Fermented seaweed, a boost for all we feed

FERMENTATIONEXPERTS
Tomorrow's solutions... today

NORTH SEA FARMERS

Rene Schepens, oct 25

CONTENT

Who are FermentationExperts?

Meat and feed market

Challenges of producing meat

Solution we developed

Impact it has

FERMENTATIONEXPERTS A/S
R&D

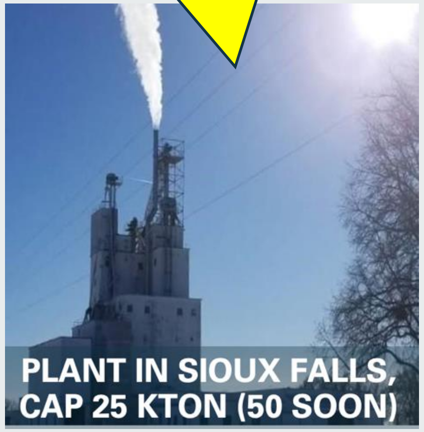
FERMENTATIONEXPERTS USA
Animal feed
50%

European Protein
Animal feed

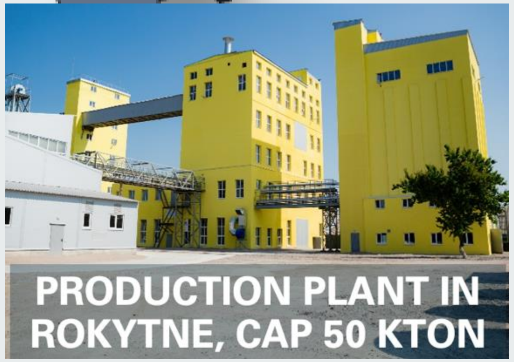
European Protein Ukraine
Animal feed 49%

European Protein ASA
Animal Feed
40%

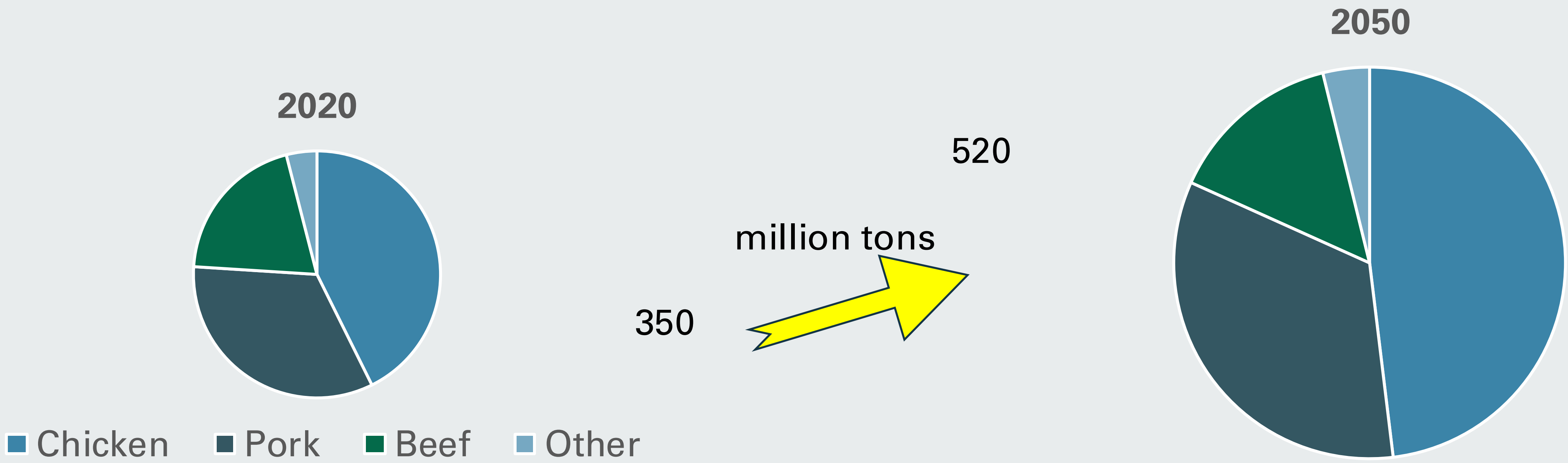
FERMFOOD
B2B fermented food ingredients


PLANT IN SIOUX FALLS, CAP 25 KTON (50 SOON)

