Probiotics and Feed Enzymes: Synergy at Play

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Higher purpose!

1960 2010 2050

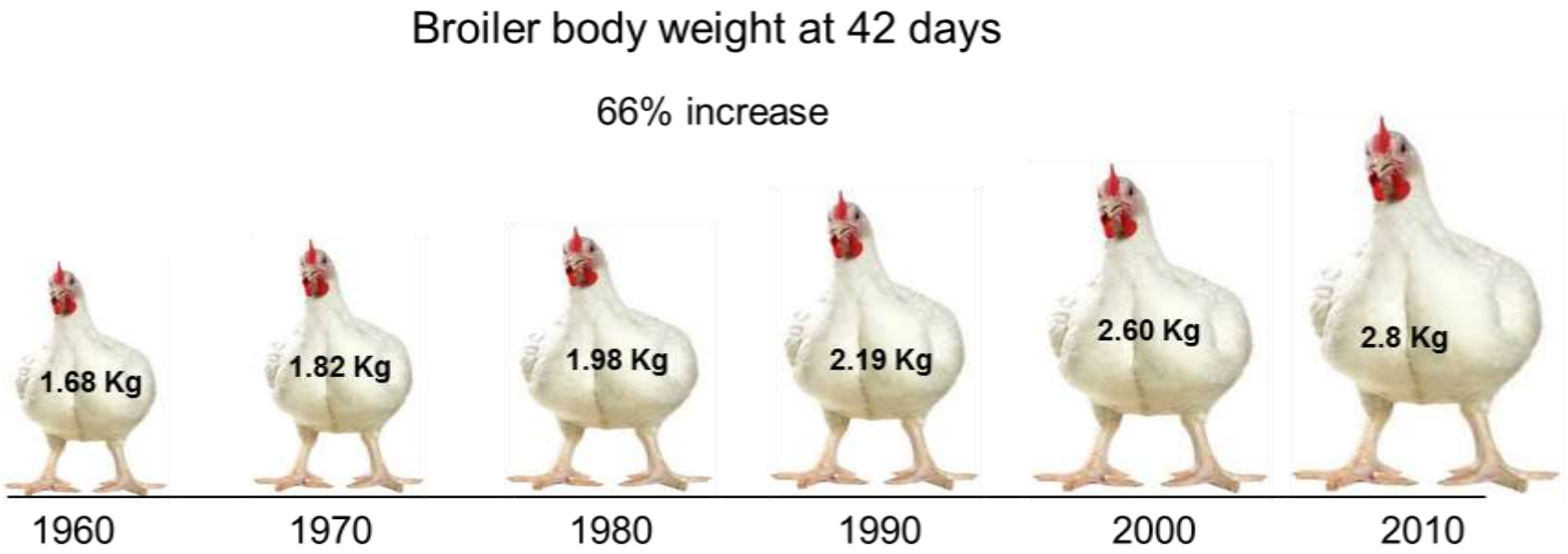
Achieved Dream

Food on plate for extra 4B people

Extra 3B still to feed

Approximates Based on 2011 Hunger report, www.bread.org

How animal production contributed to this achievement?



