



# Feed enzymes as a means of increasing feed efficiency in grow-finisher pigs

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AGRICULTURE AND FOOD DEVELOPMENT AUTHORITY

# Introduction

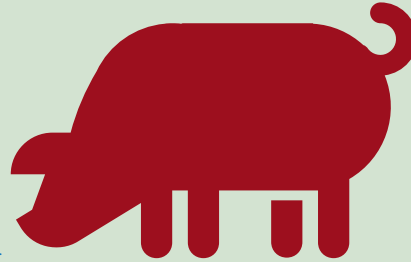
## FEED ENZYMES



50-200  
g/tonne



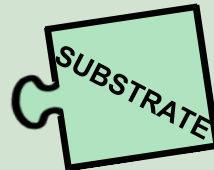
## PIG RESPONSE



↑ Nutrient digestibility

↑ Growth

↑ Feed efficiency



## ENZYME - SUBSTRATE

Phytase

Phytate

Protease

Protein

Xylanase

$\beta$ -glucanase

Mannanase

Amylase

Galactosidase

Fibre

# Objective

- Determine which exogenous **enzymes** are most consistent in improving **feed efficiency** and **nutrient digestibility**
- Investigate the **effect of diet formulation** on the response to in-feed enzyme supplementation in grower-finisher pigs
- Identify **gaps of knowledge** and **application strategies** to the Irish Industry

# Results

Summary of 138 studies:

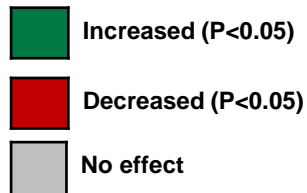
	Nutrient digestibility			Growth		
	DM	GE	CP	ADG	ADFI	G:F
<i>Xylanase (X)</i>						
<i>X + <math>\beta</math>glucanase</i>						
<i>Mannanase</i>						
<i>Protease</i>						
<i>Enzyme Complex</i>						



# Results

Summary of 138 studies:

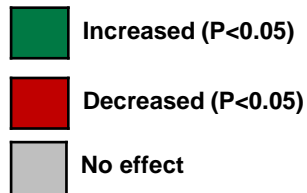
	Nutrient digestibility			Growth		
	DM	GE	CP	ADG	ADFI	G:F
<b>Xylanase (X)</b>	No effect	Increased (P<0.05)	No effect	No effect	No effect	No effect
<i>X + <math>\beta</math>glucanase</i>	Increased (P<0.05)	Increased (P<0.05)	Increased (P<0.05)	No effect	No effect	No effect
<i>Mannanase</i>	Increased (P<0.05)	Increased (P<0.05)	Increased (P<0.05)	Increased (P<0.05)	No effect	Increased (P<0.05)
<i>Protease</i>	Increased (P<0.05)	Increased (P<0.05)	No effect	Increased (P<0.05)	No effect	No effect
<i>Enzyme Complex</i>	Increased (P<0.05)	Increased (P<0.05)	Increased (P<0.05)	Increased (P<0.05)	Decreased (P<0.05)	Increased (P<0.05)



# Results

Summary of 138 studies:

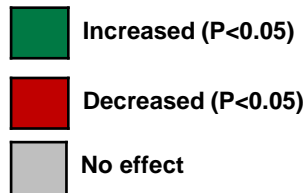
	Nutrient digestibility			Growth		
	DM	GE	CP	ADG	ADFI	G:F
<i>Xylanase (X)</i>						
<b><i>X + <math>\beta</math>glucanase</i></b>						
<i>Mannanase</i>						
<i>Protease</i>						
<i>Enzyme Complex</i>						



# Results

Summary of 138 studies:

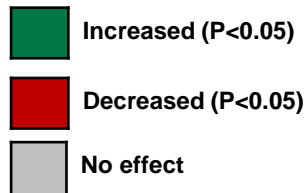
	Nutrient digestibility			Growth		
	DM	GE	CP	ADG	ADFI	G:F
<i>Xylanase (X)</i>						
<i>X + <math>\beta</math>glucanase</i>						
<b>Mannanase</b>						
<i>Protease</i>						
<i>Enzyme Complex</i>						



# Results

Summary of 138 studies:

	Nutrient digestibility			Growth		
	DM	GE	CP	ADG	ADFI	G:F
<i>Xylanase (X)</i>	Light Green	Light Green	Light Green	Light Green	Light Green	Light Green
<i>X + <math>\beta</math>glucanase</i>	Light Green	Light Green	Light Green	Light Green	Light Green	Light Green
<i>Mannanase</i>	Light Green	Light Green	Light Green	Light Green	Light Green	Light Green
<b><i>Protease</i></b>	Dark Green	Dark Green	Grey	Dark Green	Grey	Grey
<i>Enzyme Complex</i>	Light Green	Light Green	Light Green	Light Green	Light Red	Light Green

