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Getting ready for the future:
New developments in exogenous NSP enzyme application

Dr. Ajay Awati

Global Director, Enzymes

EW NUTRITION, Germany

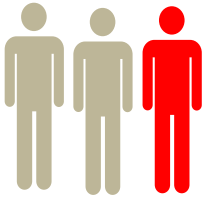
Working toward a higher goal: food security

“The World has achieved
food security
for the first time ever”

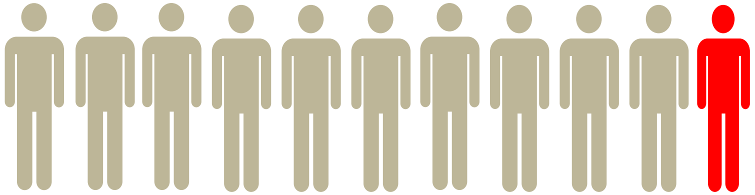
“Mankind has won
over hunger
for the first time in its
existence”

How has animal production contributed to reduce hunger?

1960



2021



73% improvement

72% improvement

FCR 2.5

36% improvement

FCR 1.61

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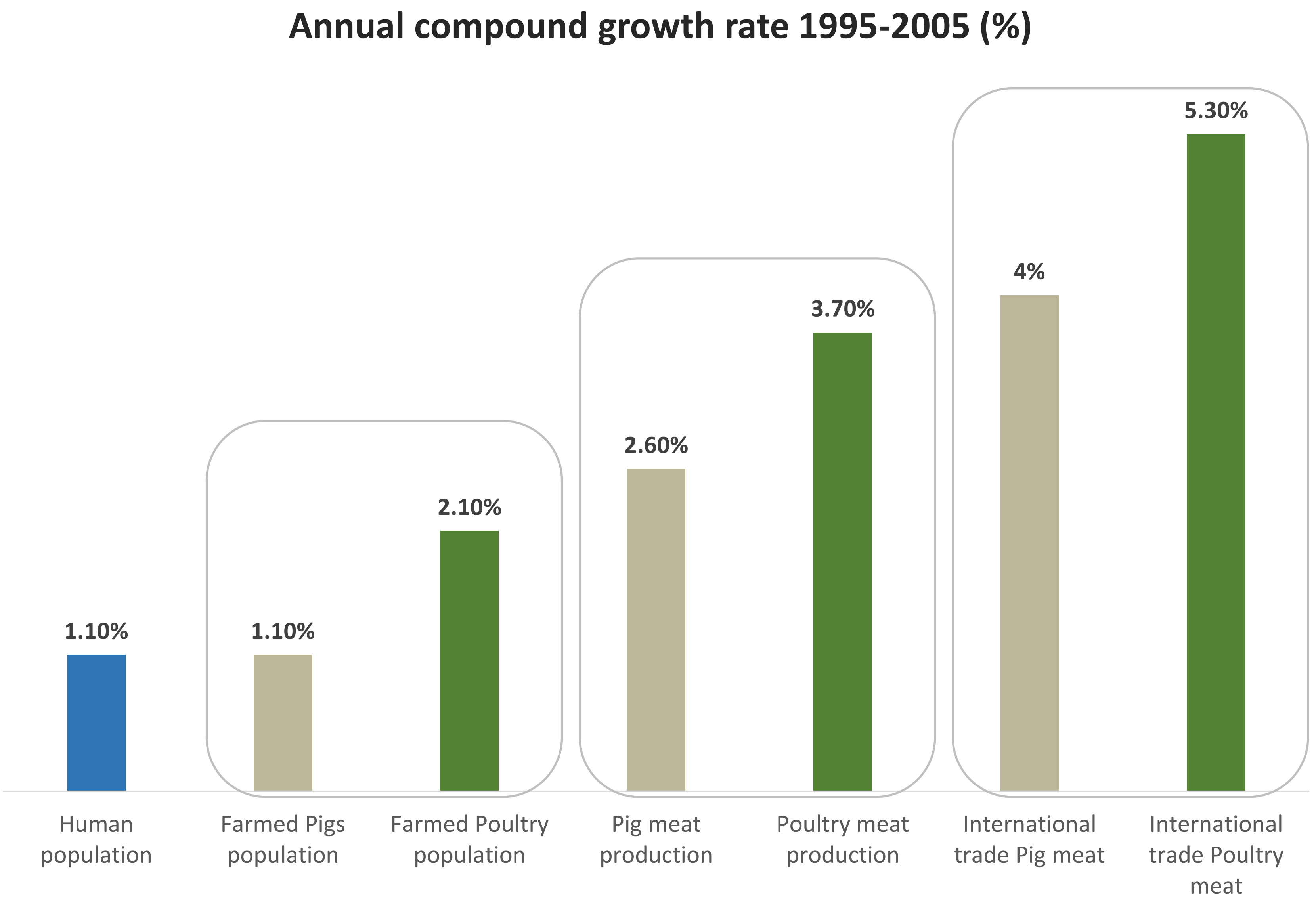
Growth in animal production



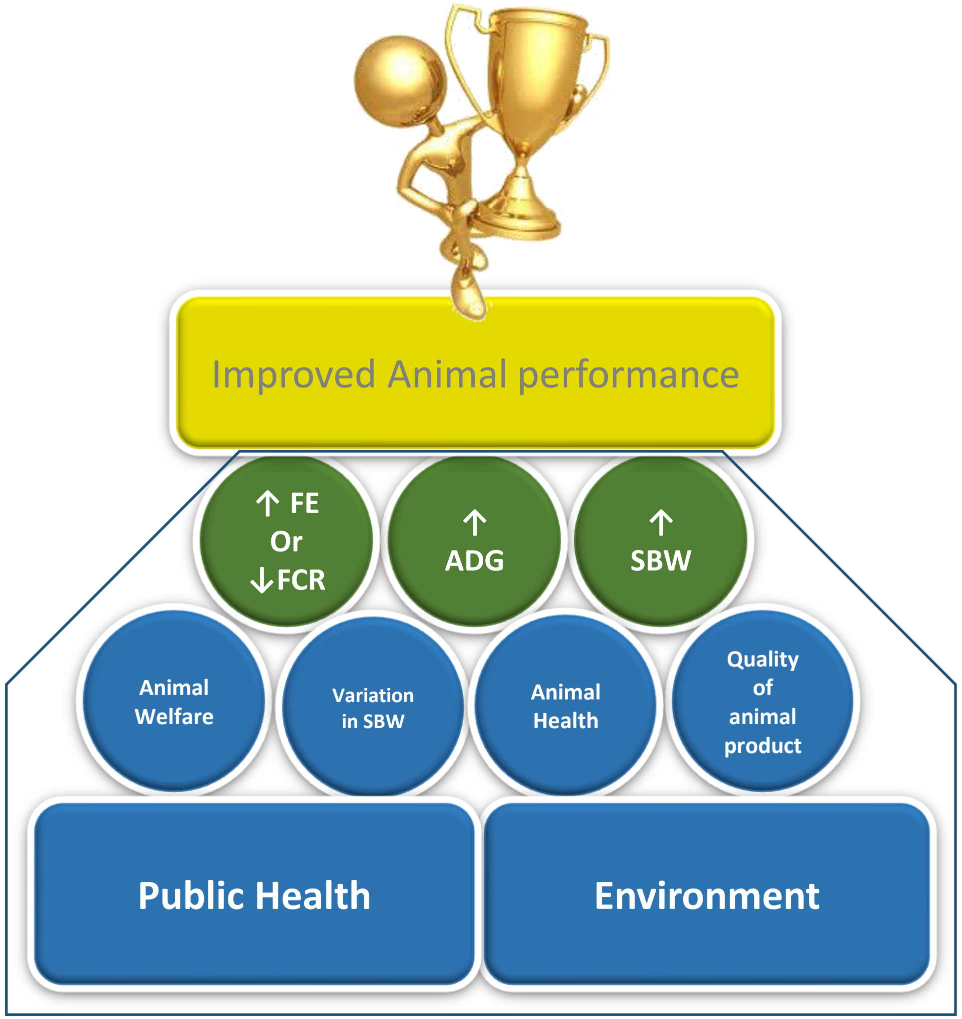
FAOSTAT

Changing scenarios

Last 5-6 decades

Future

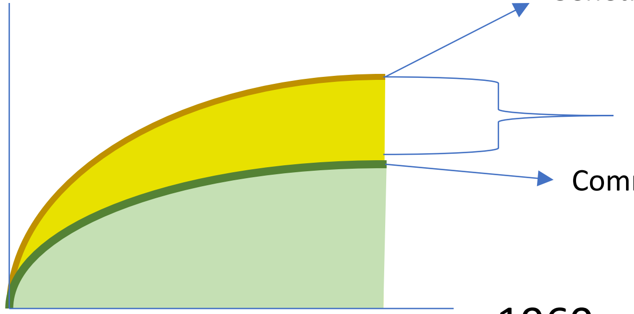
Era of increased production



Era of responsible production

In the era of responsible production, profitability and sustainability are both important

Why Enzymes?- Dealing with cost and quality variations

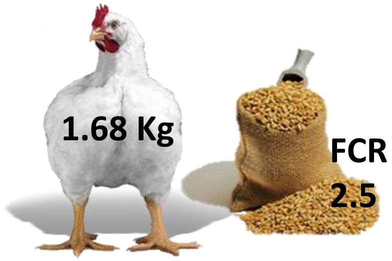


Genetic potential of the bird

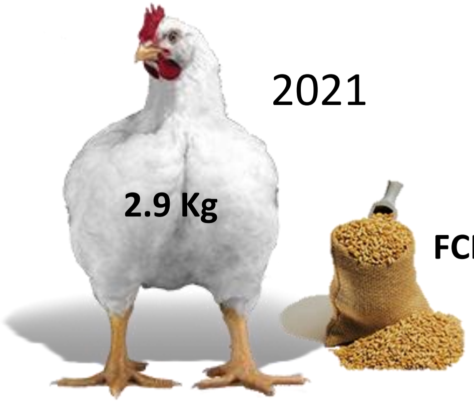
Nutritionists and vets really work hard towards

Commercial reality

1960

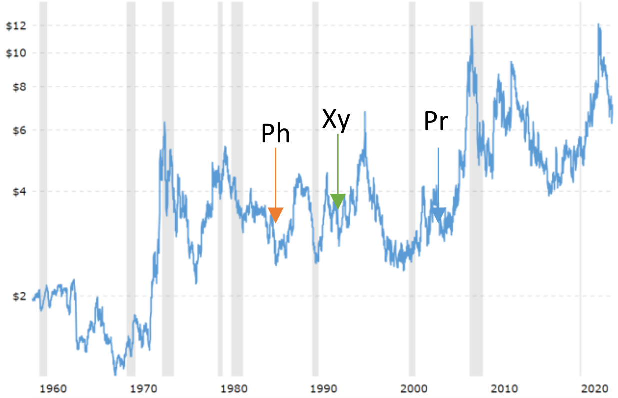


2021



FCR 1.61

$7.0051 per bushel (02/10/24).