Based on Rauw 1998 & Ross recommendations

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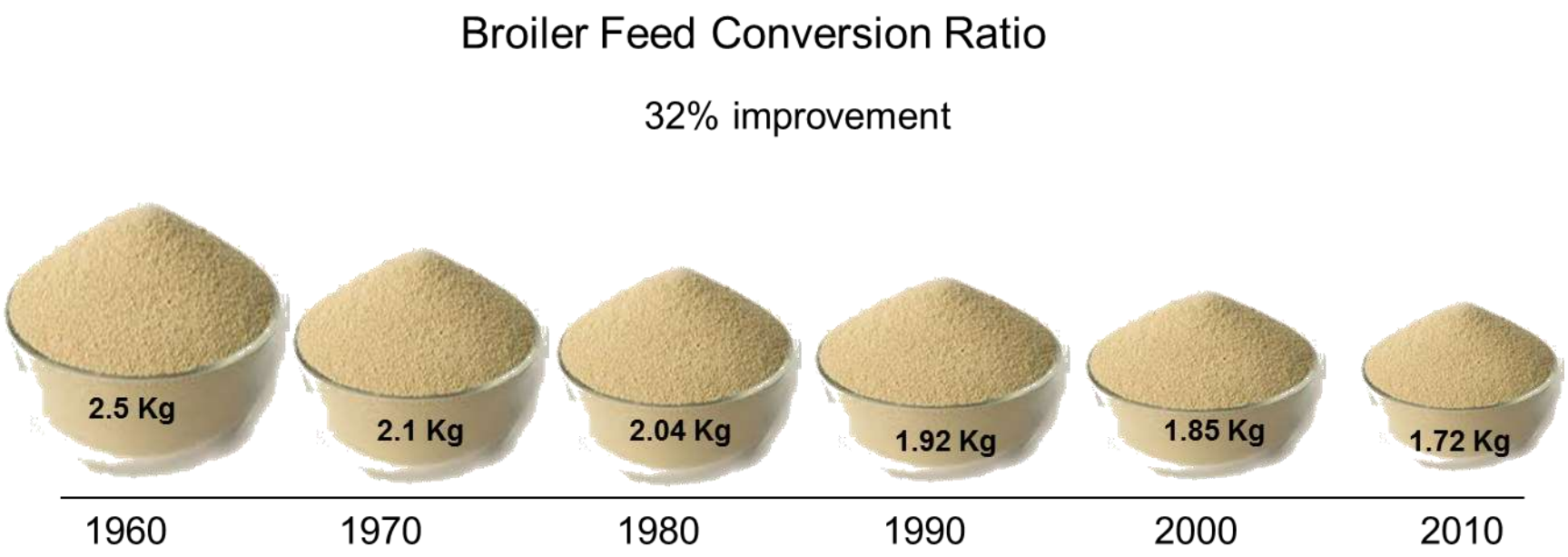


Based on Rauw 1998 & Ross recommendations

How animal production contributed to this achievement?

