



Fermented seaweed, a boost for all we feed

FERMENTATIONEXPERTS

Tomorrow's solutions... today



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



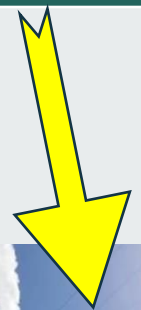
European Protein Ukraine
Animal feed 49%



European Protein ASA
Animal Feed
40%



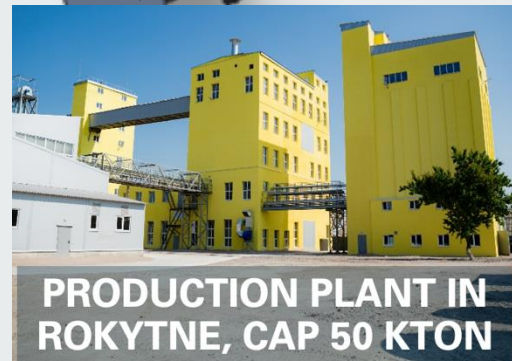
FERMFOOD
B2B fermented food
ingredients



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



PLANT IN JELLING
CAP 25 KTON

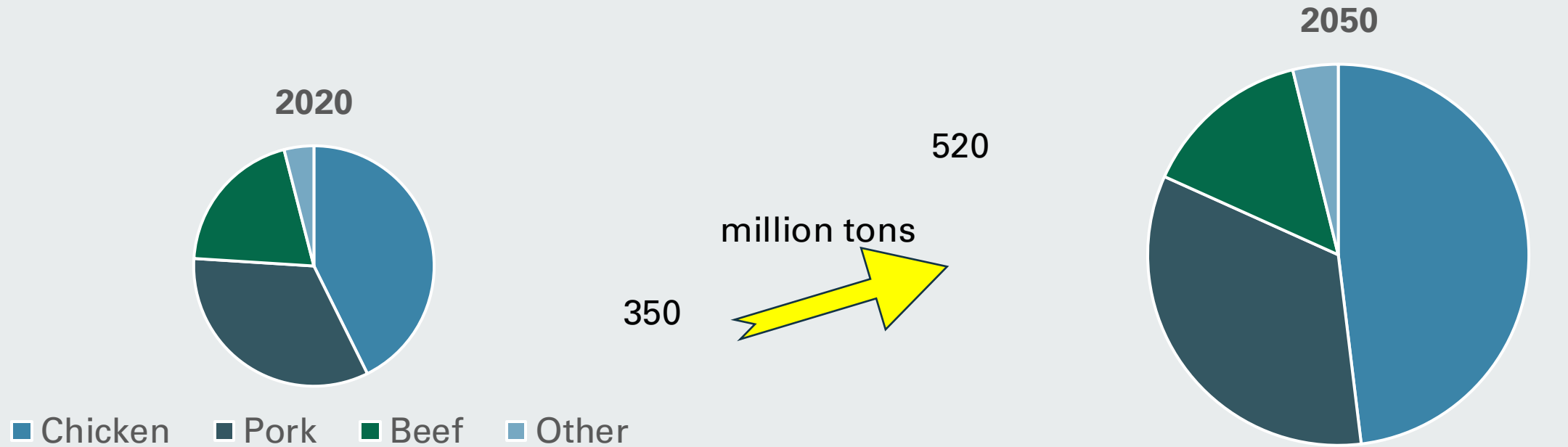


PRODUCTION PLANT IN
ROKYTNE, CAP 50 KTON

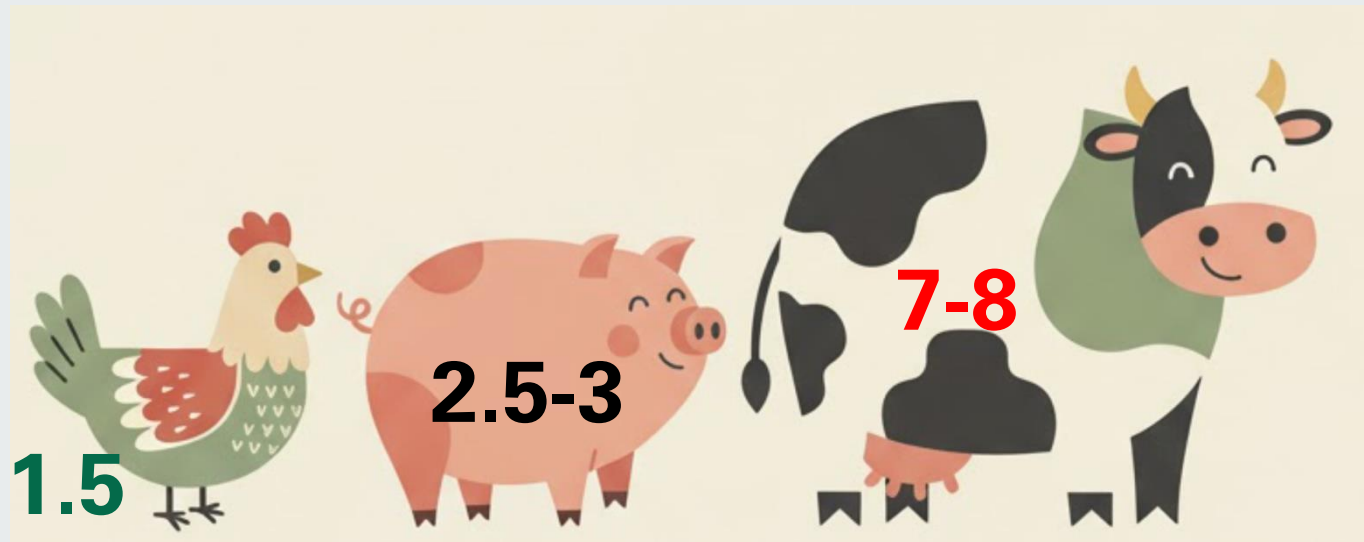




Global meat market



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
GE 17-20 Mj/kg
NE 9– 12 Mj
16% protein
Digestibility ~ 85%
Minerals ~ 5%
\$ 0.33/kg

