The Ever Changing World of Feed Additives in The Poultry Industry

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Outline

- Southern Poultry Research
- Impact of ethanol production of diet compositions
- Enzymes what are they and how they help nutritionist
- Products to aid in broiler health for a “natural” chicken

Southern Poultry Research
**The Problem at Hand**

- Nutritionists are constantly facing challenges when formulating diets
- Recent production of ethanol has created some of the biggest challenges
- In attempts to formulate least cost diets
  - Faced with lower quality ingredients due to rising prices of better quality ingredients such as corn and soybean meal
  - Fat sources also increasing in price due to biodiesel
- Do enzymes hold the answer in alleviating this stress?
A Common Enzyme in Poultry Diets

- Phytase is an enzyme that has been known to improve phosphorus utilization from grain and oilseeds (T.S. Nelson et al., 1969; M.I. Davies et al. 1970)
- Technical merits of phytase demonstrated, but commercialization was delayed until efficient fermentation technology was developed
- The current commercial phytase concentrations are effective at liberating phosphorus from the diet

Benefits of Phytase

- Phytase has also been recently credited with liberation of other nutrients including Ca, energy and amino acids
- 500 to 1000 FTU/kg of phytase in current formulations is based on costs associated with the current production technology
Added Benefits of Phytase

- Feeding of phytase at higher concentrations may result in increased performance (Putress et al., 2007; Persia et al., 2006; Shirley et al., 2002)
Day 21 Broiler performance comparison PC, NC, vs. NC + 5,000 FTU/kg Phytase
(Lumpkins, Humphrey, Mathis, and Persia, 2009)

PC = positive control, 0.45% AP; NC = negative control, 0.30% AP

Means columns with no common superscript differ significantly (p < 0.05)

Day 21 metabolizable energy, % protein digestibility, % phosphorus digestibility, and % calcium digestibility, PC, NC, vs. NC + 5,000 FTU/kg Phytase

<table>
<thead>
<tr>
<th>Treatment</th>
<th>ME (kcal/Kg)</th>
<th>Protein, %</th>
<th>Phosphorus, %</th>
<th>Calcium, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. PC, 0.45% AP</td>
<td>3263 b</td>
<td>85.5 b</td>
<td>70.1 b</td>
<td>67.0 b</td>
</tr>
<tr>
<td>2. NC, 0.30% AP</td>
<td>3272 b</td>
<td>84.6 b</td>
<td>66.6 c</td>
<td>68.9 b</td>
</tr>
<tr>
<td>3. NC + 5,000 FTU/kg phytase</td>
<td>3459 a</td>
<td>90.2 a</td>
<td>81.5 a</td>
<td>74.5 a</td>
</tr>
</tbody>
</table>

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Where can enzymes take us

- Today phytase has become a common additive in commercial poultry diets and has opened the door for other enzymes (i.e. non-starch polysaccharide enzymes)

- Distiller’s dried grains with solubles (DDGS) has a higher level of NSP’s than its parent product corn (Wang et al. 2007)

- Many common feed ingredients contain anti-nutritional factors
  - The trick is knowing how to deal with them

Common Ingredients

- Corn
- Soybean Meal
- DDGS

Alternative Feed Ingredients

- Bakery Meal
- Peanut Meal
Anti-nutritive effects of NSP

All cereals used in poultry feed contain various levels of NSP:

- Increase digesta viscosity
- Effect physiology and morphology of the intestinal tract
- Decrease digesta passage rate and increase digesta retention time (increase bacterial colonization)
- Alter intestinal microbiota profile
- Depress feed conversion efficiency and growth

NSP’s in Feed ingredients (Bach 1997)