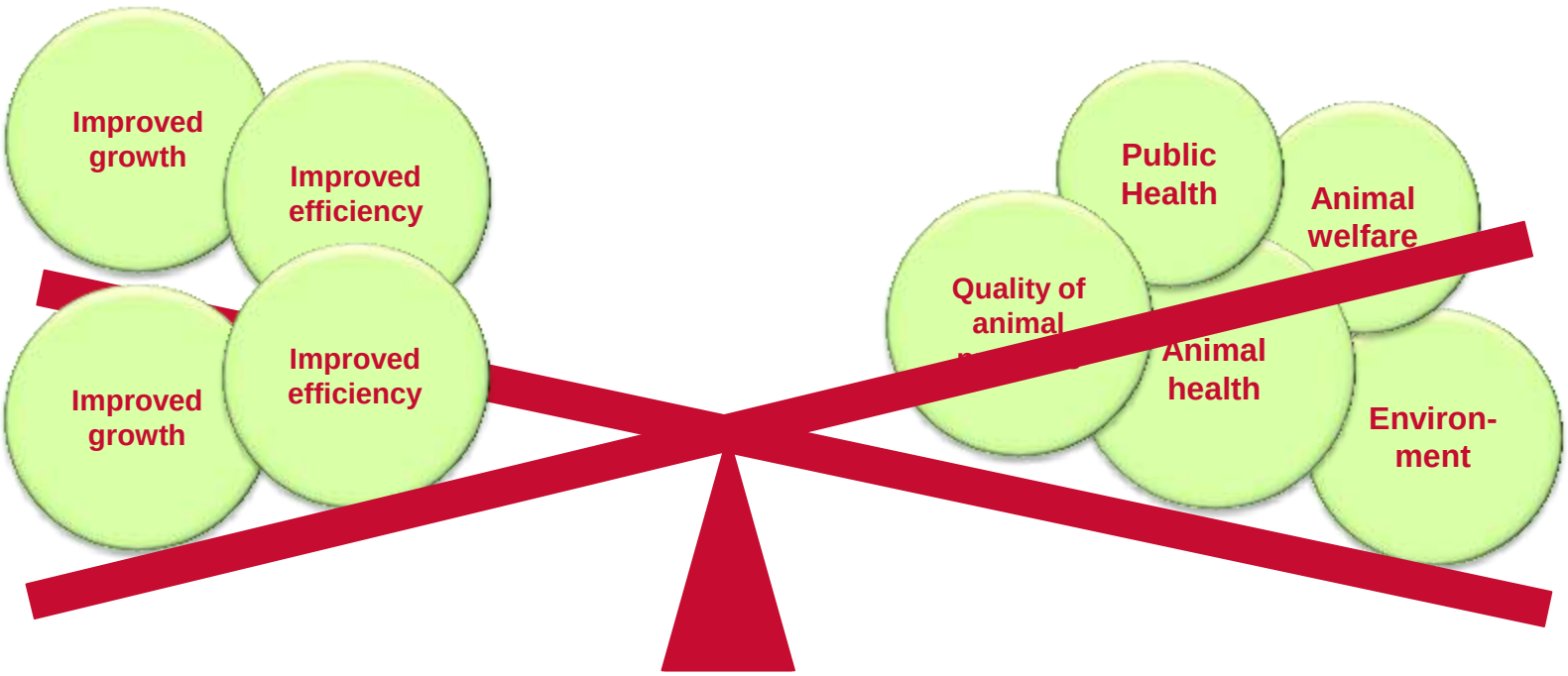
Changes in global human population, pig and poultry inventories, and production and international trade of pig and poultry meat between 1996 and 2005.

	1996	2005	Annual growth (%)
Human population	5,762	6,451	1.1
Inventory			
Pigs (million)	859	963	1.1
Poultry (million)	14,949	18,428	2.1
Production			
Pig meat (thousand tons)	79,375	103,226	2.6
Poultry meat (thousand tons)	56,408	81,856	3.7
International trade			
Pig meat (thousand tons)	6,398	9,557	4.0
Poultry meat (thousand tons)	5,359	9,234	5.3

Source: FAOSTAT

Otte *et al*., 2007

Then why ‘dream’ is still distant?



Most of these issues are gut function and gut health related

One Possible Solution….Combined Enzymes

Substrate (ANF)	Anti-nutritional effect	Enzyme
Soluble viscous NSPs (e.g arabinoxylans)	↑ viscosity and digesta retention time ↓ nutrient digestibility and absorption ↑ activity of small intestinal microflora	Xylanase
Insoluble, non-viscous NSPs	↓ accessibility of nutrients by physical entrapment	Xylanase
Resistant Starch	↓ ME value of ingredients ↑ substrate for gut microflora	Amylase
Indigestible Proteins (Trypsin Inhibitors, antigens)	↓ ME and AA value of ingredients ↑ substrate for pathogens	Protease
Phytate	↓ Dig AA and minerals, ME ↑ P and Ca excretion	Phytase

Each class of enzyme targets specific substrate
Substrates more accessible by other enzymes ….Interactions

Another Possible Solution…Probiotics

Benefits of using probiotics:

- Production of nutrients and vitamins
- Reduction in meat contamination
- Improved animal performance
- Prevention of inflammatory reactions
- Alternative to AGPs

