Value of DDGS In Poultry Diets

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Considerations for Feeding DDGS to Poultry

- Dietary levels (how high?)
- Amino acid balance
- Amino acid digestibility
- Product quality and variability
- Metabolizable energy content
- Phosphorus availability
- Cost relative to other ingredients

Historical Use of DDGS in Poultry Diets

- **Source of Unidentified Growth Factors?**
  - **Low dietary inclusion levels (< 5%)**
  - **Enhancement of growth and reproduction**
  - **Feed intake or palatability effect**
- **Protein supplement**
  - **Higher levels of inclusion (10 to 15%)**

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)

DDGS as a Protein Supplement

- **Must account for:**
  - **amino acid balance & variability**
  - **amino acid digestibility**
  - **dietary energy adjustments at high inclusion rates**

Ingredient Amino Acids (% of Protein)

AA	SBM	Corn	MBM	Canola	DDGS
M+C	3.0	4.6	2.4	4.3	4.2
Lys	6.2	3.0	5.4	5.5	2.8
Iso	4.3	3.2	3.0	3.6	3.6
Arg	7.2	5.0	6.7	6.0	4.4
Tryp	1.5	0.9	0.7	1.5	0.8
Thr	4.0	3.5	3.2	4.2	3.8
Val	4.6	4.8	3.8	4.8	4.8

Variability of Amino Acids in DDGS Among Sources (Shurson,2000)

- Lysine (DM basis)
  - Mean = 0.85%
  - Range = 0.72-1%
  - C.V. 17%
- Methionine (DM basis)
  - Mean = 0.55%
  - Range = 0.49-.65%
  - C.V. 14%

DDGS As Protein Supplement

- Limiting amino acids (Parsons et al., 1983)
  - Lysine
  - Tryptophan
  - Arginine (perhaps equally limiting with tryptophan)
- Amino acid digestibility
  - Heating

Lysine Availability (%)

Source	Lysine Bioavail.	Lysine Digest.
Combs & Bossard (1969)	71-93	----
Parsons (1983)	66	82
Heartland (1998)	----	57