Seaweed (dried)
9-15
3-5
8-14%
~ 35%
20 – 40%
\$ 3 (wild harvest) – 15 (farmed)



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 SUCCESS IN THE FEED BUSINESS



- IMPROVED PERFORMANCE



- SUPPORTING A SUSTAINABLE AGENDA FOR HEALTH AND THE ENVIRONMENT



- DOCUMENTATION



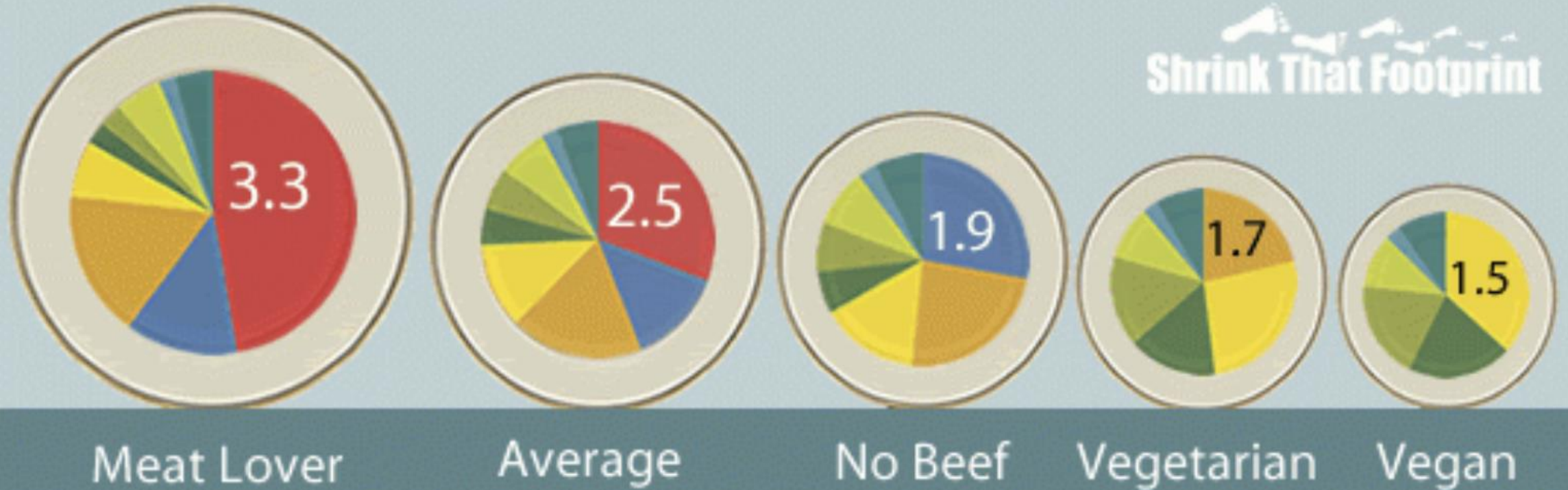
- VALUE FOR MONEY



ARE THERE CHALLENGES?

Comparing Carbon Foodprints (t CO₂e)