Ref: Ohimain and Ofongo, 2012

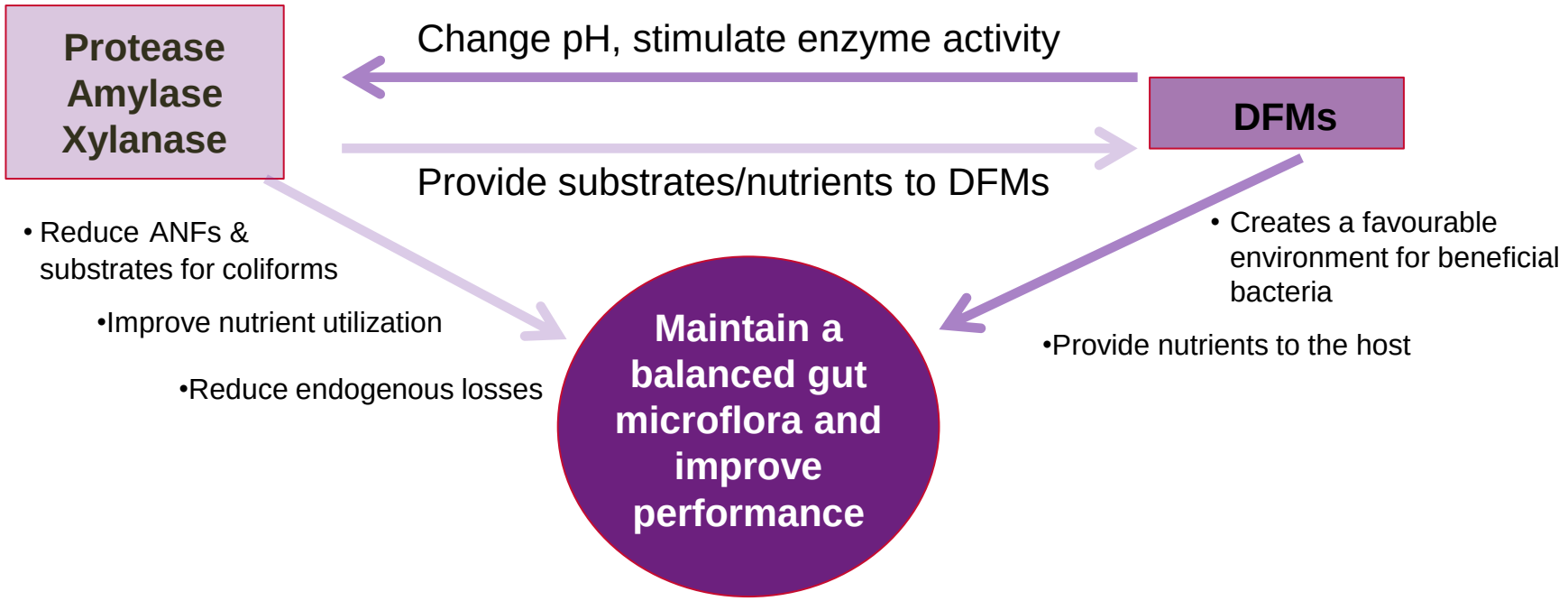
Benefits of using *Bacillus* spores:

- Stable during distribution, feed processing and storage
- Long shelf life
- In the chicken GI tract, germinate rapidly
- Active in the GI tract

Ref: Kiarie *et al*., 2013

There may be a better way…

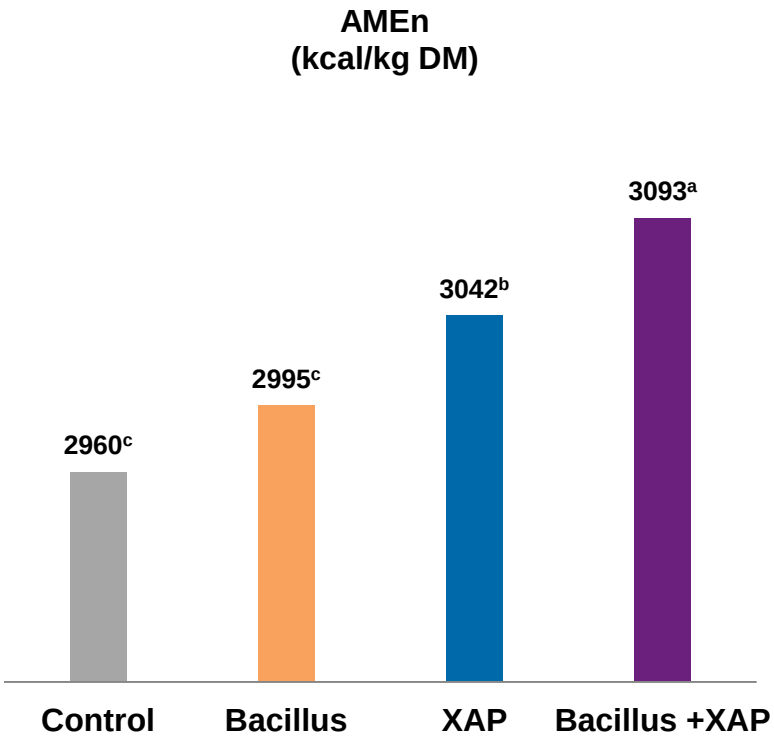
Probiotics + enzymes = better maintained 'gut health'



