Opportunities in the feed milling industry by combining new generation xylanase and phytase enzymes

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AB Vista Feed Ingredients

Contents

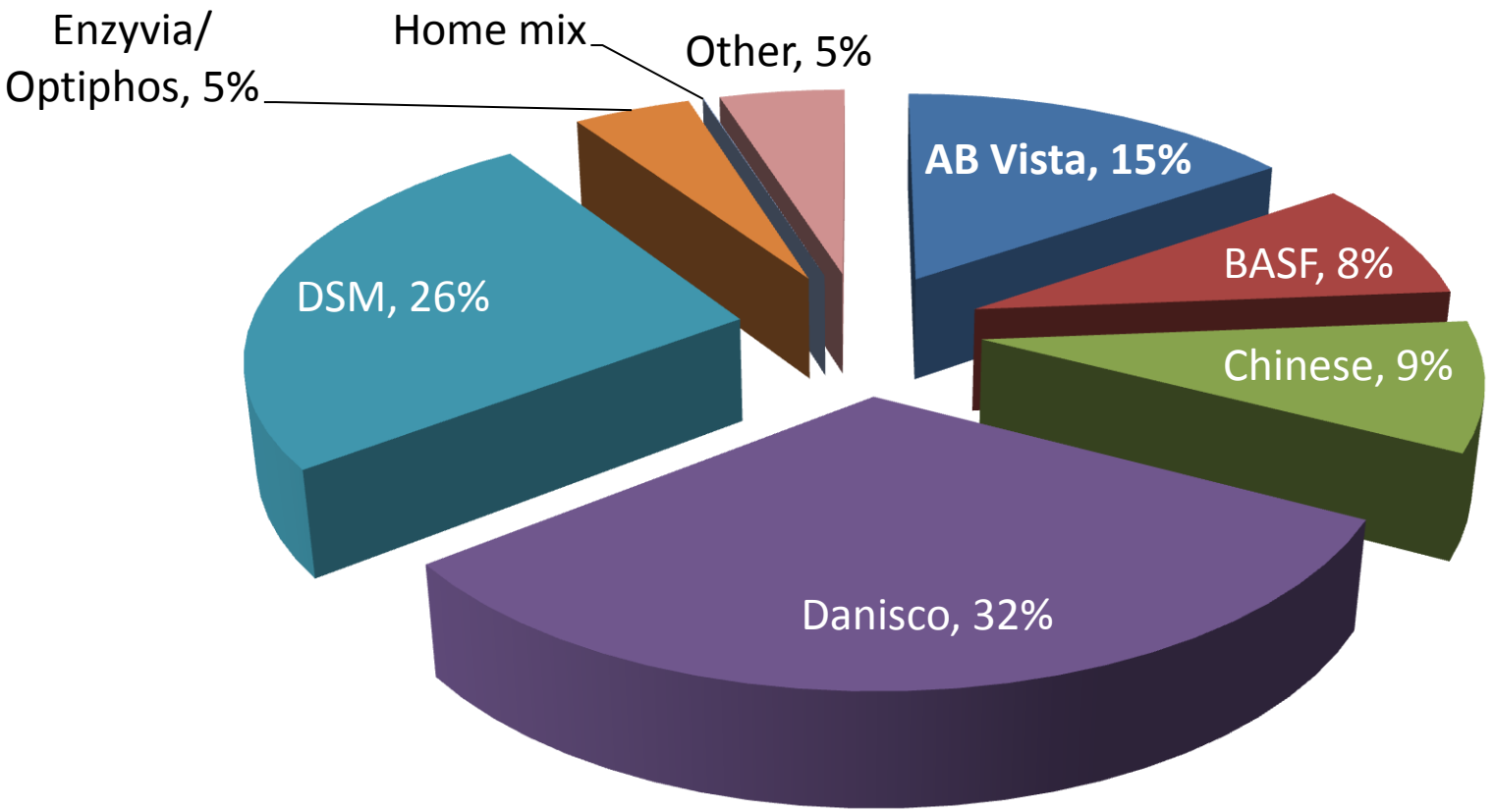
- Introduction to AB Vista
- Phytase superdosing
- New insight in mode of action of NSP enzymes
- Using enzymes together

AB Vista

- AB Vista is an integrated supplier of new generation micro-ingredients for animal feeds.

- AB Vista was founded in 2004 and operates under the AB Agri division of Associated British Foods PLC . Its headquarters are in Marlborough, UK.

Global phytase market share



	Poultry	Swine	Total
Estimated market value	$250m €184m	$150m €110m	$400m €294m

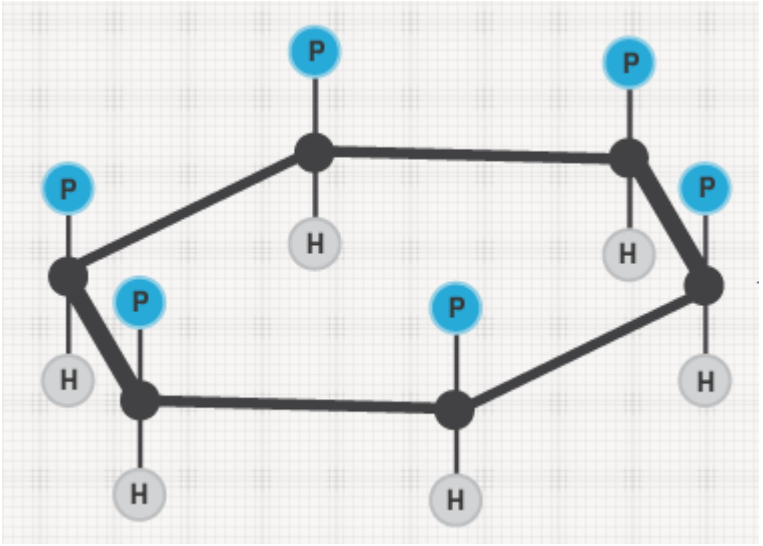
Internal data, AB Vista 2012

What is phytate?

Phytate, which is present in many plant-based feedstuffs, is the **main phosphorus (P) store** in plants (Cosgrove, 1980)

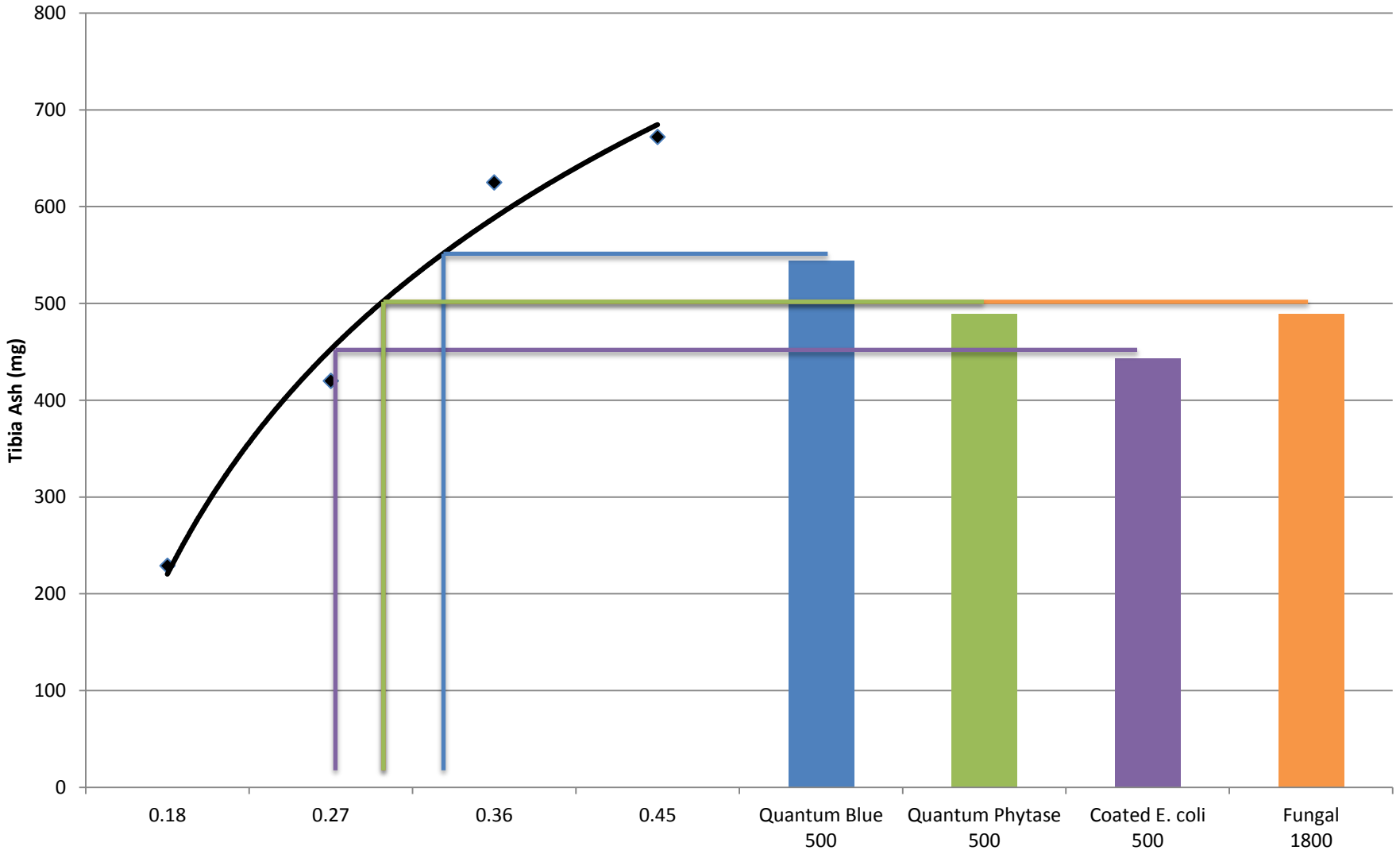
Phytate is important as a **possible source of P** for poultry and swine BUT monogastrics are less efficient at hydrolysing phytate which means that the **phytate P is unavailable** to them for absorption

