A value-based approach to compare the optimum dose of an *E. coli* and *Buttiauxella* phytase in broiler diets

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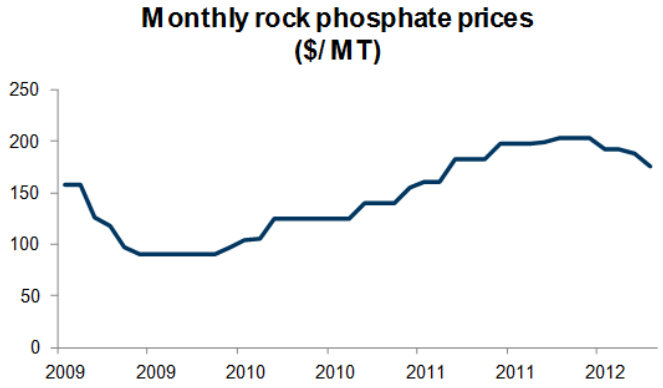
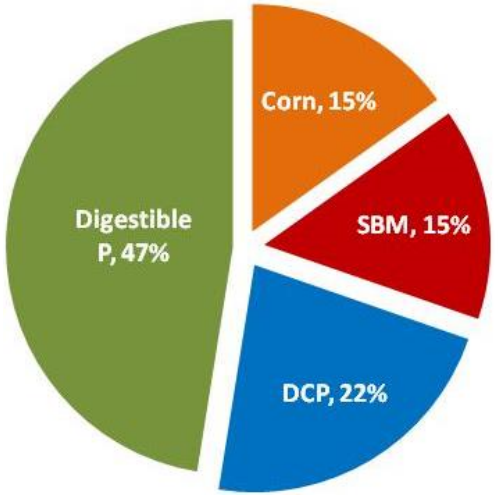
Introduction

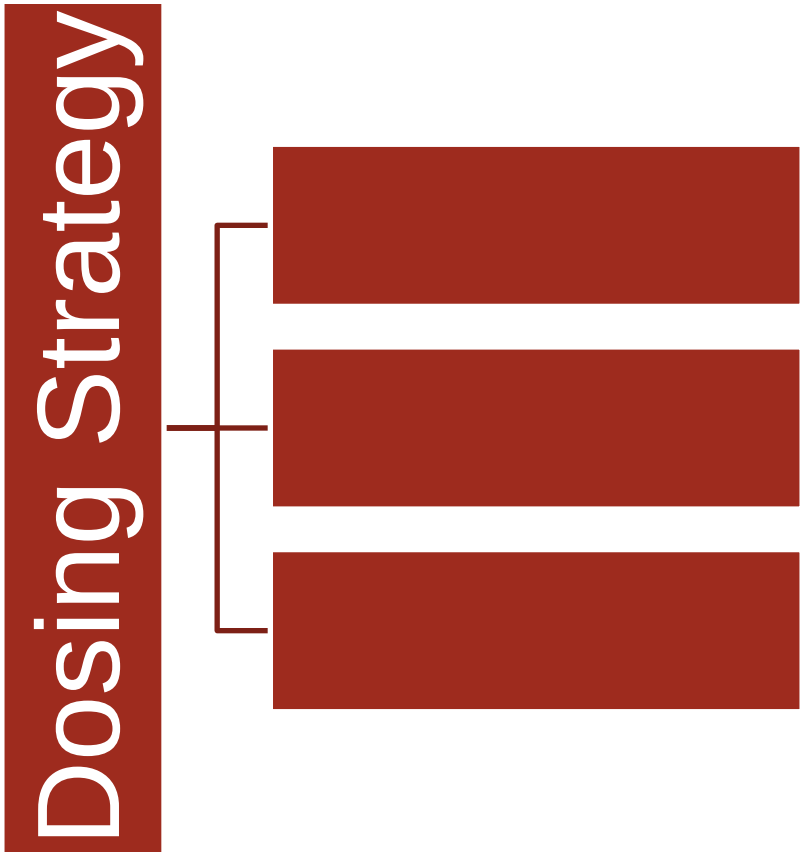
- Inorganic P:
  - Represents significant cost in the diet formulation
  - Finite resource and demand is increasing
- Organic P already present in the formulations is underutilized
- **It is important to optimize phytase inclusion to ensure maximum availability of organic P sources**





