



## Using FormaXOL™ and CLOSTAT® in a premium diet to successfully wean small piglets without medical Zinc Oxide

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### KEY CONCLUSIONS:

#### FORMAXOL™ AND CLOSTAT® SUPPORT ZINC OXIDE FREE WEANING BY IMPROVING INTESTINAL HEALTH:

- Diarrhoea score was comparable between the diet containing medical doses of ZnO and the diet reformulated with FormaXOL™ and CLOSTAT®
- FCR was significantly improved during the first 14 days after weaning, and during the overall post weaning period with the diet reformulated with FormaXOL™ and CLOSTAT® compared to the diet containing medical ZnO.
- Piglets having a small body weight at weaning particularly benefited from the diet reformulated with FormaXOL™ and CLOSTAT®

**KEYWORDS:** Zinc Oxide, small piglets, diarrhoea, FormaXOL™, CLOSTAT®

### INTRODUCTION

Zinc Oxide (ZnO) used at medical doses in weaned piglet diets will be phased out in the European Union by June 2022. Therefore, the need to develop successful strategies to replace high doses of ZnO mounts. The objective of this study was to evaluate the effect of a medical ZnO free diet formulated with FormaXOL and CLOSTAT in comparison to a standard diet containing a high dose of ZnO. Small weaned piglets of an average weight of 4.15 kg were used in the study. Diarrhoea occurrence, medication use and post weaning performance were monitored. The study was done in Denmark by TestPig at the Skjoldborg test station. The medical ZnO free diets were formulated by nutritionists of the Danish Pig Advisory Service with special care to support protein and overall nutrient digestibility.

## MATERIAL AND METHODS

All piglets were kept for the first 14 days after weaning in special care rooms (BabyPig rooms) as they had an average body weight of about 4 kg. The piglets were moved to standard weaning where they were kept for another four weeks after this period. The total duration of the trial was 43 days and the trial ended on August 10<sup>th</sup> 2021.

### ***Diet composition and test products during the first 14 days after weaning (1-14 days)***

A standard commercial diet containing 3000 ppm of Zinc Oxide, 0.5% calcium formate instead of limestone (CaCO<sub>3</sub>) and 0.5% benzoic acid was used as a control diet (ingredients provided in Appendix 1).

The test diet was a new premium diet formulated by the Danish Pig Advisory Service. In the reformulated test diet, the protein content was kept low (161 g digestible protein per kg) and the amino acid content was increased by 14-18% relative to the standard recommendations. The test diet was supplemented with 4 kg/t of FormaXOL and 750 g/t of CLOSTAT XCL (3 x 10<sup>8</sup> CFU/kg of feed). Benzoic acid and calcium formate were also used at a similar dose level compared to the standard diet (0.5% for each product). In addition, an organic acid blend was supplied in the drinking water of the piglets fed the reformulated diet. These piglets also received organic bound iron and zinc, and high vitamin and plasma powder.

All piglets had *ad libitum* access to dry feed and wet feed was fed four times during the day (7 am – 3 pm) and one time during the evening (8 pm – 11 pm).

Details concerning the composition of the control and reformulated diets are given in Appendix 1. The compositions of the test diets were unknown to the staff at the test station.

### ***Animals and measurements during the first 14 days after weaning (1-14 days)***

A total of 1072 piglets weaned at 25 ± 3 days of age were used in the study. In the control group, 538 piglets (4.2 ± 0.5 kg) were fed the standard diet. In the test group, 534 piglets (4.1 ± 0.5 kg) were fed the reformulated diet containing FormaXOL and CLOSTAT. The piglets were allocated to a total of 40 pens (20 pens in each group) containing around 27 piglets. Pens were equipped with a piglet nest and a slatted activity area.

Feed intake (FI), average daily gain (ADG), Feed conversion ratio (FCR, Kg FI/kg weight gain), mortality and medical treatments were monitored. The experimental unit was the pen.

The number of days where 0/3, 1/3, 2/3 or 3/3 of the pigs in each pen had diarrhoea was recorded during the entire study. This scoring system was based on a daily visual evaluation of faeces quality to give assess the prevalence of diarrhoea in each experimental group.



### ***Animals and measurements after the first 14 days after weaning (14-43 days)***

After the first 14-day period, all weaned piglets were moved to a standard weaning room where they were fed their respective diets for 3 days and gradually transitioned (automatically controlled) to a standard weaning diet for an additional period of 29 days. The nutritional characteristics of the diets fed during this period are given in Appendix 2.

The piglets were allocated in 8 similar rooms with their pen mates of the first experimental period. 2 double pens (4 single pens) were used in each room. FI, ADG, FCR and mortality were recorded and the experimental unit was the pen.