Phytate can **bind with other minerals and proteins** which makes them unavailable as well



More information about phytate can be found at www.phytate.info

AvP release determination

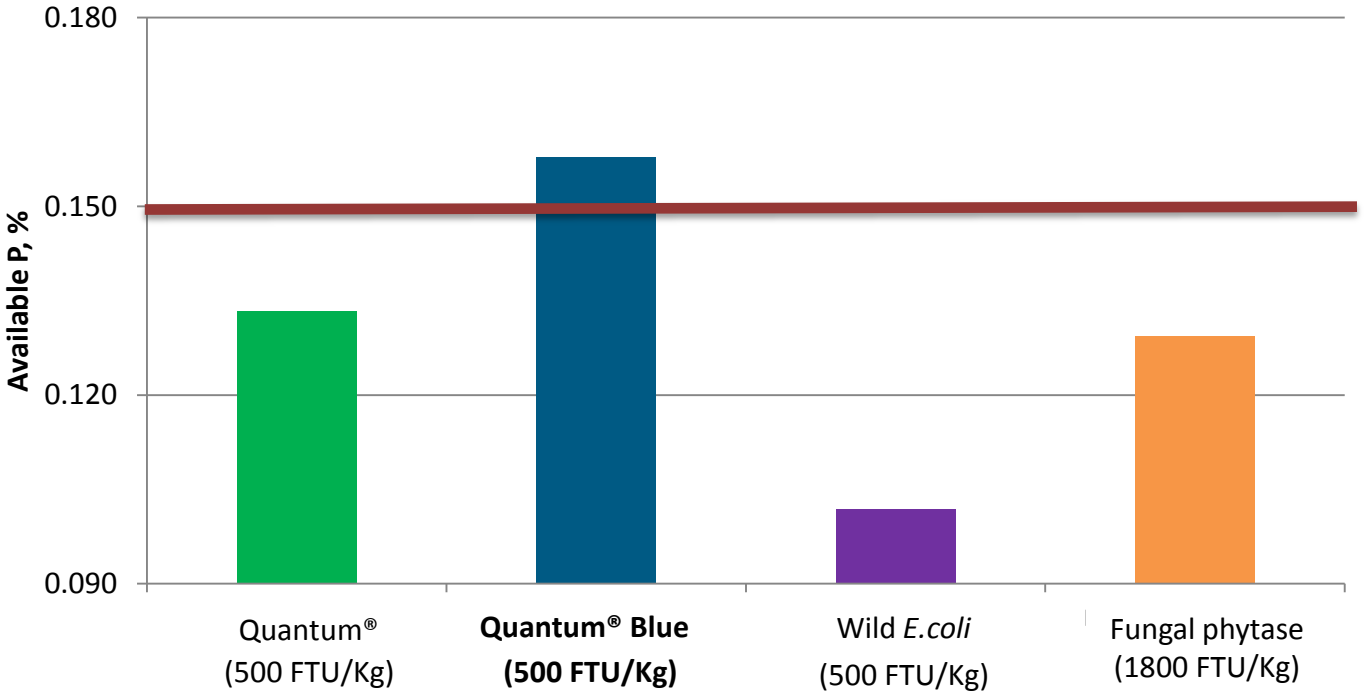


Quantum® Blue 2012 Broilers USA 111

Quantum® Blue delivers more phosphorus, more consistently

- 500 FTU/Kg Quantum Blue® gives you at least 0.15% av P*
- Quantum® Blue is markedly superior

Available P release calculated based on 18 days old broiler performance and bone paramenters