Variability in Amino Acid Digestibility Among DDGS Sources

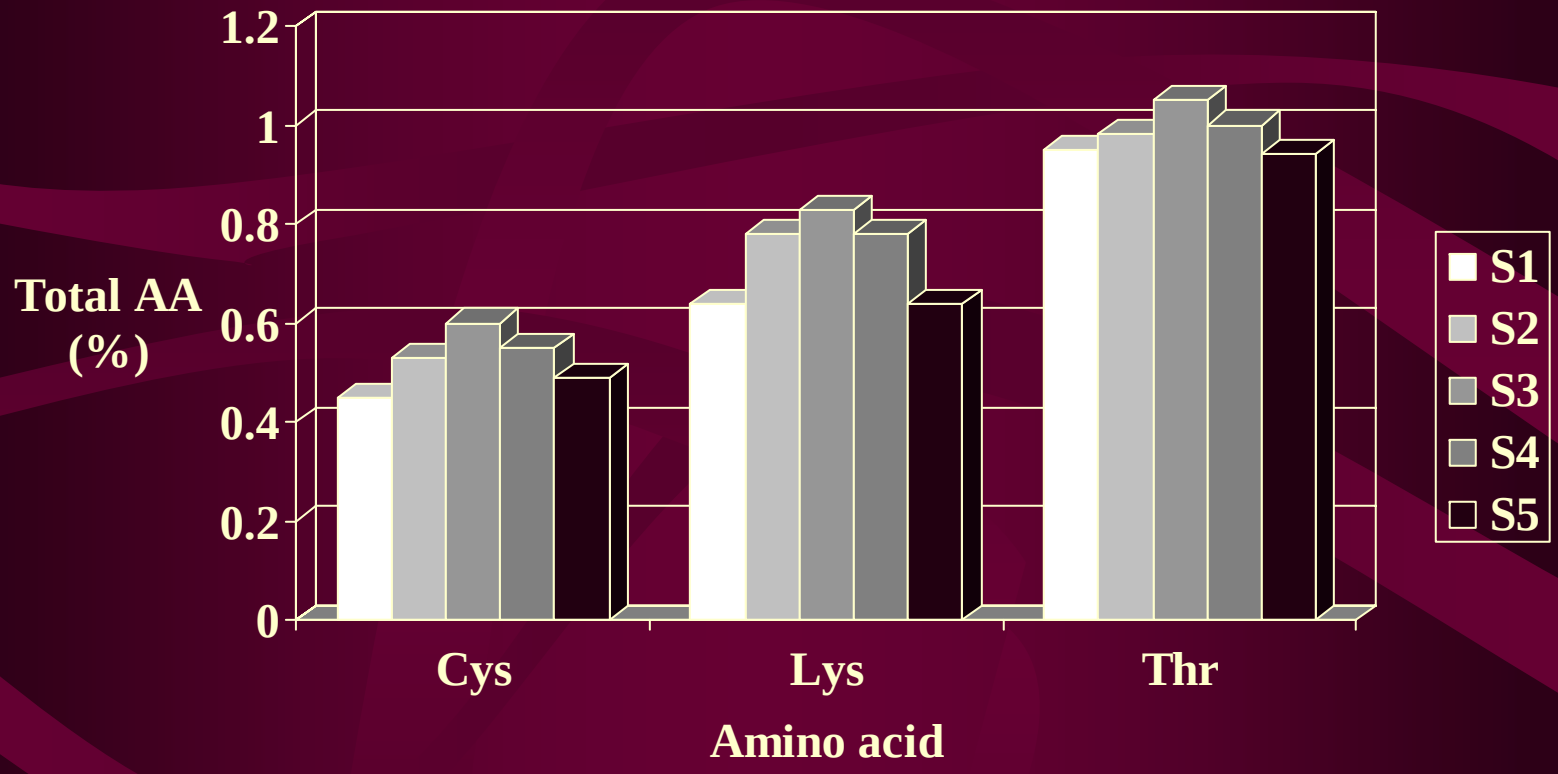
DDGS Sample Collection

- 5 Ethanol Plants
- 4 samples/plant taken periodically during Spring 2002
- Feed mills (3) collected samples from incoming lots of DDGS
- Samples were identified by feed mill, plant source, and date of sample