### ***Statistical analysis***

Animal performance (ADG, FI and FCR) data were analysed by GLM procedure using R by a mixed effect model including initial body weight (BW) at day 0, weekly batch number, diet and interactions between BW and diet. The faecal score data were analysed by a Poisson regression model.

## **RESULTS AND DISCUSSION**

### ***Piglets health and medication during the first 14 days after weaning (1-14 days)***

Overall, piglets in both experimental groups had a very good health status during the trial period. Concerning diarrhoea, only one piglet in the group fed the reformulated ZnO free diet had to be treated with injections of trimethoprim and sulfadoxine for 3 consecutive days. No piglet needed treatment for diarrhoea in the group fed the ZnO diet. The occurrence of diarrhoea in both groups was very low compared to the historical results of the test farm.

### ***Diarrhoea during the first 14 days after weaning (1-14 days)***

The average number of days with signs of diarrhoea in faeces visible in pens for each experimental group is presented in Table 1. Overall, diarrhoea occurrence was low and no significant difference could be observed between the two experimental groups. The average number of days with 1/3 of diarrhoea in the faeces of the ZnO and reformulated diet was 0.9 and 1.7 respectively ( $P > 0.05$ ). The average number of days with 2/3 of diarrhoea in the faeces of the ZnO and in the reformulated diet was 0.1 and 0.4 respectively ( $P > 0.05$ ).

**Table 1:** Average number of days with signs of diarrhea in 1/3, 2/3 or 3/3 of the feces first 14 days after weaning

	ZnO diet	Reformulated diet (FormaXOL+CLOSTAT)	P-value
Days with 1/3 diarrhoea	0.9	1.7	0.25
Days with 2/3 diarrhoea	0.1	0.4	0.30
Days with 3/3 diarrhoea	0	0	-

**Growth performance results during the study (1-14, 14-43 and 1-43 days)**

The growth performance results obtained during the different experimental periods and during the entire study period are given in Table 2.

During the first 14 days after weaning, the piglets fed the reformulated diet with FormaXOL and CLOSTAT had a numerically higher ADG (+ 14.4 %) and a significantly reduced FCR (- 7.3%,  $P < 0.05$ ) compared to their mates in the medical dose of ZnO. The energy level in the control diet was 2.3% higher than in the premium test diet. Taking this difference into account, the FCR calculated on feed energy content was 9.2% lower for the group receiving the test feed compared to the control group (1.78 and 1.96 respectively,  $P < 0.01$ ).

ADG, FI and FCR were similar between the two groups during the period 14-43 days ( $P > 0.05$ ), which is in line with the fact that piglets received the same post weaning diet produced on the test farm during this period.

Considering the total study period of 1- 43 day, FCR was significantly reduced (- 4.2%,  $P < 0.05$ ) for piglets the test group compared to those in the medical ZnO group. These results indicate that the good results given by the dietary treatment during the first 14 days provided long term benefits to the piglets that reflected in the entire post weaning period.

**Table 2:** Piglets growth performance during the first 14 days after weaning and during the overall experimental period

	Day	Experimental group		P-values		LSD
		ZnO diet	Reformulated diet (FormaXOL + CLOSTAT)	Diet	BW x diet	
<b>Body weight</b>						
Initial body weight (kg/pig) <sub>y</sub>	1	4.2 (±0.5)	4.1 (±0.6)	na	na	na
Intermediary body weight (kg/pig) <sub>y</sub>	14	6.6 (±0.8)	6.9 (±0.8)	na	na	na
Final Body weight (kg/pig) <sub>y</sub>	43	22.8 (±1.8)	22.6 (±2.0)	na	na	na
<b>1-14 days after weaning</b>						
ADG (g/d/pig) <sub>x</sub>	1-14	173	198	0.13	0.007	37
FI (g/d/pig) <sub>x</sub>	1-14	265	275	0.53	ns	36
<b>FCR<sub>x</sub></b>	<b>1-14</b>	<b>1.51</b>	<b>1.40</b>	<b>0.03</b>	<b>&lt;0.001</b>	0.16
<b>14-43 days after weaning</b>						
ADG (g/d/pig) <sub>x</sub>	14-43	549	533	0.5	ns	57
FI (g/d/pig) <sub>x</sub>	14-43	820	741	0.25	ns	80
FCR <sub>x</sub>	14-43	1.43	1.38	0.21	ns	0.09
<b>1-43 days after weaning</b>						
ADG (g/d/pig) <sub>x</sub>	1-43	427	424	0.85	ns	38
FI (g/d/pig) <sub>x</sub>	1-43	620	599	0.32	ns	49
<b>FCR<sub>x</sub></b>	<b>1-43</b>	<b>1.44</b>	<b>1.38</b>	<b>0.03</b>	<b>ns</b>	0.07

y: means ± SD (n=20), x lsmean ± SD (n=20), na: not analysed, ns: non significant

Statistical analysis showed an interaction between body weight and the diet for FCR during the first 14 days. This indicated that in this trial, the smallest piglet (<4 kg) used more efficiently the diet containing FormaXOL and CLOSTAT than the diet containing a medical dose of ZnO.

