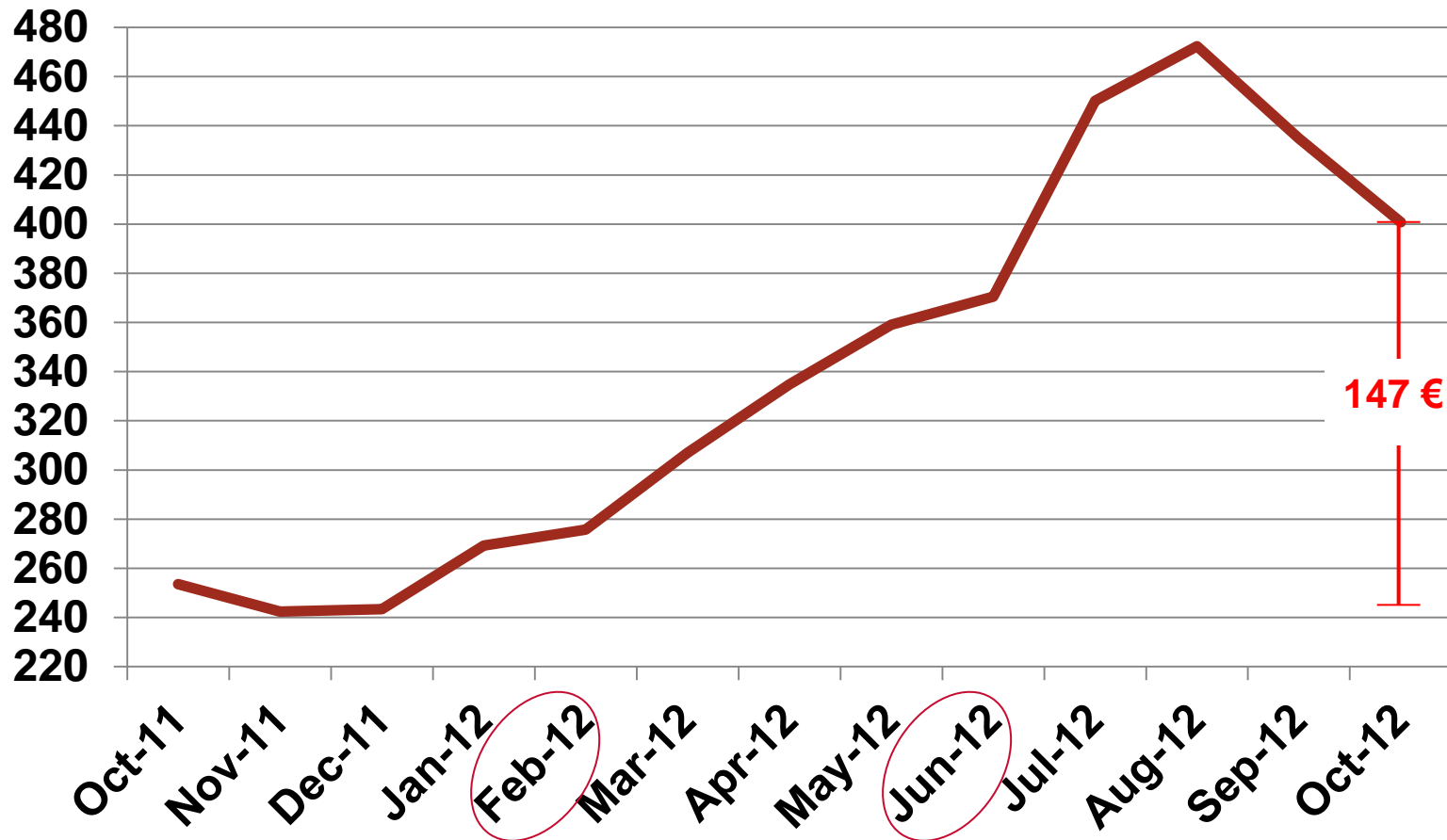


Benefits of protease on top of carbohydrases at times of high protein prices in poultry

14 NOVEMBER 2012



Soybean meal prices (€)



In the news

- Nov 7 (Reuters) - U.S. wheat, corn and soybeans rose on Wednesday as global markets rallied following President Barack Obama's election victory, while an export-boosting fall in the U.S. dollar also supported.
- Nov 7 (Reuters) - Argentina's 2013 soybean crop may be 3 million to 6 million tonnes below earlier forecasts of 55 million to 56 million tonnes as repeated rain is disrupting sowing.

Presentation objective

How DuPont/Danisco Animal Nutrition can help reduce feed costs at times of volatile vegetable protein prices



Some strategies to cope with high raw material prices

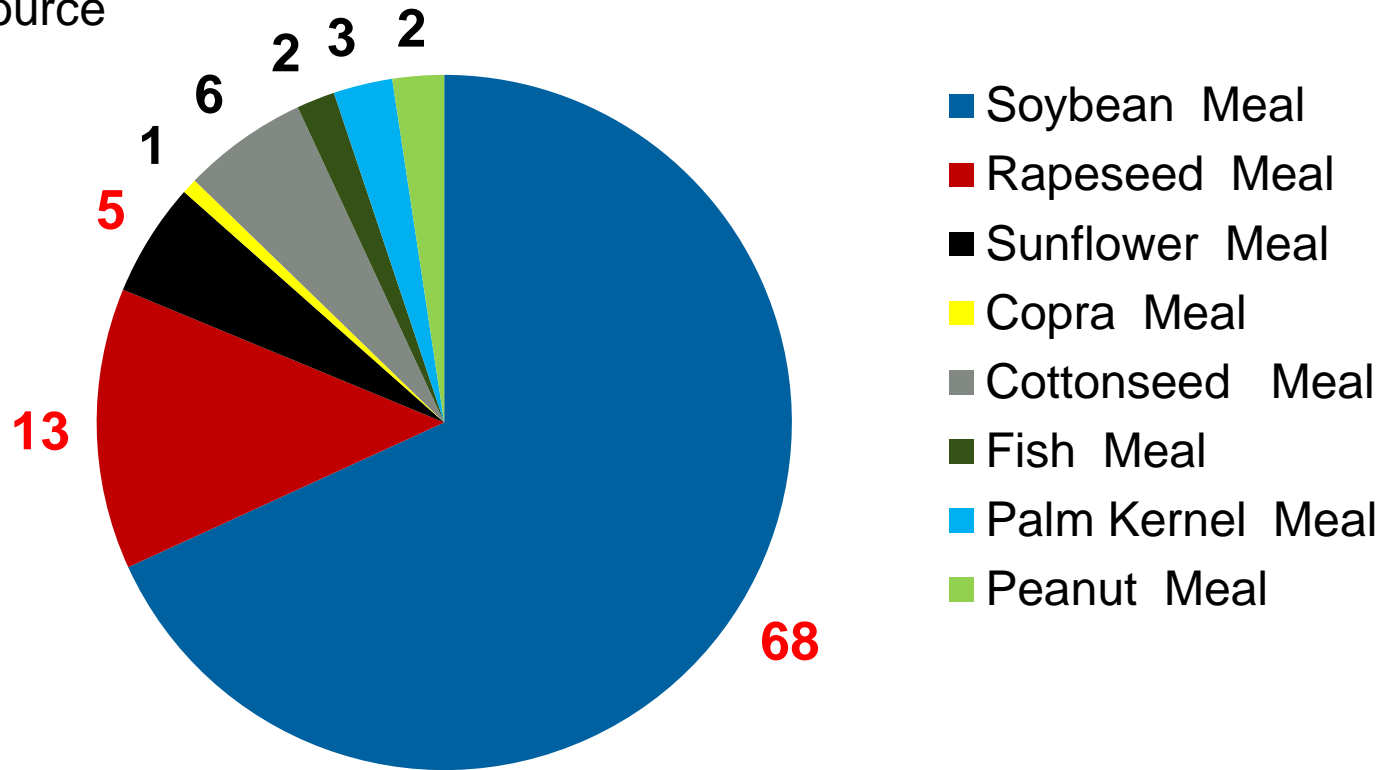
- New raw materials
- Greater focus on quality issues
- Feed formulation strategies (e.g. decrease energy/ nutrient levels with some loss of performance)
- Increased use of feed additives (enzymes and synthetic amino acids)
- Maximise nutrient extraction (enzymes, feed processing)

