Piglet vitality in a zinc free, low medication world - a Danish perspective

Lisbeth Shooter, Executive Director
SEGES

”Vets in Piglet Vitality “ Congress, Düsseldorf

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What is zinc?

Mineral zinc

- Zinc is a mineral that is vital to pigs' normal growth
- Maximum allowed inclusion according to feedstuff legislation is 150 ppm in feed for weaned pigs

Medicinal zinc

- For control of *E.coli* diarrhoea in weaned pigs
- Max 2,500 ppm in pig feed for max 14 days post-weaning
- Requires prescription

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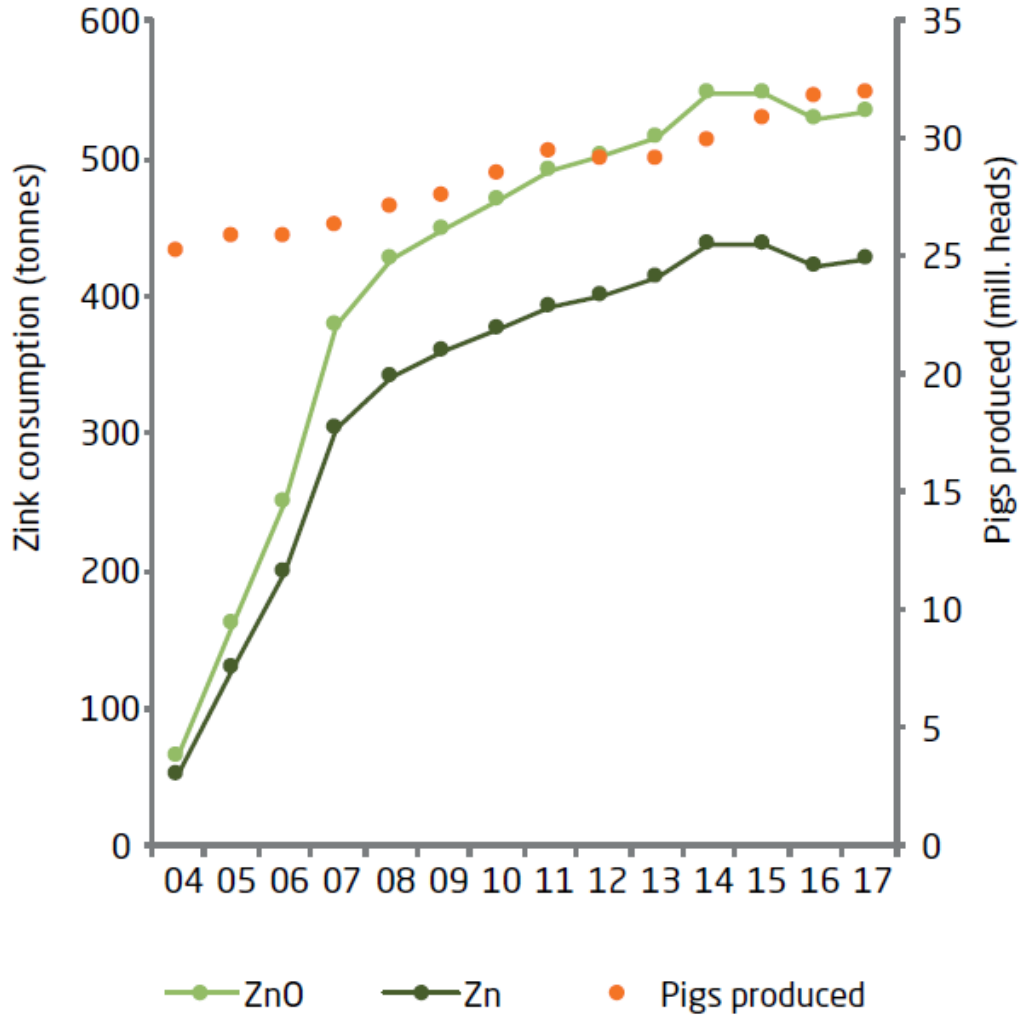
Medicinal use of zinc in Danish pig production

- Commonly used in weaner diets since the early 1990s
- 2004: Magistral ZnO allowed to control PWD – Max. level 2,500 ppm Zn, prescription required
- 2011: First registered ZnO product marketed
- 2014: Two additional ZnO products marketed
- June 2022: All marketed ZnO products will be withdrawn

Figure 4.6 Consumption (tonnes) of zinc oxide (ZnO) and zinc (Zn) in the pig production, Denmark DANMAP 2017



Action plan – phasing out medicinal zinc in Danish pig production

Goal

1. No negative effect on animal welfare – increased disease frequency
2. Maintaining a low and prudent antibiotic usage
3. Minimal negative effect on productivity and mortality

Action points

1. Research and development – multiple disciplines and collaborators
2. Communication focus – new knowledge needs to be implemented in the field
3. International focus – an urgent issue for all EU member states

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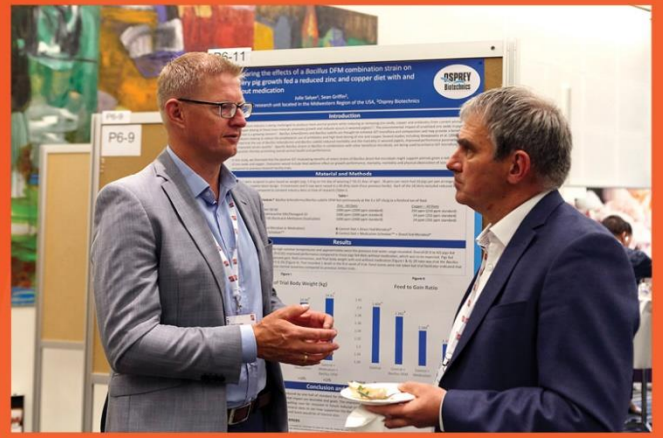
ZERO ZINC SUMMIT I BILLEDER

