

Nutritional Value of Distillers Dried Grains and Solubles for Poultry

Amy B. Batal

Poultry Science Department
University of Georgia



Considerations in Feeding DDGS to Poultry

- **Product Quality and Variability**
- **Metabolizable energy**
- **Amino Acids, total and available (digestible)**
 - **Lysine availability**
 - **Amino acid balance**
- **Phosphorus availability**
- **Minerals**
- **Diet levels**
- **Cost**

Proximate Composition (Range)¹ 86% DM basis

■ Protein	27% (23-30%)
■ Fat	8.8% (2.5-10.6%)
■ Fiber	6.6% (5.1-8.1%)
■ Ash	4.4% (3.9-5.4%)

¹ The average of seventeen DDGS samples.

Metabolizable Energy

- **Batal and Dale TME_n 2004**
 - Range 2490 to 3190 kcal/kg
 - **Mean 2813 kcal/kg**
- **Noll and Parsons TME_n 2003**
 - Range 2650 to 3082
 - Mean 2850 kcal/kg
- **Noll (Turkeys) TME_n 2004**
 - Range 2651 to 3186 kcal/kg
 - Mean 2833 kcal/kg
- **Roberson AME_n 2004**
 - 2756 kcal/kg

TME_n of DDGS = 2800 kcal/kg

NRC (1994) 2480 kcal/kg

Amino Acid (Lysine) Availability and Digestibility

Average Total and True Amino Acid Digestibility¹ of DDGS

Amino acid	Total Concentration	True AA digestibility (%)
Lys	0.71	70 (65)² (80)³
Met	0.54	87 (84)
Cys	0.56	74 (77)
Thr	0.96	75 (72)
Trp	0.20	83
Arg	1.09	84 (63)
Ile	0.97	83 (84)
Leu	3.05	89 (89)

¹Average of eight DDGS samples fed to 16 cecectomized roosters.

² In parentheses is the True amino acid digestibility coefficients from NRC (1994)

³ 80% Available lysine determine with a growth assay

Low and High Total and True Amino Acid Digestibility¹ of DDGS

Amino Acid	Low		High	
	Total AA	AA digest.	Total AA	AA digest.
Lys	0.39	46	0.86	78
Met	0.46	83	0.61	91
Cys	0.50	63	0.62	88
Thr	0.85	64	1.05	83
Trp	0.13	76	0.28	89
Arg	0.75	73	1.25	91
Ile	0.90	81	1.03	93
Leu	2.84	85	3.21	92

¹Average of eight DDGS samples fed to 16 cecectomized roosters.

Relationship of DDGS IDEA Value vs. *In Vivo* True Amino Acid Digestibility

	Mean	Stdev	Range	R ²
LYS	70	6.9	59 - 84	0.88
CYS	77	5.7	65 - 85	0.43
MET	87	1.9	82 - 90	0.12
TRP	84	5.1	76 - 95	0.14
ARG	86	3.1	81 - 92	0.33
THR	75	4.0	67 - 81	0.34

