STUDIEGROEP DIER & KRUID – 4 JUNI 2019

ZEEWIER VOOR BIGGEN EN VLEESKUIKENS;

EEN NATUURLIJK INGREDIËNT IN ANTIBIOTICA VRIJE VOEDERS.

CATHARINA NIEUWENHUIZEN, BARENTZ ANIMAL NUTRITION

DIER & KRUID – 4 JUNI 2019

SEAWEED FOR PIGS AND POULTRY;

A NATURAL INGREDIENT IN ANTIBIOTIC FREE DIETS.

CATHARINA NIEUWENHUIZEN, BARENTZ ANIMAL NUTRITION

SHORT INTRODUCTION – COMPANY PROFILE

BARENTZ ANIMAL NUTRITION

OUR LIFE SCIENCES SALES DIVISIONS

BARENTZ FOOD & NUTRITION

400 Mln €
+ 10% growth yearly
160 Experts
> 8000 customers

BARENTZ ANIMAL NUTRITION

150 Mln €
+ 12% growth yearly
40 Experts
> 800 customers

BARENTZ PHARMACEUTICALS

215 Mln €
+ 15% growth yearly
65 Experts
> 3500 customers

BARENTZ PERSONAL CARE

45 Mln €
+15% growth yearly
40 Experts
> 2500 customers

Our Joint Ventures contribute an additional 290 Mln € to the Group's results

BARENTZ ANIMAL NUTRITION

OUR USP'S

1. We are **part of a leading global distributor** and are able to leverage our combined knowledge and supply chain networks to increase cost efficiency and sales effectivity

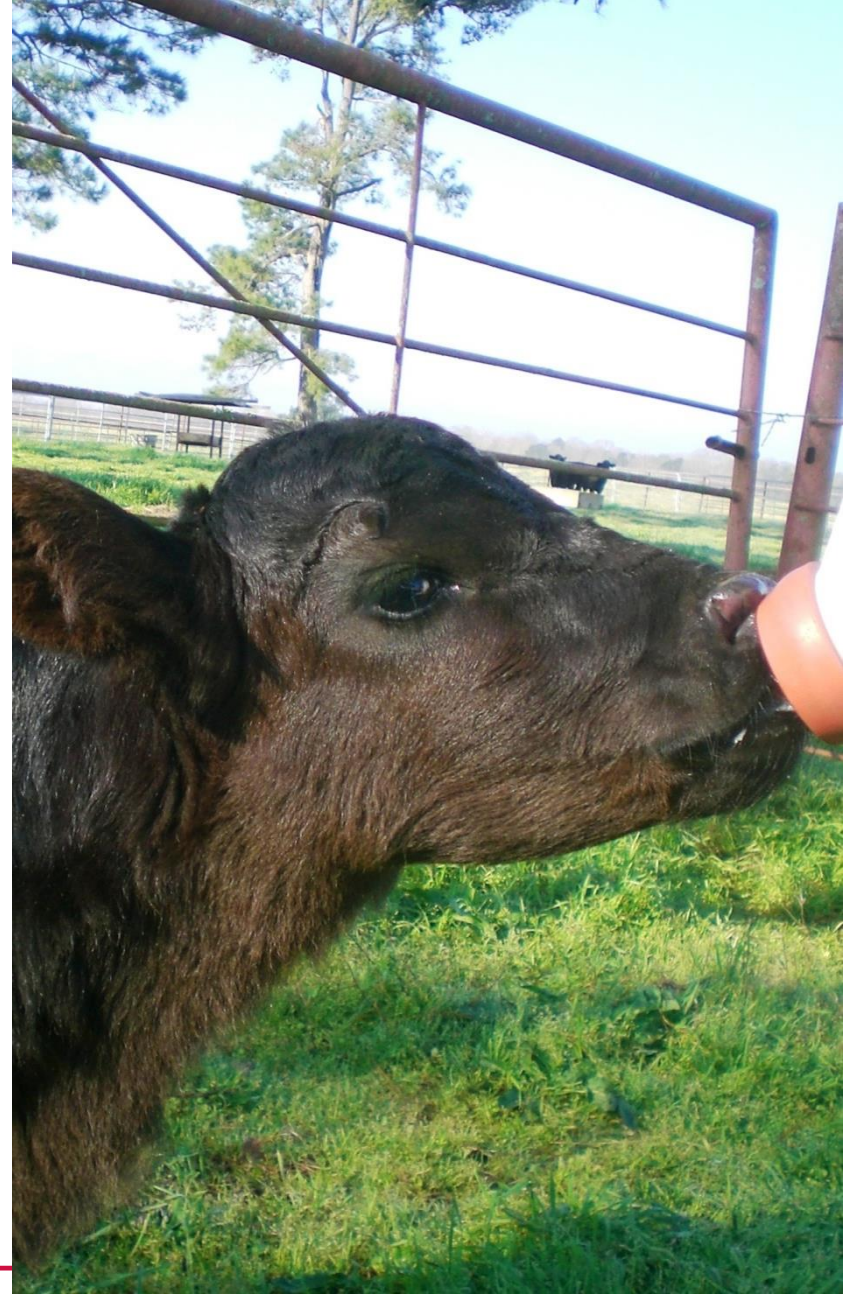
2. We serve **both animal feed customers and pet food producers** and are recognized for our **outstanding customer intimacy** serving them with a combined product offering complemented with technical assistance

3. We combine **commodities and single ingredients as well as technical products and customized solutions** in our portfolio, which aligns very well with our one-stop-shop approach

4. We are very **well positioned in Europe's biggest animal nutrition and pet food markets** and are strategically investing in unlocking new growth areas

PRODUCT PORTFOLIO FOCUS FUNCTIONAL & NUTRITIONAL

Proteins	• Strong partnerships for soy based • Other plant based, but also novel
Carbohydrates	• Long history with Roquette Freres • Other starches & derivatives
Amino Acids	• Long history and strong relationships • Not only trade, also distributor
Vitamins	• Very strong position in Chinese origin • Strategic for combined portfolio
Specialties	• Include yeasts, anti-oxidants, Sea Weed • Supported by own technical team



BARENTZ ANIMAL NUTRITION

BARENTZ DISTRIBUTOR FOR OCEAN HARVEST TECHNOLOGY

OCEAN HARVEST TECHNOLOGY

"We develop and scale unique feed ingredients from proprietary natural seaweed blends that provide the foundation of gut health and performance in our customer's animals."