Wheat prices

Corn prices

$4.3175 per bushel (02/10/24).

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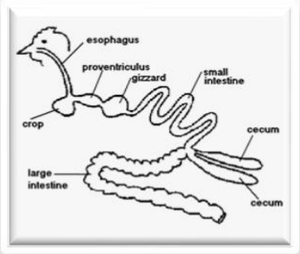
Enzymes bring value through out value chain

-Feed cost saving
-Flexibility in formulation



-Improved digestion
-Removal of anti-nutritional factors
-Better gut health

-Improved performance
-Lower variation

-Leaner meat
-Better meat quality

-Better farm environment
-Better litter
- Lower ammonia
--Lower mortality

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Enzymes application in Animal feeds

Phytase

Phytate

- ✓ Fungal - bacterial
- ✓ n3 phytase to n6 phytase
- ✓ Better pH adapted phytases

\+
Super dosing

NSPase

NSP

Well-established use for 30 years

Some exciting developments are happening pushing boundaries of xylanase usage

Protease

Indigestible protein

Took off about 15-18 years ago

Serious new developments expected

We believe

Animal production industry has grown enough in size, importance and technological knowhow that it deserves to have dedicated enzymes developed and produced to satisfy its unique needs

In the era of responsible production with precision nutrition, nutritionist should be in the driver's seat of enzyme application with full flexibility

New enzyme technologies should shift paradigm from enzyme application as "insurance cost" to enzyme application as active "feed cost saver" even for layers and swine

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David vs Goliath

Why will we (EWN) make a dent in feed enzyme-verse?

Complete dedication:
We want to be primary enzyme producer which develops their own enzymes, produces them with total focus on animal production industry only.

Strategic investments:

Cologne lab

Leuna production site

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New enzymes should be intrinsically thermostable

Feed processing throws 3 challenges at any feed additive

- High temperature
- Conditioning time especially longer conditioning
- Pressure

In nature there is only one place where all three come together:

Hydrothermal vents near volcanic grounds

AXXESS XY originates from *thermotoga maritima* (a bacterium found in hydrothermal vents) and is produced in *bacillus subtilis.*

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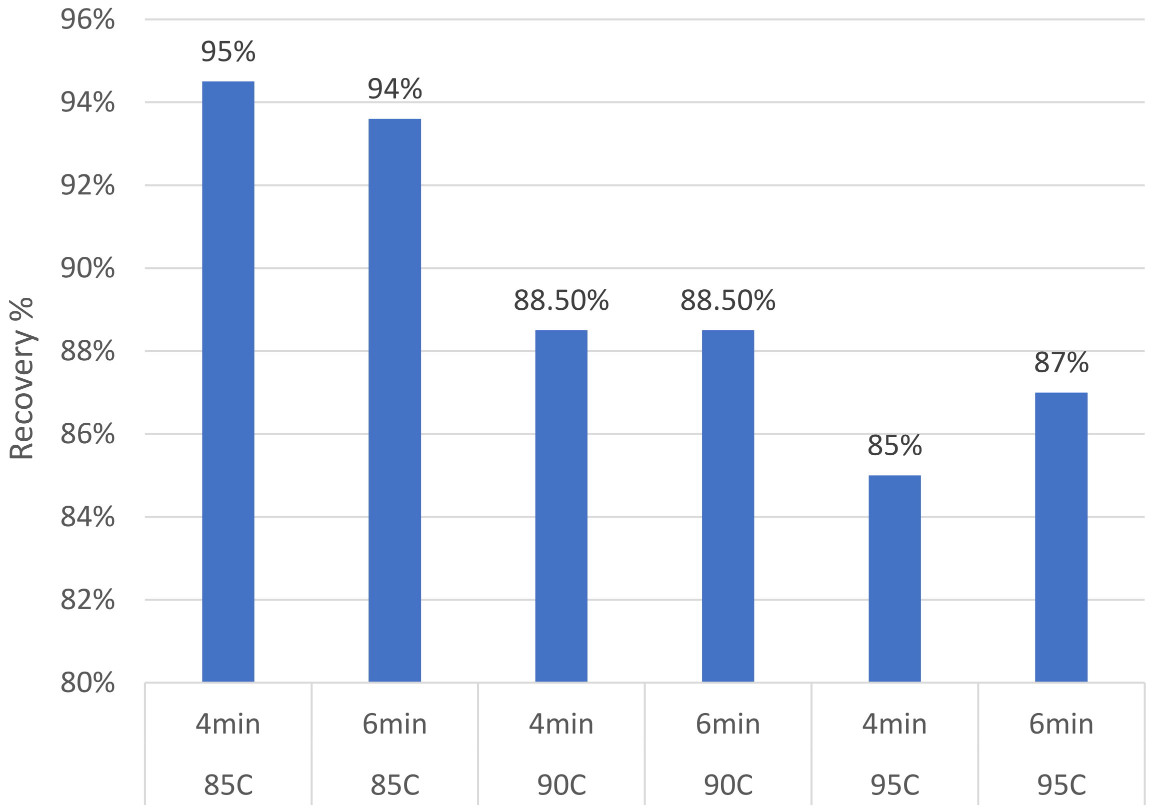
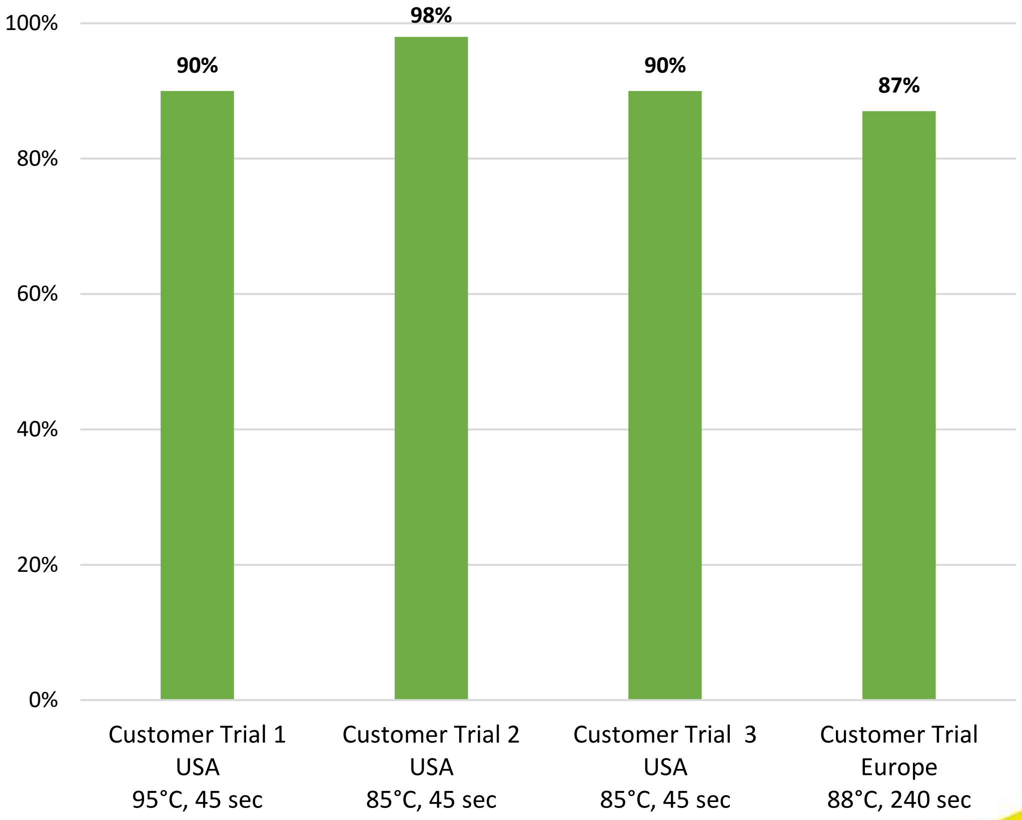
New enzymes should be intrinsically thermostable





University of Novi Sad, Serbia 2019

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NSPases application

Multienzymes cocktails | Single Xylanase

Xylanase is the most important component

	Approximate % of the total NSP content				
	AX	ß-GLUCANS	MANNOSE	GALACTOSE	Approximate NSP as % of dry matter
wheat	73%	7%	ND	3%	11%
rye	68%	15%	2%	2%	13%
corn	65%	ND	2%	7%	8%
wheat bran	62%	1%	1%	2%	35%
sorghum	61%	3%	2%	2%	6%
wheat DDGS	56%	7%	ND	3%	33%
barley	47%	26%	1%	1%	17%
corn DDGS	45%	ND	2%	7%	29%
rice bran	40%	ND	2%	6%	22%
Soy	15%	ND	2%	15%	20%
Corn (55%)-Soy (25%) diet	**39%**	**ND**	**2%**	**11.3%**	**9.4%**
Wheat (55%)-Soy (25%) diet	**47%**	**4%**	**0.9%**	**8.4%**	**11.05%**

