KEMIN
Technical Literature

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Field investigation to evaluate FormaXOL™ efficacy to control *Salmonella* in heavy pigs.

The efficacy of the *Kemin's Food Safety initiative programme* to control *Salmonella* includes the application of FormaXOL™, and has been documented previously in different EU scenarios (TL-12-00026; INF-2012-00019; INF-2012-00020).

The aim of this trial was to evaluate if the program can work also in Italian pigs which have a higher slaughtering weight (heavy pigs, *ca*. 170 kg live weight (LW)). The hypothesis was that prolonging the growing-finishing period to almost 200 days (90-290 days of age) will significantly increase the exposure to *Salmonella*, thus increasing the risk for pigs to become infected.

In this trial, the average commercial slaughtering weight was 169.81 and 167.69 kg respectively for the control and FormaXOL group, but this last one reached the commercial weight 6.6 days earlier. Feed intake was 30 kg/pig higher in control and FCR was 3.56 and 3.39 respectively in control and FormaXOL group. A significantly higher presence of *Salmonella* was registered in the lymph nodes of control (23/30) *vs.* FormaXOL (2/30) groups.

The *Food Safety initiative programme*, applying FormaXOL at 4 kg/tonne in the critical *Salmonella* challenging phase and at 1 kg/tonne to prevent the recontamination till the pigs are slaughtered, is effective also in heavy pigs. Secondly, the program positively influences the zootechnical performance, making it cost effective and guarantying to the pig farmers an extra benefit of 3.4 €/pig with a ROI of 1.5.

KEYWORDS: FormaXOL, formic acid, essential oils, *Salmonella*, broilers.

Introduction

Salmonella is considered one of the most frequent zoonosis. For this reason the EFSA (European Food Safety Agency) started a programme to monitor the prevalence of *Salmonella* in order to achieve the target to reduce its prevalence in pig flocks.

Normally pigs get infected by *Salmonella* and become seropositive after they are moved from post-weaning cages to growing boxes. Data from literature shows that organic acids, alone or in combination with essential oils, are active in controlling *Salmonella* (Van Immerseel, *et al*., 2003; Mroz, 2005). The antimicrobial effects of essential oils (EO) have been scientifically proven (Hammer *et al*., 1999). Encapsulation techniques are valid tools to increase organic acid and essential oil activity along the gastro-intestinal tract (TL-2010-00008).

Kemin developed an anti-salmonella programme for pigs, which consists of applying FormaXOL™ at 4 kg/tonne in the critical period (first 4 weeks after piglets are moved, to prevent they become seropositive) followed by 0.5-1 kg/tonne until slaughter (to prevent recontamination).

The efficacy of the *Kemin's Food Safety initiative programme*, based on different time/dosage application of FormaXOL to control *Salmonella* in swine, was previously demonstrated in different EU scenarios (TL-12-00026; INF-2012-00019; INF-2012-00020).

Aim of this trial was to evaluate if the programme can work also in the Italian swine production, differing form others for the higher slaughtering weight of pigs (heavy pigs, *ca*. 170 kg LW). The hypothesis was that extending the growing-finishing period to almost 200 days (from 90 to 290 days of age) will significantly increase the exposure to *Salmonella* challenge thus increasing the risk of pigs becoming infected.

Materials and Methods

Experimental animals and treatments. The trial was carried out in a commercial farm having a contract with an Italian cooperative feed producer, and supervised by a veterinarian. Historically high *Salmonella* prevalence in slaughtered pigs from this farm was registered. A total of 578 pigs of about 29 kg LW were housed in the same barn having two separate feeding lines, and split in 2 groups of 10 boxes each, control and FormaXOL. The control group received a commercial diet, while the FormaXOL group received the same diets supplemented with 4 kg/tonne of FormaXOL in the first 4 weeks and followed by 1 kg/tonne till slaughtering at 170 kg LW.

Animal performance. Number and body weight of piglets was recorded at arrival; mortality, feed intake and days of fattening were registered during the trial period; final weight was registered at farm during the loading of pigs. All these data were used to calculate zootechnical performance and ROI.

Microbiological analysis. At the end of the trial, 60 blood samples were collected and analysed for *Salmonella* antibody presence via an ELISA test. Positive samples were ranked basing on their S/P ratio. The S/P ratio gives an indication of how severe the infection was (the higher the S/P ratio, the stronger was the infection). Also 30 ileocecal lymph node samples per group were collected from slaughtering pigs and analysed for *Salmonella* presence/absence in 10 g. Positive samples were submitted to serological typing following the ISO 6579:2002 procedure.

