

Alternative Feed Ingredient Availability and Use

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Introduction

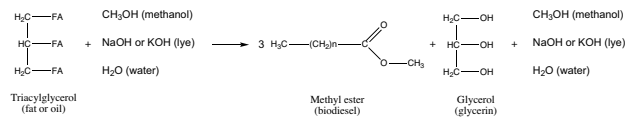
- ◆ Feed energy prices have increased sharply
 - Cereal grains
 - Oilseed meals
 - Fats and oils
- ◆ Need for alternative ingredients
 - Energy
 - Protein

Alternative feed ingredients

- ◆ Energy sources
 - Crude glycerin
 - Energy value
 - How much can you feed?
- ◆ Protein sources
 - Corn DDGS
 - How much can you feed?

Crude glycerin

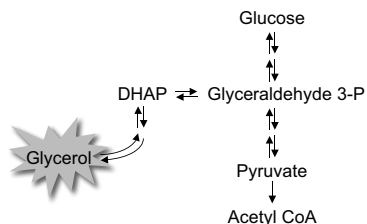
◆ Biodiesel manufacturing



Crude glycerin

◆ Glycerol metabolism

- Glucose
- Energy
- Fat synthesis
 - Fatty acids
 - Triacylglycerols



Crude glycerin

◆ Energy value of crude glycerin?

- Pure glycerin
 - 4,100–4,300 kcal/kg gross energy
- Crude glycerin
 - 3,600–3,800 kcal/kg gross energy
 - Metabolizable energy content is unknown

◆ Objective of study

- Determine AMEn of crude glycerin for laying hens



Materials and methods

◆ Basal diet

- Glucose•H₂O
 - 3,640 kcal/kg AMEn

◆ 4 treatments

- 0, 5, 10, and 15% crude glycerol replacing glucose•H₂O

Basal diet (Hy-Line W-36, 30 wk of age)

Item	Amount (%)
Ingredient	
Corn	39.82
Soybean meal (48% CP)	21.00
Meat and bone meal (60% CP)	9.60
Glucose•H ₂ O	15.00
Celite	1.00
Others*	4.35
Total	100.00
Calculated composition	
Crude protein	17.85
AMEn, kcal/kg	2,875
Linoleic acid	2.16
Calcium	4.51
Phosphorus (non-phytate)	0.51
Methionine + cystine	0.77
Lysine	0.96

*DL-Met, soy oil, CaCO₃, trace mineral premix, vit premix



Materials and methods

◆ Basal diet

- Glucose•H₂O
 - 3,640 kcal/kg AMEn

◆ 4 treatments

- 0, 5, 10, and 15% crude glycerol replacing glucose•H₂O

Crude glycerol*

Item	Amount (%)
Glycerol	86.95
Moisture	9.22
Methanol	0.03
Crude protein	0.41
Crude fat	0.12
Ash	3.19
Sodium	1.26
Chloride	1.86
Potassium	<0.01
pH	5.33
Gross energy, kcal/kg	3625 ± 25

*AGP Inc., Sergeant Bluff, IA



Material and methods

◆ 48 Hy-Line W-36 hens

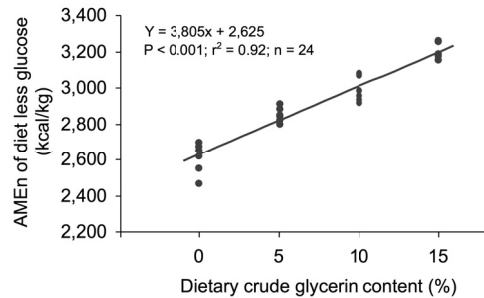
- 30 wk of age

◆ 10 d trial

- 7 d adaptation
- 3 d collection



Results



AMEn of crude glycerin = 3,805 ± 238 kcal/kg (as-is)



Egg production data*

Item	Dietary crude glycerol (%)				SEM	P
	0	5	10	15		
Feed consumption, g/d	108.0	102.3	100.1	105.6	4.3	0.59
Egg production, %	90.9	94.7	93.2	93.2	2.6	0.79
Egg weight, g/egg	55.9	55.4	57.0	56.3	0.3	0.65
Egg mass, g/hen/d	50.8	52.5	53.2	52.5	1.9	0.83

*Data from entire 10-d period; means ± SEM, n = 6



Crude glycerin use

◆ Feed flowability

- Max 5–10% (?) crude glycerin in mash diets
 - Higher contents in pelleted diets?

