Small Flock Poultry Program

Monday, May 18: Getting Your Flock Started
Tuesday, May 19: Healthy Management Practices
Wednesday, May 20: How to Increase Egg Production
Thursday, May 21: Egg Handling, Food Safety and Egg Sales

TEXAS A&M AGRILIFE EXTENSION
Key Elements of Egg Production

- **Bird genetics**  (discussed in Monday’s webinar)
- **Bird health**  (discussed in Tuesday’s webinar)
- Proper pullet development
- Proper lighting
- **Adequate, balanced nutrition**

That’s it!
Also Discussed Today

- Enhancing egg properties
  - Shell quality
  - Yolk color
  - Egg nutritional content (omega-3 fatty acids)
- Avoiding nutritional pitfalls
- Feed and plant toxicity
Commercial vs Heritage Breeds

AVERAGE HEN DAY EGG PRODUCTION

HEN DAY PRODUCTION (%)

100
90
80
70
60
50
40
30
20
10
0

PRODUCTION PERIOD

1 2 3 4 5 6 7

Black Australorp
Barred Plymouth Rock
Black Sex-linked
ISA Brown
Rhode Island Red
Red Sex-linked

Commercial strain

Slide courtesy of Dr. Jacquie Jacob, University of Kentucky Poultry Extension
Hy-line, Bovans or ISA brown commercial layers
Brown Egg Layers

Production Reds

Barred Plymouth Rocks

Rhode Island Reds

Silver Laced Wyandottes

New Hampshire Reds

Sex Links (not pictured)

Slide courtesy of Ideal Poultry
What stimulates a hen to lay an egg?

Roosters? NO
Feed? NO
Temperature? NO
Age? NO
Artificial hormones or steroids? NO!
It’s light!

- Birds are photostimulatory.
- They respond to changes in photoperiod (hours per day).
Day length is the most important facet for stimulation of sexual maturity and egg production.

General relationship is:
- Increasing photoperiod = stimulation of sexual maturity
- Decreasing photoperiod = delay of sexual maturity
Light Physiology

- During pullet growing period, day length should **NOT increase**
- Must decrease or remain constant
- Less than 12 hours of day length is best during pullet growth
- **12 hours** of day length is considered the threshold needed to stimulate egg production
With natural lighting, egg production will be suppressed in the fall and winter and resume in the spring and summer.
With natural lighting, egg production will be suppressed in the fall and winter and resume in the spring and summer.
With natural lighting, egg production will be suppressed in the fall and winter and resume in the spring and summer.
Conversely, to maintain maximum egg production during the laying period, day length must **NOT decrease**.

- Must increase or remain constant
- 15 - 16 hours is recommended for a constant day length
Example Lighting Program

DEKALB WHITE Lighting Programs

Correct age for sexual maturity

16 hours
Controlling day length can be achieved with simple timers
Starting chicks using only natural lighting in spring time
Starting chicks using only natural lighting in spring time

![Graph showing natural day length over weeks from April 15 to October 15, with peaks and troughs representing different age groups.](image)
Must add hours of light to stimulate egg production.
Starting chicks using only natural lighting

Natural daylength

- Aug 17
- Dec 21
- Feb 8
What kind of light do I need?

This is what we see
The hypothalamus is located at the base of the brain under the skull and contains photoreceptor cells.

The hypothalamus is what needs to be stimulated.
Impact of Color on Stimulation

- Red light will penetrate better into the tissues than blues and greens.
- Therefore, red light is more stimulatory for egg production.
Spectral Output of Bulbs

Incandescent

Compact Fluorescent

LED 1

LED 2

LED 3
What kind of bulb?

- Acceptable:
  - Incandescent bulbs
  - Warm-white fluorescent (2700 – 3500 K)
  - Warm-white LED (2700 – 3500 K)

- Not good:
  - Cool-white fluorescent (3500 K or higher)
  - Bright-white LED (3500 K or higher)
Choosing a Bulb for Hens

2700 – 3500 K good

no good
Feeding Layer Pullets

- Pullets should be fed in phases so nutritional requirements for development are met:
  - **Starter (0 - 6 to 8 weeks)**
    
    18-20% crude protein, 1% Ca
  - **Grower (6 to 8 - 16 weeks)**
    
    15-16% crude protein, 1% Ca
  - **Pre-lay (16 weeks – light stimulation, 18 to 20 weeks)**
    
    15-17% crude protein, 2-2.5% Ca
    (probably easiest to accomplish by mixing grower and layer feed 50/50)
Poultry
Grower/Finisher 15%

A Complete Formula for Growing and Finishing Poultry.

