

# FEED INTELLIGENCE BULLETIN

INSIGHTS FROM ESPN 2019



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At AB Vista we recognise the challenges our customers face to remain competitive and profitable in today's market climate. That's why we're committed to working with our customers to bring them the latest scientific insights, which can be commercially applied to their business for improved productivity.

Our Feed Intelligence Bulletin aims to keep you up to date on the latest scientific developments within the field of animal nutrition.

This first instalment brings you the latest research from AB Vista to presented at ESPN 2019, providing a wealth of new insights on the nutritional impact of phytate and fibre. This research shines light on new feed strategies to capitalise on the inherent value held within these substrates.

**Dr. Tiago Tedeschi Dos Santos,  
Marketing & Technical Director,  
AB Vista**

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# REDUCING CARBON FOOTPRINT OF BROILER PRODUCTION



## Combination of enzymes and fermentable oligosaccharides improve sustainability of broiler production

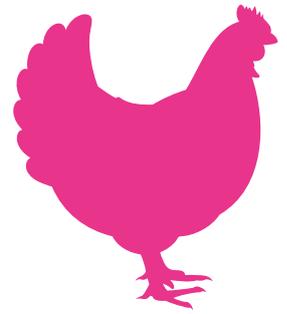
**Authors:** G. Gomes<sup>1</sup>, R. Ten Doeschate<sup>1</sup>, O. Kinsey<sup>1</sup>, C. Young<sup>2</sup>, C. Kwakernaak<sup>3</sup>

1. *AB Vista, UK*    2. *AB Sustain, UK*    3. *Schothorst Feed Research, Netherlands*

**Key findings:** A 3% reduction in the carbon footprint of broiler production was shown when using AB Vista's Maximum Matrix Nutrition application, a targeted enzyme application designed to extract maximum value from phytate and fibre. The study demonstrated the potential of the application to provide savings on formulation costs, whilst simultaneously reducing the environmental impact of broiler production, when compared with using a standard 500FTU/kg dose of Quantum Blue.

**Abstract:** The objective was to study the effect of supplementation of an additive combination to a diet with reduced nutrient contents on broiler performance and carbon footprint (CO<sub>2</sub>e). Two diets with 3 phases (0-13, 14-24 & 25-34 days of age) were fed to Ross 308 sexed broilers housed in 8 replicate floor pens per sex (24 birds/pen). The wheat-based (49-68%) control diets (PC) were formulated according to AB Vista's matrix recommendations with 500 FTU/kg phytase. The nutrient reduced diets (RED) were lowered by an extra (g/kg) 0.7 avP, 0.8 Ca, 0.2 Na, 0.33 dLys, 0.1 dM+C, 0.17 dThr, 0.17 dVal and 0.42 MJ/kg AME, and were supplemented with 1500 FTU/kg phytase (Quantum Blue), and a combination of 9600 BXU/kg xylanase and fermentable xylo-oligosaccharides (Signis). Feed (pellets) and water were freely available. Body weight gain (BWG), Feed Intake (FI) and Feed Conversion Ratio (FCR) were determined from 0-34 d. At day 34, carcass and cuts yield were determined on 4 birds/pen. CO<sub>2</sub>e was calculated using an accredited model (AB Sustain, 2017) and expressed as kg of CO<sub>2</sub> per kg carcass. Data was submitted to two-way ANOVA. Liveability was not affected by diet. Compared to males, females had lower FI (11%; P<0.001) and BWG (12%, P<0.001) but similar FCR. Females tended to have higher breast yield than males (P = 0.06). Compared to PC, performance and carcass traits were similar with RED (P>0.05), and CO<sub>2</sub>e was reduced (4%, P<0.001). There was a tendency (P = 0.10) that this CO<sub>2</sub>e effect was more pronounced in females. It was concluded that using high doses of phytase, combined with xylanase and fermentable xylo-oligosaccharides, can allow a reduction in dietary nutrients while maintaining broiler performance, reducing CO<sub>2</sub>e and potentially lowering production costs.