◆ Quality variation

- Glycerin content
- Fatty acid content
- Salt content (NaCl or KCl)
- Methanol (CH₃OH)
 - Max 150 ppm (0.015%) allowed by FDA



Photo courtesy of Dr. Brian Kerr, USDA/ARS



Corn DDGS

◆ Dietary corn DDGS inclusion

- Industry
 - Anywhere from 0–20%
 - Most (that use corn DDGS) feed 5–10%
- Published research
 - 0–15%

◆ How high can you go...?



Material and methods

Ingredient	Corn DDGS treatment			
	0%	23%	46%	69%
	%			
Corn DDGS	–	23.00	46.00	69.00
Corn	61.08	41.64	20.89	0.22
Soybean meal (48% CP)	19.00	15.00	12.00	9.00
Meat and bone meal (50% CP)	7.10	5.70	4.30	2.80
Vegetable oil	2.08	3.68	5.50	7.32
DL-Methionine	0.23	0.17	0.11	0.04
Calcium carbonate	9.76	10.16	10.55	10.97
Salt (iodized)	0.10	–	–	–
Traceminer premix	0.30	0.30	0.30	0.30
Vitamin premix	0.35	0.35	0.35	0.35
Total	100.00	100.00	100.00	100.00



Material and methods

Item	Corn DDGS treatment			
	0%	23%	46%	69%
	%			
MEn, kcal/kg	2,850	2,850	2,850	2,850
Crude protein*	17.36	18.22	20.29	21.90
Methionine + cystine (digest.)	0.73	0.73	0.73	0.73
Lysine (digest.)	0.88	0.85	0.85	0.84
Ether extract*	4.71	7.35	13.16	16.96
Linoleic acid	1.45	2.15	2.82	3.50
Neutral detergent fiber	9.86	13.16	16.43	19.67
Acid detergent fiber	3.13	4.37	5.61	6.86
Calcium	4.50	4.50	4.50	4.50
Phosphorus (non-phytate)	0.40	0.40	0.40	0.40
Potassium	0.66	0.69	0.73	0.77
Sodium	0.19	0.19	0.21	0.24
Chloride	0.28	0.24	0.26	0.27

*Analyzed values

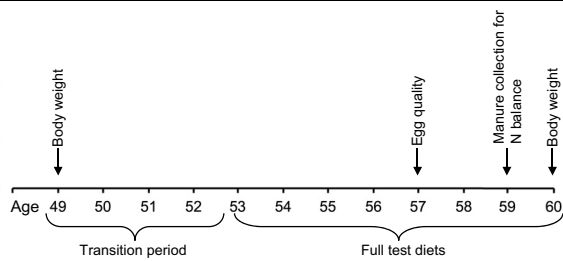


Material and methods

Week of exp.	Age	Corn DDGS treatment			
		0%	23%	46%	69%
		% corn DDGS in diet			
	Weeks				
–2	47	10	10	10	10
–1	48	10	10	10	10
1	49	0	23	23	23
2	50	0	23	35	35
3	51	0	23	46	46
4	52	0	23	46	58
5	53	0	23	46	69
6	54	0	23	46	69
7	55	0	23	46	69
8	56	0	23	46	69
9	57	0	23	46	69
10	58	0	23	46	69
11	59	0	23	46	69
12	60	0	23	46	69