NET WT. 50 lb (22.67kg)
POULTRY GRO/FINISH
15% (GD)

This feed is designed to be fed to growing and finishing poultry.

GUARANTEED ANALYSIS:

<table>
<thead>
<tr>
<th>Component</th>
<th>Min.</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crude Protein</td>
<td>15.0%</td>
<td></td>
</tr>
<tr>
<td>Lysine</td>
<td>0.65%</td>
<td></td>
</tr>
<tr>
<td>Methionine</td>
<td>0.29%</td>
<td></td>
</tr>
<tr>
<td>Crude Fat</td>
<td>2.70%</td>
<td></td>
</tr>
<tr>
<td>Crude Fiber</td>
<td>5.0%</td>
<td></td>
</tr>
<tr>
<td>Calcium</td>
<td>0.6%</td>
<td></td>
</tr>
<tr>
<td>Phosphorus</td>
<td>0.4%</td>
<td></td>
</tr>
<tr>
<td>Salt</td>
<td>0.2%</td>
<td></td>
</tr>
<tr>
<td>Sodium</td>
<td>0.2%</td>
<td></td>
</tr>
<tr>
<td>Selenium</td>
<td>0.3 PPM</td>
<td></td>
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</tbody>
</table>

INGREDIENTS:
Grain Products, Plant Protein Products, Processed Grain By Products, Animal Protein Products, Cane Molasses, Vitamin A Supplement, Vitamin D Supplement, Vitamin E Supplement, Vitamin B12 Supplement, Riboflavin Supplement, Thiamine Mononitrate, Pyridoxine Hydrochloride, Menadione Sodium Bisulfite Complex (source of Vitamin K activity), Biotin, Folic Acid, Choline Chloride, DL-Methionine Hydroxy Analogue, Calcium Carbonate, Dicalcium Phosphate, Monocalcium Phosphate, Salt, Manganese Oxide, Manganese Sulfate, Ferrous Sulfate, Copper Chloride, Copper Sulfate, Zinc Oxide, Zinc Sulfate, Ethylenediamine Dihydroiodide, Sulfur, Propionic Acid (a preservative).

FEEDING DIRECTIONS: Feed DUMOR® Poultry Grower/Finisher 15% as the sole ration to pheasant, quail, turkey, and chukar from 12 weeks until market or up until one month prior to egg production. Feed as sole ration to chickens, ducks, and geese greater than 10 weeks of age until one month prior to egg production.

For laying and breeding hens, begin feeding DUMOR® Poultry Layer 16% one month prior to egg production.

This is a complete and balanced ration. Do not blend with grain.

Provide access to clean drinking water at all times.

Store feed in a dry, well ventilated area protected from rodents and insects. Do not feed moldy or insect-infested feed to animals as this may cause illness, abortion, or death.

Ruminant Meat and Bone Meal Free
Made in U.S.A.
Feeding Laying Hens

- Suggested daily nutrient intake per hen (under ideal conditions)

  Crude protein: 17g  
  Metabolizable energy: 280 kcal  
  Methionine (essential amino acid): 360 mg  
  Lysine (essential amino acid): 720 mg  
  Calcium: 3.5 grams  
  Available phosphorus: 0.4 gram

Feeding Laying Hens

- **Suggested daily nutrient intake per hen (under ideal conditions)**

  consumption = **100 g/hen/day**
  (about **1/4 lb/day**)

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Value</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crude protein</td>
<td>17g</td>
<td>17%</td>
</tr>
<tr>
<td>Metabolizable energy</td>
<td>280 kcal</td>
<td>1271 kcal/lb</td>
</tr>
<tr>
<td>Methionine</td>
<td>360 mg</td>
<td>0.36%</td>
</tr>
<tr>
<td>Lysine</td>
<td>720 mg</td>
<td>0.72%</td>
</tr>
<tr>
<td>Calcium</td>
<td>3.5 grams</td>
<td>3.5%</td>
</tr>
<tr>
<td>Available P</td>
<td>0.4 grams</td>
<td>0.4%</td>
</tr>
</tbody>
</table>
The image shows two bags of Dumor poultry feed. The bag on the left is labeled "Layer 16% Pellets" and the bag on the right is labeled "Layer 16% Crumble." Both bags are intended for egg-producing poultry. The text "broken" is indicated by an arrow pointing to the left bag.
**GUARANTEED ANALYSIS:**