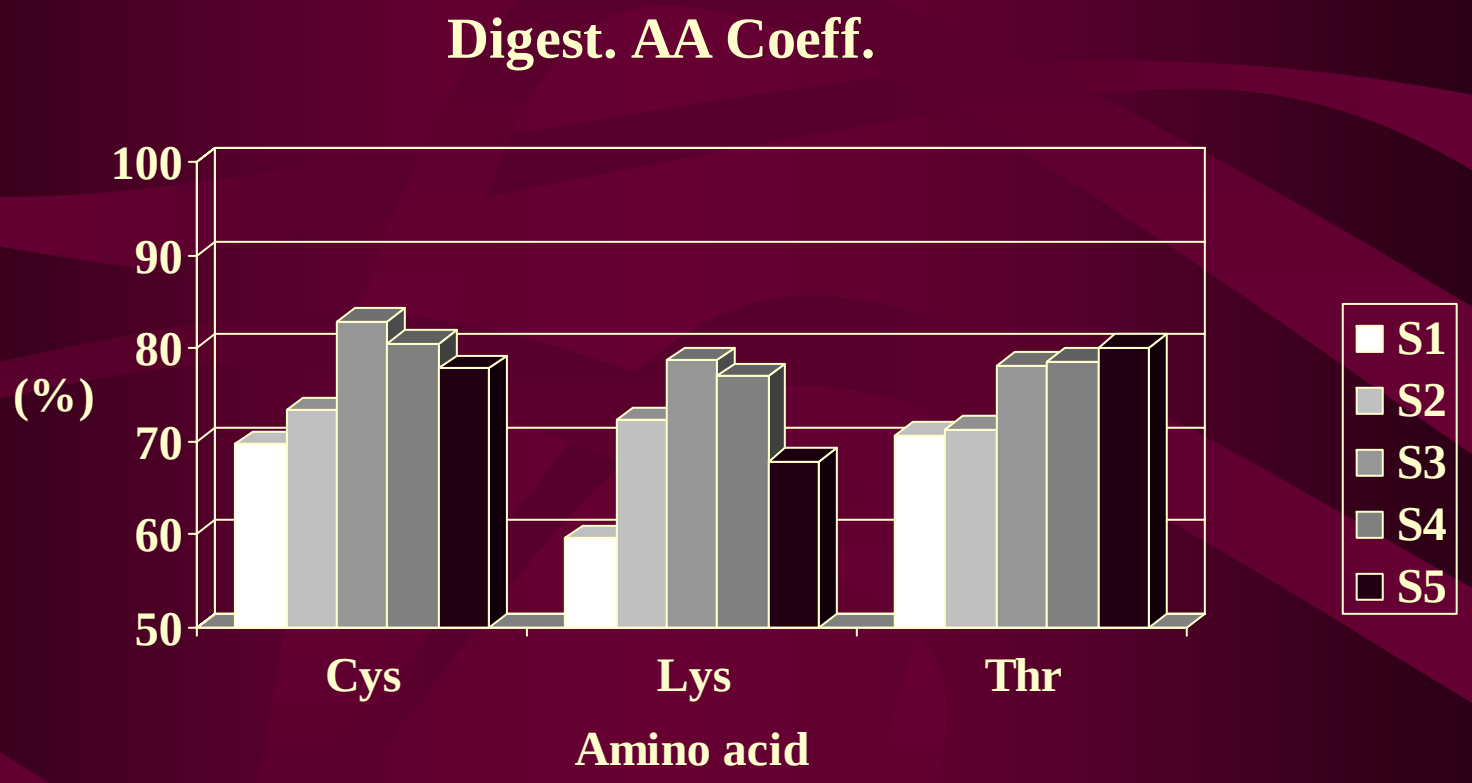
DDGS Sample Analyses

- Chemical analyses
  - Amino acids
  - Proximate analysis
  - Minerals
  - Sugar and Starch
- Amino acid digestibility (chickens)
- TME (turkeys)

