# A value-based approach to the determination of optimal phytase dose to be utilized in the diets of laying hens.

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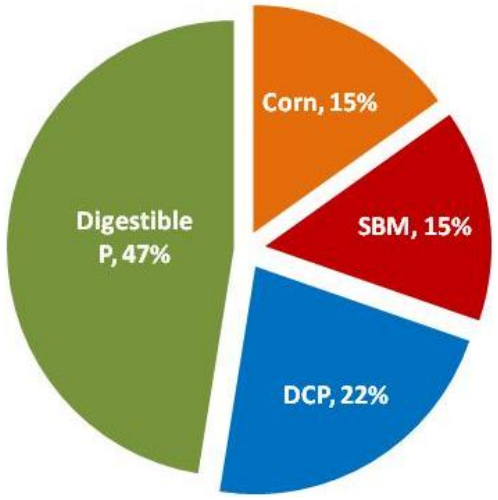
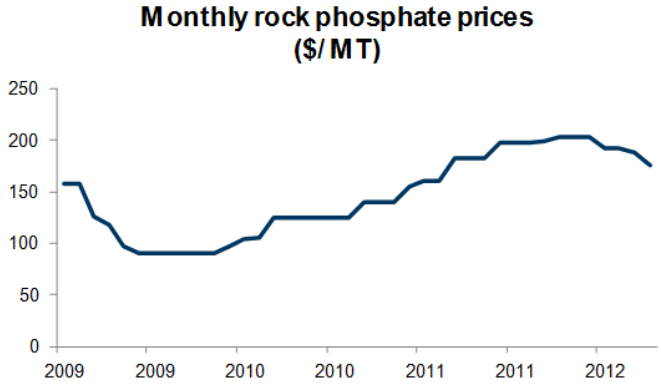
# Introduction

- Inorganic P represents significant cost in the diet formulation
- Organic P already present in the formulations is underutilized
- Moreover, P is a finite resource and demand is increasing and as economically viable stocks run low costs are likely to increase
- **Therefore it is important to optimize phytase inclusion to ensure maximum availability of organic P sources**




% undigested P from feedstuffs



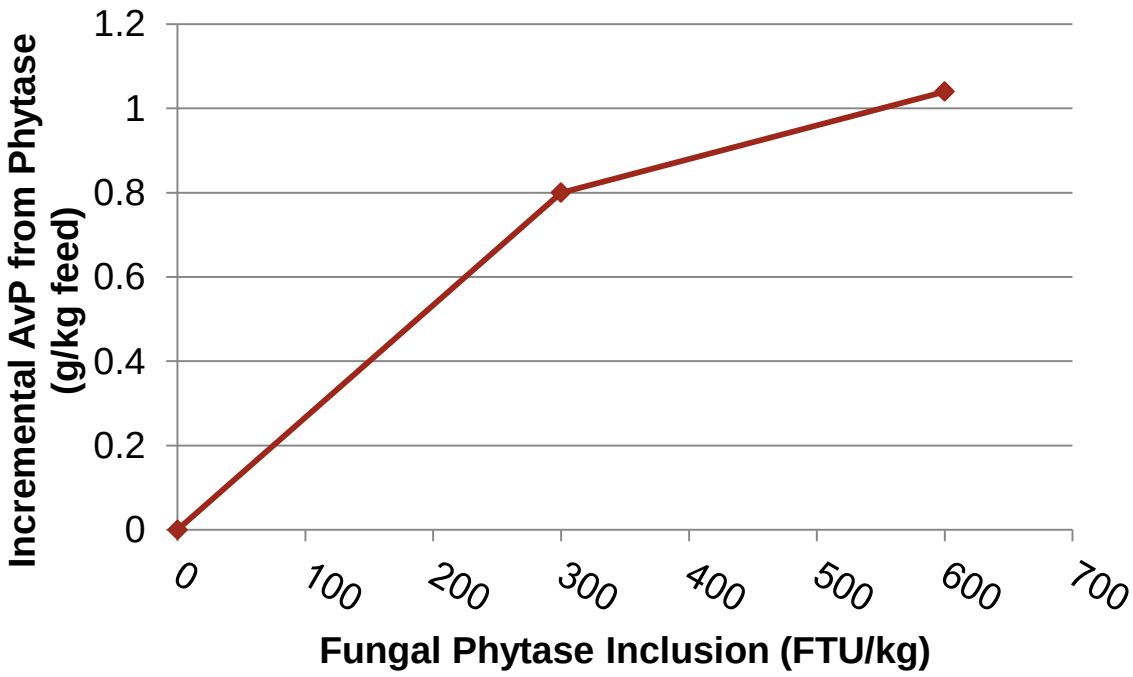
# Traditional Phytase use in Laying Hens