% undigested P from feedstuffs

Phytase Dosing Strategies



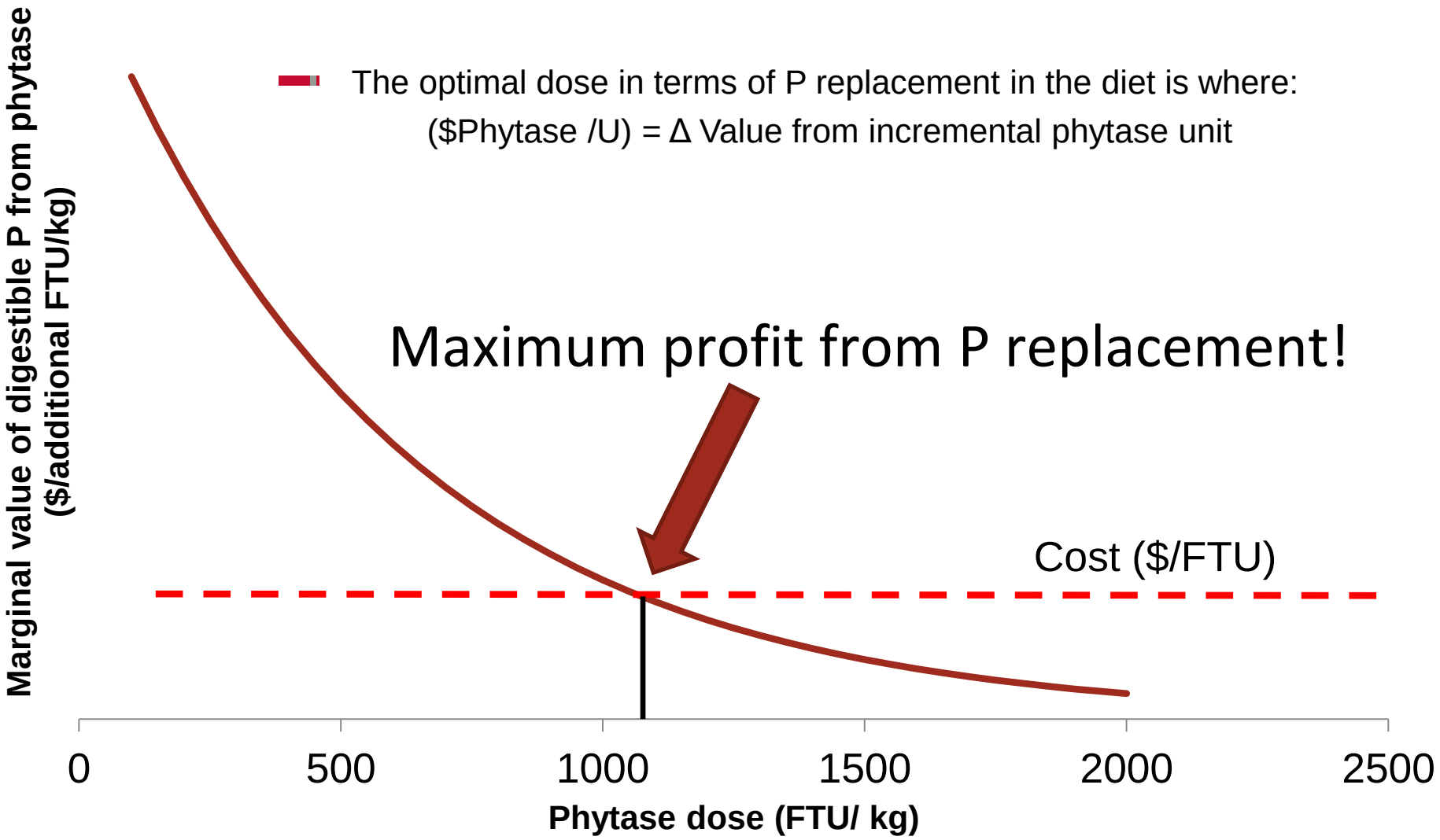
Objectives

- To investigate the optimal inclusion level in terms of P replacement of 2 different phytases from *Buttiauxella* and *E. coli* in broilers based on the "Laws of Diminishing Marginal Utility"

Hypothesis

- *Buttiauxella* phytase will be more efficacioous
- *Buttiauxella* phytase will deliver more value per fTU
- *Buttiaxuella phytase witl have a higher optimal dose*

The Law of Diminishing Marginal Utility



Limitations of the method - effects on performance and digestibility

- Phytase does improve bird performance, in terms of BWG and FCR (Dilger *et al.*, 2004)
- There are also beneficial effects on energy (Ravindran *et al.*, 2008) and amino acid (Amerah *et al.*, 2014) digestibility which are not captured in this model
- Based on this method one can determine where value is captured from phosphorus and have confidence that there will be beneficial effects above and beyond

