

Hog Feeding Strategies for Maximizing Growth Efficiency and Reducing Manure Nutrient Output

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Atlantic Canada Hog Feeding Strategies Workshop

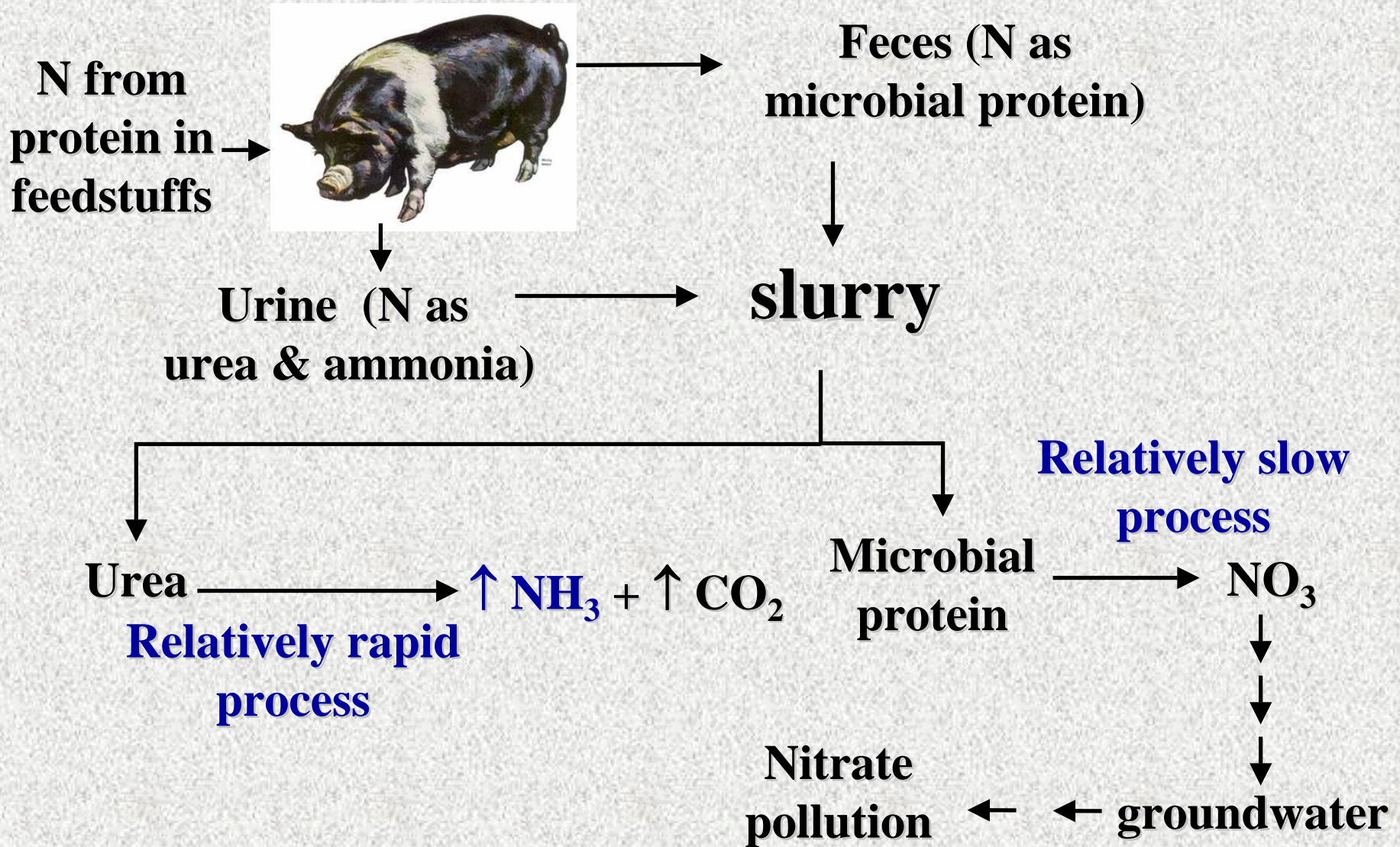


Outline

- **Environmental concerns**
 - **Nutrient excretion (N and P)**
 - **Gas emissions (NH_3 , H_2S)**
 - **Odour emissions**
 - **Green-house gas emissions (2003 WNC)**
- **Dietary manipulation to reduce:**
 - **N excretion**
 - **P excretion**

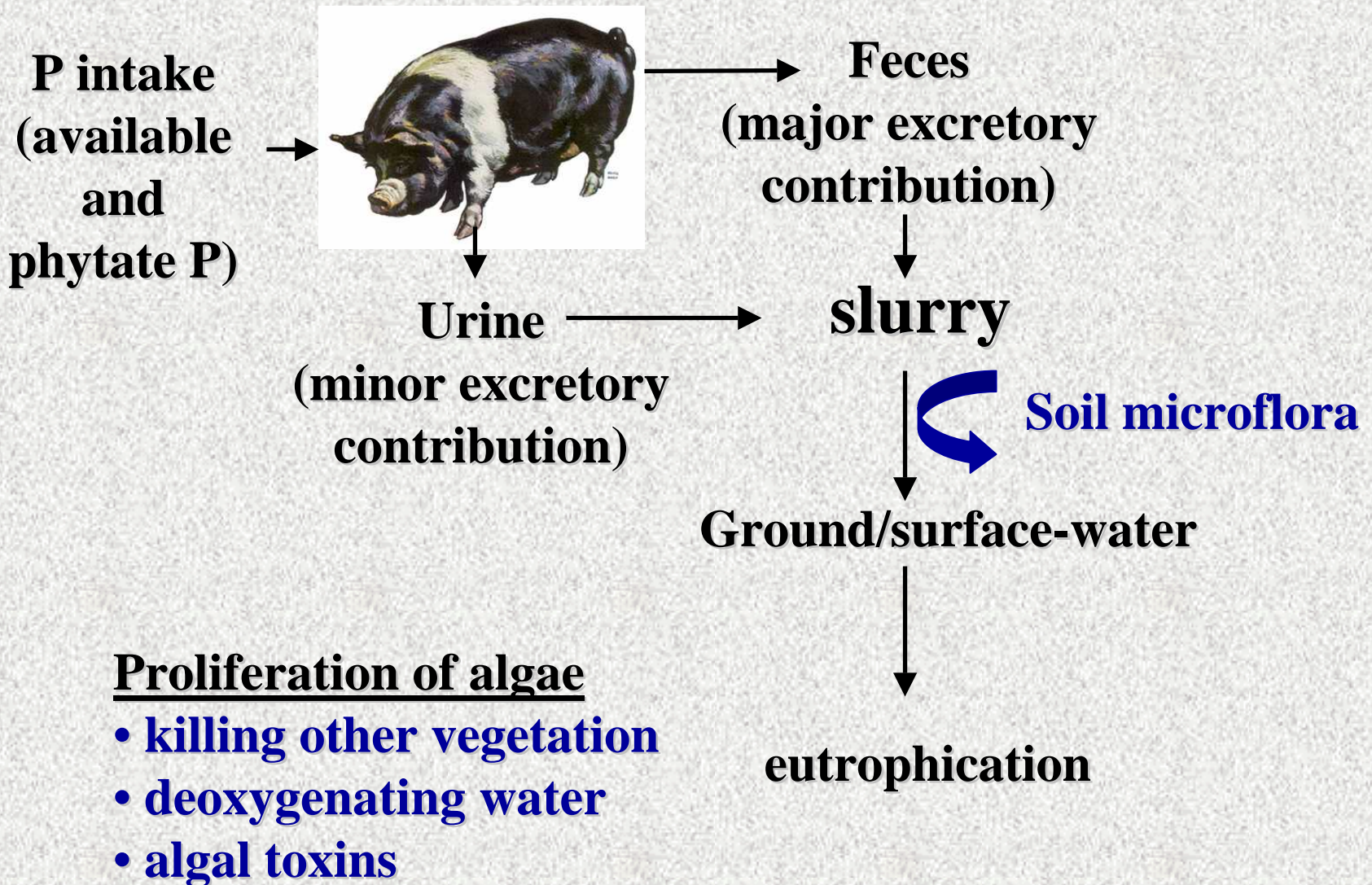


Problem: Nitrogen excretion





Problem: Phosphorus excretion





General Introduction

- **Nutrients: Nitrogen (N) and Phosphorus (P)**

	N	P
Dietary levels (%)	2.7 (16.9% CP)	0.55
Intake (kg/pig)	6.75	1.38
Excretion (kg/pig)	4.80 (71%)	0.92 (67%)
Retention (kg/pig)	1.95 (29%)	0.46 (33%)

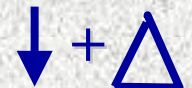
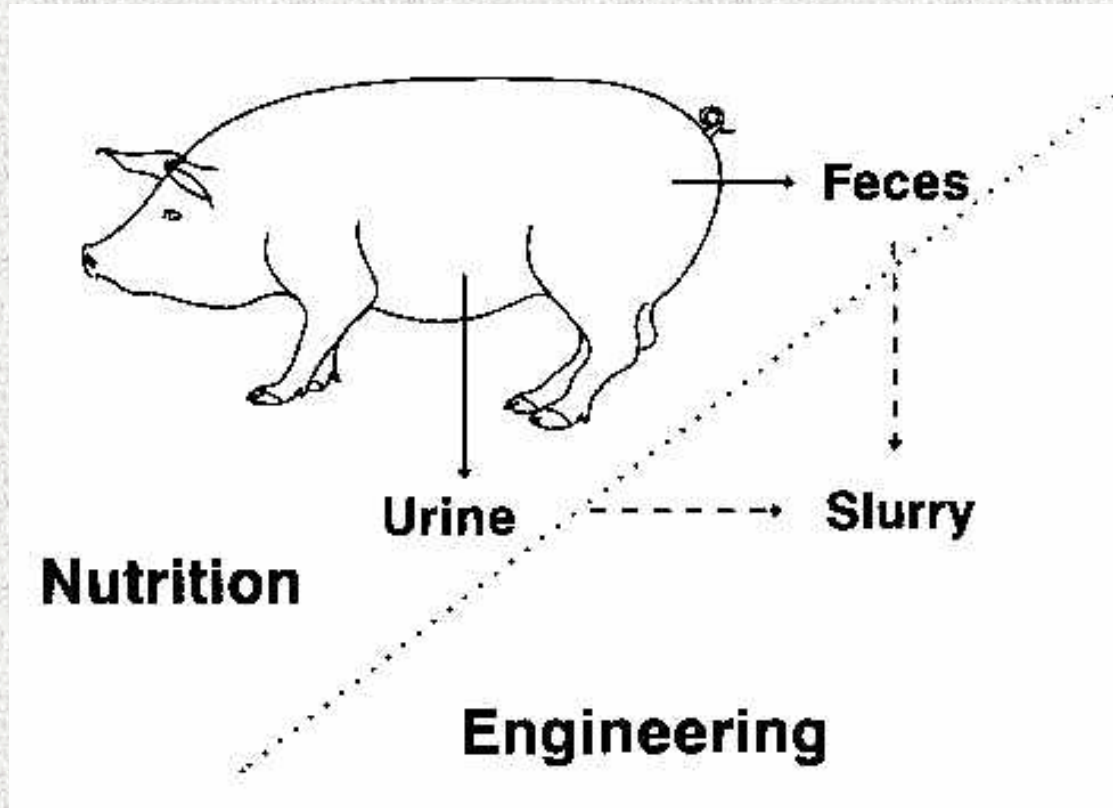
250 kg feed/G-F pig

Other minerals in future? (Cu, Zn)



General Introduction

- **(How)** can we affect nutrient excretion with feed formulation?