Combination of 3 strains of *Bacillus* + xylanase, amylase and protease enzymes

Scientific studies showed…(1)

- Corn/SBM/corn DDGs
- Ross 308 male broiler
- 6 replicate pens
- 22 birds/pen
- DFM: 3 *Bacillus* strains
- 21d digestibility study



Unchallenged conditions

Romero *et al*., 2013

Scientific studies showed…(2)

- Corn/SBM/corn DDGs
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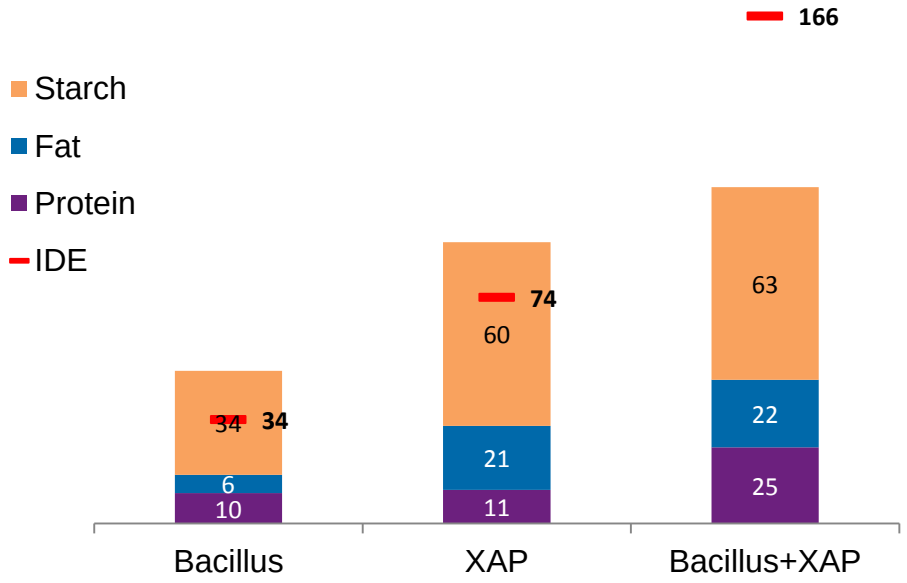
Ileal energy digestibility improvement provided by starch, fat and protein
(kcal/kg dry matter)



