

Use of Distiller's Dried Grains plus Solubles in Poultry Feeding Trials at the University of Georgia

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Introduction

- Distillers dried grains plus solubles not a new by-product
- “One of the hottest topics in the feed industry today”
- In the past, the majority of DDGS has come from the beverage industry and consisted of several grains in the fermentation process
- The “New Generation” DDGS is almost exclusively for corn fermentation
- Modern ethanol plants tend to produce a higher quality product (reduced heat during processing)

Historical Use of DDGS in Poultry Diets

- **Growth Response** (with low inclusion levels, 5%)
 - Source of unidentified growth factor
- **Feed preference** (positive effect on palatability)
- **Reproduction improvement**
- **Egg quality**
- **Protein source** (higher inclusion levels)

Nutritional Consideration of feeding DDGS to Poultry

- **Levels of DDGS that can be incorporated into diets**
- **Amino acid digestibility**
- **Phosphorus availability**
- **Metabolizable energy (fiber)**
- **Nutrient variability and quality**

Objectives

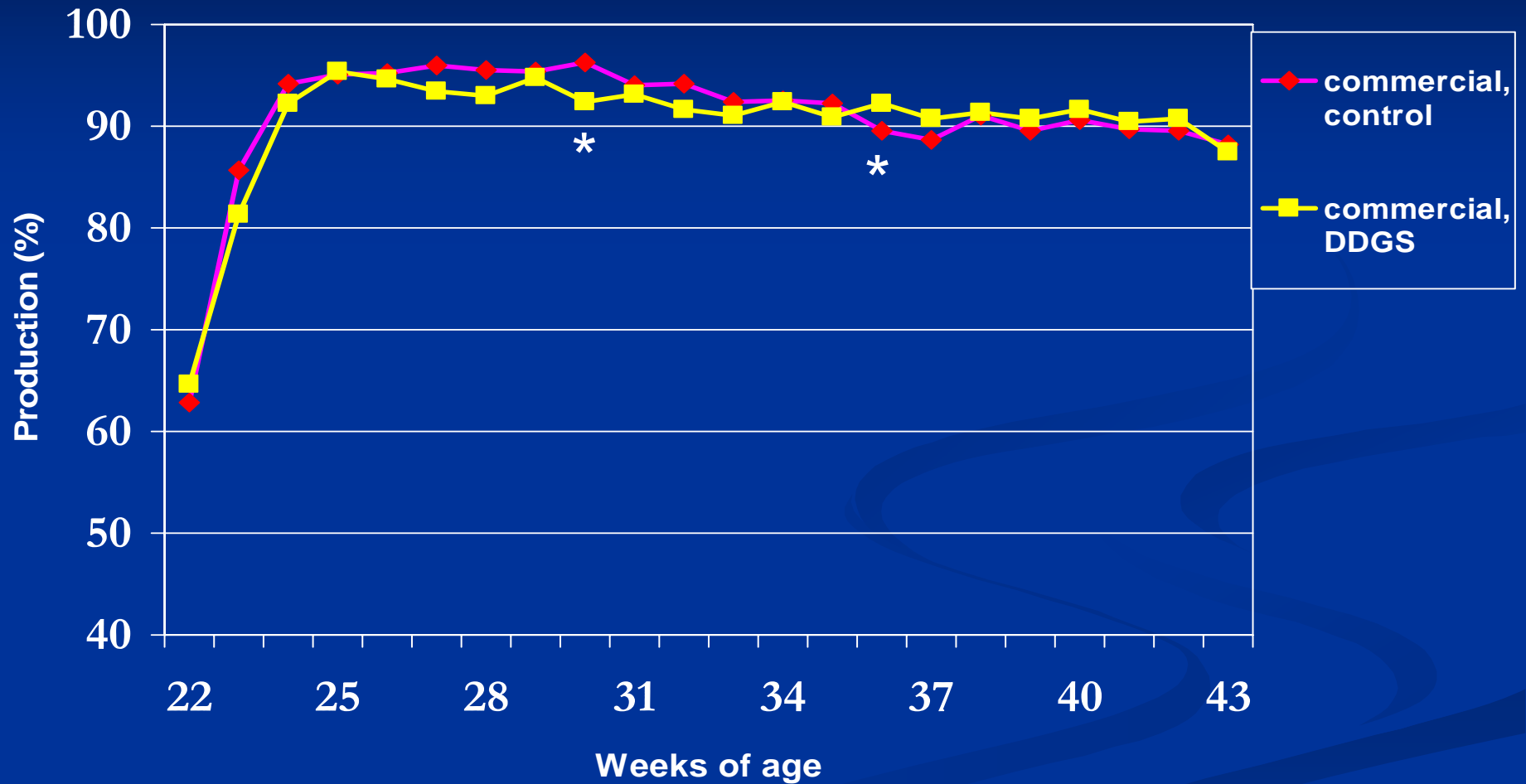
- **To evaluate the use of “New Generation” Distiller’s Dried Grains plus Solubles in Poultry Diets**
 - **Maximum inclusion levels for broiler and layer diets**
 - **Amino acid (lysine) digestibility**
 - **Phosphorus availability**