General Introduction

- The objective of **nutrition** within the total of nutrient management should be to alter nutrient excretion without reducing pig performance

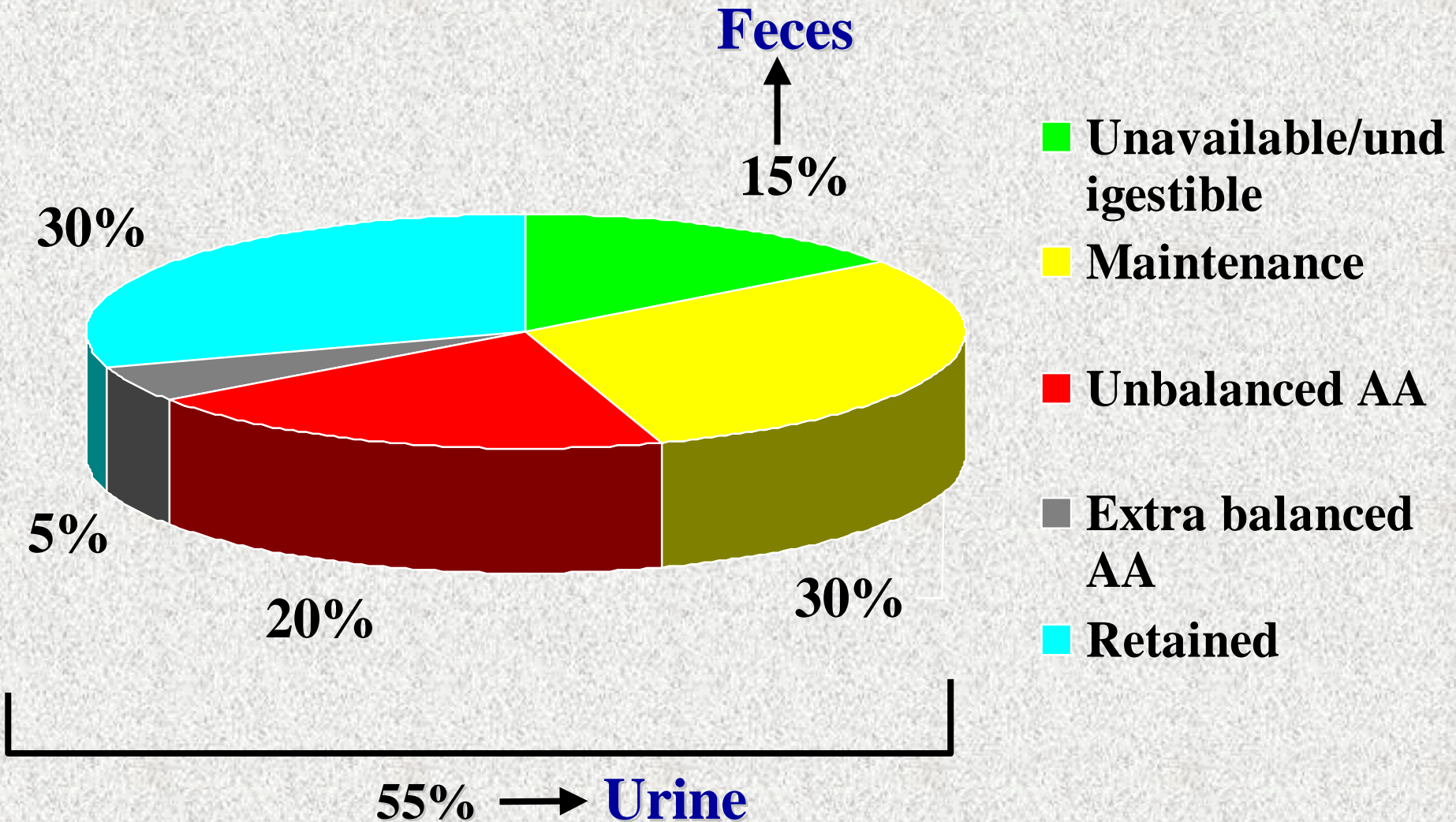


General Introduction

- **Nitrogen**
 1. **Concepts**
 2. **Examples**
 3. **Take Home Message**
- **Phosphorus**
 1. **Concepts**
 2. **Examples**
 3. **Take Home Message**



Concepts - N



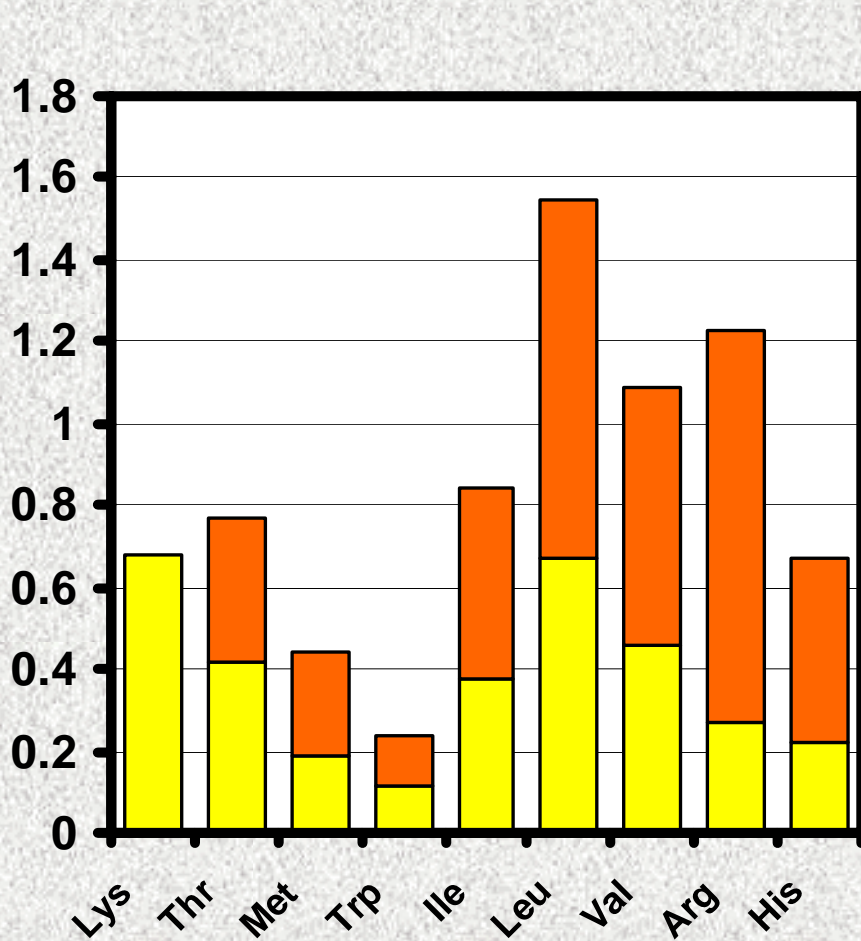


Concepts - N

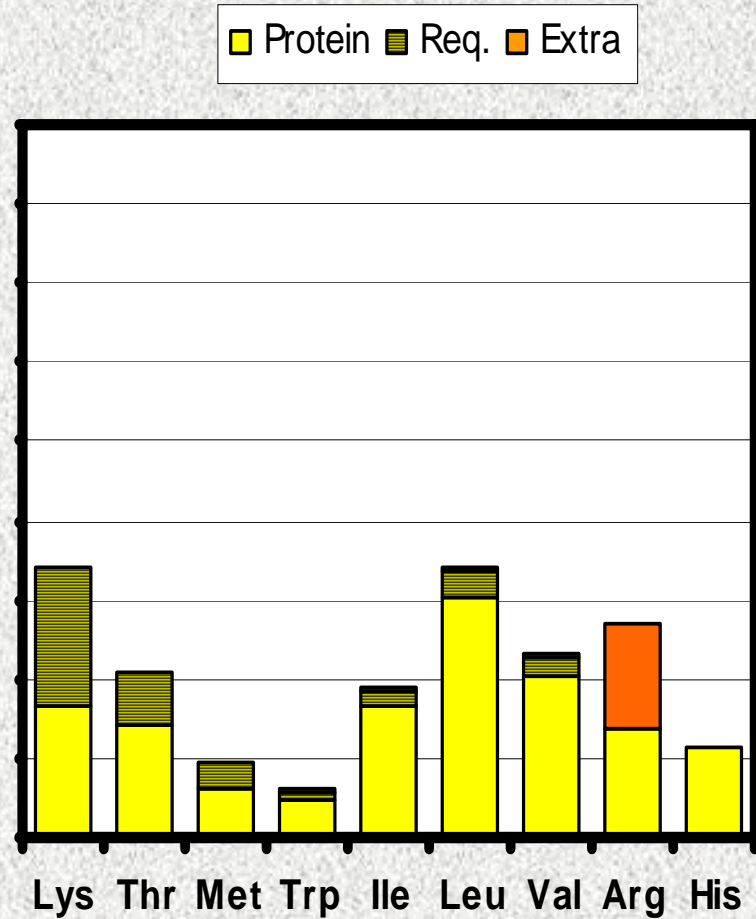
- **Before synthetic AA were available, requirement of the most-limiting AA (lysine) was met by protein sources only**
 - **Overfeeding of 19 other AA: → urinary N**
- **The increase in availability of synthetic AA has allowed us to reduce dietary protein content while still balancing for the most-limiting AA**



Concepts - N



21% Protein



12% Protein



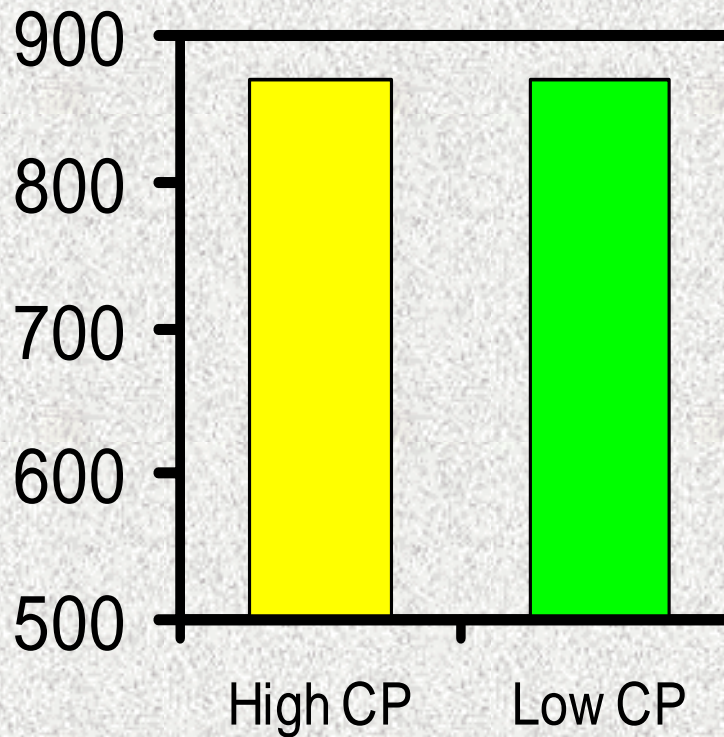
Example N: Low CP-Diets

Ingredient, %	High CP, 17.8%	Low CP, 15.1%
Hull-less barley	88.56	96.14
Soybean meal, 48%	8.20	---
L-Lysine-HCl	0.44	0.72
L-Threonine	0.20	0.33
DL-Methionine	0.05	0.10
L-Tryptophan	---	0.04
Minerals	2.65	2.67