- OHT was founded in 2005 in Ireland, where we still maintain blending, R&D, and order handling.
- Vietnam is main manufacturing hub linked closely with ops in the Philippines and Indonesia
- Commercial and technical management in UK.

OCEAN HARVEST TECHNOLOGY

- *Seaweeds blends* allow us to target specific performance and bioactivity while avoiding issues such as high levels of arsenic and iodine
- *Whole seaweeds* deliver tangible benefits with reduced processing and cost.
- *Unique supply chain* of critical seaweeds across the EU and South East Asia, at a *scale* that is relevant.
- Proprietary manufacturing allow us to create *unique product forms* including crumbles, pellets, and finely milled powders.
- Our team comprises *experts in both seaweed and animal nutrition*, giving us the ability to unlock value for our customers

Seaweed harvesting site Vietnam

TECHNICAL BACKGROUND

SEAWEED & SEAWEED BLENDS

SEAWEED

WHAT IS SEAWEED?

- Macro algae with bioactive components
- Unique Polysaccharides
  - Alginates, fucoidan, laminarin, ulvan, agar, carrageenan
- Specific protein, peptides and amino acids
- Antioxidants
- Long chain fatty acids / omega-3
- Rich in minerals, Vit E and C

SPECIES SEAWEED

CLASSIFIED INTO THREE GENERAL GROUPS

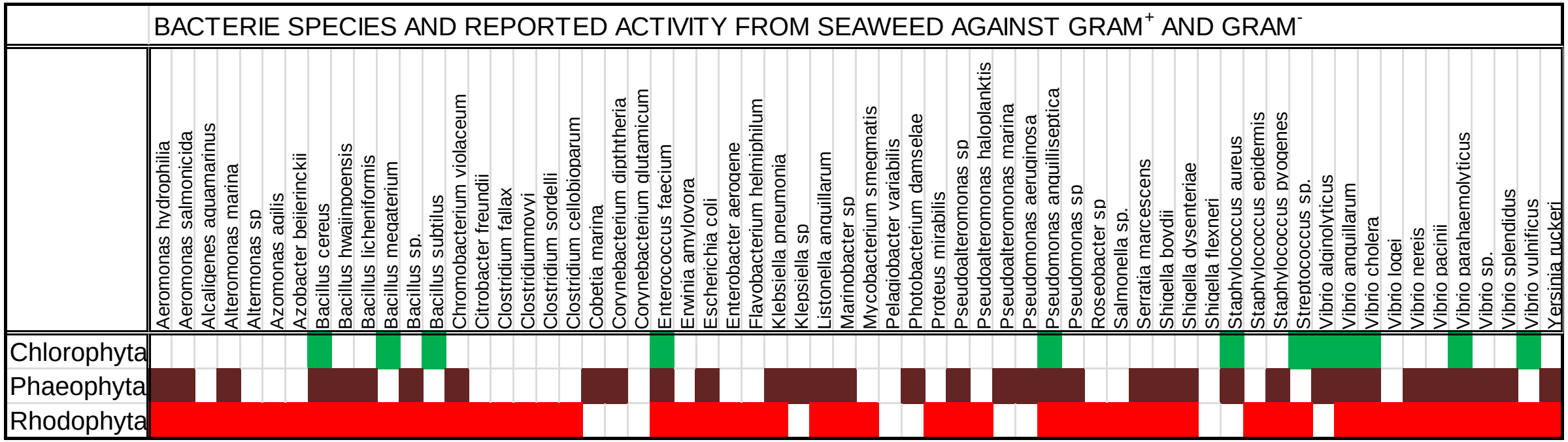
- **Brown** Seaweeds (~1800 species)
  - Generally the largest seaweeds, mostly marine
  - Includes kelps which can be several metres long
  - Examples: Sargassum, Ascophyllum, Fucus, Laminaria
- **Red** Seaweeds (~7000 species)
  - Mostly marine
  - Deeper in the ocean than brown seaweeds
  - Example: Gracilaria, Palmaria, Chrondrus
- **Green** seaweeds (>1500 species)
  - Marine or Fresh waters
  - Examples: Ulva, Codium

TYPICAL COMPOSITION & VARIATION OF SEAWEEDS

Component	Contents
Moisture	8 - 15 %
Ash	20 - 45 %
Carbohydrates	35 - 45 %
Lipids	0.25 - 5 %
Proteins	4 - 40 %
Fibre	3 - 7 %