<table>
<thead>
<tr>
<th>Component</th>
<th>Min.</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crude Protein</td>
<td>16.0%</td>
<td></td>
</tr>
<tr>
<td>Lysine</td>
<td>0.7%</td>
<td></td>
</tr>
<tr>
<td>Methionine</td>
<td>0.35%</td>
<td></td>
</tr>
<tr>
<td>Crude Fat</td>
<td>2.5%</td>
<td></td>
</tr>
<tr>
<td>Crude Fiber</td>
<td></td>
<td>7.0%</td>
</tr>
<tr>
<td>Calcium</td>
<td>3.8%</td>
<td>4.8%</td>
</tr>
<tr>
<td>Phosphorus</td>
<td>0.25%</td>
<td>0.5%</td>
</tr>
<tr>
<td>Salt</td>
<td>0.1%</td>
<td>0.2%</td>
</tr>
<tr>
<td>Sodium</td>
<td>0.25%</td>
<td>0.5%</td>
</tr>
</tbody>
</table>

**INGREDIENTS:**
- Grain Products, Plant Protein Products, Processed Grain By-
- Products,
- Vitamin A Supplement, Vitamin D Supplement, Vitamin B
- Supplement, Vitamin B12 Supplement, Riboflavin
- Supplement, Niacin Supplement, B-Calcium Pantothenate
- Supplement, Pyridoxine Hydrochloride, Folic Acid, Menadione Sodium
- Pyridoxine Pyruvate, Thiamine, Biotin, L-Lysine, DL-Methionine Hydroxy
- Mononitrate, B12, L-Lysine, DL-Methionine Hydroxy
- Analogue,
- Calcium Carbonate, Dicalcium Phosphate, Manganese
- Phosphate, Salt, Bentonite, Manganese Sulfate, Manganese
- Sulfate, Ferrous Sulfate, Copper Chloride, Copper Sulfate,
- Zinc Oxide, Zinc Sulfate, Ethylenediamine Dihydroiodide,
- Sodium Selenite, Propionic Acid (as a preservative).

**FEEDING DIRECTIONS:**

Feed DUMOR® Poultry Layer 16% as the sole ration to hens producing eggs for human consumption beginning at 18 weeks of age.

For breeding hens, begin feeding DUMOR® Poultry Layer 16% one month prior to egg production. This is a complete and balanced ration. Do not blend with grain. Provide access to clean drinking water at all times.

Furnish grit and/or oyster shell as supplement to daily diet. Store feed in a dry, well-ventilated area protected from rodents and insects. Do not feed moldy or insect-infested feed to animals as this may cause illness, abortion, or death.

Ruminant Meat and Bone Meal Free
Made In U.S.A.
This feed is designed to be fed to caged layers and free-range hens from onset of egg production to the end of the laying cycle.

**GUARANTEED ANALYSIS:**

<table>
<thead>
<tr>
<th>Nutrient</th>
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<td>0.5%</td>
</tr>
<tr>
<td>Sodium</td>
<td>0.1%</td>
<td>0.2%</td>
</tr>
</tbody>
</table>

**INGREDIENTS:**

- Grain Products, Plant Protein Products, Processed Grain By-Products,
- Vitamin A Supplement, Vitamin D Supplement, Vitamin B
- Supplement, Vitamin B12 Supplement, Riboflavin
- Supplement, Niacin Supplement, D-Calcium Pantothenate
- Pyridoxine Hydrochloride, Folic Acid, Menadione Sodium
- Bisulfite Complex (source of Vitamin K activity), Thiamine
- Mononitrate, Biotin, L-Lysine, DL-Methionine Hydroxy
- Analogue,
- Calcium Carbonate, Dicalcium Phosphate, Manganese
- Phosphate, Salt, Bentonite, Manganese Oxide, Manganese
- Sulfate, Ferric Sulfate, Copper Chloride, Copper Sulfate,
- Zinc Oxide, Zinc Sulfate, Ethylenediamine Dihydroiodide,
- Sodium Selenite, Propionic Acid (a preservative).