Noll and Parsons, based on 28 DDGS samples



1

2

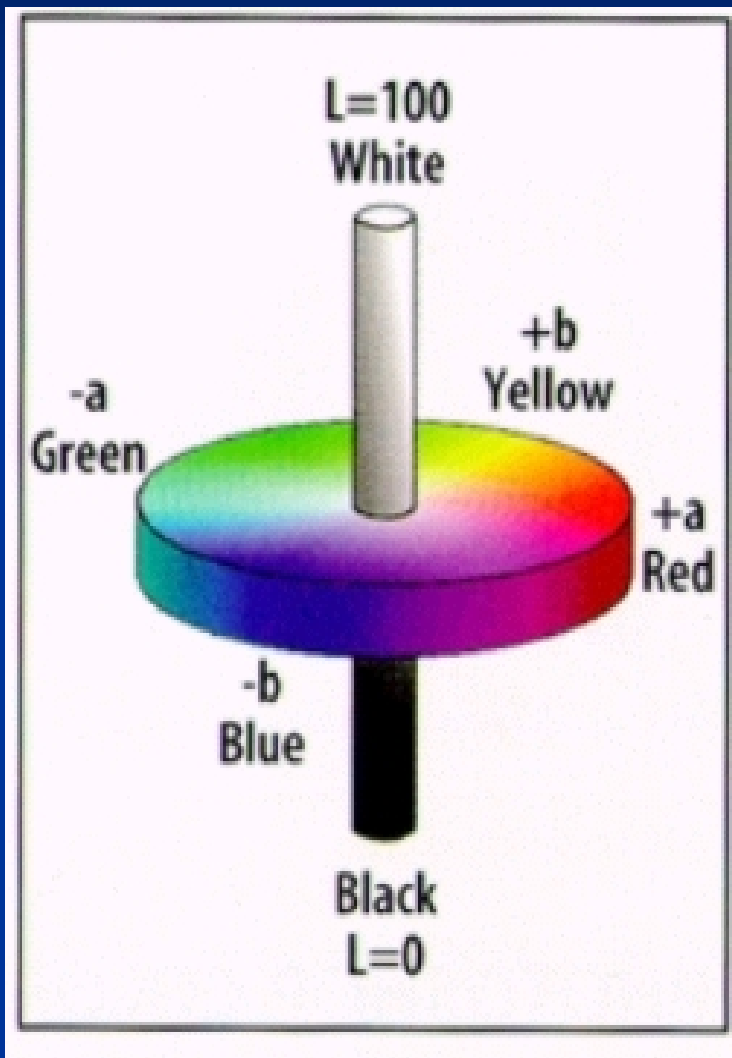
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Color

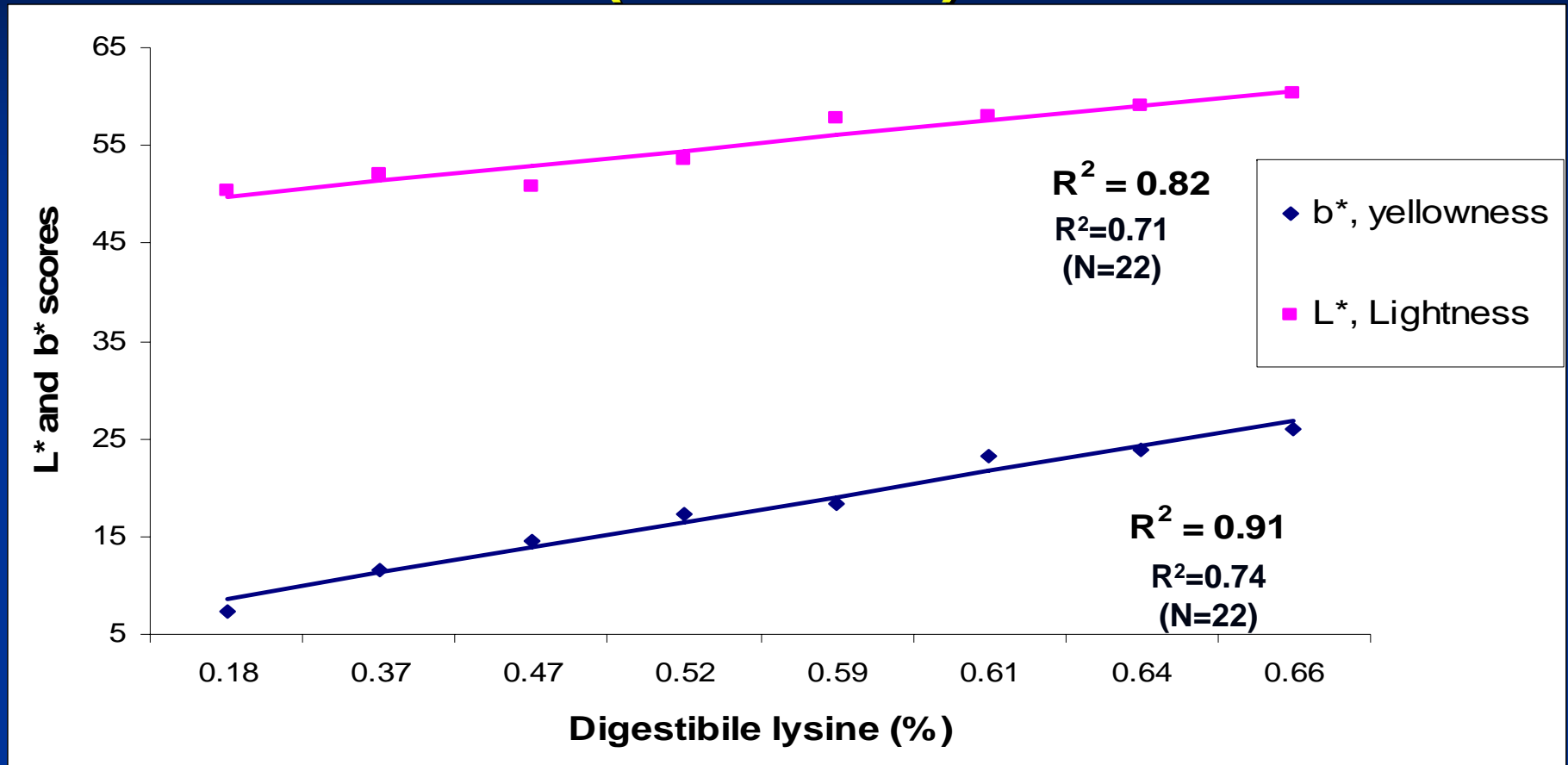
Spl	L* (Lightness)	b* (Yellowness)	a* (Blueness)	Total Lys	Lys Dig.	Dig. Lys
1-High	60.3	25.9	5.0	0.86	76.8	0.66
2	57.7	18.3	6.2	0.82	72.1	0.59
3-Low	50.4	7.41	5.2	0.39	45.8	0.18