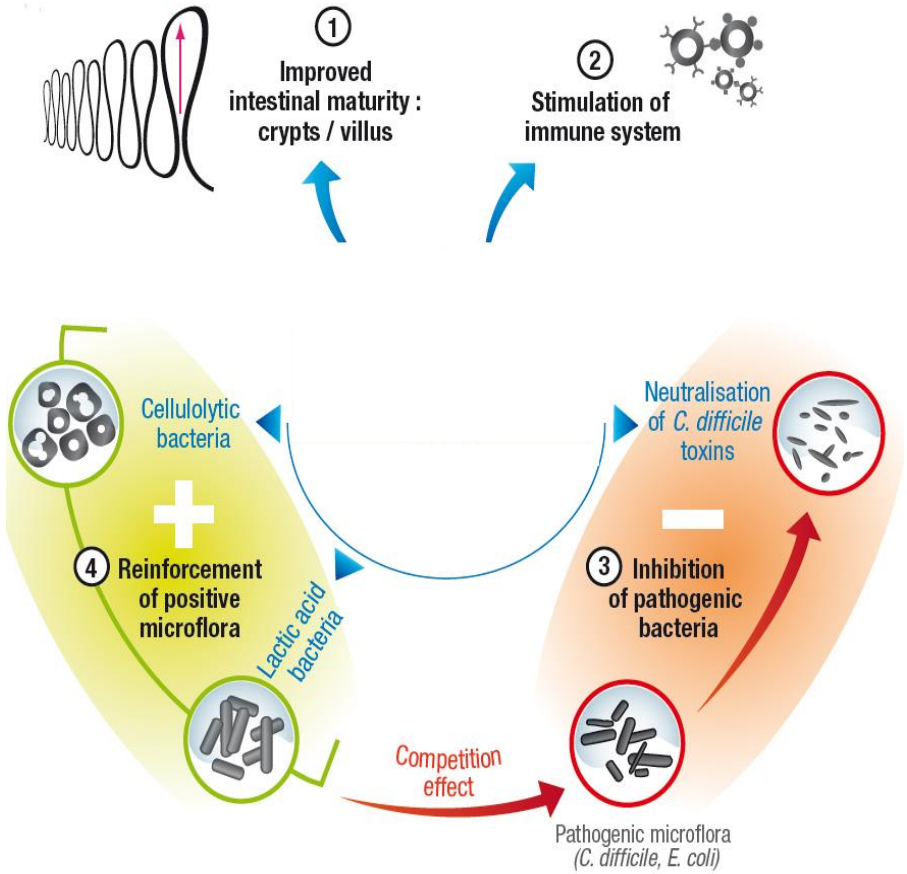
Component	Contents
Vitamin A	0.7 - 0.8 ppm
Vitamin C	500 - 1650 ppm
B-Carotene	35 - 80 ppm
Vitamin B1	1 - 5 ppm
Vitamin B2	5 - 10 ppm
Vitamin B3	10 - 30 ppm
Vitamin B6	0.1 - 0.5 ppm
Vitamin B12	0.8 - 3 ppb
Vitamin E	260 - 450 ppm
Vitamin H	0.1 - 0.4 ppm
Vitamin K3	10 ppm
Calcium	1 - 3 %
Iodine	50 - 4500 ppm
Iron	101 - 176 ppm
Magnesium	0.5 - 0.9 %
Manganese	10 - 15 ppm
Sodium	3 - 4 %
Zinc	70 - 240 ppm

ANTIBIOTIC PROPERTIES OF MACROALGAE



- A wide body of academic work supports seaweed as a source of anti-bacterial activity.
- Observations and trials of seaweed confirm enhanced wellness in swine, as well as excellent feed performance.

SEAWEED POLYSACCHARIDES – MODE OF ACTION



- **Prebiotic** polysaccharides exert positive effects on beneficial bacteria
- **Inhibition** of commonly occuring **pathogenic** bacteria
- Some polysaccharides stimulate the innate **immune system**
- The net effect is a better **balance of the gut** microbiome
- **Reduced inflammation** leading to improved gut morphology and nutrient adsorption

SEAWEED AS PREBIOTICS – EFFECT ON PIG PERFORMANCE

Reference	Test animals	Control Diet	Polysaccharides Tested	Findings
Turner et al (2002)	Weanling Pigs (4 wks, 7.1 kg) challenged with salmonella	Corn-Soy-Whey	A. Nodosum extract	FI and WG increase
Gahan et al (2009)	Weanling pigs (4 wks, 7.5 kg)	Wheat-Soy-Whey, High or low lactose	Laminarin & Fucoidan	FI, WG & FCR
McDonnell et al. (2010)	Weanling pigs (4 wks, 6.4 kg)	Wheat-Soy-Whey	Laminarin	WG & FCR
O'Doherty et al. (2010)	Weanling pigs (4 wks, 7.6 kg)	Wheat-Soy-Whey, High or low lactose	Seaweed Extract, Laminarin & Fucoidan	ADG & FCR

SEAWEED AS PREBIOTICS – EFFECT ON GUT MICROFLORA

Reference	Test animals	Polysaccharides Tested	Findings – Microbial
Gardiner et al. (2008)	Finishing pigs	Crude A. nodosum extract	↓Ileal Colliform ↓Cecal bifidobacteria
Reilly et al. (2008)	Weanling pigs	L. digitata containing laminarin and fucoidan	↓Enterobacteria, bifidobacteria and lactobacilli in the cecum and/ or colon
Dierick et al. (2010)	Weanling Pigs	A. nodosum meal	↓SI E. coli ↑SI Lactobacillus/E. coli ratio
Lynch et al. (2009)	Finishing pigs	Laminarin & Fucoidan extract	↓Enterobacteria ↑Lactobacillus in the proximal and distal colon
Janczyk et al. (2010)	Weanling pigs	Alginate	↑SI, Caecum & Colon enterococci counts
McDonnell et al. (2010)	Weanling pigs	Laminarin alone or Laminarin+ fucoidan	↓Fecal E. coli counts ↑fecal lactobacilli (fucoidan alone)
O'Doherty et al. (2010)	Weanling pigs	Laminarin+ fucoidan	↓fecal E. coli counts ↑ lactobacilli numbers

SEAWEED AS PREBIOTICS – EFFECT ON IMMUNE STATUS

Reference	Test animals	Polysaccharides Tested	Findings – Microbial
Leonard et al. 2010a	Sows & piglets (6-12 d) post-farrow	Crude extract of Laminarin+ fucoidan	Sow: ↑milk IgG Piglet; ↑serum IgG and IgA ↑E. coli phagocytizing leukocytes
Leonard et al 2010b	Sows & piglets (7-14 d) post-farrow	Crude extract of Laminarin+ fucoidan	↑Pro-inflammatory cytokines
Smith et al 2011			↑MUC2 expression ↑expression of IL6 & IL8 with LPS

Seaweed Blends: A natural prebiotic solution for in-feed antibiotic growth promotor use in swine & poultry

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TRIAL DATA – 2 EXPERIMENTS

SWINE – WEANED PIGLETS

EXPERIMENT 1

MATERIAL AND METHODS

- Total 96 pigs (PIC L337 x C24)
- Weaning age 28 days, body weight 10 kg
- 8 replicates, 4 pigs per pen

- 3 dietary treatments:
  - Control diet
  - Control diet + AGP (Tiamulin + CTC/ Chlortetracycline)
  - Control diet + 2% OceanFeed Swine (OFS)

- Measurements; diarrhea scoring, ADG, ADFI, FCR
- Analyzed as randomized block design using MIXED procedure of SAS, pen as experimental unit.