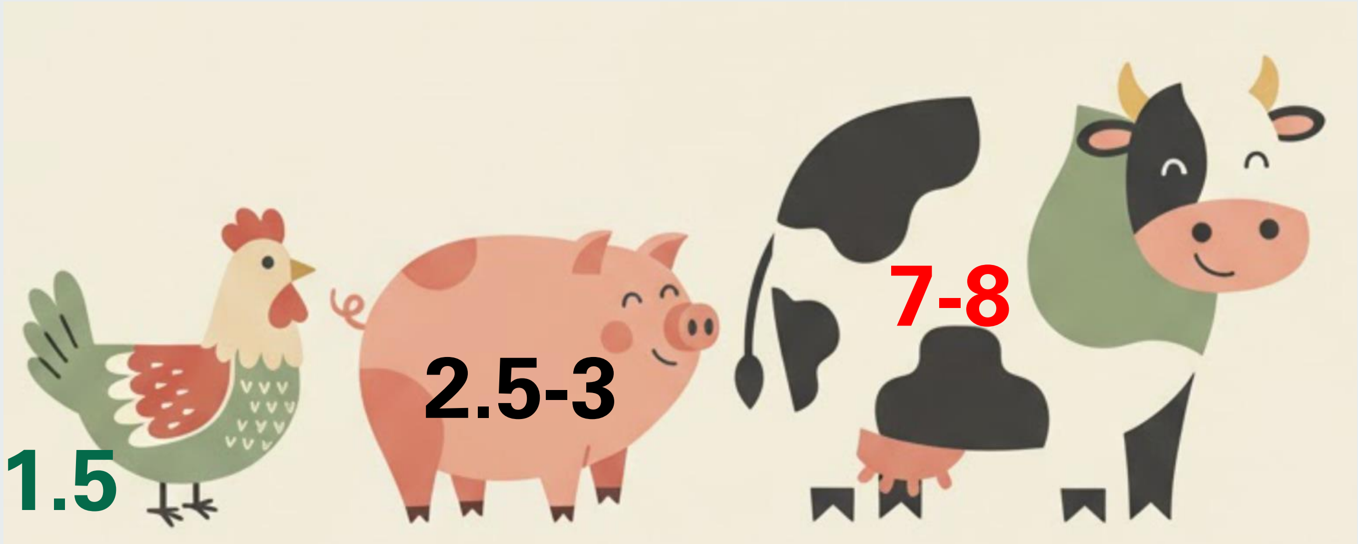
PLANT IN JELLING
CAP 25 KTON


PRODUCTION PLANT IN ROKYTNE, CAP 50 KTON

Global meat market



Kg feed/kg meat



GLOBAL ANIMAL FEED MARKET

Huge market: Valued at $ 600 billion, compound feed 400 billion, 1.2 billion metric tons

Competitive market: Nobody is big enough to influence price for the end products
Cost price is the main driver to stay in business
Feed costs are 50 – 80% of the total cost price

Main drivers for feeding value are energy and protein content

Feed	Seaweed (dried)
GE 17-20 Mj/kg	9-15
NE 9– 12 Mj	3-5
16% protein	8-14%
Digestibility ~ 85%	~ 35%
Minerals ~ 5%	20 – 40%
$ 0.33/kg	$ 3 (wild harvest) – 15 (farmed)

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NO CHANCE AS A REGULAR FEED

Despite all the soft environmental benefits of seaweed

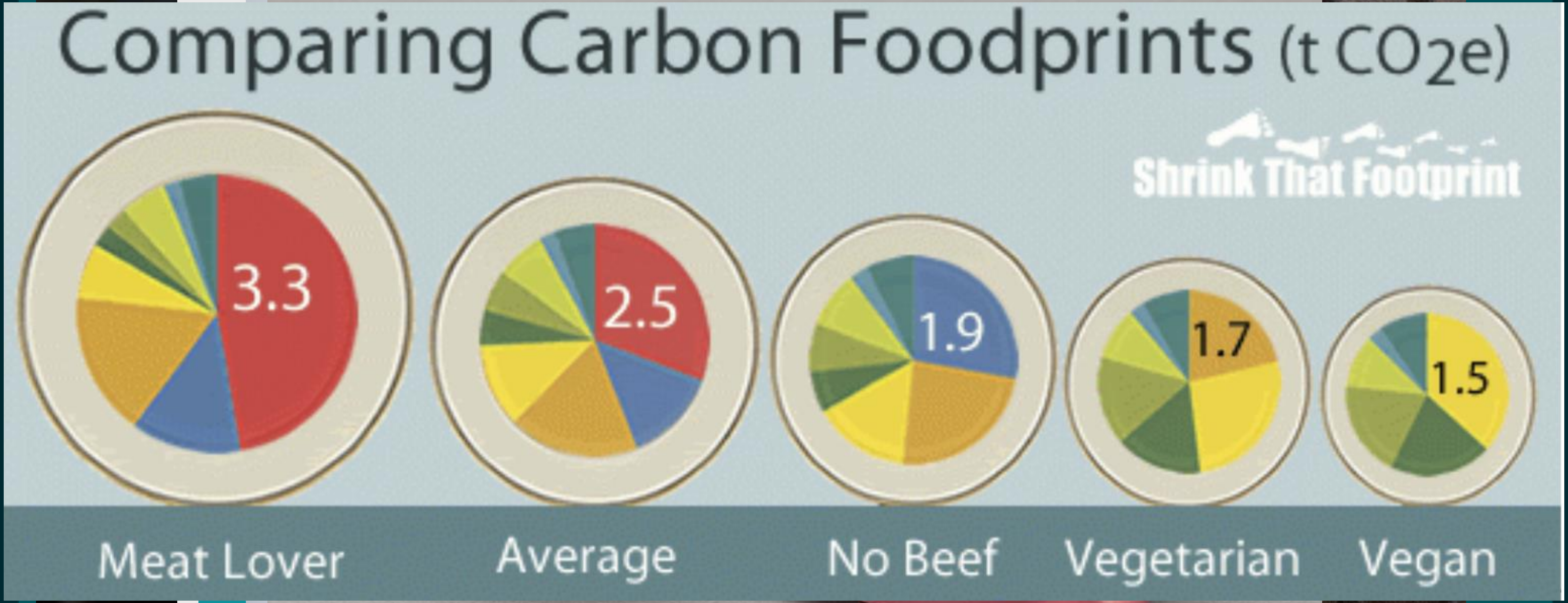
It is too expensive to compete with land plants for inclusion in feed

So, seaweed will need to be marketed as an additive with benefits on animal health and (monetary) performance