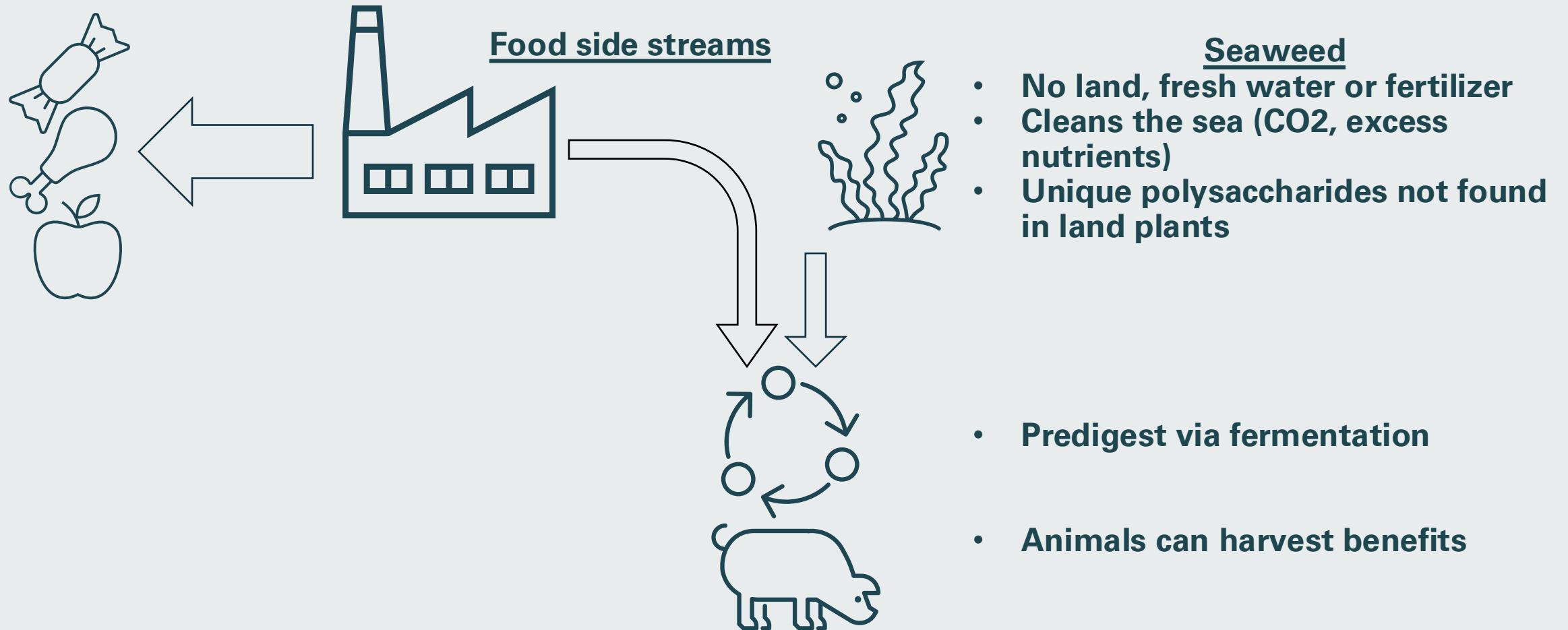
Shrink That Footprint





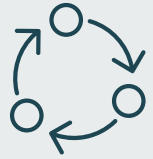
OUR SOLUTION

Fermented seaweed, a boost for all we feed





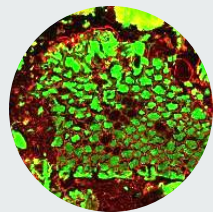
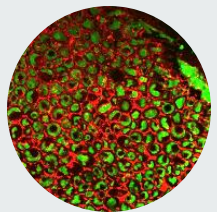
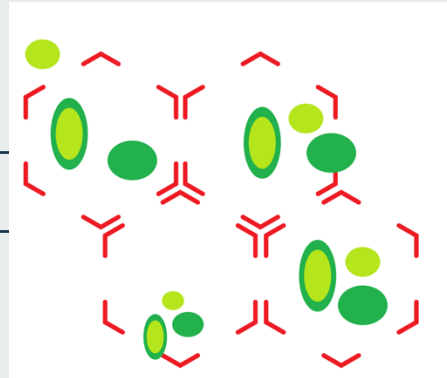
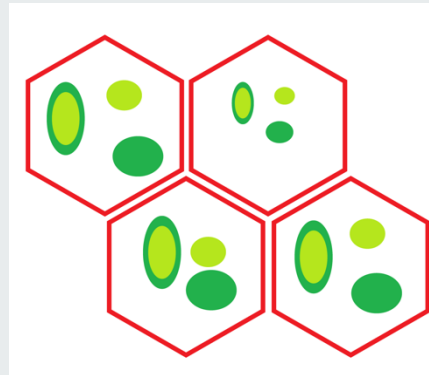
OUR SOLUTION



Fermentation

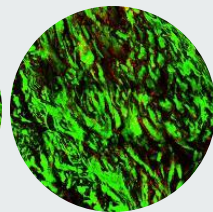
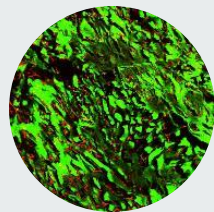
BEFORE