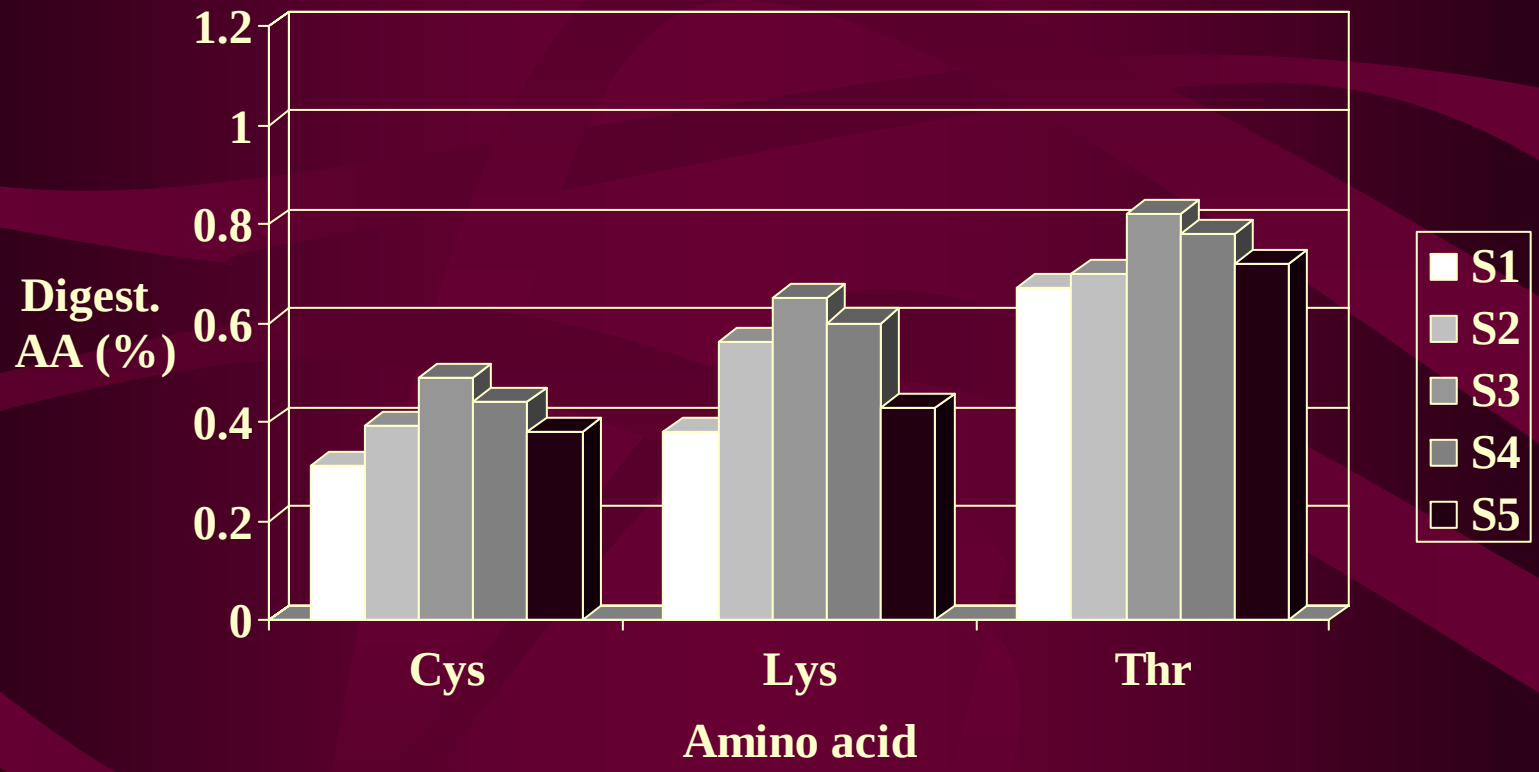
Comparison of Total Amino Acid Content of DDGS Among Ethanol Plants