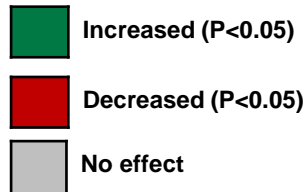




# Results

Summary of 138 studies:

	Nutrient digestibility			Growth		
	DM	GE	CP	ADG	ADFI	G:F
<i>Xylanase (X)</i>	Grey	Green	Grey	Grey	Grey	Grey
<i>X + <math>\beta</math>glucanase</i>	Green	Green	Green	Grey	Grey	Grey
<i>Mannanase</i>	Green	Green	Green	Green	Grey	Green
<i>Protease</i>	Green	Green	Grey	Green	Grey	Grey
<b>Enzyme Complex</b>	Green	Green	Green	Green	Red	Green



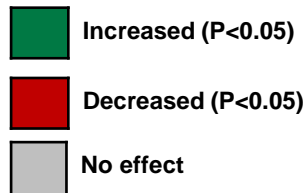
# Results

Summary of 138 studies:



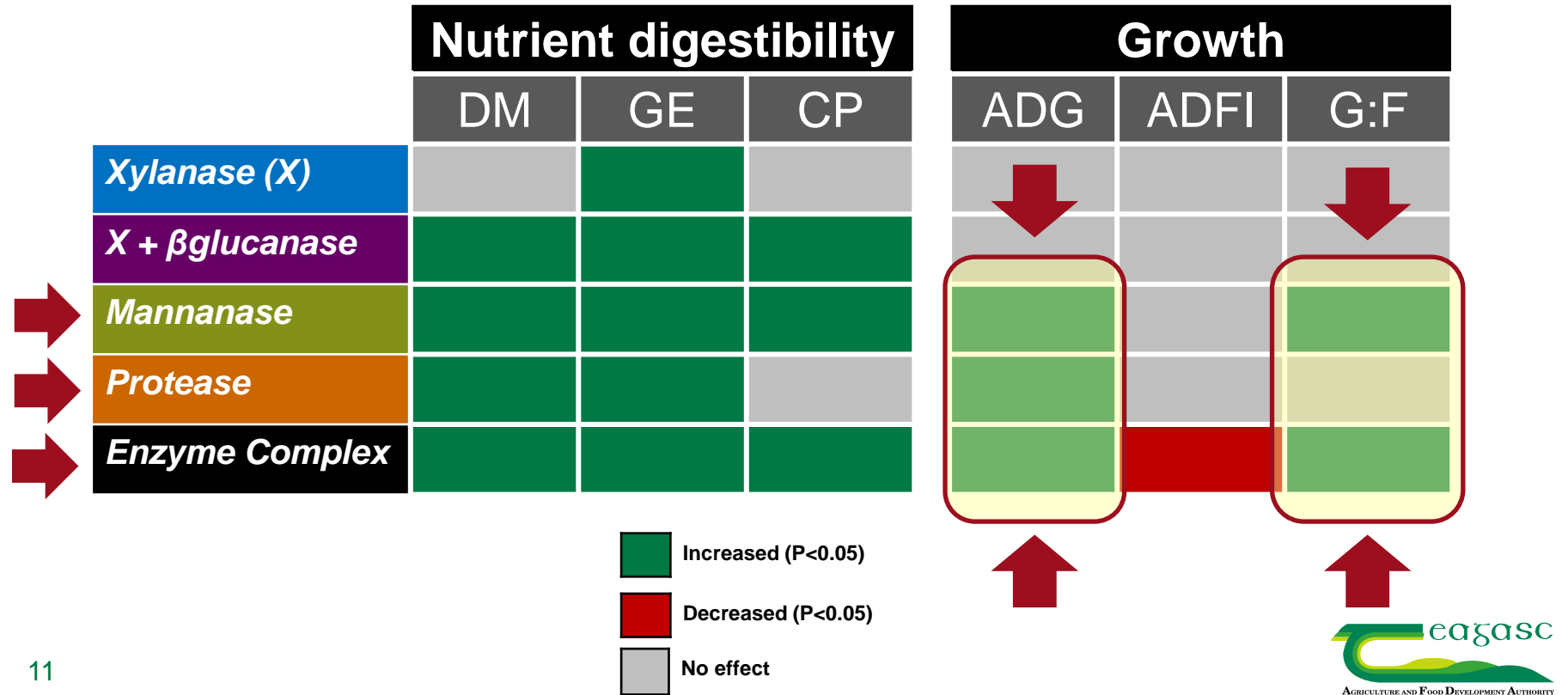
	Nutrient digestibility		
	DM	GE	CP
<i>Xylanase (X)</i>	Light Green	Green	Light Green
<i>X + <math>\beta</math>glucanase</i>	Green	Green	Green
<i>Mannanase</i>	Green	Green	Green
<i>Protease</i>	Green	Green	Light Green
<i>Enzyme Complex</i>	Green	Green	Green