Having a very good xylanase is more important than having more activities

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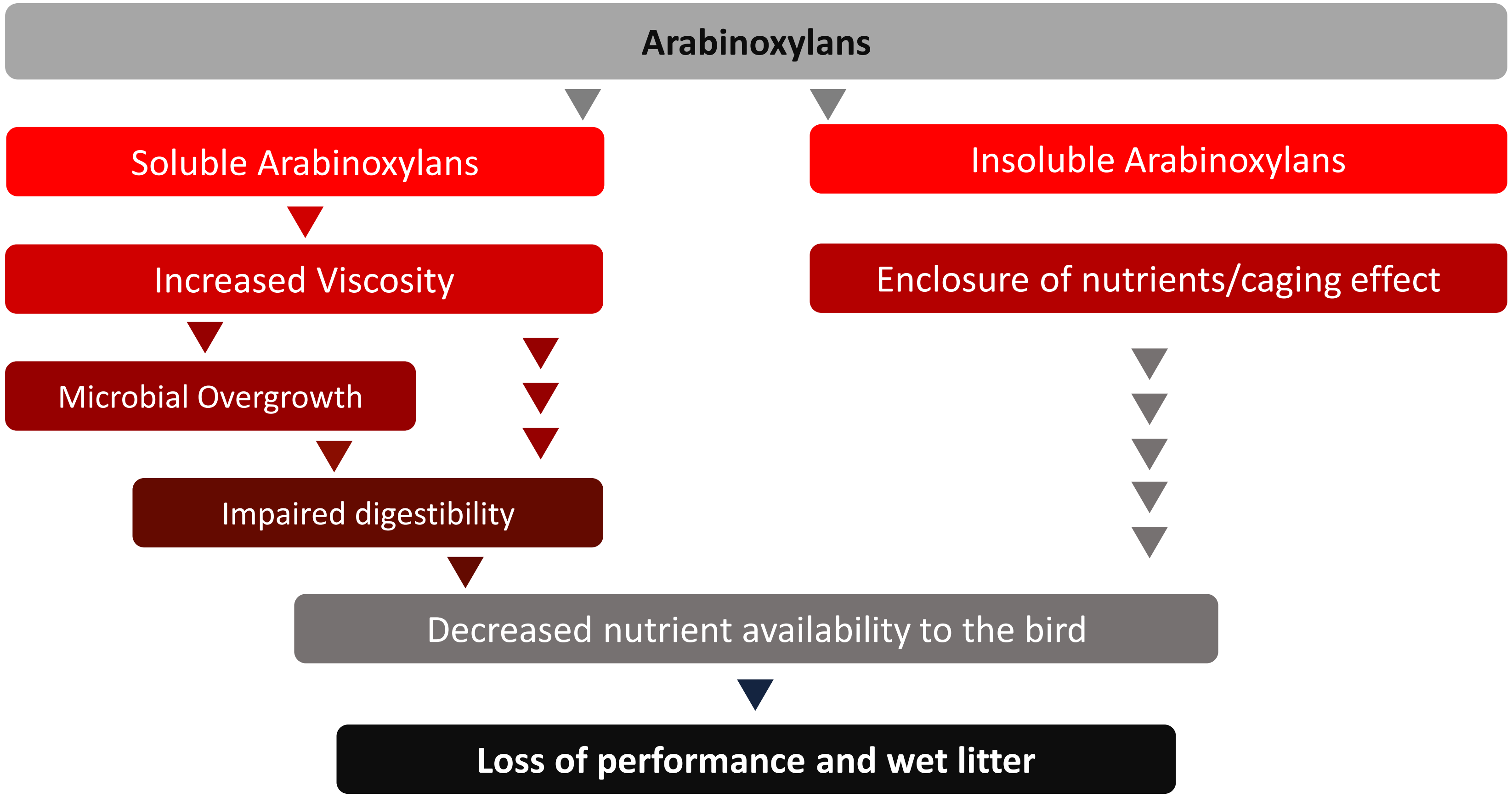
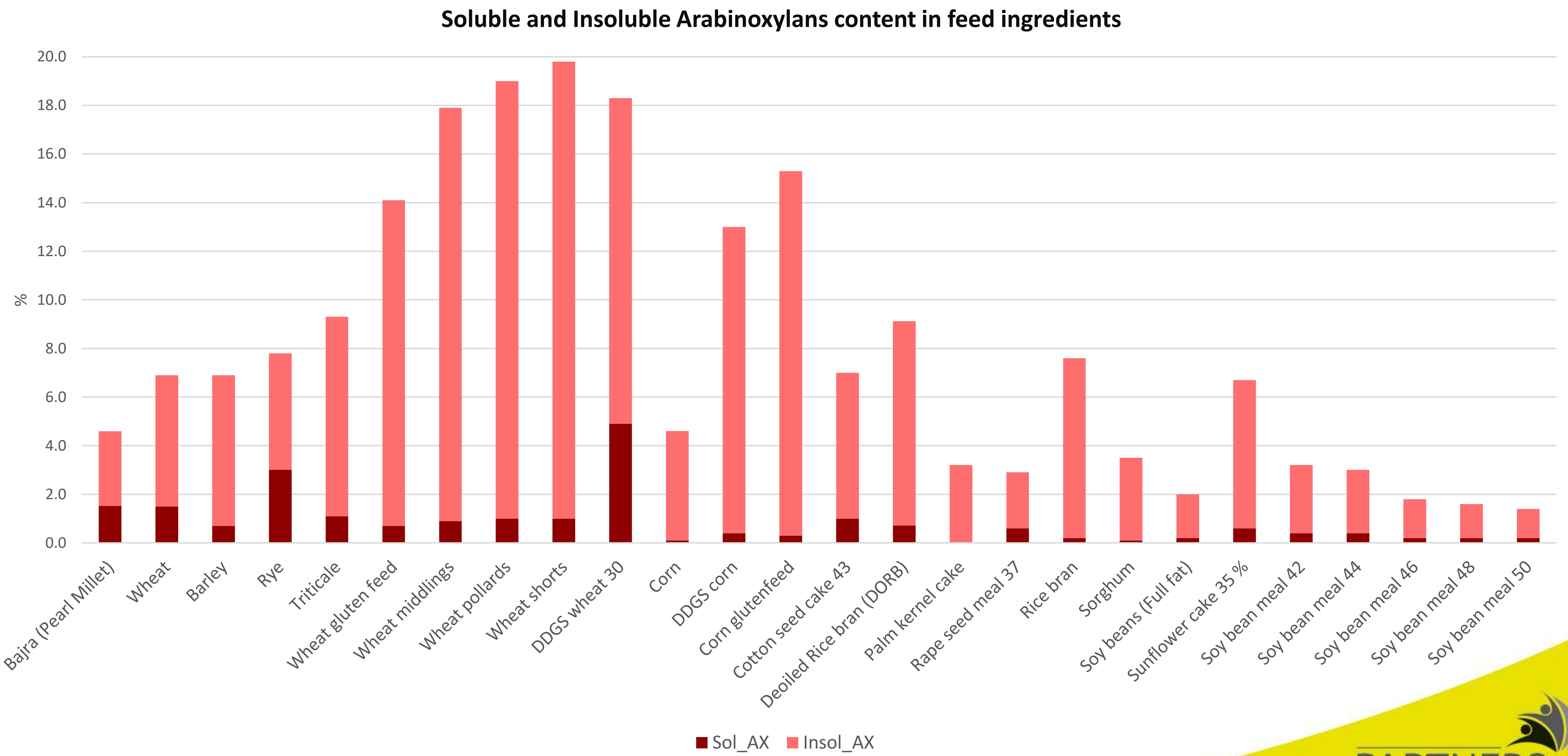
Anti-nutritional effect of Arabinoxylans



Why innovation in xylanase is important for full flexibility?



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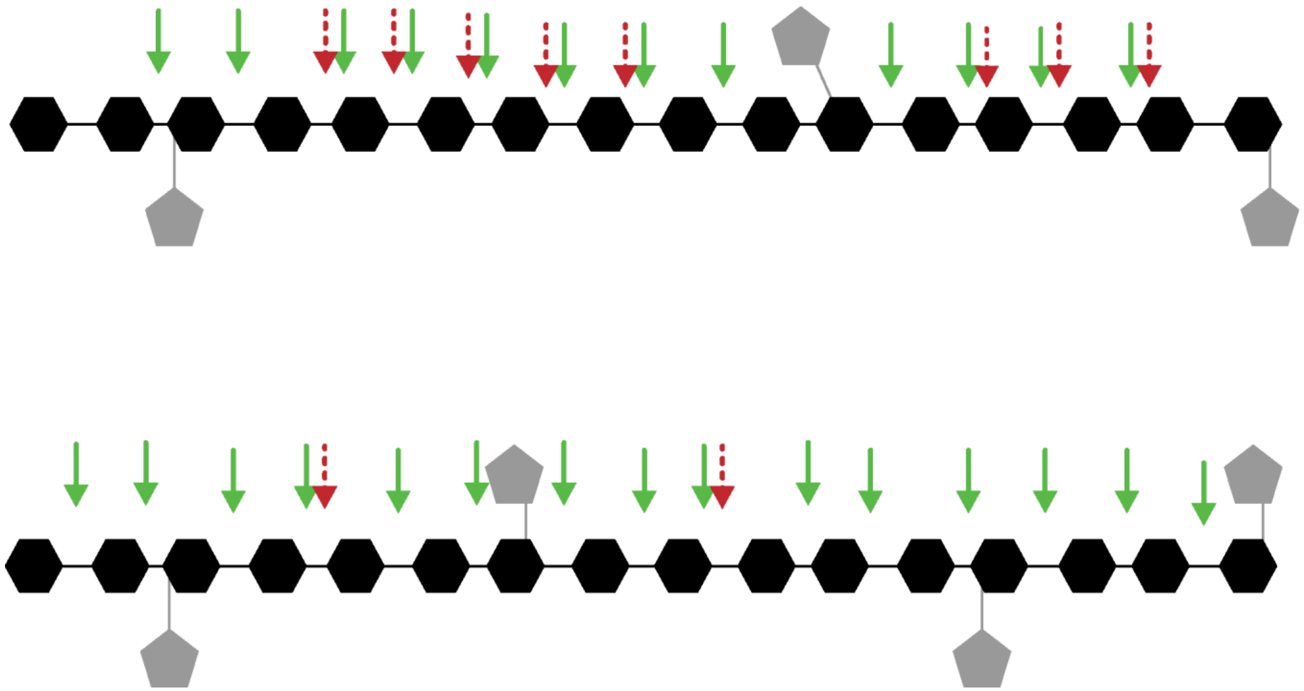