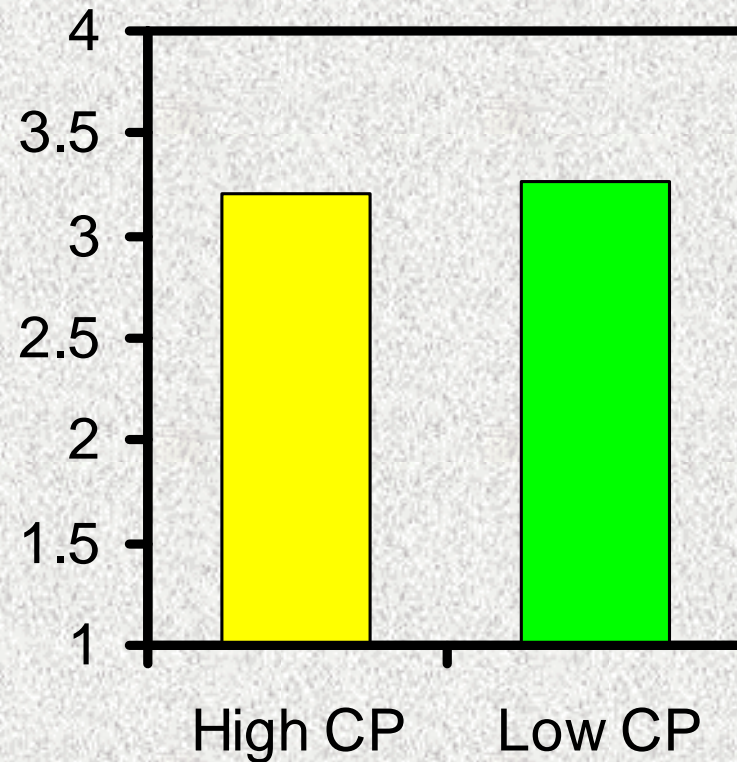


Example N: Low CP-Performance

ADG, g/d

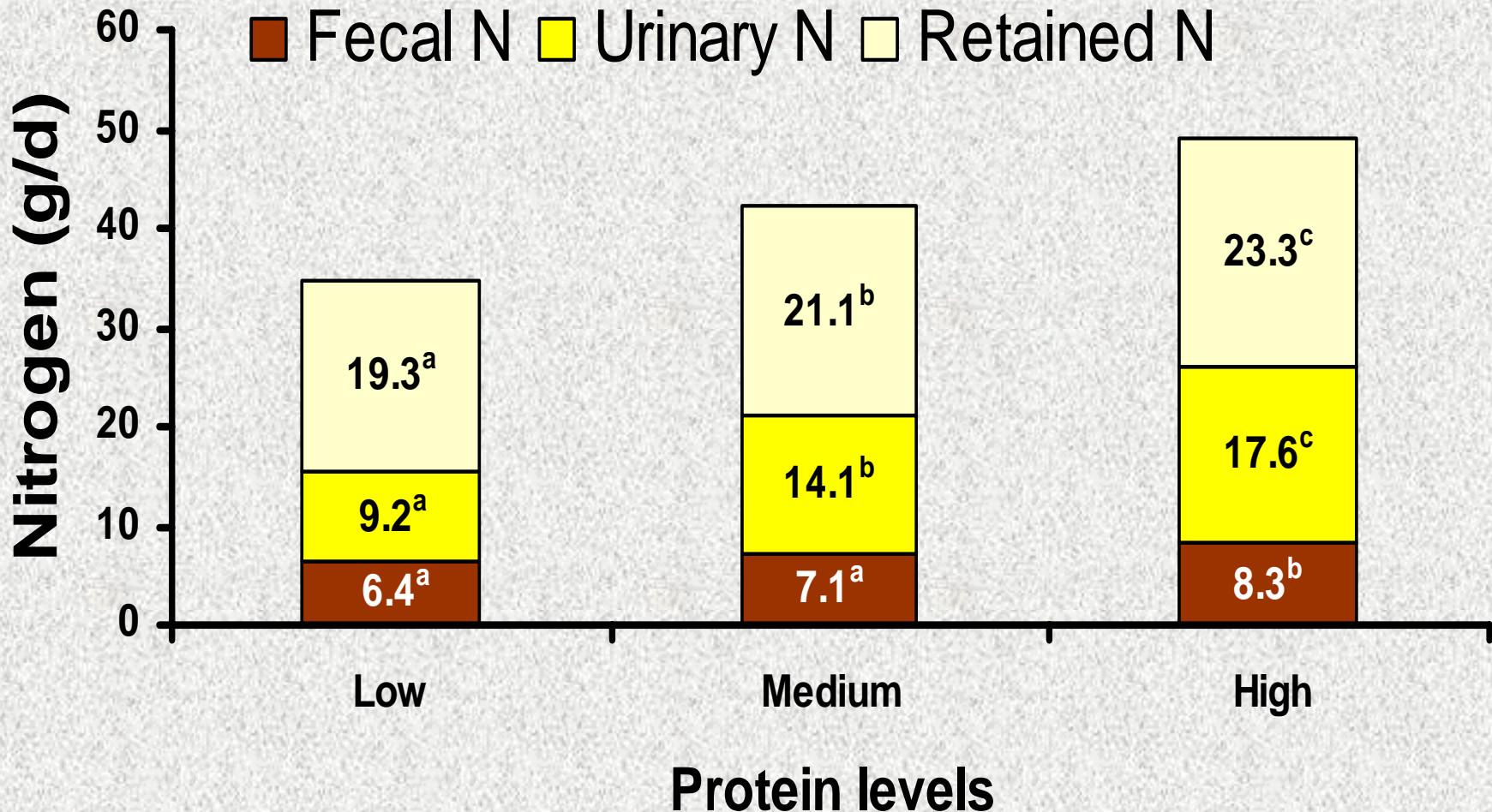


Feed/gain





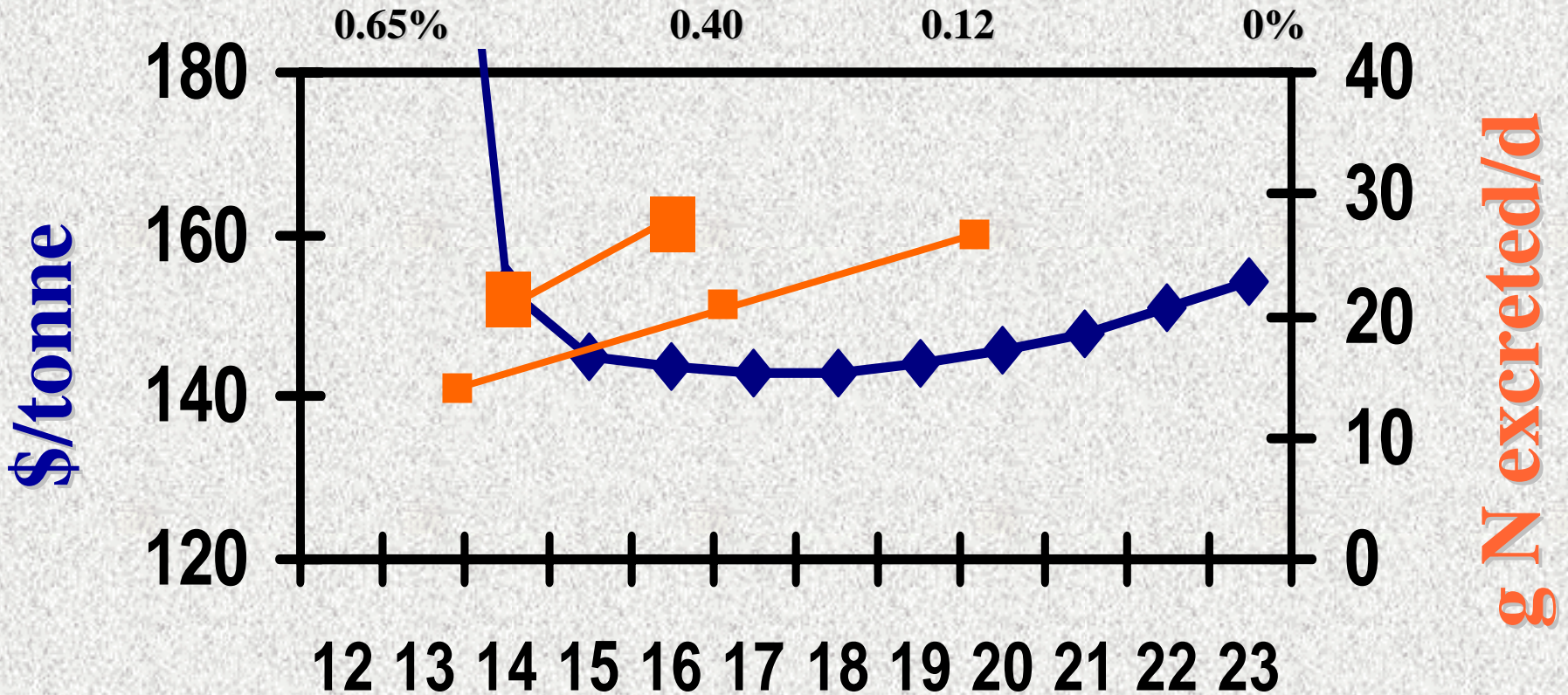
Example N: Low CP-Excretion



Reduced protein + balanced amino acid will reduce N excretion from urine: will reduce ammonia emissions



Take Home Message



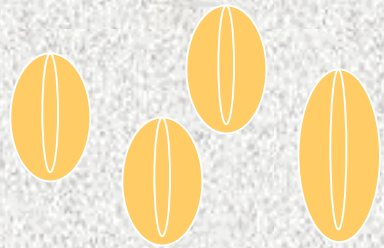
2.1 g dLys/Mcal

Dietary protein (%)