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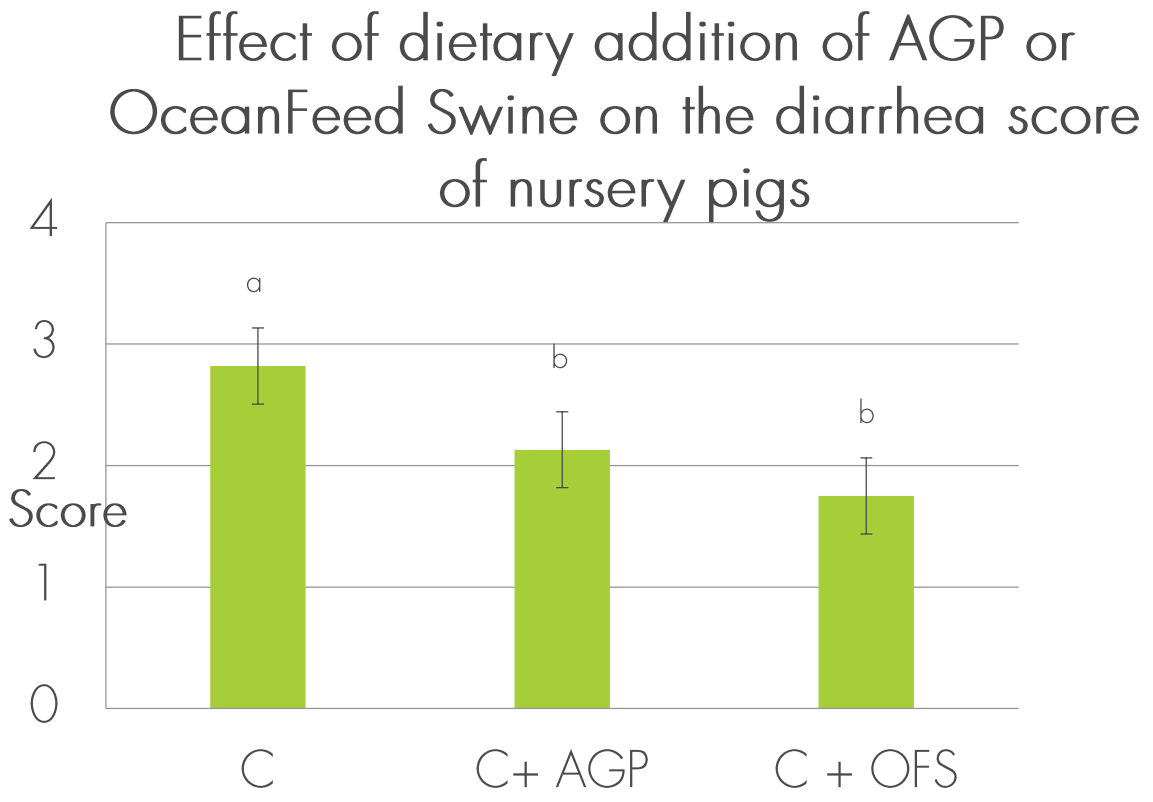
RESULTS –EXPERIMENT 1 – TECHNICAL PERFORMANCE

- OFS and AGP group significantly higher weight, growth, feed intake compared to control
- Performance of OFS group equal to AGP group

Effect of dietary treatment on Body Weight, ADG, ADFI & FCR in nursery pigs				
	C	AGP	OFS	p value
Start weight, kg	10.1	10.1	10.2	0.81
End weight, kg	23.2b	25.4a	25.4a	0.004
ADG, total, g/d	0.548b	0.637a	0.636a	0.03
ADFI, total, g/d	0.952a	1.058b	1.072ab	0.09
FCR, total	1.74	1.66	1.68	0.32

RESULTS –EXPERIMENT1 – DIARRHEA SCORE



- Group with OFS shows lowest diarrhea score, significant $P < 0.01$
- Diarrhea score - OFS group equal to AGP group.

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EXPERIMENT 2

MATERIAL AND METHODS

- Total 936 pigs (genetic cross 276 Fast female x Fast Duroc sire line)
- Weaning age 21 days, body weight 6 kg
- Period of 56 days. 4 phase feeding.
- 12 replicates, 26 pigs per pen

- 3 dietary treatments:
- AGP+ZNO: Standard diet with subtherapeutic levels of AGP and high ZnO (2500 mg/kg in phase 1+2 + 2000 mg/kg phase 3)
- ZNO: Diet without AGP and with high ZnO (same as group A)
- OFS: Diet without AGP, reduced levels of ZnO to 500 mg/kg + 0.75% OFS

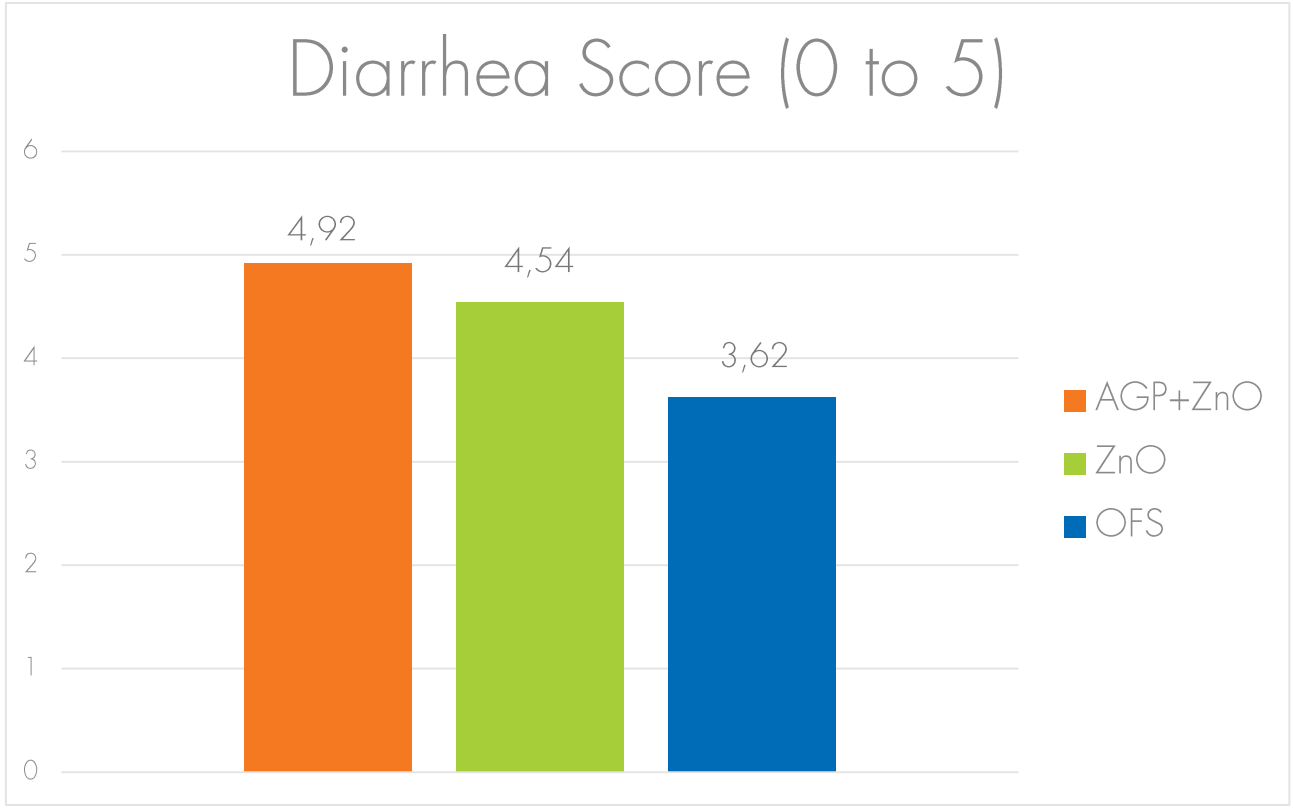
- Measurements; diarrhea scoring, frequency diarrhea, weekly ADG, weekly ADFI, FCR
- Analyzed as randomized block design (blocked by room) using Statistix 8 software, pen as experimental unit.

