine in DDGs for turkey toms

- Corn – soy- meat diet
- Ingredient digestibility
- Formulated to digestible val (reduced CP)
- Isocaloric
- Supplementation with lys, met, thr
- Test diet with DDGs and canola meal
 - Calculated deficiencies of try, iso, arg

Study #1 contd

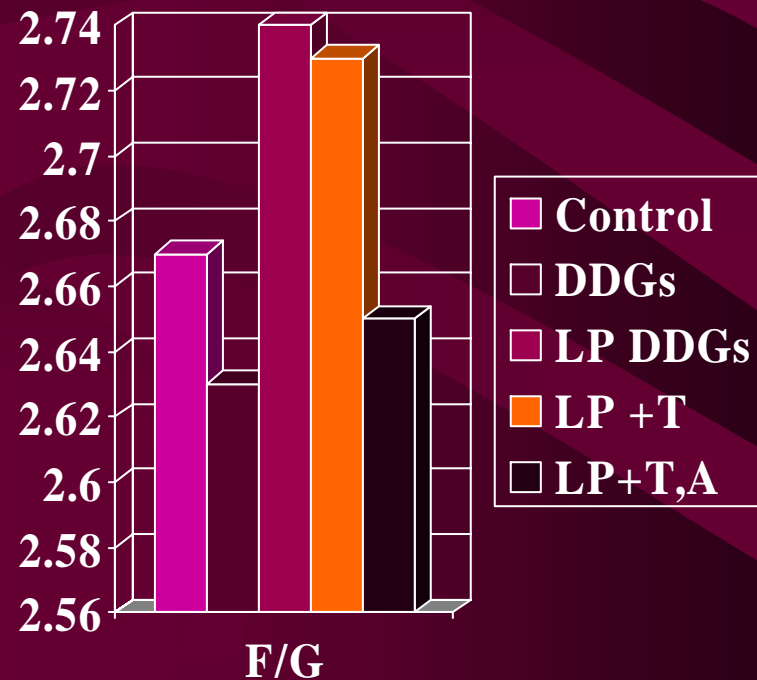
- **Treatments**
 - **1. Control - corn, SBM, MBM**
 - **2. As 1 plus DDGS**
 - **3. As 1 plus canola**
 - **4. As 1 plus DDGS and canola**
 - **5. As 4 plus tryp to Trt 1**
 - **6. As 4 plus tryp, iso to Trt 1**
 - **7. As 4 plus tryp, iso, arg to Trt 1**

Study 1. Alternative Ingredients and Amino Acids



Limiting nature of tryptophan and arginine in DDGs for turkey toms

- Experiment 2 – Lowered protein diet with DDGs resulted in poorer feed conversion – restored with try & arg



DDGs in Market Turkey Diets

- Tryptophan and arginine may become limiting as diet protein levels are reduced
- Inclusion level of 10-20%
 - Hens 10%
 - Toms 15%