DRIVERS FOR SUCCES IN THE FEED BUSINESS

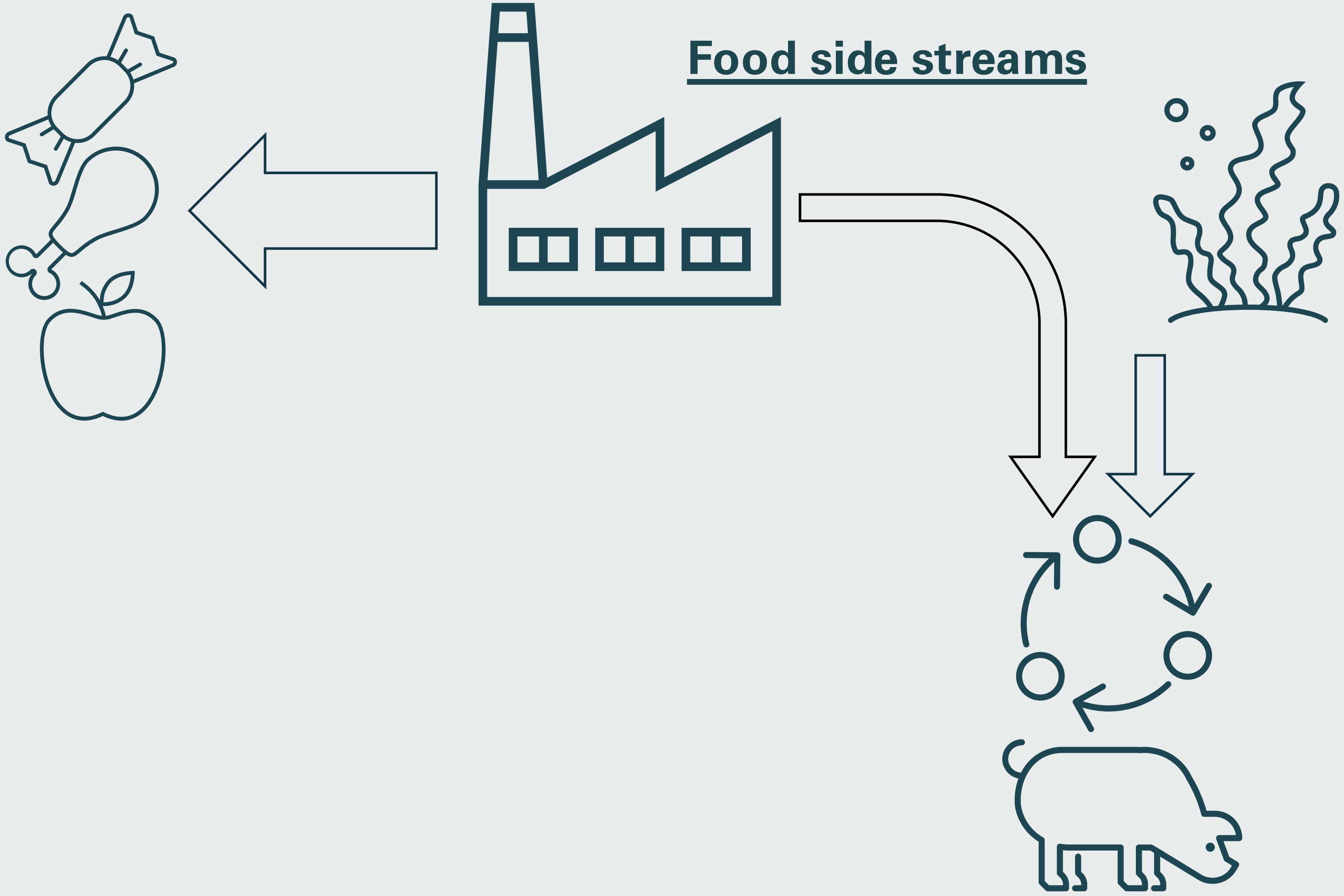
- IMPROVED PERFORMANCE
- SUPPORTING A SUSTAINABLE AGENDA FOR HEALTH AND THE ENVIRONMENT
- DOCUMENTATION
- VALUE FOR MONEY

ARE THERE CHALLENGES?



OUR SOLUTION

Fermented seaweed, a boost for all we feed



Seaweed

- No land, fresh water or fertilizer
- Cleans the sea (CO_2, excess nutrients)
- Unique polysaccharides not found in land plants