RESULTS –EXPERIMENT 2 – TECHNICAL PERFORMANCE

- OFS group shows significantly equal performance regarding growth and feed intake compared with AGP+ZNO group

Growth performance of pigs fed a positive control diet with antibiotic growth promoter and high ZnO (AGP+ZnO), high ZnO (ZnO) or OceanFeed Swine (OFS)				
	AGP+ZNO	ZNO	OFS	p value
Start weight, kg	6.12	6.08	6.14	
End weight, kg	32.69	31.58	32.32	> 0.05
ADG, total, g/d	538a	518b	531a	< 0.05
ADFI, total, g/d	813a	782b	807a	< 0.05
FCR, total	1.51	1.51	1.52	> 0.05

RESULTS –EXPERIMENT 2 – DIARRHEA SCORE



- Group with OFS shows lowest diarrhea score, although not significant P > 0.05.

- 0-5 point scale
  0 = absence of diarrhea
  1 = very low diarrhea
  2 = low diarrhea
  3 = intermediate diarrhea
  4 = severe diarrhea
  5 = very severe diarrhea

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DISCUSSION & CONCLUSION

Experiment 1:

- OceanFeed Swine was equally effective compared to AGP (Tiamulin + CTC) -> ADFI, ADG, FCR was improved.
- Diarrhea score was lower, less diarrhea in AGP and OFS group. OFS stimulated gut health.

Experiment 2:

- Removal of AGP impacted performance negatively, even when high levels of ZnO were maintained
- Use of OFS, in absence of AGP and high ZnO, provided equivalent growth performance, compared to AGP + ZnO.

TRIAL DATA – 2 EXPERIMENTS

POULTRY - BROILERS

EXPERIMENT 1 – UNIVERSITY OF GUELPH

MATERIAL AND METHODS

- 864 d old (male) Ross x Ross 708 broiler chicks used to test response to OF Poultry

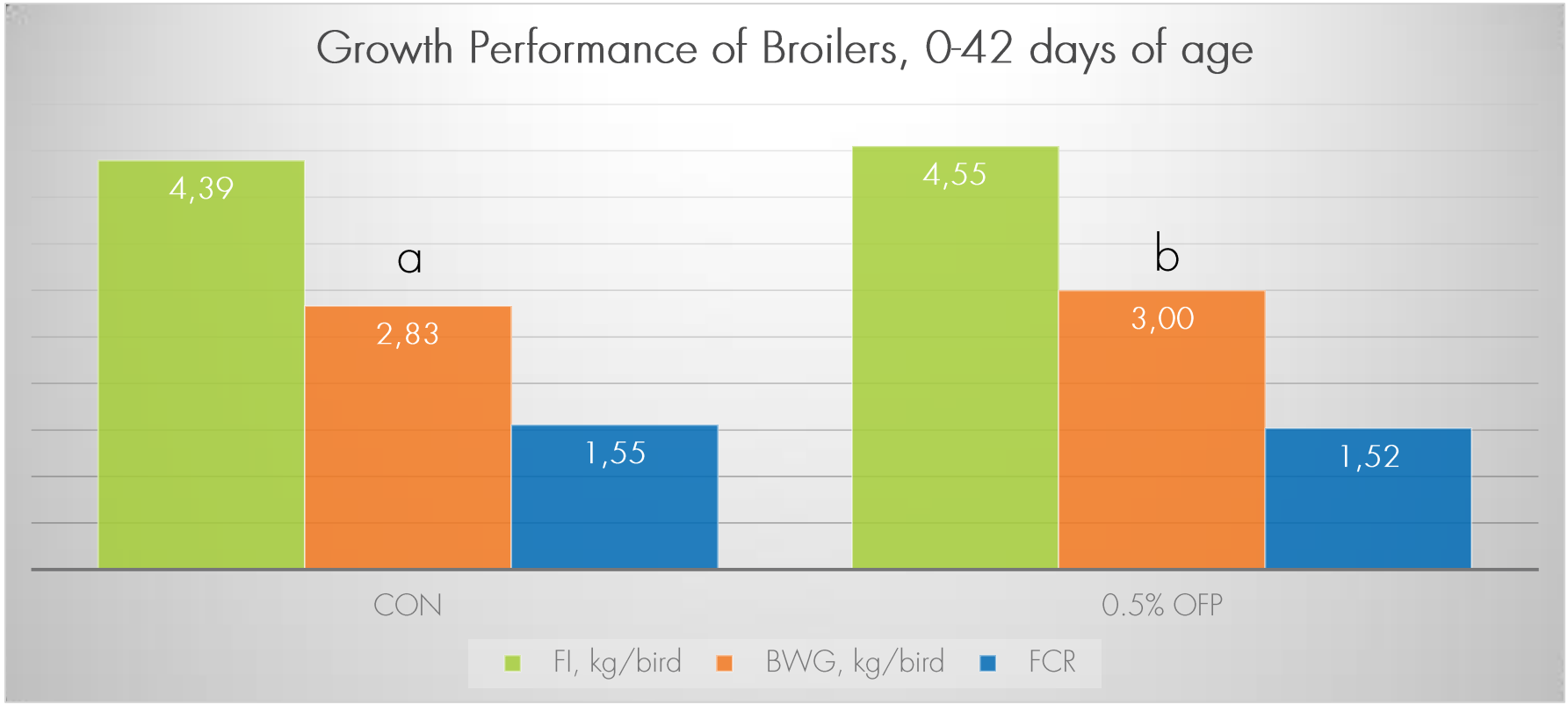
- Corn-soy-based diets were formulated for a 3-phase feeding program: Starter; d 0-10, Grower: d 11-24, and Finisher; d 25-42. Starter feed as crumble. Grower/finisher as pellet.
- OF_Poultry added to the Control diet at 0% (control), 0.5%
- Control diet was free of AGPs, other prebiotics and probiotic additives