<table>
<thead>
<tr>
<th></th>
<th>Corn</th>
<th>Wheat</th>
<th>Rye</th>
<th>Barley</th>
<th>Oats</th>
<th>Soybean meal</th>
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</thead>
<tbody>
<tr>
<td>Starch</td>
<td>690</td>
<td>651</td>
<td>613</td>
<td>645</td>
<td>557</td>
<td>27</td>
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<tr>
<td>Beta-glucan</td>
<td>1</td>
<td>8</td>
<td>16</td>
<td>42</td>
<td>41</td>
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<tr>
<td>Arabinose</td>
<td>3</td>
<td>7</td>
<td>12</td>
<td>3</td>
<td>3</td>
<td>9</td>
</tr>
<tr>
<td>Xylose</td>
<td>2</td>
<td>9</td>
<td>20</td>
<td>4</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Raffinose</td>
<td>2</td>
<td>4</td>
<td>4</td>
<td>...</td>
<td>...</td>
<td>10</td>
</tr>
<tr>
<td>Stachyose</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>...</td>
<td>...</td>
<td>47</td>
</tr>
<tr>
<td>Cellulose</td>
<td>22</td>
<td>20</td>
<td>16</td>
<td>10</td>
<td>14</td>
<td>62</td>
</tr>
<tr>
<td>Total NSP</td>
<td>97</td>
<td>119</td>
<td>152</td>
<td>124</td>
<td>116</td>
<td>217</td>
</tr>
<tr>
<td>SNCP&lt;sup&gt;1&lt;/sup&gt;</td>
<td>9</td>
<td>25</td>
<td>42</td>
<td>50</td>
<td>54</td>
<td>63</td>
</tr>
<tr>
<td>INCP&lt;sup&gt;1&lt;/sup&gt;</td>
<td>66</td>
<td>74</td>
<td>94</td>
<td>64</td>
<td>49</td>
<td>92</td>
</tr>
</tbody>
</table>

Benefits of NSP Enzymes

- Supplementing with exogenous enzymes degrade fiber and improve the availability from various grains i.e. DDGS (Min et al., 2009)
Enzymes decrease the anti-nutritive components of NSP

Guar meal: high levels of β-mannan

Corn/soy meal + 10% Guar meal
Day 42: FC 2.131
Wt. Gain 1.656 (kg)

Corn/soy meal + 10% Guar meal + Hemicell (β-mannanase)
Day 42: FC 1.924
Wt. Gain 1.958 (kg)
**Body weight gain (kg)**

<table>
<thead>
<tr>
<th>Days of age</th>
<th>PC</th>
<th>NC</th>
<th>NC + Rovabio</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 to 21</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0 to 35</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0 to 45</td>
<td></td>
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**Feed Conversion (kg:kg)**

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**NSP Enzymes Cont.**
Enzymes influence bacterial populations and reduce microbial use of nutrients (Bedford and Apajalahti, 2001)

CFU*10^5 (Coliforms, LAB, Enterococci)

Control Xylanase

Protease

NSP enzymes going beyond nutrient utilization
Alternatives for a “Natural” broiler

Other Factors at Hand
- Feed cost may be the main concern, but there are other issues currently arising
- The EU ban of antibiotics
- Push from consumers to produce “natural” chicken (antibiotic and drug free)
- Recently, the removal of 3-nitro
  - What's next to go?
- The need to search for alternatives

Growth Promoting Antibiotics
Antibiotics for many years have been an effective way of enhancing animal health, uniformity, and production efficacy (Bedford, 2000)
**Probiotics: stabilize and balance host intestinal microbiota**

Most important role of beneficial bacteria is inhibit colonization of pathogenic bacteria
- Compete for adhesion receptors and nutrients
- Produce antibacterial substances
- Modulate immune response
- Lower pH by production of lactic acid and short chain fatty-acids

**Influencing Bacterial Populations**
- Beneficial compete with Detrimental bacteria for nutrients
- Competitive Exclusion: Beneficial bacteria block adhesion sites (Hofacre, et. al. 2002)

**Can a Probiotic replace Antibiotic Growth Promoters and Improve Performance of Broiler Chickens**
Thoughts to Consider

- Enzymes have the potential to help liberate the availability of nutrients in plant origin feedstuffs
- Feeding NSP enzymes from hatch to harvest provide maximal benefit.
- May provide other benefits in addition to improved performance
Thoughts to Consider

- Probiotics may provide a natural alternative to aid in the bird's wellbeing.
- Both probiotics and enzymes alter the community of the intestinal bacterial population to improve performance.
- The combination of probiotics and exogenous enzymes in poultry diets can provide the answers to the main issues facing nutritionists today.

Questions?