FOTOS: PETER PRIK LARSEN



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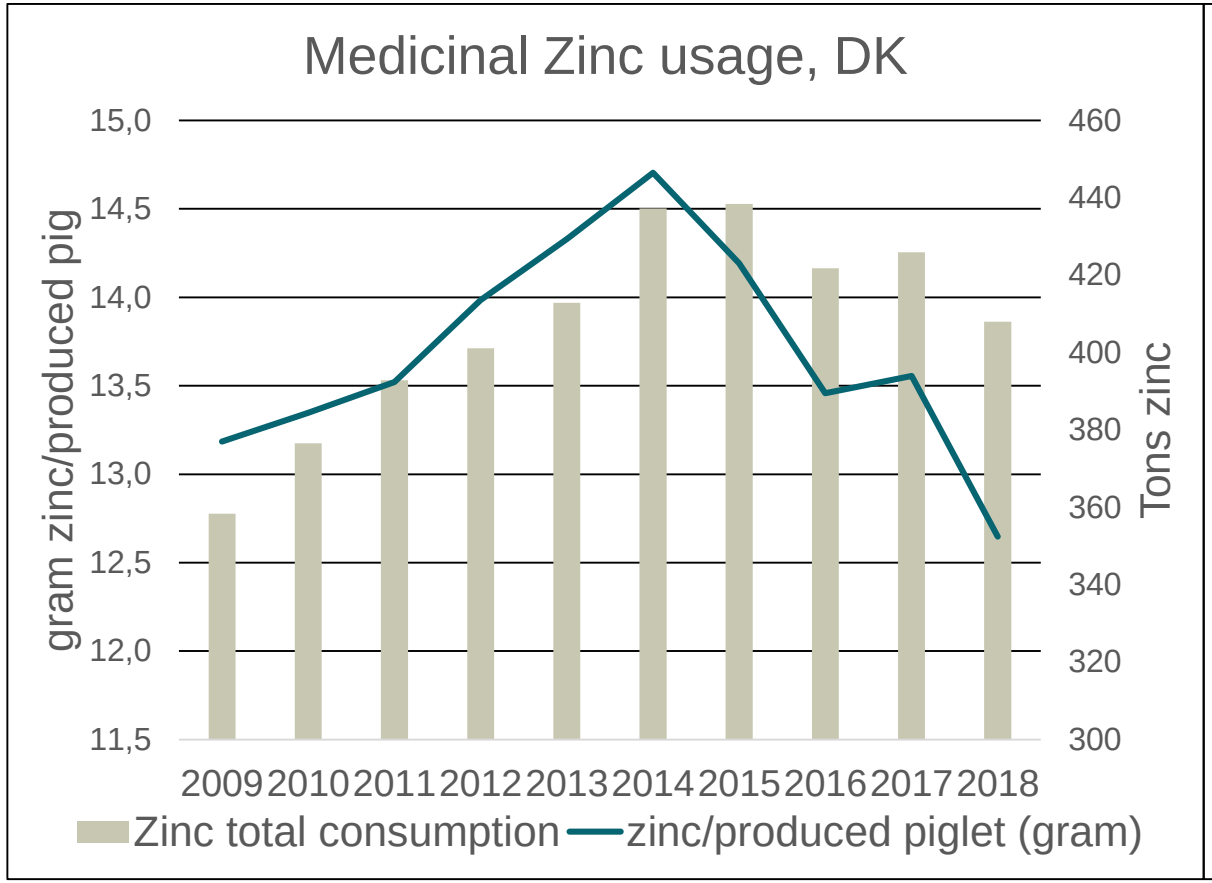
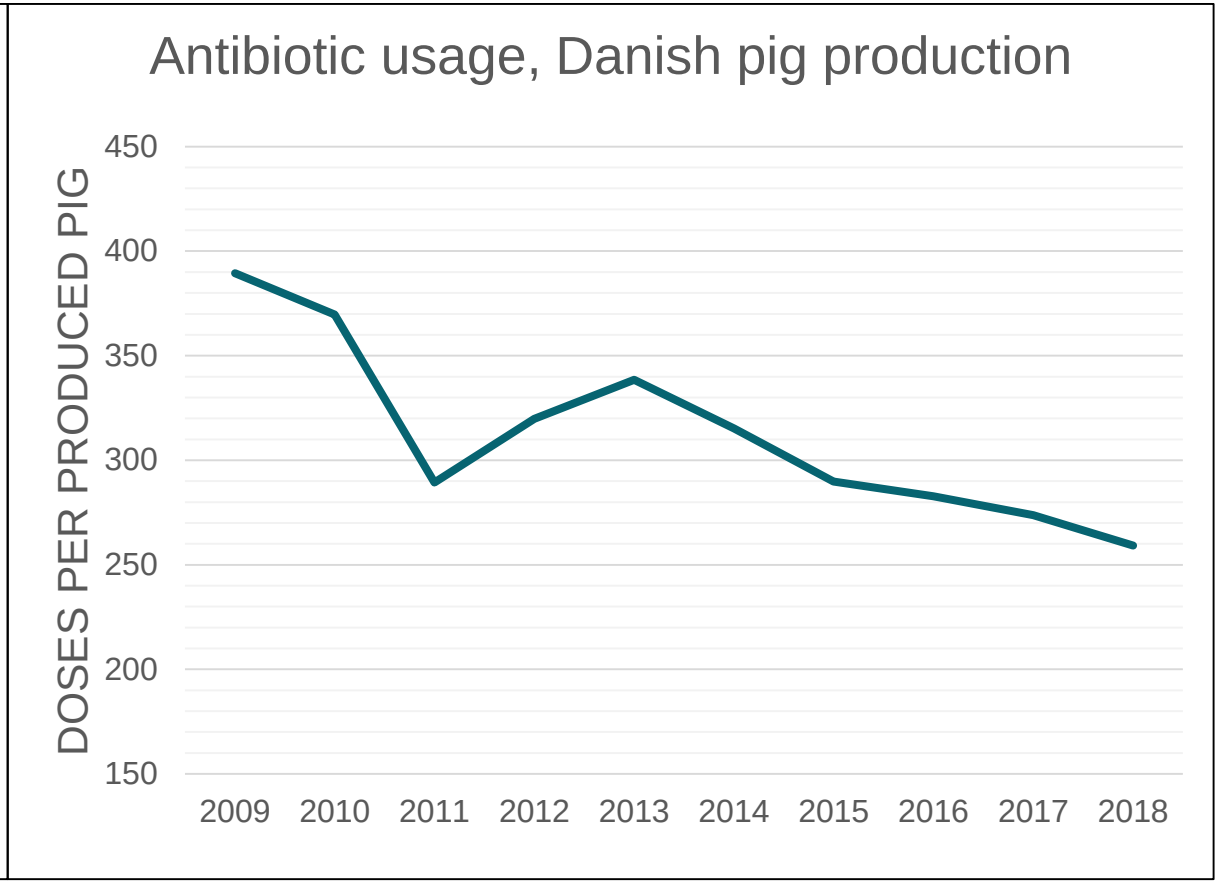
In recent years – reduction in zinc and antibiotic usage





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Reduction driven by reduced dose of medicinal zinc in piglet diets

SEGES trial report no. 1101(2017):

2,500 ppm → 1,500 ppm zinc = same productivity and AB usage

Implemented on many Danish pig farms resulting in a reduction in the national use of zinc oxide*

Few farms have fully phased out the use of medicinal zinc

*Based on questionnaire answers and reports from the field veterinarians

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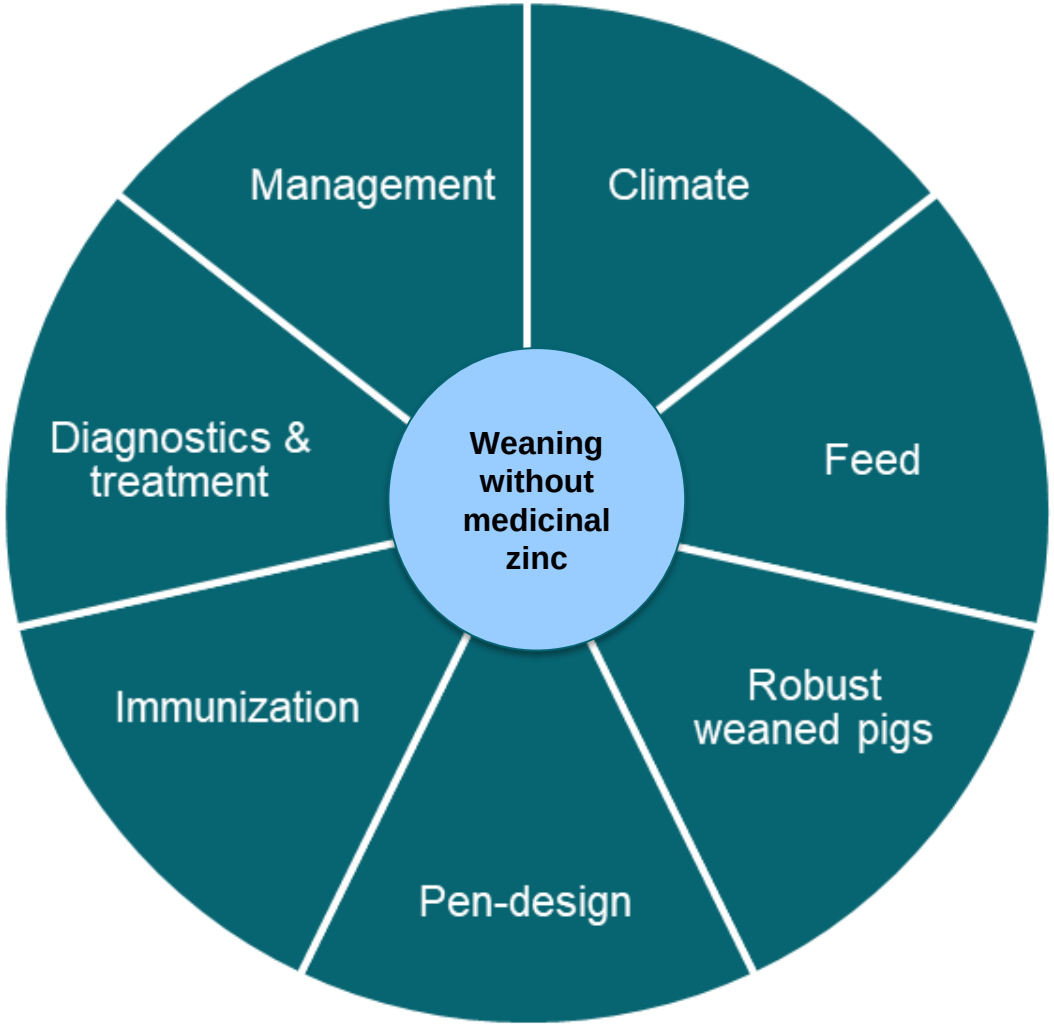
Weaning without zinc oxide:
- multifactorial and complex