Laying Hen Trial

Materials and Methods

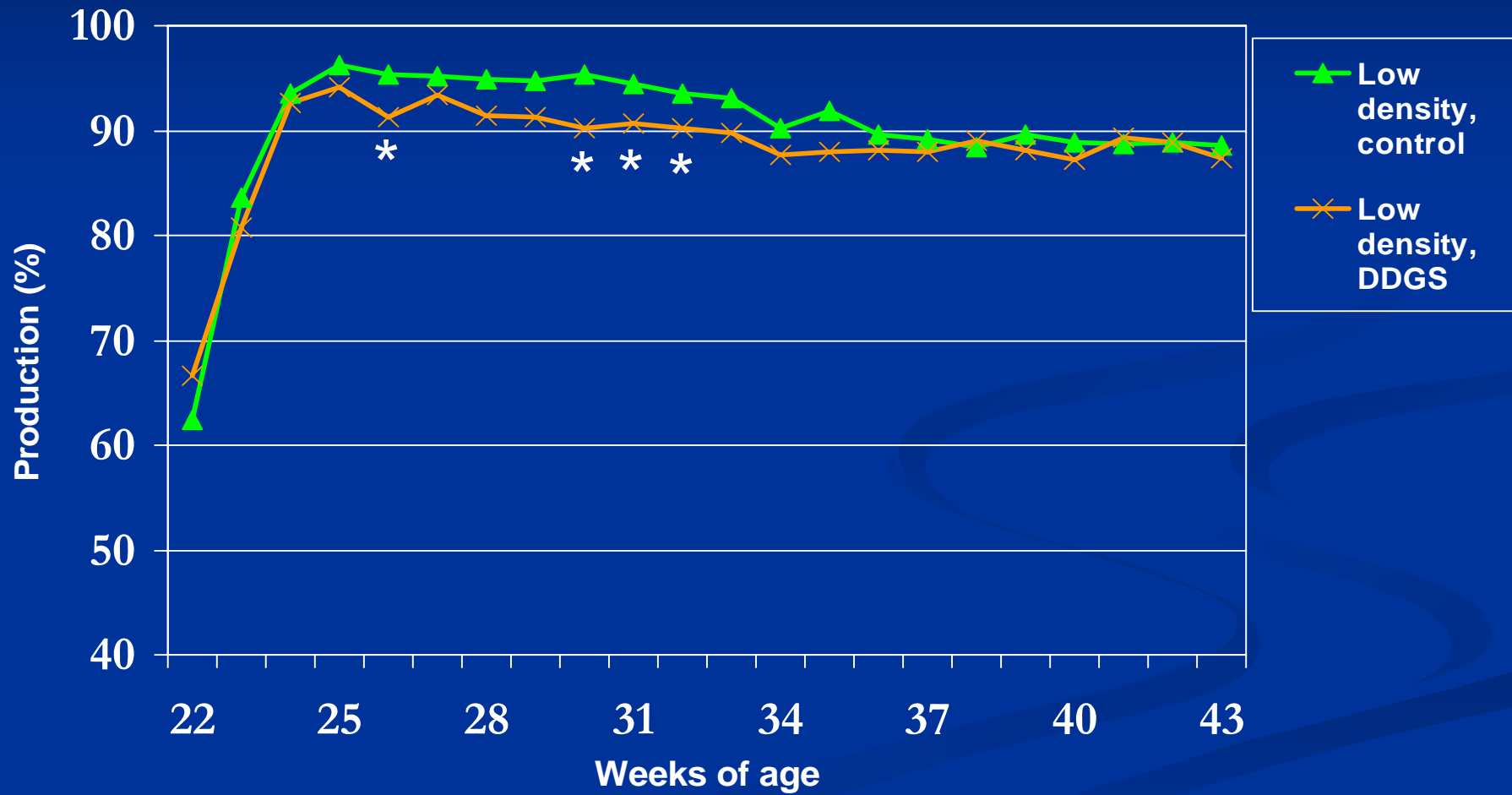
- **Four experimental diets were fed to eight replications of 16 Hy-line W36 hens (128 hens / treatment).**
 1. **Commercial diet - 0% DDGS**
 2. **Commercial diet - 15% DDGS**
 3. **Low density diet - 0% DDGS**
 4. **Low density diet - 15% DDGS**
- **The experiment was conducted from 21 to 43 weeks of age.**