- Each treatment was fed to 12 replicate pens of 18 birds

- Feed Intake and Body Weight were measured at 0, 10, 24 and 42 days of age.
- Mortality adjusted FCR was calculated using the following equation: FCR Adjusted for mortality (AFCR = weight of feed consumed)/(weight gain of survivors + weight gain of mortalities).

RESULTS – TECHNICAL PERFORMANCE

ADFI, BWG and FCR of broiler chickens fed a control diet or the control diet supplemented with 0.5% OceanFeed Poultry.



Result: Improvement technical performance, BWG showed significant improvement in OF group

$P < 0.05$

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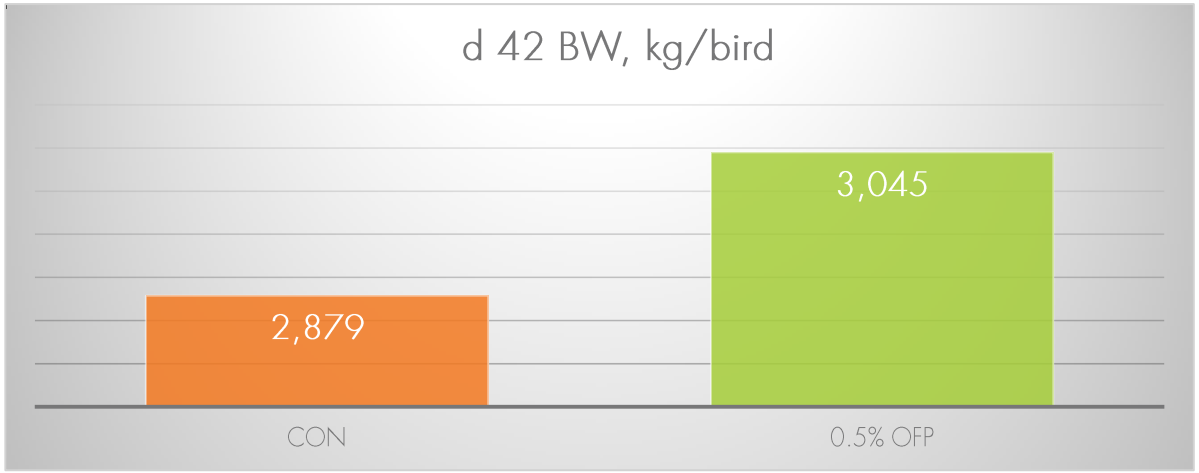
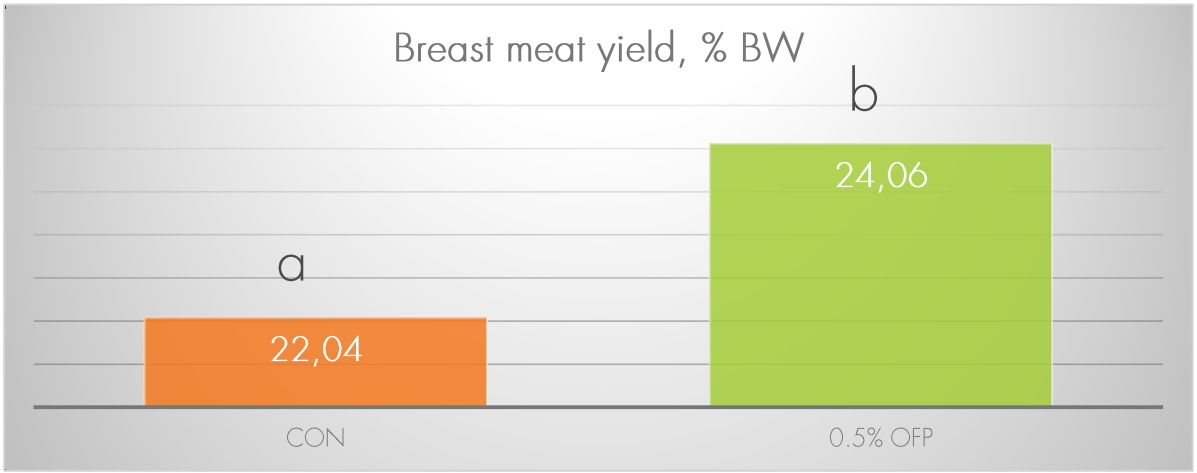
RESULTS – TECHNICAL PERFORMANCE

Final body weight (kg) of broiler chickens fed a control (CON) diet or the control diet supplemented with 0.5% OceanFeed Poultry.