Unchallenged conditions

Romero *et al*., 2013

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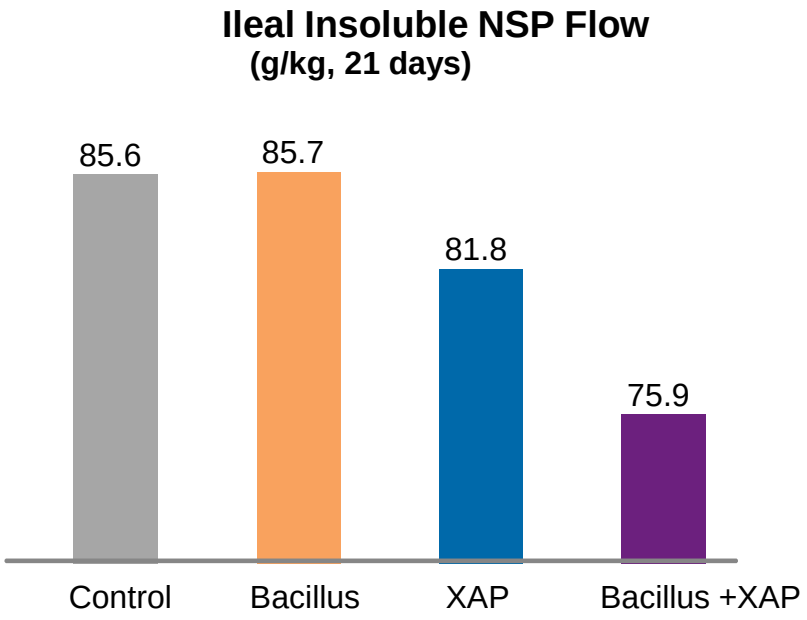


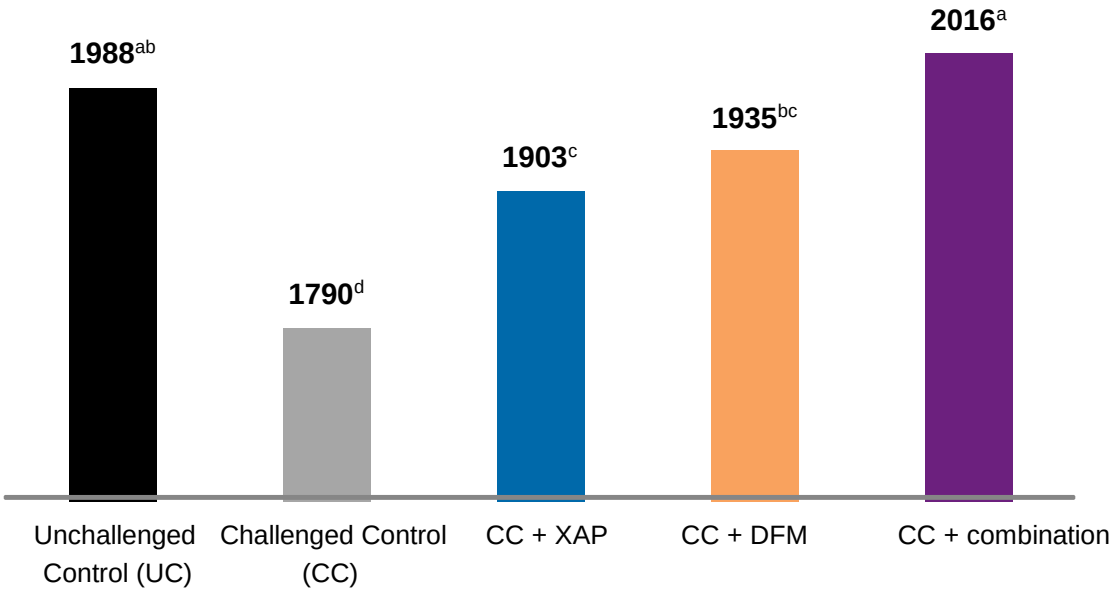
Unchallenged conditions

Romero *et al*., 2013

Scientific studies showed…(4)

- Cobb x Cobb 500 male broilers
- Corn/SBM, 10% corn DDGs
- 8 replicates (pen)/treat
- 50 birds/pen
- NE (necrotic enteritis) induced by a broth culture of *Clostridium perfringens* during day 20-22

Body weight gain (g, 0-42 days)



NE-Challenged conditions

abc Values without a common superscript are significantly different (P<0.05)
XAP= xylanase, amylase and protease
DFM = A mixture of 3 *Bacillus* strains