Soluble AX

Less branched molecule

Insoluble AX

Heavily branched molecule

GH11

- Most commercial Xylanases
- Require at least 3-4 unsubstituted Xylans for active site

GH10

- Require only 1 or 2 unsubstituted Xylans for active site.
- Can also cleavage the substituted Xylans

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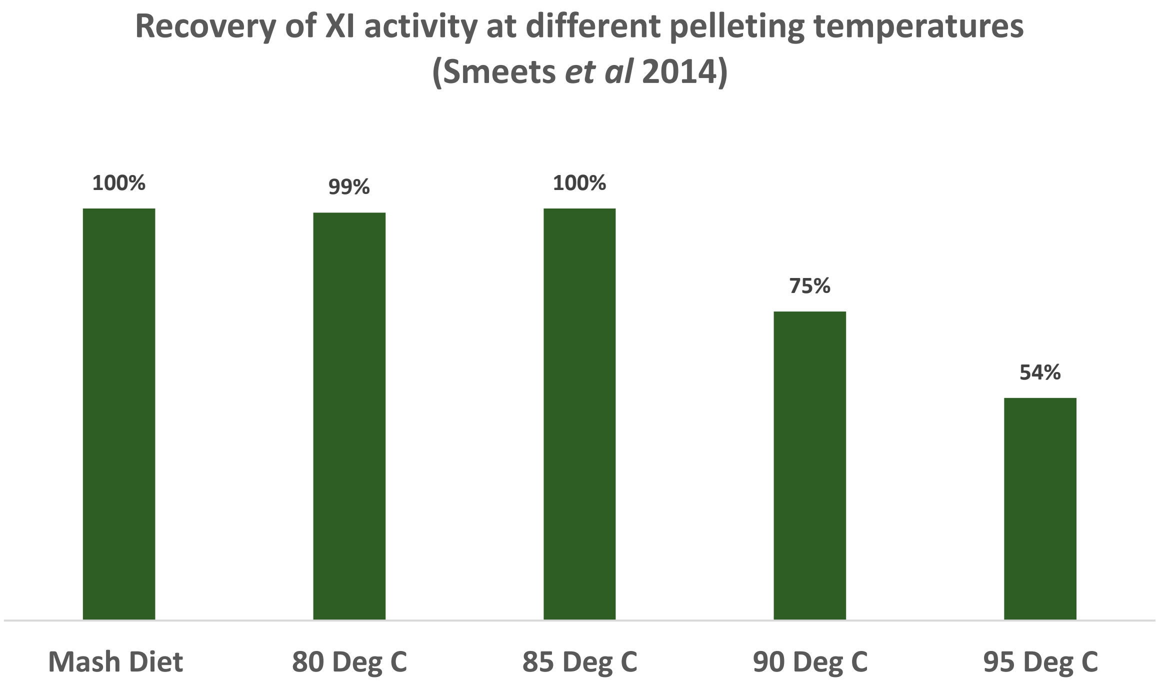
Knowledge about ingredients evolve so should xylanase

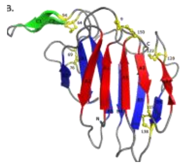
- Xylanase Inhibitors are naturally present & function as plant defense
- XI are present in all different cereal grains
- Three different inhibitors – TAXI, XIP and TLXI
- Affect xylanase activity & efficacy
- XI are relatively resistant to feed processing temperatures



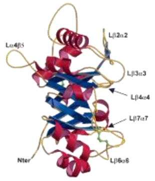
Knowledge about ingredients evolve so should xylanase

TAXi

TLXi



XiP



	TAXi	TLXi	XiP	
Fungal GH - 11	+++	+++	+++	**Most commercial xylanases**
Fungal GH - 10	---	---	+++	
Bacterial GH - 11	++	---	---	
Bacterial GH - 10	---	---	---	**Next Generation Xylanase**

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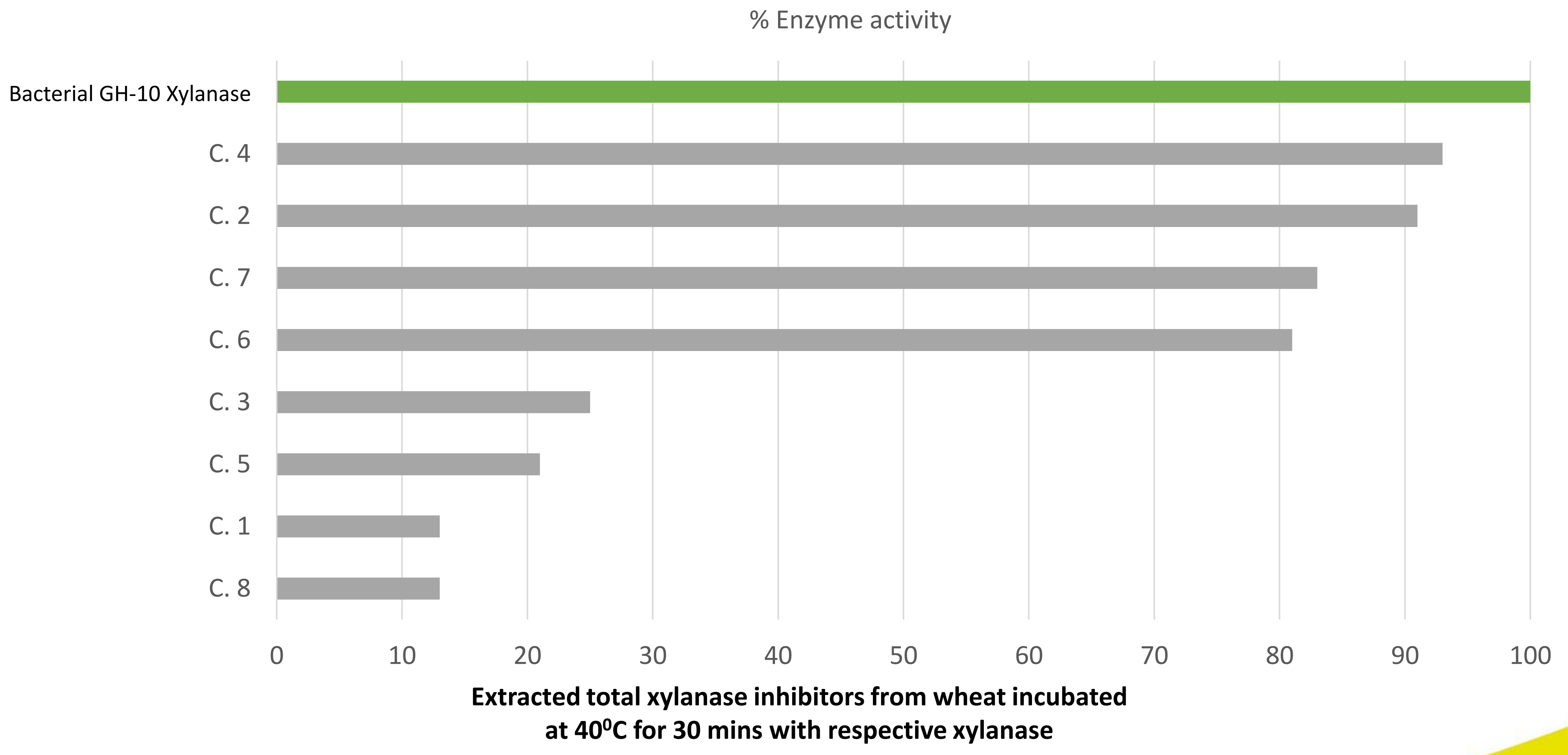
New generation xylanase should not be inhibited by xylanase inhibitor



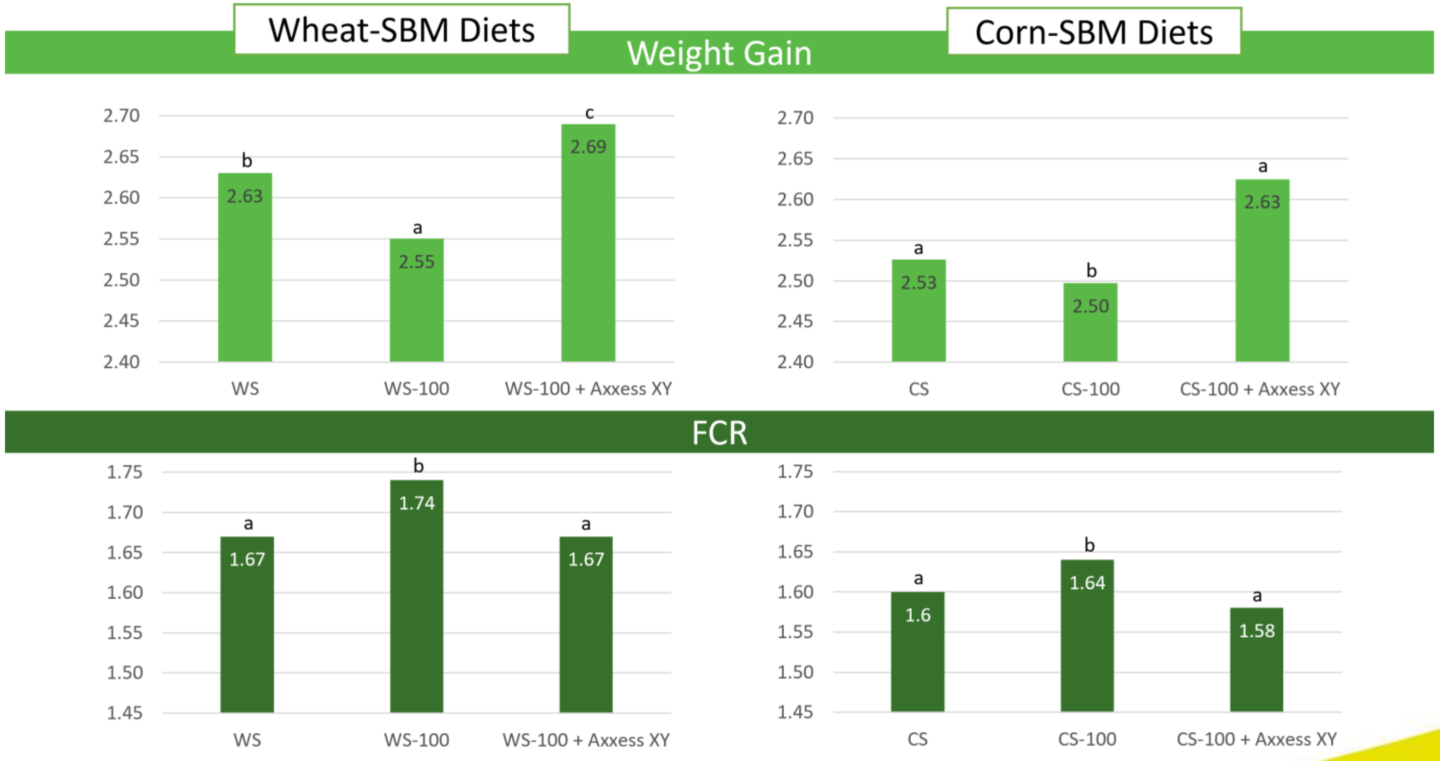
New generation xylanase should give extra savings and freedom to formulate