Egg Production



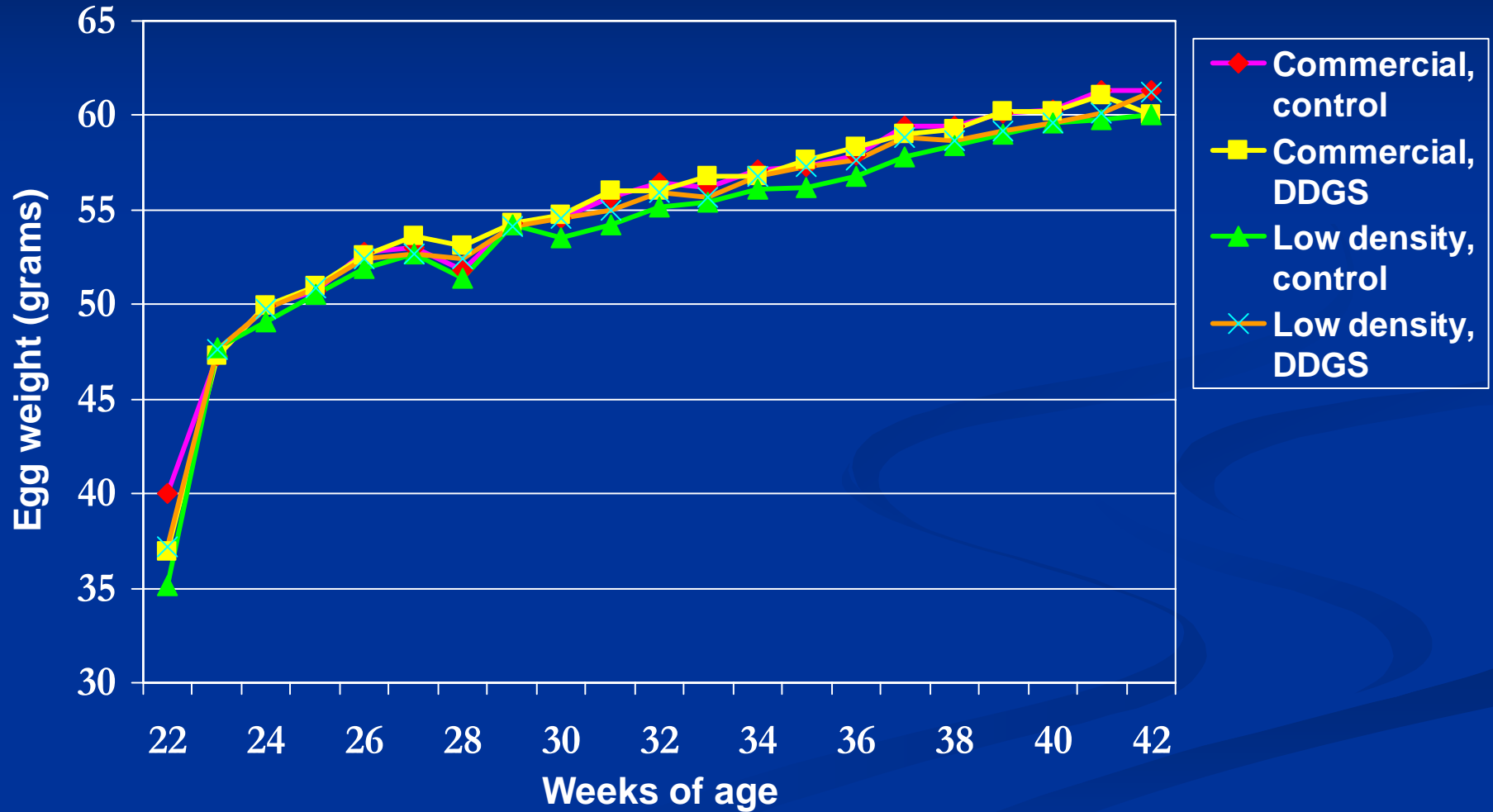
* Denotes significant difference between the treatments ($P < 0.05$)

Egg Production



* Denotes significant difference between the treatments (P < 0.05)

Egg Weights



Feed Intake¹

		Week 25	Week 31	Week 43
		-----gram/hen/day-----		
Commercial	0% DDGS	83	91	94
	15% DDGS	83	91	94
Low Density	0% DDGS	83	90	95
	15% DDGS	84	92	95
Pooled SEM		0.65	0.73	0.68

¹ Means represent 8 replications per treatment (16 hens/replication)

Specific Gravity¹

	Treatments	Week 25	Week 35	Week 43
Commercial	0% DDGS	1.088	1.085	1.085
	15% DDGS	1.088	1.084	1.085
Low Density	0% DDGS	1.089	1.085	1.086
	15% DDGS	1.087	1.084	1.084
	Pooled SEM	0.0003	0.0004	0.0005

¹ Means represent 16 hens per replication, 128 hens per treatment.

Haugh Units¹

		Week 25	Week 35	Week 43
		-----Haugh units-----		
Commercial	0% DDGS	95.2	91.6	85.4^{ab}
	15% DDGS	96.4	94.5	87.2^a
Low Density	0% DDGS	93.7	95.3	85.9^{ab}
	15% DDGS	95.6	93.8	84.3^b
	Pooled SEM	0.89	1.66	0.66

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

¹ Means represent 8 replications per treatment (16 hens/replication)

Yolk Color¹ (Week 43)

	Treatments	L	a	b
Commercial	0% DDGS	55.16	-2.01 ^b	45.46
	15% DDGS	54.34	-0.11 ^a	47.62
Low Density	0% DDGS	55.13	-1.75 ^b	46.14
	15% DDGS	54.15	-0.19 ^a	48.20
	Pooled SEM	0.19	0.24	0.45

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

¹ Means represent 16 hens per replication, 128 hens per treatment.