- Initial work suggested that the optimum dose for phytase use in Laying hens is 300FTU/kg

- However, there have been many changes since these recommendations were made;

- New generation phytases
  - Higher bioefficacy
  - Higher activity levels earlier in the digestive tract

- Markets have changed
  - Phytase price has decreased
  - Inorganic P price has increased



**Our Question….**

# Is the Optimal Dose of Phytase for Laying Hens really 300FTU/kg

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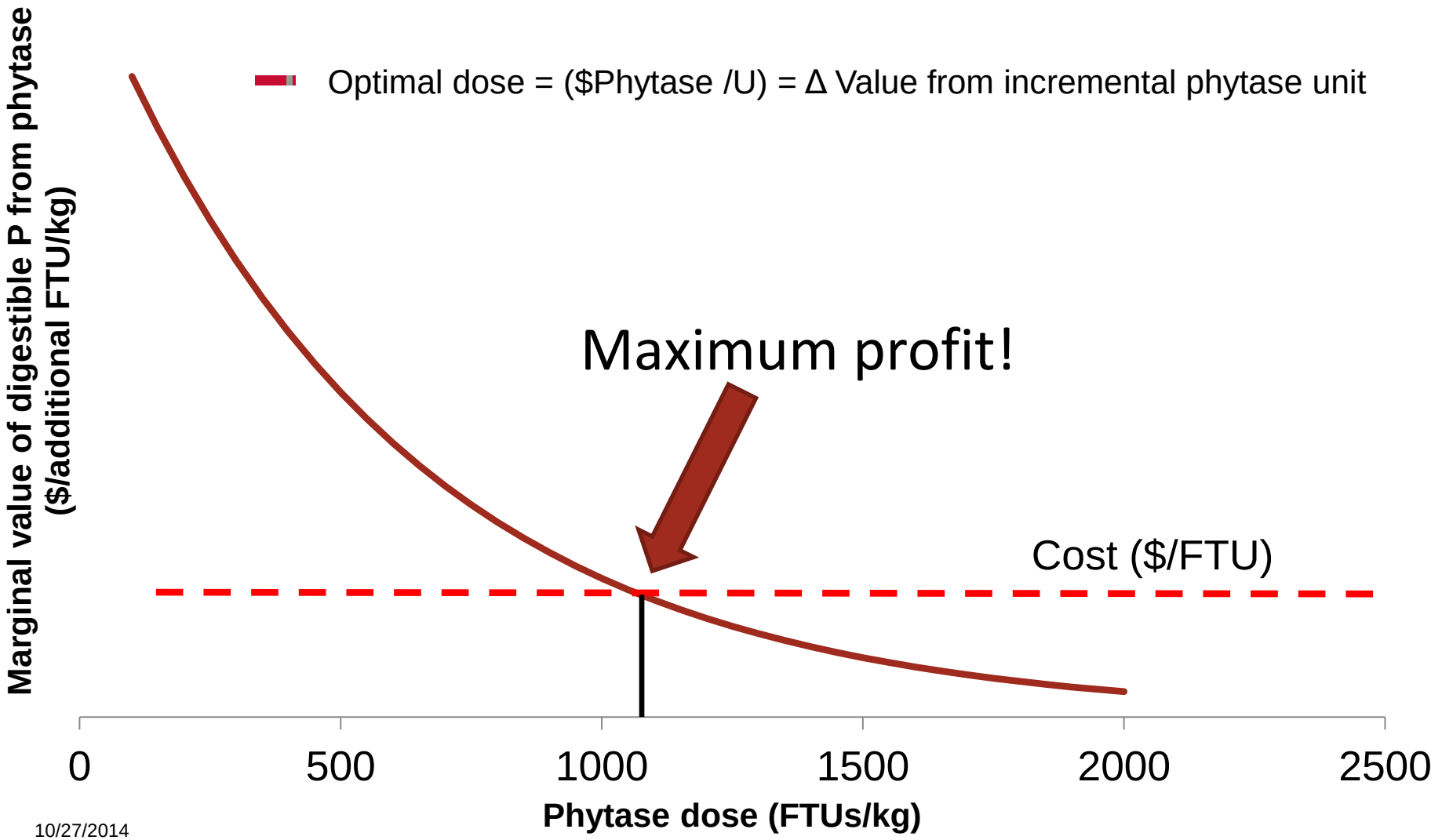
## Objectives