**FEEDING DIRECTIONS:**

Feed DUMOR® Poultry Layer 16% as the sole ration to hens producing eggs for human consumption beginning at 18 weeks of age.

For breeding hens, begin feeding DUMOR® Poultry Layer 16% one month prior to egg production. This is a complete and balanced ration. Do not blend with grain. Provide access to clean drinking water at all times.

Furnish grit and/or oyster shell as supplement to daily diet. Store feed in a dry, well ventilated area protected from rodents and insects. Do not feed moldy or insect-infested feed to animals as this may cause illness, abortion, or death.

Ruminant Meat and Bone Meal Free
Made In U.S.A.
Layer nutrition pitfall #1
This feed is designed as an energy source for growing and laying poultry.

GUARANTEED ANALYSIS:
Crude Protein: Min. 8.0 %
Crude Fat: Min. 2.5 %
Crude Fiber: Max. 4.5 %

INGREDIENTS:
Grain Products, Soybean Oil.

FEEDING DIRECTIONS:
Feed Producer’s Pride® Scratch Grains as an energy supplement to growing and laying poultry. Producer’s Pride® Scratch Grains is not a complete feed and should not be offered free choice. Provide specific poultry feeds for the birds being raised at the rate of 90% or greater of the poultry’s daily diet. Scatter Producer’s Pride® Scratch Grains on dry ground where poultry species are present. Scratch grains are not fortified and should not comprise more than 10% of total daily intake for poultry.

Provide plenty of fresh clean water at all times.

Store feed in a dry, well ventilated area protected from rodents and insects. Do not feed moldy or insect infested feed to chicks as this may cause illness, abortion, or death.

Ruminant Moor and Bone Meal Free
Made in U.S.A.
This feed is designed as an energy source for growing and laying poultry.

**GUARANTEED ANALYSIS:**

- Crude Protein: Min. 8.0%
- Crude Fat: Min. 2.5%
- Crude Fiber: Max. 4.5%

**INGREDIENTS:**

Grain Products, Soybean Oil.

**FEEDING DIRECTIONS:**

Feed Producer's Pride® Scratch Grains as energy supplement to growing and laying poultry. Producer's Pride® Scratch Grains is not a complete feed and should not be offered free choice. Provide specific poultry feeds for the birds being raised at the rate of 90% or greater of the poultry’s daily diet. Scatter Producer’s Pride® Scratch Grains on dry ground where poultry species are present. Scratch grains are not fortified and should not comprise more than 10% of total daily intake for poultry.

Provide plenty of fresh, clean water at all times.

Store feed in a dry, well ventilated area protected from rodents and insects. Do not feed moldy or insect infested feed to chicks as this may cause illness, abortion, or death.

Ruminant Meat and Bone Meal Free
Made In U.S.A.
# TAMU Poultry Farm Layer Diet

Can be fed as a mash feed – pelletizing not necessary

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ground corn</td>
<td>59.5</td>
</tr>
<tr>
<td>Soybean meal</td>
<td>27.3</td>
</tr>
<tr>
<td>DL-methionine</td>
<td>0.14</td>
</tr>
<tr>
<td>Lysine</td>
<td>0.14</td>
</tr>
<tr>
<td>Limestone</td>
<td>10.7</td>
</tr>
<tr>
<td>Monocalcium phosphate</td>
<td>1.6</td>
</tr>
<tr>
<td>Salt</td>
<td>0.38</td>
</tr>
<tr>
<td>Trace mineral premix</td>
<td>0.05</td>
</tr>
<tr>
<td>Vitamin premix</td>
<td>0.25</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>Nutrients</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crude protein</td>
<td>18.5</td>
</tr>
<tr>
<td>Crude fat</td>
<td>2.5</td>
</tr>
<tr>
<td>Crude fiber</td>
<td>2.4</td>
</tr>
<tr>
<td>Calcium</td>
<td>4.4</td>
</tr>
<tr>
<td>Available P</td>
<td>0.44</td>
</tr>
<tr>
<td>Energy (kcal/lb)</td>
<td>1,213</td>
</tr>
<tr>
<td>Methionine</td>
<td>0.42</td>
</tr>
<tr>
<td>Lysine</td>
<td>1.1</td>
</tr>
</tbody>
</table>
Calcium Sources in Feed

- **Limestone and oyster shell** are usually added to layer diets as primary sources of calcium.
Improving Shell Quality

- For maximum shell quality, it is recommended that 50% of the calcium in a layer diet be of large particle size.