Comparison of Amino Acid Digestibility Coefficients of DDGS Among Ethanol Plants



Comparison of True Digestible Amino Acid Content of DDGS Among Ethanol Plants



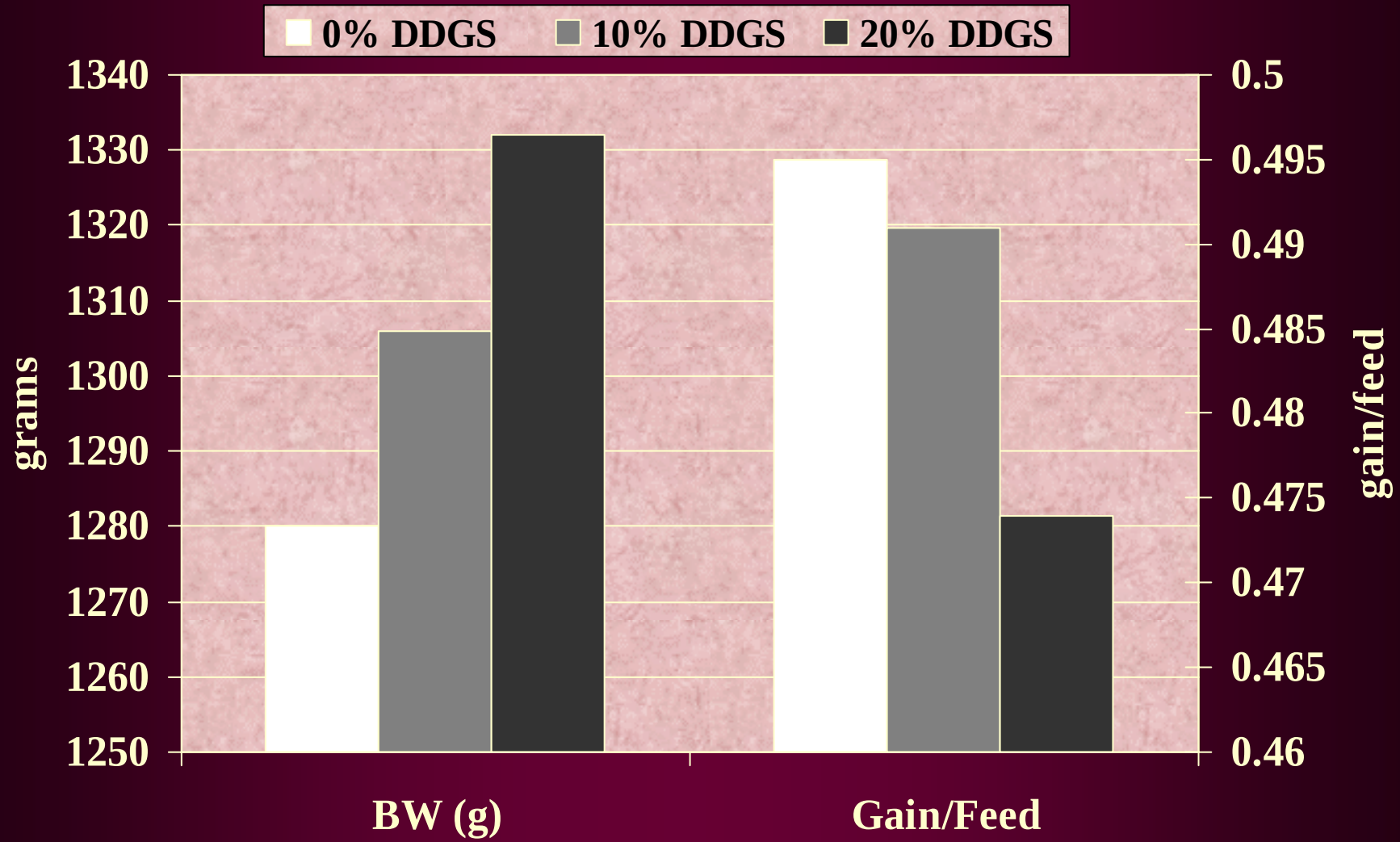
Nutrient Variability Among DDGS Sources

- Protein (26.2-30%)
- Fat (9.4-11.1%)
- Minerals
  - Na, P, K, S most variable
  - Na (mean range 720-1520 ppm)
  - Na (sample range 500-1670)

DDGS as a Protein Supplement

- **Dietary adjustments for lysine and energy are needed for optimal performance when DDGS is added to the diet**

Turkey Poults 8 Weeks (Potter, 1966)



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**

Waldroup et al, 1981

Why Conduct Research on DDGS?

- Limited current information on DDGS use for turkey growth and meat yield
- Limited nutritional information on “new generation” DDGS
- Dramatic improvements in poultry production and nutrition from previous DDGS studies

Poultry Production Changes

- Intensive genetic selection for growth
  - Past (28# tom at 20 wks of age)
  - Current (40# tom at 20 wks of age)
- Marketing of turkey meat products vs traditional “Ready to Cook”
- Targeted feed formulation - growth, meat, environment

Recent Turkey Nutrition Research University of Minnesota

- Study 1
  - "High" DDGS inclusion level in combination with canola meal
  - Potential limitation of trp and arg
- Study 2
  - Diet protein reduction
  - Potential limitation of thr

Objectives – Study 1

- Determine if significant inclusion of canola meal and DDGS affects turkey meat yield
- Determine potential for limiting amino acids other than lysine and methionine
- Determine amino acid digestibility of DDGS and other alternative ingredients