Materials and Methods

- One day old Ross 308 broiler chickens (N=448) were allocated to 7 treatments (8 replicates/treatment; with 8 birds/replicate)
- The study lasted for 21 days.
- Dietary treatments were based on a negative control (NC) diet, deficient in Ca (0.73%) and nPP (0.2%), supplemented with *Buttiauxella* or *E. coli* phytase at 250, 500, 1500 FTU/kg
- Ileal contents collected from all birds on d21
- Feed and digesta samples were analysed for Phosphorus

Diet Formulations

Ingredient	Inclusion (%)
Corn	53.3
SBM	35.0
Canola Meal	4.0
Soybean Oil	3.4
Limestone	1.4
MCP	0.21
Salt	0.45
Marker	0.30
Other	1.94

Nutrient	Calculated (%)
ME (MJ/kg)	12.65
Crude Protein	22.7
Dig. Lys	1.37
Dig. Met + Cys	1.02
Dig. Thr	0.93
Ca	0.73
P	0.47
nPP	0.20

Statistical Methods

- Non-linear regression analysis was carried out using the Fit Model platform of JMP 11.0 (SAS Institute)
- Data fitted using the equation;
  - $y = a + b * (r^{x})$
- The first derivative of this line was then determined and plotted showing increments in P digestibility % from each unit of phytase added
- The amount of actual P digested was then calculated and its value calculated based on the price of DCP

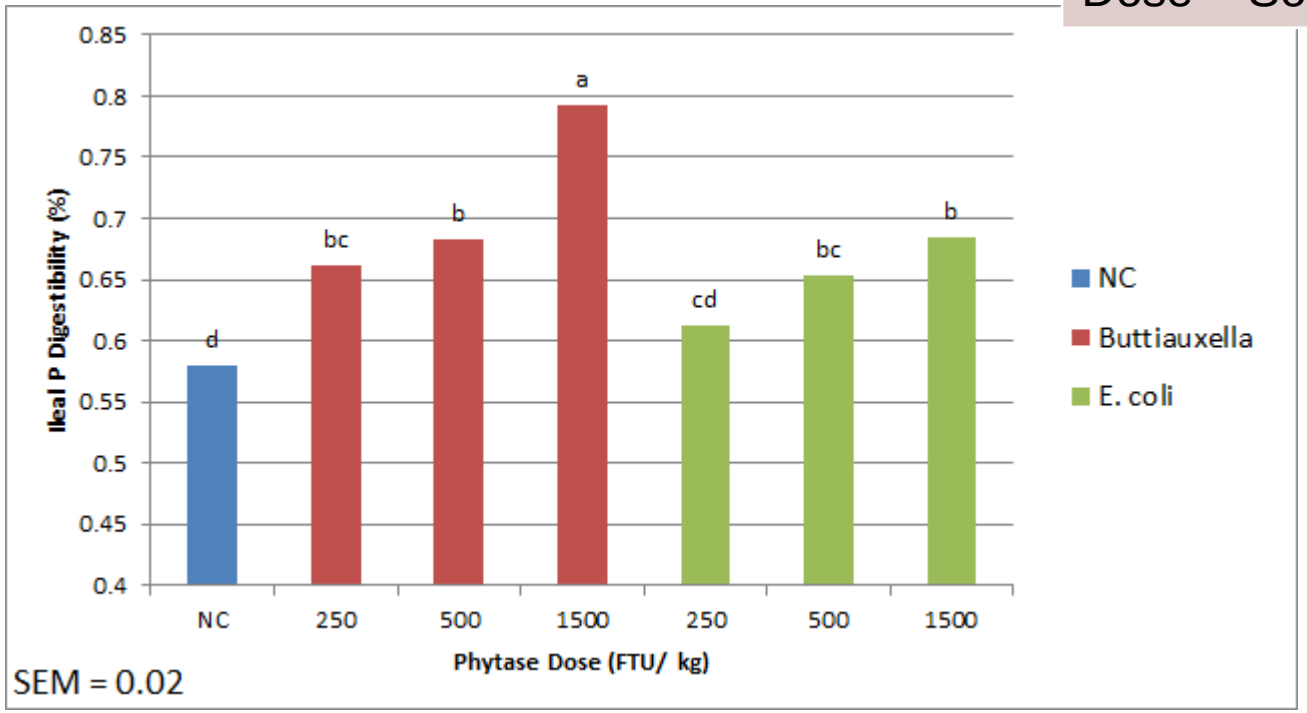
Assumptions

- The cost of the P liberated from Phytase is = to the cost of P from DCP
- DCP cost = $660/tonne – with 18.2% total P and 78% retainable P (CVB tables, 2011)
  - Price taken as an example cost in the US in Q1 2014
- Phytase cost assumed to be $0.0016/FTU – taken to be the market average in Q1 2014
- The cost of *Buttiauxella* phytase = the cost of *E. coli* phytase
- The birds requirements are not met/exceeded by the P liberated from phytate