Materials and methods



◆ Every week

- Feed consumption
- Egg weight
- Egg production
- Egg mass



Materials and methods

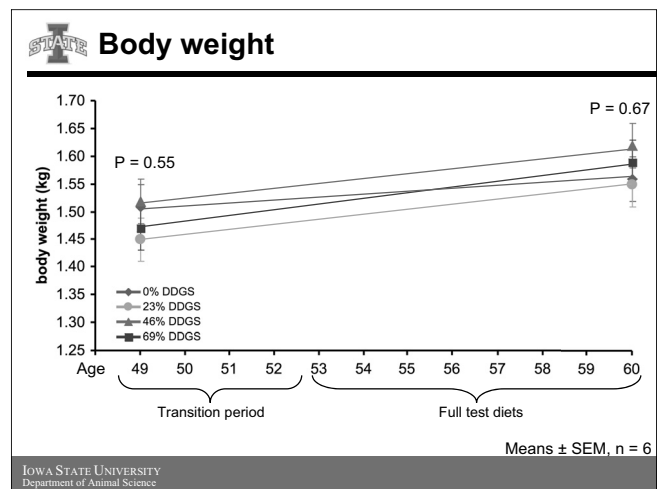
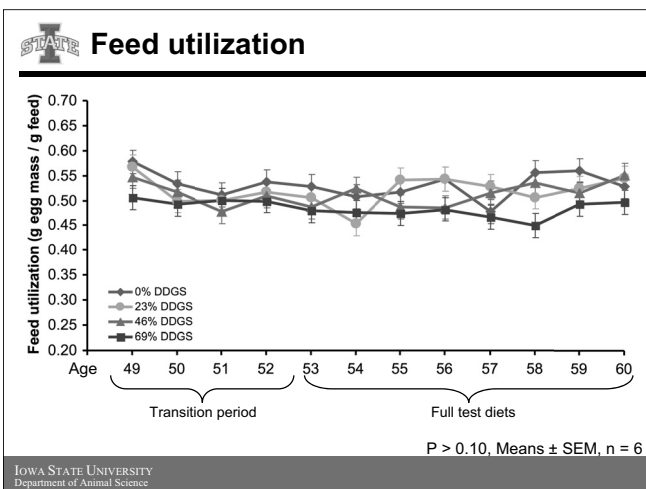
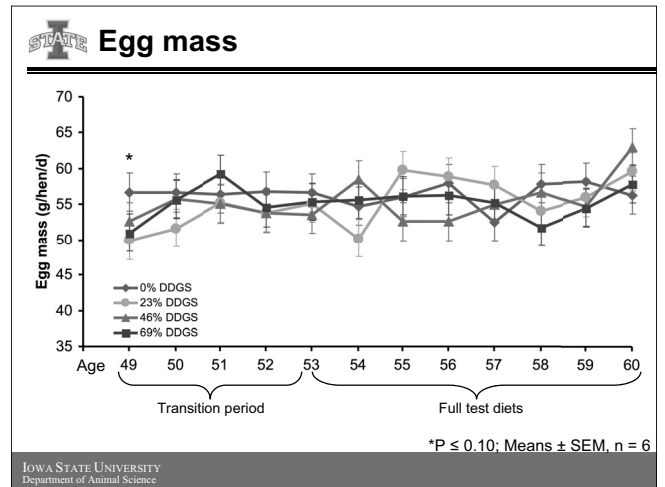
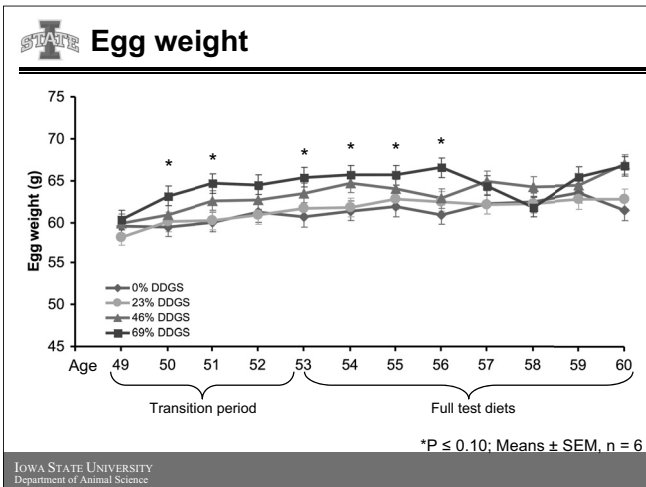
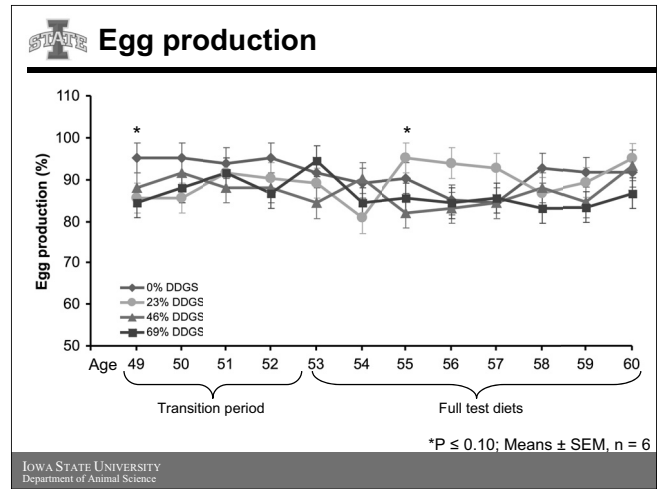
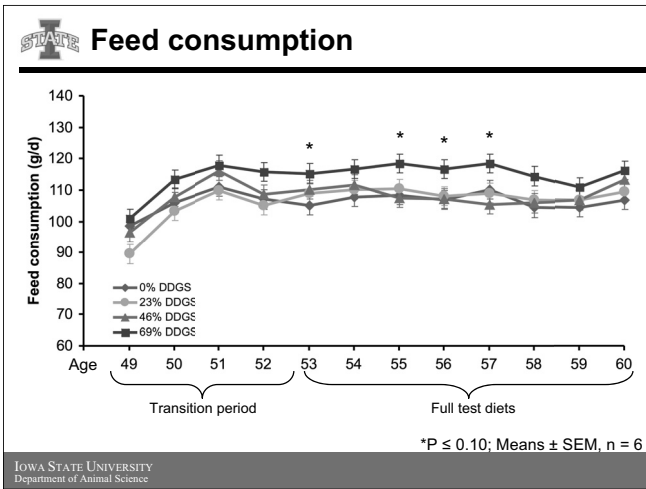
◆ Only 24 cages!