Experimental Methods and Measurements

- Trial duration: 5 to 20 wks
- 70 turkeys/dietary treatment
- Weight and feed intake determined at 8, 11, 14, 17 and 19 wks of age
- Carcass and meat yield were determined

Dietary Treatments

- **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**

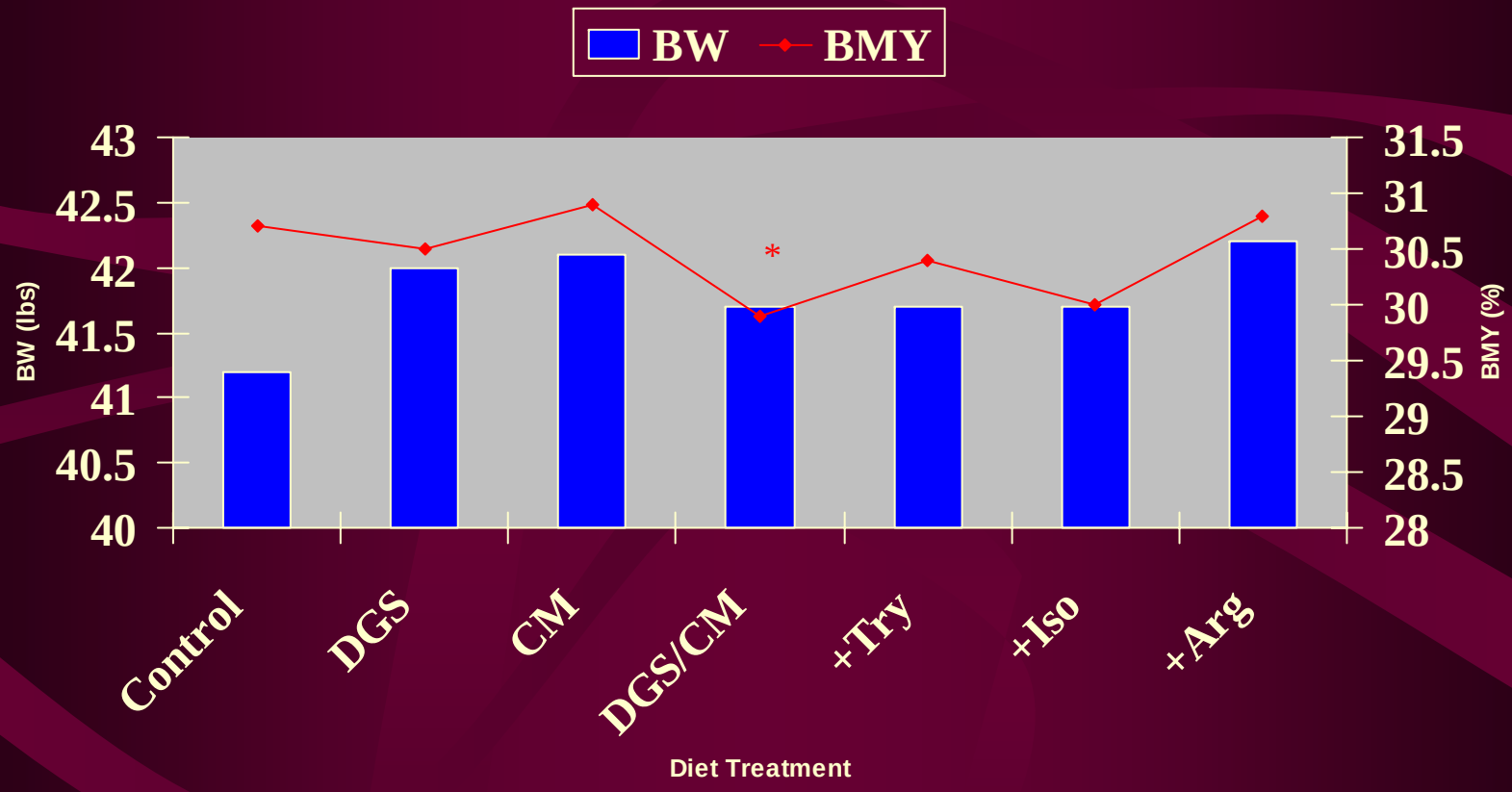
Nutrient Analysis of Ingredients

Nutrient	Corn	SBM	MBM	Canola	DDGS
		%			
Protein	7.56	46.77	58.11	37.12	26.39
Fat	4.67	2.31	11.37	3.45	11.51
Fiber	1.70	2.47	.51	10.15	6.17
Met	.15	.63	.99	.65	.49
Cys	.16	.64	.53	.77	.53
Lys	.22	2.69	2.99	1.71	.81
Tryp	.05	.60	.47	.45	.24
Val	.36	2.03	2.19	1.48	1.36
Thr	.24	1.50	1.81	1.23	1.00
Iso	.25	1.93	1.73	1.16	.96

Amino Acid Digestibility (% of total)

AA	Corn	SBM	MBM	DDGS	Canola
	---------- % ----------				
Met	97.9	94.3	92.3	88.5	90.2
Cys	88.2	-----	84.7	78.4	79.7
Lys	86.2	91.8	90.3	78.6	84.2
Arg	96.1	93.5	94.0	92.5	92.7
Tryp	96.8	93.7	95.1	91.8	98.4
Thr	81.1	84.3	90.1	82.5	81.5
Iso	86.4	90.9	92.2	89.1	85.8
Val	93.3	89.4	90.2	88.1	83.5

2000-2001 Studies
Alternative Ingredients and Amino Acids



Summary

- **Digestibility of DDGS quite improved from book values**
- **Inclusion of 12-8% canola *or* DDGS had no effect on weight or feed conversion**
- **Inclusion of both canola and DDGS resulted in a slight depression in breast meat yield - recovered with tryptophan addition**

Objectives – Study 2

- Determine the response to threonine in diets with adequate and reduced dietary crude protein, and in diets with and without DDGS

