Exogenous phytase is added to poultry feed to liberate phosphorous (P), bound as phytate in raw materials, with the aim of lowering feed costs by reducing the amount of inorganic P added to the diet and having a degradation of phytic acid, known as an anti-nutritional factor in feed. Both actions lead to an improved poultry performance.

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Comparing phytases: bone ash and digestibility studies

In order to compare different phytases on their potential to release P from phytate, trials are often conducted by adding the phytase at different inclusion levels to a P deficient diet. Technical performance is measured alongside parameters related to P digestion by the animal. This can either be the measurement of bone ash or by calculating a P digestibility value.

In the bone ash method, a feed deficient in P is fed to the animal. This leads to poor bone formation, substantiated by a low bone ash content. Adding inorganic P to the feed (MCP or DCP) leads to a reduction of the P deficiency, resulting in a better bone formation and higher bone ash in the bird (Fig. 1).

This way, a ‘calibration curve’ between P added to the feed and bone ash is produced. Adding a phytase at a certain level to the P deficient feed will also reduce its P deficiency due to the liberation of P from phytate, leading to a higher bone ash content. With the latter value, and using the calibration line, the equivalent P value can be estimated for this phytase (see arrows in Fig. 1).

Alternatively, P values of a phytase can be estimated from digestibility studies, similar to trials conducted for protein digestibility. In brief, P intake in the bird is measured, while P excretion (in manure) or P levels in the end part of the intestine are also determined. Based on these values, and using an indigestible marker in feed, the amount of P retained or digested by the animal can be calculated.

Adding a phytase to this feed will reduce the P level at the intestinal level and in faeces, which allows the calculation of a digestible P value for the phytase.

Biased comparisons based on equal FTU per kg of feed inclusion

The way to determine the levels of different phytases to be included in the feed in order to compare them can already skew the outcome of the trial. In comparative trials, it is often seen that the activity of the different phytases is ‘quantified’ using the official method (ISO 30024:2009) expressed in FTU per gram pure phytase product.

Based on this analytical result, the different phytases are then dosed to reach a certain inclusion level, for example, 500, 1000 or 1500 FTU per kg of feed. However, this is not the correct way, as explained below, as every phytase has its own pH profile.

The ISO method is measuring the activity of the phytase at pH 5.5, while it is common knowledge that phytases need to work at levels between pH 2 and pH 4 (Fig. 2). The phytase indicated in blue in Fig. 2 has a pH optimum at 5.5, while the phytase indicated in green has a pH optimum around 3.5, meaning that the latter will perform better in the animal.

When the activity of both phytases is determined by the ISO method (at pH 5.5) it can be seen that the blue phytase will have a higher activity (for instance 10,000 FTU/g), while the green phytase has a lower activity at this pH (for instance 5,000 FTU/g).

According to this trial protocol, one should then add 50g of the blue phytase, but 100g of the green phytase per kg of feed in order to reach 500 FTU/kg feed inclusion level. This means that this type of trial protocol will favour the phytase which has the better pH profile for activity in the animal.

Continued on page 58
How to do it better

From a commercial point of view, the main question for the feed industry is: how many grams of a commercial phytase product, with a certain declared activity, with a certain claim for P and with a certain price, are comparable?

Indeed, every phytase has its own phytase unit based on its own analytical method, and this phytase unit corresponds to a certain P or dig P value declared by the supplier. For instance, a trial could be set up in which a feed, not deficient in P (= positive control) is reduced in P by 0.5, 1.0 and 1.5g/kg (negative controls).

To these feeds, each of the phytases is included at the supplier recommended inclusion levels to compensate for the 0.5, 1.0 and 1.5g reduction. By doing so, it can be validated, based on technical performance, bone ash analysis and/or P digestibility, if the matrix value for P proposed by each phytase supplier is correct. At the same time, all phytases can be compared on technical performance, including economic performance, as these are the drivers for the correct choice of a phytase.

It should, of course, also be clear that when comparing phytases, the same form (liquid, granular or coated) should be used. It is well known that coatings might hinder the release of a phytase, which can impact its P release from phytate. As phytate degradation needs to take place in the first part of the intestine (gizzard), a reduced release of phytase might impact its effect.

Conclusion

It is quite clear that the set-up of trials to compare different phytases needs to be done properly in order to provide practical answers to the nutritionist.

This means comparing different phytases at their recommended inclusion levels, taking into account their proposed matrix values for phosphorous and their price, and not based on their FTU activity measured at pH 5.5. In this way, an easier and more correct comparison can be made based on the technical and economic performance obtained.

Continued from page 57

(pH 2 to 4; this is the green phytase) and a lower activity measured at pH 5.5.

Fig. 3. How to set up a phytase trial with the appropriate inorganic controls and different phytases at inclusion levels proposed by the supplier.

<table>
<thead>
<tr>
<th>Bodyweight gain at day 21 (g)</th>
<th>Negative control (NC)</th>
<th>NC - 0.5 P as MCP</th>
<th>NC - 1.0 P as MCP</th>
<th>NC - 1.5 P as MCP</th>
<th>OptiPhos</th>
<th>Competitor A</th>
<th>Competitor B</th>
<th>OptiPhos</th>
<th>Competitor A</th>
<th>Competitor B</th>
</tr>
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<tbody>
<tr>
<td>Single dose</td>
<td>1.52</td>
<td>1.49</td>
<td>1.46</td>
<td>1.44</td>
<td>1.42</td>
<td>1.39</td>
<td>1.37</td>
<td>1.36</td>
<td>1.34</td>
<td>1.32</td>
</tr>
<tr>
<td>Double dose</td>
<td>1.47</td>
<td>1.43</td>
<td>1.40</td>
<td>1.38</td>
<td>1.36</td>
<td>1.33</td>
<td>1.31</td>
<td>1.30</td>
<td>1.28</td>
<td>1.24</td>
</tr>
</tbody>
</table>

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Poultry Watering

Dry floors promote bird welfare and reduce reliance on antibiotics

Enhancing bird welfare and eliminating non-therapeutic use of antibiotics is a world-wide trend and poultry producers are discovering that one of the most effective ways to achieve this goal is by maintaining dry litter conditions. Central to this goal is effectively managing nipple type watering systems in a manner that discharges sufficient water to stimulate bird growth, but not over-supply water which creates wet litter. Wet litter can become a breeding ground for disease and ammonia release resulting in pododermatitis and a host of other bird welfare and health issues.

Understanding enclosed watering system concepts and applying them when managing watering systems is essential for maintaining drier litter conditions year round.

Best practices and guidelines available for enclosed watering systems are available through poultrywatering.com, a reference and resource site for all things related to poultry watering.

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