KEMIN

# Technical Literature

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## The benefits of zinc oxide replacement in Pre-starter and Starter diets for piglets

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### Key conclusions

- ✓ **A combination of Formyl™, ButiPEARL™ and CLOSTAT® can easily replace zinc oxide (Zincopremix) in piglet pre-starter and starters**
- ✓ **The trial was repeated once, both repeats showed the alternative perform as well as zinc oxide in the pre-starter**
- ✓ **In the starter phase better feed intake, FCR and an improved final weight of around 4 kg could be observed.**

## Introduction

### Zinc oxide in piglets

In many European and neighbouring countries zinc oxide (ZnO) is currently licensed up to the level of 2,500 mg/kg zinc for 14 days post-weaning. It is aimed at reducing weaning diarrhoea and widely used where permitted. The benefits are maintained essential zinc supply after weaning, improved gut integrity via tight junctions and reduced pathogen pressure and resupply of zinc lost to diarrhoea. Despite the increased need for such tools, with decreased anti-microbial and copper use, many countries are in the process of banning this use of zinc oxide or are likely to follow in the next years.

### The Kemin alternative solution

As zinc oxide acts on at least two characteristics gut integrity and microbiome, any functional alternative must address both. In this field trial a slow release butyrate (ButiPEARL™) was used to ensure gut integrity and villous health during the critical period after weaning. To manage the microbiome, which undergoes a drastic change at weaning, two approaches were chosen. First a probiotic (CLOSTAT®) to promote and maintain the natural positive gut flora and minimise the risk posed by Clostridia. Secondly organic acids have been shown to be effective against *E.coli*, for this reason a protected form of organic acids (Formyl™) was included in the solution. *E. coli* diarrhoea is a well-known risk at weaning, without the application of zinc oxide.

## Piglet trials

### Materials and Methods: Setup of the zinc oxide replacement

The trials were performed in commercial trial units of AGROFEED Kft. at Lovászpatona in Hungary based on their proven diets. The piglets had a standard diet that consisted of a Pre-Starter from approximately 7.5 kg (for 15 days) and a starter being fed from an average of 11 kg for 26 days. Weaning was routinely done at the age of 26 days. The trial was repeated twice with equal group sizes for the zinc oxide and trial groups respectively. The first trial (trial 1) was run from July with 160 piglets, the second set (trial 2) was an exact repeat of trial 1 with 172 piglets.

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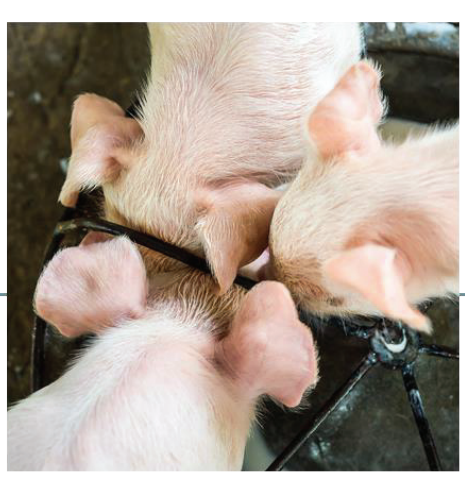
## Objective of the trial

The replacement was to be considered successful if all performance, health and mortality in both trial groups were at least equal to that of the respective control groups with zinc oxide.

**Figure 1 Overview replacements Prestarter and Starter feeds**



**Prestarter out**

3 kg/ton zinc oxide (2400 ppm Zn)
3 kg/ton free organic acids

**Prestarter in**

1.5 kg/ton slow release ButiPEARL™
5 kg/ton Formyl™
$2x10^8$ CFU/kg B. *subtilis* (CLOSTAT®)

**Starter out**

3 kg/ton zinc oxide (2400 ppm Zn)
3 kg/ton free organic acids

**Starter in**

1 kg/ton slow release ButiPEARL™
4 kg/ton Formyl™
$2x10^8$ CFU/kg B. *subtilis* (CLOSTAT®)

## Pre-Starter

For the prestarter trial diet a total replacement of zinc oxide dosed at 3 kg/t was carried out (Figure 1). This complete exchange was cost neutral. The prestarter did already contain a butyric acid source, however as a slow release could not be guaranteed it was replaced by 1.5 kg of ButiPEARL per ton of feed. Additionally, a partial replacement of 3 kg free organic acids with 5 kg Formyl/t of feed was carried out. As free organic acids have proven to be beneficial in piglets a complete exchange of all free acids was not recommended. To help prepare the microbiome for weaning CLOSTAT was dosed at 2x108 CFU kg of feed.
This feed was medicated with Amoxycillin (400 mg/kg) and Colistin (120 mg/kg). This medication was not changed, as the aim of the trial was only to replace zinc oxide, not to remove antibiotics.

## Starter

For the starter trial diet, a total replacement of zinc oxide dosed at 3 kg/t was carried out as well as 3 kg of free organic acids. The complete exchange was cost neutral.

The ButiPEARL supplementation was continued in the starter at 1 kg/ton of feed. Additionally, a full replacement of 3kg/ton of feed free organic acids with 4 kg Formyl/t of feed was carried out. To help the microbiome cope with weaning CLOSTAT® was dosed at $2x10^8$ CFU per kg of feed.

Neither the zinc oxide control nor the alternative starter feed were medicated.