Presentation overview

- Soybean meal alternatives
- Features of Danisco protease
- Research data to support the use of protease

Major protein meals production % (2012)

The second largest component of poultry feed after cereals is the protein source

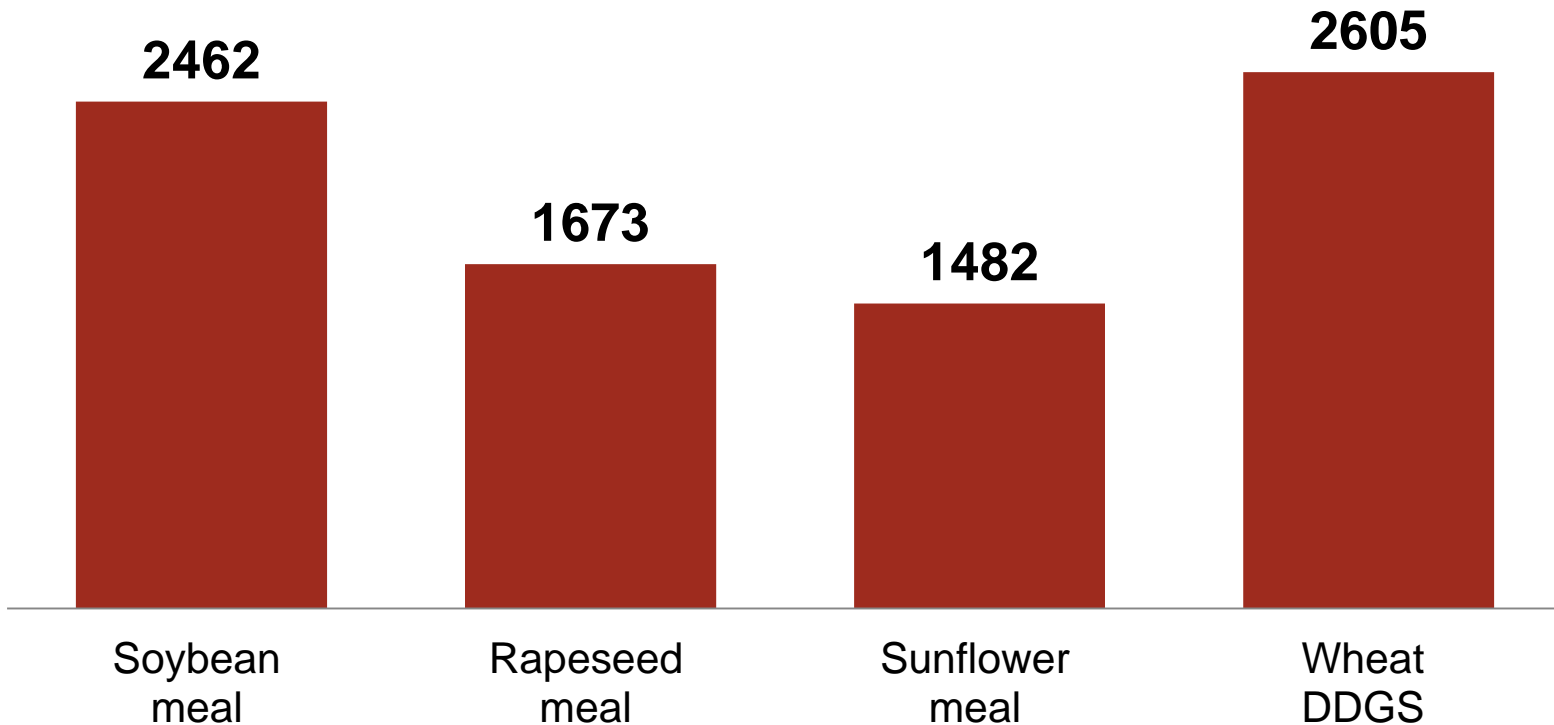


Comparison of protein level and digestibility in some vegetable protein sources (% "as received") ¹