Mathis et al., 2013

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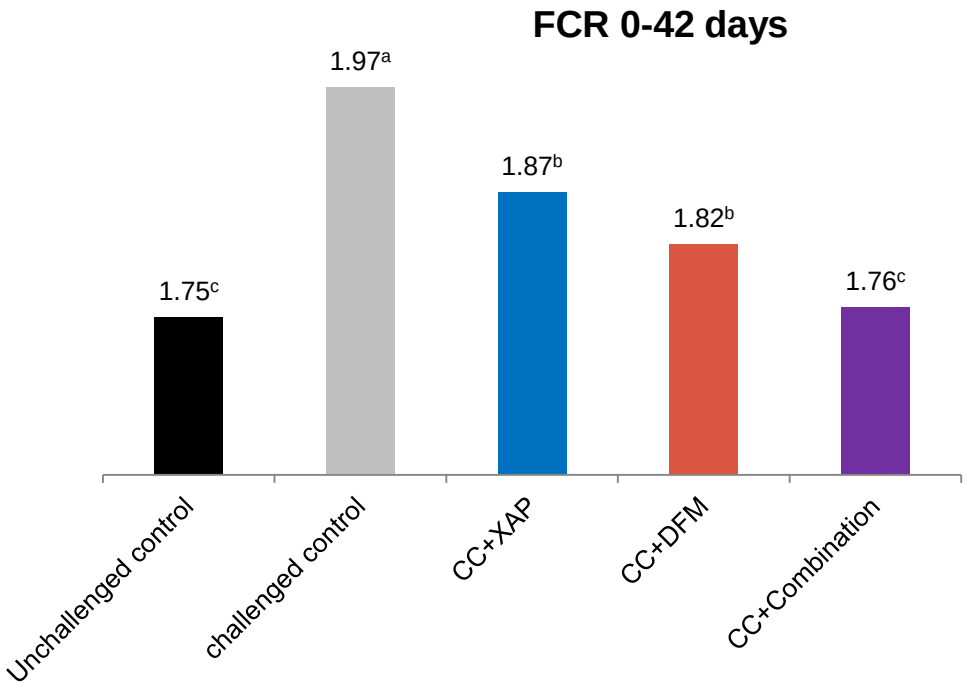

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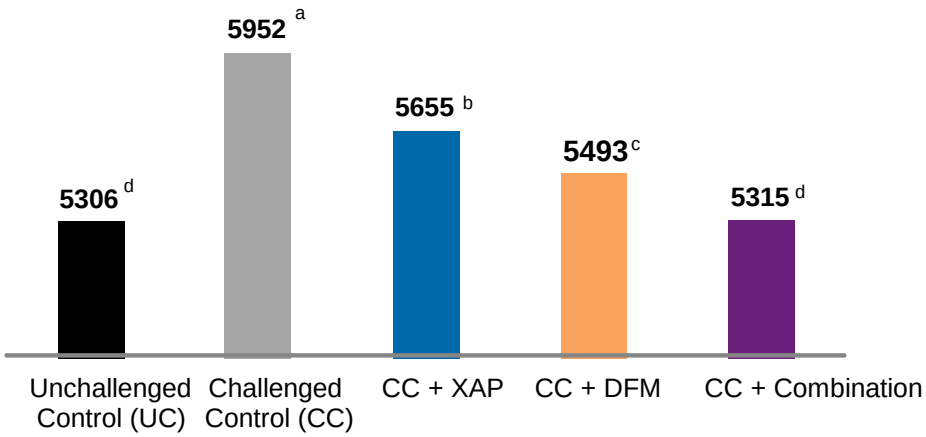
Calorie conversion (kcal/body weight gain)