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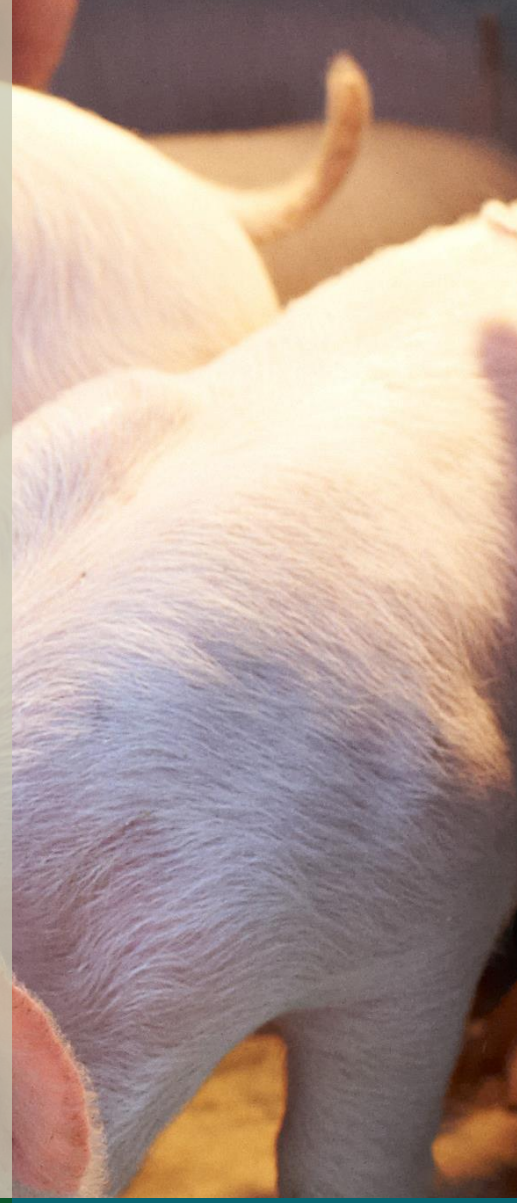
Feeding strategies as measures to prevent diarrhoea



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Feeding: The best ”tools” in the box

- Robust weaned pigs – sow feeding ➡ high milk yield
- Supply of feed in the farrowing pen
- Restricted feeding post-weaning
- Low protein
- Low calcium
- Feed ingredients
- Additives

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Alternatives to zinc oxide for piglets

1. 2,500 ppm zinc
2. 1,500 ppm zinc
3. 0 zinc
4. Seaweed from Ocean Harvest, Ireland
5. ‘MiyaGold’ from Huvepharma
6. ‘GærPlus’ from Danish Agro

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Trial design (60 replicates, 4,200 piglets)

Group	1	2	3	4	5	6
Name	Positive control		Negative control	Seaweed product	Probiotic	Yeast product
Diet 1 (7-9 kg)	2,500 Zn*	1,500 Zn*	0 Zn*	1.5% OceanFeed Swine	2 kg/tonne MiyaGold	0.5 kg/tonne GærPlus
Diet 2 (9-15 kg)	0 Zn*	0 Zn*	0 Zn*	1.5% OceanFeed Swine	1 kg/tonne MiyaGold	0.5 kg/tonne GærPlus
Diet 3 (15-30 kg)	0 Zn*	0 Zn*	0 Zn*	1.5% OceanFeed Swine	0.5 kg/tonne MiyaGold	0.25 kg/tonne GærPlus

*Zn = the level of medicinal zinc added

Trial report 1101, 2017

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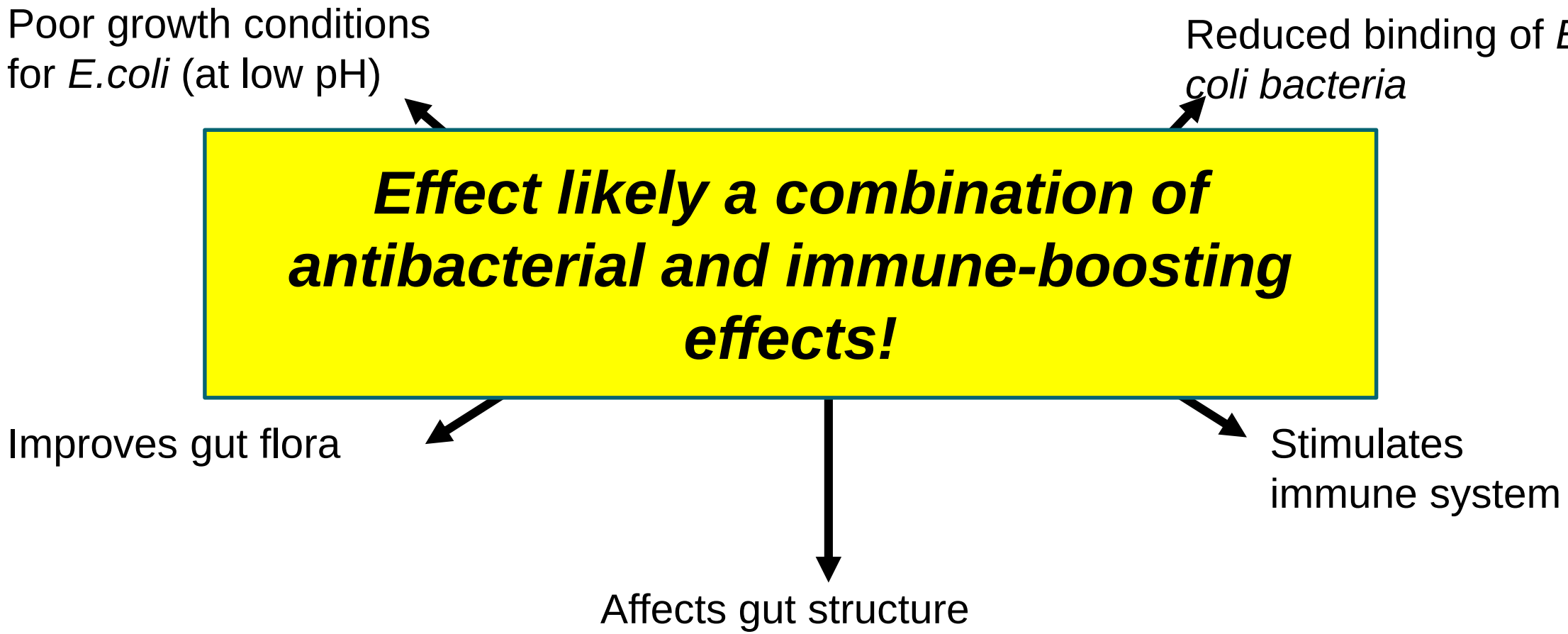
Conclusion

- 2,500 and 1,500 ppm medicinal zinc identical effect on productivity and treatments for diarrhoea
- 0 ppm medicinal zinc identical with the three alternative products