## Results

**Figure 2 Average body weight at start and phase ends**

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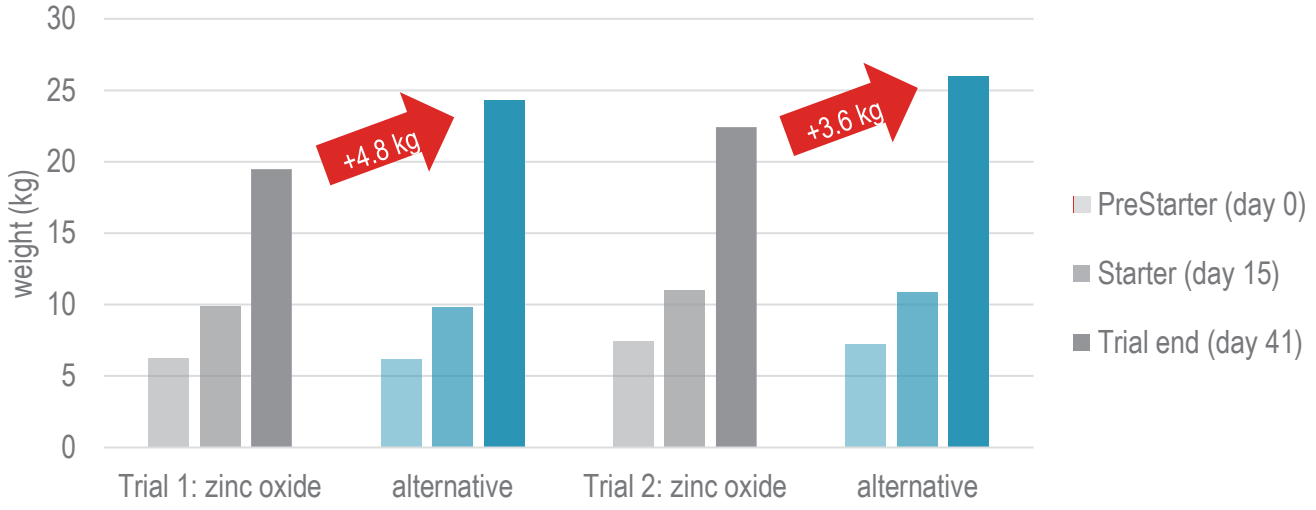


**Table 1 key performance parameters, mortalities and economics of the starter phase**

| | Trial 1 Starter Phase | | Trial 2 Starter Phase | |
|---|---|---|---|---|
| | zinc oxide | alternative | zinc oxide | alternative |
| Initial number of animals | 80 | 79 | 86 | 86 |
| Initial average weight kg/animal | 9.90 | 9.86 | 10.97 | 10.90 |
| Mortality and reject (head) | 5 | 1 | 13 | 1 |
| Final weight kg | 1463 | 1895 | 1638 | 2208 |
| Additional weight with mortality (kg) | 715.6 | 1120.8 | 867 | 1287 |
| Average weight (kg) | 19.5 | 24.3 | 22.4 | 26 |
| Total feed consumption (kg) | 1165 | 1534 | 1439 | 1767 |
| FCR kg/kg | 1.63 | 1.37 | 1.66 | 1.37 |
| Cost of feed (at 0.36 €/kg) | 419 | 552 | 518 | 636 |
| Value of piglets for sale (at €1.52 per kg) | 2224 | 2880 | 2490 | 3356 |
| Economic benefit per piglet at start compared to zinc oxide (€) | 0 | 6.91 | 0 | 8.70 |

## Economics of the replacement package

The exchange (Figure 1) removed ZnO (Zincopremix) priced at about 5€/kg, and an acidifier at 1.4 €/kg. The inclusion of both cost 19.2 € per ton of feed given the respective inclusion rates. The alternative solution was equal in price.

For the overall economic result there was an effect of mortality but also on feed conversion (Table 1). At an approximate price of a starter feed of € 0.36, and a piglet price of €1.52 per kilo, a cost benefit per piglet could be calculated. The economic benefit of replacing zinc oxide came to nearly 7 Euro in the first trial, and €8.70 in the second trial. The zinc oxide alternative is therefore not cost neutral in feed basis but brings big economic benefits.

## Discussion

In the pre-starter Phase (Figure 2) both the zinc oxide and alternative groups showed very similar results. No diseases or diarrhoea requiring treatment was observed in either group. Therefore, the zinc oxide replacement was considered successful.

In the starter phase (Figure 2) after weaning noticeable differences could be observed. The difference in mortality was mainly due to culling for ear necrosis. The reduction of ear necrosis could be linked to better absorption of minerals from the diet in the absence of zinc oxide and better gastro-intestinal welfare.

The weight of the culled animals has been considered for the FCR calculations. In both trials the alternative group was heavier at the end of the phase compared to the control groups (4.8 and 3.6 kg respectively). The zinc oxide alternative showed much higher daily feed intake in both groups, probably due to better palatability of due to the lack of zinc oxide supplementation. Despite the higher feed intake FCR was markedly improved by the replacement of zinc oxide in the diet.

Economically the exchange was cost neutral from the additive point of view. From the value of the piglets for sales, the alternatives had an economic benefit of nearly 7 Euro and € 8.70. this benefit was based both om the better survivability and the improved feed conversion in the alternative groups.

## Conclusion

Provided the physiological need of zinc is covered in the diet, an exchange of zinc oxide can be undertaken safely and with added economic benefits.

The absence of high level of zinc oxide can directly benefit the uptake of other bivalent minerals which are important for the healthy weaning phase. Benefits can range from direct decreases in diarrhoea and mortality, to indirect ones such as decreased ear necrosis.

A better feed intake around weaning is strongly linked to good gut health, which in turn will always results in better feed conversion. This link could also be observed in this trial.