Broiler Trials

Materials and Methods

■ Experiment 1

■ Dietary treatments (2 x 2 factorial design)

1. High density diet - 0% DDGS
2. High density diet - 15% DDGS
3. Low density diet - 0% DDGS
4. Low density diet - 15% DDGS

■ Study was conducted in battery brooders from 2 to 18 days of age

Materials and Methods

■ Experiment 2

■ Dietary treatments

1. Corn-Soybean meal basal diet (0% DDGS)
2. Basal diet + 6% DDGS
3. Basal diet + 12% DDGS
4. Basal diet + 18% DDGS

- All diets were formulated to isocaloric and isonitrogenous

- Study was conducted in floor pens from 0 to 42 days of age

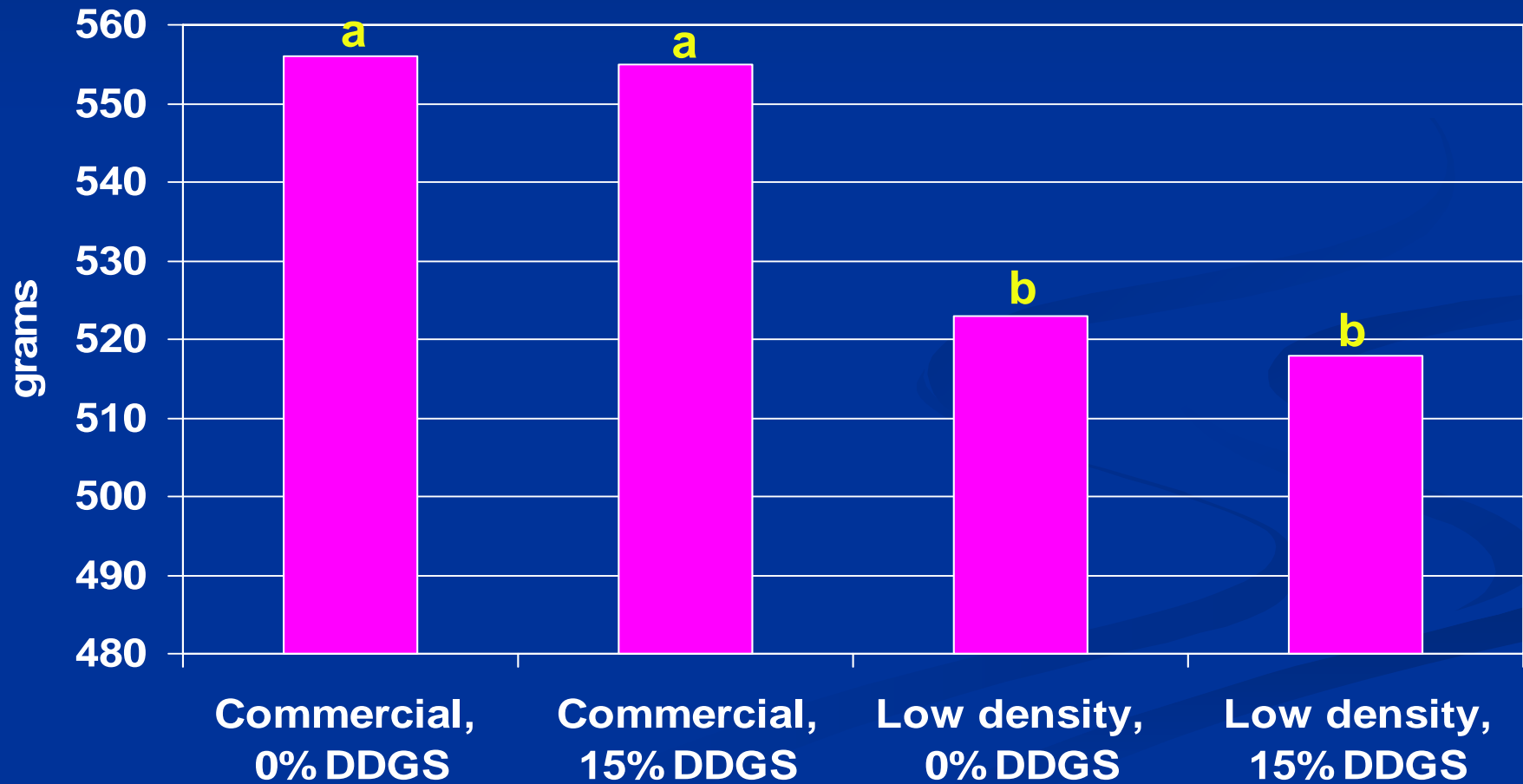
Results from Experiment 1 (2–18 days of age)

	Treatment	Weight gain (g)	Gain:Feed (g:kg)
High Density	0% DDGS	556 ^a	782 ^a
	15% DDGS	555 ^a	772 ^a
Low Density	0% DDGS	523 ^b	712 ^b
	15% DDGS	518 ^b	705 ^b
Pooled SEM		3.8	0.01

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

¹ Means represent 8 pens per treatment, 6 chicks per pen (48 chicks per treatment).