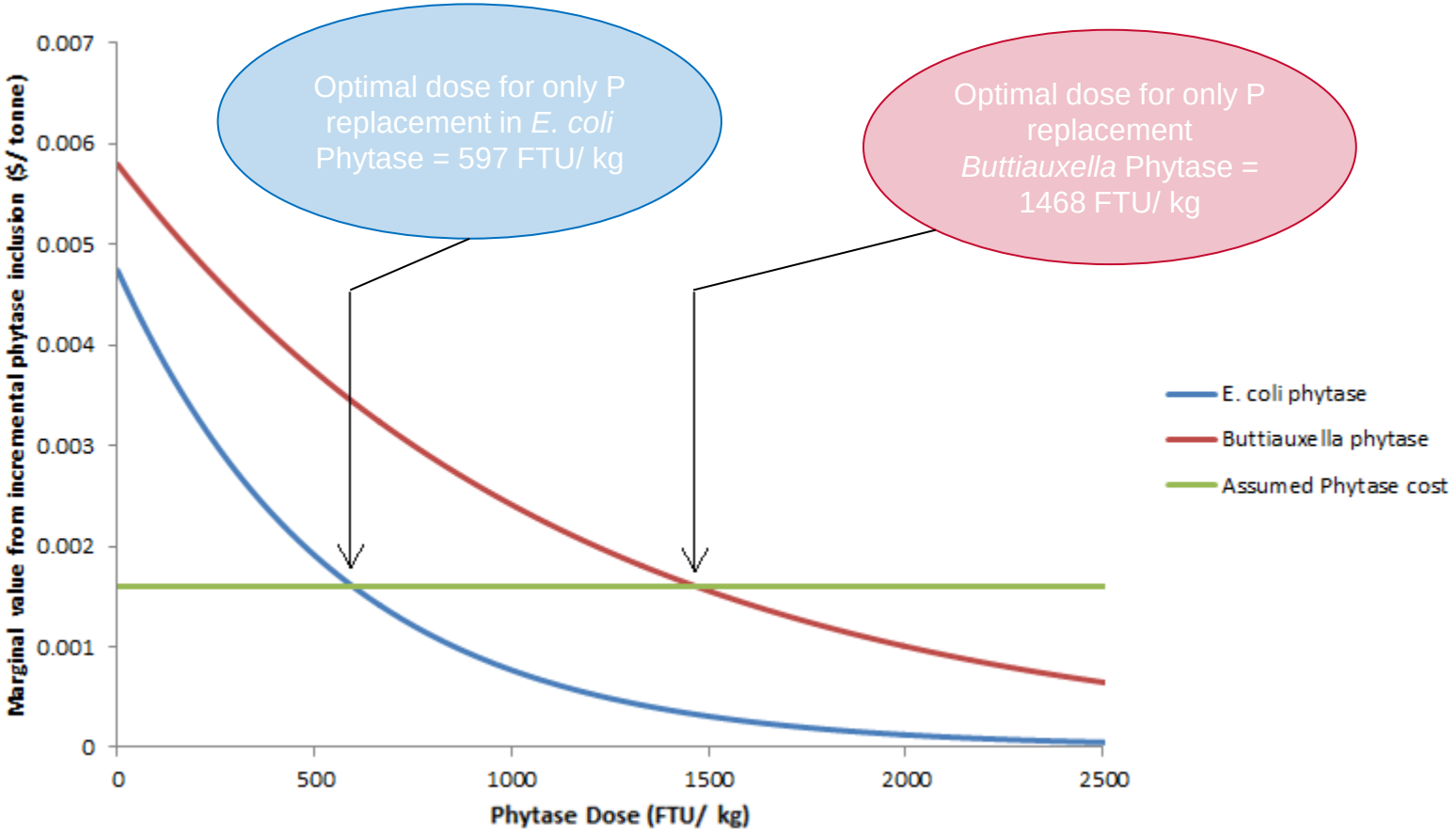
Results

- There was a significant effect of phytase dose and source on ileal P digestibility %
- There was a trend for there to be a difference in the rate of response between *Buttiauxella* and *E. coli* phytase