AFTER



PECTIN
Fibers

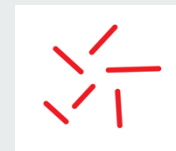
MANNAN
Fibers



PECTIN
Fibers

MANNAN
Fibers

+



+



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

Fiber with
prebiotic
properties

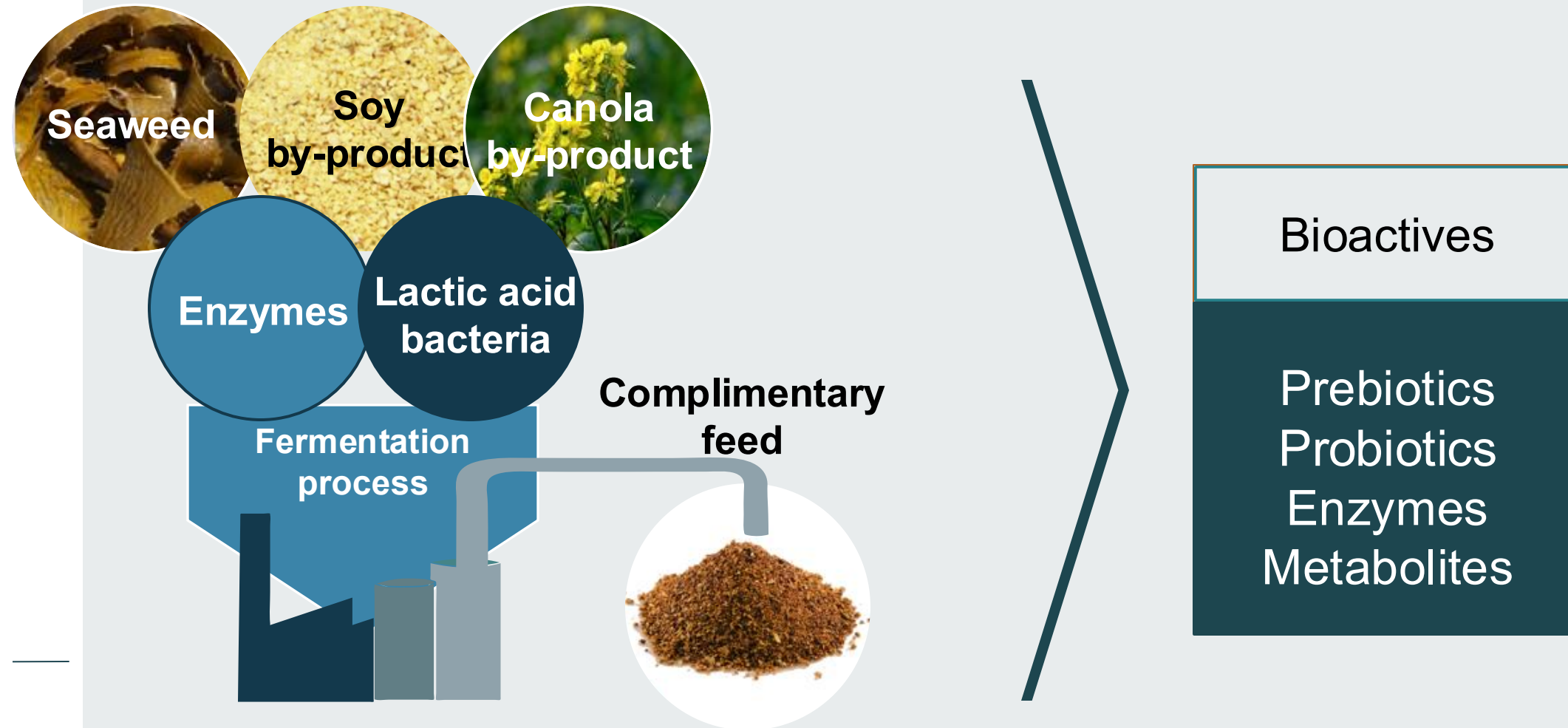
Metabolites
like **lactic acid,
fatty acids &
vitamins**





OUR SOLUTION

Solid-state fermentation



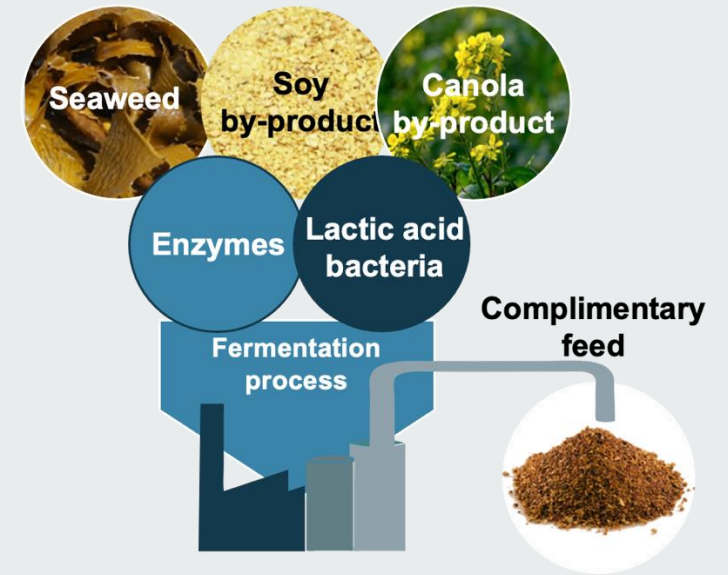


AVANTAGES OF SOLID-STATE FERMENTATION

- › 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





WHAT CAN THE GUT MICROBIOME DO?



Produces vitamins,
hormones and other active
metabolites



Harvests energy from food



Aids digestion



Supports immune
function



Protects against
pathogens



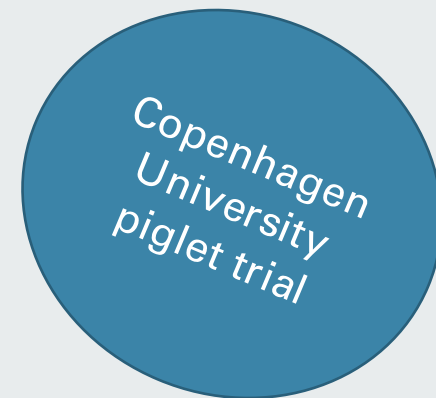
Improves gut transit
and function



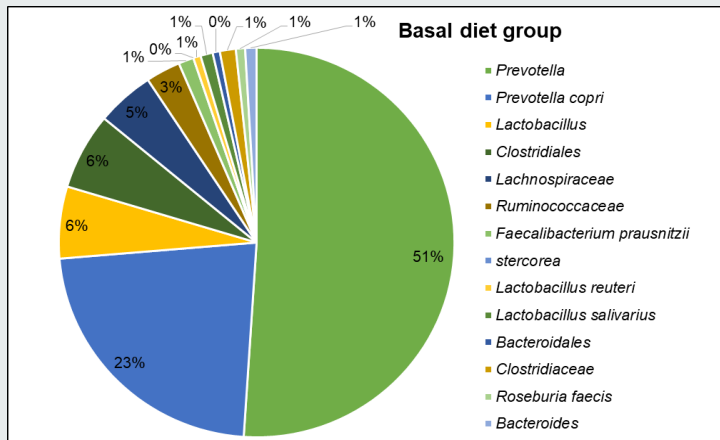
Sends signals to the
brain and other organs