- To investigate the optimal inclusion level of phytase in Laying Hens using a based on the “Laws of Diminishing Marginal Utility”
- To investigate the effects Inorganic P price and phytase cost on the optimal phytase inclusion.

## Hypothesis

- There is scope to use higher levels of phytase in laying hens than are currently used today based solely on P replacement
- As inorganic P prices rise or phytase cost decreases – so will the optimum inclusion of phytase.

# The Law of Diminishing Marginal Utility



# Materials and Methods

- A total of 576 23-week old ISA-Brown Laying Hens (with a minimum laying rate of 90%) were allocated to battery cages corresponding to one of six treatments
- The study lasted for 3 weeks. There were 6 replicates per treatment, with 16 birds per replicate
- Dietary treatments were based on a negative control (NC) diet, deficient in Ca and P, supplemented with *Buttiauxella* phytase at 250, 500, 1000 and 2000FTU/kg or 0.13% total P from dicalcium phosphate (DCP)
- Production parameters were recorded throughout the experimental period
- At the end of the trial birds were euthanized via an injection of T61 into the wing vein and ileal digesta samples were taken from the distal ileum and freeze dried ahead of analysis to enable calculation of P digestibility using $Cr_2O_3$ marker

# Diet Formulations

| Nutrient | Calculated (%) |
|---|---|
| AMEn (MJ/kg) | 11.6 |
| Crude Protein | 18.5 |
| Dig. Lys | 0.61 |
| Dig. Met + Cys | 0.56 |
| Dig. Thr | 0.51 |
| Dig. Trp | 0.17 |
| Ca | 3.65 |
| P | 0.33 |
| IP | 0.21 |

| Ingredient | Inclusion (%) |
|---|---|
| Wheat | 45 |
| Barley | 15 |
| SBM | 14.1 |
| Corn Gluten Meal | 5.3 |
| Wheat Midds | 1.0 |
| Corn Starch | 6.1 |
| Animal Fat | 1.7 |
| Soy Oil | 1.0 |
| Salt | 0.17 |
| $NaHCO_3$ | 0.06 |
| Vits/ Mins | 1 |
| $Cr_2O_3$ Marker | 0.075 |
| Limestone | 8.88 |
| Corn Starch | 1.13 |
| Diamol | 0.58 |

## Statistical Methods

- Non-linear regression analysis was carried out using JMP 11.0 software.
- Data fitted using the equation;
  - $y = a + b * (r^{x})$
- The first derivative of this line was then determined and plotted showing incremental increase in P digestibility % with each unit of phytase added
- The amount of P digested was then calculated, based on dietary P, and its value calculated based on DCP costing $660/ tonne, having 18.2% P, with 78% retention (CVB tables, 2011)