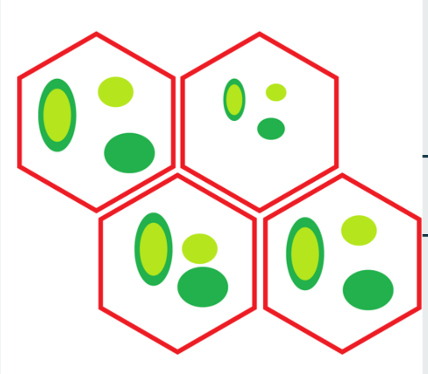
- Predigest via fermentation

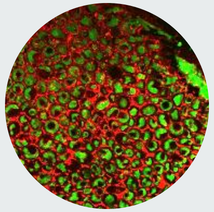
- Animals can harvest benefits

OUR SOLUTION

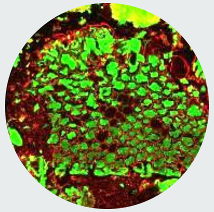
Fermentation

BEFORE



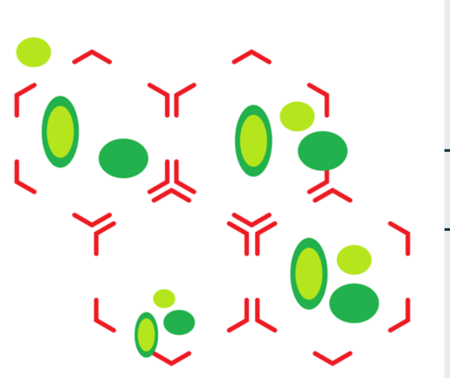


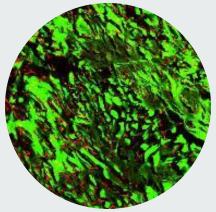
PECTIN
Fibers



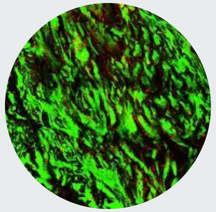
MANNAN
Fibers

AFTER





PECTIN
Fibers



MANNAN
Fibers

+

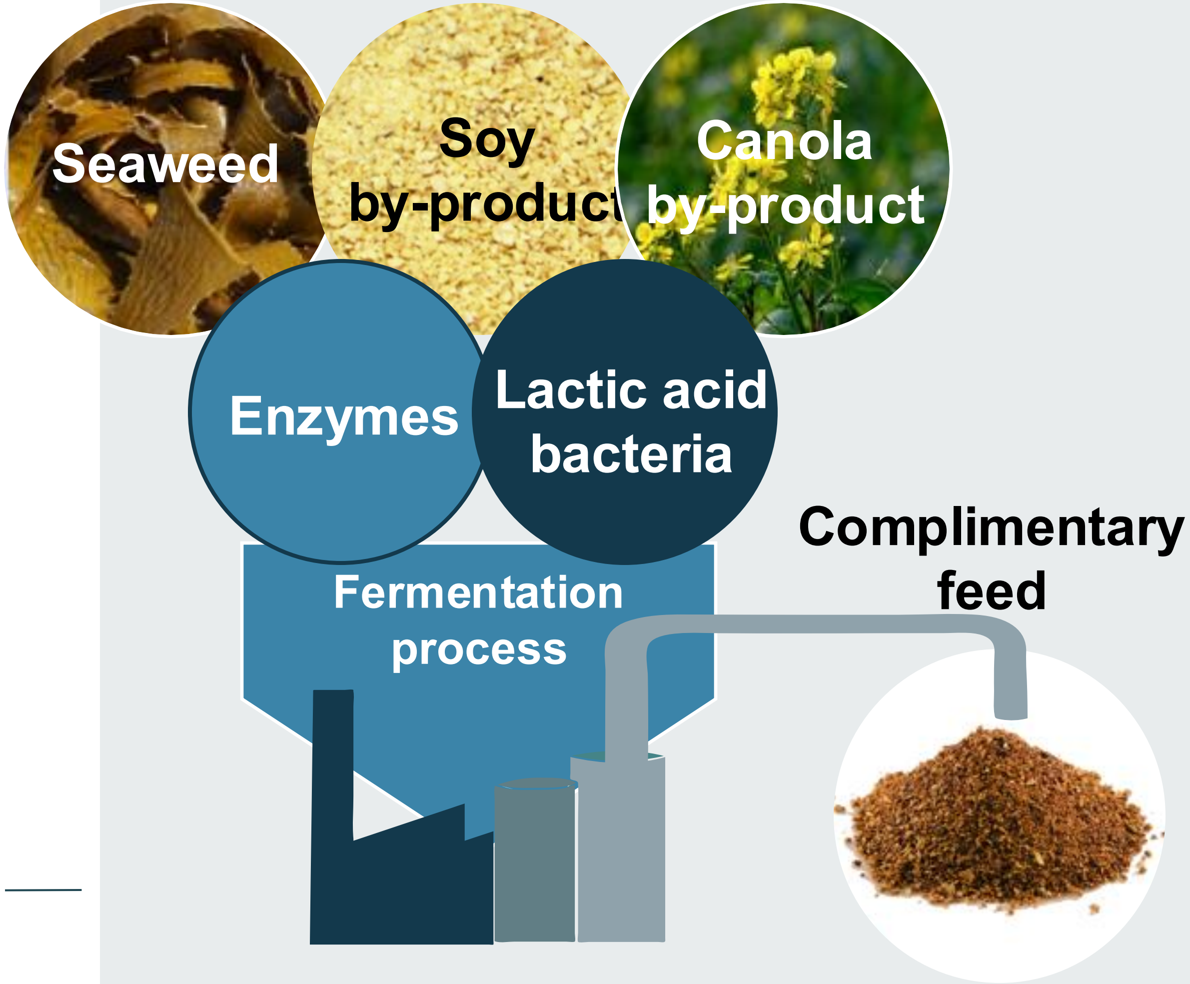
+

Increase in digestibility of **proteins, peptides & minerals**

Fiber with **prebiotic** properties

Metabolites like **lactic acid, fatty acids & vitamins**

OUR SOLUTION
Solid-state fermentation

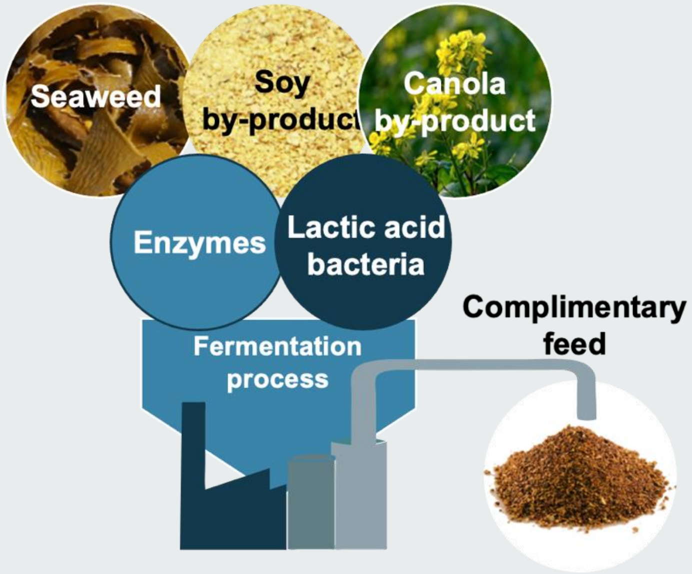


Bioactives

Prebiotics
Probiotics
Enzymes
Metabolites

AVANTAGES OF **SOLID-STATE FERMENTATION**

- Increases digestibility, NSP, minerals (P)
- Eliminates ANF’s like TIA, glucosinolates, oligosaccharides
- Acidification, decrease of buffer capacity for vegetable protein
- Higher protein, phosphorous, fibre and energy digestibility
- Produces lactic acid and other organic acids (3-8% depending on product). Live lactobacillus are present in the dry feed
- Produces natural enzymes and vitamins (B)
- **Modulates the gut microflora**
- Formats health promoting compounds
  - Anti microbial
  - Anti inflammatory
  - Immunity activating compounds