Trial Report: Quantum Blue 2012 Broiler USA 111

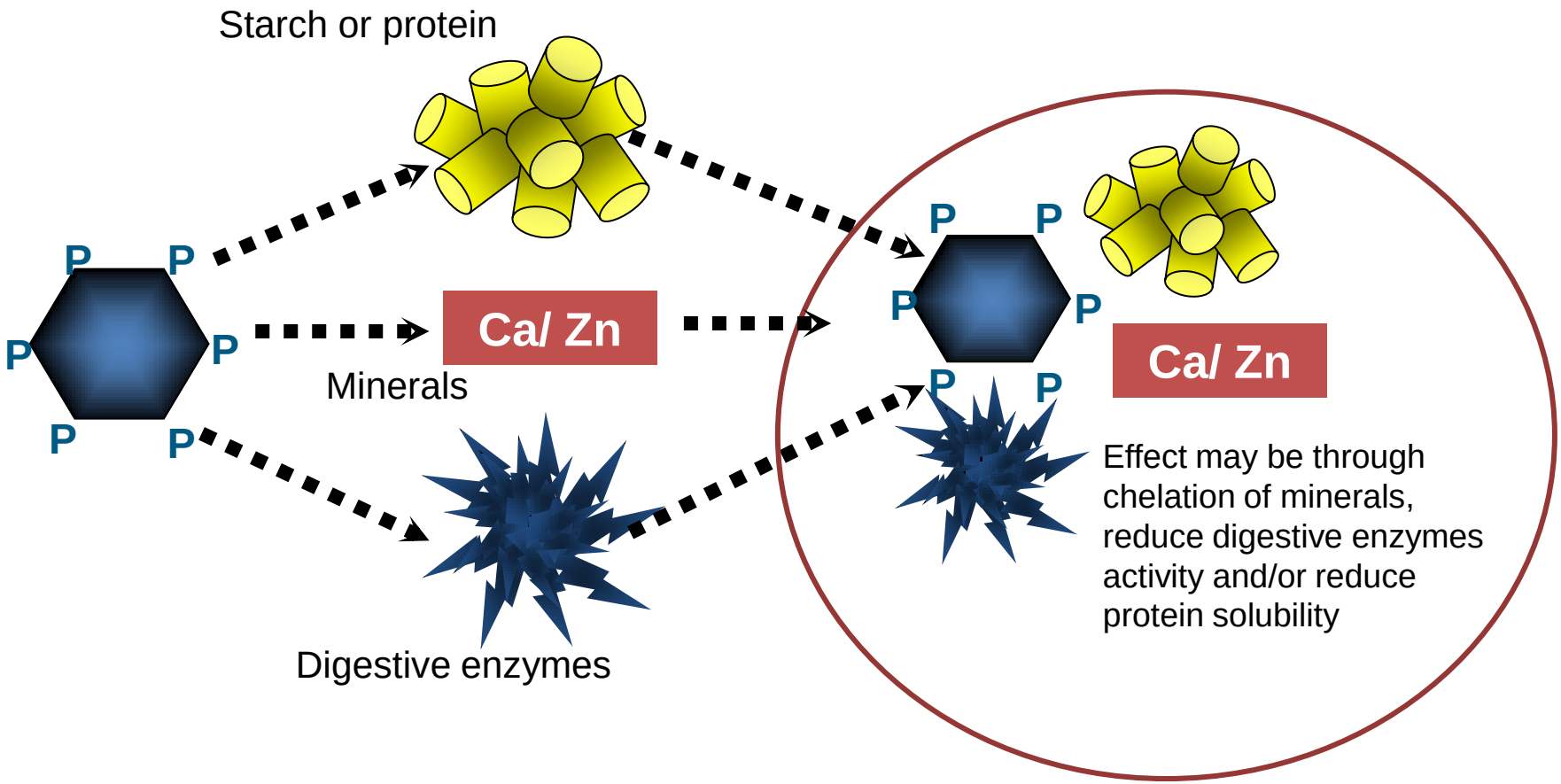
*based on 90% confidence limits

Phytate

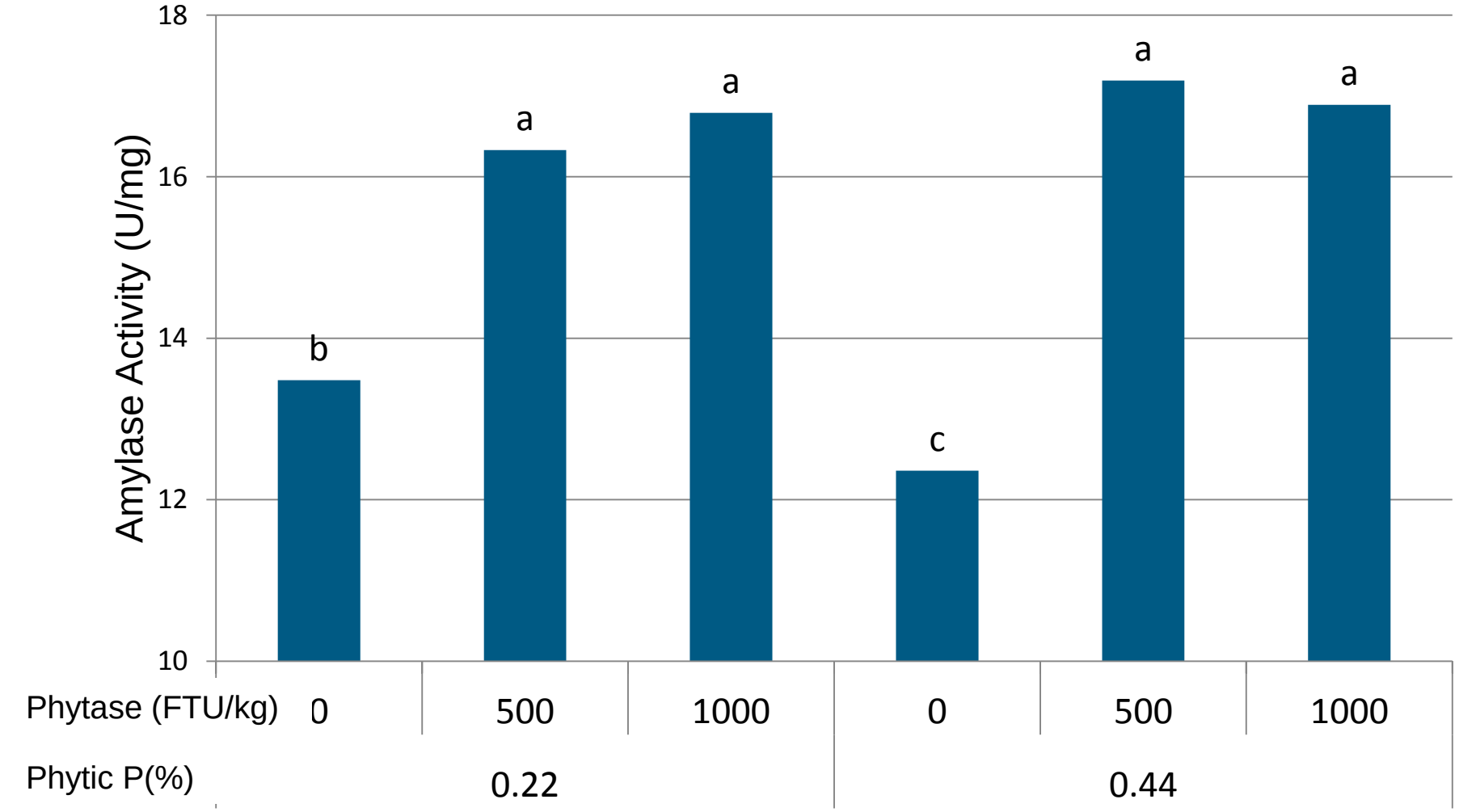
Anti-nutritional effects

Anti-nutritional effect of phytate

Phytate can decrease feed digestibility by forming insoluble complexes with nutrients and digestive enzymes or reduce nutrient solubility



Phytate reduces amylase activity in intestinal mucosa



Liu *et al.*, 2008

IP6 is not the only problem
Phytase has to get rid of IP5→IP2 as well

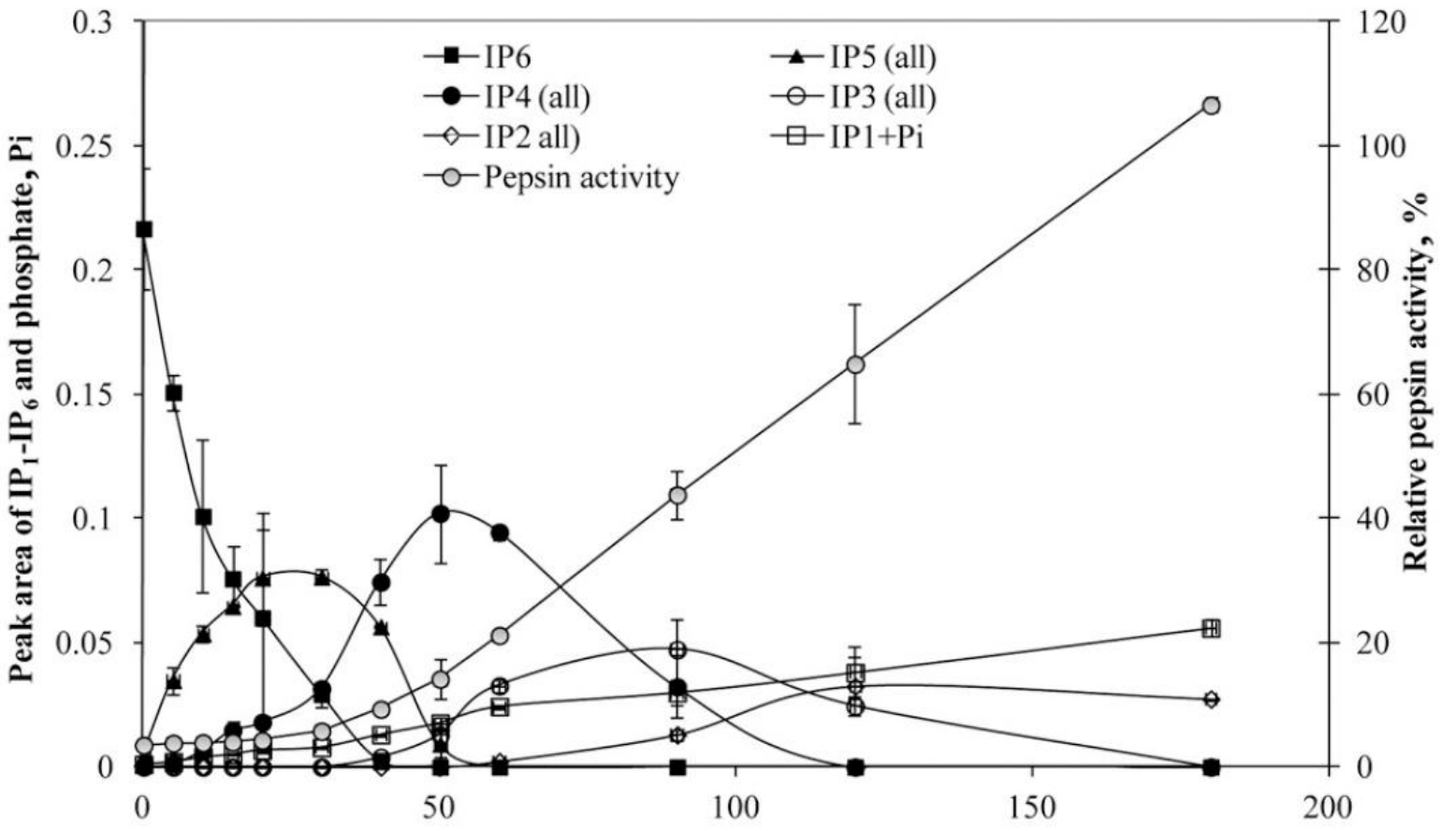


Figure 6. Time course of phytic acid hydrolysis by *E. coli* phytase (Phyzyme XP, Danisco A/S, Brabrand, Denmark; 0.08 phytase unit≅mL^{-1}) and inhibition of porcine pepsin catalyzed azurine cross-linked casein hydrolysis by the hydrolyzates. Phytic acid hydrolysis was performed at 37°C; pepsin activity assay was carried out at 40°C. Each data point is an average of 2 separate experiments.

Yu et al 2012

AB Vista definition of superdosing:

Supplementing high doses of phytase to maximize phytate degradation rather than P release.

'Superdosing' will depend on:

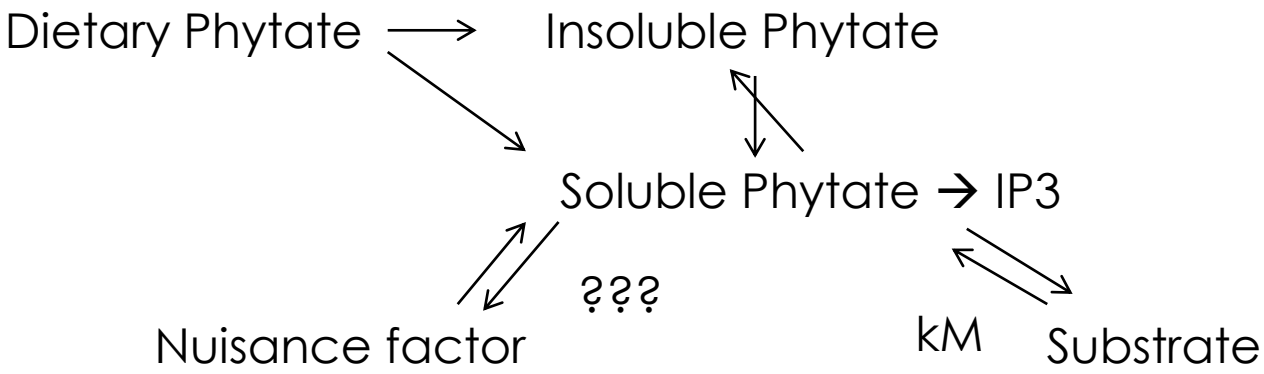
1. Species and category
2. Matrix and current feeding program

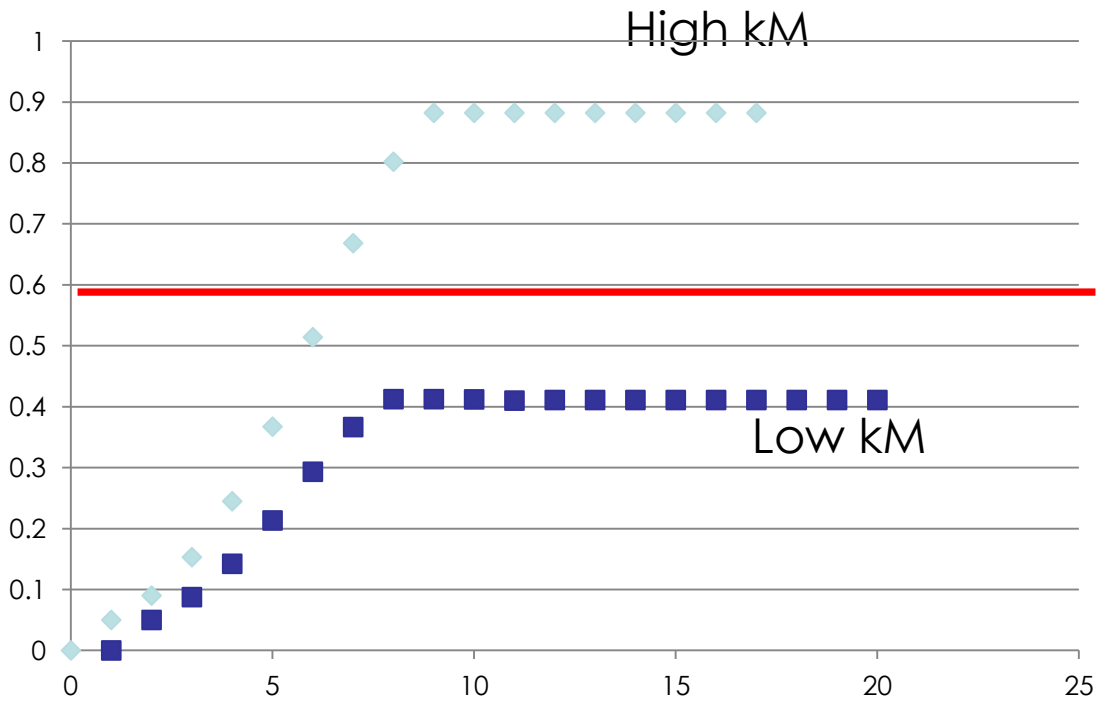
Caveats: What is a high dose?