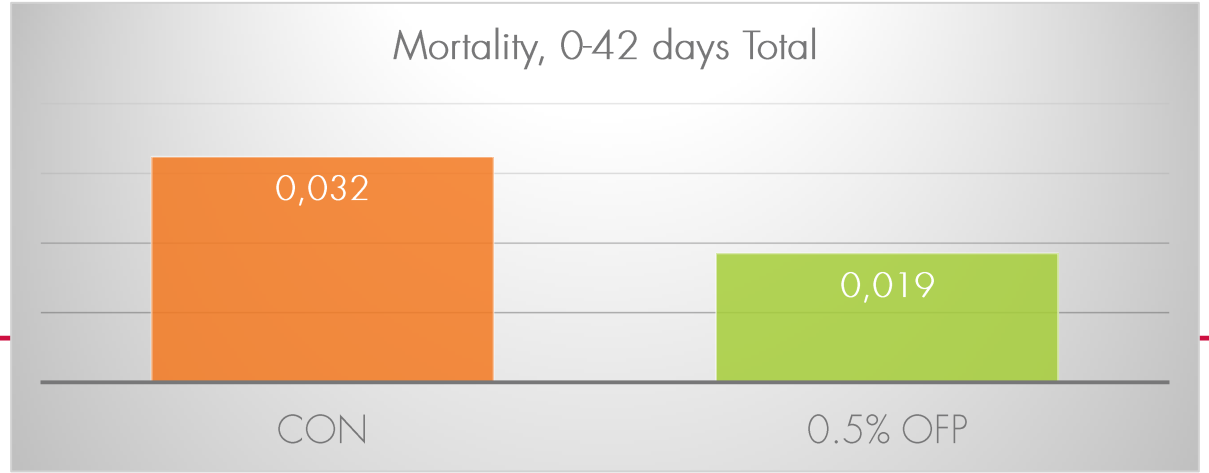


Breast Meat Yield as a percent of broiler chickens fed a control (CON) diet or the control diet supplemented with 0.5% OceanFeed Poultry.



$P < 0.05$

Mortality rate, fraction, of broiler chickens fed a control (CON) diet or the control diet supplemented with 0.5% OceanFeed Poultry.



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EXPERIMENT 2 – ROSLIN INSTITUTE

MATERIAL AND METHODS

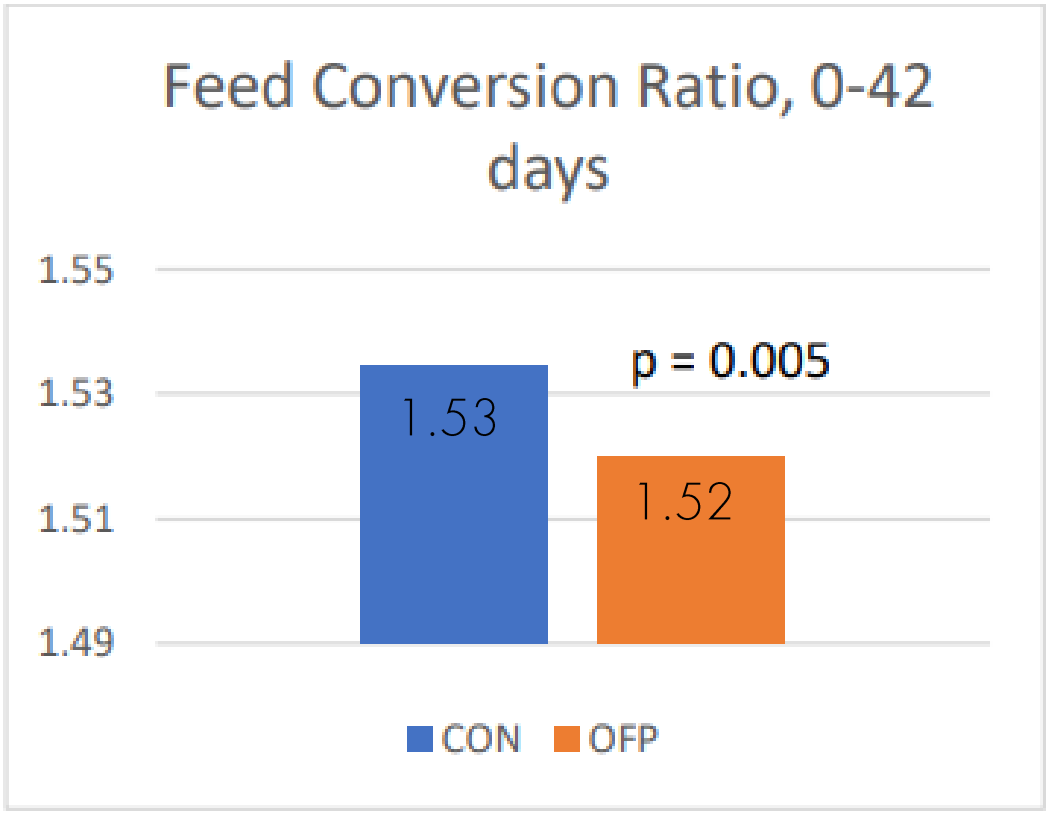
- 1120 d old (male) Ross x Ross 308 broiler chicks used to test response to OF Poultry