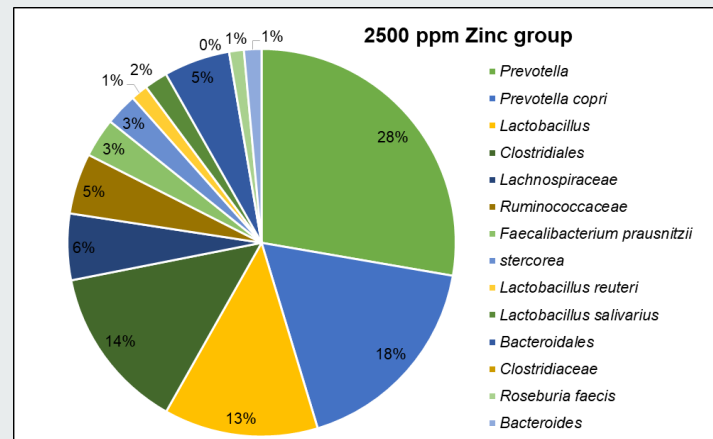
INFLUENCE ON GUT DEVELOPMENT



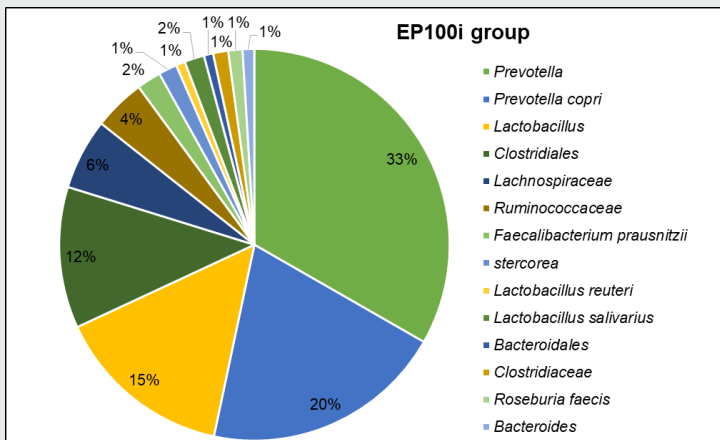
Basal diet



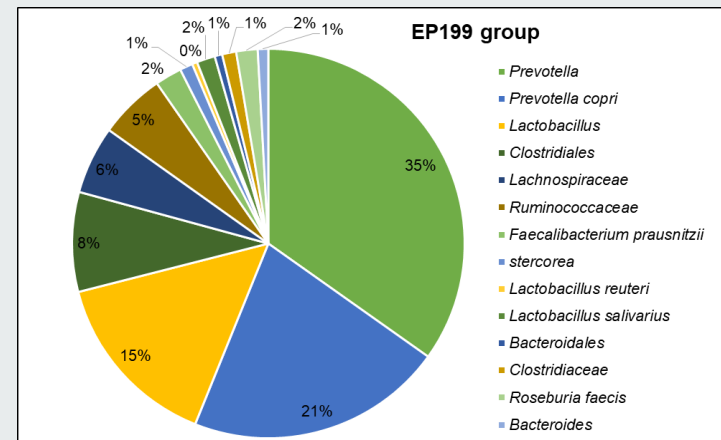
Basal diet+2.500 ppm zinc



Basal diet+ FERMEX 100i



Basal diet+ FERMEX 199



	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

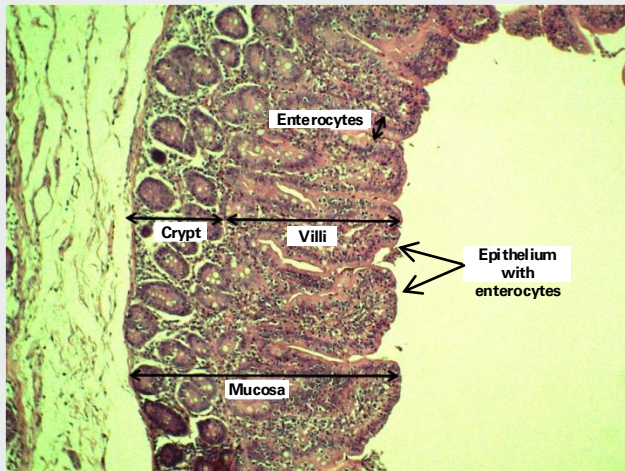
Even dominance of several bacterial groups corresponds to improvement in animal health and performance as they improve gut-homeostasis