# OPTIMISING GUT FUNCTION TO IMPROVE PERFORMANCE



## Evaluation of xylanase alone or in combination with xylo-oligosaccharides on performance of broiler chickens fed corn- or wheat-based diets

**Authors:** G. Gomes<sup>1</sup>, T. Santos<sup>1</sup>, R. Ten Doeschate<sup>1</sup>, U. Aftab<sup>1</sup>, S. Srinongkate<sup>2</sup>, D. Creswell<sup>3</sup>  
1. AB Vista, UK 2. ARC, Thailand 3. Creswell Nutrition, Australia

**Key findings:** Supplementation of Signis, a dual-action microbiome activator, to both corn- or wheat-based diets improved performance of NC fed birds (reduced by 150kcal/kg, plus AAs), resulted in performance similar to PC fed birds.

**Abstract:** This study evaluated the effects of xylanase alone (XYL) or a combination of xylanase plus fermentable xylo-oligosaccharides (XYL+XOS) on broiler performance fed energy-deficient diets based on corn or wheat. Day-old male Ross 308 broiler chicks were randomly allocated to 6 pens per treatment, with 12 chicks per pen, and assigned to a factorial arrangement (2 x 4): positive control (PC); negative control (AME reduced by 0.63 MJ/kg; NC); NC+XYL; NC+XYL+XOS, with diets based on either corn or wheat as main cereals. All diets contained 1,000 FTU/kg phytase, and were fed as pellets in three dietary phases. Feed and water were available ad libitum throughout the trial. Body weight gain (BWG) and feed intake (FI) were measured from 0-40 d. Feed conversion ratio was calculated after correcting for mortality and adjusting to equal body weights (FCR). Data was submitted to two-way ANOVA, and means separated using Student's T-test ( $P < 0.05$ ). No differences in liveability were seen throughout the experiment ( $P > 0.05$ ). There were no significant interactions or cereal effect throughout the whole experimental period ( $P > 0.05$ ). FI ( $P = 0.08$ ) and BWG ( $P = 0.10$ ) tended to be affected by diet. NC-fed birds showed the highest FI and the lowest BWG when compared to all other diets. BWG was highest in birds fed PC and NC+XYL+XOS. Birds fed PC diets had a better FCR than those fed NC diets ( $P < 0.05$ ). Birds fed XYL+XOS improved FCR in NC-fed birds ( $P < 0.05$ ), while birds fed NC+XYL did not differ from either NC or NC+XYL+XOS ( $P > 0.05$ ). Birds fed diets supplemented with XYL+XOS showed improved performance when compared to NC-fed birds, recovering bird performance to similar levels as PC-fed birds.

## Evaluation of xylanase and a fermentable oligosaccharides on performance of broiler chickens fed energy and amino acid deficient diets

**Authors:** G. González-Ortiz<sup>1</sup>, M. García<sup>2</sup>, J. Sanchez<sup>2</sup>, M. Bedford<sup>1</sup>  
1. AB Vista, UK 2. Imasde Agroalimentaria, Spain

**Key findings:** Inclusion of Signis in the diet improved performance and intake of digestible nutrients of broiler chickens, particularly those fed diets deficient in energy and amino acids. When added to energy and energy plus amino acid deficient diets, Signis recovered performance and the intake of digestible nutrients to the level of the positive control.