Weight Gain¹ (2-18 days of age)



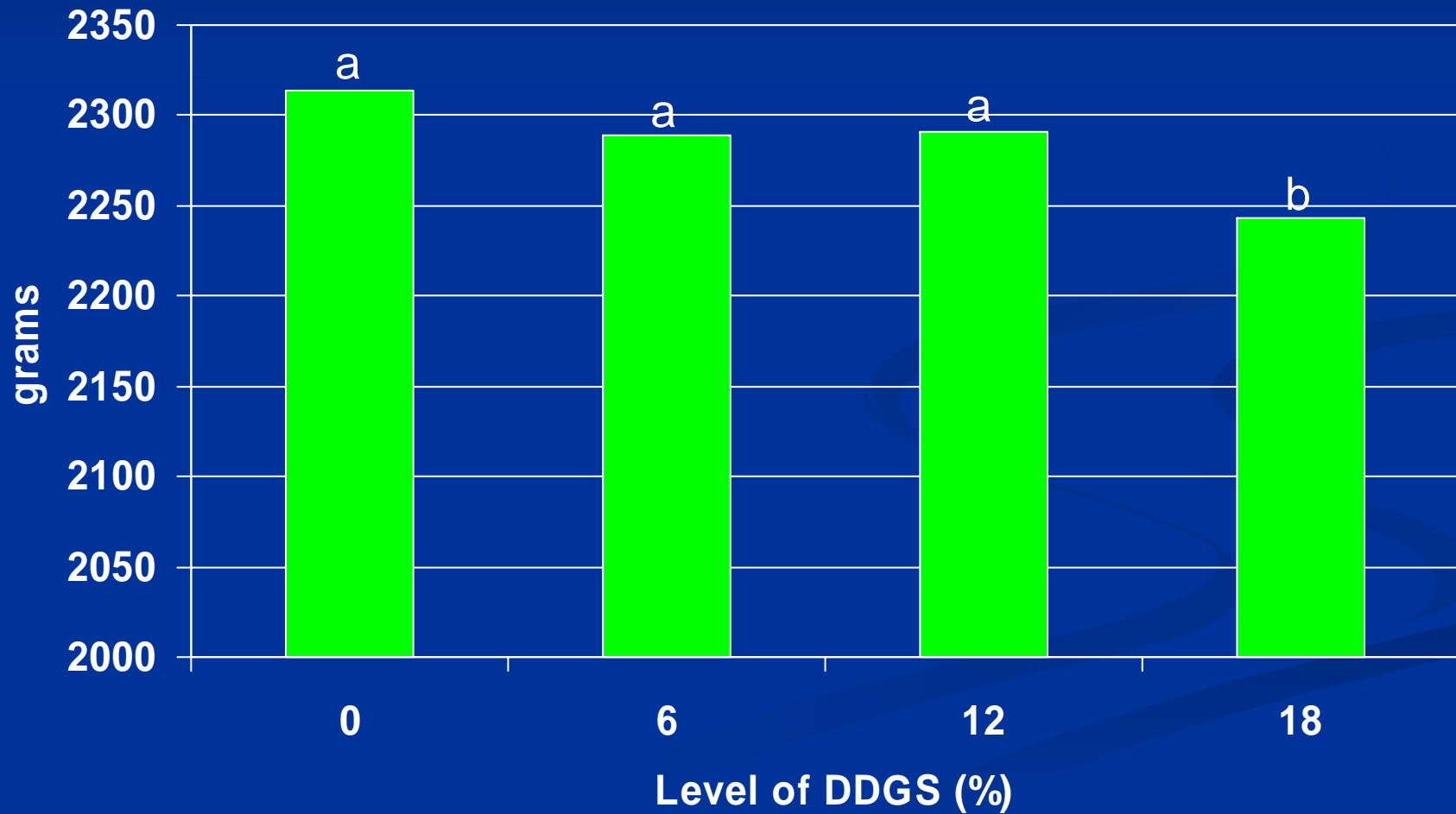
Results from Experiment 2 (0-42 days of age)

% DDGS	Weight gain (g/chick)	Gain:feed ratio (g:kg)
0	2314^a	566
6	2289^a	555
12	2291^a	563
18	2243^b	553
Pooled SEM	14.4	6.7

^{a-b} Means within columns having the same superscript do not differ significantly ($P > 0.05$).

¹ Means represent 6 pens per treatment; 50 chicks per pen (300 chicks per treatment).

Weight Gain¹ (0-42 days of age)



Carcass Yield¹ (%)

% DDGS	Carcass²	Breast³	Wings³	Front half³	Back half³
0	71.2	16.9	11.5	43.0	45.5
6	70.9	16.5	11.7	42.9	45.4
12	70.3	16.8	11.7	43.2	45.2
18	70.8	16.6	11.8	43.0	45.2
SEM	0.80	0.29	0.09	0.29	0.33

¹ Means represent 10 birds per pen, 60 birds per treatment.