Depends on biologically relevant characteristics of that enzyme

1. Enzyme activity at pH 3
2. Pepsin resistance
3. Low Km – high activity at low phytate concentrations
4. Rapid release

Equilibria to consider

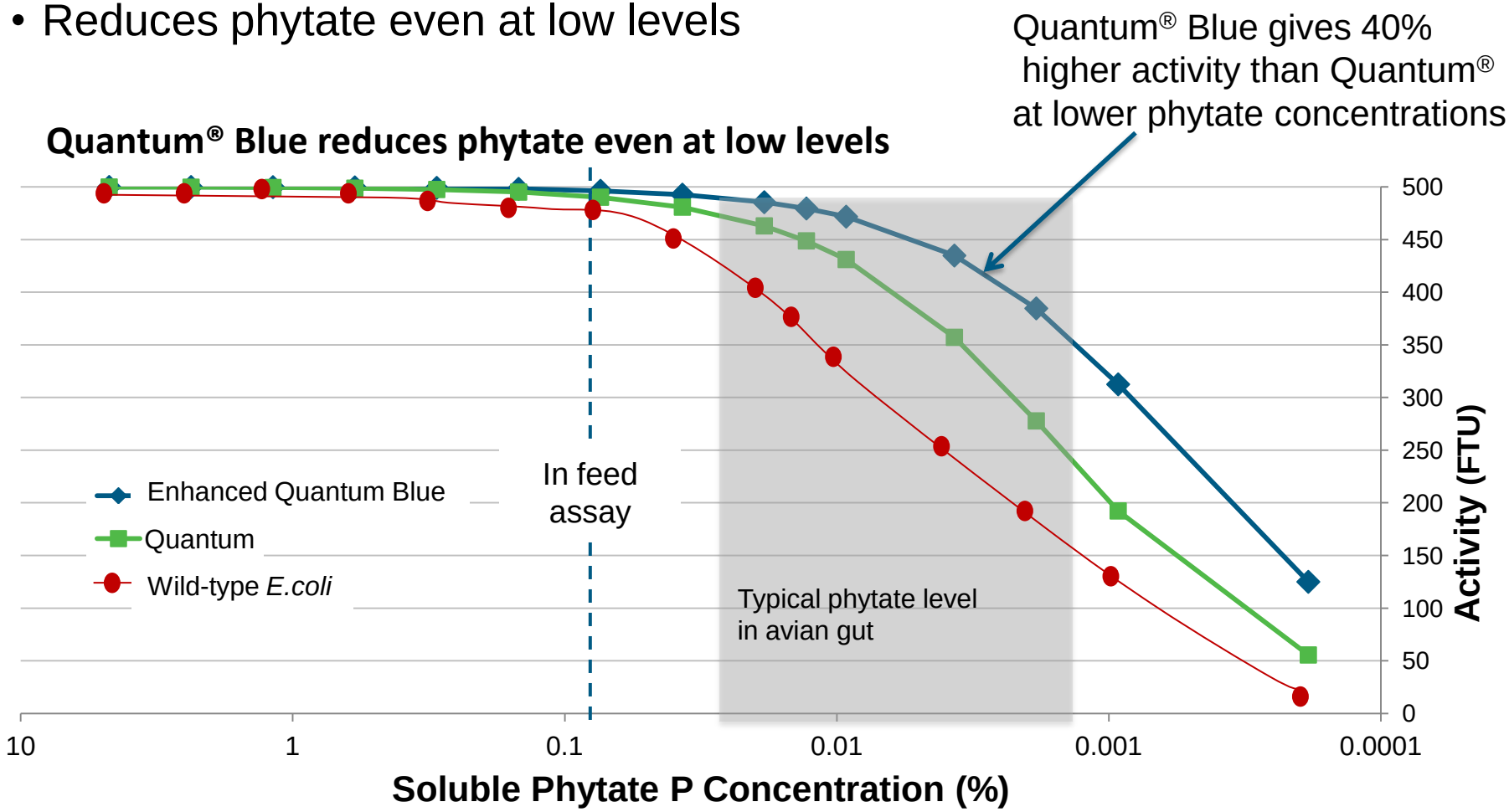




Critical phytate concentration

Quantum® Blue is optimised for phytate destruction

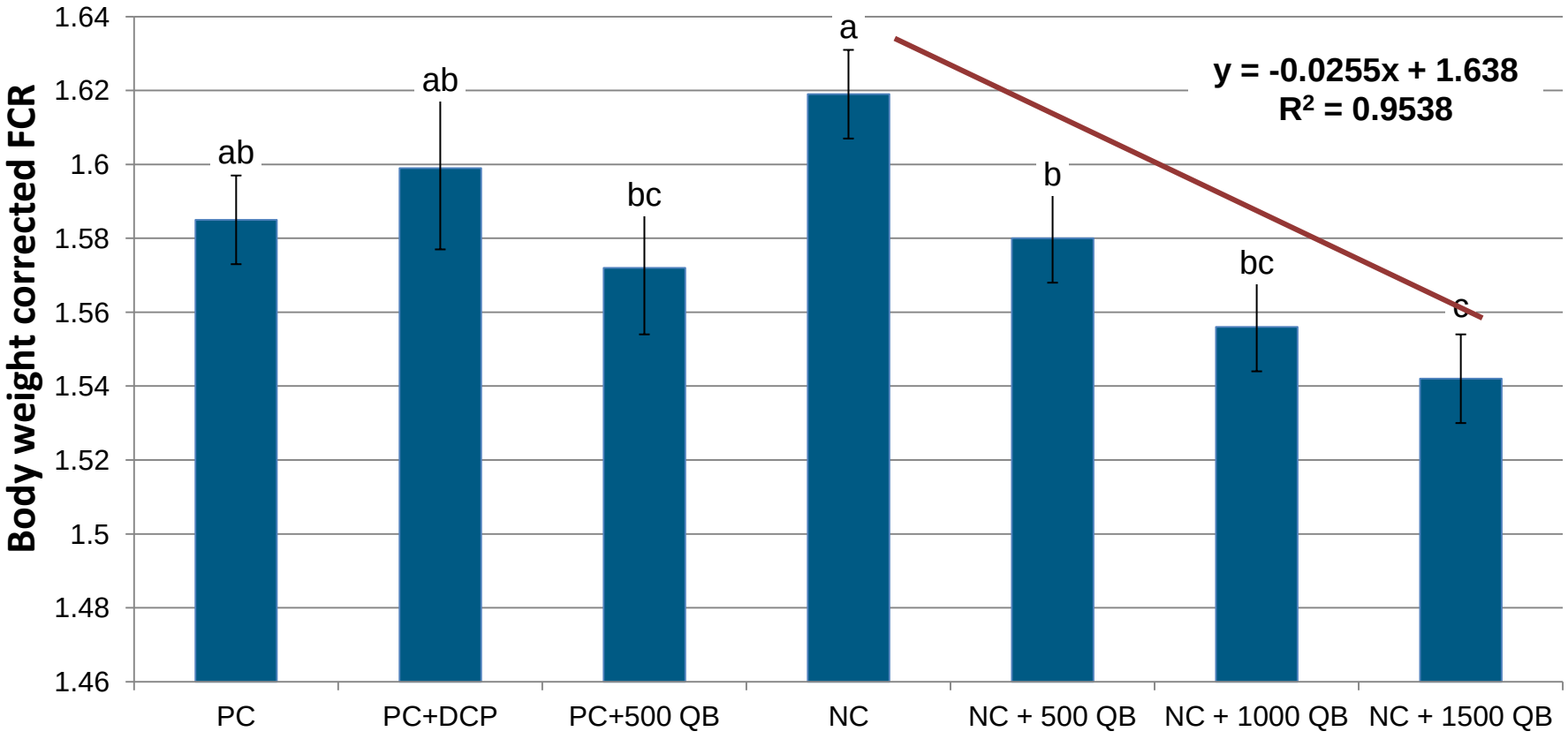
- Delivers high and consistent activity at gastric pH
- Reduces phytate even at low levels



Quantum® Blue Superdosing – 4 point improvement in FCR

4 points in FCR currently worth €5 per tonne of feed

Composite analysis of 6 trials:
Body weight corrected FCR of broilers from d 0 to 35/42 (n = 35)