- No Silver Bullet

ZZS 2019: Additives - a strategy to optimise gastric health



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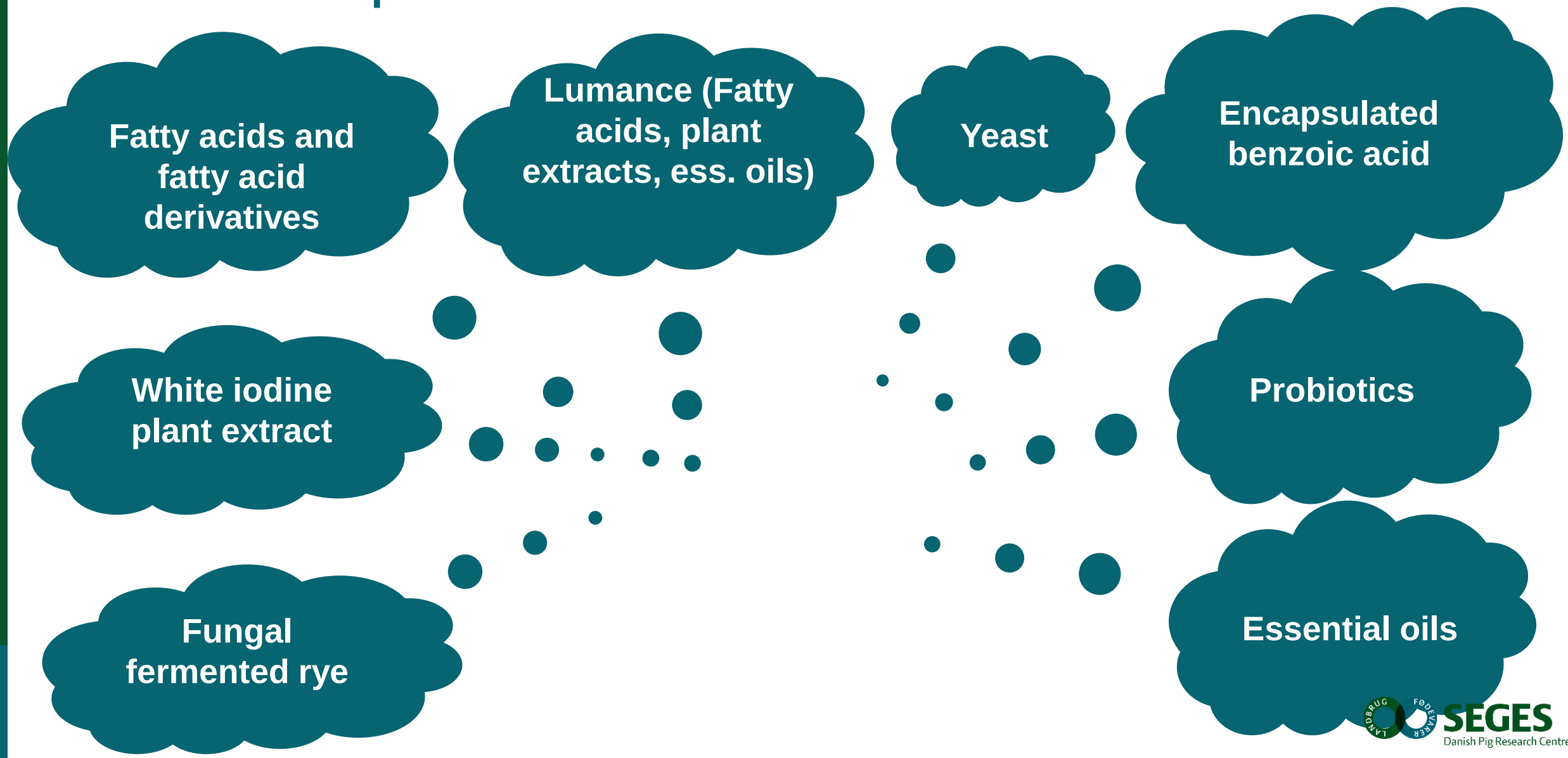
ZZS 2019: Multiple additives have been tested ….



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ZZS 2019: Additives: Points of attention?

- The effect (productivity, antiinflammatory or diarrhoea)?

Feed additives are often expensive - be critical of choice and effect!

In many cases, some effect on productivity

- But the effect is often poorly documented in terms of health and diarrhoea!

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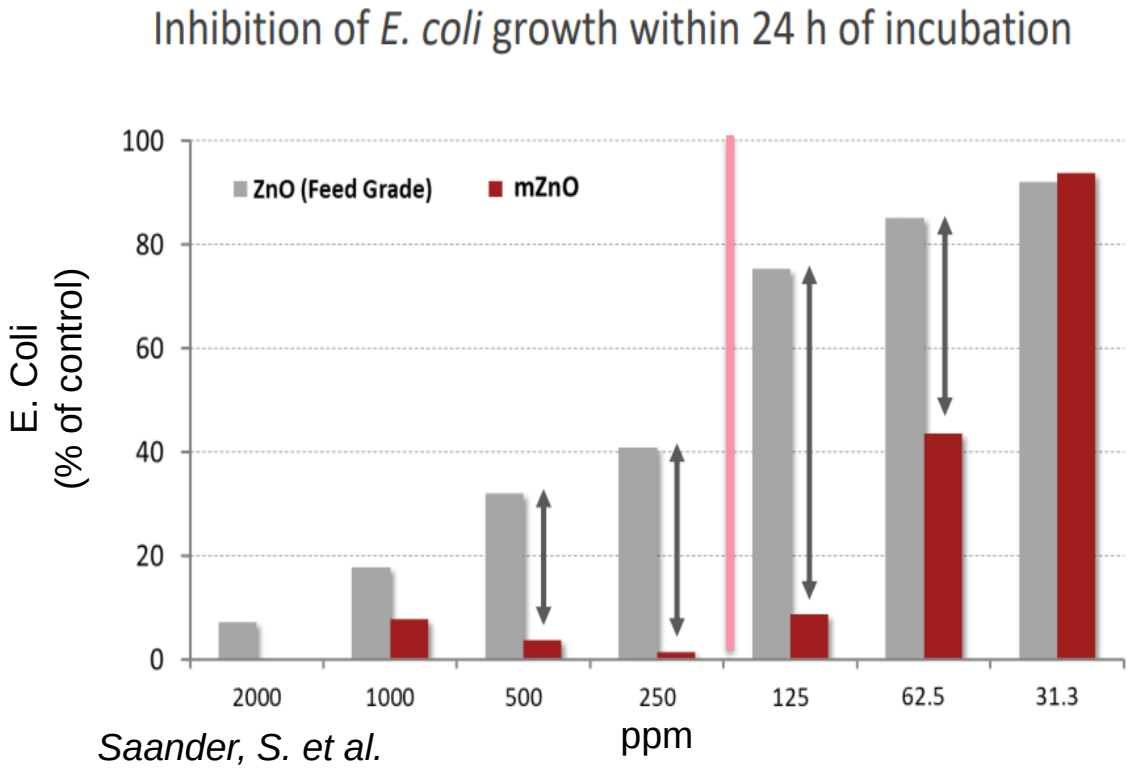
ZZS 2019: The most promising additives

Micronized ZnO



Saander, S. et al.
H. Wilhelm Schaumann GmbH

Product	Productivity	Diarrhoea
Lumance® (Fatty acids, plant extract, ess. oils)	↑	↓
Provenia CF-Z (Encapsulated Benzoic acid)	↑	↓

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SEGES Concept trial:
The four selected concepts

	FraMelco	Trouw Nutrition	Evonik	Vitfoss
Reduced protein		x	x	x
Increased threonine/lysine		x	x	x
Monoglycerides	x			x
Organic acids	x	x	x	x
Probiotics		x	x	x
Fibre		x	x	x
Additional enzymes		x		x
Chelated minerals				x
Addition to drinking water		x	x	

Control diets, ingredients

Ingredients, %	Diet 1	Diet 2	Diet 3
Wheat	51	53	47
Barley	23	21	21
Soy prot. conc	13	6.7	2.7
Soybean meal		8	22
Potato protein	3	3.5	
Fish meal	2.8	1	
Protein, %	19.4	18.6	18.6