Location: SPRPF, Hyderabad, India
Animals: 750 male broilers, Cobb **Duration**: 42d
Diets: Corn/soy- and wheat/soy-based pelleted diet (85°C, 30 sec conditioning)
CS - Total AX: 3.34%; Ins-AX: 3.21%; **WS** - Total AX: 4.85%; Ins-AX: 3.85%
CS/WS: nutritionally adequate diet;
CS/WS-100: reduced metabolizable energy by 100 kcal/kg
CS/WS-100 + Axxess XY: CS/WS-100 with Axxess XY 100 g/MT

Axxess XY

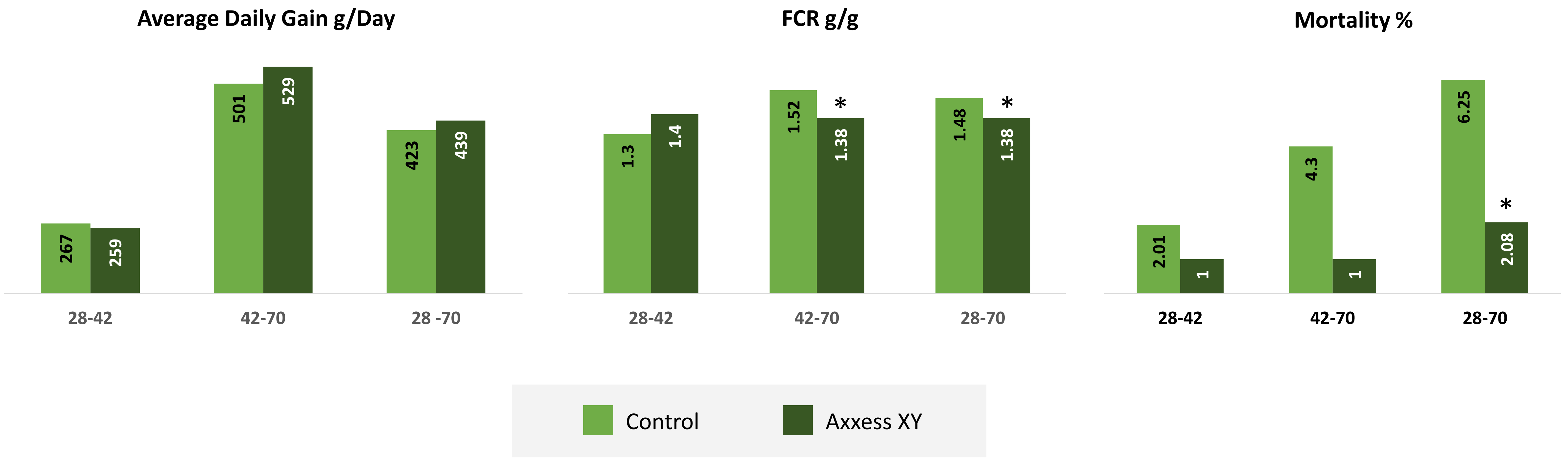
- Significantly higher weight gain with both diets despite ME reduction
- Significantly better FCR as the control with lower ME

TRIAL RESULTS – INDIA



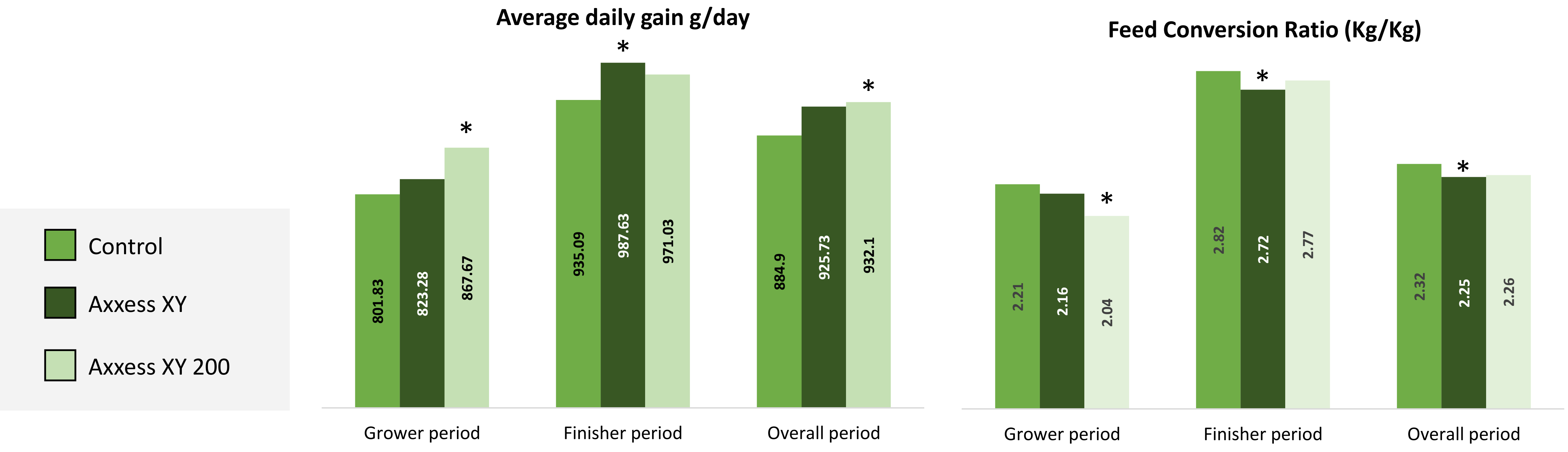
Check TRS137 Check TRS138

New generation xylanase should give extra savings and freedom to formulate



Trial site: IMASDE, Spain
Trial: Nursery pigs/weaning piglets
Phytase: 500 FTU/MT

New generation xylanase should give extra savings and freedom to formulate



	Start Wt (Kg)	End of Grower Wt (Kg)	End of Finisher Wt (Kg)	
Control	37.41	60.67	105.55	
Axxess XY 100	37.36	61.24	108.88*	**+3.33Kg**
Axxess XY 200	37.38	62.54	109.82*	**+4.32Kg**

Trial site: FBF, UK
Trial: Grower finisher pigs
Phytase: 500 FTU/MT

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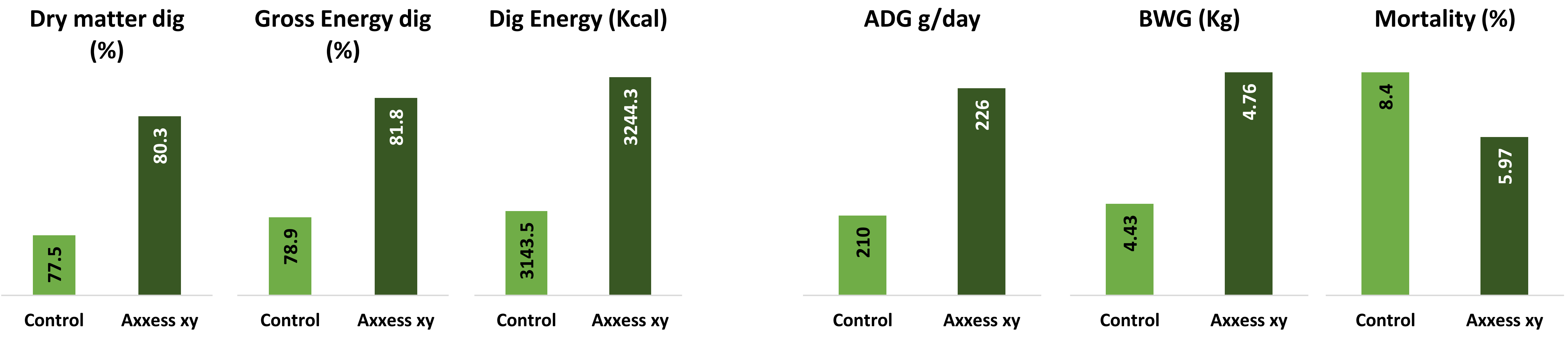
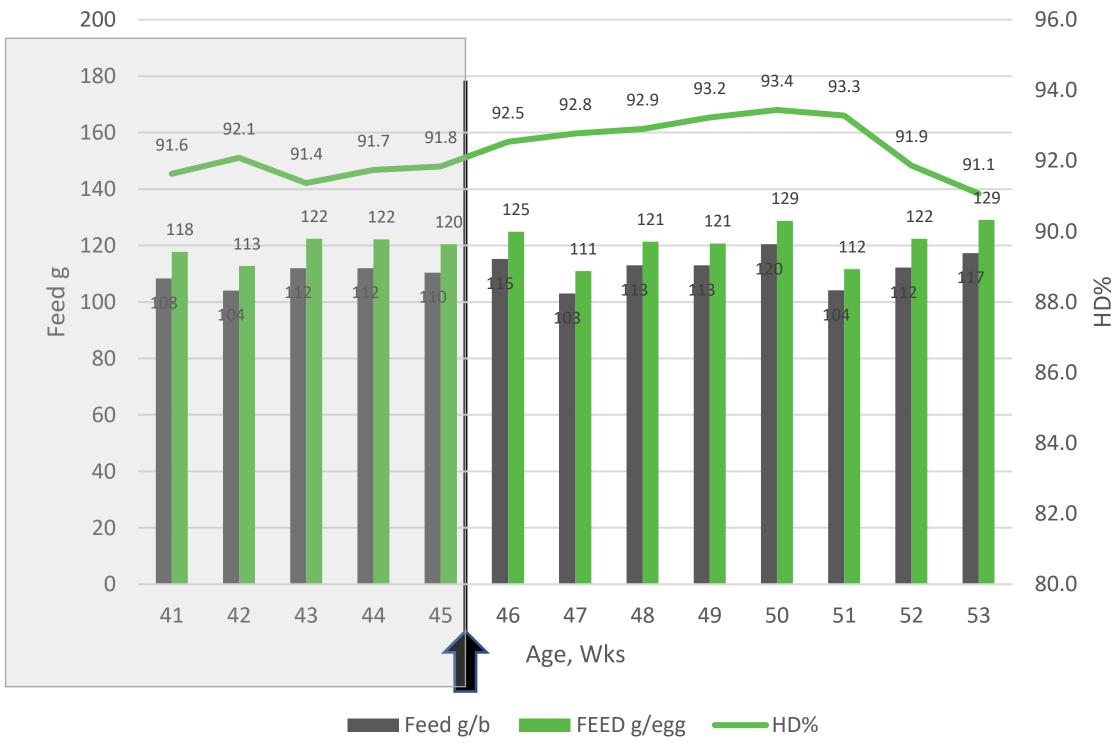