Color (L*, b*, a*) was measured with a Minolta Chroma Meter CR-300

Minolta Chromameter (L^* , b^* , a^*)



Regression of Digestible Lysine and Color (L* and b*)



Correlations ($P < 0.01$) were also found between digestible thr, arg, his, and trp and L* values and b* values, but not with a* values

Ergul et al., 2003

Phosphorus Availability- Sodium

Phosphorus Availability of DDGS

(University of Illinois Experiments)

	Bioavailability Coefficient (%)	Total P Content (%)	Bioavailable P Content (%)
DDGS – control spl (UGA)	69 (68)	0.72	0.49
Low Digestible Lys DDGS (64.2% dig. coeff.)	102	0.74	0.75
Low Digestible Lys DDGS (61.2% dig. coeff.)	82	0.72	0.59
High Digestible Lys DDGS (78.8% dig. coeff.)	75	0.73	0.55

Available Phosphorus (P) in DDGS

Ingredient	% P	Avail. P %	% Phytate P	% Avail. P
Corn*	0.28	0.08	0.20	29
SBM*	0.62	0.22	0.40	35
DDGS*	0.72	0.39	0.33	54
DDGS (UGA)¹	0.74	0.47	0.27	64 (68)
DDGS (UI) (MSU)	0.73	0.60 (approx.)	0.13	69-102 (82) 76-85 (80)

¹ Average of 9 DDGS samples varying in color and plant location.

* NRC (1994) values for poultry

Sodium (%) Composition of DDGS

Sample	Sodium	
1	0.09	
2	0.12	
3	0.29	
4	0.11	Avg. 1-7 = 0.13%
5	0.12	
6	0.11	
7	0.09	
8 ¹	0.42	
9 ¹	0.44	
10 ¹	0.39	Avg. 8-12 = 0.42%
11 ¹	0.43	
12 ¹	0.43	
Average ± SD	0.25 ± 0.15	
NRC (1994)	0.48	
Projected	0.06	

¹ Samples obtained from same plant at different time periods

DDGS as a Feed Ingredient for Broilers

Results from Experiment 1 (2–18 days of age)

	Treatment	Weight gain (g)	Feed:Gain
High Density ¹	0% DDGS	556 ^a	1.28 ^a
	15% DDGS	555 ^a	1.30 ^a
Low Density ²	0% DDGS	523 ^b	1.40 ^b
	15% DDGS	518 ^b	1.42 ^b
Pooled SEM		3.8	

^{a-b} Means within column with no common superscript differ significantly ($P < 0.05$).

¹ 22% Crude protein, 3,200 kcal/kg

² 20% Crude protein, 3,000 kcal/kg

³ Means represent 8 pens per treatment, 6 chicks per pen (48 chicks per treatment).