Growth		
ADG	ADFI	G:F
Light Gray	Light Gray	Light Gray
Light Gray	Light Gray	Light Gray
Green	Light Gray	Green
Green	Light Gray	Light Gray
Green	Red	Green



# Results

Summary of 138 studies:



# Conclusions

## Feed efficiency was improved when:

- **Mannanase** was supplemented to **maize** based diets
- **Complex of enzymes** supplemented to **maize, wheat** or **barley** diets
- **Protease** supplemented to **barley** diets
- **Low density diets**



# Gaps of knowledge

- Response to feed enzymes in **soya-free diets**
- Response to feed enzymes in **liquid diets**
- Response to **protease**



## Enzymes supplementation to:

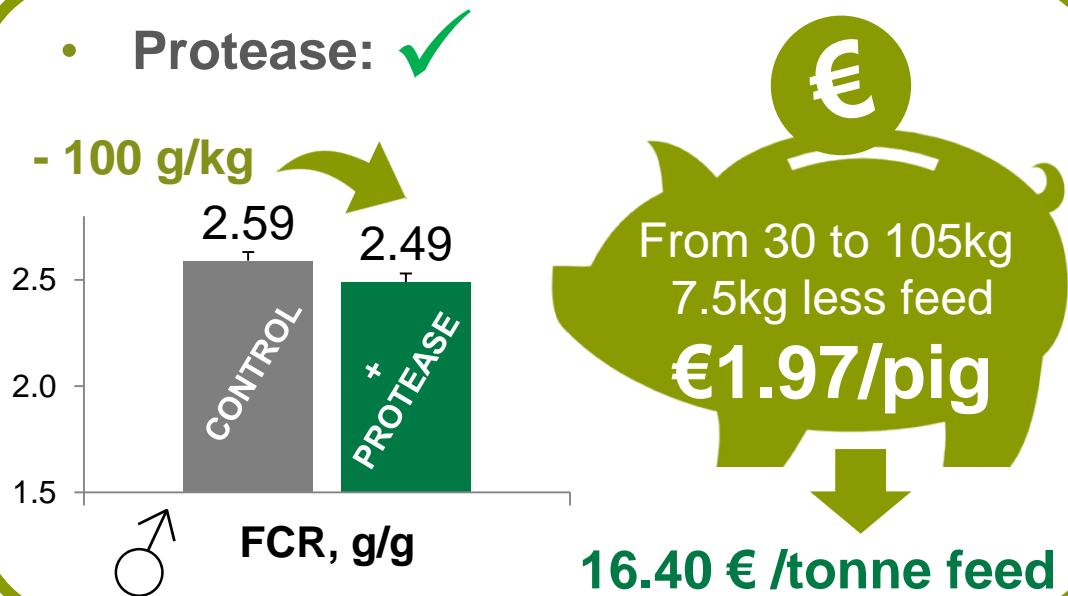
- Rapeseed and wDDGS-based diets (Exp.1)
- Field beans-based diets (Exp.2)

- Liquid and cereal soaked diets (Exp.3)
- Liquid and cereal fermented diets (Exp.4)