No organic acids, no probiotics

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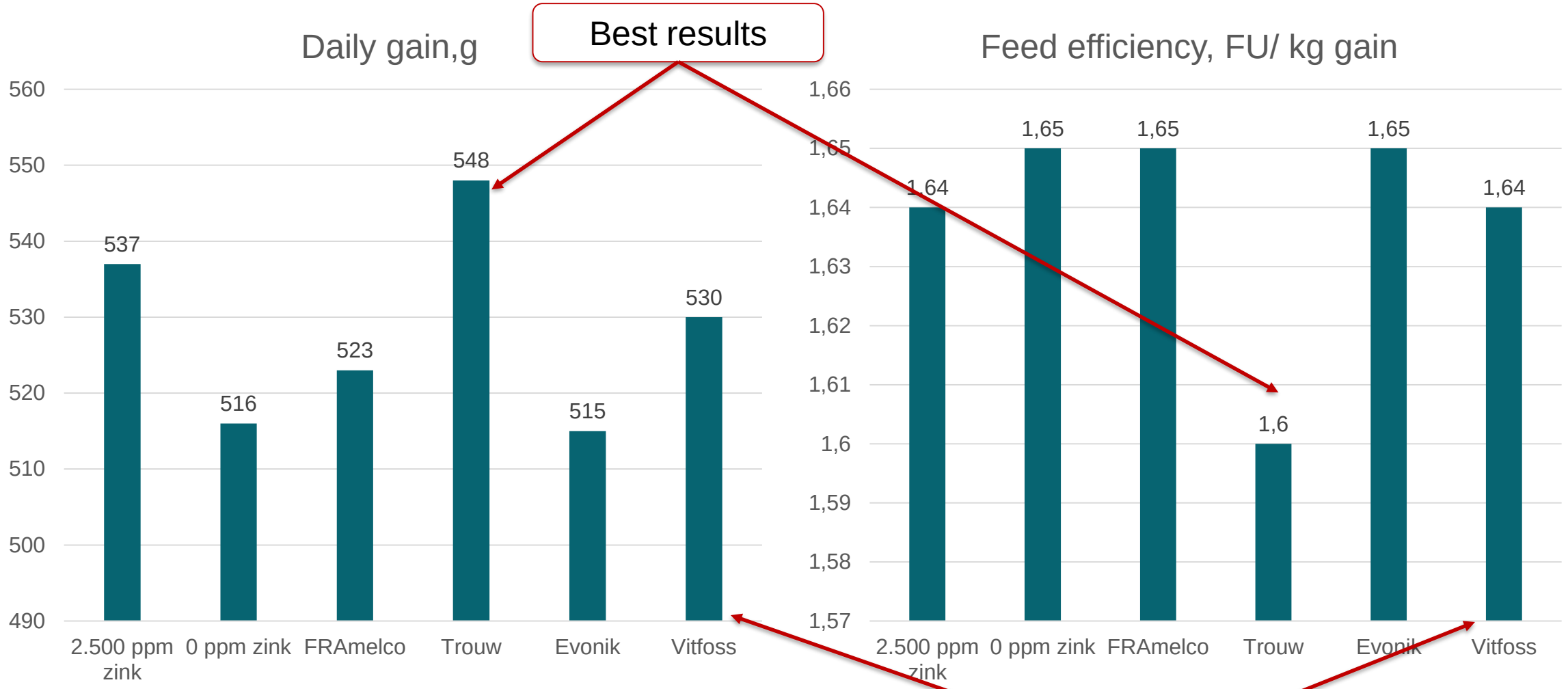
Trial design (63 replicates, 4,200 pigs)

	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6
	Positive control	Negative control	FraMelco	Trouw Nutrition	Evonik	Vitfoss
ppm Zn	2,500 Zn	0	0	0	0	0
7-9 kg, diet 1	2,500 Zn	0	0.4% LAC 34 0.4% C12 Dry	5% Nucleo 20% Vario	0.12% CreAmino	30% Mix 1
9-15 kg, diet 2	0	0	0.3% LAC 34 0.3% C12 Dry	5% Nucleo 8% Vario	0.12% CreAmino	17% Mix 2
15-30 kg, diet 3	0	0	0.2% LAC 34 0.2% C12 Dry	5% Nucleo	0.12% CreAmino	7.1% Mix 3
In drinking water				Selko 1.5 L/1000 L	Fecinor 50 g/1000 L	

Production results 7-30 kg



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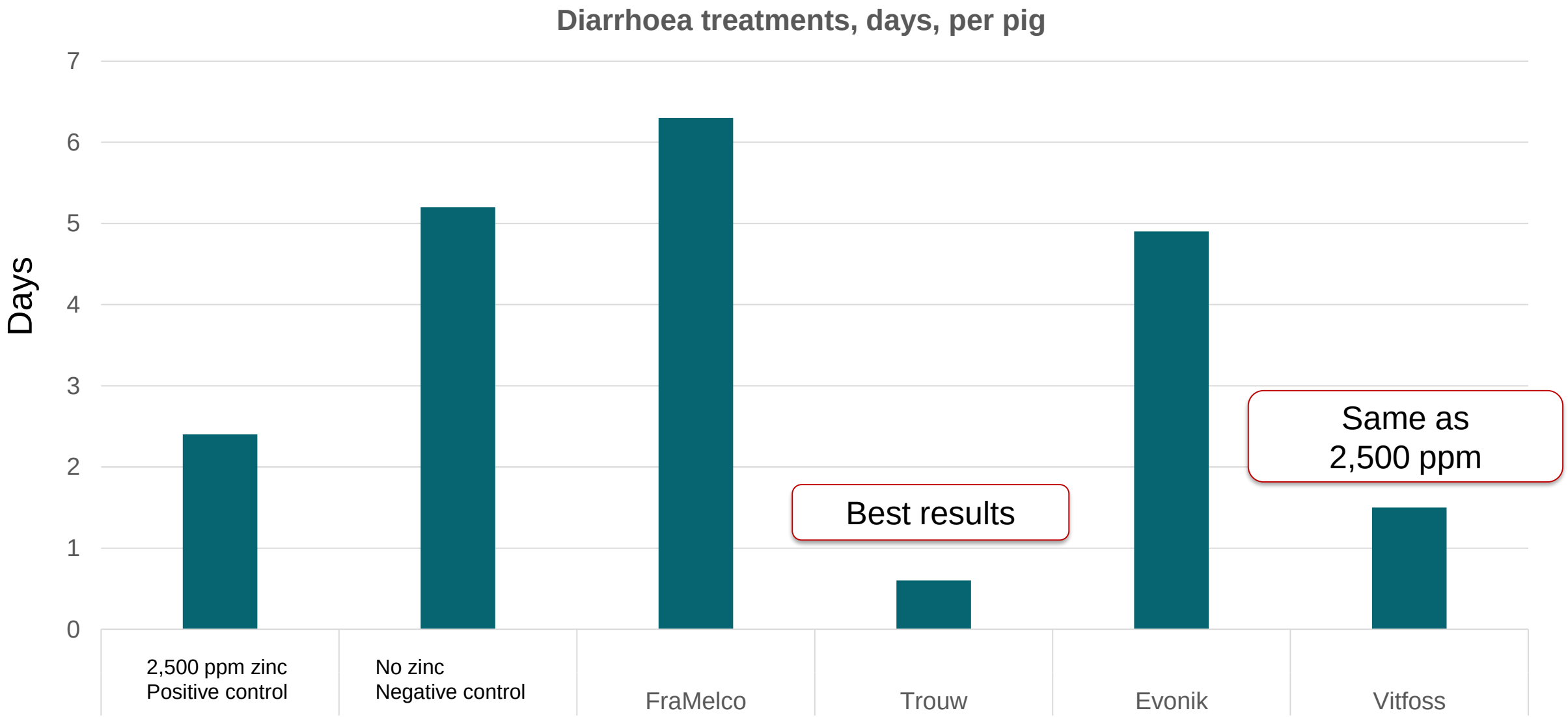
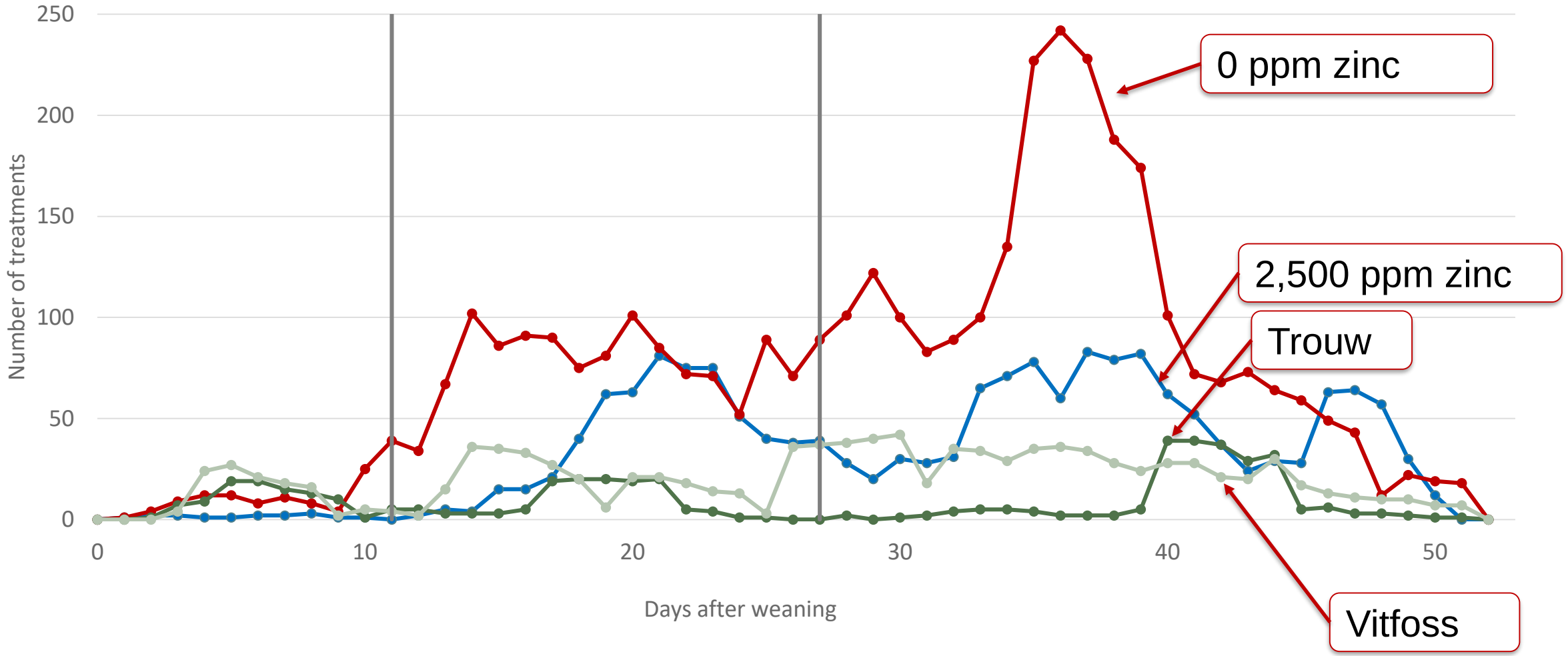
Diarrhoea treatments, days, 7-30 kg