Trial site: IMASDE, Spain
Trial : Sows digestibility and lactating performance
Phytase: 500 FTU/MT

New generation xylanase should give extra savings and freedom to formulate

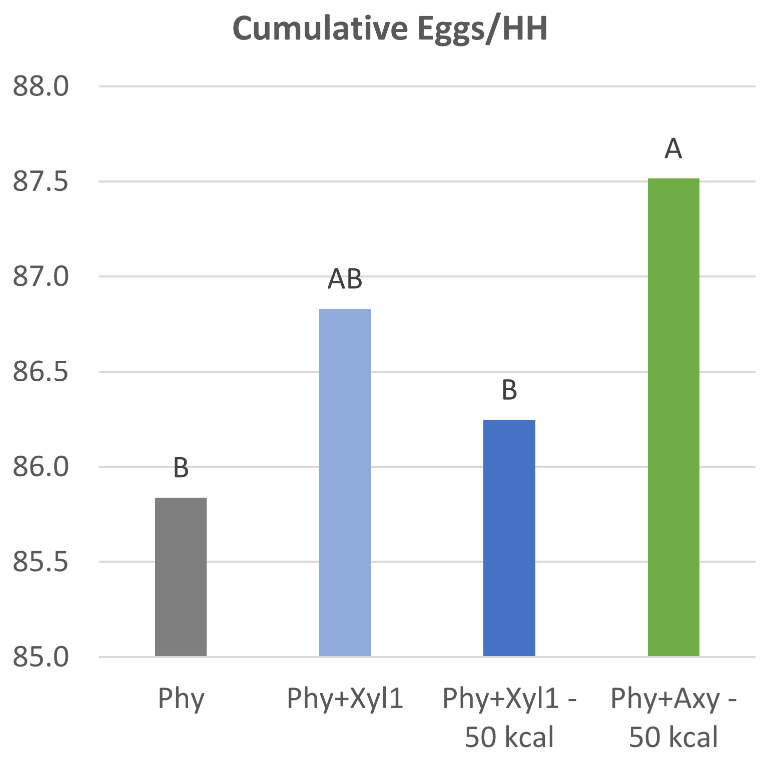
- Commercial layer trial started at Age 45th week
- Novel GH10 Xylanase replaced an enzyme blend
- Enzyme blend was used on top with no energy uplift
- Xylanase was used with 80 kcal/kg ME reduction in feed
- Egg production & feed intake were maintained
- Xylanase Reduced Feed Cost

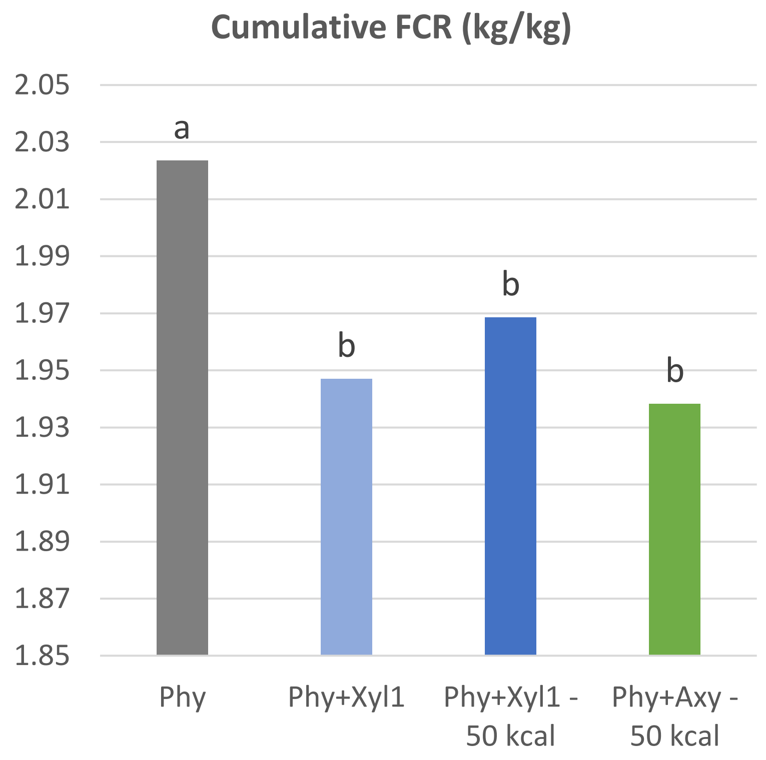


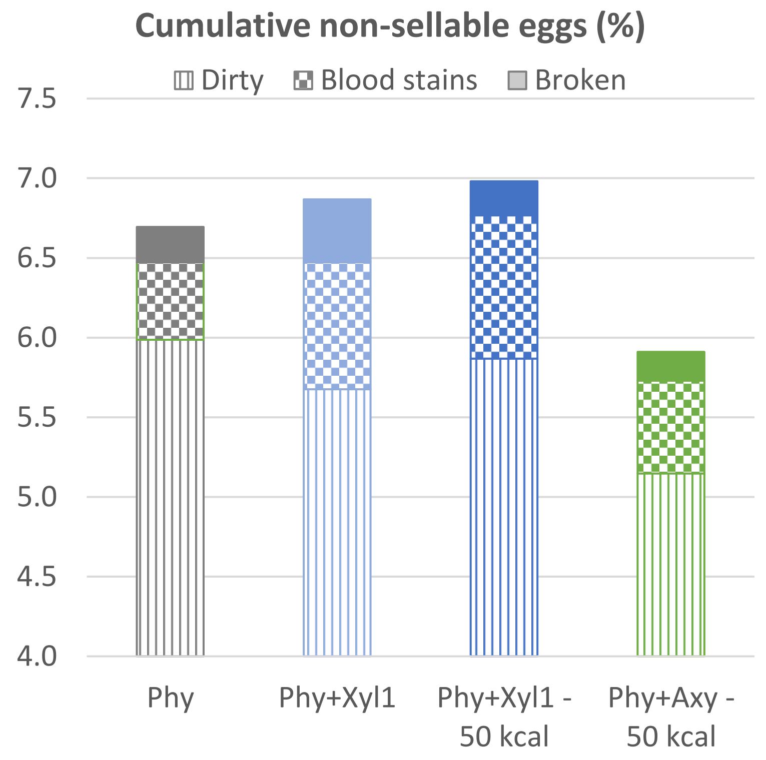
New generation xylanase should give extra savings and freedom to formulate

Location: Customer trial farm - Mexico
Animals: 576 HyLine W-80 laying hens, 12/repetition
Trial period: from 23 to 36 weeks of age
Diets : corn-SBM based diets

Control 1: nutritionally adequate diet, including phytase and xylanase 1
Control 2: nutritionally adequate diet, including phytase
Test group 1: Axxess XY 100g/MT, applying 50 kcal as matrix value
Test group 2: Xylanase 1, commercial dose, applying 50 kcal as matrix value







ab – small letters indicate significant differences ($p<0.05$)
AB – capital letters indicate a statistical tendency ($p<0.10$)

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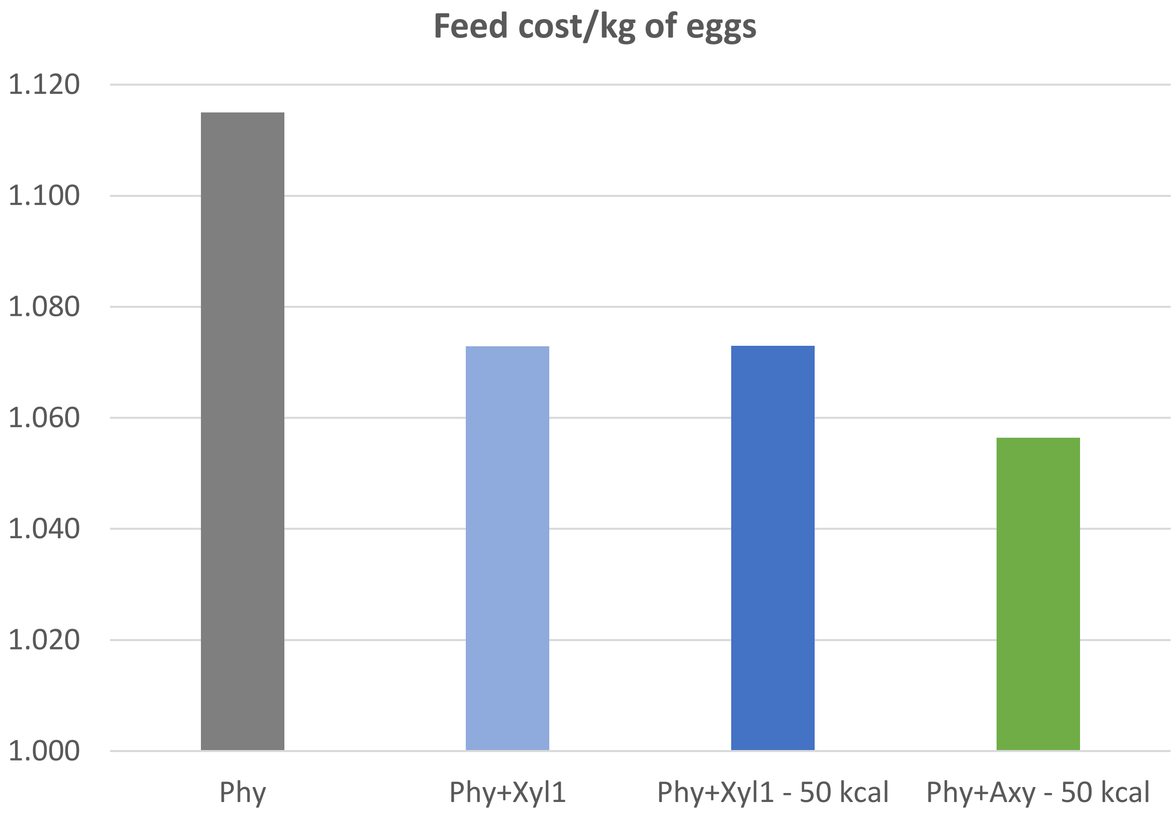