Feed intake



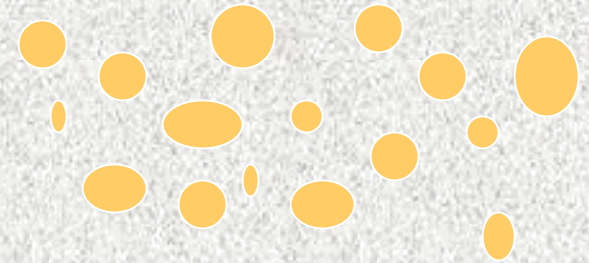
Processing: Reducing Particle Size



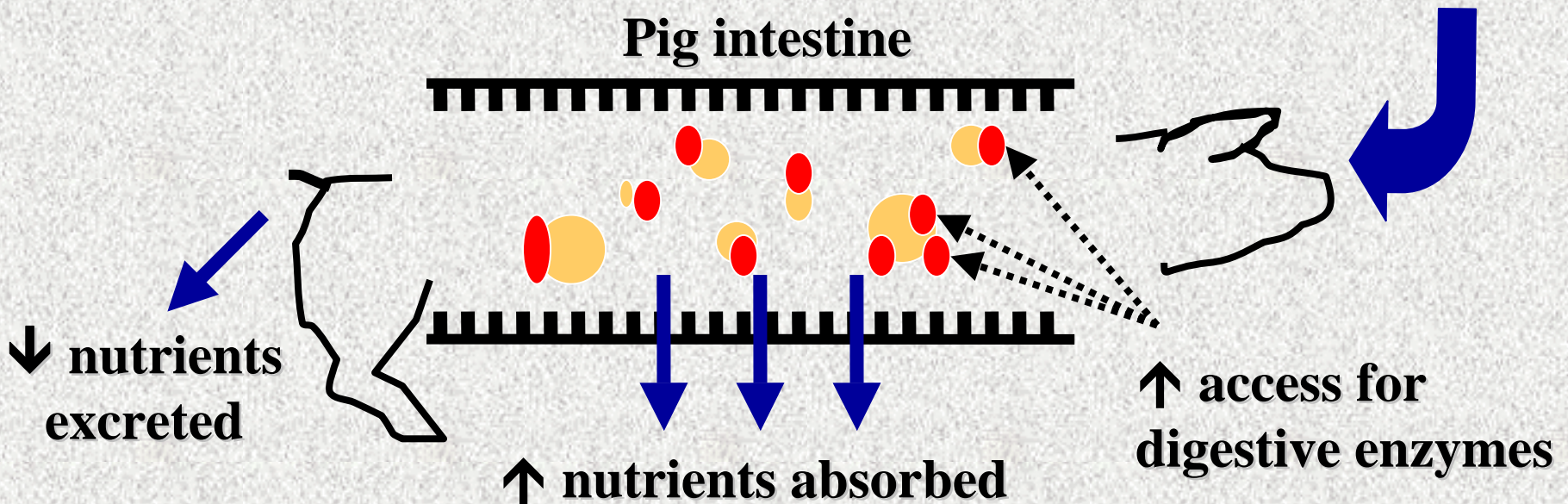
whole grain



hammermill

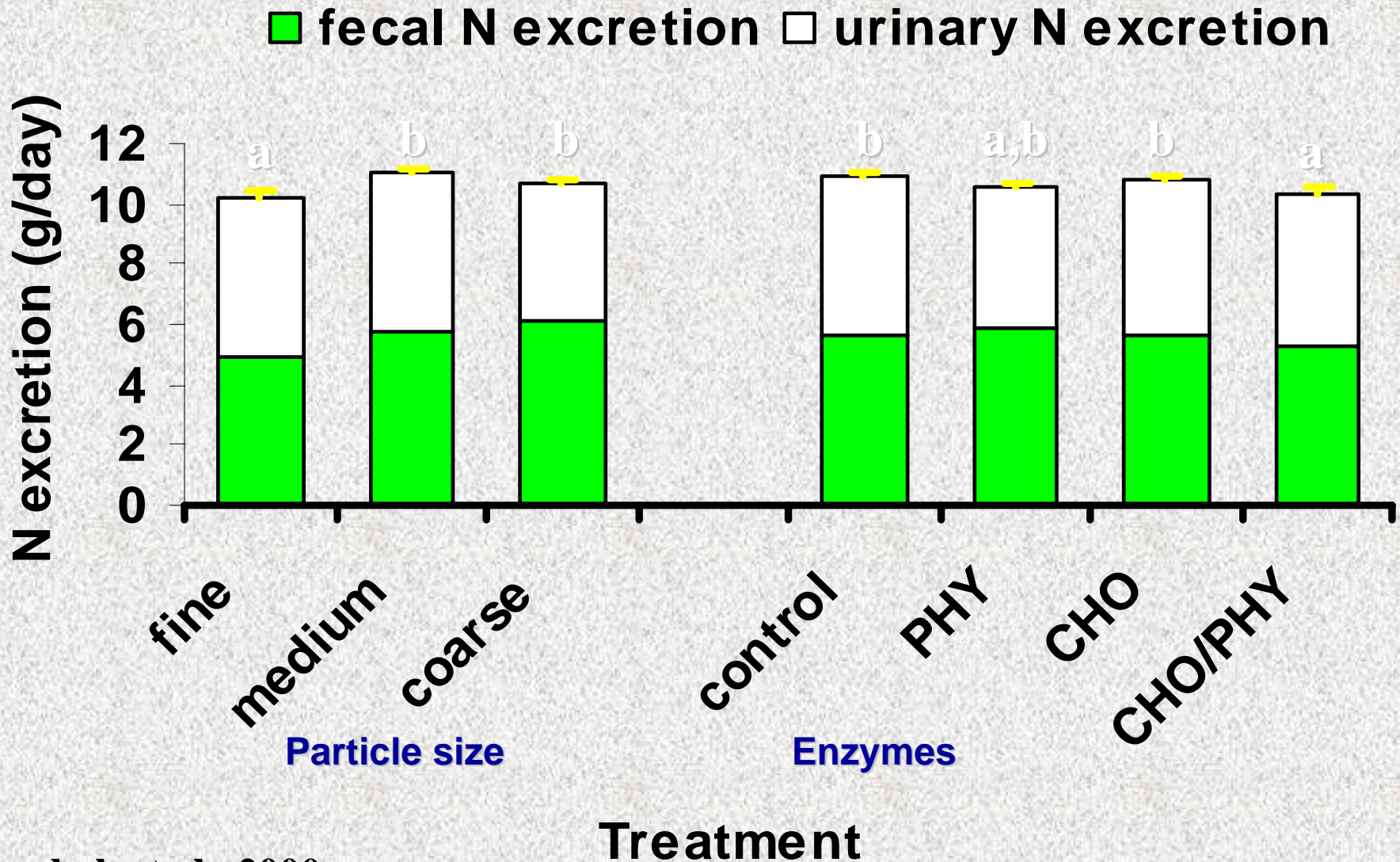


↓ particle size +
↑ relative surface area



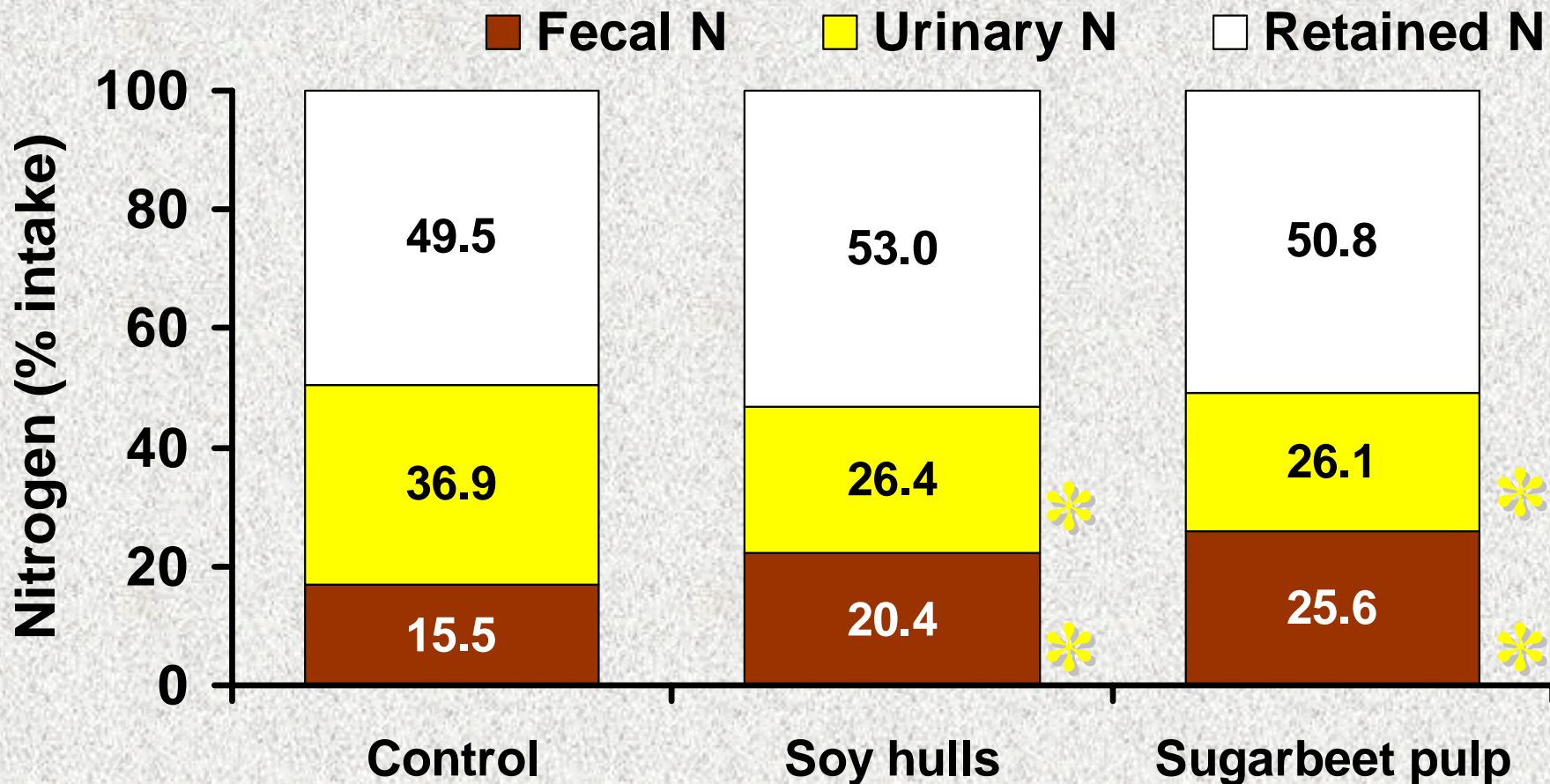


Example N: Particle size/Enzymes





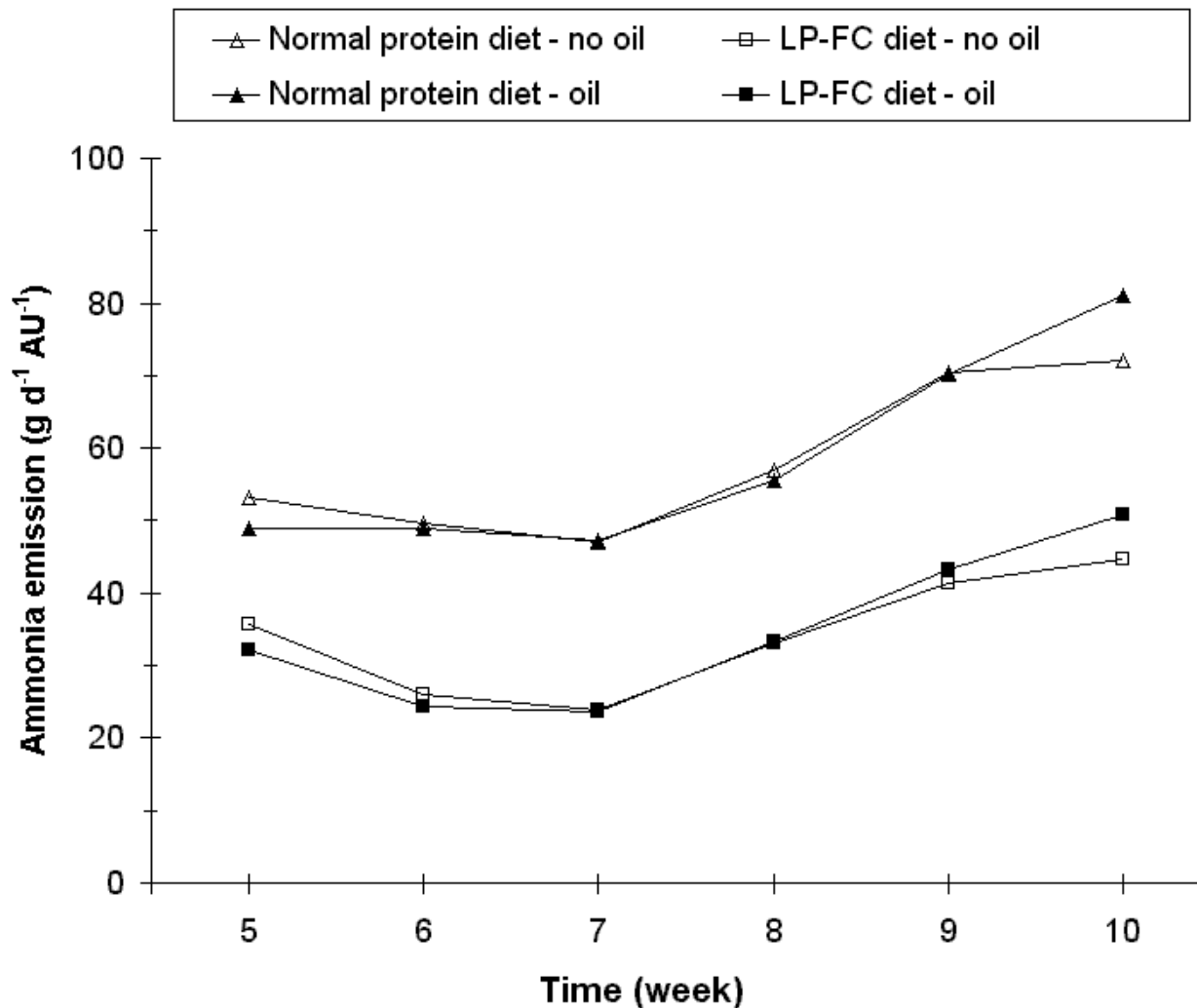
Example N – Fermentable Fiber



**Fermentable fiber will shift N excretion from urine to feces:
will reduce ammonia emissions**