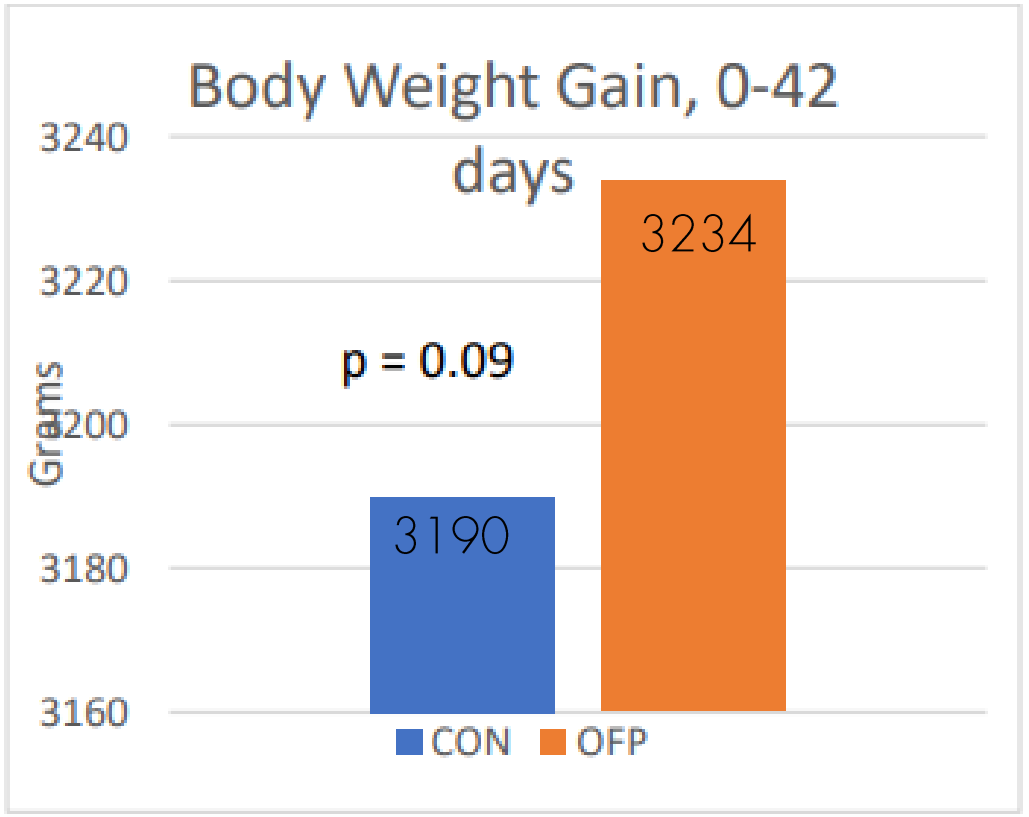
- **Wheat-soy-based** diets were formulated for a 3-phase feeding program: Starter; d 0-10, Grower: d 11-24, and Finisher; d 25-42. Diets in mash form.
- OF_Poultry added to the Control diet at 0% (control), 0.5%
- Control diet was free of AGPs, anticoccidials, prebiotics and probiotic additives

- Each treatment was fed to 32 replicate pens of 35 birds

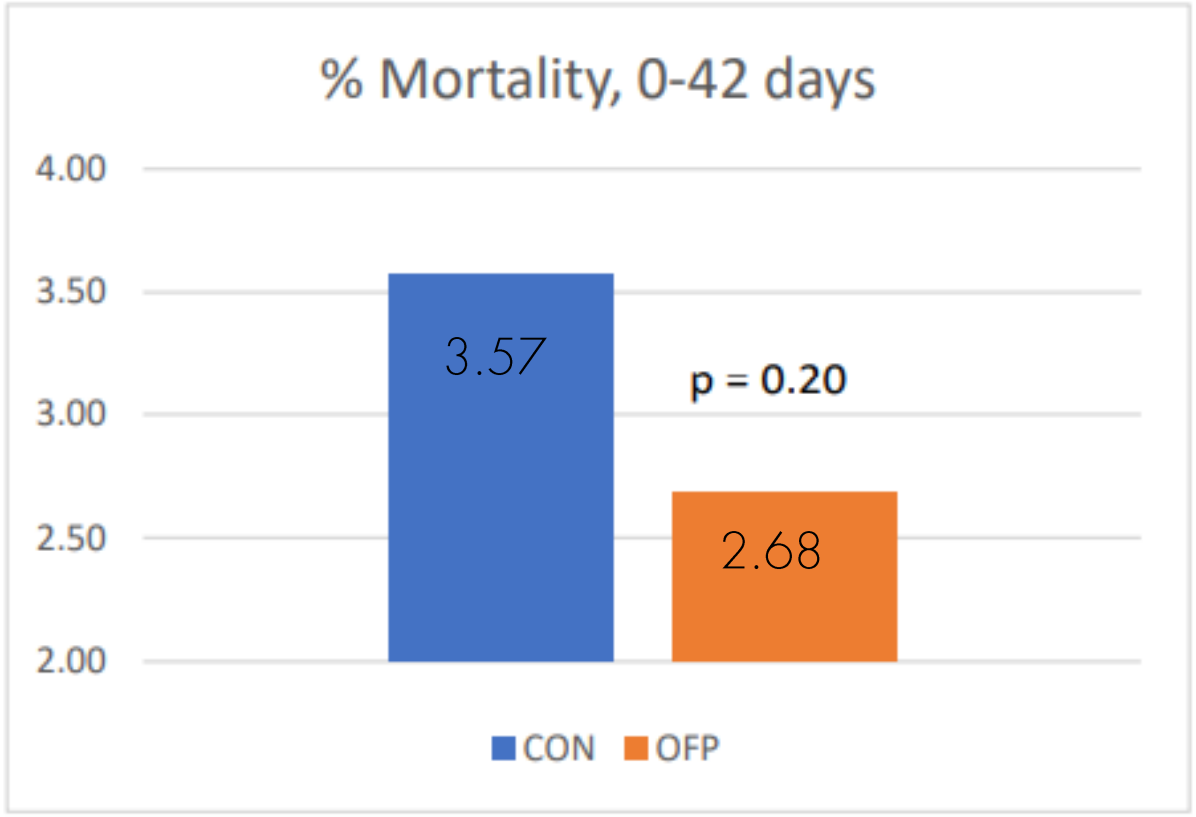
- Feed Intake and Body Weight were measured at 0, 10, 24 and 42 days of age.
- Mortality adjusted FCR was calculated using the following equation: FCR Adjusted for mortality (AFCR = weight of feed consumed)/(weight gain of survivors + weight gain of mortalities).

RESULTS – TECHNICAL PERFORMANCE – FCR & BWG





RESULTS – TECHNICAL PERFORMANCE – MORTALITY



CONCLUSION POULTRY EXPERIMENTS

EXPERIMENT 1 - GUELPH

- 0,5% Ocean Feed Poultry improved BWG and Breast yield significantly.

EXPERIMENT 2 – ROSLIN

- 0,5% Ocean Feed Poultry improved BWG, FCR and mortality significantly.

FINAL CONCLUSION

- OceanFeed Swine Seaweed blend was equally effective compared to a growth promoting antibiotic combination
  - ADFI, ADG, diarrhea score, FCR
- OceanFeed Poultry Seaweed blend improves BWG, FCR, Mortality, Breast Yield in Broilers
- OceanFeed Seaweed blends improves gut health, due to presence of polysaccharides with an prebiotic effect.
- OceanFeed Seaweed blends can be used as one of the natural feed ingredients for antibiotic free diets.

Thank you for your attention

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