Effects of Post Pellet Liquid Fat Application (PPLA) Accuracy on Broiler Performance

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Feed Mill Challenges

- Energy is an expensive nutrient.
  - Over application of fat results in inventory loss ("shrink") in the mill.
  - Under application of fat results in inventory gain.
Feed Mill Challenges

• Feed mill managers typically spend more time and money monitoring the level of fat in feed than any for other ingredient.

• Variation in the amount of applied fat of individual feed samples will typically be in the range of 80 - 120% of theoretical.

• Satisfactory variation is 90 – 110% of theoretical.
Factors that Contribute to Fat Variation in Finished Feed

- Ingredient matrix values
- Types of PPLA equipment
- Application rates
- Sampling
- Quantity of pellet fines
- Analytical method
- Feed processing rates
Post Pellet Liquid Application (PPLA)

• Ingredients typically applied by PPLA include:
  • Liquid Enzymes
  • Fat
  • Molasses
  • Vitamins
  • Trace Minerals
  • Medicated Feed Additives
PPLA

Continuous process that involves complex equipment:

- Dry Flow System for Feed
  - Volumetric Feeder
  - Gravimetric Feeder
  - Mass Flow Feeder
- Liquid Flow System for Fat
  - Mechanical Liquid Meter
  - Coriolis Meter
- Spray Nozzles for fat application
Types of PPLA Equipment

Feed

Load Cell

Fat

Fat

Belt
Types of PPLA Equipment

Feed

Fat

Spinning Feed Disk

Spinning Liquid Disk

Fat
Previous Research

• **Post-Pellet Liquid Application (PPLA)** has been used to apply fat, as well as **micro-ingredients**. (Froetschner, 2007)

• **Applying fat later in the feed manufacturing process preserves pellet quality.** (Froetschner, 2007)
Hypothesis

Inaccurate post pellet liquid application of fat increases production costs.
Objective

Determine the effect that various amounts of post pellet liquid fat application error has on broiler performance.
Diets

- The treatments were created from a common corn-soy basal diet.
- Fat was applied to the basal diet at three levels: 80%, 100%, and 120% of theoretical.
- The starter diet was crumbled.
- Grower and finisher diets were pelleted.
<table>
<thead>
<tr>
<th>Diets</th>
<th>Amount</th>
<th>Days Fed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Starter</td>
<td>1.5 lbs (0.68 kg)</td>
<td>0-14</td>
</tr>
<tr>
<td>Grower</td>
<td>6.0 lbs (2.73 kg)</td>
<td>14-35</td>
</tr>
<tr>
<td>Finisher</td>
<td>6.0 lbs (2.73 kg)</td>
<td>35-45</td>
</tr>
</tbody>
</table>
Treatments

• **Trt 80**: Diet with 80% of the theoretical fat.

• **Trt 100**: Diet with 100% of the theoretical fat.

• **Trt 120**: Diet with 120% of the theoretical fat.

• **Mix**: Random rotation of 80, 100, and 120% diets within starter, grower, and finisher series.
## Feeding Sequence of Mix Treatment

<table>
<thead>
<tr>
<th>Starter (1.5 lbs/bird)</th>
<th>Grower (6.0 lbs/bird)</th>
<th>Finisher (6.0 lbs/bird)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trt 120</td>
<td>Trt 80</td>
<td>Trt 80</td>
</tr>
<tr>
<td>Trt 80</td>
<td>Trt 100</td>
<td>Trt 120</td>
</tr>
<tr>
<td>Trt 100</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Trt 120</td>
<td>Trt 100</td>
</tr>
<tr>
<td></td>
<td>Trt 80</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Trt 120</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Trt 80</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Trt 100</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Trt 120</td>
</tr>
</tbody>
</table>
Feed Preparation

Add 0.5% Fat

Ingredients

Mixer

Pellet

Cooler

Add PPLA Fat
Experimental Design

- There were 32 experimental pens of 32 Ross 344 X Ross 708 chicks each.
- There were eight replicate pens for each of the four treatments total.
- BW and feed intake were recorded at 0, 14, 35, and 45 d.
- FCR was adjusted for mortality (AdjFCR).
Statistical Design