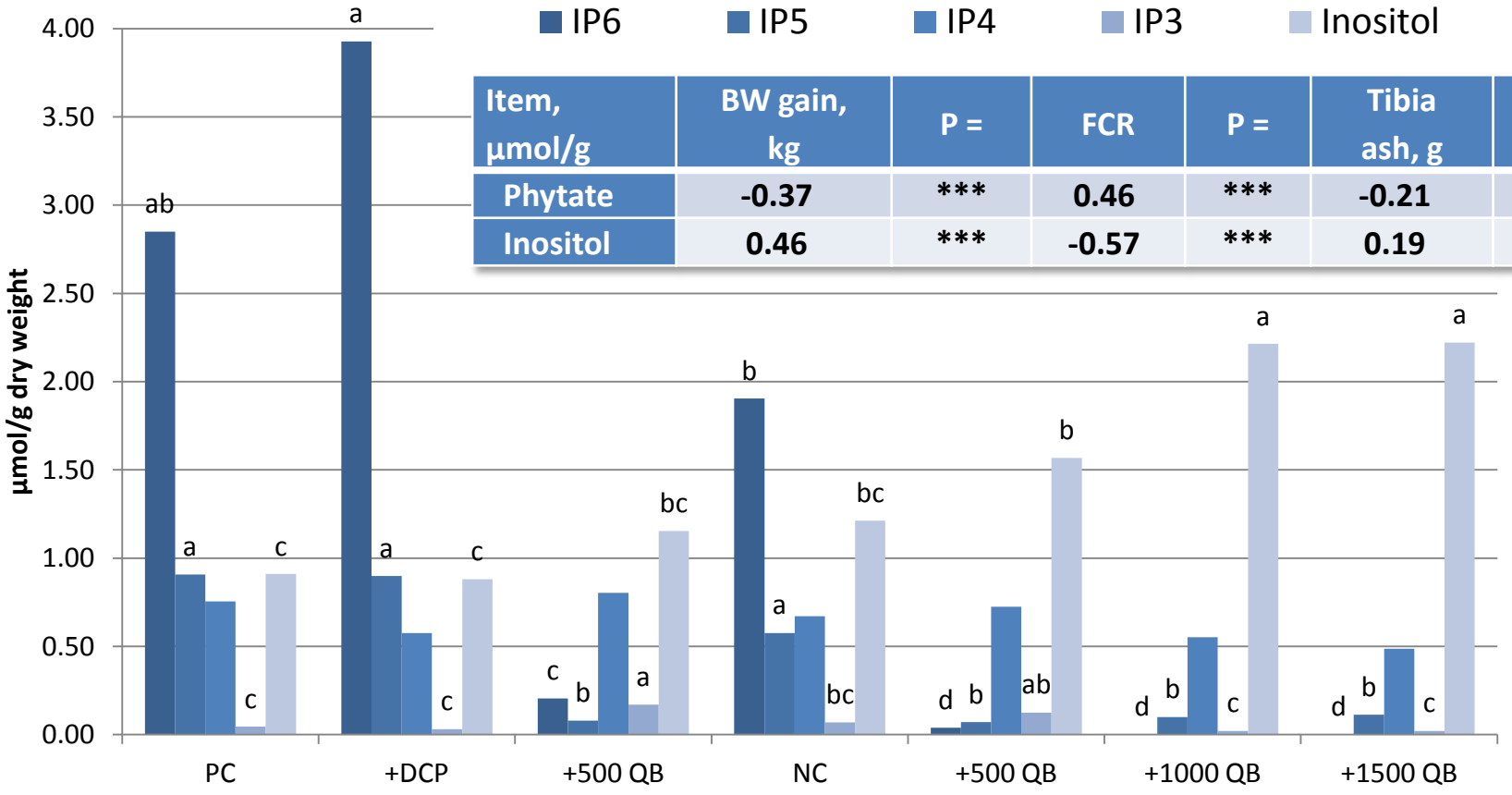


Extra-phosphoric effects of phytase

Broiler gizzard phytate, phytate ester and inositol concentration (d21)

Superdosing Quantum Blue decreased phytate and increased inositol concentration

Part of the superdosing response may be associated with inositol provision as well as phytate destruction



Item, µmol/g	BW gain, kg	P =	FCR	P =	Tibia ash, g	P =
Phytate	-0.37	***	0.46	***	-0.21	NS
Inositol	0.46	***	-0.57	***	0.19	NS

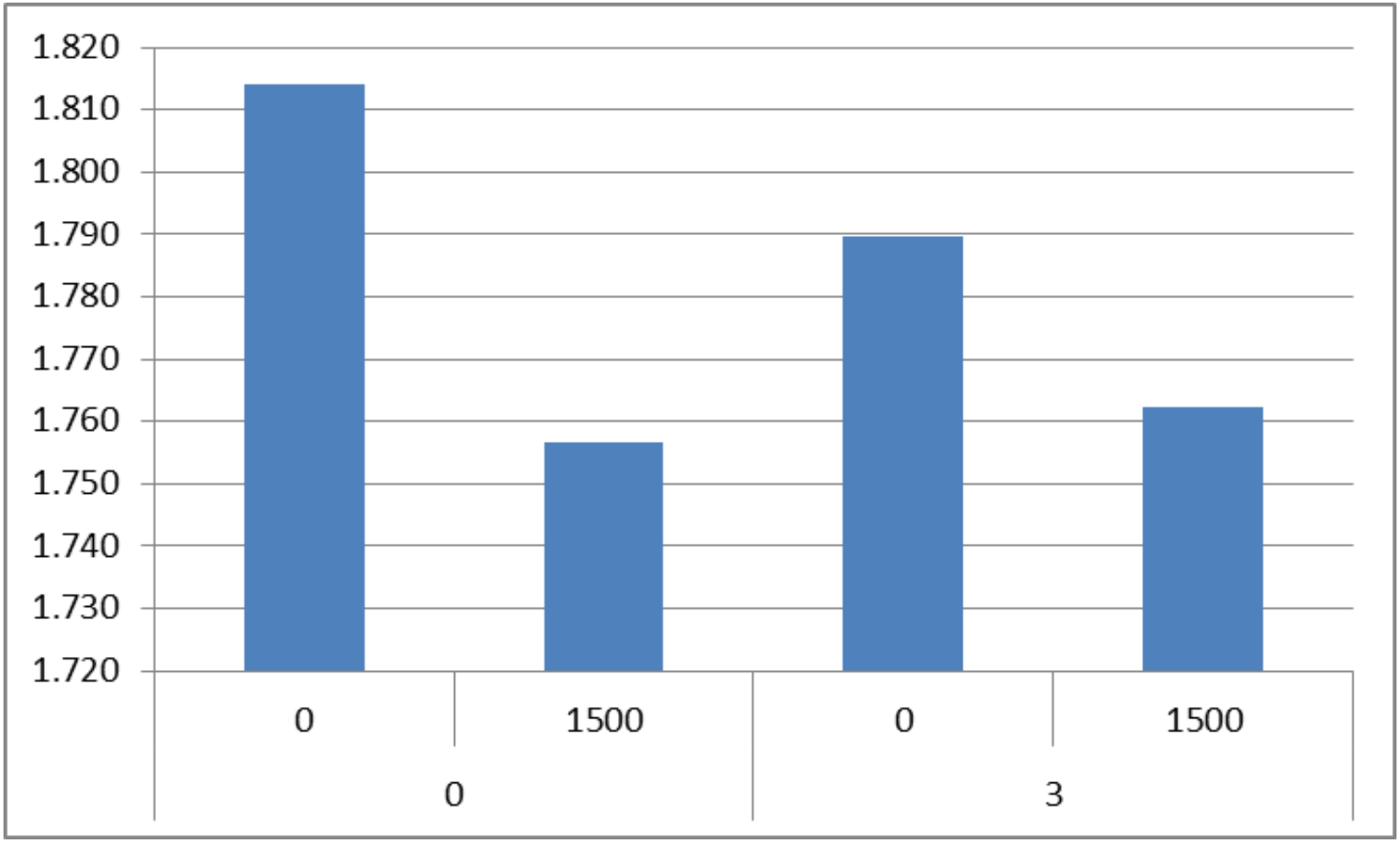
Walk *et al.*, 2014

Inositol interacts with phytase
It is likely part of the superdosing effect

FCR

Inositol* Phytase interaction p<0.0143

LSD = 0.017



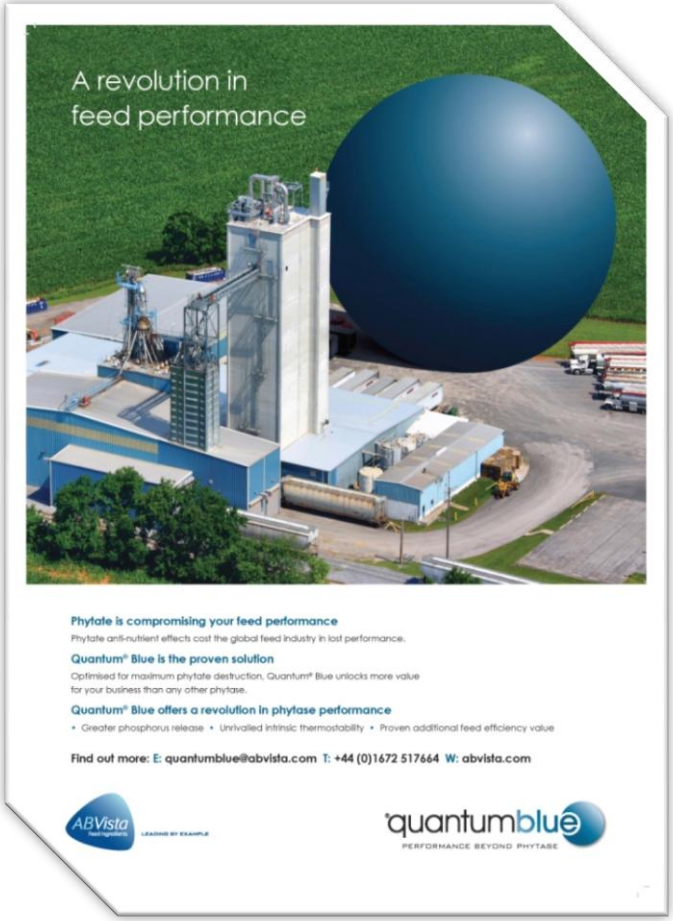
Enzymes

quantumblue®

PERFORMANCE BEYOND PHYTASE

Optimised for maximum phytate destruction, Quantum Blue unlocks more value for your business than any other phytase.