  - Limestone, depending on particle size and physical structure, is more soluble, and there is little retention in the gut.
  
  - Oyster shell is regarded as an “insoluble” slow-release form of calcium and residues remain in the digestive tract longer.

  - Oyster shell is commonly provided as free choice for hens to consume as needed.
Improving Shell Quality

- Vitamin D supplementation
  - Can help with calcium absorption in older hens
  - Can help with calcium absorption during heat stress
  - Usually added in drinking water
    - Vitamin and electrolyte mix
    - Following dosing instructions on package
Which egg will have the darkest yolk color?
Egg composition has everything to do with what the chicken eats.
Yolk Pigmentation

- Yolk color is related to the deposition of carotenoid pigments called *xanthophylls*.
  - Xanthophyll content of various feed ingredients:
    - Corn: 20 mg/kg
    - Wheat: 4 mg/kg
    - Milo (grain sorghum): 1 mg/kg
    - Alfalfa meal: 175 mg/kg
    - Corn gluten meal: 275 mg/kg
    - Marigold petals: 7,000 mg/kg
Yolk Pigmentation

- Other feed ingredients that may enhance yolk color:
  - Tomato pulp
  - Dried carrot leaves
  - Green forages (pasture)
  - Algae
  - Paprika
Adding paprika to layer rations makes them produce eggs with deep orange yolks. Courtesy Amir Cahaner
Fig. 136. Colony houses on grass range. All the vitamin requirements are taken care of when birds have a good green, young, and tender grass range. (Ohio Extension Bulletin 126.)
Vitamin Feedstuffs

Many of the feedstuffs used in poultry rations are good sources of more than one group of nutrients. In this chapter the feedstuffs have been classified according to the primary purpose for which they are fed. Some of the following feedstuffs classed as vitamin feedstuffs are also good sources of proteins and minerals.

Green grass. Young, tender, green grass supplies all of the vitamins needed by chickens except vitamin D (Fig. 136). When the birds are on range they will secure this vitamin from sunlight. Grass also supplies protein, minerals, and carbohydrates needed by poultry. Less expensive feed and a smaller amount are needed by poultry when they are kept on young, tender, green grass range (Table 55). Unfortunately, suitable range is generally available only during the spring and early summer months. As the season advances and the grass becomes older, the protein, mineral, and vitamin content declines rapidly and the fiber content increases. By pasturing the range closely or by making frequent cuttings of the grass, and by irrigation, it is possible to maintain suitable pasture for poultry. Alfalfa or ladino clover range may be used to supply green feed throughout the summer and fall.

Layers given green grass range produce eggs of lower market quality than birds kept in confinement. The yolks have a darker yellow color and the whites are more watery. While such eggs are of lower value from the standpoint of market grade, they are of greater food value because of the higher vitamin A, D, and G content.

Alfalfa. Alfalfa meal or hay is used as a substitute for green grass for birds kept in confinement and during the winter months. It is fed primarily to supply vitamins A and G, but it also supplies other vitamins, proteins, and minerals.
Definite differences in yolk color and albumen quality

Conventional feed egg
“Yard” eggs collected fresh from neighbor’s hens

Commercial egg out of carton
Definite differences in yolk color and albumen quality
Omega-3 Enhancement of Eggs