With Axxess XY, using a matrix of 50 kcal/kg:

- 1,68 more eggs/HH than a diet without xylanase
- 0,69 more eggs/HH than Xyl1 used on top
- 1,27 more eggs/HH than Xyl1 applying the matrix

- 2,7% (8pt) improvement in FCR vs a diet without xylanase
- 0,5% (1pt) improvement in FCR vs Xyl1 used on top
- 1,5% (3pt) improvement in FCR vs Xyl1 using the matrix

- Lower dirty and broken eggs

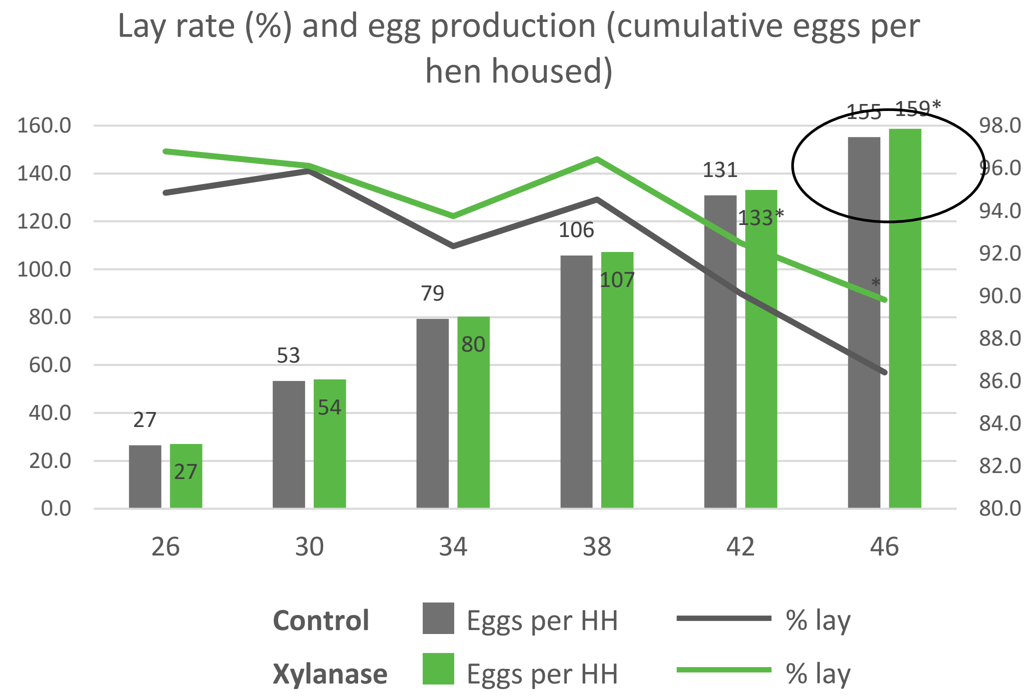
- 5,3% lower cost/kg of eggs vs a diet without xylanase
- 1,6% lower cost/kg of eggs vs Xyl1 with or without applying the matrix

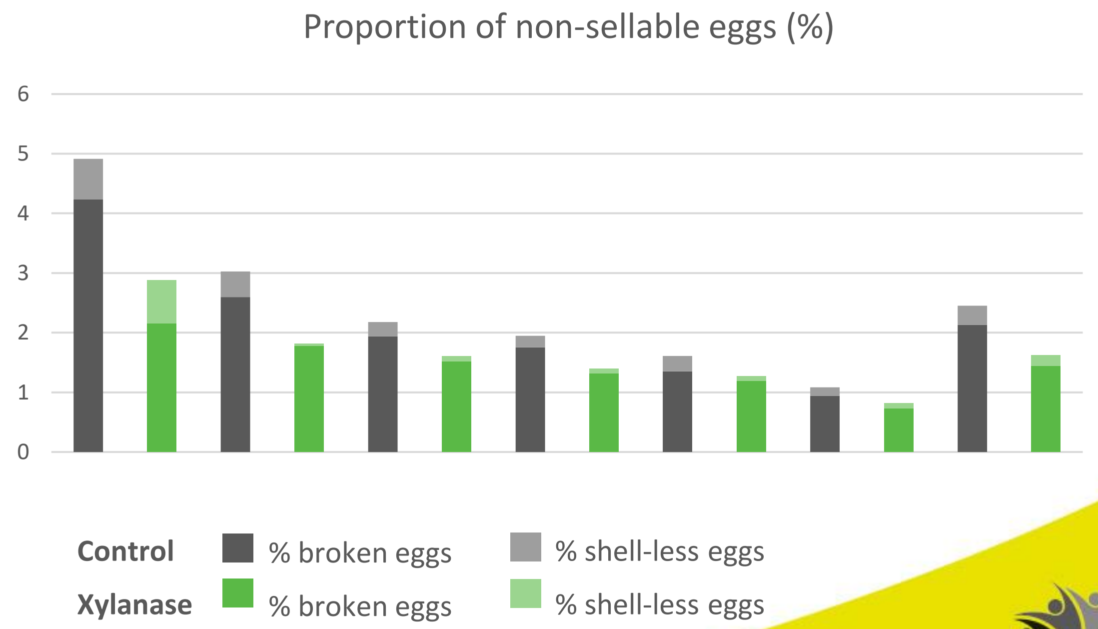
ab – small letters indicate significant differences ($p<0.05$)
AB – capital letters indicate a statistical tendency ($p<0.10$)

New generation xylanase should give extra savings and freedom to formulate

Location: Research and Technology of Food and Agriculture (IRTA) in Spain
Animals: Commercial laying hens **Duration**: 24w
Diet: wheat-based feed including rye, SBM, and animal fat
Total Arabinoxylans: 4.65%; Ins-Arabinoxylans: 3.62%
Groups (12 replicates): Control – no enzyme supplement
Novel GH10 Xylanase – 100 g/MT

Novel GH10 Xylanase
- Higher egg production: 3.4 Eggs/HH
- Higher lay rate, 2 % higher egg production/HH
  Share of dirty eggs reduced by 39 %
- Proportion of broken eggs is 34 % lower





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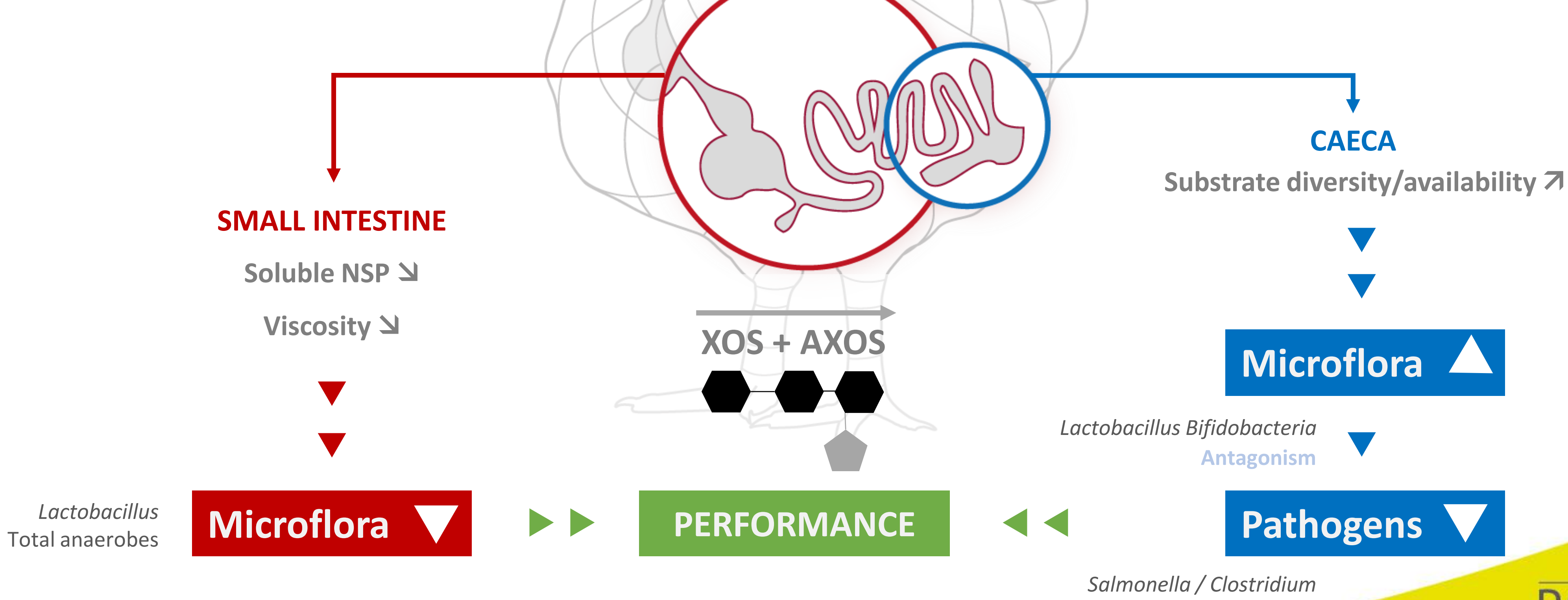
New generation Xylanase should be part of your gut health and antibiotic reduction strategy