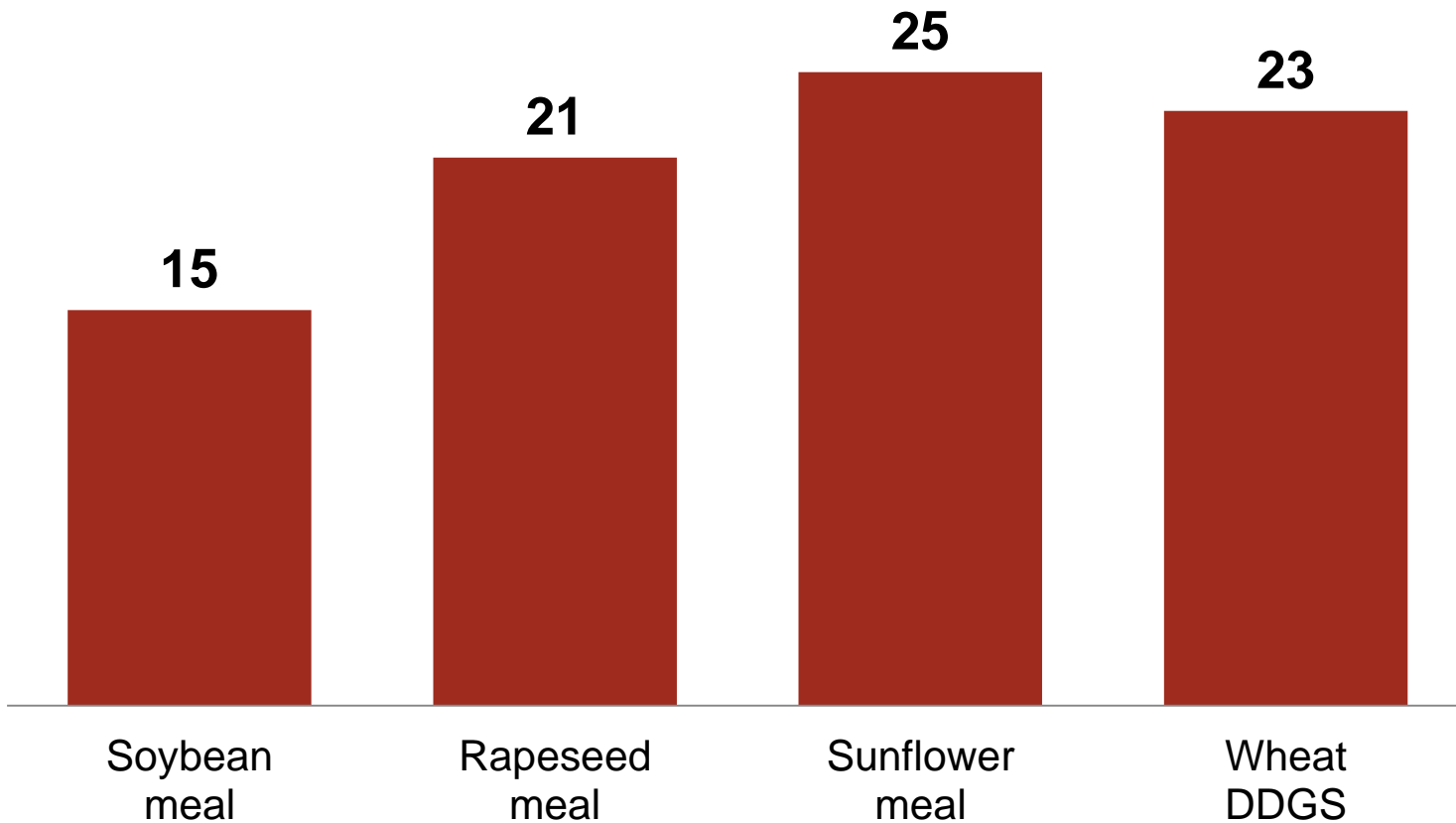
	CP level	CP digestibility	Cost/t (€)	Cost (€) per unit of dig. protein
Soybean meal	48.0	89	462	10.7
Rapeseed meal	34.0	78	288	10.9
Sunflower meal	28.0	83	233	10.0
Wheat DDGS	37.5	71	265	10.0

¹ Premier atlas, ingredients matrix 2008 ; Cozannet *et al.* 2009 and 2010

Metabolisable energy in some vegetable protein sources (kcal/kg)



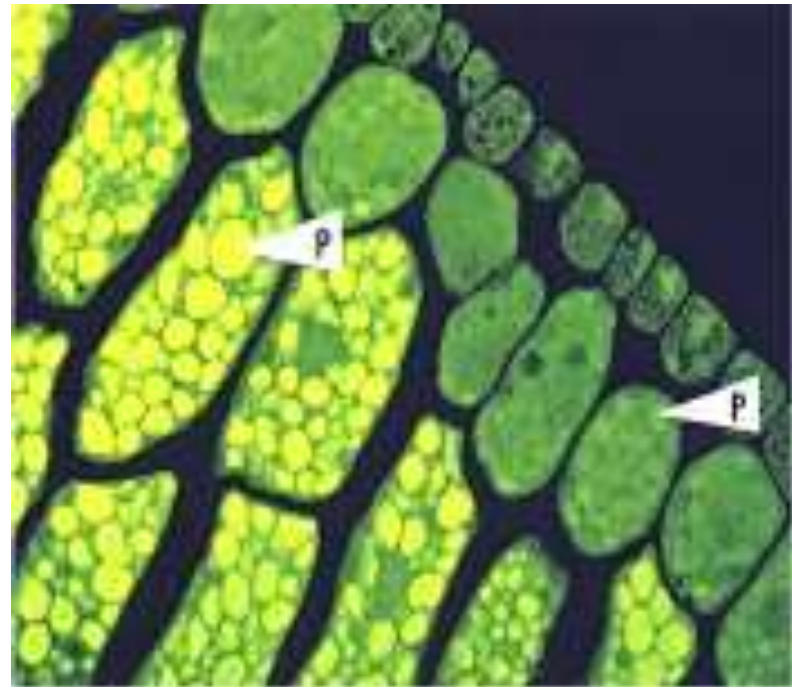
Non-starch polysaccharide in some vegetable protein sources (% dry matter)



Source: Danisco Non Starch Polysaccharide (NSP) database (2012); Widyaratne and Zijlstra (2007)

Soybean meal proteins

- Glycinin + β -conglycinin 80%
- Antinutritional factors 5%
- Other proteins 15%