Body weight, % DDGS (0 to 42 days)

% DDGS

	0	6	12	18
0-16 days	414 ^a	417 ^a	400 ^{ab}	388 ^b
17-31 days	1053	1055	1049	1038
42 days	2314 ^a	2289 ^a	2292 ^a	2243 ^b

a-b P <0.05

Feed to Gain , % DDGS (0 to 42 days)

% DDGS

	0	6	12	18
0-16 days	1.34 ^a	1.35 ^a	1.40 ^{ab}	1.42 ^b
17-31 days	1.68	1.67	1.66	1.67
42 days	1.78	1.80	1.78	1.81

a-b P <0.05

Performance Response of Broiler fed DDGS (0 to 42 days)

DDGS Level (%)	BW (g)		Gain/Feed	
	Fixed Energy	Variable Energy	Fixed Energy	Variable Energy
0	1288	1206	0.513	0.493
5	1237	1227	0.518	0.505
10	1237	1203	0.508	0.490
15	1220	1165	0.513	0.444*
20	1246	1167	0.498	0.467
25	1247	1096*	0.500	0.446*

* Different from the control

Waldroup et al, 1981

DDGS and Laying Hen Performance

DDGS in laying Hen Trials (University of Georgia)

- **Trial 21 to 42 wks of age – peak production**
 - Hy-line W-36
- **Levels 0 or 15% in commercial or low density diet**
 - Commercial diet, 18.5% CP and 2,870 kcal/kg; Low Density, 17% CP and 2,075 kcal/kg
- **Egg production:**
 - Commercial – no effect of DDGS level
 - Low Density – reduced egg production until 36 wk of age
- **No effect on egg weight or specific gravity**
- **Trends:**
 - 42 wks – increase in interior egg quality (increase in haugh units)
 - Dark Yolks – increase in the redness

DDGS Laying Hen Diets (Roberson, 2004)

- **Two trials - postpeak (48-55 to 60-68 wks)**
 - **Hy-line W-36**
- **Levels 0, 5, 10 and 15%**
- **Generally no effect on (inconsistent at certain wk)**
 - **Weekly egg production (1 wk of 9)**
 - **Specific gravity**
 - **Exp 1 (1 wk of 4)**
 - **Exp 2 – no effect**
- **No effect on egg weight**
- **Yolk color was significantly darker**
 - **Based on Minolta Chroma (L*) or Roche fan**
 - **0% - 8.63, 5% - 8.98, 10% - 9.02, 15% - 9.22**

Shadow Price DDGS - Broiler Starter Diet

	<u>\$/ton</u>			<u>% Use</u>
Corn	90			
SBM	220	DDGS	\$159.40	0
Fat	240	DDGS	\$159.20	5.4
Dical.	250	DDGS	\$146.40	29.2

- DDGS will contribute energy, protein, and phosphorus to poultry diets

Conclusions – Keys to DDGS Use

1. **TME_n 2,800 kcal/kg (1,270 kcal/lb)**
 1. **Considering using a higher TME than reported in the NRC (1994)**
2. **Lysine availability (digestibility coefficient) 70% (variable –range 46 to 78%)**
 1. **Total lysine concentration 0.70%**
 2. **Available lysine concentration 0.50%**
 3. **Formulated diets on a digestible amino acid basis**
3. **Phosphorus availability at least 50% - may be as high as 80%**
 1. **Total Phosphorus – 0.68 to 0.78**

Need Current Analytical Information

Conclusions - Recommendations

- **Broilers**
 - 5 - 9% inclusions rates during starter period
 - 12 - 15% inclusions rates during the grower and finisher periods
- **Laying Hens (chickens)**
 - 10% inclusions rates during peak production
 - 15% inclusions rates after approx. 36 wks of age

Higher inclusion levels may be used but require careful adjustment of amino acid and energy levels