² as % of live weight

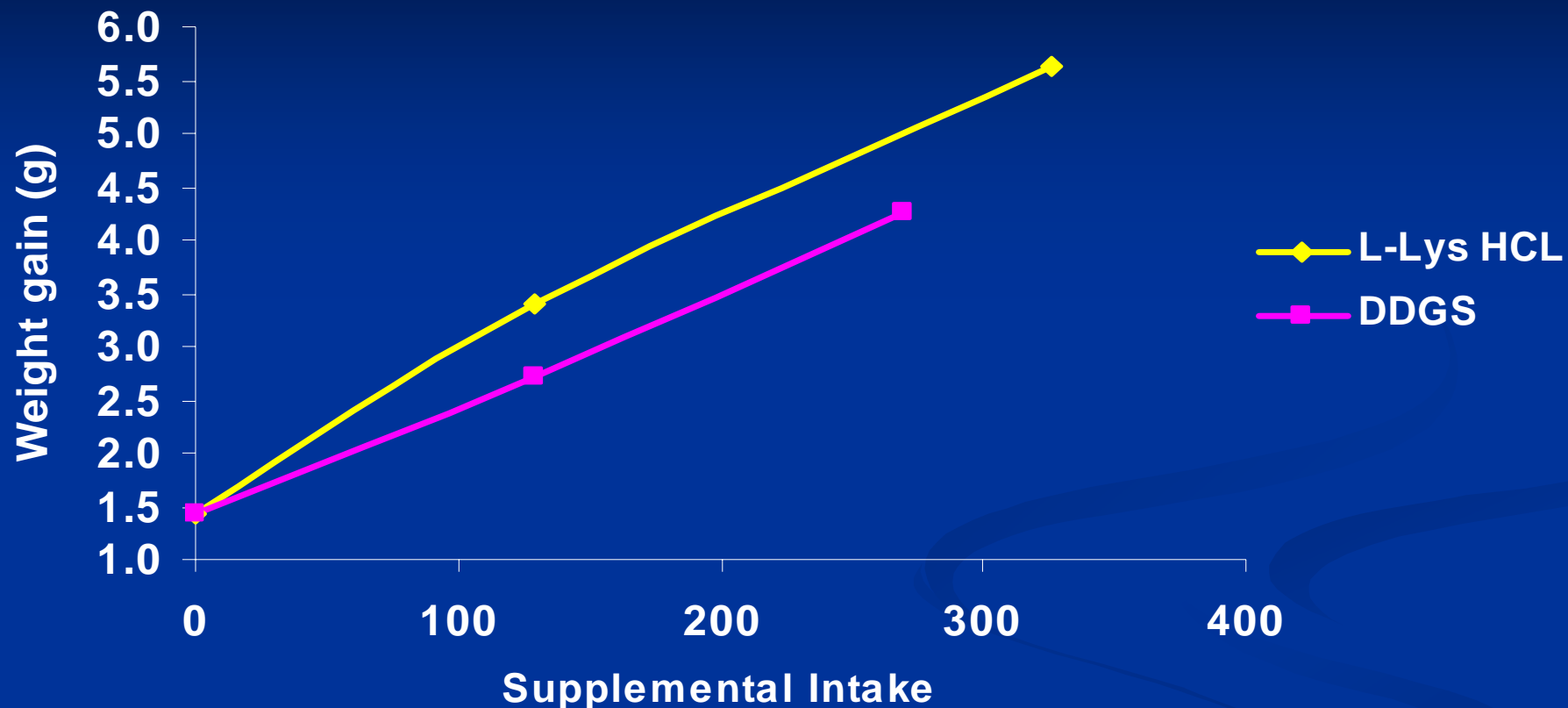
³ as % of chilled carcass weight

Lysine Availability and Digestibility

Materials and Methods

- **Treatments:**
 1. **Basal (cornstarch-corn gluten meal-dextrose) diet - 0.60% total available lysine**
 2. **Basal + 0.10 % Lys**
 3. **Basal + 0.20 % Lys**
 4. **Basal + 8% DDGS**
 5. **Basal + 16% DDGS**
- **Used Multiple liner regression and standard curve methodology to estimate availability based on weight gain and feed efficiency**

Lysine Availability of DDGS



Gain (g) = 14.4 + 0.15 lysine intake (mg) + 0.10 DDGS intake (g); $R^2 = 0.98$

$0.10/0.15 * 100 = 66\%$ bioavailable lysine

$0.66/0.83 * 100 = 80\%$ Available lysine in DDGS

True Amino Acid Digestibility¹

Amino acid	Total Concentration	True AA digestibility (%)
Lys	0.85	75 (65)²
Met	0.56	90 (84)
Cys	0.62	75 (77)
Thr	1.05	76 (72)
Trp	0.28	84
Arg	1.25	84 (63)
Ile	1.03	84 (84)
Leu	3.10	89 (89)

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

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

Lysine Availability (%)