**Abstract:** The objective of this study was to evaluate the effect of a product consisting of a xylanase and a fermentable oligosaccharide (Signis) on performance of broiler chickens fed energy and amino acid deficient diets. Day-old male Ross 308 broiler chicks were randomly allocated to 8 pens per treatment, with 25 chicks per pen. Forty percent of the litter was reutilized from the previous flock. Treatments based on wheat-corn-soybean meal diets were arranged in a 3 x 2 factorial: a positive control that met or exceeded nutrient recommendations (PC), a negative control diet with a 50 kcal/kg AME reduction (NC1) and a NC2 further reducing amino acids (AA) by 3%, each with or without supplementation of 100 g/t of Signis. Starter, grower and finisher diets and water were available ad libitum. Body weight gain (BWG), feed intake (FI), feed conversion ratio corrected for mortality (FE) and the European Production Efficiency Factor (EPEF) were recorded from 0-42 days. Statistical comparisons were performed using a two-way ANOVA. A significant interaction was observed for BWG and FI ( $P < 0.001$ ). The energy and AA dilution reduced ( $P < 0.05$ ) BWG when compared to the PC (NC1=1722 vs. NC2=1592 vs. PC=1978 g/bird), and although Signis improved BWG in all diets (NC1=+451 vs. NC2=+314 vs. PC=+176 g/bird;  $P < 0.05$ ), the effect was greater in the NC1 birds. No interactions were observed on the EPEF or FE; however, Signis supplementation improved EPEF (230 vs. 278;  $P < 0.001$ ) and FE (1.766 vs. 1.608 g/g;  $P < 0.001$ ) irrespective of the energy reduction or AA density. Signis supplementation improved performance of broiler chickens fed all diets, particularly those deficient in energy and AA. When added to energy and energy plus AA deficient diets, Signis recovered performance to similar levels to the PC.

# BENEFITS OF PHYTASE SUPERDOSING

## Phytase superdosing increased yolk mineral concentration while decreasing yolk inositol concentration from breeder hens aged 35 or 40 weeks

**Authors:** C. Granghelli<sup>1</sup>, C. Walk<sup>2</sup>, L. Araujo<sup>1</sup>, S. Silva<sup>1</sup>, M. Cuadros<sup>1</sup>, Y. Sartore<sup>1</sup>, M. Dias<sup>1</sup>, C. Brearley<sup>3</sup>, M. Smith<sup>3</sup>, and C. Araujo<sup>1</sup>  
1. University of São Paulo, Brazil 2. AB Vista, Marlborough, UK 3. University of East Anglia, UK

**Key findings:** This study showed that increasing the phytase dose up to 4,500 units resulted in increased yolk mineral and glycerol content, which may be beneficial for the survival and hatchability of the chick. At the same time, inositol levels were reduced, which is surprising but may be linked to the glycerol increments - glycerol being a potential energy source for hatching chicks.

**Abstract:** Previous experiments reported a significant increase in yolk mineral content as phytase dose increased in a diet fed to laying hens. A trial was conducted to determine the influence of increasing doses of phytase on breeder hen production and mineral and inositol concentration in the yolk. Two-hundred and sixteen 27-week-old breeder hens were obtained from a commercial hatchery and housed at 4 hens/box to 50 weeks of age. Hens were fed one of three nutrient adequate diets, reduced in Ca and P by 0.16 and 0.15%, respectively, and containing 500, 1,500 or 4,500 FTU/kg of phytase. Hen feed intake, gain and egg production were measured every 4 weeks to represent a phase (P1 to P6). Fresh egg yolks were collected from one hen/box at week 35 and 40 and freeze dried. Data were analysed using JMP. The model included diet, replicate cage, and phase as a repeated measure. Hen intake was 169g in P1 and decreased to 162g by P6. Total egg production ( $P = 0.06$ ) and total eggs/hen/week ( $P < 0.05$ ) was greatest in hens fed 1,500 FTU/kg phytase when compared with hens fed 4,500 FTU/kg phytase and decreased ( $P < 0.05$ ) from P2 to P6. Yolk inositol decreased ( $P < 0.05$ ) and yolk glycerol concentration increased ( $P < 0.05$ ) as phytase dose increased from 500 to 4,500 FTU/kg. In general, yolk Ca, Na, and K were greater in 40-week-old breeder hens and influenced by phytase dose  $\times$  hen age ( $P < 0.05$ ). Phosphorus concentration in the yolk was highest ( $P < 0.05$ ) in hens fed 4,500 or 500 FTU/kg phytase when compared with hens fed 1,500 FTU/kg of phytase, regardless of breeder age. In conclusion, phytase supplementation had an influence on mineral, inositol and glycerol concentration in the yolks of breeder hens and this may have an influence on chick quality, hatchability, and initial growth rate.