P = protein bodies

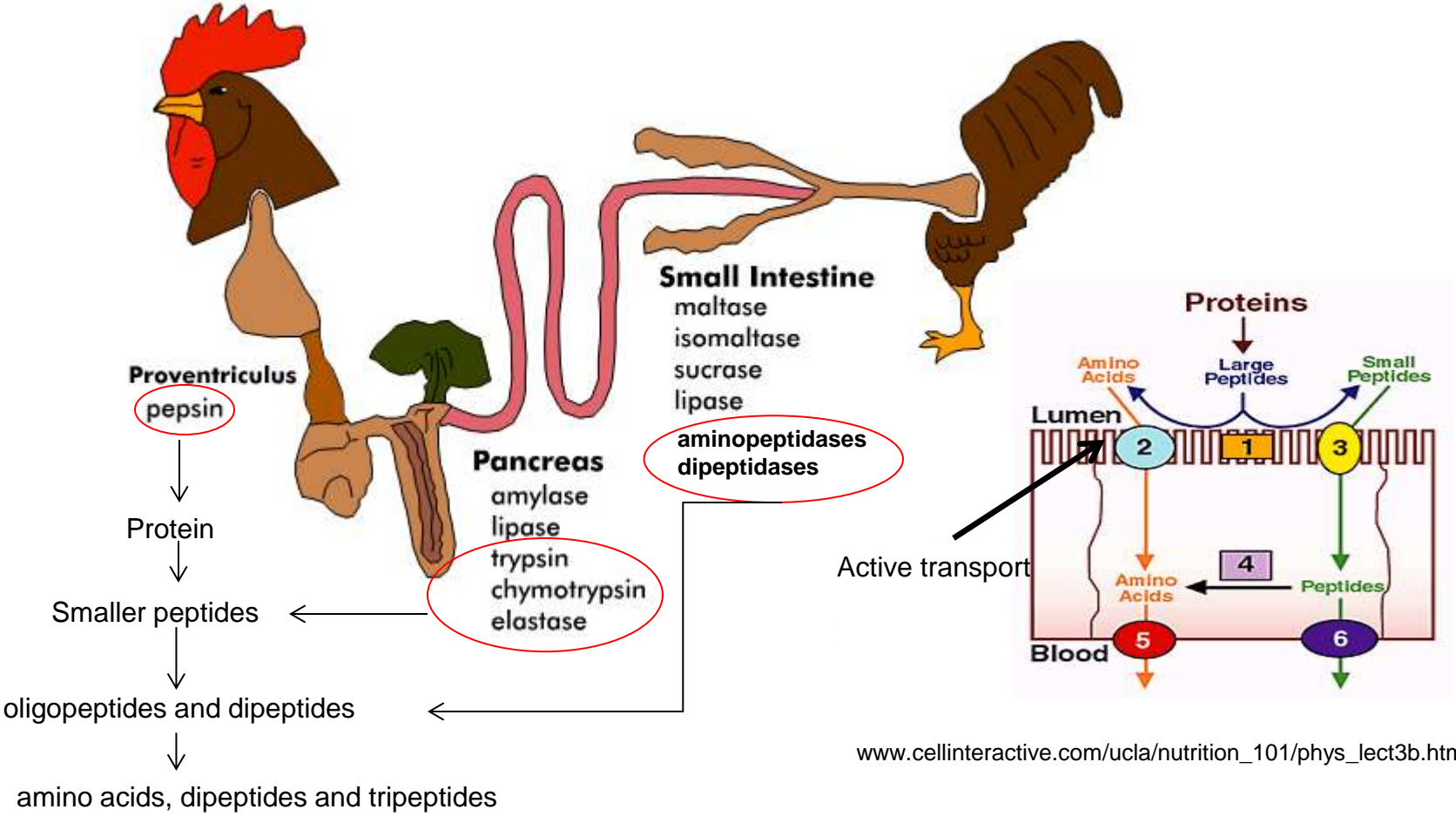
Fischer (2006)

Global soybean meal survey (88% DM)¹

	n	DM	CP	CF	NDF	EE	TIA (g/kg)
ARG	136	885	45.4 ^c	4.8 ^b	9.2 ^b	1.7 ^{ab}	2.5 ^b
BRA	131	88.6	46.6 ^b	5.5 ^a	10.6 ^a	1.8 ^a	2.6 ^b
USA	164	88.6	47.3 ^a	3.8 ^c	7.8 ^c	1.6 ^b	3.1 ^a
SEM		0.08	0.12	0.08	0.13	0.04	0.05
<i>P</i>		NS	***	***	***	**	***

¹Source: Mateos 2012

Protein digestion



Agenda

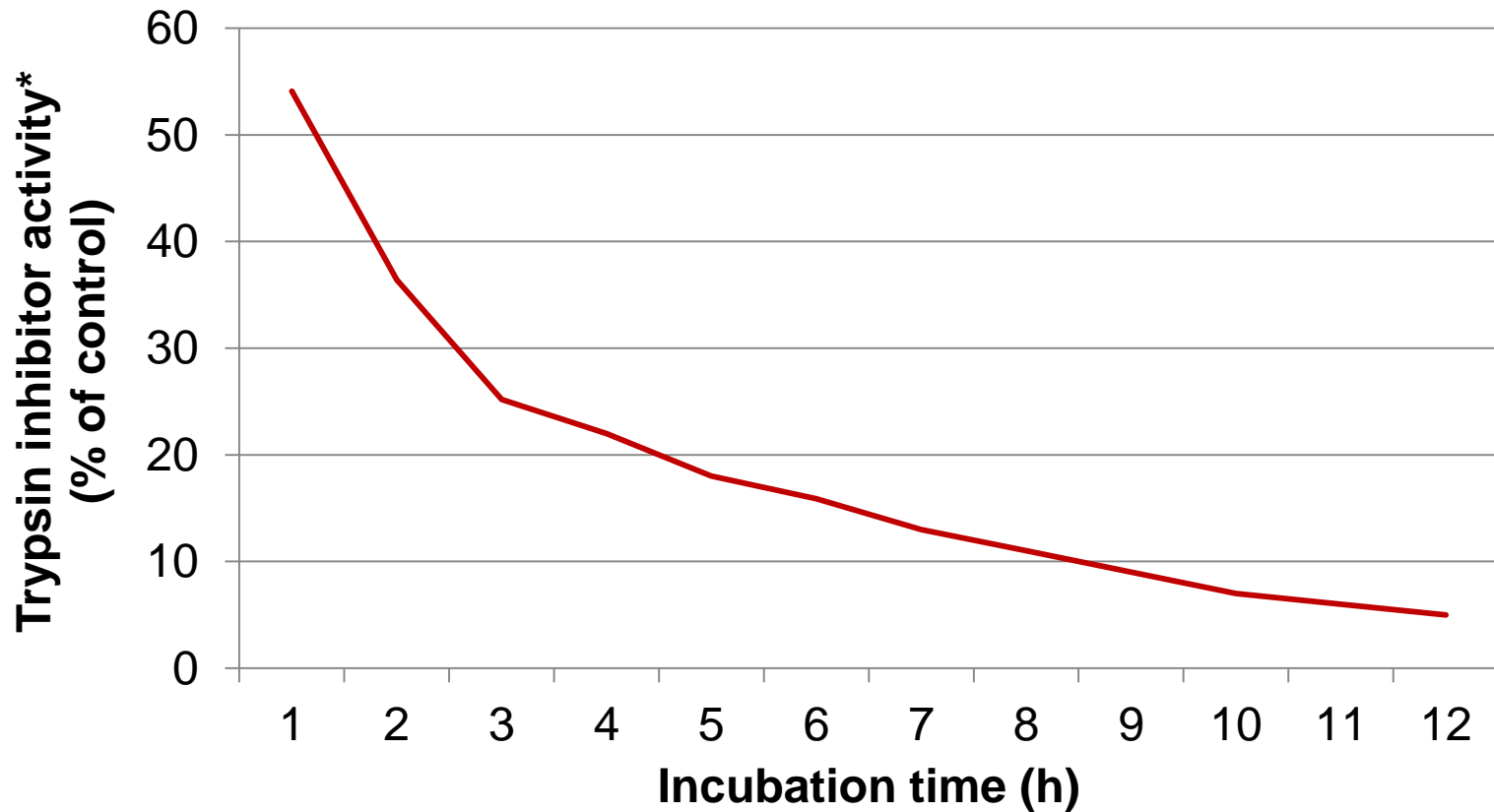
- High prices and volatility of soybean meal
- Features of Danisco protease
- Research data to support the use of protease