Total number of diarrhoea treatments, 7-30 kg



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Costs of the concepts

	2,500 Zn	0 Zn	FraMelco	Trouw Nutrition	Evonik	Vitfoss
G/day	537[a]	516[b]	523[b]	548[b]	515[b]	530[a]
FU/kg gain	1.64[a]	1.65[a]	1.65[a]	1.60[b]	1.65[a]	1.64[a]
Production value/pig/day Index	**100[a]**	96[b]	97[b]	104[b]	96[b]	99[a]
Diff. Euro/pig	-	-0.26	-0.12	+0.33	-0.26	+0.03
Price diff. feed, Euro/pig	**-**	**-0.13**	**+0.58**	**+1.49**	**+2.30**	**+0.93**

Red: worse than 2500 Zn
Green: better than 0 Zn

*1 FU = 8.8 MJ NE or 12.2 MJ DE

Trial report 1147, 2018

SEGES Danish Pig Research Centre

Conclusion

- Removal of zinc oxide from the feed lowered production value by **approx. € 0.26 per pig**

Effect on productivity or treatments for diarrhoea:

- Trouw Nutrition concept better than zinc oxide, but cost net **approx. € 1.1 per pig**
- Vitfoss concept level with zinc oxide, but cost net **approx. € 0.9 per pig**
- Remaining two concepts (FraMelco and Evonik) not different from the group given ***no*** zinc oxide

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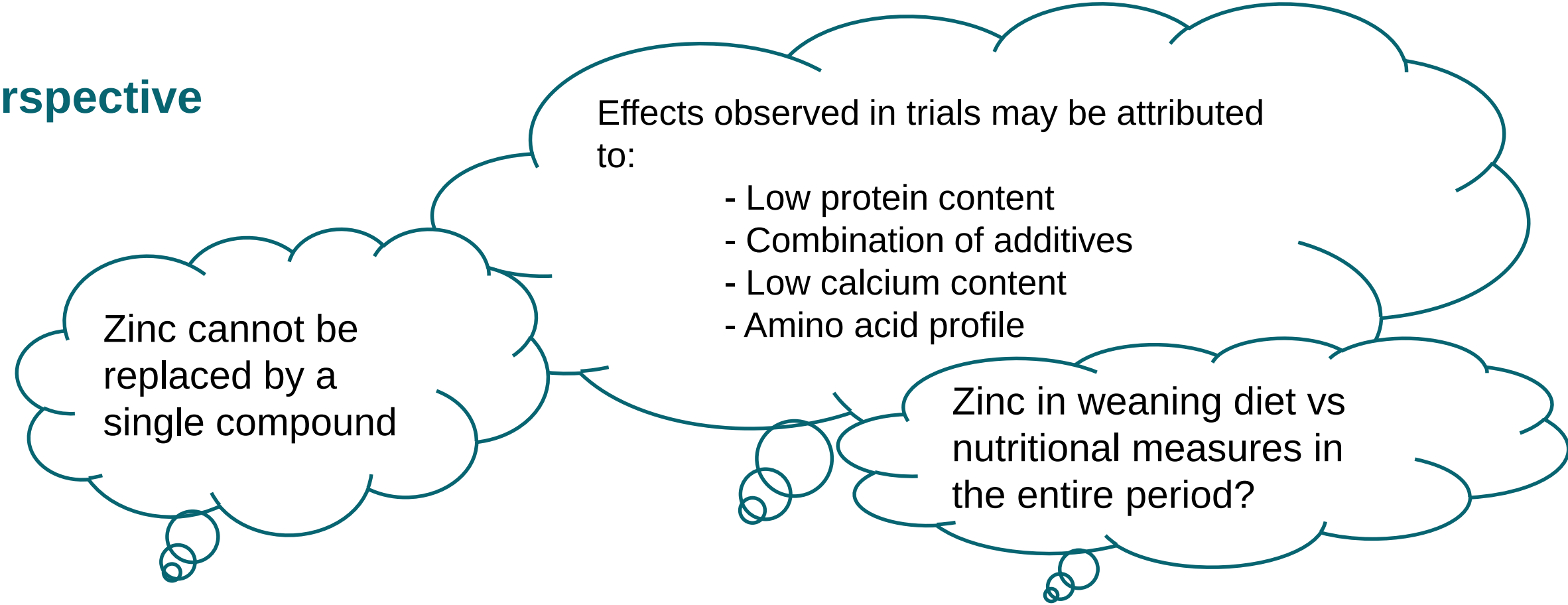
Perspective



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Reduced protein, why ?

- Reduce amount of undigested protein in the hindgut
  - To reduce risk of osmotic diarrhoea
  - To prevent protein fermentation
    - Reduce microbial metabolites (NH3, amines) which damage colonic epithelium, interrupt mucosal function and structure, and increase villous atrophy
  - To reduce colonisation of E.coli

- But also adverse effect on productivity

Reduced protein as an alternative to medicinal zinc: Aim of the study

- **Four strategies for reducing protein post-weaning compared with positive (2,500 ppm Zn) and negative (0 Zn) control groups**

- **Hypotheses:**
  - **Medicinal zinc reduces diarrhoea treatment days by 35% compared to no zinc**
  - **Reduced protein same effect - but**
    - **Negative effect on daily gain (6-30 kg)**

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Trial design

- 6 treatment groups
- Approx. 75 replicates (pens) per treatment group
- 6,800 piglets age 25-27 days, weight 5.5-9.0 kg
- Experimental herd
- DanBred pigs
- Pelleted feed