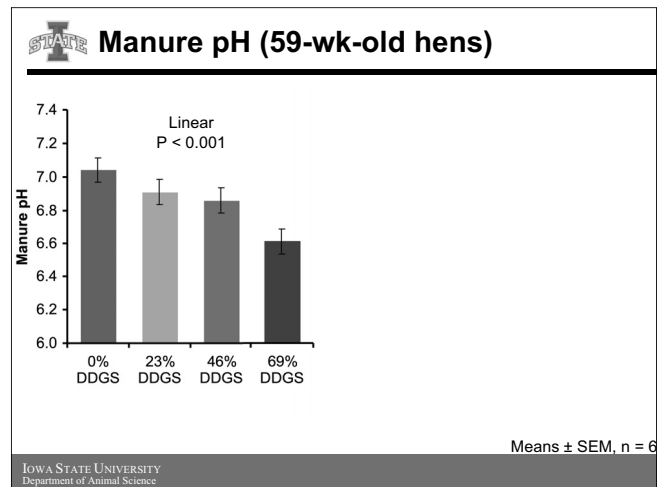
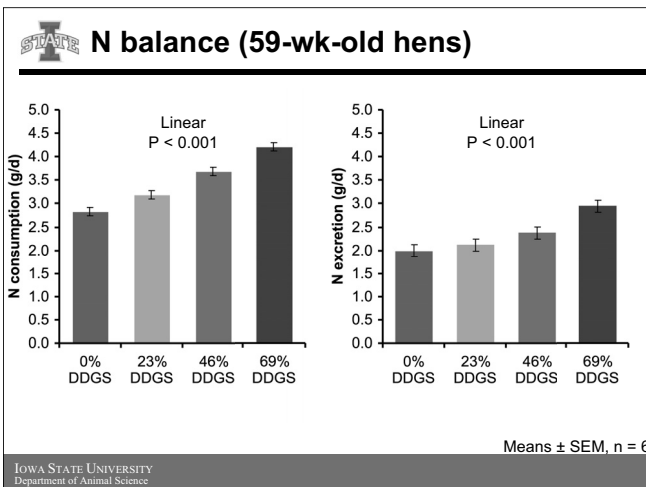
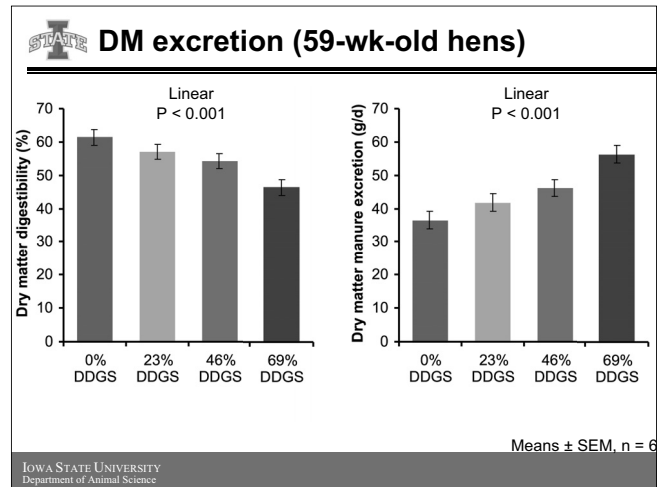
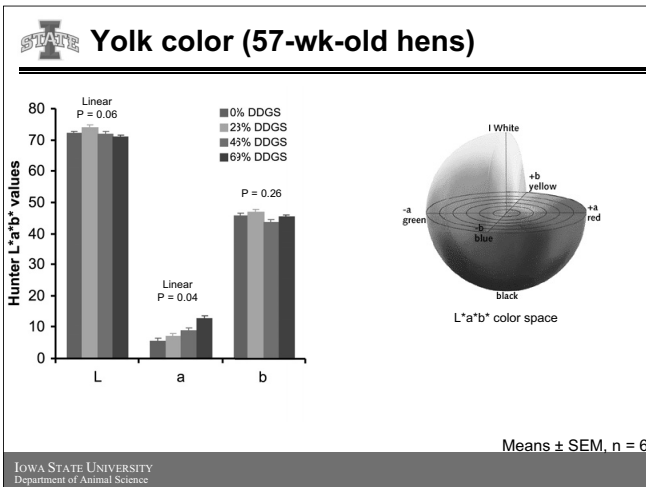
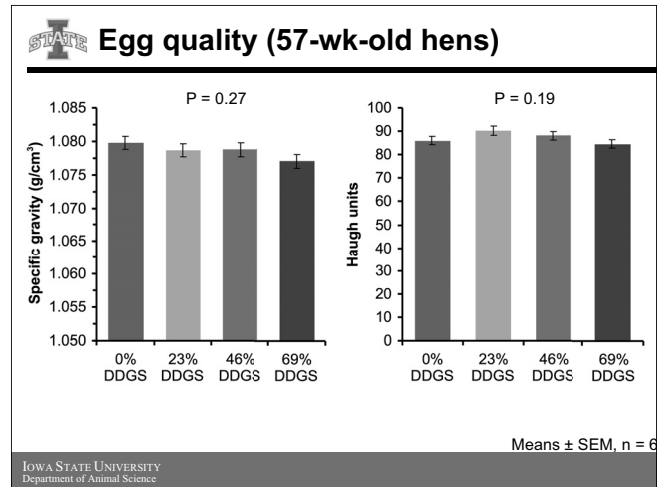
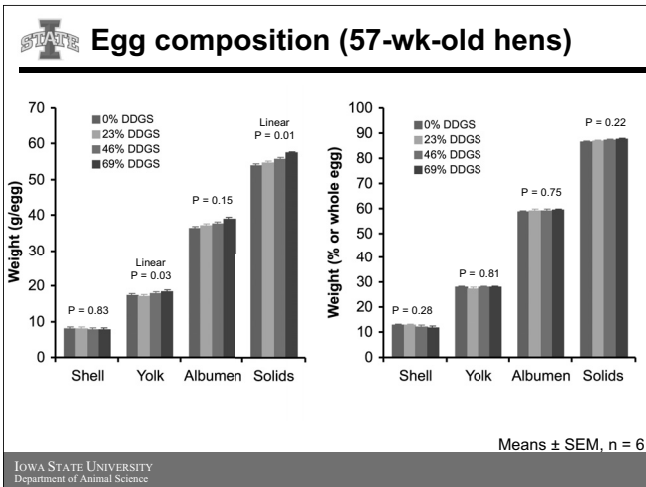
- 48 hens total
 - Hy-Line W-36