The protease in Avizyme® 1505

- *Bacillus Subtilis* serine endopeptidase
- Designed for rapid hydrolysis of proteins
- Degrades Soybean storage proteins
- Degrades soybean anti-nutritional factors proteins



Effect of Danisco protease on trypsin inhibitor activity in raw soybean



Measured in a slurry at 50°C, enzyme at 1% w/w

*Control TIA 47.5 mg/g after 1 hour incubation

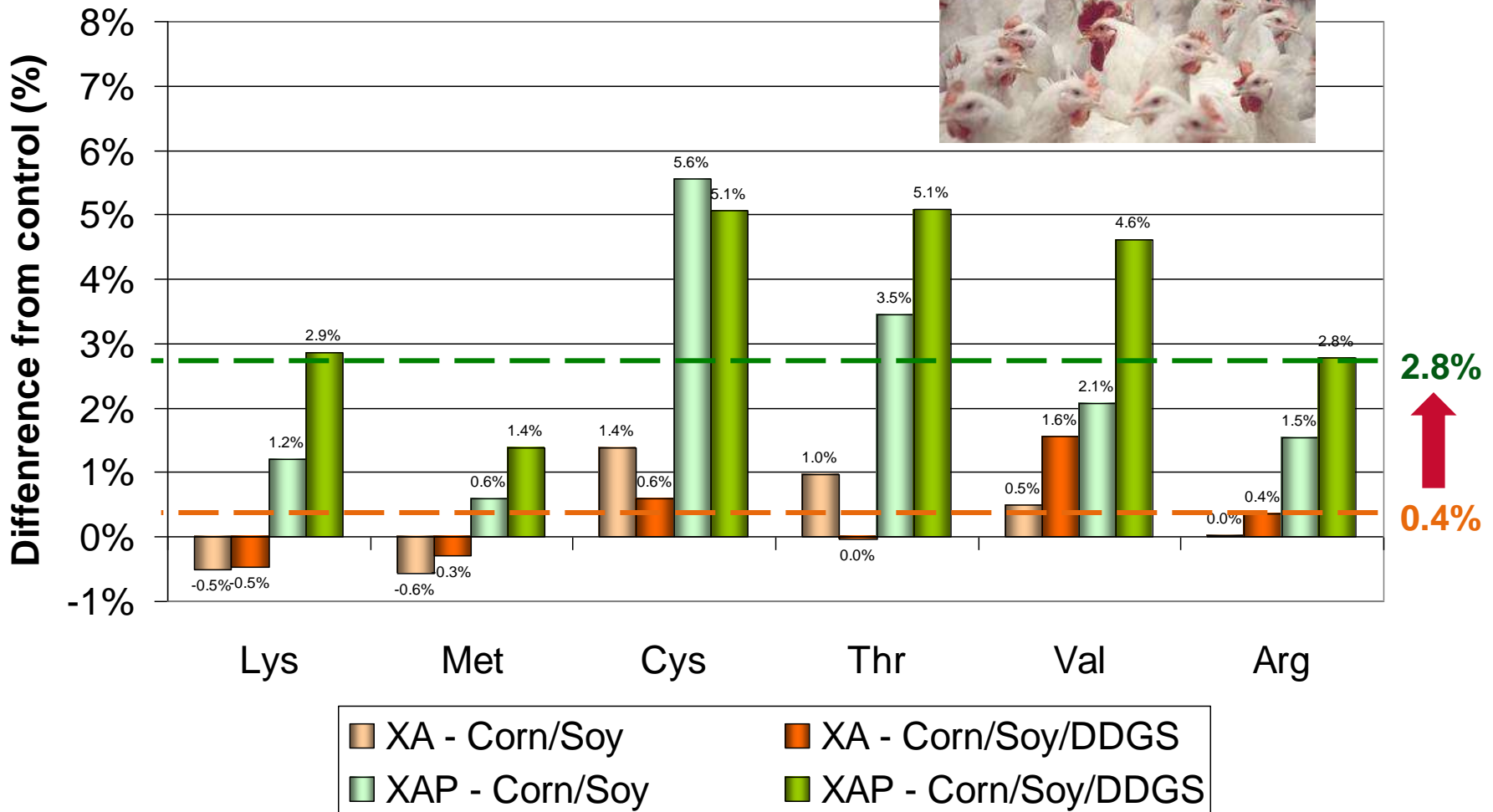
Agenda

- High prices and volatility of soybean meal
- Features of Danisco protease
- Research data to support the use of protease

Effects of protease on top of XA on amino acid digestibility in diets with or without corn DDGS

- Meta-analysis of 4 Trials with similar design: Massey University, NZ and U. of Illinois, USA
- 21-d digestibility trials
- Ross 308 males
- Three treatments in each trial: control, XA, and XAP (Avizyme 1505)
- Two trials with corn/SBM based and two trials with corn/SBM/DDGS (7-10%)
- Amino acid digestibility evaluated on an apparent ileal basis
- Titanium oxide was marker
- Mixed Procedure of SAS. Experiment was random term