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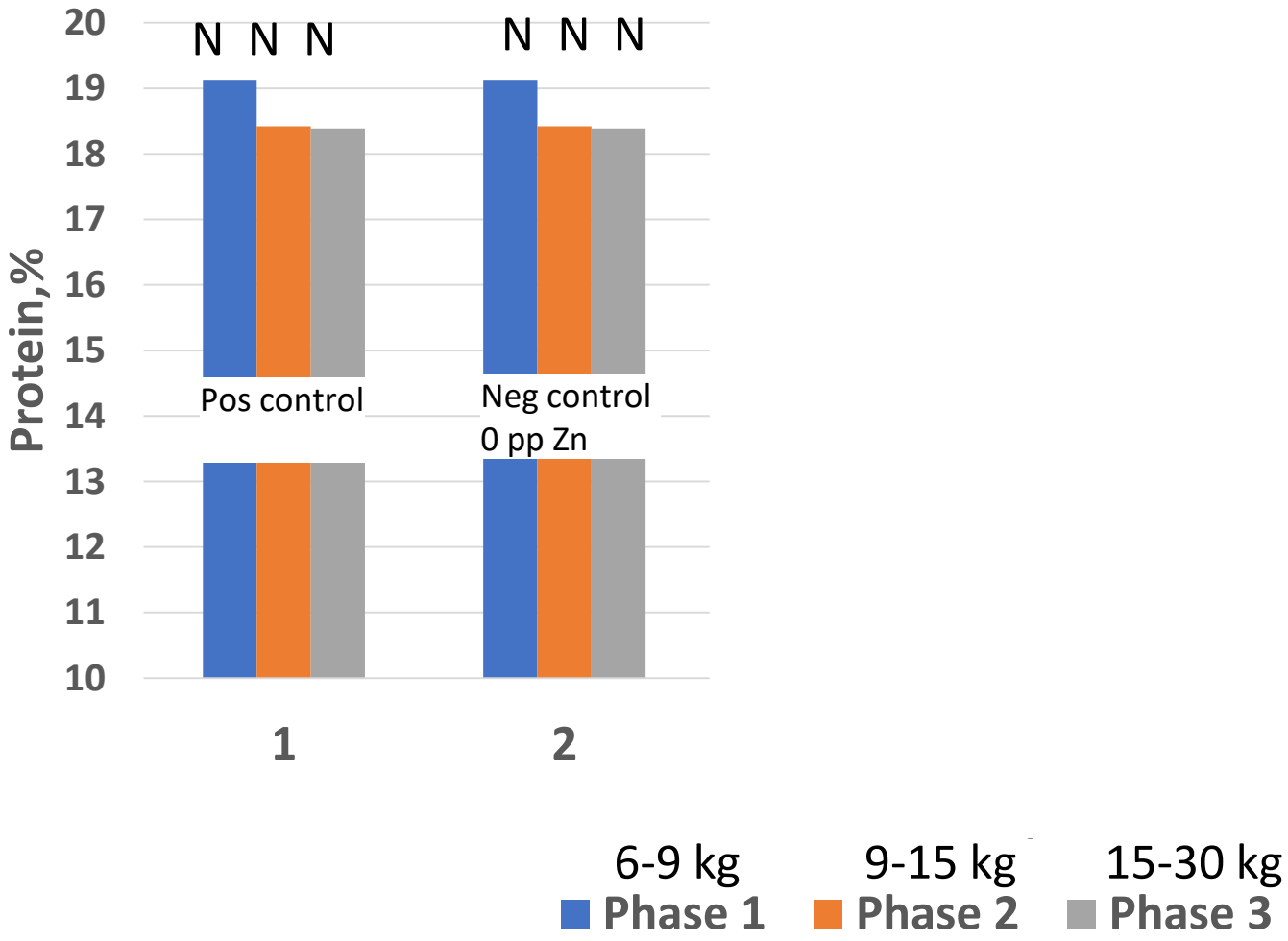
Trial design



N=norm, L=low, H=high, VL=very low, M=middle

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Feed composition

- **Same level of soybean meal in all groups in each phase**
  - **Phase 1 (6-9 kg): 7%**
  - **Phase 2 (9-15 kg): 14%**
  - **Phase 3 (15-30 kg): 21%**

  - **Reduction of protein in the diet**
    - **Reducing soy protein concentrate, potato protein and fish meal**

Results: Diarrhoea treatments, days, 6-30 kg

Group	1 NNN + Zn	2 NNN	3 LNN	4 LLH	5 VLHH	6 VLMH
Treatments, days per pig						
Total, 6-30 kg	2.08^{b}	4.19^{a}				
Phase 1, 6-9 kg						
Phase 2, 9-15 kg	1.57	**2.83**				
Phase 3, 15-30 kg	0.47	**1.11**				

Difference groups 2 and 1:
+2 treatment days = 50%

N=norm, L=low, VL=very low, H=high, M=middle

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Results: Diarrhoea treatments, days, 6-30 kg

Group	1 NNN + Zn	2 NNN	3 LNN	4 LLH	5 VLHH	6 VLMH
Treatments, days per pig						
Total, 6-30 kg	2.08^{b}	4.19^{a}	3.75^{a}	3.10^{b}	3.68^{a}	3.24^{a}
Phase 1, 6-9 kg	0.04				0.11	0.17
Phase 2, 9-15 kg	1.57	**2.83**	2.39	1.77	2.10	1.65
Phase 3, 15-30 kg	0.47	**1.11**	1.31	1.20	1.47	1.42

Difference groups 2 and 4:
1 treatment day= 25%

N=norm, L=low, VL=very low, H=high, M=middle

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Production results, 6-9 kg (6,800 piglets)

Group	1 N+Zn	2 N	3 L	4 L	5 VL	6 VL
Daily gain, g/day	184[a]	**184[a]**				
Feed conversion, Kg feed/kg gain	1.20[a]	**1.21[a]**				

N=norm, L=low, VL=very low

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Production results, 6-9 kg (6,800 piglets)

Group	1 N+Zn	2 N	3 L	4 L	5 VL	6 VL
Daily gain, g/day	184[a]	**184[a]**	177[a]	173[a]		
Feed conversion, Kg feed/kg gain	1.20[a]	**1.21[a]**	**1.28[b]**	**1.32[b]**		

N=norm, L=low, VL=very low

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Production results, 6-9 kg (6,800 piglets)

Group	1 N+Zn	2 N	3 L	4 L	5 VL	6 VL
Daily gain, g/day	184^{a}	**184^{a}**	177^{a}	173^{a}	**148^{b}**	**143^{b}**
Feed conversion, Kg feed/kg gain	1.20^{a}	**1.21^{a}**	1.28^{b}	1.32^{b}	**1.43^{c}**	**1.47^{c}**

N=norm, L=low, VL=very low

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Production results, 6-30 kg (6,800 piglets)

Group	1 NNN+Zn	2 NNN	3 LNN	4 LLH	5 VLHH	6 VLMH
Daily gain, g/day	520[a]	**519[a]**				
Feed conversion, Kg feed/kg gain	1.43[a]	**1.44[a]**				

N=norm, L=low, VL=very low, H=high, M=middle

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Production results, 6-30 kg (6,800 piglets)

Group	1 NNN+Zn	2 NNN	3 LNN	4 LLH	5 VLHH	6 VLMH
Daily gain, g/day	520[a]	**519[a]**	516[ab]	**504[b]**		
Feed conversion, Kg feed/kg gain	1.43[a]	**1.44[a]**	1.44[a]	1.44[a]		

N=norm, L=low, VL=very low, H=high, M=middle

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Production results, 6-30 kg (6,800 piglets)

Group	1 NNN+Zn	2 NNN	3 LNN	4 LLH	5 VLHH	6 VLMH
Daily gain, g/day	520^{a}	**519^{a}**	516^{ab}	**504^{b}**	517^{ab}	**504^{b}**
Feed conversion, Kg feed/kg gain	1.43^{a}	**1.44^{a}**	1.44^{a}	1.44^{a}	1.40^{b}	1.42^{ab}

N=norm, L=low, VL=very low, H=high, M=middle

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What did we find?

- **The best strategy: Low Low High**
  - **25% drop in treatment days (hypothesis: 35%)**

- **Daily gain reduced by 15 g/day**

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Why not greater effect on diarrhoea with low protein?

Our protein levels (6-9 kg): 19%, 16.5% and 14%, respectively

Other trials:

- **Yue et al (2008): Sign. effect from 23-19%, NS 19-17%**
- **Heo et al. (2010): Sign. effect from 25-19%**
- **Halas et al. (2007): Sign. effect from 24-18 %**
- **Kim et al. (2011): Sign. effect from 23-18.5%**
- **SEGES (2006): Sign. effect from 21-18%**
- **SEGES (2017): Sign. effect from 21-18%**

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Conclusion

- **Medicinal zinc diarrhoea treatment days reduced by 50% compared with no zinc**
- **Low protein reduced diarrhoea treatment days by 25%**
  - **But zinc is better**
- **Low protein = low productivity**
  - **Partially compensated by subsequent high protein**
- **Reduced protein plays a role in the solution**
- **New SEGES recommendation: 17.5% protein in phases 1 and 2**

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Field experiences:
Weaning without medicinal zinc oxide

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Danish field experiences

Purpose:
Identify common features in weaner herds with no use of medicinal zinc

- Farms recruited mainly through network of field veterinarians
- Farm owners were interviewed:
  - Management, herd health, feed, hygiene, personnel, etc.