All samples were sent to the “Istituto Zoorpofilattico Sperimentale Lombardia e Emilia Romagna (IZSLER)”, the Italian Health Minister Authority for Public Health, for *Salmonella* presence and typing or for *Salmonella* antibodies analysis.

Results

Performance data are reported in table 1. At the beginning of the trial piglets were split by live weight in two homogenous groups. Heavy pigs were sent to slaughter house in different group and times, as soon they reached the commercial weigh (170 kg). For this reason no differences in final weight were registered between the groups. However pigs from the FormaXOL group reached the final weight on average 6.6 days earlier and the average daily gain (ADG) was 13 g better in this group. Pigs from the FormaXOL group consumed also 31.2 kg less feed per pig, leading to a FCR 0.17 point lower than control (3.39 *vs.* 3.56). Feeding FormaXOL gave the farmers an extra benefit of 3.4 €/pig *vs.* the control, with a ROI of 1.5.

Table 1. Zootechnical performance

Groups	Initial weight kg	Final weight kg	ADG kg	Rearing time (days)	Total feed intake kg/pig	FCR
Control	29.27	169.81	0.707	195.4	492.03	3.56
FormaXOL	29.16	167.69	0.720	188.8	461.80	3.39

At arrival of the piglets, 60 rectal swabs were collected from both groups and they were all negative for *Salmonella.*

Results for the microbiological analysis are shown in table 2. The number of ileocecal lymph node samples positive to *Salmonella* were respectively 23 in Control (76.7%) and 2 in FormaXOL group (6.6%) ($p<0.01$). This proves the efficacy of FormaXOL to reduce the *Salmonella* prevalence in slaughtering pigs. Also when the blood samples were analysed for the presence of *Salmonella* antibodies, the FormaXOL group showed a lower number of positives *vs.* the control (51 *vs.* 58). The high rate of positive samples is due to the high *Salmonella* challenge present in that farm. Moreover, detailed blood analysis reveals some additional interesting factors. In fact, all the positive samples were

ranked based on the S/P ratio. The S/P ratio gives an indication of how severe the infection was (the higher the S/P ratio, the stronger was the infection). As reported in table 2, FormaXOL group had the majority of positive samples ranked in the lowest range (between 1 and 2), while the control group in the higher (> 2), with 10 pigs more than FormaXOL having a S/P ration higher than 3, which is an indication of a severe infection.

Table 2. *Salmonella* analysis of blood and lymph nodes samples collected at the slaughter house

Groups	Ileocecal lymph node		Blood		
	Negative	Positive	Negative	Positive	Ranking of S/P ratio of positive samples (n)
Control	7	23 (76.7%)[a]	2	58	13 1≤S/P≤2 27 2<S/P≤3 18 S/P>3
FormaXOL	28	2 (6.6%)[b]	9	51	28 1≤S/P≤2 15 2<S/P≤3 8 S/P>3

[a,b] Means in a column without a common superscript are significantly different (P <0.01).

Conclusions

In conclusion it could be confirmed that the *Kemin Salmonella Program*, applying FormaXOL at 4 kg/tonne in the critical *Salmonella* challenging phase and at 1 kg/tonne to prevent the recontamination till the pigs are slaughtered, is effective also in heavy pigs. Secondly, the program positively influences the zootechnical performance, making it cost effective and guarantying a ROI of 1.5 to the pig farmers.

References

1. Effect of FormaXOL™ in broilers infected with *Salmonella gallinarum.* TL-2010-00008
2. Kemin Program for improving performances and to control *Salmonella* prevalence in pigs. TL-12-00026
3. FormaXOL reduced *Salmonella* in a swine herd in Ireland. INF-2012-00019
4. FormaXOL reduced *Salmonella* in slaughtering pigs in Spain. INF-2012-000202
5. Hammer K.A., Carson C.F., Riley T.V. (1999). Antimicrobial activity of essential oils and other plant extracts. Journal of Applied Microbiology 1999, 86, 985–990. SA-11-00314
6. Mroz Z. (2005). Organic acids as alternatives to antibiotic growth promoters for pigs. In: Advances in Pork Production, (Ed. G. Foxcroft). University of Alberta Press, Edmonton, Alberta. pp. 169-182. SA-08-01280
7. Van Immerseel, F., J. de Buck, F. Pasmans, P. Velge, E. Bottreau, V. Fievez, F. Haesebrouuck, and R. Ducatelle (2003). Invasion of *Salmonella* enteritidis in avian intestinal epithelial cells in vitro is influenced by short-chain fatty acids. Int. J. Food Microbiol. 85:237-248. SA-10-01066.