- Must supplement hen diet with an ingredient high in omega-3 fatty acids
  - Canola oil
  - Flaxseed and oil
  - Linseed and oil
  - Fish meal and oil
  - Other marine sources
  - Forages
<table>
<thead>
<tr>
<th>added to corn/soy diet:</th>
<th>3% canola oil</th>
<th>3% sunflower oil</th>
<th>3% flaxseed oil</th>
<th>3% fish oil</th>
<th>1.5% flaxseed oil + 1.5% fish oil</th>
<th>9% ground whole flaxseed</th>
<th>1.18% soybean oil (control)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Saturated fats (%)</td>
<td>33.52</td>
<td>33.94</td>
<td>34.75</td>
<td>32.12</td>
<td>34.65</td>
<td>35.5</td>
<td>36.54</td>
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<tr>
<td>Mono-unsaturated fats (%)</td>
<td>49.44</td>
<td>43.01</td>
<td>43.55</td>
<td>43.95</td>
<td>43.72</td>
<td>44.07</td>
<td>48.51</td>
</tr>
<tr>
<td>Poly-unsaturated fats (%)</td>
<td>17.03</td>
<td>21.9</td>
<td>23.31</td>
<td>20.74</td>
<td>21.62</td>
<td>20.43</td>
<td>16.57</td>
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<tr>
<td>n-6 fatty acids (%)</td>
<td>15.5</td>
<td>23.1</td>
<td>16.39</td>
<td>21.75</td>
<td>17.66</td>
<td>14.85</td>
<td>14.47</td>
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<tr>
<td>n-3 fatty acids (%)</td>
<td>2.15</td>
<td>0.65</td>
<td>6.83</td>
<td>2.28</td>
<td>4.28</td>
<td>5.59</td>
<td>0.7</td>
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<tr>
<td>n-6:n-3</td>
<td>7.24</td>
<td>35.09</td>
<td>2.37</td>
<td>10.02</td>
<td>3.88</td>
<td>2.65</td>
<td>21.44</td>
</tr>
<tr>
<td>Cholesterol (mg/g of yolk)</td>
<td>10.9</td>
<td>10.71</td>
<td>11.15</td>
<td>12.05</td>
<td>12.55</td>
<td>13.11</td>
<td>13.27</td>
</tr>
</tbody>
</table>
### Table of Fatty Acid Composition

<table>
<thead>
<tr>
<th>Added to Corn/Soy/Wheat Diet</th>
<th>3.4% Soybean Oil</th>
<th>3.4% Sunflower Oil</th>
<th>3.4% Linseed Oil</th>
<th>No Added Oil (Control)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Saturated Fats (%)</td>
<td>34.00</td>
<td>33.36</td>
<td>32.07</td>
<td>35.77</td>
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<tr>
<td>Mono-unsaturated Fats (%)</td>
<td>39.96</td>
<td>41.75</td>
<td>42.42</td>
<td>46.09</td>
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<tr>
<td>Poly-unsaturated Fats (%)</td>
<td>24.14</td>
<td>22.41</td>
<td>23.95</td>
<td>15.38</td>
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<tr>
<td>n-6 Fatty Acids (%)</td>
<td>21.96</td>
<td>21.23</td>
<td>16.05</td>
<td>14.34</td>
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<tr>
<td>n-3 Fatty Acids (%)</td>
<td>1.86</td>
<td>0.91</td>
<td>7.70</td>
<td>0.84</td>
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<td>n-6:n-3</td>
<td>11.82</td>
<td>23.58</td>
<td>2.09</td>
<td>17.26</td>
</tr>
</tbody>
</table>
Ingredient Restrictions for Layer Feeds

- Fish meals and oils
  - Potential for problems with “fishy” taint of eggs (trimethylamine) above 4-5% fish meal inclusion in diet.
  - Problems as low as 2.5% fish meal with brown-egg layers.
  - Fish oil in excess of 1% of the diet can result in fishy taint of eggs.
Ingredient Restrictions for Layer Feeds

- Omega-3 enhancement
  - Diets high in omega-3 have been shown to reduce vitelline membrane strength and egg size.
  - May result in broken yolks inside the egg
  - The problem can be counteracted with the addition of vitamin B6 to the diet
Omega-3 Enhancement

Can pasture rearing reduced egg cholesterol?
Penn State Pastured Hen Study
Renewable Agriculture and Food Systems, 2010

- No differences between pasture and cage for:
  - Egg weight
  - Yolk weight
  - Cholesterol

- Pastured hens were deficient in protein and energy
  - Egg production 15% lower than caged birds
  - Body weights 14% lower than caged birds
# Penn State Pastured Hen Study

Renewable Agriculture and Food Systems, 2010

<table>
<thead>
<tr>
<th></th>
<th>Alfalfa pasture</th>
<th>Clover pasture</th>
<th>Grass pasture</th>
<th>Caged</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commercial layer diet fed</td>
<td>70 g/hen/day</td>
<td>70 g/hen/day</td>
<td>70 g/hen/day</td>
<td>113 g/hen/day</td>
</tr>
<tr>
<td>Total fat (% of yolk)</td>
<td>29.8</td>
<td>30.4</td>
<td>30.0</td>
<td>30.5</td>
</tr>
<tr>
<td>Total ω-6 (% of yolk FA)</td>
<td>16.5</td>
<td>16.98</td>
<td>16.9</td>
<td>16.31</td>
</tr>
<tr>
<td>Total ω-3 (% of yolk FA)</td>
<td>3.76</td>
<td>3.59</td>
<td>3.03</td>
<td>1.28</td>
</tr>
<tr>
<td>ω-6:ω-3</td>
<td>4.44</td>
<td>4.76</td>
<td>5.7</td>
<td>12.05</td>
</tr>
</tbody>
</table>
Penn State Pastured Hen Study
Renewable Agriculture and Food Systems, 2010
North Carolina State University Study
Poultry Science 90:1600-1608 (2011)