- Greater phosphorus release
- Unrivalled intrinsic thermostability
- Proven additional feed efficiency value



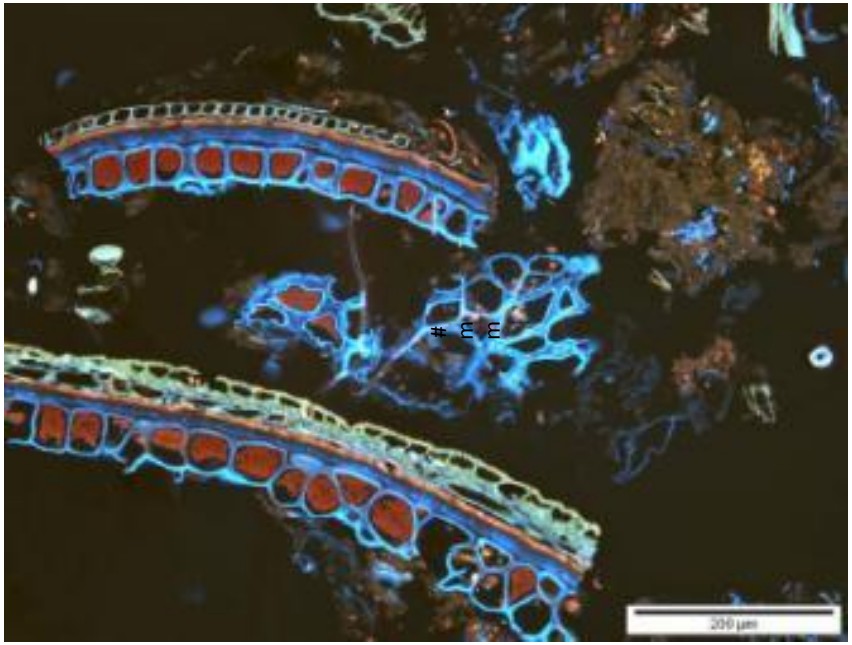
ABVista Feed Ingredients

Xylanase Mode of Action

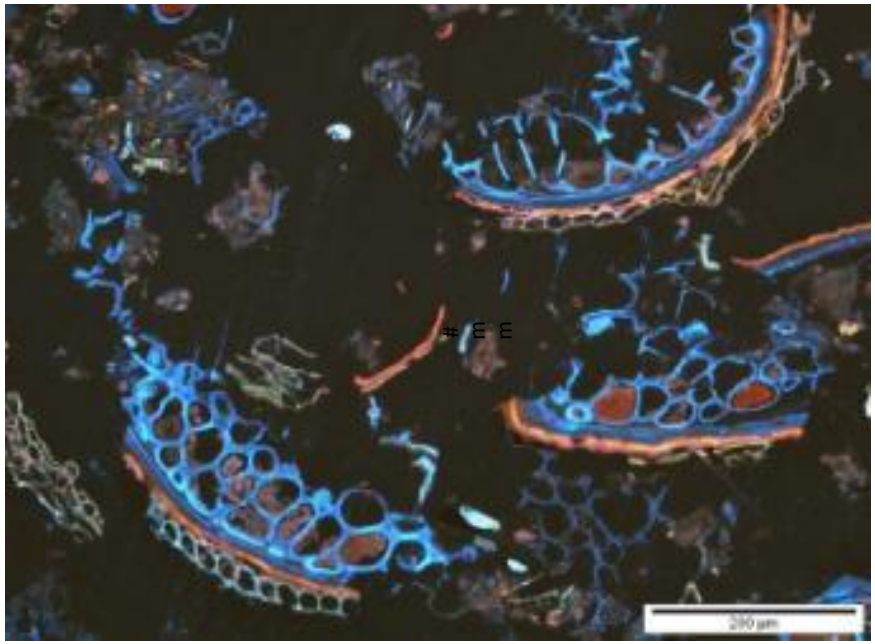
1. Opens up feedstuff cell walls (insoluble fibre)
    - Corn-based diets
2. Reduces intestinal viscosity (soluble fibre)
    - Wheat and barley diets
3. Produces oligosaccharides (prebiotics)

Cell wall hypothesis

Samples taken from terminal ileum



no enzyme



xylanase added

Is cell wall hydrolysis realistic in the intestine?

- Time and pH

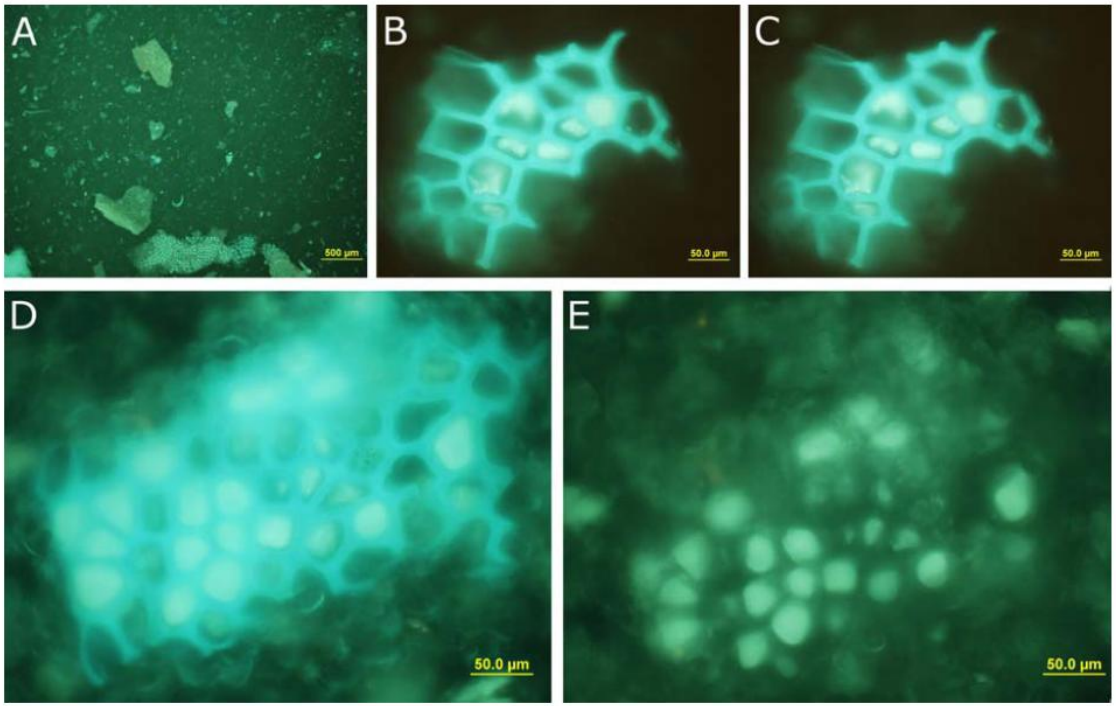


Fig. 2. Visualization of the degradation of aleurone arabinoxylan cages present in milled wheat after incubation with Ronozyme WX xylanase (1 g of enzyme/kg of diet) at 30°C. **A,** Milled maize as seen under a microscope; **B–E,** close-up of a cell wall structure containing ferulic acid, which fluoresces with an intense blue-green fluorescence. B and C present cell walls treated with a buffer solution lacking enzymes, and D and E present cell walls before and after addition of the xylanase, leading to breakdown and disappearance of the cell wall architecture.

Lei et al 2013

Xylanase Mode of Action

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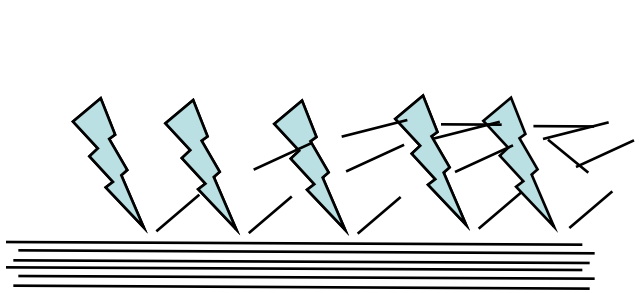
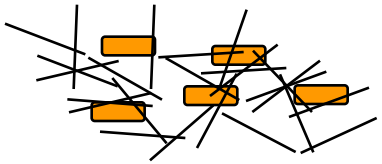
VFA production stimulates PYY release