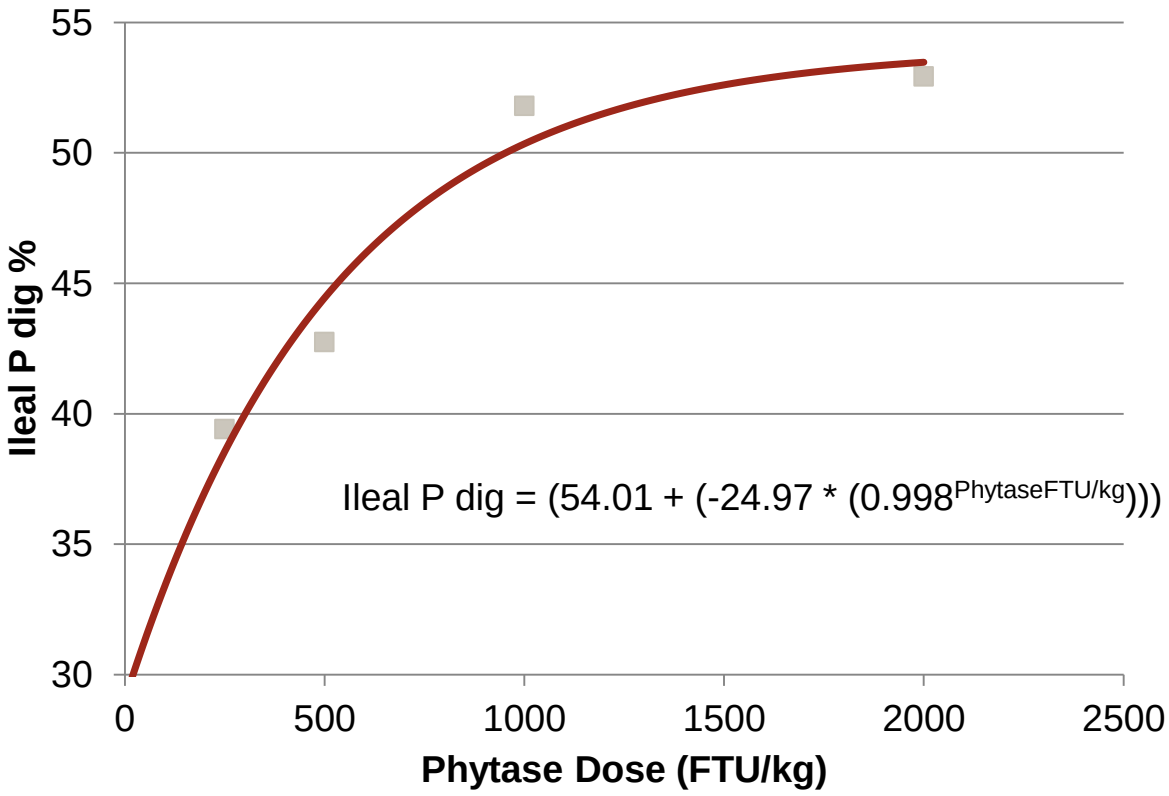
# Assumptions

- DCP cost = $660/ Tonne – with 18.2% total P and 78% retainable P
  - In the exercise we looked at +/- 20% of this cost
- Phytase cost assumed to be $0.0016/FTU
  - In the exercise we looked at +/- 20% of this cost
- The cost of the P liberated from Phytase is = to the cost of P from DCP
- The birds requirements are not met/ exceeded by the P liberated from Phytate