Limiting Factors or Issues for DDGS Use in Poultry Diets

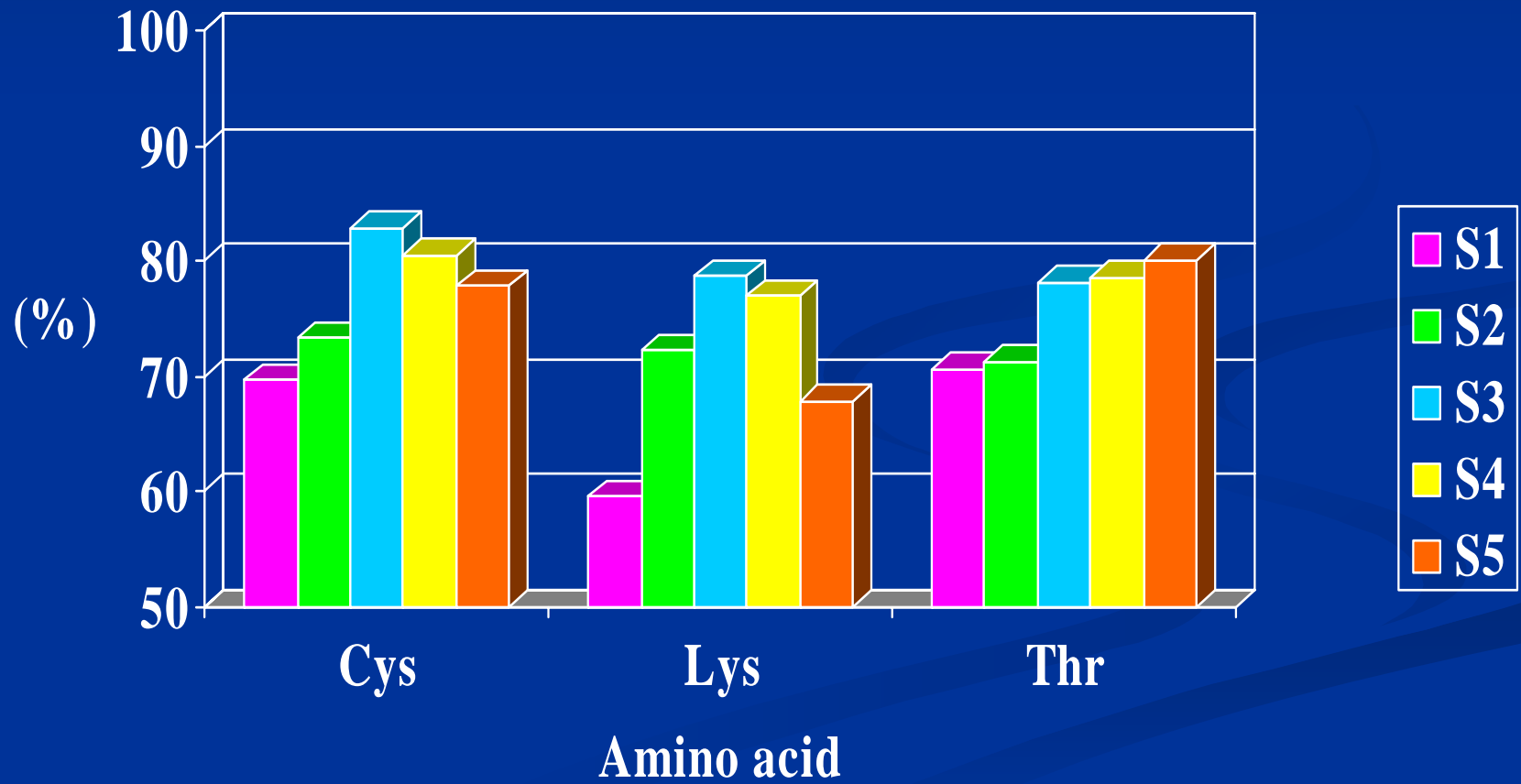
- **Protein composition – Amino acid balance**
 - Formulating diets for digestible
- **Nutrient quality** (nutrient specifications)
- **Consistent product**
- **Distribution- shipping and handling**
- **Mycotoxins**

Nutrient Specifications DDGS

- Moisture – maximum 12%
- Protein – minimum 26.5%
 - Lysine total conc. 0.65 – 0.70%
- Fat – minimum 8.5%
- Fiber – maximum 7.5%