## Phytase dose fed to breeder hens has an influence on yolk inositol concentration, chick quality and hatchability, and early chick growth rate

**Authors:** C. Granghelli<sup>1</sup>, C. Walk<sup>2</sup>, L. Araujo<sup>1</sup>, F. Roque<sup>1</sup>, B. Leite<sup>1</sup>, P. Pelissari<sup>1</sup>, C. Brearley<sup>3</sup>, M. Smith<sup>3</sup>, and C. Araujo<sup>1</sup>  
1. University of São Paulo, Brazil 2. AB Vista, Marlborough, UK 3. University of East Anglia, UK

**Key findings:** Linked to the above study, the eggs were set and hatched and performance of chicks followed. As phytase dose increased the number of early dead chicks during incubation increased but this was more than offset by the reduction in the number of later losses during incubation and pipping. Pipping losses often relate to poor energy status. Inositol concentrations in the yolk sac on the day of hatch were linearly correlated with phytase dose, which is the opposite of what was found in the yolk at day of lay. This incremental inositol was linked with better 7 and 14d body weights and suggests up to 4,500 FTU/kg feed may enable breeder hens to produce more viable and rapidly growing offspring.

**Abstract:** The objective of this trial was to determine the influence of breeder hen diet on hatchability, chick quality, and yolk nutrient concentration of chicks at day of hatch and subsequent starter diet on chick growth performance to 42-d post-hatch. Breeder hens ( $n = 216$ ) were fed one of three nutrient adequate diets, with reduced Ca and P by 0.16 and 0.15%, respectively, and 500, 1,500 or 4,500 FTU/kg phytase from 27- to 50-weeks of age. There were 4 hens/cage and 18 cages/diet. At 38-weeks of age, eggs ( $n = 648$ ) were collected and incubated using standard procedures. At day of hatch, chick quality and hatchability were determined and 18 chicks/diet were sacrificed for yolk sac collection and determination of inositol concentration. The remaining chicks were equally divided into three groups and fed one of three nutrient adequate diets, with reduced Ca and P by 0.16 and 0.15%, respectively, containing 0, 500 or 1,500 FTU/kg of phytase to d 42 post-hatch. Increasing phytase concentration in the breeder hen diet linearly ( $P < 0.05$ ) increased the number of early dead and linearly ( $P < 0.05$ ) decreased the number of late dead and pips. Inositol concentration in the yolk sac at day of hatch increased (quadratic,  $P < 0.05$ ) as phytase dose increased in the breeder hen diet. Body weight of chicks at day of hatch and d 7 increased (linear,  $P < 0.05$ ) as phytase dose increased in the breeder hen diet. There was no effect of breeder hen diet or subsequent broiler chick diet on growth performance at d 42. Inositol concentration in the yolk at day of hatch was positively correlated ( $P < 0.05$ ) with d 7 ( $r = 0.32$ ) and d 21 ( $r = 0.30$ ) chick body weight, indicating inositol may influence the development of newly hatched chicks resulting in an increase in early growth rate.

## Effect of phytase on real-time gastric acid secretion and calcium solubility in the gizzard of laying hens

**Authors:** S. Lee<sup>1</sup>, E. Febery<sup>2</sup>, T. Mottram<sup>3</sup>, M. Bedford<sup>1</sup>

1. AB Vista, UK 2. Drayton Animal Health, UK 3. eCow Devon Ltd., UK

**Key findings:** Feeding 1500 FTU to laying hens and then measuring blood Ca and gizzard pH through one day lay cycle suggested that phytase increased blood Ca and reduced pH in the gizzard during the 10-14 hr period of the lay cycle. The increment in blood Ca, which is necessary for shell formation, may be as a result of a reduction in pH of the gizzard when feeding phytase during this critical period of lay, which resulted in better Ca absorption at the end of the small intestine.