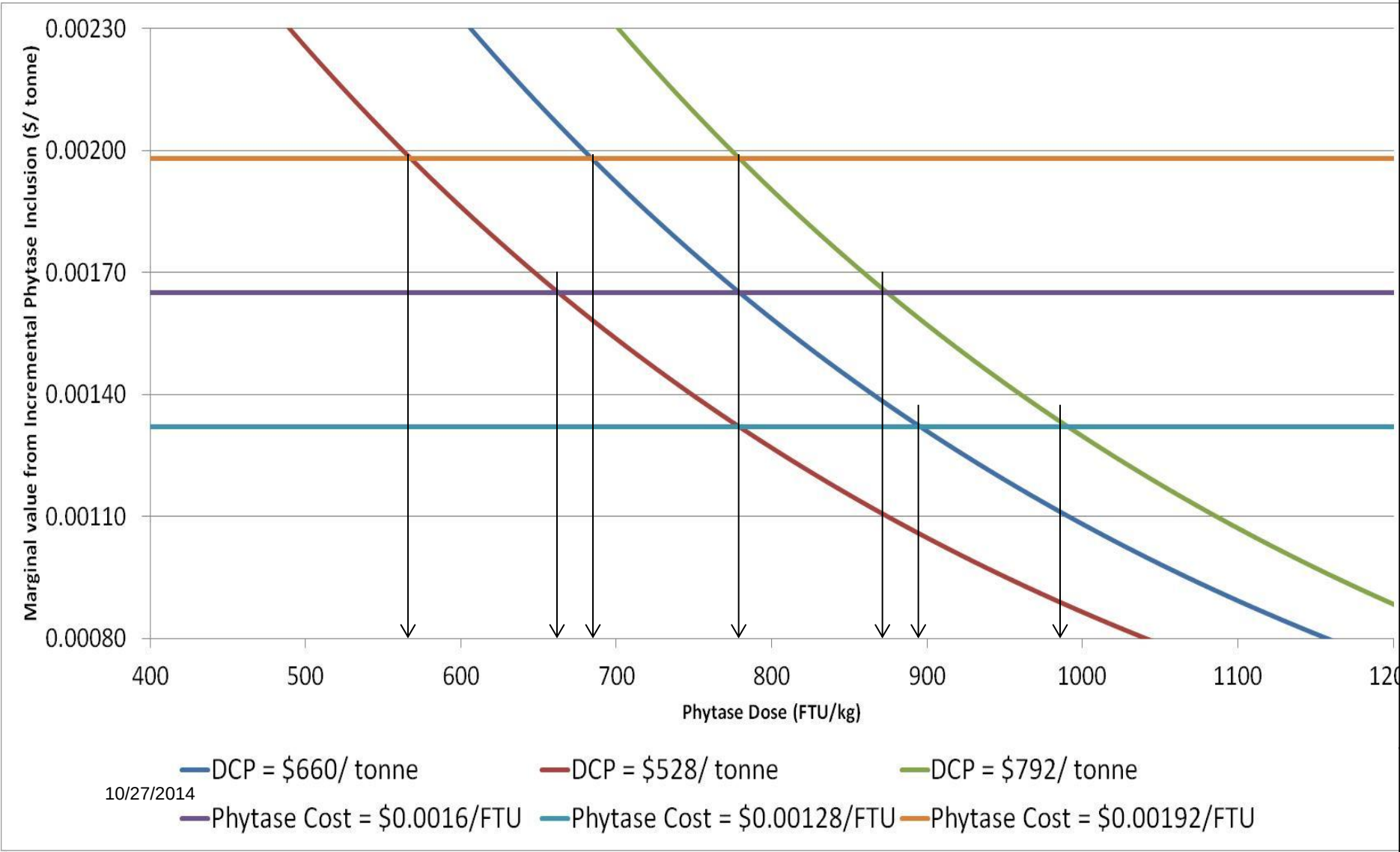
# Results

- Over the three week period there was a significant increase in laying rate (%), egg mass (g/d) and feed intake (FI) in all phytase treatments vs. NC