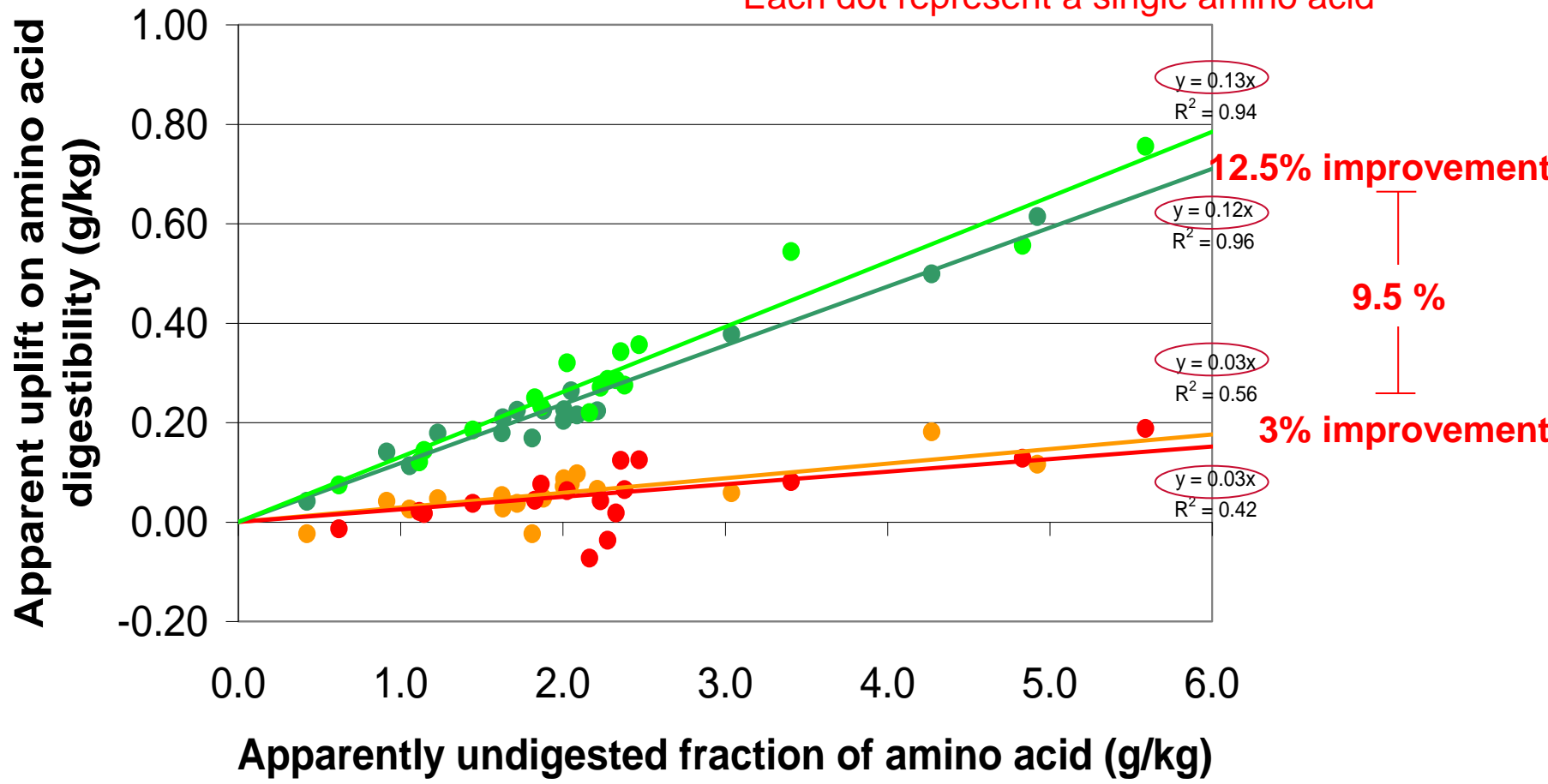
Addition of XAP increased amino acid digestibility by 2.8% compared to 0.4% for XA



Why are there differences in the response to enzymes between the different amino acids?

Avizyme 1505 (XAP) effects on undigested fraction of amino acids were very consistent

Each dot represent a single amino acid



- XA-Corn/SBM
- XAP-Corn/SBM
- XA-Corn/SBM/DDGS
- XAP-Corn/SBM/DDGS

Amino acids with high concentration x low digestibility had greater improvements due to Avizyme[®] 1505

Corn/SBM

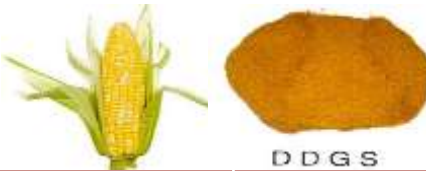


Amino acid	Ileal digestible (g/kg)	Ileal digestibility (%)	Ileal undigested fraction (g/kg)	Avizyme 1505 effect	
				Digestibility coefficient (%)	Ileal digestible (g/kg)
Lysine	12.2	87.1	1.81	1.4	0.17
Methionine	5.9	93.3	0.42	0.7	0.04
Cysteine	2.4	72.2	0.91	5.8	0.14
Threonine	6.1	75.3	2.01	3.7	0.23
Valine	8.6	81.1	2.00	2.4	0.20
Total of 17 A.A			34.61		4.10

Improvement due to Avizyme 1505 = 11.8%

Amino acids with high concentration x low digestibility had greater improvements due to Avizyme[®] 1505

Corn/SBM/DDGS



Amino acid	Ileal digestible (g/kg)	Ileal digestibility (%)	Ileal undigested fraction (g/kg)	Avizyme 1505 effect	
				Digestibility coefficient (%)	Ileal digestible (g/kg)
Lysine	10.8	82.6	2.28	2.6	0.29
Methionine	5.7	90.1	0.62	1.3	0.07
Cysteine	2.5	68.9	1.12	4.9	0.12
Threonine	5.8	71.3	2.33	4.9	0.29
Valine	8.0	77.3	2.36	4.3	0.34
Total of 17 A.A			40.10		5.22

Improvement due to Avizyme 1505 = 13%

What does that mean?

- XAP effects on amino acid digestibility may be predicted based on ileal undigested fraction: ~**12.5%** of ileal undigested amino acids