- Compared eggs from cage and free-range hens
  - Free-range eggs had:
    - More total fat (monounsaturated and polyunsaturated)
    - Higher β-carotene (darker yolks)
    - Higher omega-3 fatty acids
      » 84.3 mg/50 g of egg for range
      » 70.6 mg/50 g of egg for cage
  - No differences in:
    - Saturated fat
    - Vitamin E
    - Vitamin A
    - Cholesterol (free-range actually 2 mg more/50 g)
Pasture management is important.
Pasture management is important.

Fence was here

Chickens were here.
Influencing Egg Size

- **Egg size promoters**
  - Increase crude protein
  - Increase amino acids, particularly methionine
  - Increase linoleic acid (fatty acid from vegetable oils)

- **Egg size retardants**
  - High omega-3 fatty acids
  - Restriction of feed or nutrients
  - Restriction of dietary energy (calories)
  - Restriction of protein or methionine

- **Caution:** any nutrient restrictions have the potential to lower overall egg numbers
Problem Feed
Ingredients

- Avoid cottonseed meal and oil
  - Cottonseed contains the compound gossypol.
  - Gossypol can cause green-brown-black discoloration in the yolk depending on gossypol levels and length of egg storage.
  - As storage time increases, the discoloration intensifies, especially at cool temperatures (5°C).
  - If cottonseed meal contains any residual oil, a characteristic “pink” albumen discoloration can occur. Therefore, avoid cottonseed oil as well.
Phytotoxins for Poultry

- Toxic substances derived from plants, including roots, stems, leaves, flowers and seeds.
- From *Diseases of Poultry* (American Association of Avian Pathologists)
  - Avacado
  - Black locust
  - Bladder pod seed
  - Castor beans
  - Cassava root
  - Coffee senna seed
  - Corn cockle seed (weed in wheat fields)
  - Coyotillo fruit and seed (indigenous to Texas)
Phytotoxins for Poultry

- From *Diseases of Poultry*
  - Cacao (or cocoa beans and cocoa waste)
  - *Crotalaria* seed (rattlepods or rattlebox)
  - *Daubentonia* seed (ornamental shrub)
  - Death camas
  - *Eucalyptus cladocalyx* (causes acute death)
  - Hemlock seed
  - Jimsonweed seed
  - *Glottidium* seed
  - Yellow jessamine, Caroline jessamine
  - Lily of the Valley
  - *Leucaena leucocephala* (leaves)
Phytotoxins for Poultry

- From *Diseases of Poultry*
  - Vetch seed (pea)
  - Milkweed
  - Nightshade
  - Oak leaf
  - Oleander
  - Green onion
  - Parsley
  - Pokeberry fruit
  - Potatoes (particularly green or raw, such as peelings)
Phytotoxins for Poultry

- From *Diseases of Poultry*
  - Rapeseed
  - Ragwort
  - Sweet pea seed
  - Tobacco
  - Velvetweed
  - Yew
  - Certain types of algae (such as blue-green algae)
Another Resource

- Toxic Plants of Texas (book)
  by Charles Hart and Bruce Carpenter
  Texas A&M AgriLife Extension Service
  • Focus on plants toxic to grazing animals

- 2 plants listed as toxic to poultry
  • Chinaberry
  • Black Locust
Chinaberry
Chinaberry
Black Locust
Black Locust
• Apricot leaves and pits
• Oak trees
• Azalea
• Uncooked beans
• Rhubarb
• Holly
• Yew (ornamental shrub)

• Flowers
  • Bulbs (daffodils, iris, narcissus, tulips)
  • Bracken ferns
  • Foxglove
  • Lobelia
  • Lupine
  • Nightshades
  • Periwinkle
Any Questions?