- **Additional information**:
  - Antibiotic usage – Vetstat
  - Feed recipes – piglet diets
  - Productivity reports
  - Vaccination schemes

Results, Danish field experiences

Herd description 26 weaner herds (600,000 weaners/year)	
Production scope	**1,650-80,000** weaners per herd
Avg. lactation period	**29.4** days
Weaning weight	**5.5-8.5** kg
Avg. daily weight gain, 7-30 kg	**462** g (nat. avg. 2018 = 462 g)
Avg. weaner mortality	**2.1%** (nat. avg. 2018 = 3.1%)

23/26 farms have weaned pigs without medicinal zinc for more than a year

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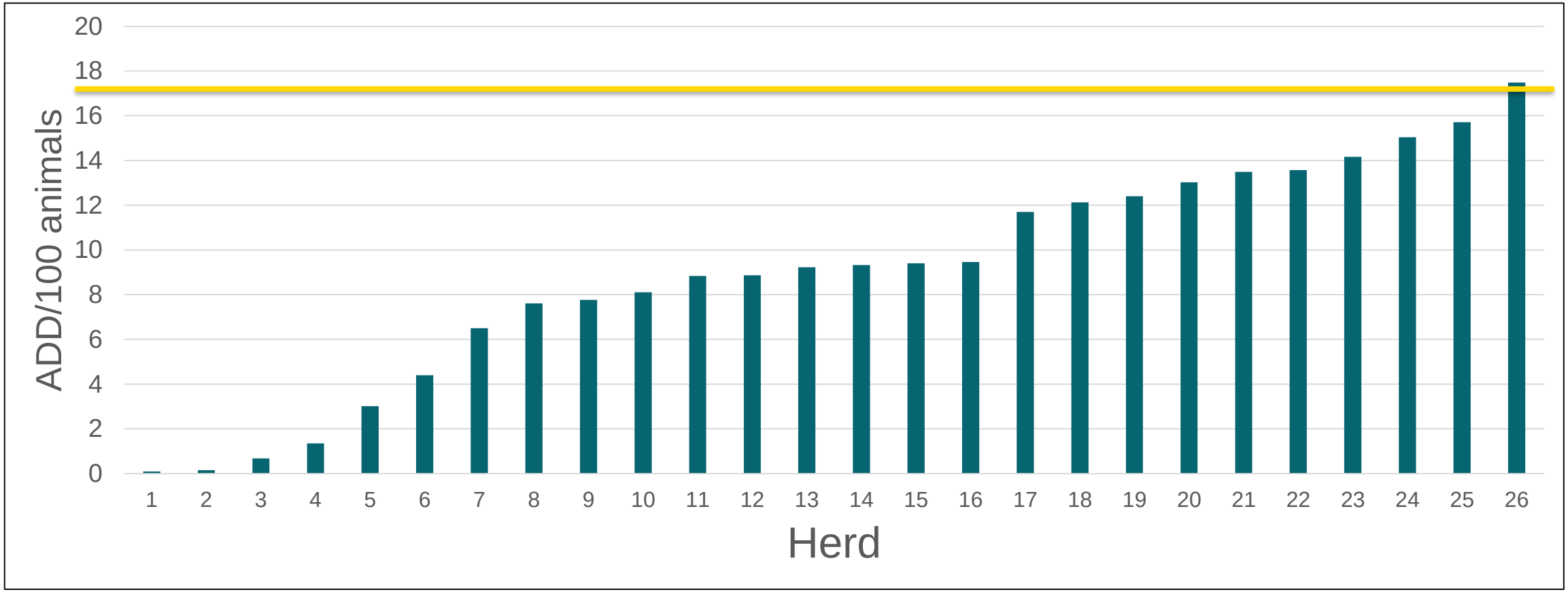
Antibiotic use, in herds weaning without use of medicinal ZnO



Nat. avg. 2018, weaners = Approx. 10 ADD/100 animals
15/26 herds, pen level treatment the first 14 days post-weaning

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Common approaches – Protein/lysine levels

Protein/lysine levels, piglet diets	Min	Max	Average	Recommended levels
SID protein (g/FU)	113	146	135.6	144
SID Lysine (g/FU)	6.7	12	10.8	10.6
Crude protein (%)	14.8	20.5	18.8	



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Common approaches – Feed uptake

Special measures to increase feed intake after weaning	# farms
Extra feeding on the floor	10
Extra feeding spaces in troughs	5
Extra drinking spaces	4
Supply with milk products	3
Gruel feed	2
Other measures	2
No special measures	2

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Common approaches – Trained personnel

Employment period:
20/26 farms: Manager of piglets employed more than a year

Experience:
18/26 farms: Manager of piglets has worked with piglets for more than 3 years

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Summary

- The goal is cost-effective solutions without increasing antibiotic usage
- Not an easy task for the majority of Danish farms

- Zinc is still a common approach to control PWD in DK
- Zinc usage dropping – reduced doses is the main driver

- Farms without medicinal usage of zinc have:
  - Reduced protein levels in piglet diets
  - Focus on feed intake after weaning
  - Trained personnel with a longer employment period – stability

No common solutions
– each farmer needs to learn what works at his/her farm!

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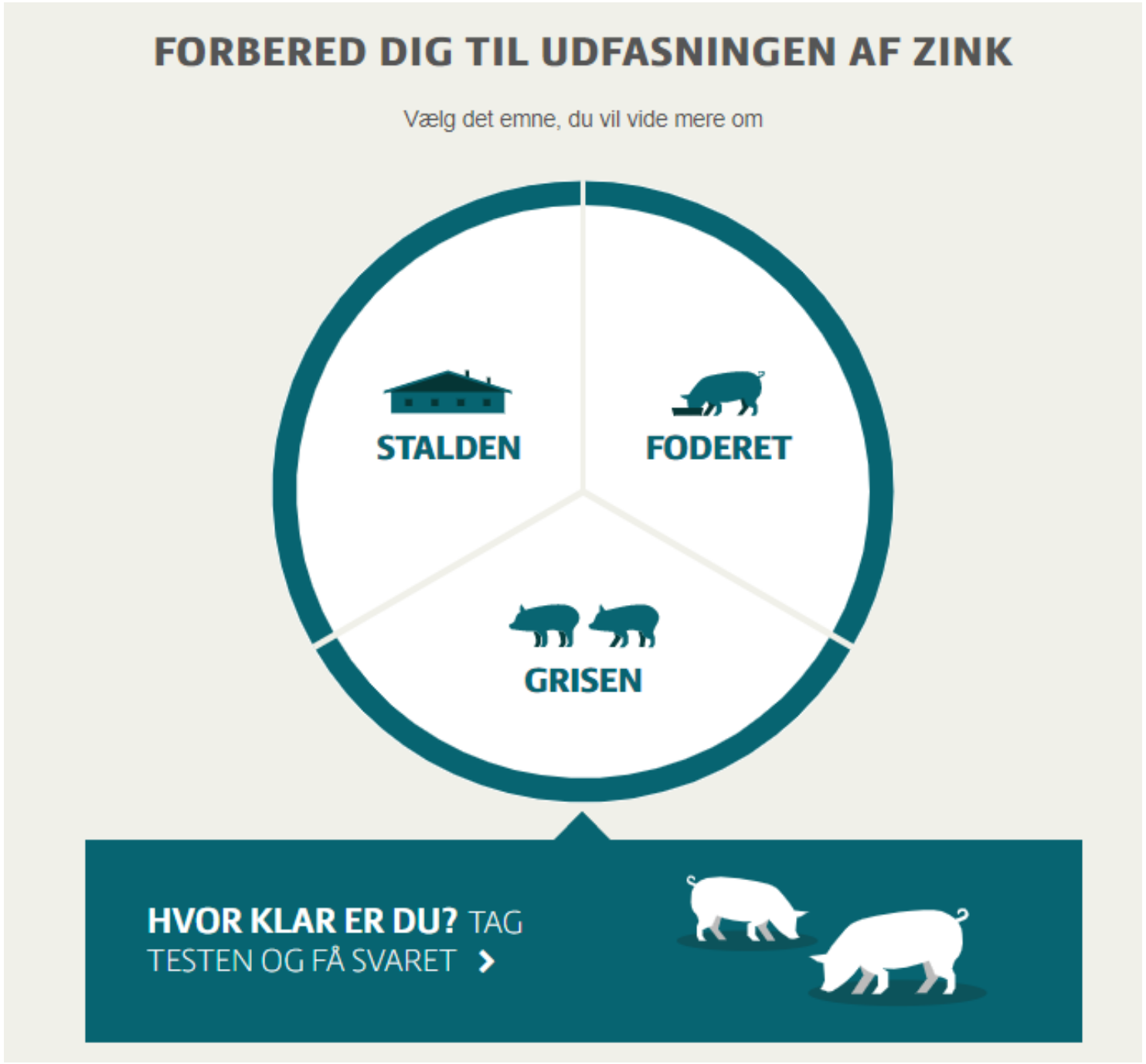

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