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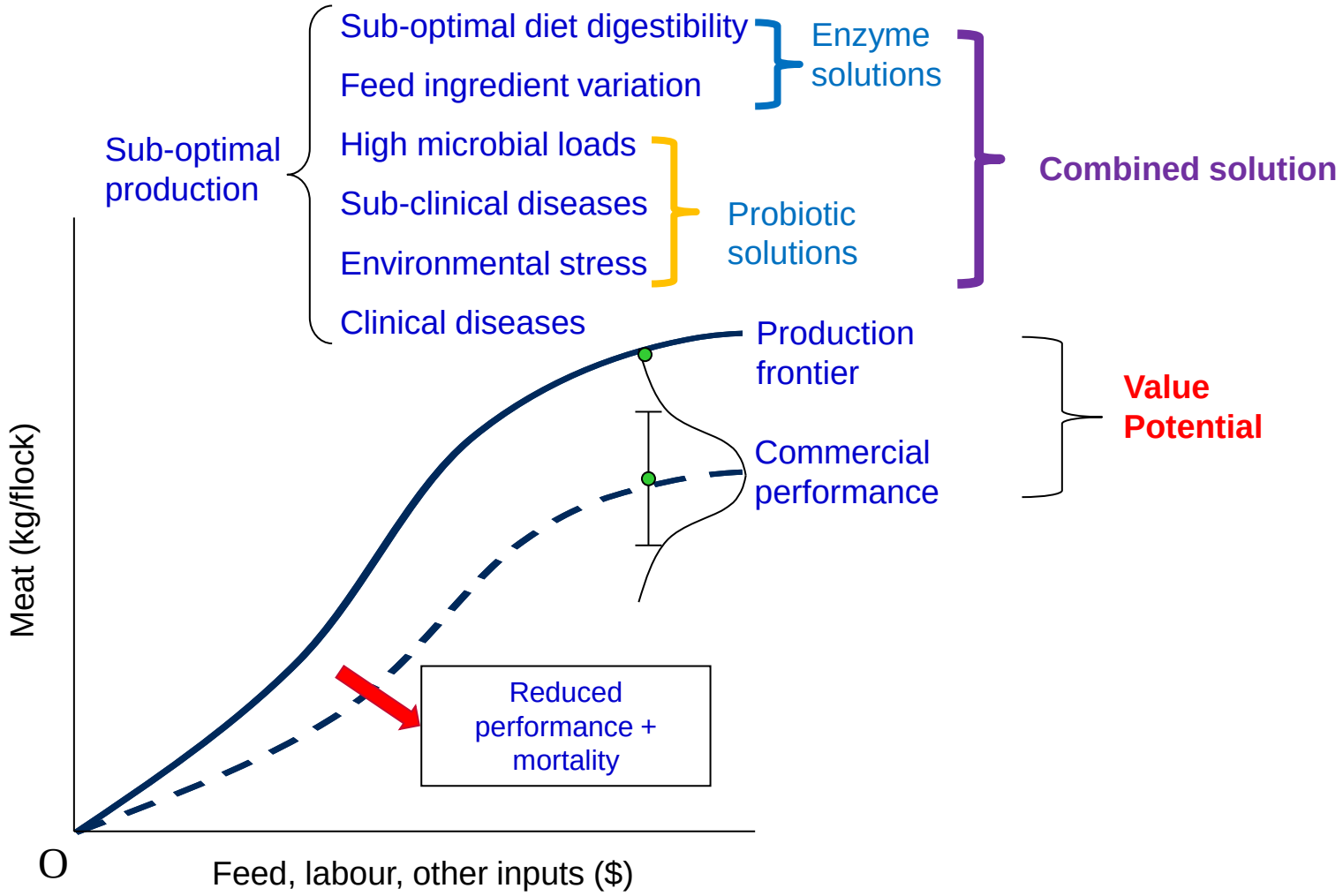
The gap between genetic potential and actual performance is variable and under-estimated



Conclusions:

Enzymes are substrate specific and with this specificity they target certain ANFs to improve nutrient digestion in the gut

Probiotics by providing a healthy environment for beneficial bacteria create a better gut condition to improve nutrient absorption

Combination of enzymes and probiotics can have positive additive effect on feed utilization either in normal unchallenged conditions or under challenge conditions like Necrotic Enteritis.

Thank You!!

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