Metabolizable Energy

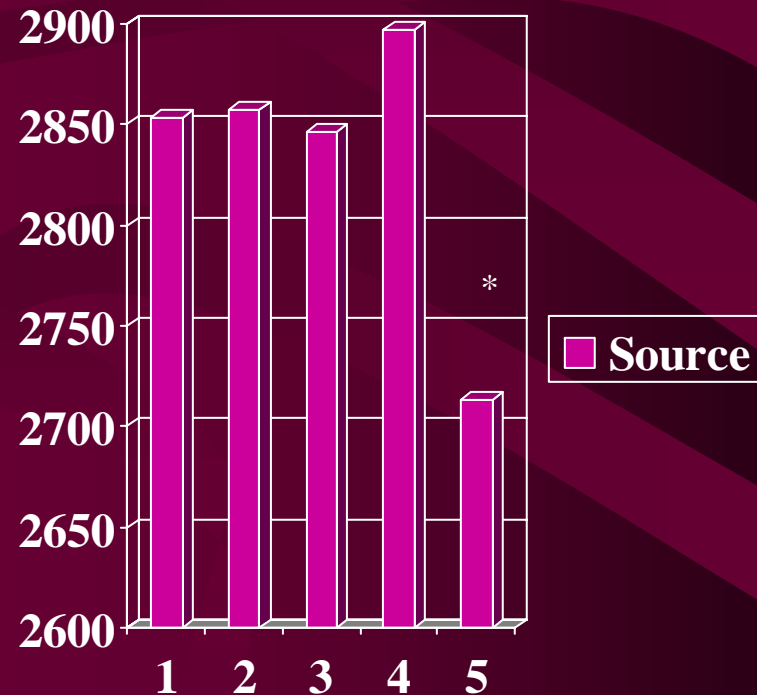
- Importance of energy level
 - Feed conversion
 - Least cost formulation for high energy diets
- AMEn 2480 kcal/kg, 9% fat (NRC, 1994)
 - Current DDGs
 - 10-11% fat
 - 2570 to 2650 kcal/kg
- Potter (1966) 2880 kcal/kg (AMEn)

Metabolizable Energy Value

- UM Research trials
 - AMEn 2810 to 2850 kcal/kg
- Roberson (2004)
 - AMEn Layers 2770 kcal/kg
 - AMEn Turkey poult 2750 kcal/kg
- Batal and Dale (2004) Chicken TMEn
 - Range 2380 to 3079 kcal/kg
 - Ave. 2831 kcal/kg

DDGs Source and TMEn (Turkeys)

- Sources (5)
- Samples per source (4)
 - Source Mean
 - 2833 kcal/kg
 - Individual Sample Range
 - 2651 to 3186 kcal/kg



Metabolizable Energy Value

- Noll 2004 Turkey TMEn (20 samples)
 - Range 2651 to 3186 kcal/kg
 - Mean 2833 kcal/kg
- Roberson 2004
 - AMEn 2756 kcal/kg
- Batal and Dale 2004 Chicken TMEn
 - Range 2380 to 3079 kcal/kg
 - Ave. 2831 kcal/kg

DDGs and Energy Level

DDGs ME Kcal/kg	Fat Cost \$/100 lbs	% DDGs Inclusion \$/100 lbs	DDGs Opportunity Cost, \$/100 lbs	
2810	11	10		
2810	15	10		
2480	11	0	3.82	
2480	15	0	3.34	

Availability of Phosphorus

Ingredient	P, %	P, avail. %	% P Avail.
Corn*	.28	.08	28
SBM*	.62	.22	35
DDGs*	.72	.39	54
DDGs (UGA)	.74	~.47	61-68 (64)
DDGs(UI)	.73	~.6	69-102 (82)
DDGs (MSU)			76-85 (80)

*NRC, 1994



Economics and DDGs Quality

Comparison of DDGS Total Amino Acids (Digestible)

%	Hi Dig Lys	Lo Dig Lys
CP	26.4	27.8
Met	.49(.43)	.51(.44)
Cys	.53(.42)	.49(.32)
Lys	.81(.64)	.72(.46)
Thr	1(.82)	1.03(.75)
Tryp	.24(.19)	.2(.16)

Influence of digestible lysine on value of DDGs (\$/cwt)

	High dAA	Low dAA
Corn, 3.10	4.78	4.28
Corn, 3.50	5.00	4.54
Corn, 5.30	6.02	5.70
SBM, 8.25	5.00	4.54
SBM, 8.70	5.21	4.72

Recommendations for Use of DDGs

- Corn DDGs (to 15%) can be fed to chicken layers and broilers; Turkeys - to 10% of diet
- Formulate with minimums for tryptophan and arginine, especially as diet protein is decreased
- Formulate on basis of digestible amino acid content
- Consider AMEn value of 2750 to 2850 kcal/kg
- Increase available phosphorus (higher than NRC '94) – 65%

University of Minnesota DDGS Webpage

- www.ddgs.umn.edu



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