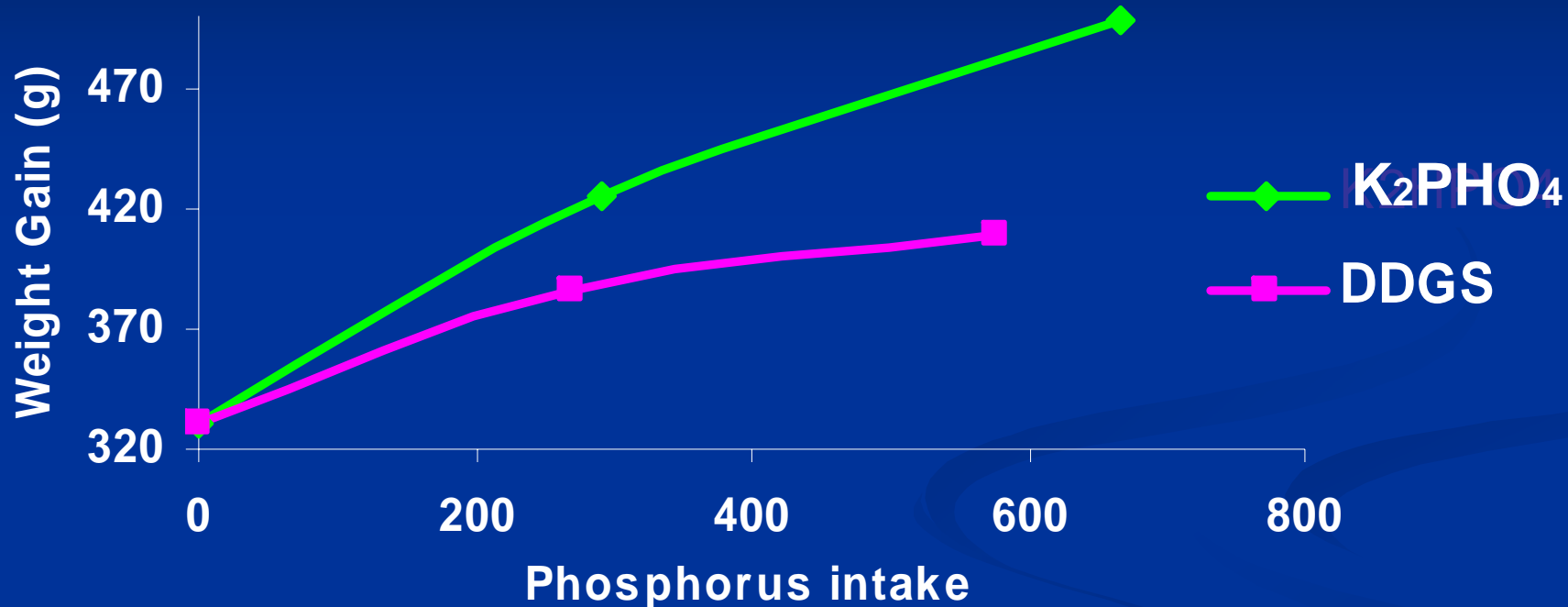
Source	Lysine Bioavailability (chicks)	Lysine Digestibility
Lumpkins et al. 2003 (University of Georgia)	80	75
Parsons et al. (1983)	66	82
Combs and Bossard (1969)	71-93	—

Phosphorus Availability

Materials and Methods

- **Treatments:**
 1. **Basal (Corn-soybean meal) basal diet – 0.12% avail. P**
 2. **Basal + 0.05% avail. P**
 3. **Basal + 0.10% avail. P**
 4. **Basal + 5% DDGS**
 5. **Basal + 10% DDGS**
- **Used Multiple liner regression and standard curve methodology to estimate availability based on weight gain and bone ash**