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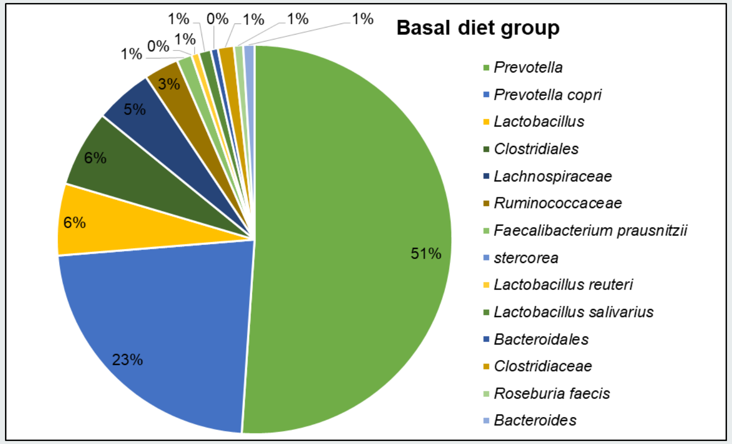
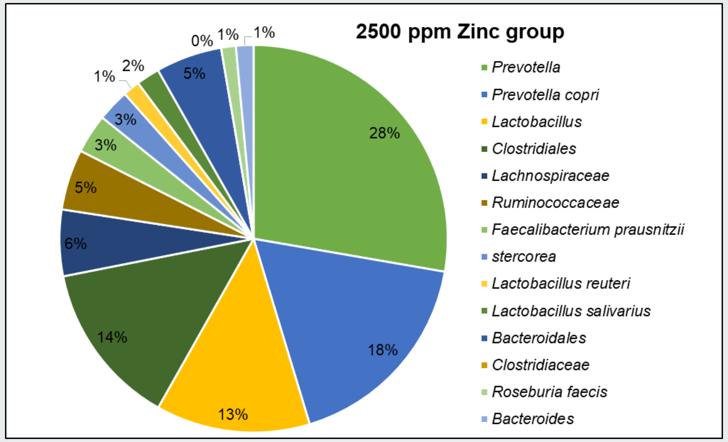
INFLUENCE ON **GUT DEVELOPMENT**

Copenhagen University piglet trial

Basal diet

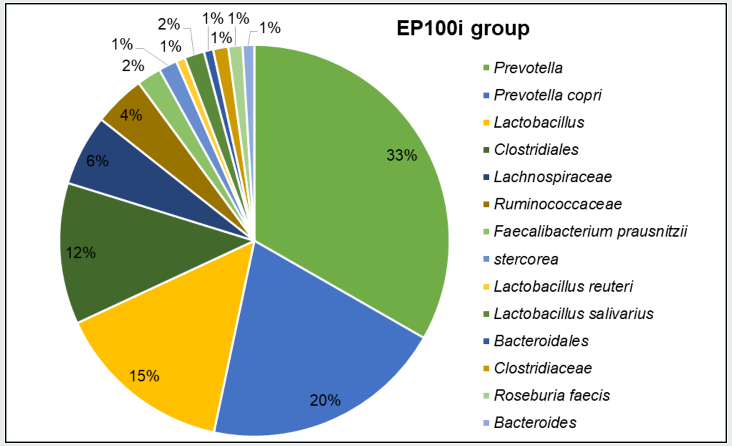


Basal diet+2.500 ppm zinc

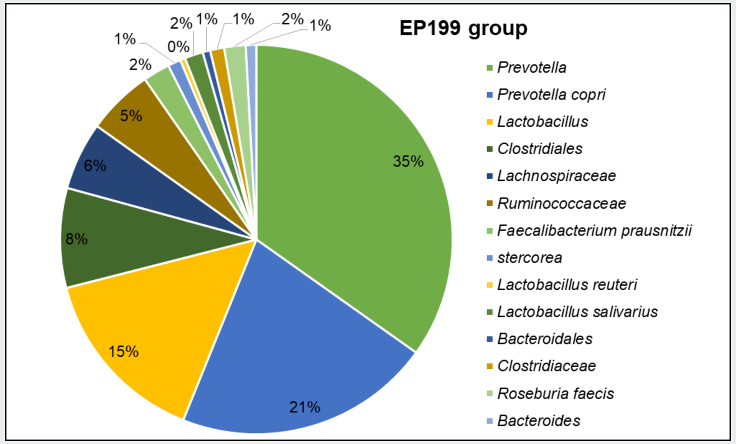


	Basal diet	10 % EP199	10 % EP100i
Lactobacillus spp.	5.9	**14.8**	**14.5**
Lachnospiraceae spp.	4.7	**5.6**	**5.7**
Ruminococcaceae spp.	2.8	**5.4**	**4.2**
Faecalibacterium prausnitzii	1.2	**2.2**	**2.0**
Lactobacillus salivarius	1.0	**1.5**	**1.6**

Basal diet+ FERMEX 100i



Basal diet+ FERMEX 199

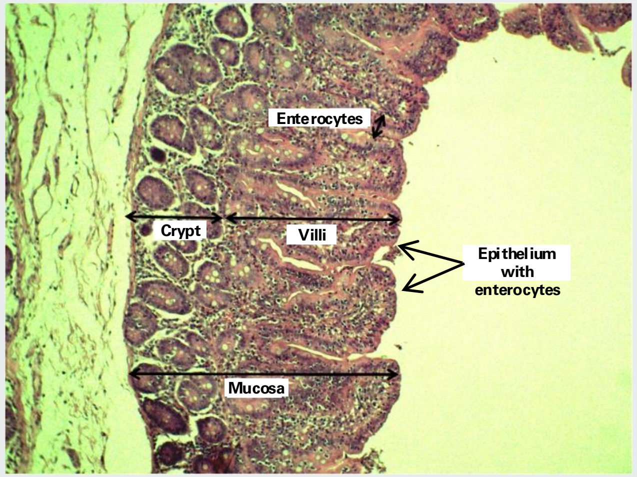


Even dominance of several bacterial groups corresponds to improvement in animal health and performance as they improve gut-homeostasis