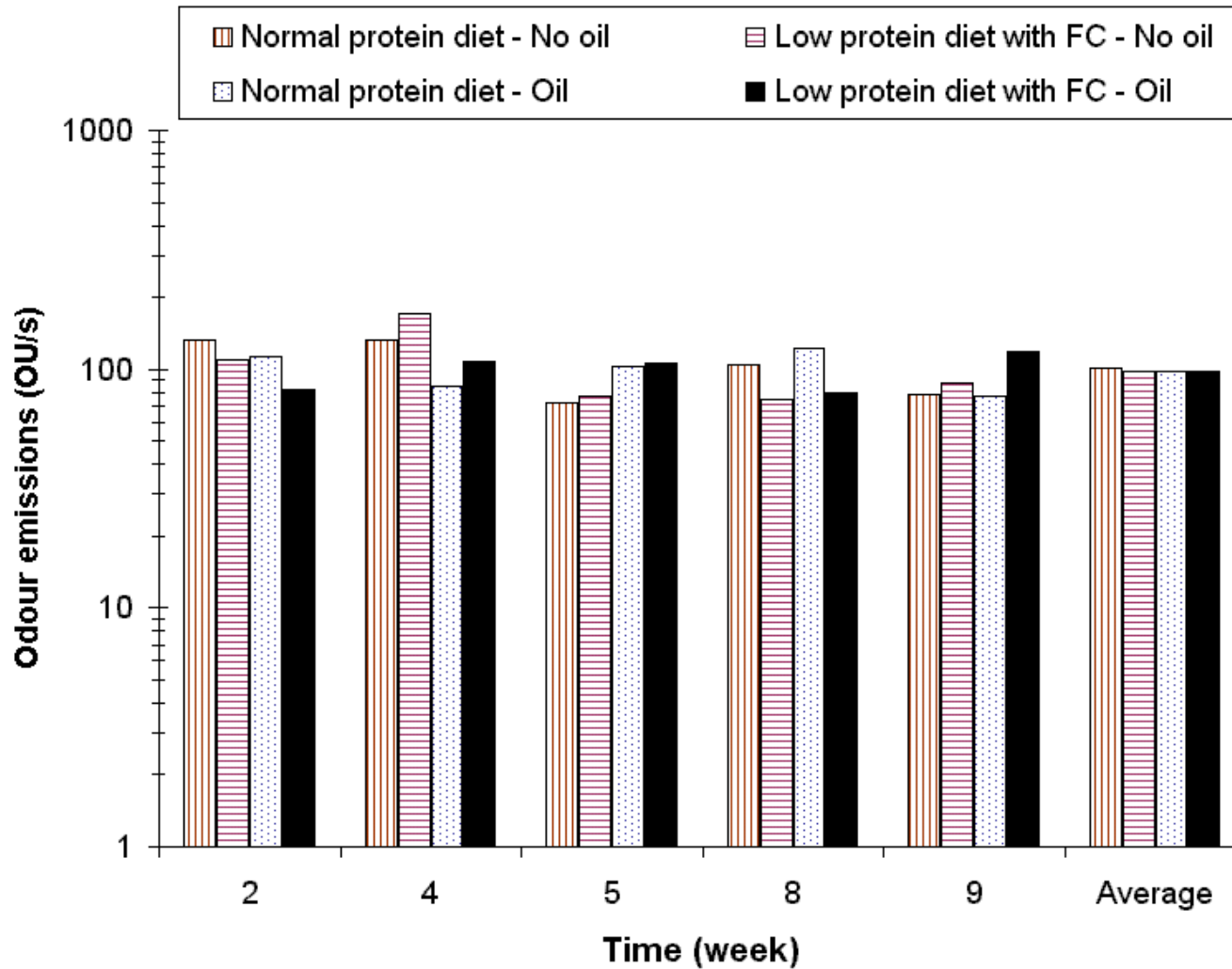


LP + FF – Ammonia Emission





LP + FF – Odour Emission



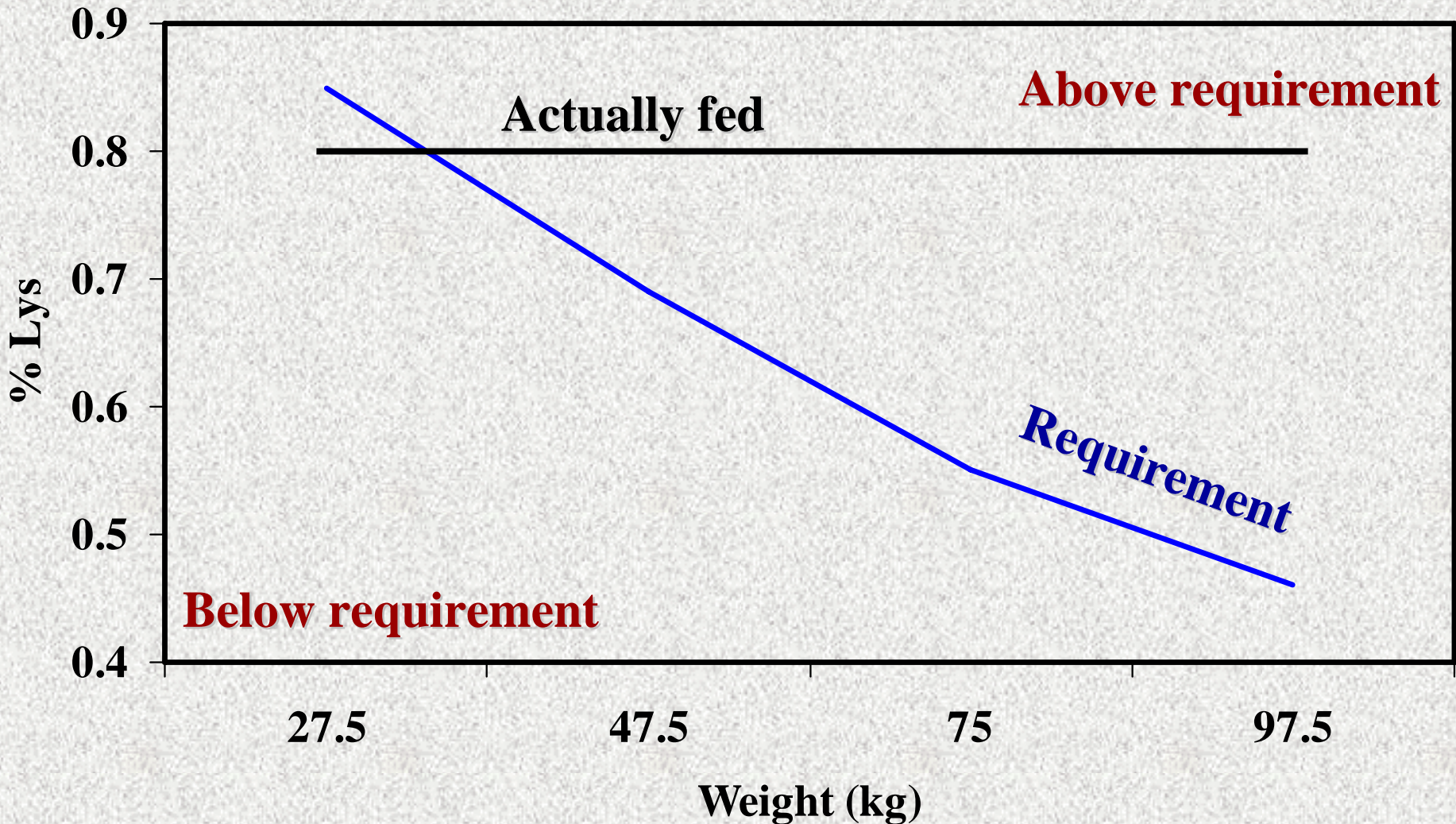


N - Multi-Phase Feeding

- **Theoretically, could reformulate diets each day to reflect the changing requirements of pigs**
- **Multi-phase feeding: offer several diets over grower-finisher period**
- **Aimed at providing nutrients to pig in better agreement with their requirements**