INFLUENCE ON GUT DEVELOPMENT

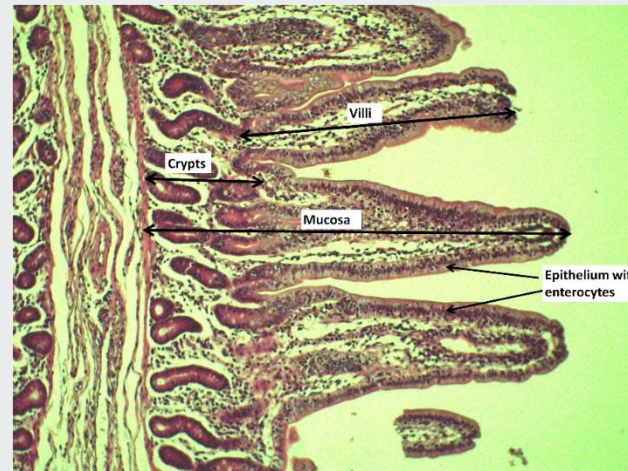
Copenhagen
University
piglet trial

Basal diet



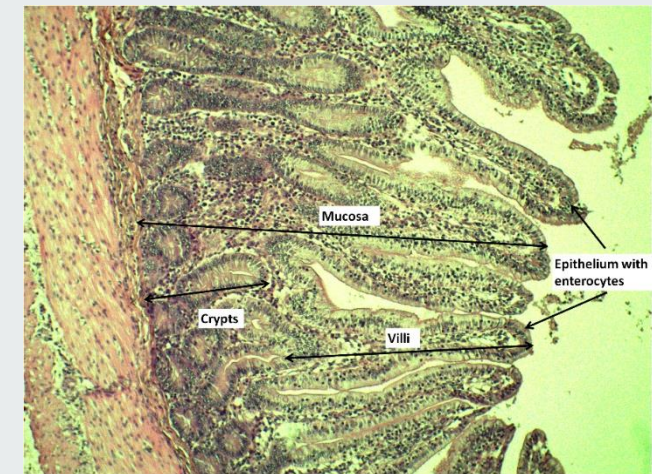
Thinner mucosa in jejunum in comparison with zinc and FERMEX100i groups.
Sign of an under- developed gut

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



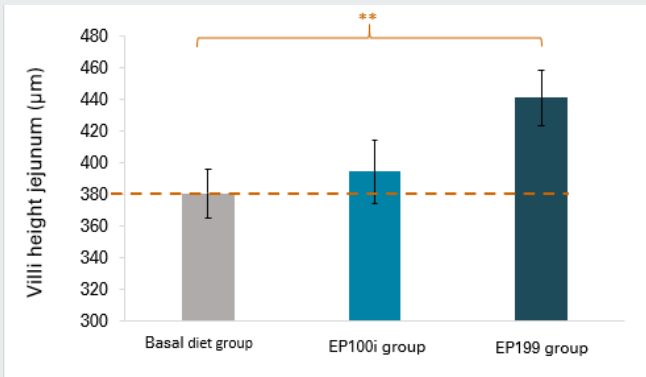
Thick and packed mucosa in jejunum in comparison with basal and zinc groups.
It is a sign of a well- developed gut.



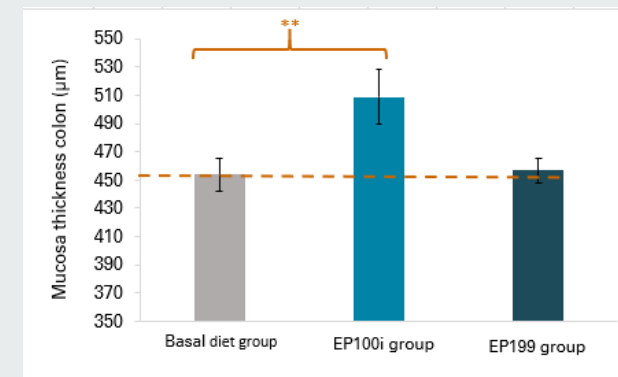
GUT MODULATION



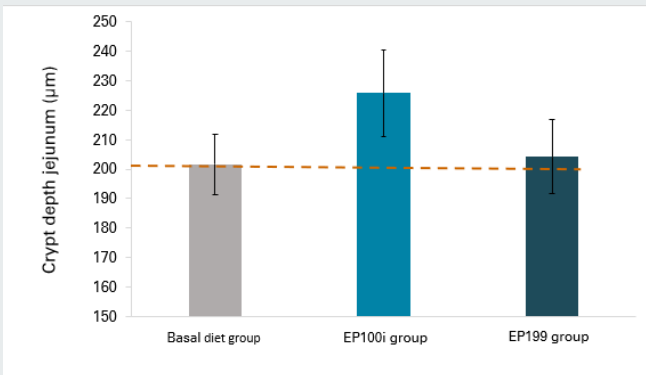
IN
VIVO



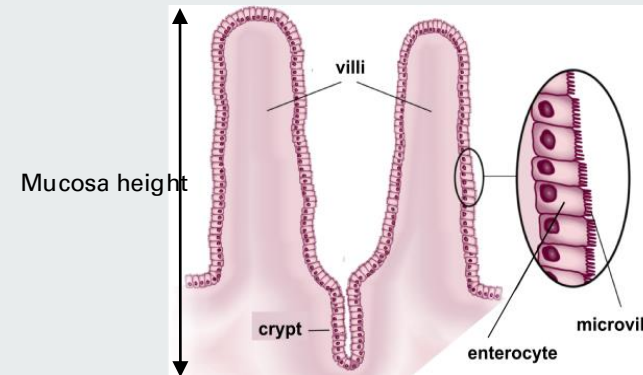
EP100i & EP199 displayed an average of 10% longer jejunum villi in comparison with the basal group