INFLUENCE ON **GUT DEVELOPMENT**

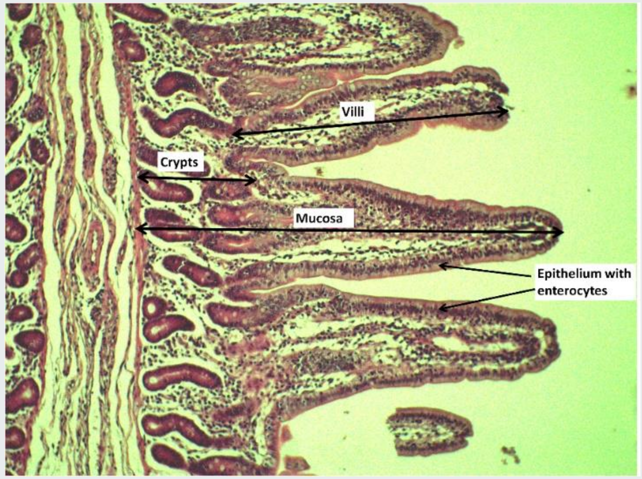
Copenhagen University piglet trial

Basal diet



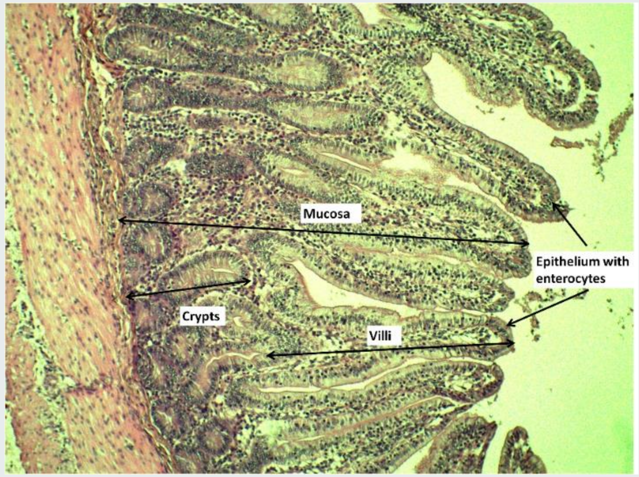
Thinner mucosa in jejunum in comparison with zinc and FERMEX100i groups.
Sign of an under- developed gut

Basal diet+2.500 ppm zinc



Lose mucosa in jejunum in comparison with basal and FERMEX 100i groups.
A sign of physiological stress, indicating a gut that is vulnerable to pathogen invasions and inflammation

Basal diet+ FERMEX 100i



Thick and packed mucosa in jejunum in comparison with basal and zinc groups.
It is a sign of a well- developed gut.

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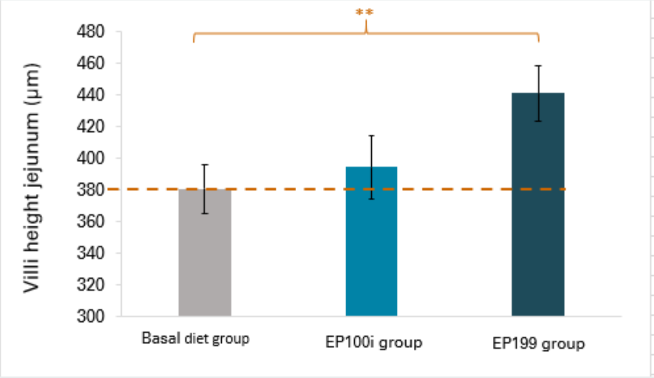
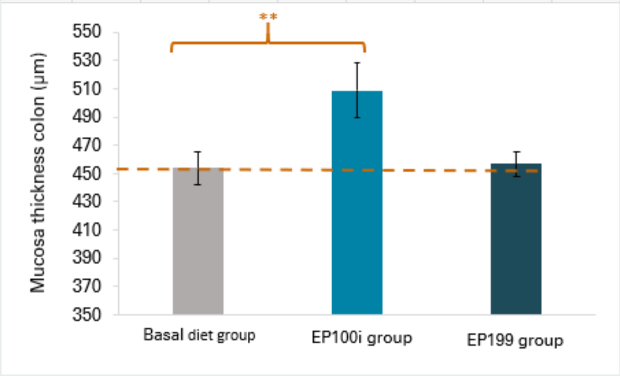
GUT MODULATION

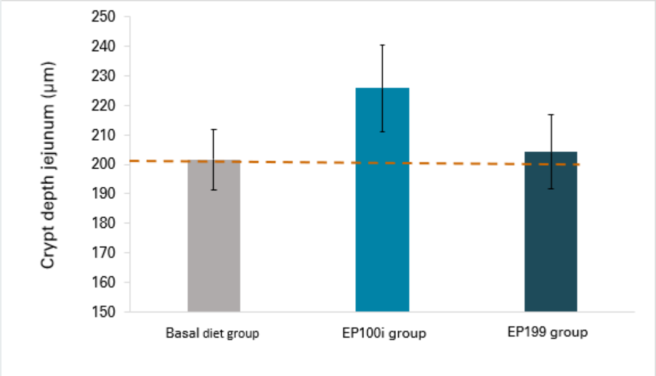
IN VIVO



EP100i & EP199 displayed an average of 10% longer jejunum villi in comparison with the basal group

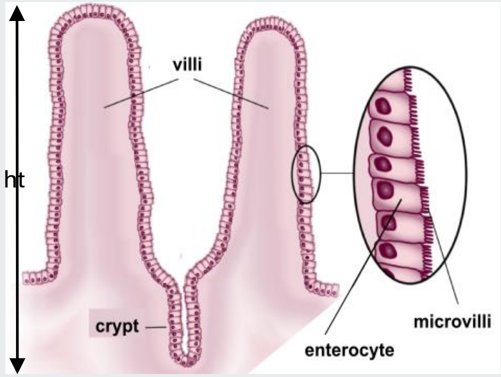


EP100i & EP199 displayed an average of 6% thicker colon mucosa in comparison with the basal group



EP100i & EP199 displayed an average of 7% deeper jejunum crypts in comparison with the basal group

Mucosa height



Source: Data from commercial trial in Poland 2018/2019. 599 piglets divided into three feeding regime. Conducted by European Protein, Copenhagen University and Lublin University, Poland.