1. Xylanases breakdown cell walls

2. Release prebiotic xylo-oligosaccharides



3. Fermented by bacterial species

VFA's

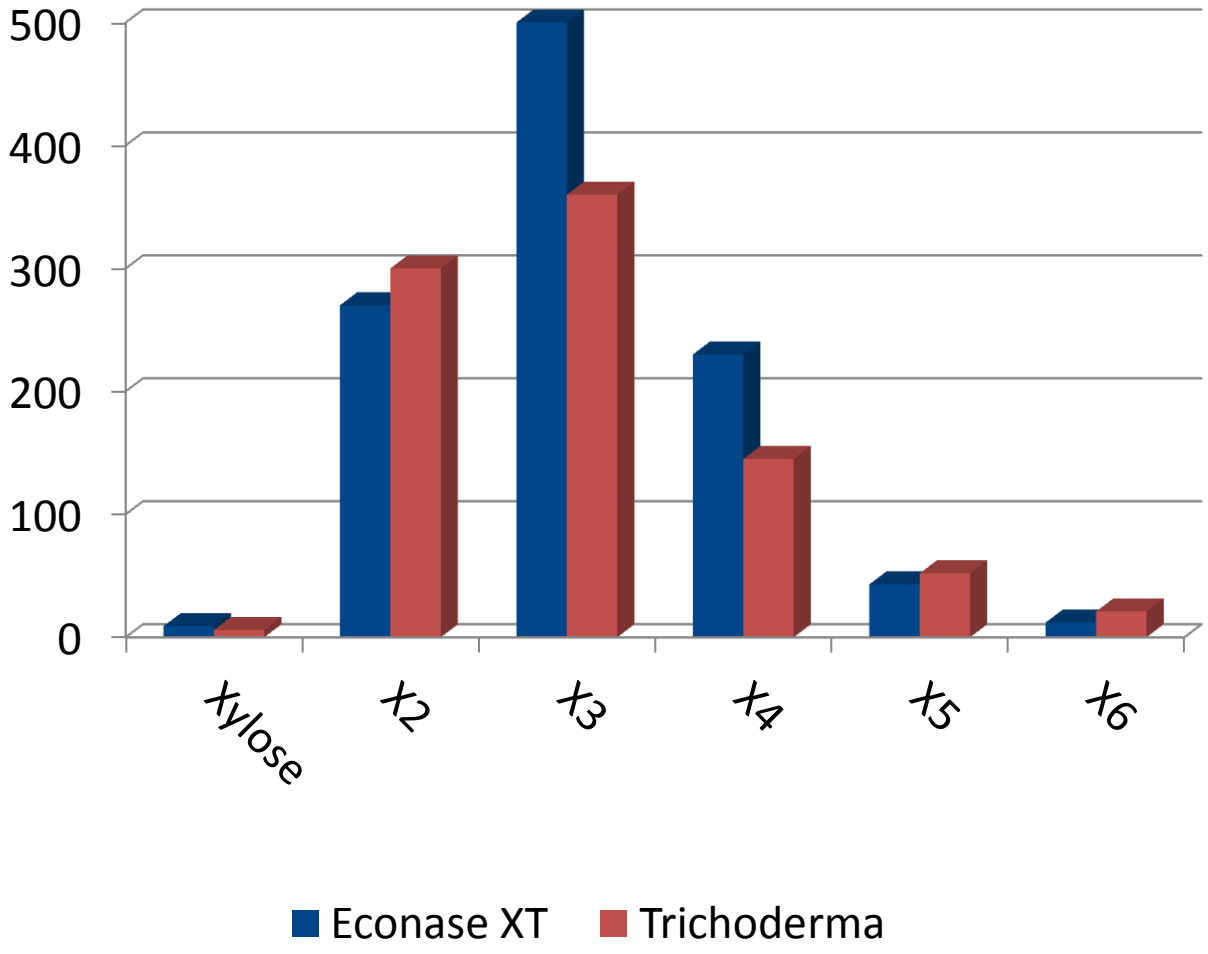
Energy

Bacterial control

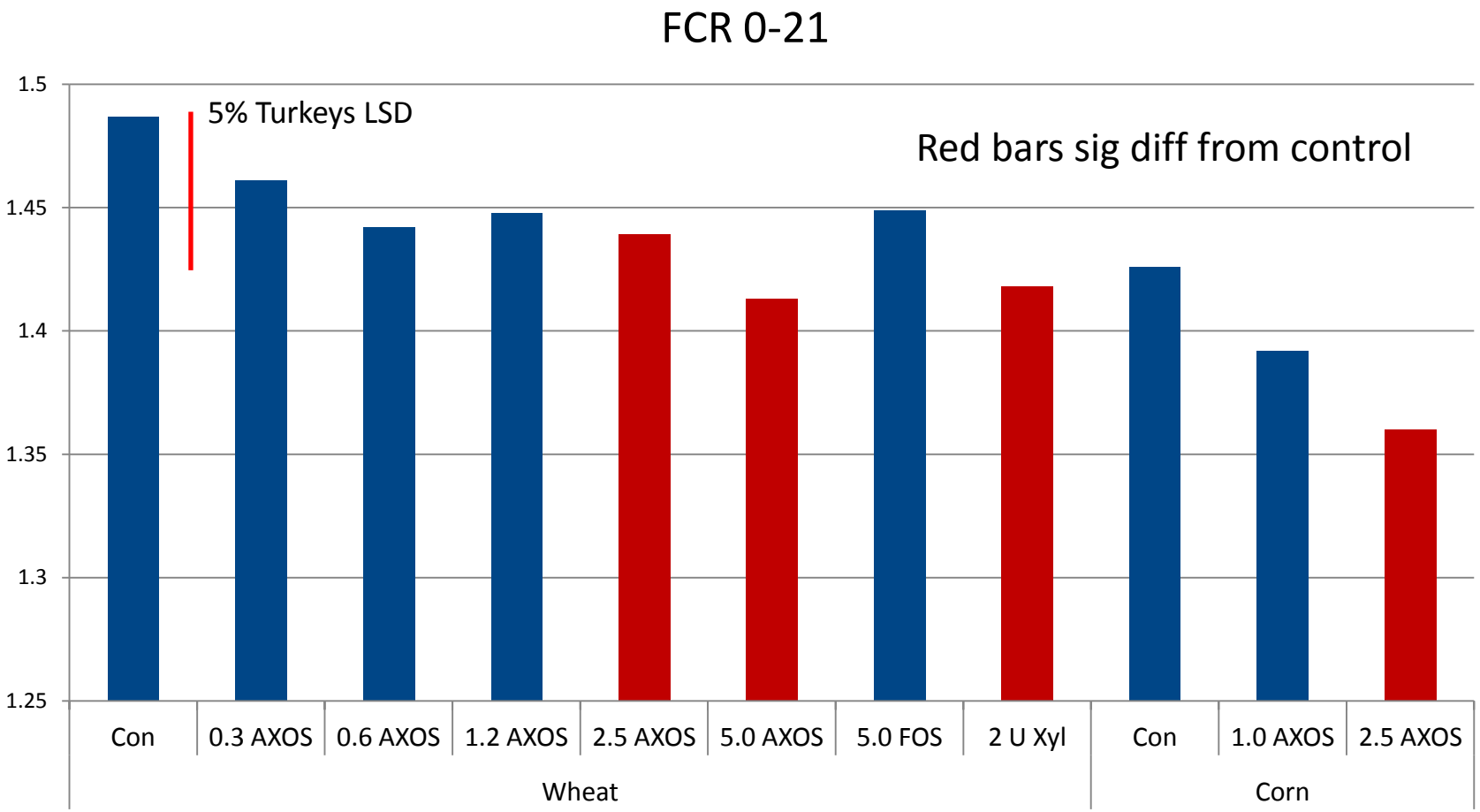
4. Support growth of beneficial gut microflora and suppress growth of pathogenic bacteria

P-YY release → Gizzard → delays gastric emptying

Differences exist between xylanases in end products

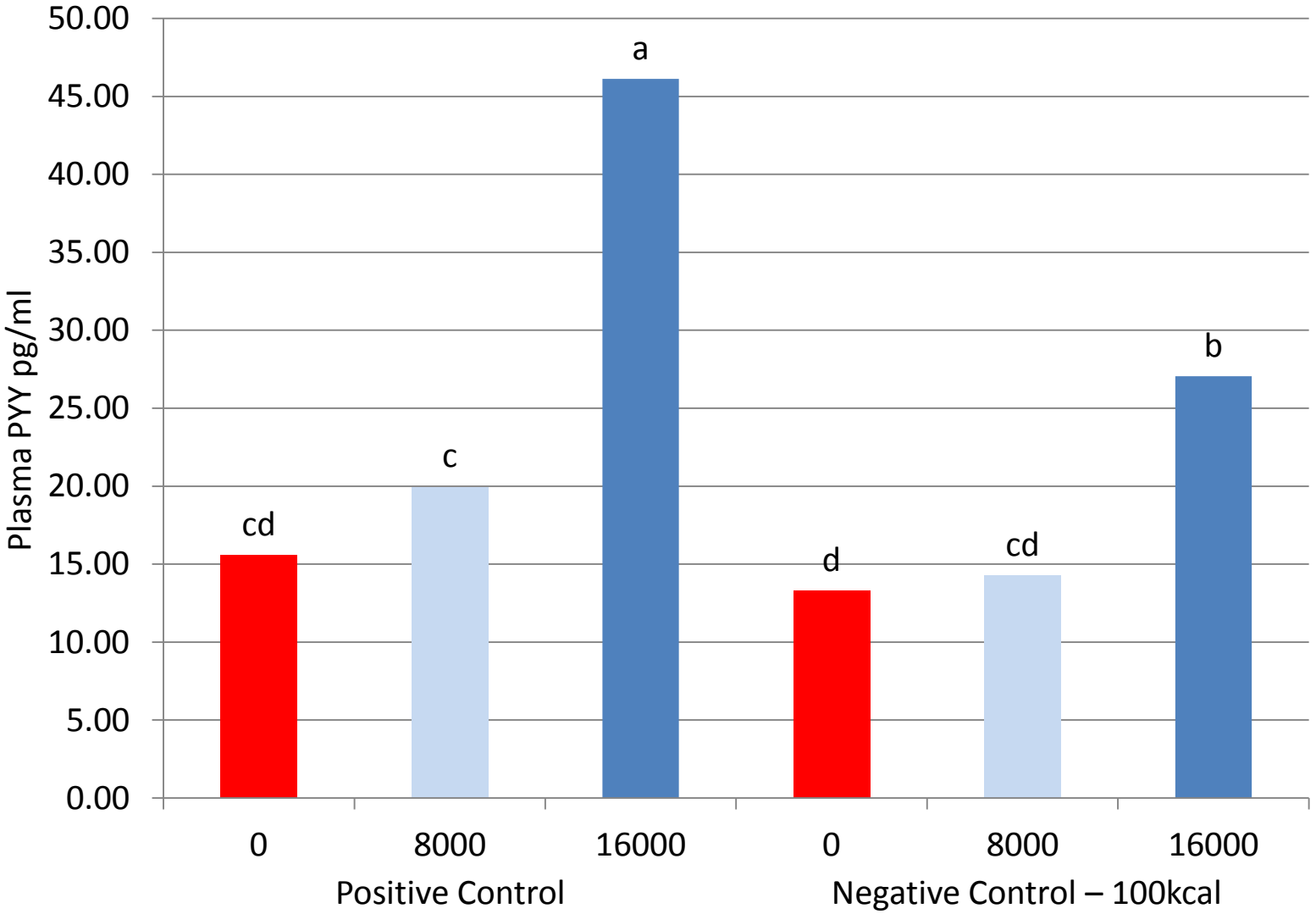


Xylo-oligomer efficacy?