Mortality was 1.5% in both experimental groups during the entire test period (1-43 days after weaning). The percentage of disease was 1.1% in the group fed with the diet containing medical ZnO for the first 14 days and 1.9% in the test group.

### Follow up field tests

To confirm the results of this experimental trial, the performance of the diet containing FormaXOL and CLOSTAT was qualitatively evaluated in three commercial herds in Denmark for 14 days after weaning (in total 400 pigs, 120 pigs and 250 pigs each). During the three evaluations, the reformulated diet performed similarly or better than the control diets containing medical ZnO.

## CONCLUSION

Finding suitable alternatives to medical doses of ZnO is a major challenge, especially when the need is to support small piglets at weaning which are known to benefit more from ZnO supplementation. With this trial, the supplementation of FormaXOL and CLOSTAT in a reformulated premium diet proved to be an excellent strategy to successfully help pig actors secure ZnO free weaning while maintaining health status and improving performance.

## APPENDIX 1:

**Table 3: Feed composition of the diet given during the first 14 days after weaning.**

### Reformulated diet

Ingredients of the reformulated diet (test)	%
Barley (heat treated)	13.5
Wheat (Gelatinazed)	52.8
Milk powder	16
Arbocel	1.5
Soy protein AX3 Digest	5
Plasma powder	5
Monocalcium phosphate	1.29
Fat	1
L-Lysine	0.764
DL-Methionine	0.271
L-threonine	0.294

DL-Tryptophan	0.082
L-valine	0.132
Calcium formate	0.5
Benzoic acid	0.5
FormaXOL	0.4
CLOSTAT	0.075
Aroma Luctarom Advance	0.1
Iron chelate of amino acid	0.071
Zinc chelate of amino acid	0.118
Premix + SR Elite Blanding	0.575
Feed energy unit per kg	1.27

### Control diet

Ingredients of medical ZnO diet (control)	%
Wheat (20% of the wheat was heat treated)	44.3
Corn, Flakes	3.0
Milk powder	18.0
Lactose powder	9.1
Soy protein concentrate	10.0
Potato protein	7.0
Fat	2.7
Benzoic acid	0.5
Calcium formate	0.5
Zinc Oxide premix	0.3
Minerals, vitamins, amino acids etc.	4.6
Feed energy unit per kg	1.30

**Table 4: Nutritional characteristics of the reformulated (ZnO free diet given) during the first 14 days after weaning**

<b>Nutritional characteristics</b>	<b>%</b>
Dry matter	92.35
Crude protein	17.91
Crude fat	5.9
Crude ash	5.09
Fiber	3.44
Starch	39.6
Lactose	6.4
<b>Macro-elements</b>	<b>%</b>
Calcium	6.94
Phosphorus	6.87
Sodium	3.25
<b>Amino acids</b>	<b>‰</b>
Dig protein	161.33
Dig Lysin	14.99
Dig Methionine	4.93
Dig Met+Cyst	8.2
Dig Threo	9.24
Dig Tryp	3.46
Dig Isoleu	6.23
Dig Val	9.27



## APPENDIX 2: Feed composition of the standard weaning diets

**Table 5: Feed ingredients (%) in the starter diet 6-9 kg**

Ingredient	(%)
Wheat	65
Fish Meal	6.5
Soy oil	2.4
Premix <sup>(1)</sup>	26.1

(1) Containing soy-, potato-, and milk proteins, vitamins, minerals, amino acids, phytase, antioxidants, xylanase and organic acids

**Table 6: Feed ingredients (%) in the starter diet 9-15 kg**

Ingredient	(%)
Wheat	61.1
Barley	10
Soybean meal	10
Soy oil	135
Alpha Soy	10.1
Premix <sup>(1)</sup>	7.3

(1) Containing potato protein, vitamins, minerals, amino acids, phytase, antioxidants and organic acids

**Table 7: Feed ingredients (%) in the starter diet 15-30 kg**

Ingredient	(%)
Wheat	41.3
Barley	25
Soybean meal	26.9
Soy oil	1.7
Premix	5.1

(1) Containing potato protein, vitamins, minerals, amino acids, phytase, antioxidants and organic acids