BACTERIA

Strain	Type strain:	Concentration of bioactives at inhibition zone (mg/mL)			
EP-product	**Pathogen**	**100 mg/mL**	**50 mg/mL**	**25 mg/mL**	**DMSO control**
Gram positive					
Methicillin-resistant Staphyloccocus aureus (MRSA)	USA_300	-	-	+	++
Methicillin-resistant Staphyloccocus aureus (MRSA)	COL	-	-	-	++
Staphyloccocus carnosus	15605T (CCUG)	-	-	-	++
Clostridium perfringens	19408 (CCUG)	-	-	-	++
Streptococcus bovimastiditis	69277T (CCUG)	-	-	++	++
Gram negative					
Campylobacter jejuni	29428 (CCUG)	-	-	-	++
Campylobacter coli	45147 (CCUG)	-	-	-	++
E. coli	11775 (CCUG)	-	-	-	++
Vibrio parahaemolyticus	27657 (DSM) / 67711 CCUG	-	-	+	++
Salmonella enterica, supsp enterica	46220 (CCUG)	-	++	++	++

– Symbol indicates no visible growth was observed in the MBC experiments.

+ Symbol indicates some visible growth and a small inhibition zone.

++ Symbols represents visible growth and no inhibition zone.

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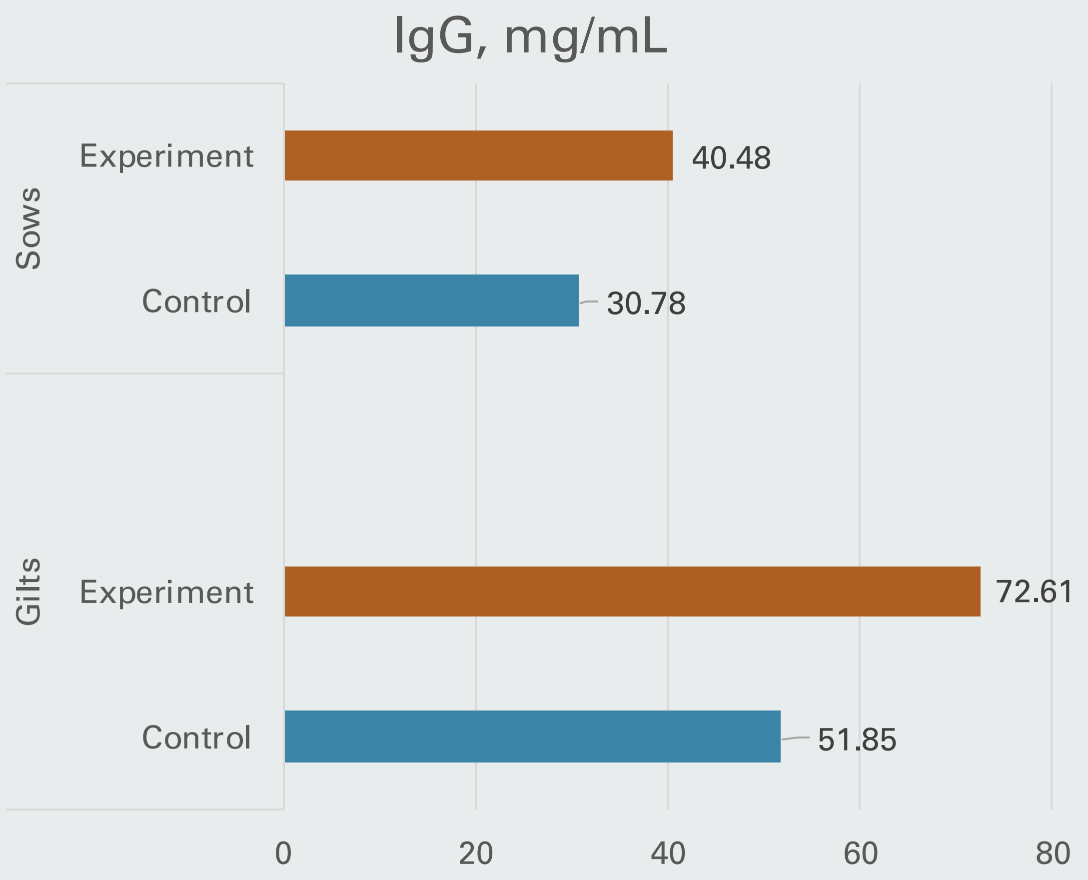
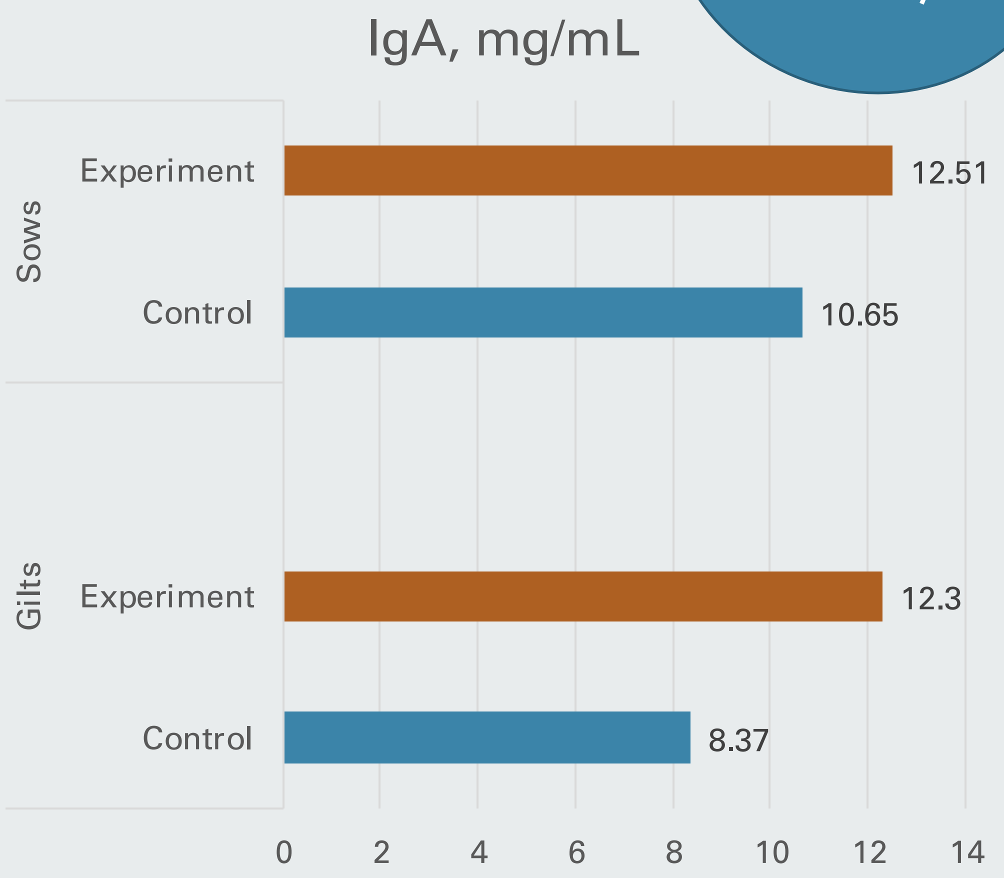
ANTIBODIES IN SOW MILK