## Exp.1: Rapeseed-based diets (dry-pellets)

- Phytase: ✓
- Xylanase +  $\beta$ -glucanase: X
- Protease: ✓

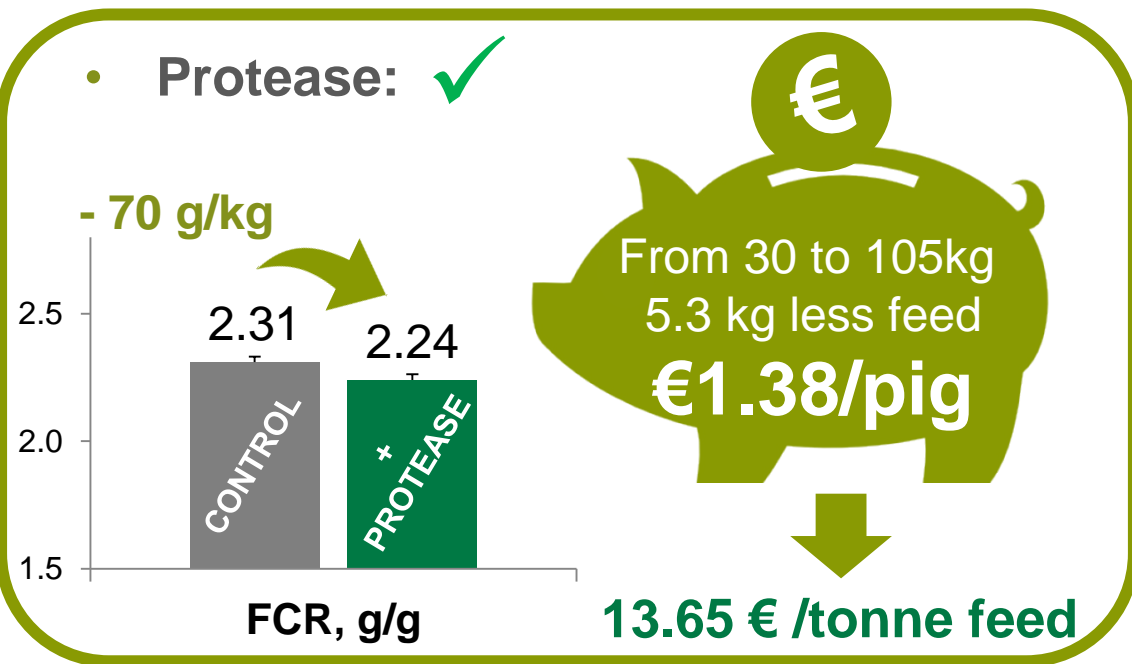




## Exp.2: Field beans-based diets (dry-pellets)

- $\alpha$ -galactosidase: **X**

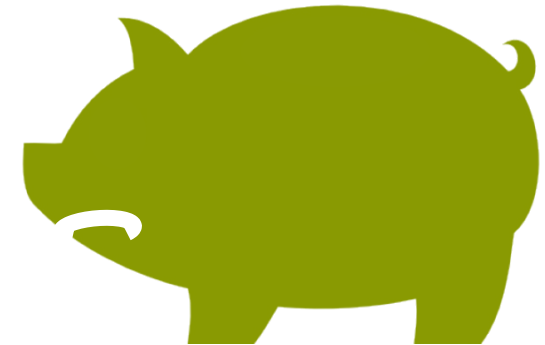
- Protease: **✓**





## Exp. 3: Liquid and cereal soaked diets

- Soaking cereals: ✓ (↑ ADG)
- Xylanase +  $\beta$ -glucanase: X

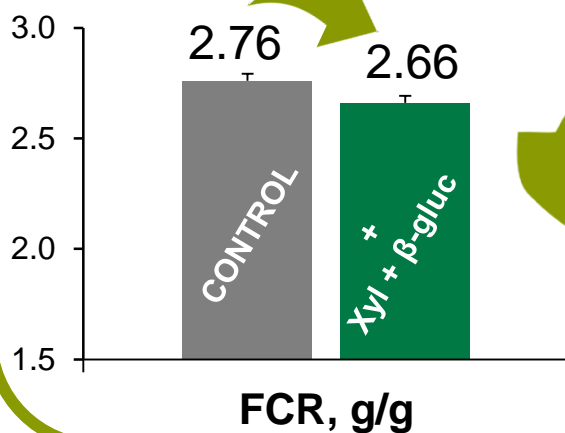




## Exp. 4: Liquid and cereal fermented diets

- Fermenting cereals: ✓ (↑ADG)
- Xylanase +  $\beta$ -glucanase: ✓

- 100 g/kg



14.31 € /tonne feed

# Take home message



- Literature says:

- Phytase: ✓ ✓ ✓
- Xylanase and  $\beta$ -glucanase: ✓ / X ⚠

- Protease: ✓ ⚠
- Mannanase: ✓

- We found:

- Phytase: ✓ ✓ ✓
- Xylanase and  $\beta$ -glucanase: ✓ / X ⚠
- Protease: ✓



# Acknowledgments

- **Teagasc personnel:** Farm staff, research technicians and placement students

- **Project partners:**



- **Funding bodies:**



- **Industry partners:**



**Thanks for your attention!**