Phosphorus Availability of DDGS

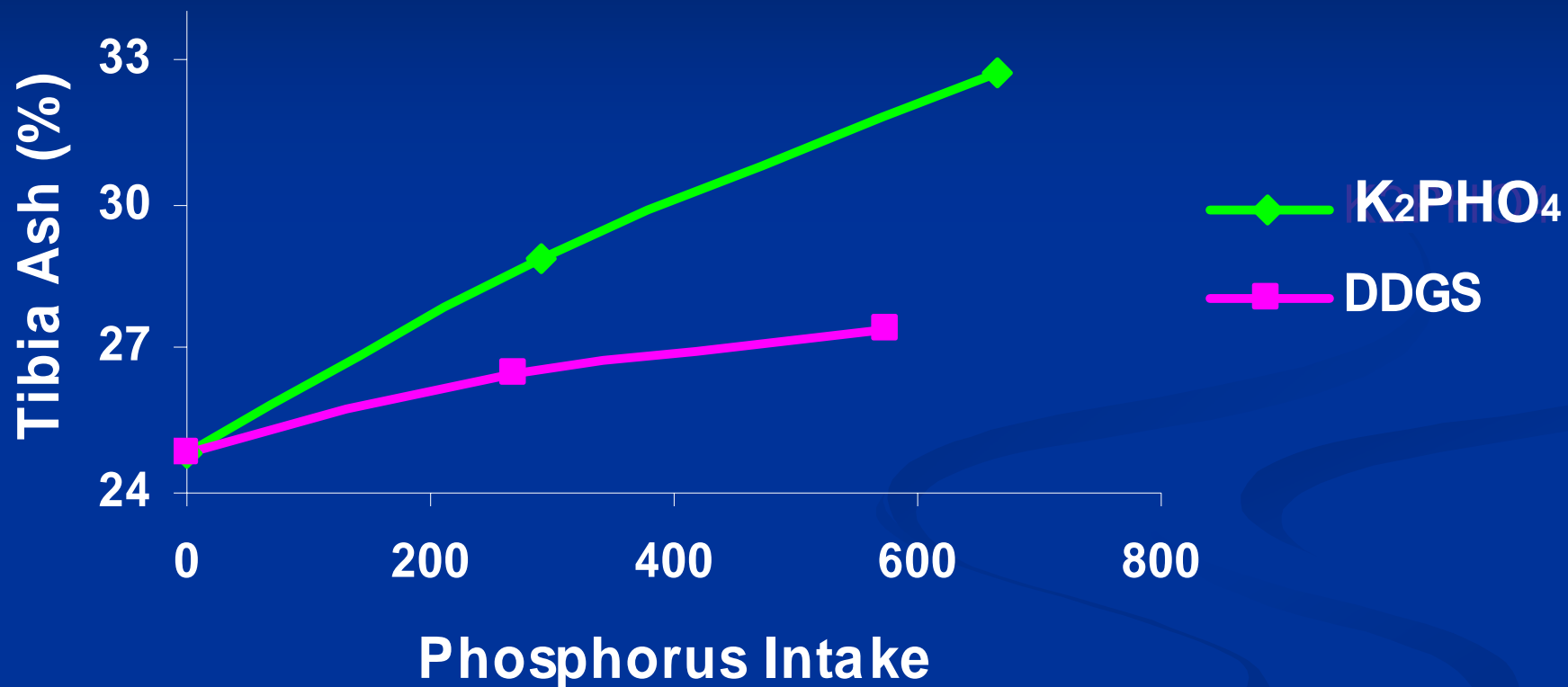


Gain (g) = 324.9 + 0.26 phosphorus intake (mg) + 0.16 DDGS intake (g); $R^2 = 0.78$

$0.16/0.26 * 100 = 62\%$ bioavailable phosphorus

$0.62/0.74 * 100 = 84\%$ Available phosphorus in DDGS

Phosphorus Availability of DDGS



Gain (g) = 25.09 + 0.01 phosphorus intake (mg) + 0.005 DDGS intake (g); R² = 0.81

$0.005/0.01 * 100 = 50\%$ bioavailable phosphorus

$0.50/0.74 * 100 = 68\%$ Available phosphorus in DDGS

Available Phosphorus in DDGS

	% Total Phosphorus	% Phytate Phosphorus	% Available Phosphorus
Corn (NRC 1994)	0.28	0.20	29
DDGS ¹	0.74	0.27	64

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

Mineral Analysis and True Metabolizable Energy

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

Mineral composition of DDGS

	Mineral									
	K	P	Ca	Mg	S	Mn	Fe	Al	Cu	Zn
	%					PPM				
Average	0.91	0.68	0.29	0.28	0.84	22	149	56	10	61
NRC (1994)	0.65	0.72	0.17	0.19	0.30	24	280	—	57	80
Projected¹	0.90	0.84	0.06	0.36	0.24	21	135	—	9	54

¹ Projected assuming a 3 fold increase compared to yellow corn grain, NRC (1994)

True Metabolizable Energy

Sample	TME _n Kcal/lb	TME _n Kcal/kg	Crude Protein
	(as-fed basis)		(%)
1	1353	2978	28
2	1320	2904	30
3	1399	3079	28
4	1321	2906	30
5	1310	2883	30
Average	1341	2950	29

Summary

- When 15% DDGS was incorporated to a commercial grade laying hen diet no differences for any of the parameters measured was observed.
- The incorporation of 15% DDGS to the low density laying hen diet did result in a slight depression in egg production.
- No differences were observed in chick performance for chicks consuming up to 15% DDGS
- Chick weight gains were slightly depressed due to 18% inclusion level of DDGS
 - Could be due to the high level of protein ($\pm 40\%$) from corn

Summary

- **The available/digestible lysine of DDGS**
 - 78% based on chick growth assay
 - 75% based total fecal collection of adult cecectomized roosters
- **The available phosphorus of DDGS**
 - Wt gain = 84%; tibia ash= 68% based on chick growth assays
 - Available phosphorus = 64%

Available lysine and phosphorus values reported for DDGS are improved from book values

Summary

- **The sodium content of DDGS proved to be extremely variable (0.09 – 0.44%)**
- **The average composition of other minerals agreed with projected values (based on a 3x increase of levels in yellow corn grain)**
- **True metabolizable values of “new generation” DDGS are higher than previously reported**

Conclusion

- **“New generation” DDGS is an excellent source of energy, digestible amino acids, and available phosphorus for poultry**
- **Distiller’s dried grains plus solubles is a highly acceptable feed ingredient for poultry rations**

Limiting Factors for DDGS Use in Poultry Diets

- **Protein composition – Amino acid balance**
 - Formulating diets for digestible or total amino acids (not crude protein)
- **High fiber limits its maximum inclusion level**
- **Nutrient quality** (nutrient specifications)
- **Consistent product**
- **Distribution- shipping and handling**
- **Mycotoxins**

Benefits of DDGS in Poultry Diets?

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

Recommended Maximum Inclusion rates of DDGS for Poultry diets

- **Broilers**
 - 10% inclusions rates during starter period
 - 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