Lublin University sow trial





EFFECT OF MATERNAL FEEDING

Lublin University

Blood	Mineral utilization	Piglets	Up to 35% better
		Sows	Up to 32% better
	Albumin (transport of nutrients)	Sows and piglets	Up to 13% more
	Iron binding capacity	Sows and piglets	Up to 23% better
Milk	Immunoglobulins in sow colostrum	Sows	Up to 40% more IgG
Feces	Bacteria in feces	Sows	Reduced by up to 95-98%
	(*E.coli, C. perfringens, Salmonella*)		
	Diarrhoea incidence	Piglets	Reduced by up to 58%
Bones	Cartilage in knee joints	Piglets	Increased by up to 75%
	Bone strength: Load before fracture	Piglets	Increased by up to 18%

Source: https://content.sciendo.com/view/journals/aoas/20/2/article-p535.xml?language=en
https://www.sciencedirect.com/science/article/abs/pii/S1871141319305165
https://www.sciencedirect.com/science/article/pii/S2405654519300587

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P ≤ 0.05

DOCUMENTATION

Our products are documented in independent trials conducted by Copenhagen, Aarhus and Aalborg University (DK), Lublin University (PL), Uni of Illinois and Minnesota (USA).

IMPACT

Trial on 35 Sow farms, before/after

- Increase in health, reproduction and productivity

+ 2 PIGLETS MORE WEANED PER SOW PER YEAR

- 2% mortality

More milk, piglets weaned 360 grams heavier

12% LESS SOW FEED PER PRODUCED PIGLET

50 -100 EUR MORE PROFIT PER SOW PER YEAR

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IMPACT

Multisite farm, comparing full year results Apr 24 – Apr 25. Home feed mill, feeding fermented soy/seaweed on 4 farms, control feed without on 1 farm.

Fermex 299	No, 1 farm	Yes, 4 farms	Diff absolute	Diff %
Sow number	3000	8600		
Birth loss	16,54%	10,57%	5,97%	36%
of which mummified	10,28%	5,63%	4,65%	45%
Av liveborn per litter	13,84	14,28	-0,44	-3%
Pre weaning mortality	26,92%	17,85%	9,07%	34%
Pigs weaned / sow / yr	23,55	28,34	-4,79	-20%
Av. Sow mortality	30,05%	17,25%	12,80%	43%
Feed use per sold weaner (lbs)	98,97	87,06	11,91	12%
Add feed costs per sow /yr ($)		35,00		
Add sales op weaners / sow/ yr ($)		250,00		
Saved costs per av sow to buy and raise gilts ($)		128,00		
Projected annual extra income per sow ($)		**$343,00**		

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IMPACT Use of medicines

Medicin	Melovem (cc)		Linco (DD*1000)		Peni-Kel (DD*1000)		Total (DD*1000)	
Group	Test	Control	Test	Control	Test	Control	Test	Control
All sows	5,63	8,24	4,28	5,04	0,32	1,67	4,60	6,70
Multiparous	5,76	7,17	4,10	4,49	0,46	1,02	4,60	5,50
Gilts	5,33	9,86	4,69	5,87	0,00	2,65	4,70	8,50

In test group compared to control:

32% less use of pain killer Melovem

15% less Linco

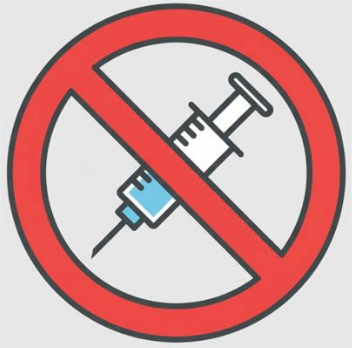
81% less Peni-Kel

31% lower Defined Daily Dose of antibiotics used per animal

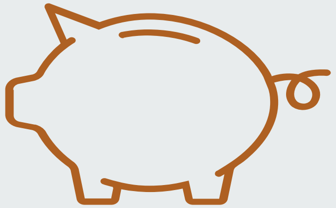
Differences are larger in gilts than in multiparous sows

Summariced positive impact

- We click 12 out of 17 boxes of the UN SDGs!
- Better health and animal welfare
- Reduced medicine and AB use



- Economics



- Sustainability :↓ feed miles, better LCA,↓CO2,↓ Nitrogen,
  ↓ pollution

CUSTOMER TESTIMONY

Thanks for your attention!

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Tomorrow's solutions... today

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