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



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					
<i>Methicillin-resistant Staphylococcus aureus (MRSA)</i>	USA_300	-	-	+	++
<i>Methicillin-resistant Staphylococcus aureus (MRSA)</i>	COL	-	-	-	++
<i>Staphylococcus carnosus</i>	15605T (CCUG)	-	-	-	++
<i>Clostridium perfringens</i>	19408 (CCUG)	-	-	-	++
<i>Streptococcus bovimastiditis</i>	69277T (CCUG)	-	-	++	++
Gram negative					
<i>Campylobacter jejuni</i>	29428 (CCUG)	-	-	-	++
<i>Campylobacter coli</i>	45147 (CCUG)	-	-	-	++
<i>E. coli</i>	11775 (CCUG)	-	-	-	++
<i>Vibrio parahaemolyticus</i>	27657 (DSM) / 67711 CCUG	-	-	+	++
<i>Salmonella enterica, supsp enterica</i>	46220 (CCUG)	-	++	++	++

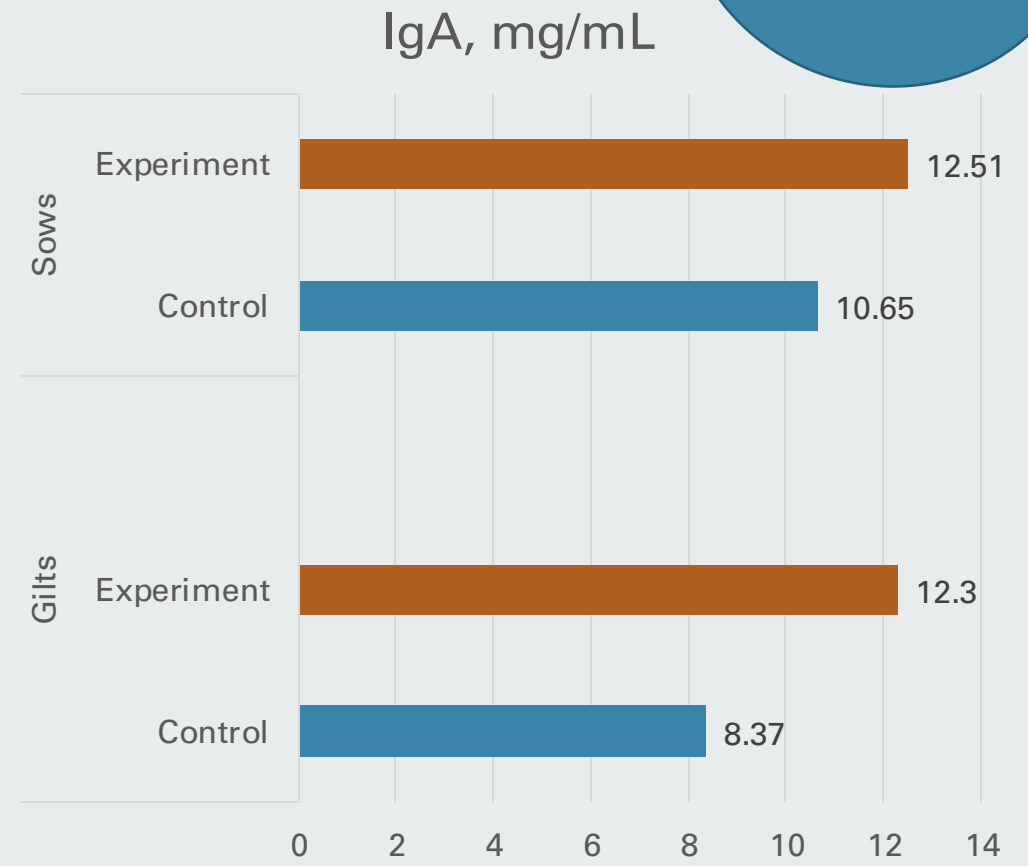
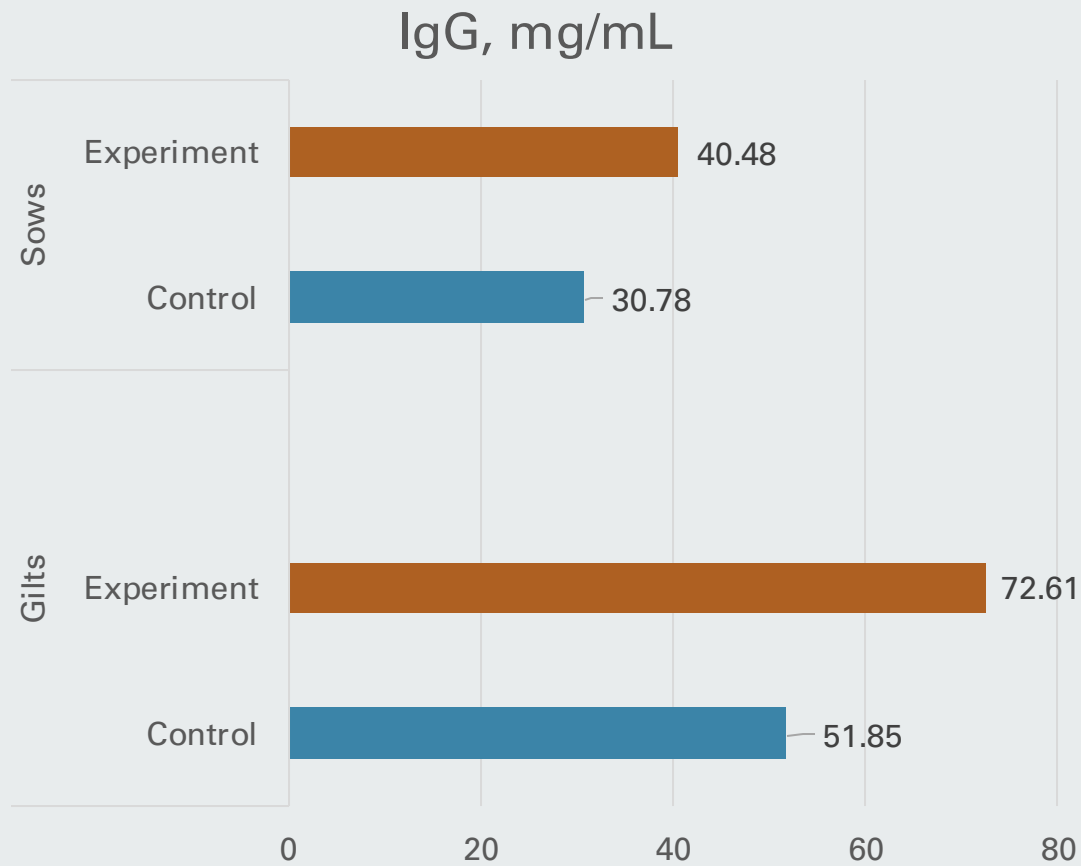
– Symbol indicates no visible growth was observed in the MBC experiments.