- Completely Randomized Design
- Proc GLM procedure of SAS
- Means were partitioned by LS Means
- Significance set at $P < 0.05$
<table>
<thead>
<tr>
<th>Ingredients</th>
<th>Basal Diets</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Starter</td>
</tr>
<tr>
<td>Corn</td>
<td>51.67</td>
</tr>
<tr>
<td>Soybean Meal (48%)</td>
<td>37.94</td>
</tr>
<tr>
<td>Dicalcium Phosphate</td>
<td>2.09</td>
</tr>
<tr>
<td>Calcium Carbonate</td>
<td>0.94</td>
</tr>
<tr>
<td>Vitamins/Trace Premix</td>
<td>1.13</td>
</tr>
<tr>
<td>Amino Acids</td>
<td>0.22</td>
</tr>
<tr>
<td>Poultry Fat (Mixer)</td>
<td>0.50</td>
</tr>
<tr>
<td>Poultry Fat (PPLA)</td>
<td>5.50</td>
</tr>
</tbody>
</table>
## Dietary Specifications

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Starter</th>
<th>Grower</th>
<th>Finisher</th>
</tr>
</thead>
<tbody>
<tr>
<td>ME, kcal/kg</td>
<td>3150.00</td>
<td>3200.00</td>
<td>3068.00</td>
</tr>
<tr>
<td>CP, %</td>
<td>23.00</td>
<td>20.30</td>
<td>18.50</td>
</tr>
<tr>
<td>Lysine, %</td>
<td>1.29</td>
<td>1.12</td>
<td>1.10</td>
</tr>
<tr>
<td>Met + Cys, %</td>
<td>0.96</td>
<td>0.82</td>
<td>0.75</td>
</tr>
<tr>
<td>Calcium, %</td>
<td>0.90</td>
<td>0.85</td>
<td>0.80</td>
</tr>
<tr>
<td>Total P, %</td>
<td>0.75</td>
<td>0.67</td>
<td>0.60</td>
</tr>
<tr>
<td>AvP, %</td>
<td>0.45</td>
<td>0.40</td>
<td>0.35</td>
</tr>
<tr>
<td></td>
<td>80%</td>
<td>100%</td>
<td>120%</td>
</tr>
<tr>
<td>------------------------</td>
<td>-------</td>
<td>-------</td>
<td>-------</td>
</tr>
<tr>
<td><strong>Starter - Theoretical</strong></td>
<td>6.16</td>
<td>7.70</td>
<td>9.24</td>
</tr>
<tr>
<td><strong>Starter - Actual</strong></td>
<td>6.50</td>
<td>7.91</td>
<td>9.58</td>
</tr>
<tr>
<td><strong>Starter - % Theoretical</strong></td>
<td>84%</td>
<td>103%</td>
<td>124%</td>
</tr>
<tr>
<td><strong>Grower - Theoretical</strong></td>
<td>5.90</td>
<td>7.37</td>
<td>8.84</td>
</tr>
<tr>
<td><strong>Grower - Actual</strong></td>
<td>6.23</td>
<td>7.42</td>
<td>8.90</td>
</tr>
<tr>
<td><strong>Grower - % Theoretical</strong></td>
<td>85%</td>
<td>101%</td>
<td>121%</td>
</tr>
<tr>
<td><strong>Finisher - Theoretical</strong></td>
<td>5.02</td>
<td>6.28</td>
<td>7.54</td>
</tr>
<tr>
<td><strong>Finisher - Actual</strong></td>
<td>4.88</td>
<td>6.17</td>
<td>7.22</td>
</tr>
<tr>
<td><strong>Finisher - % Theoretical</strong></td>
<td>78%</td>
<td>98%</td>
<td>115%</td>
</tr>
</tbody>
</table>
Feed Intake

Feed Intake (kg/bird)

Age (d)

- 0-14
- 0-35
- 0-45

- 80
- 100
- 120
- Mix
Adjusted Feed Conversion Ratio

P values = $P < .05$
Discussion

- There were no effects on BW and AdjFCR until after 35 d of age.
- Birds fed the 80% fat diet from 35 to 45 d and 0 to 45 d exhibited poorer AdjFCR in comparison to the other treatments (1.85 vs. 1.79, 1.81, and 1.81).
Discussion

- Greatest effect on AdjFCR was detected in birds fed the 80% diet from 35 to 45 d (2.70 vs. 2.51, 2.55, and 2.56).
- Energy apparently became limiting above 2.2 kg BW in this study.
Discussion

- Under application has a negative impact on AdjFCR and over application increases feed cost with no additional benefit in bird performance.
Hypothesis

Inaccurate post pellet liquid application of fat increases production costs.

Accept
Conclusions

- The results indicated over application of fat simply increases feed costs and will create ingredient loss ("shrink"), at the feed mill.
- It appears that fat is often being wasted at lower BW.
Questions?