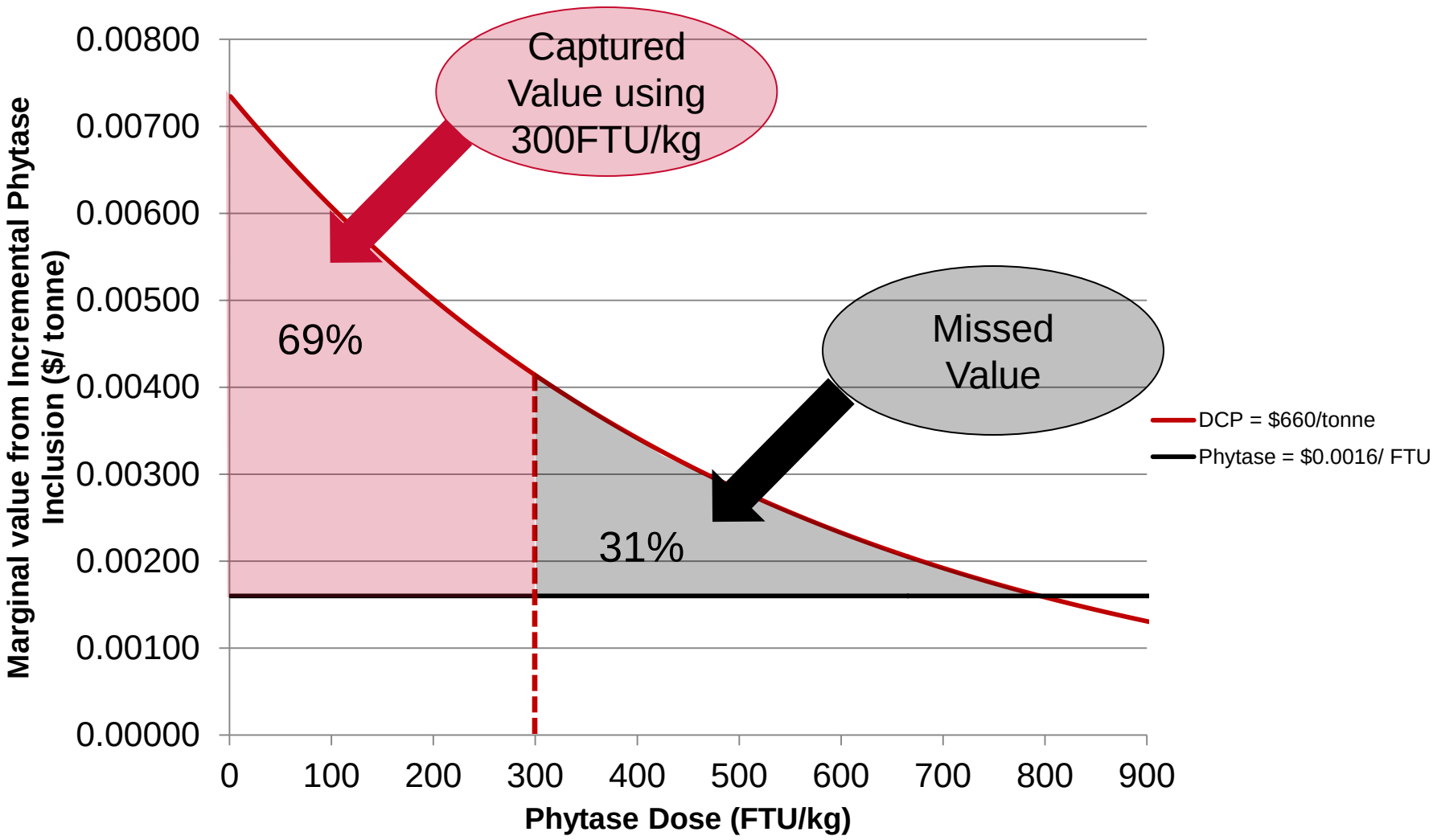
- There was a significant effect of Phytase on Ileal P digestibility %



# What is the optimal dose for laying hens?

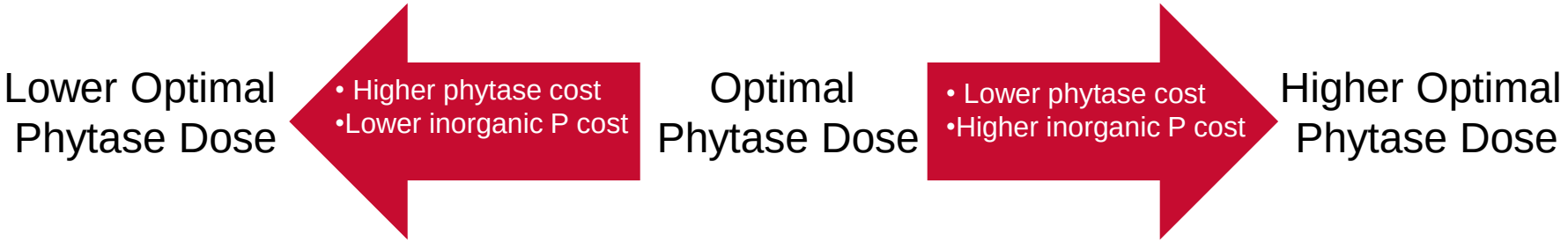


# Maximizing Profit



# Discussion

- Using this method – the optimum dose is calculated to be much higher than what was previously used;
  - **580 – 985FTU/kg** vs. 300FTU/kg




- Optimal doses should be reconsidered due to vast differences between old and new generation phytases
- There is less risk with using higher doses of phytase
- Environmental benefits too

# Thank You for Listening

# Any Questions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