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

++ Symbols represents visible growth and no inhibition zone.



ANTIBODIES IN SOW MILK





EFFECT OF MATERNAL FEEDING



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%
	(<i>E.coli</i> , <i>C. perfringens</i> , <i>Salmonella</i>)		
	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>



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).



ady was to estimate the influence of 'micro' to mixtures with low (425 ± 25 PU kg⁻¹) or haematological and biochemical indices a omponents in blood of sows during pregn: conducted on 75 sows in each one, all the e e experimental groups. Diets with low ce nt 1 were based on barley, wheat, oat and r: se level used in experiment 2 contained tri ditionally, lactating diets were supplement d design was analogical in both experiment was supplemented with the standard mixt d P according to NRC recommendations (1



Dried fermented post-extraction rapeseed meal given to sows as an alternative protein source for soybean meal during pregnancy improves bone development of their offspring

E. Tomaszewicz¹*, S. Muszyński¹, P. Dobrowolski¹, D. Kamiński¹, A. Czech¹, E.R. Grells¹, D. Wójcik¹, A. Tomczyk-Wójcik¹

<https://doi.org/10.1016/j.livsci.2019.04.009>



Impact of Dietary Supplementation of *Lactic Acid Bacteria* Fermented Rapeseed with or without Macroalgae on Performance and Health of Piglets Following Omission of Medicinal Zinc from Weaner Diets

Gizaw D. Satessa¹, Paulina Tamez-Hidalgo², Yan Hui³, Tomasz Cieplak⁴, Lukasz Krych³, Søren Kjærulff⁵, Grete Brunsgaard⁶, Dennis S. Nielsen⁷ and Mette O. Nielsen^{8,*}

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Simple Summary: Weaning is the most stressful event in pig production and is often associated with reduced performance, diarrhoea and piglet mortality. Currently, a high dose of zinc oxide (ZnO) is used to prevent weaning-related loss in productivity. However, the feeding of ZnO in weaner piglets will be phased out by 2022 in Europe, leaving pig producers without options to manage post-weaning disorders. This study investigated whether fermented rapeseed meal (FRM) alone or in combination with one (FRMA) or more (FRMAS) brown macroalgae species could improve weaner piglet growth, intestinal development and health compared to either non-supplemented diets (negative control, NC) or diets supplemented with 2500 ppm ZnO (positive control, PC). Both FRM and FRMA resulted in a similar production performance to PC when fed to weaned piglets. The PC, FRM and FRMAS (gender-specific) improved jejunal villus development more than the NC. Colon mucosal development was stimulated, and signs of intestinal inflammation were reduced by FRM. The composition and diversity of colon microbiota were similar between all fermented feeds and PC, but different compared to NC. In conclusion, FRM was at least as effective as ZnO to improve piglet growth, intestinal development and health.

rapeseed meal increased bone ing.
physis increased in offspring peseed meal.
rapeseed meal decreased trabecular r offspring.
stallites in bone decreased in mented rapeseed meal.

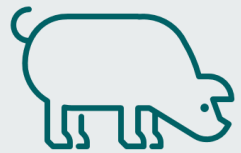


IMPACT

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



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		



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

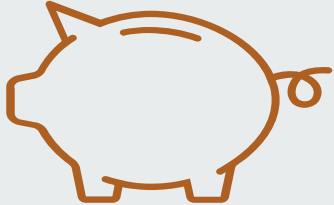
81% less Peni-Kel

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!

FERMENTATIONEXPERTS

Tomorrow's solutions... today



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