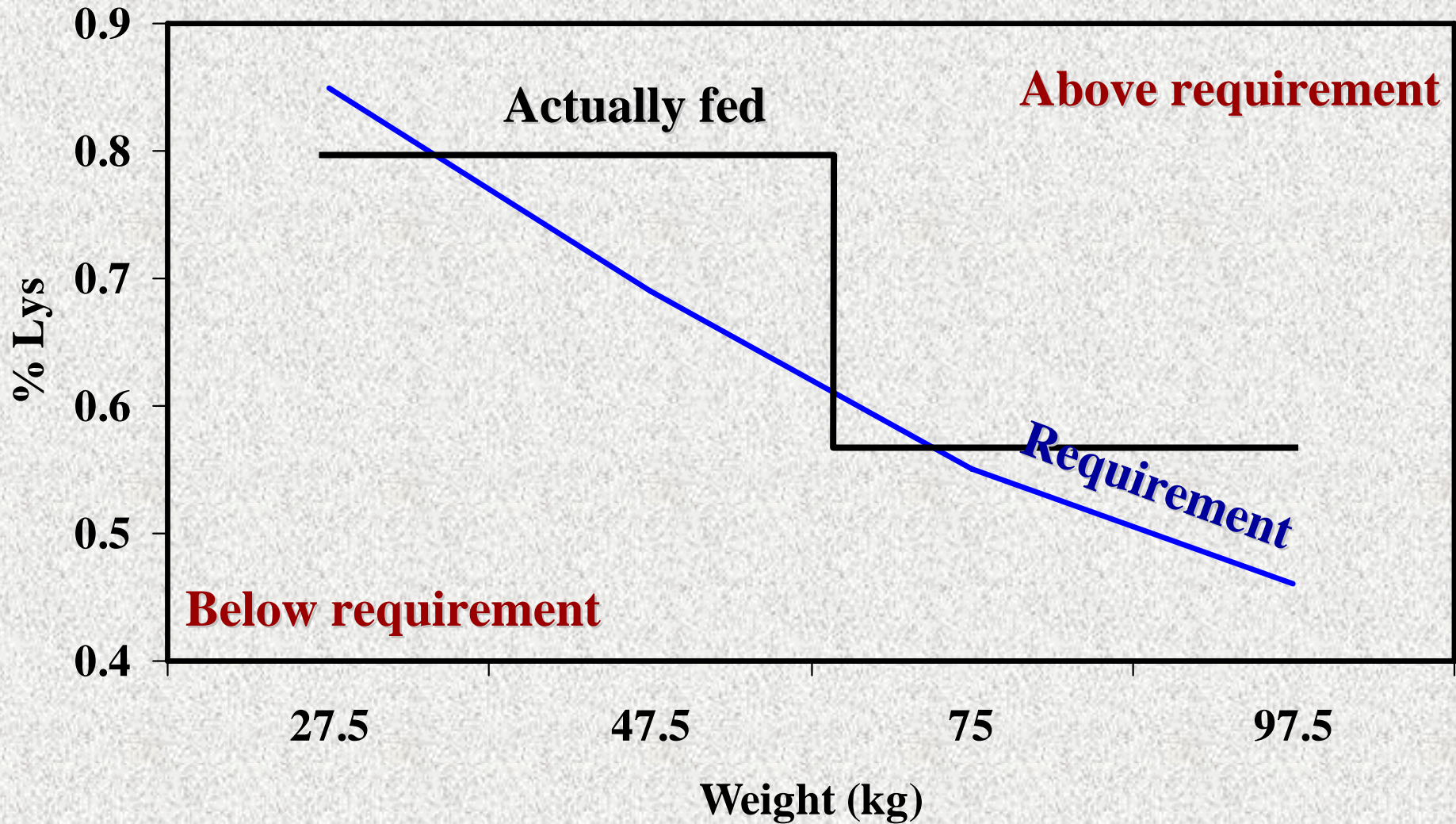


Single-Phase Feeding



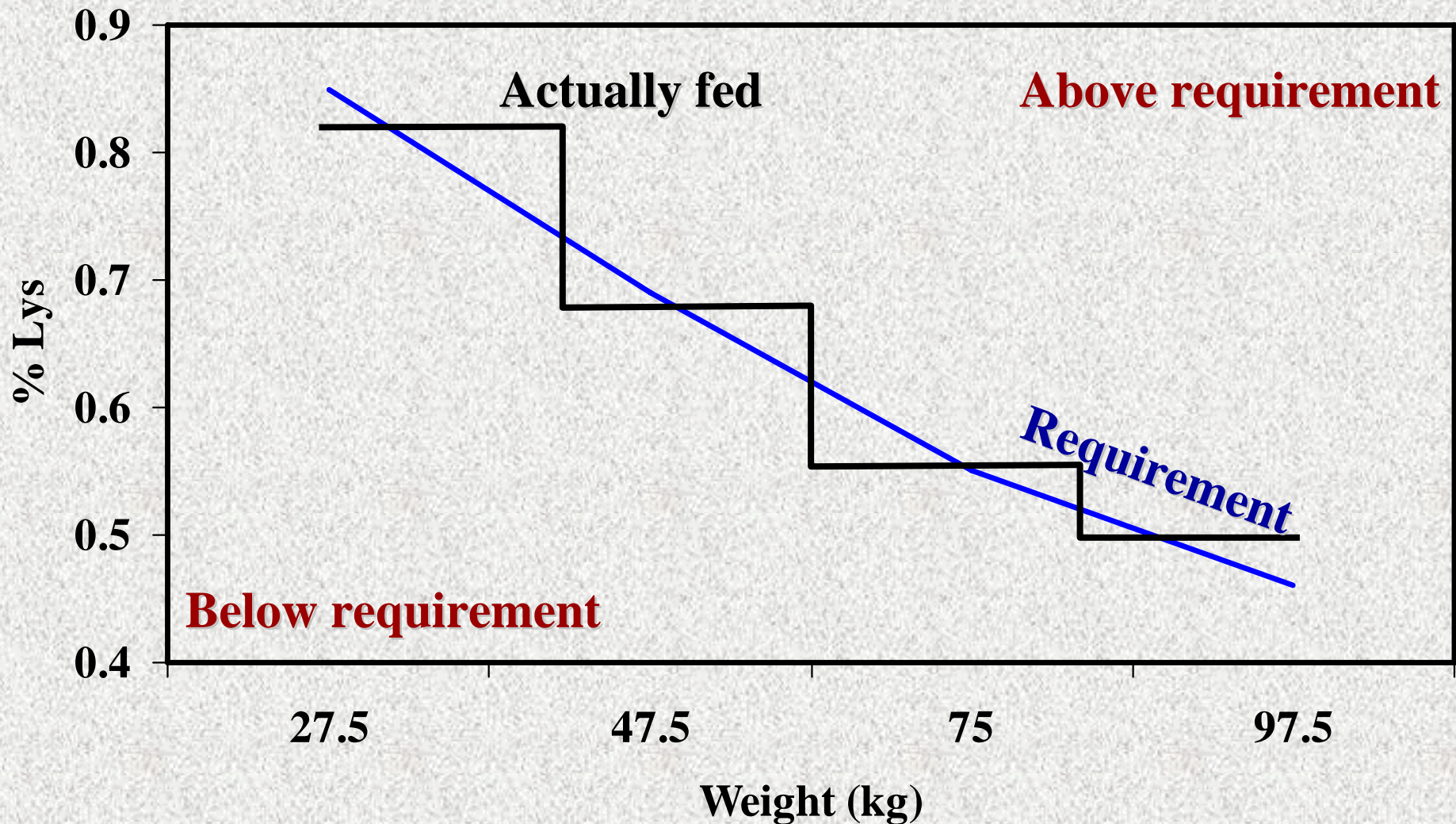


Double-Phase Feeding





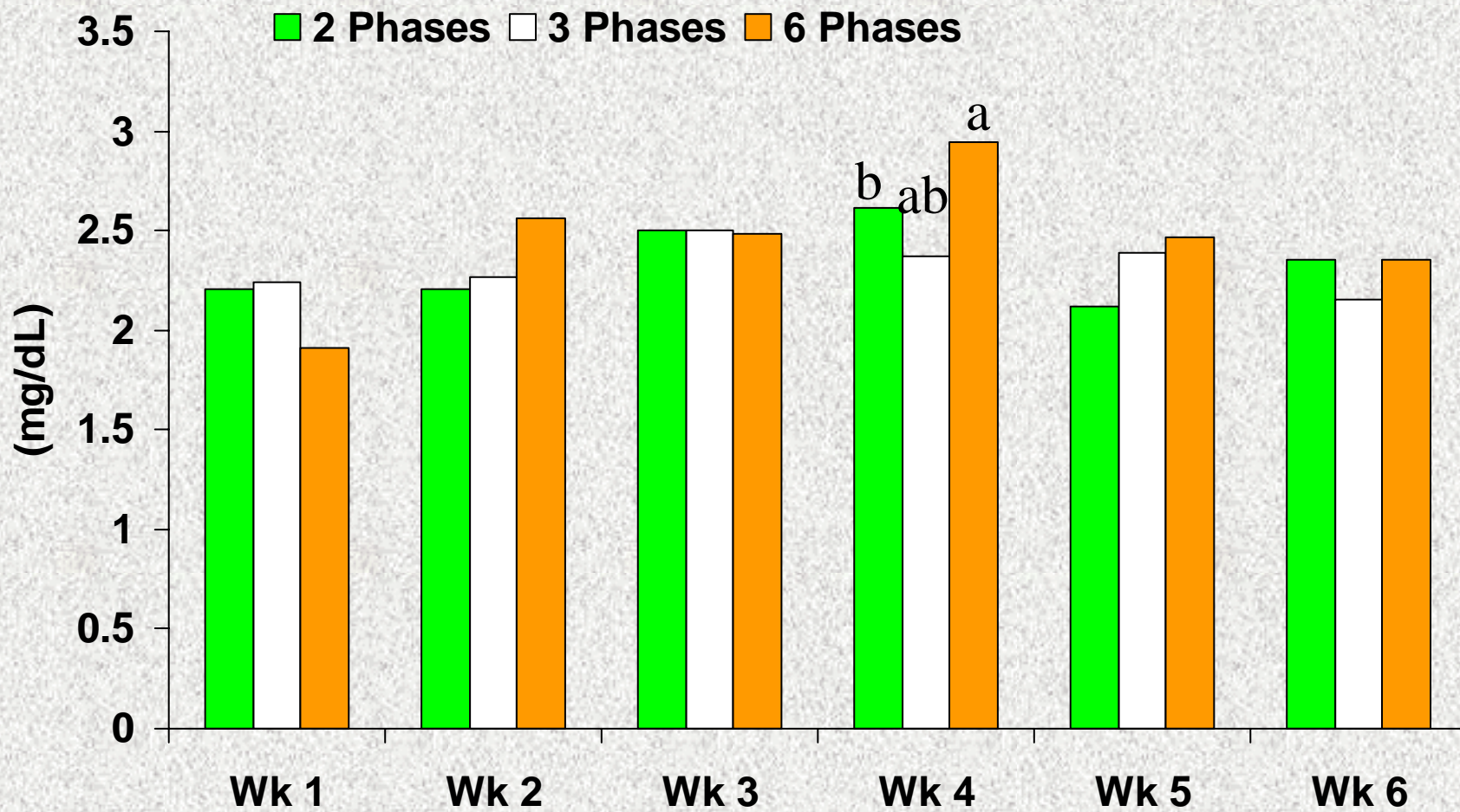
Multi-Phase Feeding





Plasma Urea N of Grower Pigs

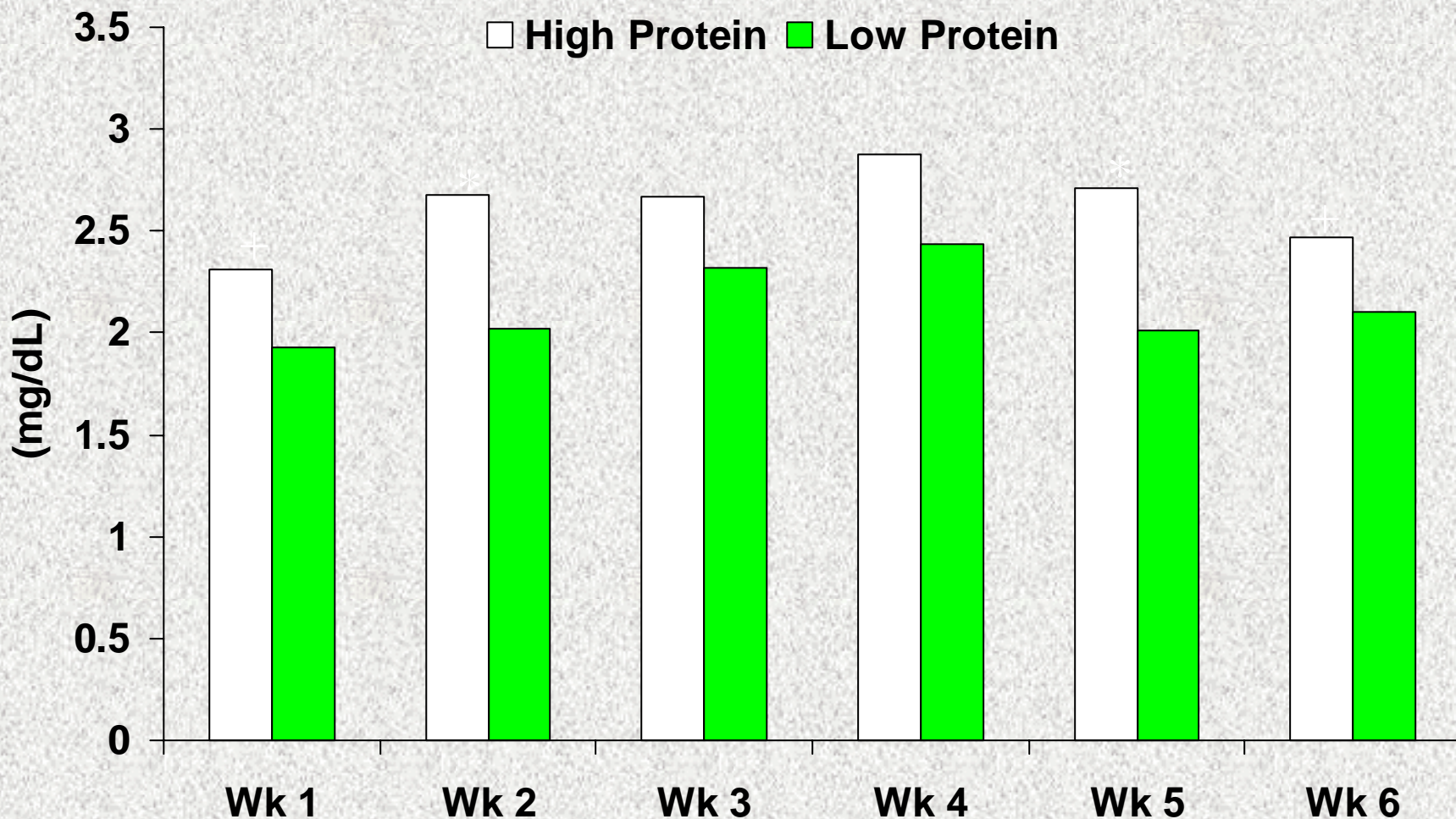
Phase Feeding Treatment





Plasma Urea N of Grower Pigs

Dietary Protein Treatment





Take Home Message

- **Excretion of N can be reduced by balancing dietary amino acids; may reduce land-base required for spreading slurry, will reduce ammonia emissions**
- **Depending on ingredient prices, synthetic AA may reduce feed costs**
- **Excretion of N can be shifted from urine to feces by dietary fermentable carbohydrates, will reduce ammonia emissions**