**Abstract:** An experiment was conducted to evaluate the effect of phytase on real-time gizzard pH and calcium solubility in laying hens during peak-lay. A total of 50 laying hens (33wk) were housed individually and fed a nutrient-adequate diet with or without 1500 FTU/kg Quantum Blue phytase. At 36wk, following a dietary adaptation period, pH capsules (Heidelberg Medical) were administered to 4 hens per treatment for each 3h monitoring period from 6 to 22h post-egg lay (32 hens in total). Subsequent to capsule dosing, birds were humanly euthanised and a spear-tip probe used to measure gizzard pH. Real-time pH capsule readings showed a significant interaction between the time period post-egg lay and phytase ( $P < 0.001$ ), whereby pH in the gizzard was lower ( $P < 0.05$ ) in phytase fed birds at 10-14h post-egg lay compared to the control. Conversely, spear-tip probe readings were not significantly affected by time post-egg lay or phytase supplementation. Irrespective of the time post-egg lay, phytase increased ( $P < 0.05$ ) blood Ca concentrations compared to the non-supplemented control, suggesting better digestion and absorption of Ca in the diet. Phytase had no effect on soluble Ca in the gizzard, however it tended ( $P < 0.1$ ) to increase soluble Ca in the small intestine. These findings suggest that phytase increased blood Ca as a result of improved solubility and absorption of Ca in the small intestine. Increased Ca solubility could be attributed to the synergistic effect of phytase on phytate degradation and gastric acid secretions.

## Influence of freezing method on determined phytate disappearance in gizzard and ileum samples of broiler chickens

**Authors:** S. Künzela<sup>1</sup>, V Sommerfelda<sup>1</sup>, M. Schollenbergera<sup>1</sup>, I. Kühn<sup>2</sup> and M. Rodehutschord<sup>1</sup>

1. Institut für Nutztierwissenschaften, Germany 2. AB Vista, Germany

**Key findings:** When phytate and its lower esters are measured in the intestinal contents, there is always the risk that there will be enzymatic degradation of these esters during the sampling process. This work confirmed that to be valid, samples should be fast frozen, preferably on dry ice, to make sure that no losses occur and as a result the data are reliable.

**Abstract:** When sampling for analysis of inositol phosphates (InsP), digesta is usually taken with a spatula (gizzard) or rinsed with water (ileum), pooled per pen, and then frozen. Endogenous or added phytases might continue to function in the period between sacrificing the bird and freezing the sample to the core with unknown effects for analyzed InsP. The objective was to study whether such effects exist. Broilers were fed P and Ca reduced diets with or without phytase addition. Content from the gizzard and ileum was removed with a spatula, pooled per pen, and split: one portion was immediately shock frozen in liquid nitrogen (LN), another put in a -20 °C freezer immediately (F) or after a 30 min period of holding at room temperature (RT, gizzard) or mixer with double distilled water to mimic flushing before placing in the freezer immediately (W, ileum). Without added phytase, InsP6 concentration in the gizzard (n=7 samples) was significantly lower in RT than LN ( $p = 0.007$ ). With added phytase, InsP6 and Ins(1,2,5,6)P4 were lower in F and RT than in LN, while InsP3 was only lower in RT ( $p < 0.05$ ). In both diets, method F was in between RT and LN. In the ileum (n=6 samples), InsP6 concentrations were not different when phytase was added, but significantly lower in W when phytase was not added ( $p = 0.015$ ). In both diets, concentrations of some InsP isomers were minimally lower in W than in other procedures ( $p < 0.05$ ). We concluded that fast freezing can prevent or reduce post-slaughter activity of phytase in the upper digestive tract. Ileal samples seem to be less influenced by sampling procedure, possibly due to the high level of InsP6 disappearance up to this point and the reduced phytase activity at ileal pH.



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