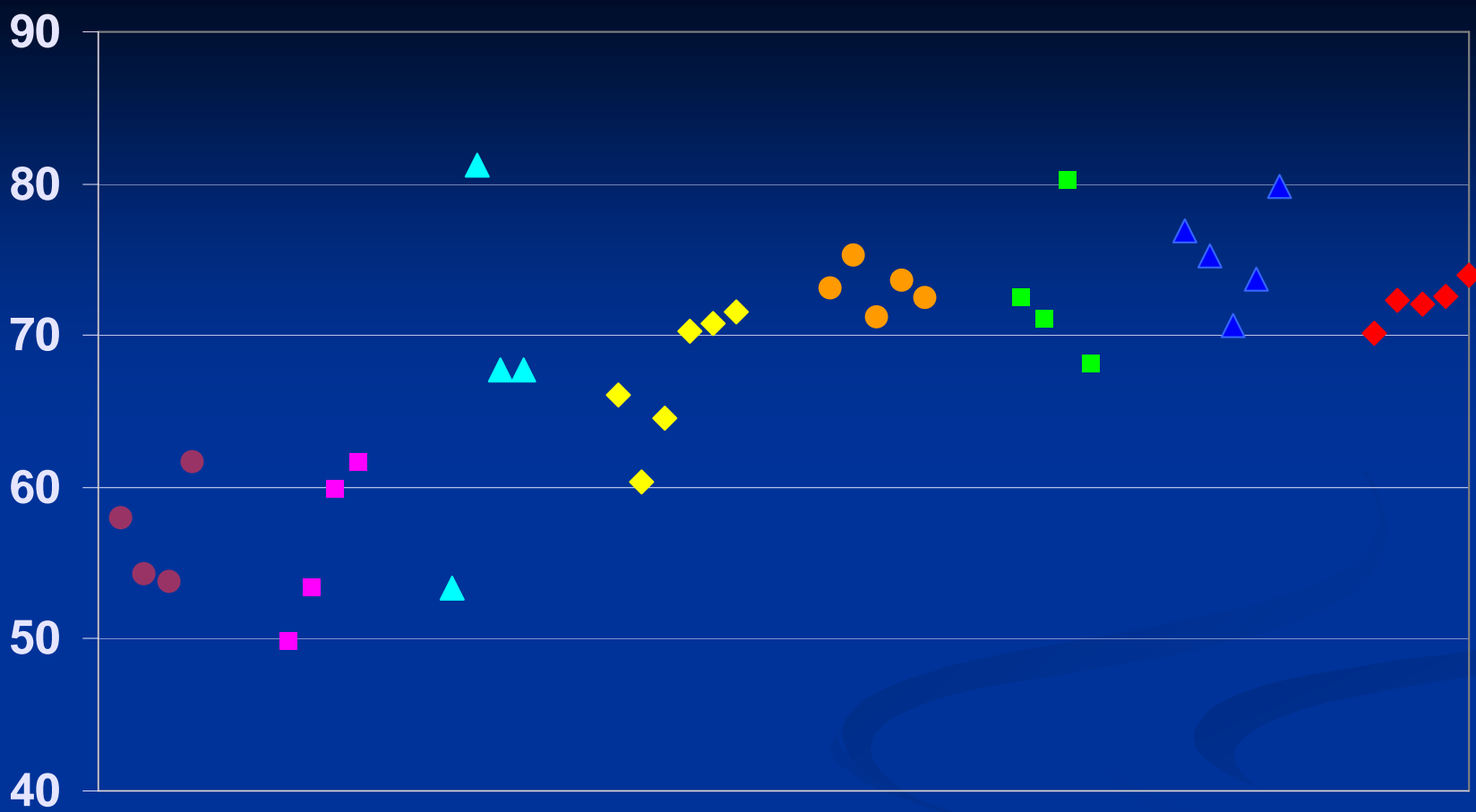
Comparison of Amino Acid Digestibility Coefficients of DDGS Among Ethanol Plants

Digest. AA Coeff.



Noll and Parsons

IDEA predicted Lysine Digestibility (%)



	<u>Mean</u>	<u>Spread</u>		<u>Mean</u>	<u>Spread</u>
● Supplier 1	56.9	7.9	● Supplier 5	73.1	4.0
■ Supplier 2	56.3	11.9	■ Supplier 6	73.1	12.1
▲ Supplier 3	67.5	27.8	▲ Supplier 7	75.3	9.1
◆ Supplier 4	67.2	11.1	◆ Supplier 8	72.2	3.9

Benefits of DDGS in Poultry Diets?

- High available P reduces the level of dietary P supplementation needed
- Adding 5% DDGS may improve:
 - feed preference
 - Egg number and hatchability of breeder hens
 - Interior egg quality
- Reduce diet costs