Concepts - P

Urine

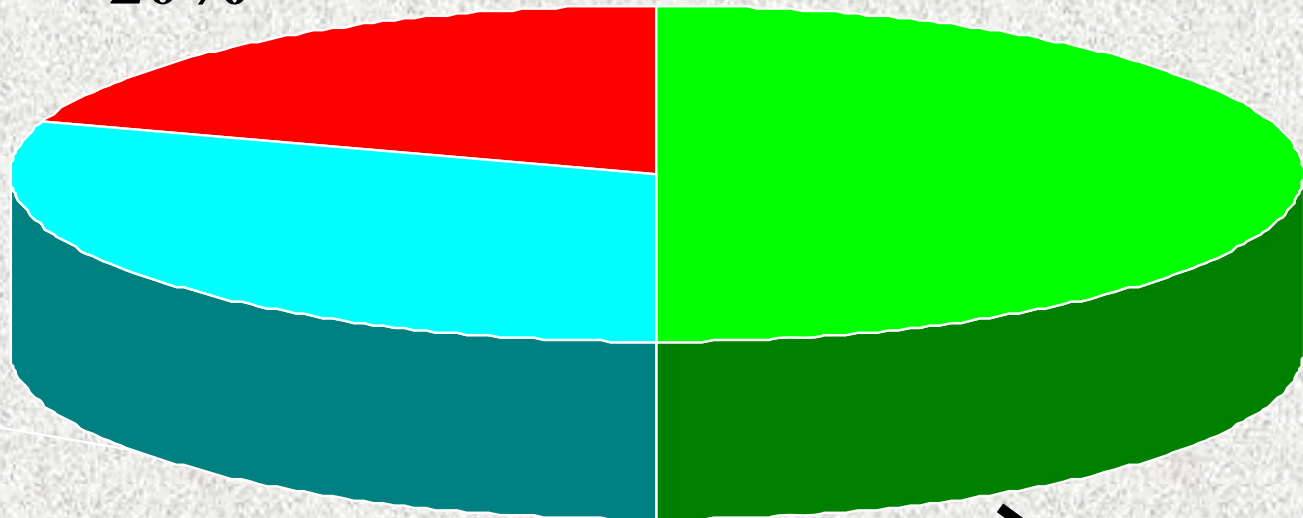
20%

30%

50%

- Unavailable=phytate bound
- Retained
- Above requirement

Feces





Concepts - P

- **Phytate = complex compound that binds P, other minerals, and even starch**
- **Thus, P digestibility is low in plant products**
- **P requirements are thus met with inorganic phosphorus that is highly digestible**
- **Supplemental phytase can digest phytate and thereby release P, minerals, and energy**



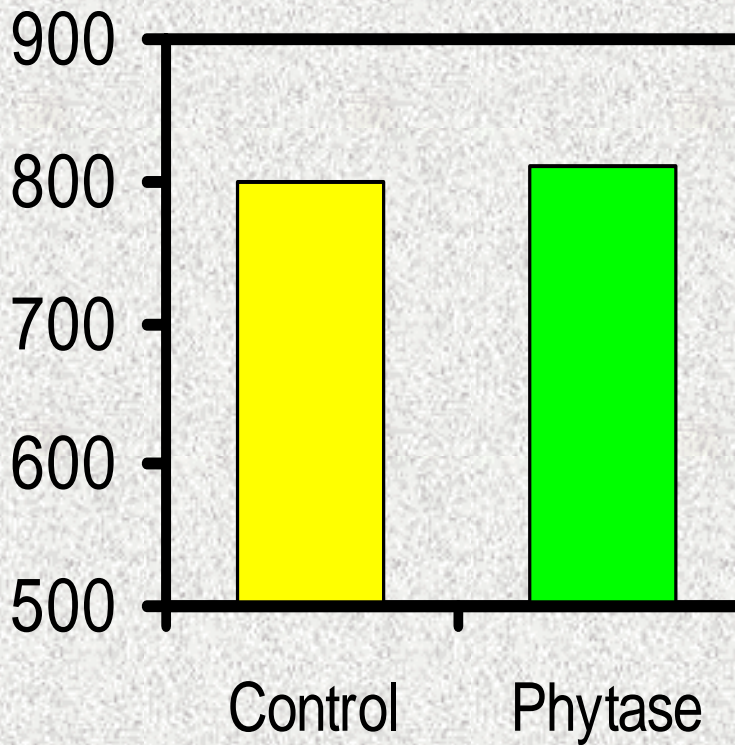
Example P: Phytase-Diet

Ingredient, %	Control	Phytase
Hull-less barley	86.36	86.65
Soybean meal, 48%	10.70	10.70
Calcium carbonate	1.36	1.57
Mono-Ca-phosphate	0.50	---
Salt+Premix	0.90	0.90
Amino acids	0.18	0.18
Phytase	---	+