Courtin et al 2008

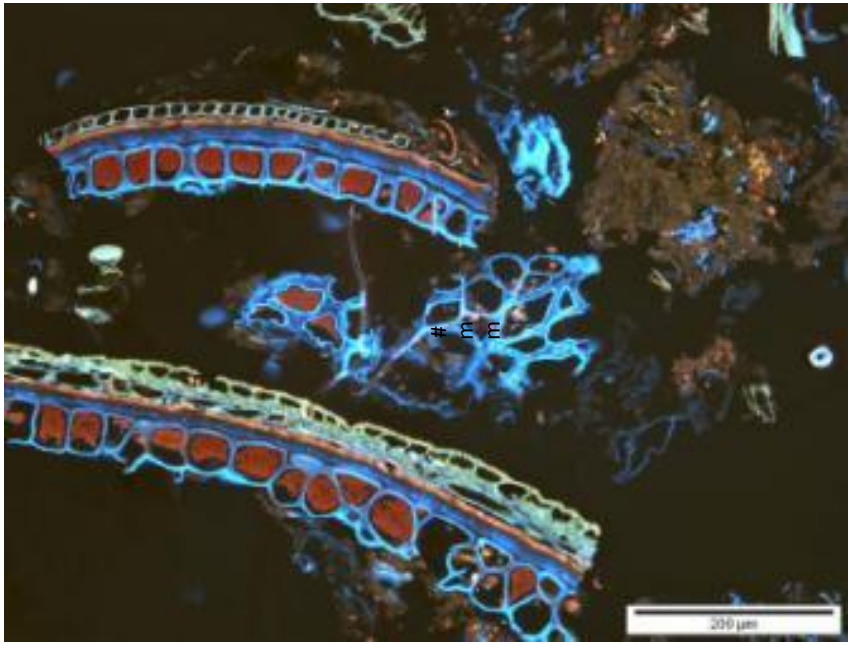
Econase® XT increases Peptide-YY release



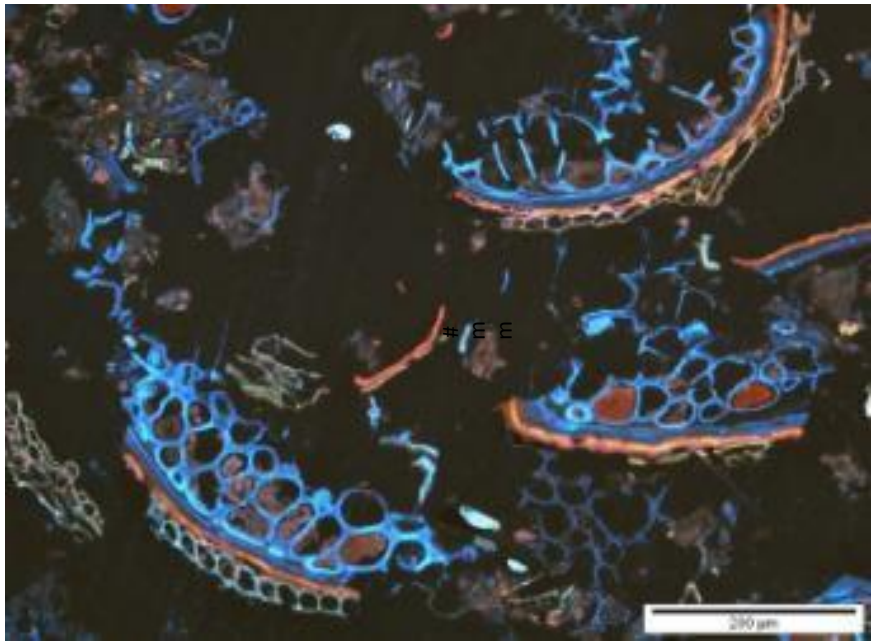
Masey O'Neill, 2012

PYY release effects improved digestion?

Samples taken from terminal ileum



no enzyme



xylanase added

Improvement of digestion based on bigger gizzard activity and delay on gizzard empting, not on enzyme directly opening cell walls!

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econase XT LEADING BY EXAMPLE

Why should there be a benefit in combination

- Phytase improves Energy and amino acid digestibility
  - Leaves less for the xylanase to work on
  - Empirically the matrices are not additive

But …..

- Increased gastric residence time increases time available for phytase to work
- Better P matrix (more security) and better superdosing response
- SD = 4 points in FCR
- SD + Econase XT = 6 points
- Still value in the combination

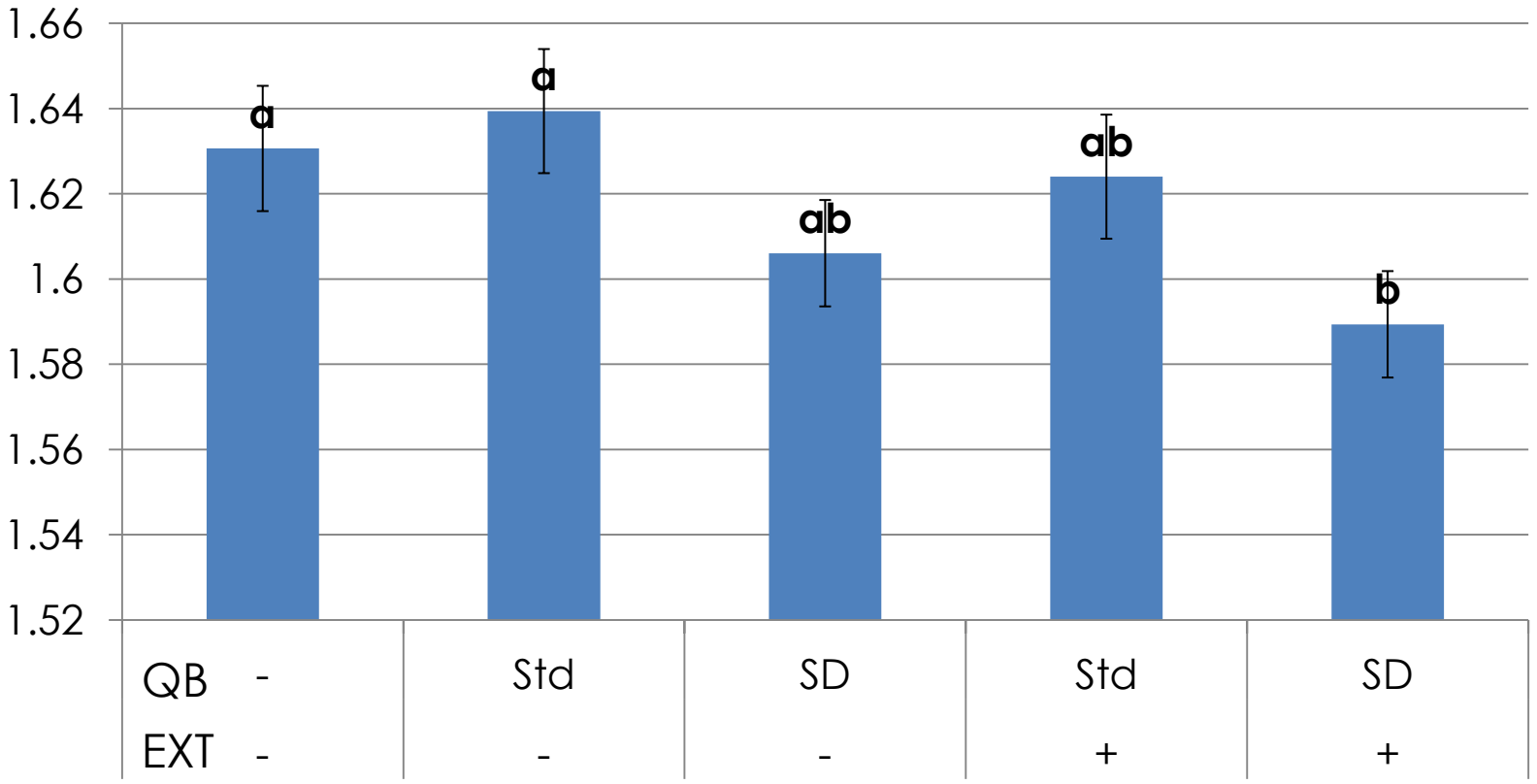
ABVista Feed Ingredients

econase XT LEADING BY EXAMPLE

SD combination with XT?

BWcFCR of broilers > 35 d fed QB with or without Econase XT

N = 70; 6 trials conducted in Mexico (1), Brazil (1), India (1), UK (2) and Germany (1)



Conclusions?

- Each enzyme has different substrate and hence activity in the animal
- BUT there is an overlap in the mechanisms by which they elicit improvements in digestibility
- Combination will result in better performance but reduced individual matrices

1 + 1 ≠ 2, ~ 1.5-1.6

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econase XT LEADING BY EXAMPLE

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Thank you!

For more information visit:
www.abvista.com or www.phytate.info