- Factorial Experimental Design
  - Diet protein (Thr at 90, 95 & 100% NRC)
  - Diet type (corn-soy-PBM with and without DDGS)
  - Threonine supplementation at 10% of NRC

Study 2. Preliminary Results - Turkey Performance

Dietary Treatment	Body weight at 19 wks (lbs)	F/G 5-19 wks
1. Corn-soy-meat, 100% NRC thr	42.4	2.62
2. As 1, 95% NRC thr	42.5	2.62
3. As 1, 90% NRC thr	41.5	2.66
4. As 1 with DDGs	42.5	2.64
5. As 2 with DDGs	42.4	2.65
6. As 3 with DDGs	42.0	2.66

Study 2. Preliminary Results
Live Performance

- Inclusion of DDGS (11-8%) resulted in similar performance to control
- Performance was reduced in diets formulated to 90% NRC thr

Comparison of Total and Digestible Amino Acids of DDGS Used in Both Studies

%	Study 1	Study 2
CP	26.4	27.8
Met	.49 (.43)	.51 (.44)
Cys	.53 (.42)	.49 (.32)
Lys	**.81(.64)**	**.72 (.46)**
Thr	1.0 (.82)	1.03 (.75)
Tryp	.24 (.19)	.20 (.16)

Table 3. Influence of formulation basis and poultry diet type on value of DDGs ($/ton)[1].

	Total Amino Acids	Digestible Amino Acids
Broiler Starter	93.40	84.30
Broiler Finisher	93.39	84.30
Turkey Starter	82.15	75.49
Turkey Finisher	82.15	75.49
Egg Layer Developer	102.74	95.54
Egg Layer - Peak	92.63	75.49

[1]From Jackson, 2002.

Influence of Digestible Lysine Level of DDGS on Value ($/cwt)

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

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

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