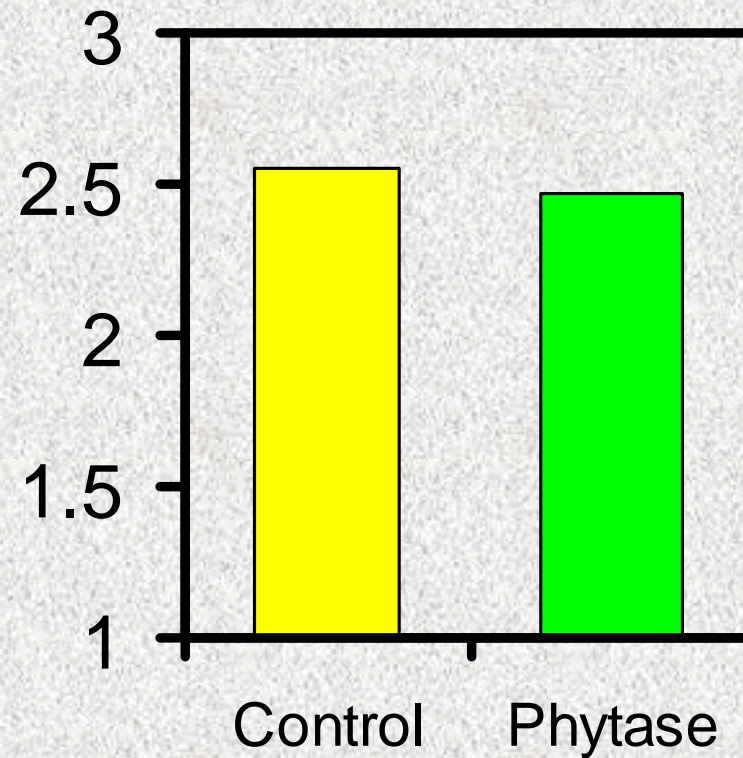


Example 1: Phytase-Performance

ADG, g/d



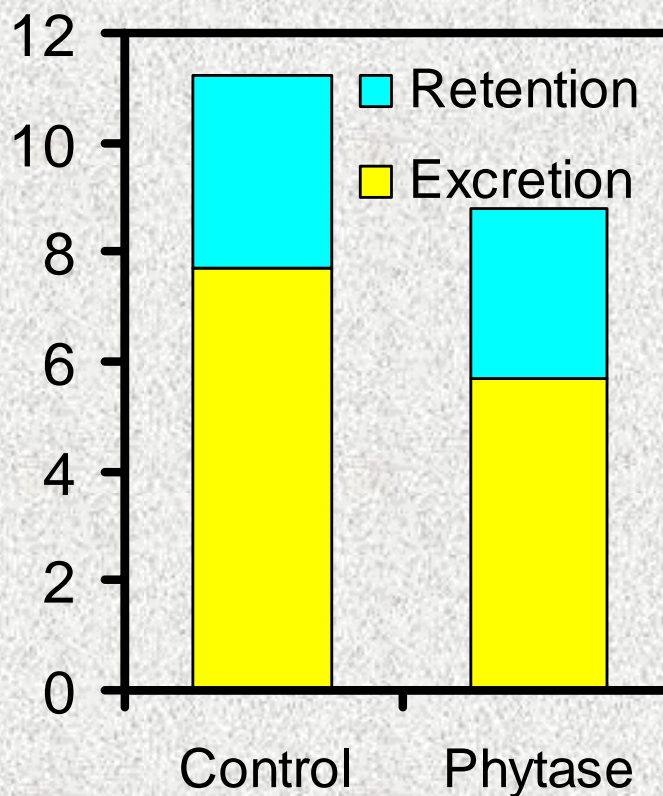
Feed/gain



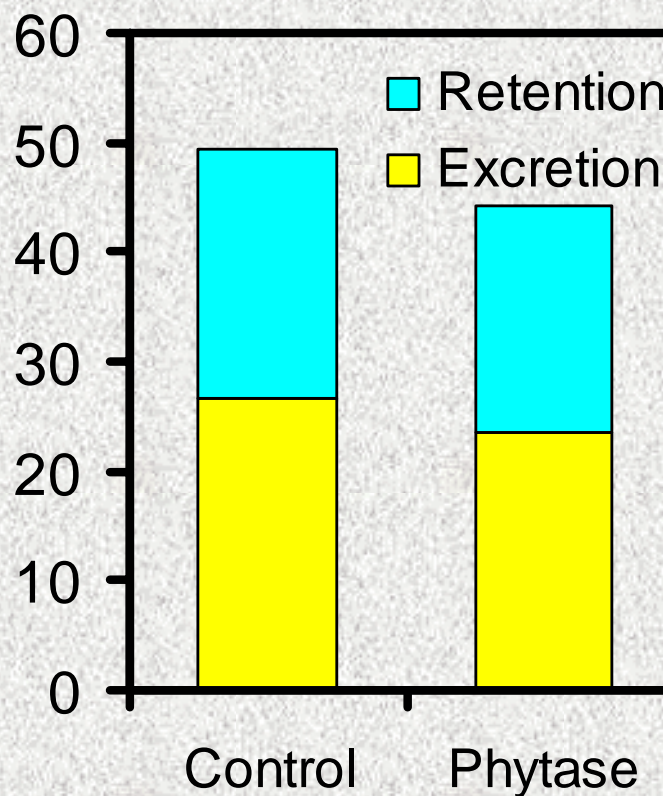


Example 1: Phytase-Excretion

Phosphorus, g/d

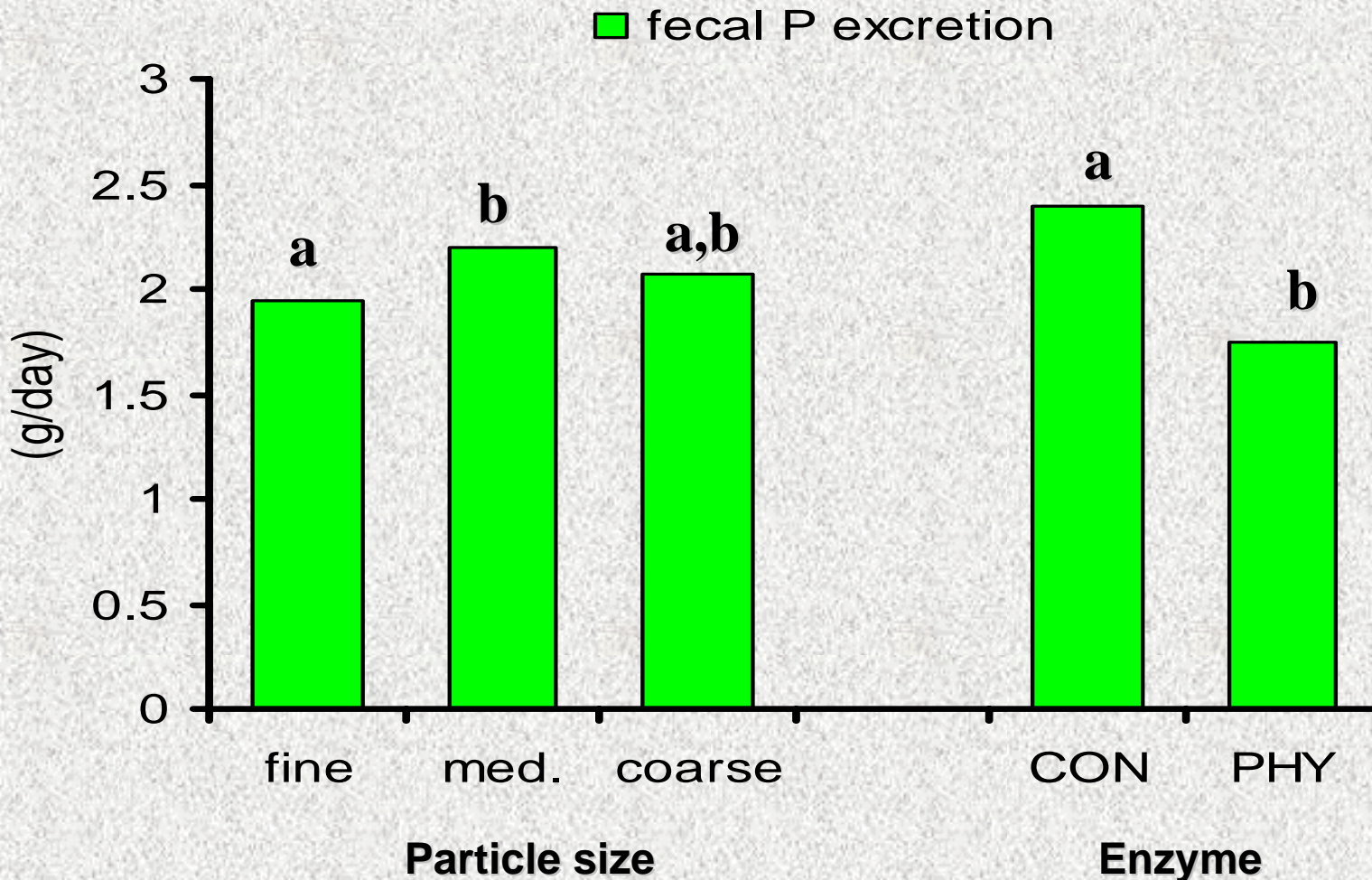


Nitrogen, g/d





P: Particle size/Enzymes



Phytase will improve phosphorus digestibility and thereby reduce phosphorus excretion in feces; it also saves money



Take Home Message

- **Economic value of phytase:**
 - **Cost price of mono/di-calcium phosphate**
 - **Inclusion level of phytase**
 - **Dietary ingredients (wheat vs. barley, etc.=phytate content & endogenous phytase)**
 - **Improvements in nutrient digestibility (P, AA, E)**
 - **Legislation RE manure application**



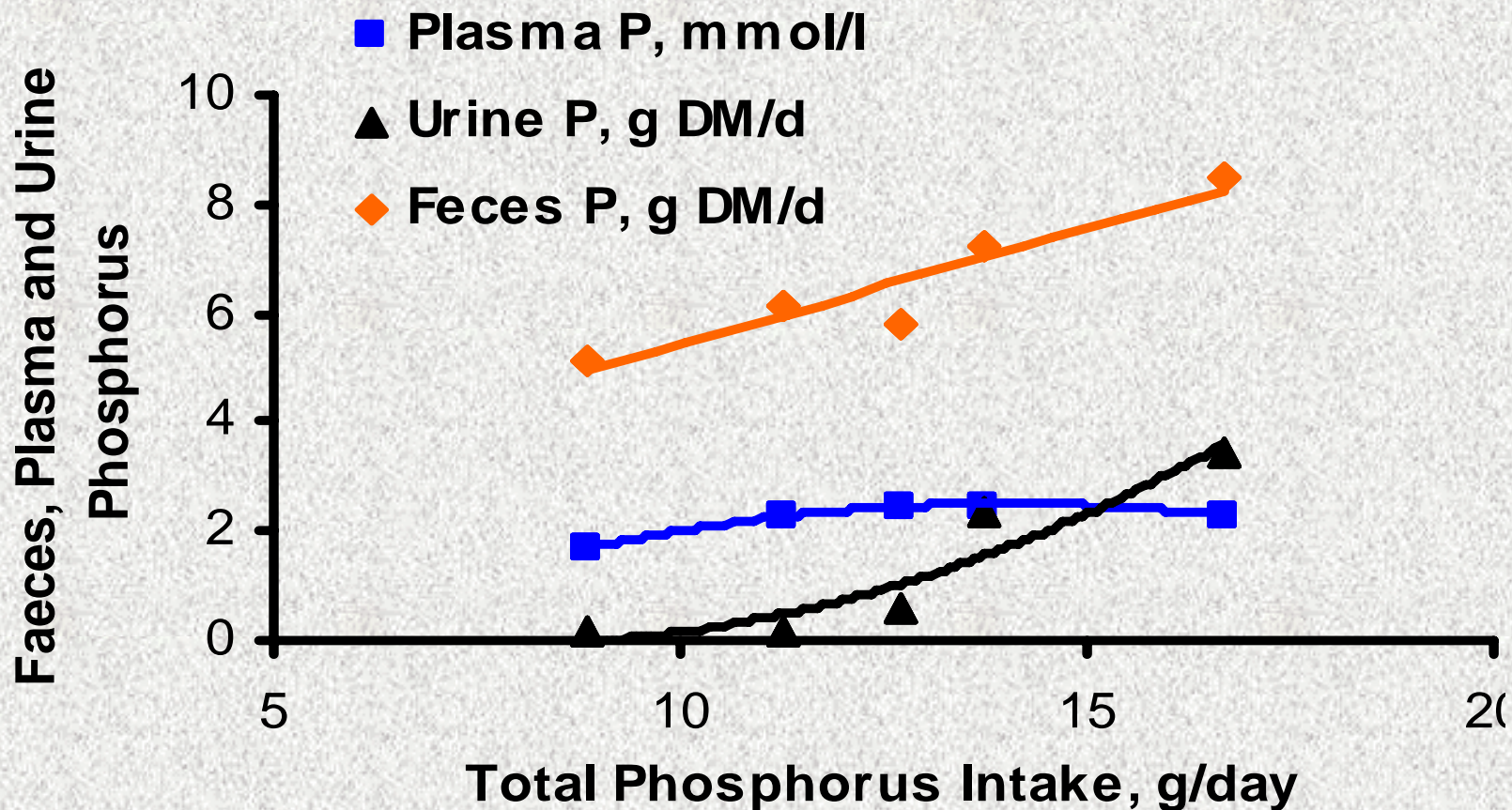
Value of Phosphorus Released

	P released	Value
P released by phytase/ton feed	1.0 kg	
Equivalent 18.5% inorganic P units	5.4 kg	
18.5% inorganic P		\$ 0.25/kg
Value of P released by phytase/ton feed		\$ 0.25 * 5.4 kg = \$1.35/ton feed

Source: BASF 2000



Example P: Requirement





Take Home Message

- **Excretion of P can be reduced drastically by phytase supplementation; may reduce land-base required for spreading slurry**
- **Depending on ingredient prices, etc., phytase supplementation can reduce feed costs**



Summary

- **Excretion of N can be reduced by balancing dietary amino acids to meet amino acid-requirements; maintain performance, and reduces ammonia emissions and amount of land required to spread slurry.**
- **Excretion of N can be shifted from urine to feces by dietary fermentable fiber; this reduces ammonia emissions**
- **Excretion of P in feces can be reduced drastically by phytase supplementation; saves some money and reduces amount of land required for spreading**
- **This research helps to be prepared if legislation similar to Europe comes to western Canada**



Summary

- **Can we affect nutrient excretion and gas emissions with feed formulation?**

For sure!