Controlling undesired microbial overgrowth in the small intestine is crucial to reduce the use of antibiotics

New generation Xylanase positively affects the gut environment



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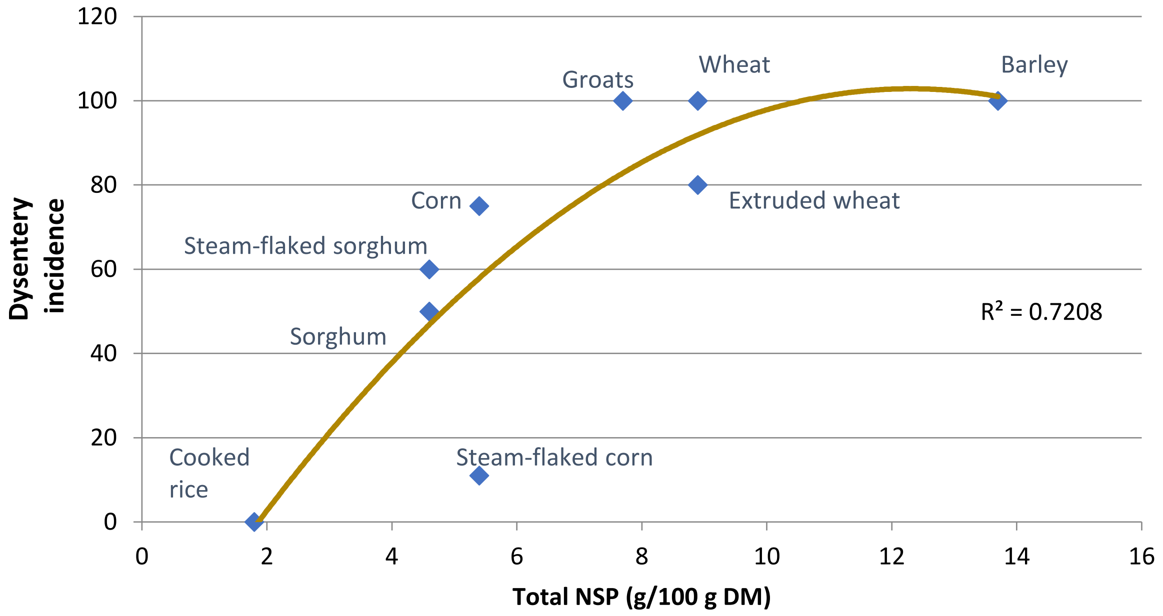


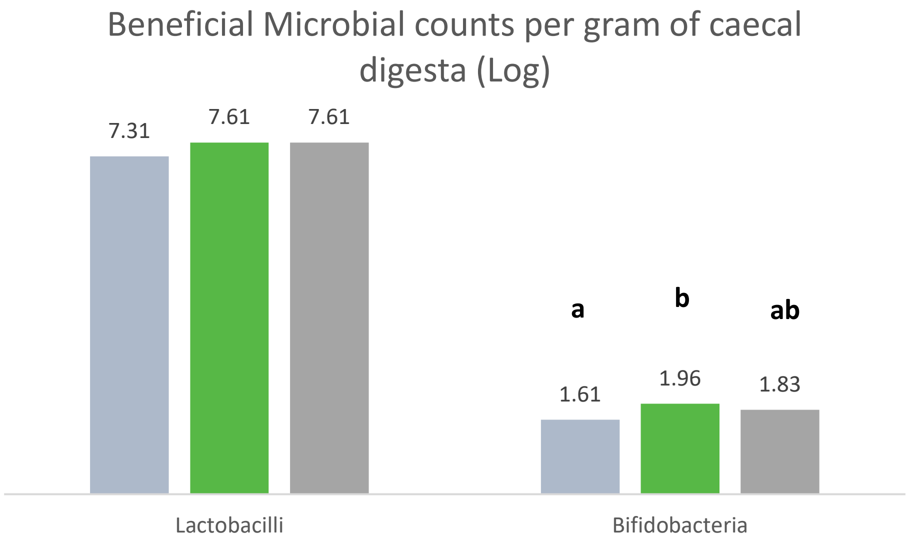
↓ NSP in the small intestine

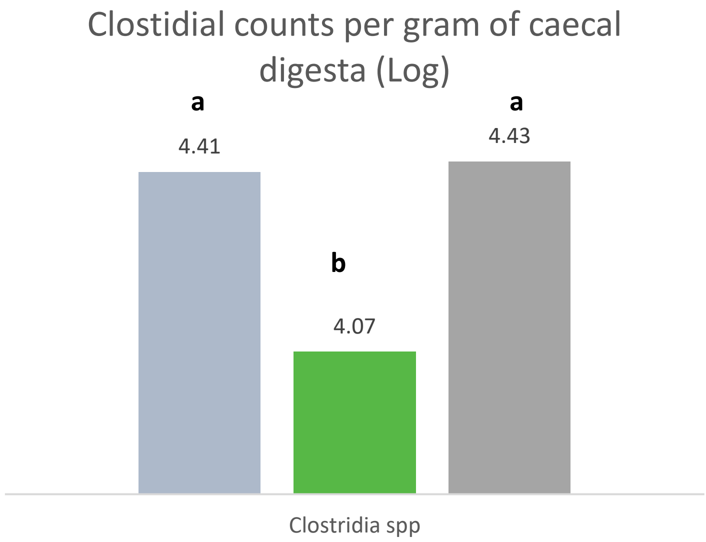
↓ Incidence of swine dysentery

Pluske et al (1996): positive correlation between NSP content of diet and swine dysentery

Diets based on different cereals and pigs (30Kg) challenged with 10^{10} CFU/Animal of *Brachyspira Hyodysenteriae*

New generation Xylanase should be part of your gut health and antibiotic reduction strategy





Broilers
University of Georgia, USA
Diet corn soy based

Control   Bacterial GH-10   Fungal GH-11

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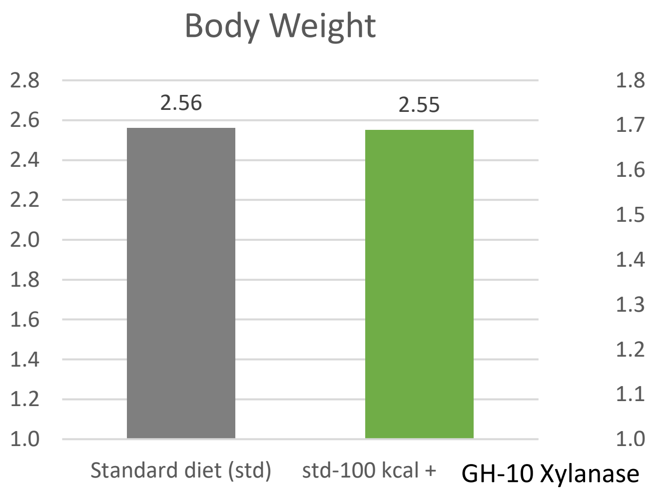
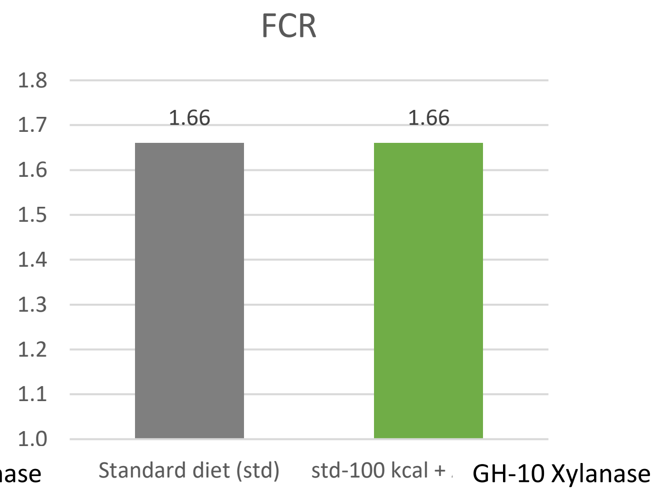
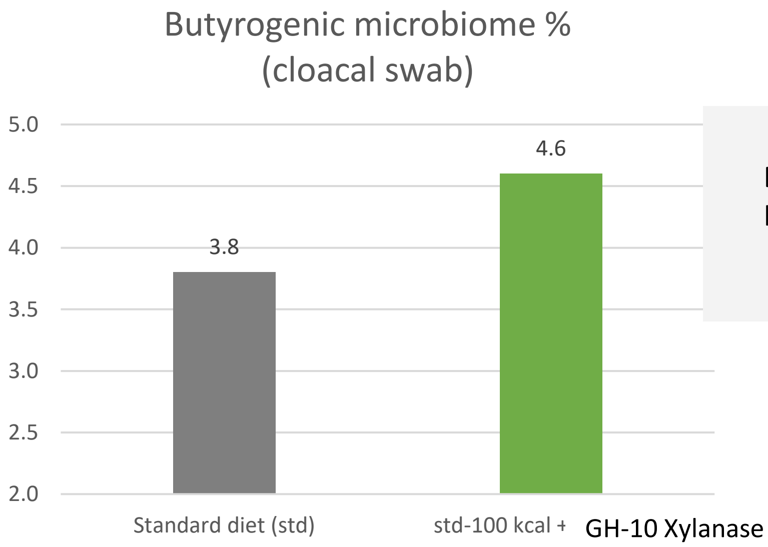
New generation Xylanase should be part of your gut health and antibiotic reduction strategy







Broilers
Hyderabad,India

Conclusion

- Today and in future, strategic use of xylanase to improve performance and gut health is vital for responsible, sustainable but still profitable animal production
- New advanced bacterial GH-10 technologies open up new possibilities for cost savings with special focus on true flexibility to formulate
- New technologies as single enzyme application puts Nutritionist in the driver's seat in leading animal production with more precision nutrition
- New advanced bacterial GH-10 technologies shift paradigm from enzyme application as "insurance cost" to enzyme application as active "feed cost saver" in animal nutrition

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Thank you

…and let's stay in touch!

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