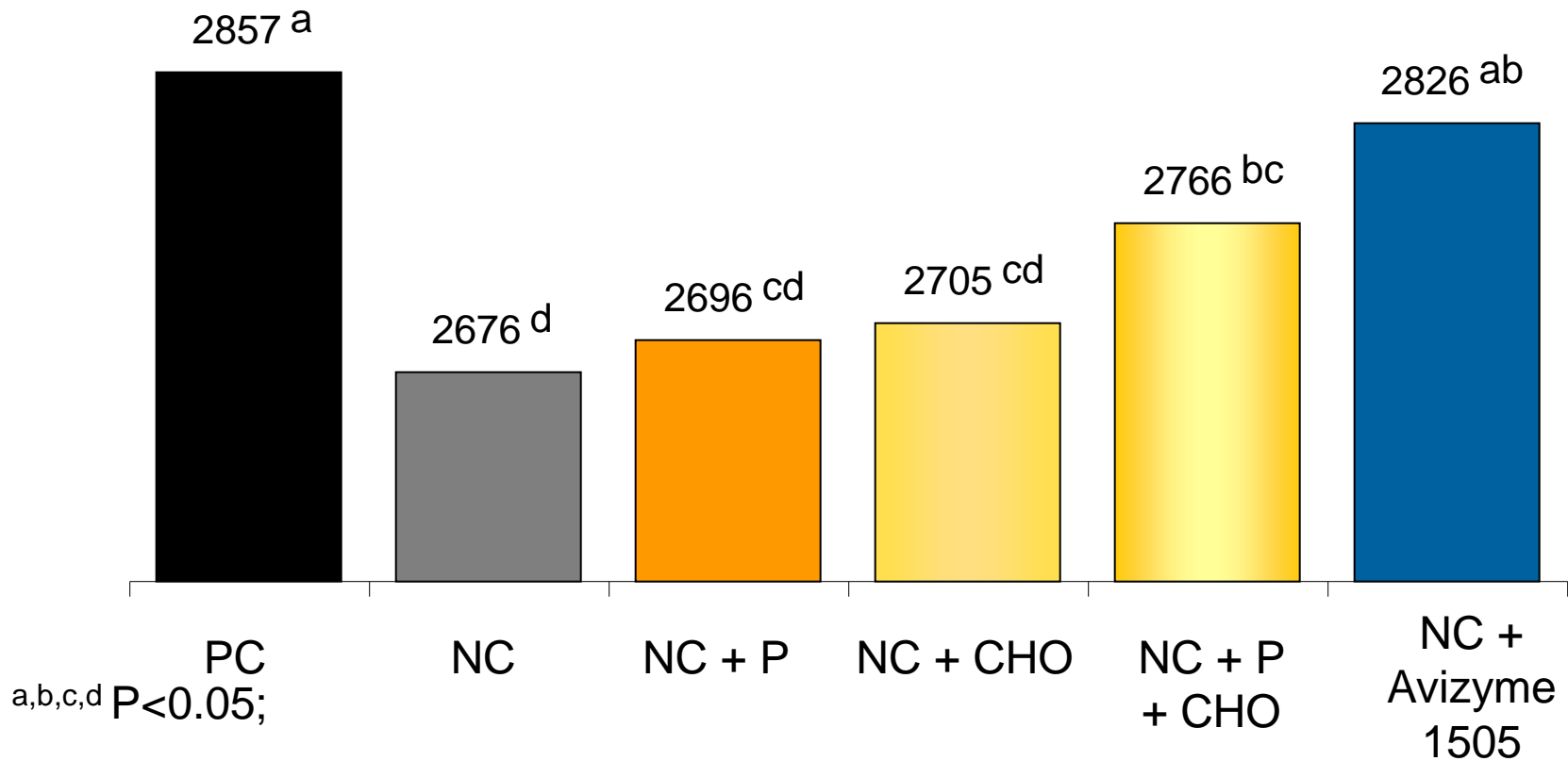
Avizyme 1505 outperforms competitor products in broilers fed mixed grain diets

DESIGN

- 720 male Ross 308 broiler chicks housed in floor pens
- 6 treatments with 8 pen replicates/treatment and 15 birds/pen
- Corn/Wheat/Wheat DDGS/Soybean meal-based mash diets
- 6 dietary treatments
 - Positive control (PC)
 - Negative control (NC; - 85kcal ME/kg feed, - 2.5% amino acids versus PC)
 - NC + 200 g/t competitor protease
 - NC + 500 g/t competitor carbohydrase (Amylase + β -glucanase + xylanase)
 - NC + 700 g/t competitor protease + carbohydrase (Amylase + β -glucanase + xylanase)
 - NC + 200 g/t Avizyme 1505
- Birds and feed weighed at 42 days of age

Avizyme 1505 outperforms competitor products in broilers fed mixed grain diets

Weight gain (g, 1-42 days)