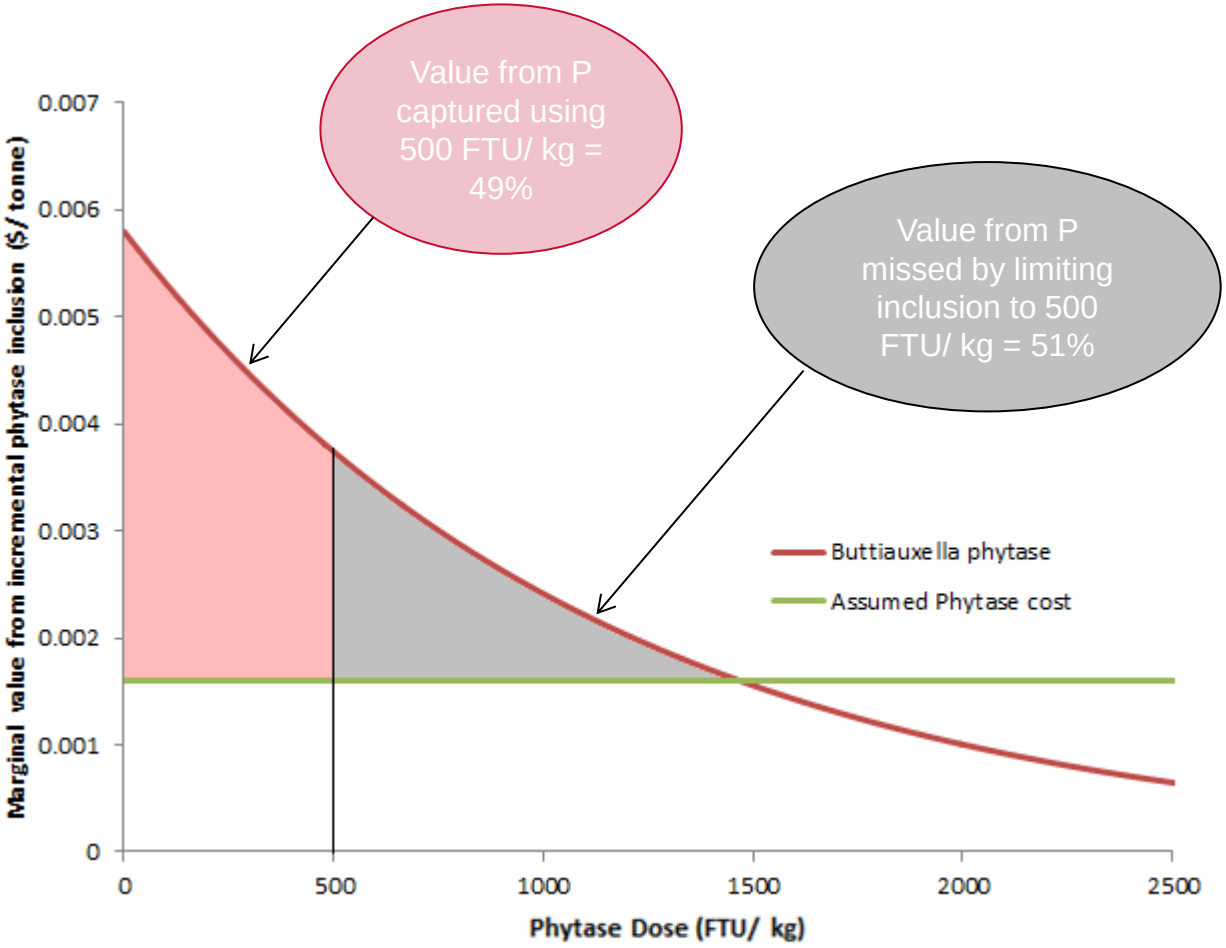
Effect Test	*P* – value
Phytase Dose	<.0001
Phytase Source	0.0019
Dose × Source	0.066



What are the optimal doses based solely on P replacement for the two phytases in this broiler study?