◆ Statistics

- 4 diets
- 6 replications
- ANOVA
 - Linear and quadratic contrasts
 - $P \leq 0.10$ considered significant







Discussion

- ◆ **Feeding high levels of co-products appear to be OK if**
 - Nutrient and energy contents are known
 - Diets formulated on digestible amino acid basis
- ◆ **However, excretion increases**
 - Nitrogen
 - Dry matter manure



ISU poultry nutrition research support

- ◆ ADM
- ◆ Ag Processing (AGP), Inc.
- ◆ Alaska Manufacturing and Extension Partnership
- ◆ Alaska Protein Recovery
- ◆ APC, Inc.
- ◆ Center for Designing Foods to Improve Nutrition, ISU
- ◆ Dakota Gold Research Association
- ◆ Darling International
- ◆ Degussa Corporation
- ◆ DSM Nutritional Products
- ◆ Feed Energy Company
- ◆ Golden Harvest Seeds
- ◆ ILC Resources
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- ◆ Iowa Egg Council
- ◆ Iowa Turkey Federation
- ◆ Kent Feeds
- ◆ Lincolnway Energy
- ◆ Midwest Poultry Research Program
- ◆ Novus International
- ◆ Nutra-Flo Company
- ◆ Rembrandt Enterprises
- ◆ Rose Acres
- ◆ Southwest Iowa Eggs
- ◆ Sparboe Farms
- ◆ United Egg Producers
- ◆ USDA Natural Res. Conservation Service



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