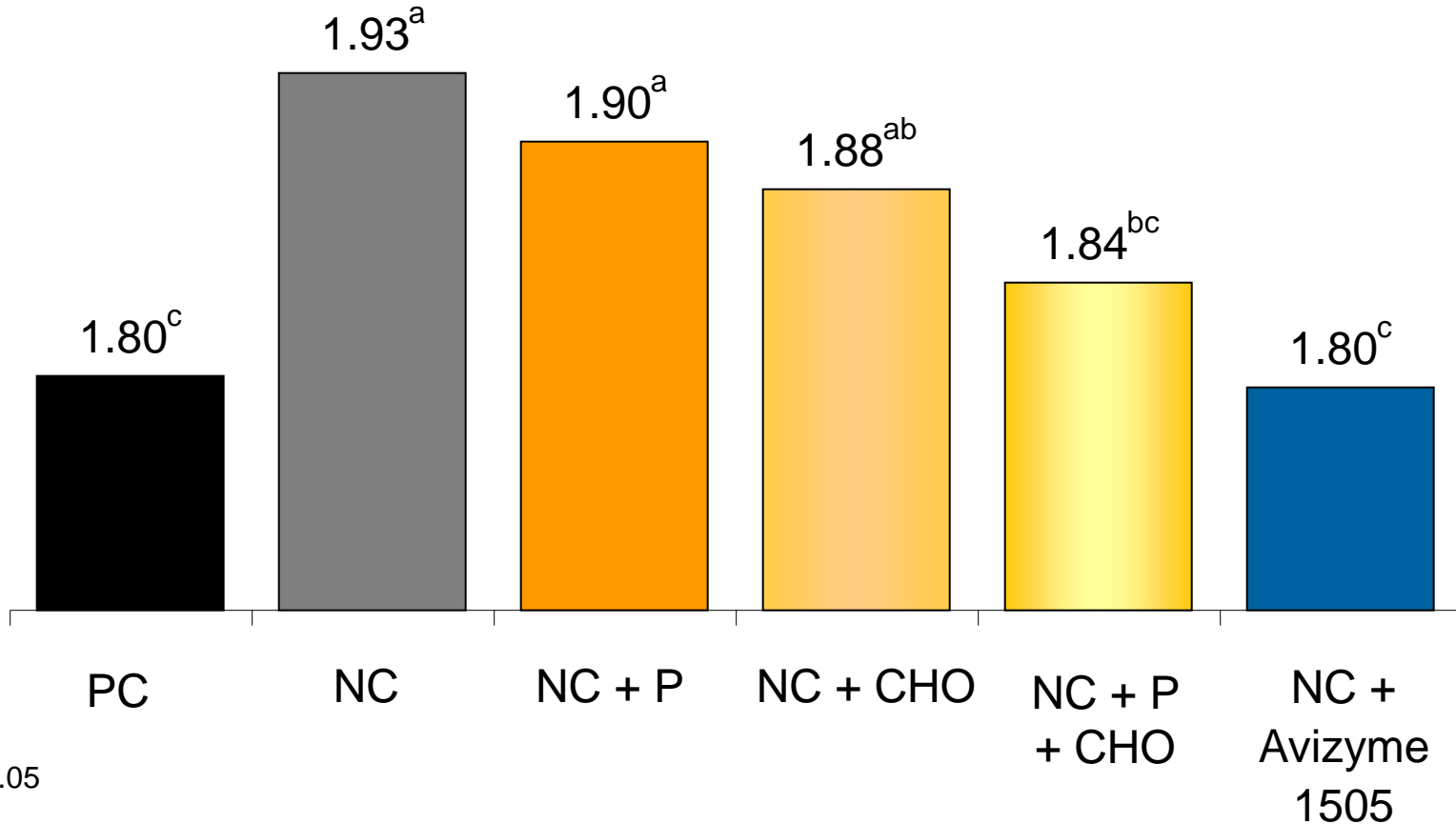


PC = Positive control
 CHO = amylase + β -glucanase + xylanase

NC = Negative Control
 P = Protease

Avizyme 1505 outperforms competitor products in broilers fed mixed grain diets

FCR_c* (1-42 days)



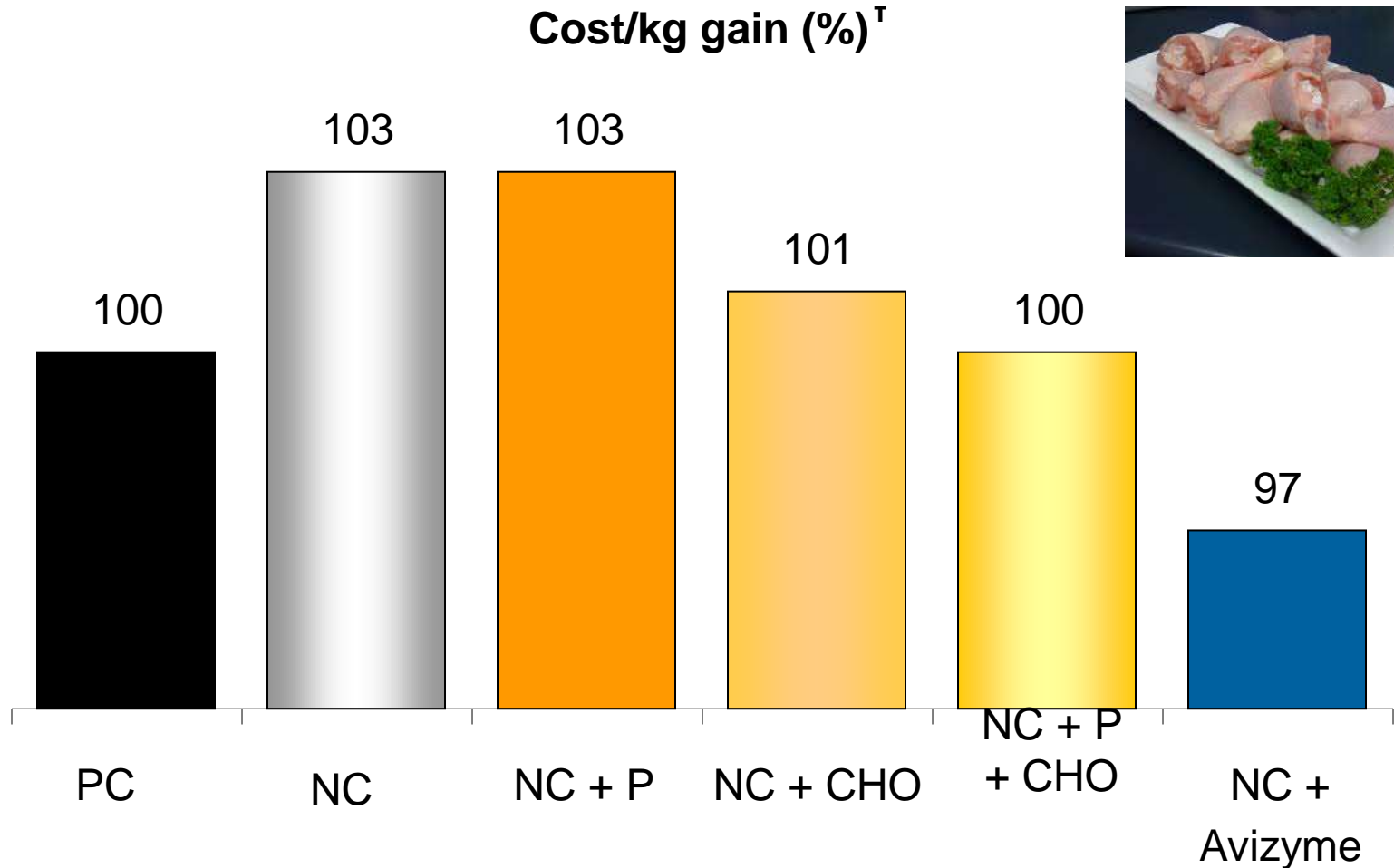
a,b,c P<0.05

PC = Positive control
 CHO = amylase + β-glucanase + xylanase

NC = Negative Control
 P = Protease

* FCR corrected 3 points for every 100g difference in bodyweight versus the Positive control

Avizyme 1505 outperforms competitor products in broilers fed mixed grain diets



PC = Positive control
 CHO = amylase + β -glucanase + xylanase

NC = Negative Control
 P = Protease

1505
 1505.UK.B.10.19
 Roslin Nutrition, Midlothian, UK

[†] Expressed relative to the Positive control, including product prices

Danisco Animal Nutrition can help reduce feed costs at times of volatile vegetable protein prices

	Basal diet (BD)*	BD + Avizyme 1505 (CP&AA)*	BD + Avizyme 1505 (full matrix)*	Ingredient price (€/t)
Corn	48	50	51	245
Wheat	15	15	15	235
SBM 48%	28	26	26	477
Rapeseed meal	3.0	3.0	3.0	300
Soy oil	3.1	2.9	1.6	910
<i>Economics</i>				
Feed cost (€/t)	339.3	337.3	328.6	-
Net savings (€/t)	-	-2.0	-10.7	-

* Calculated analysis for all diets: 20% CP and 12.7 MJ/kg ME

Conclusions – Take home messages

- Protease on top of XA increased digestibility of undigested amino acid fraction from ~3.0% (XA) to **12.5 % (XAP)**
- In the current situation of high raw material prices, enzymes are one of the tools to help reduce the price pressure on poultry producers and consumers
- Using matrix values for Avizyme 1505 (energy, protein and amino acids) allows reductions of 10.7 €/t and for protein and amino acids 2.0 €/t





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