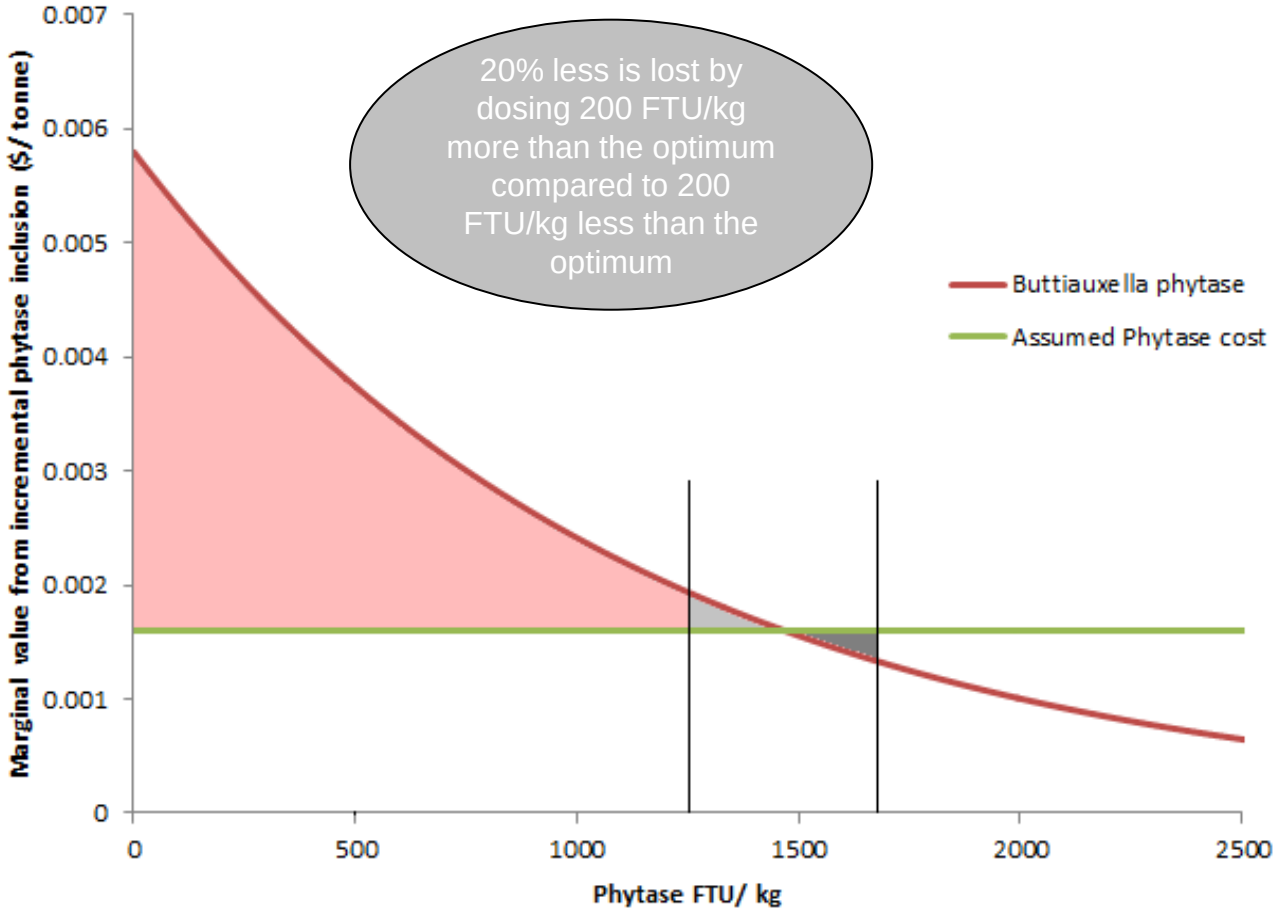


Benefits of applying the model



Using the model to manage risk

- Dosing above the optimum there is less risk associated with dosing phytase above the optimum in terms of P replacement than dosing less than the optimum



Summary

- Using the marginal decision rule – we compared the optimum doses of the two phytases
  - *Buttiauxella* = 1468 FTU/ kg
  - *E. coli* = *597* FTU/ kg
- Important to note this was only based on one study
- The optimum doses are heavily dependent on the cost of the phytase and inorganic P, but this model can be easily adapted to account for that
- The limitation of the method is that energy and amino acid effects are not captured – nor are performance effects, but it still represents a good basis to have confidence in dose selected

Conclusion

- Optimal dose will depend on the situation, the requirements of the birds, the cost of the raw materials and the cost of phytase – its important to consider these factors when deciding on a phytase dose to use

- One dose does not fit all

Thank you

Questions?

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