

THE EFFECT OF A PROBIOTIC, KE-01, AND NEOTERRAMYCIN ON NURSERY PIG GROWTH PERFORMANCE¹

N. Z. Frantz, J. L. Nelssen, J. M. DeRouchey, R. D. Goodband, M. D. Tokach, and S. S. Dritz²

Summary

A 35-d growth study with a total of 168 weanling pigs (21 ± 2 d of age) was conducted to determine the effects of feeding a probiotic, (KE-01) and an antibiotic, Neoterramycin (neomycin 140 g/ton, oxytetracycline 140 g/ton), on nursery pig performance. Experimental treatments were arranged in a 2×2 factorial with main effects of antibiotic (none or neomycin 140g/ton and oxytetracycline 140g/ton) or probiotic (none or KE-01, 0.35%). KE-01 is a probiotic containing a novel strain of lactobacillus casei. A KE-01 by Neoterramycin interaction was observed for ADFI ($P < 0.05$) from d 14 to 35, but no other interactions were detected. From d 0 to 14, pigs fed diets containing Neoterramycin had improved ($P < 0.01$) ADG, ADFI, and F/G compared with those of pigs fed diets without Neoterramycin. Pigs fed diets containing KE-01 had similar growth performance to that of pigs fed diets without KE-01. From d 14 to 35, pigs fed diets containing Neoterramycin had increased ADG compared with that of pigs fed diets without Neoterramycin. The ADG of pigs fed diets containing KE-01 did not differ from that of pigs fed diets without KE-01. There was a tendency for pigs fed KE-01 to consume less feed, whereas pigs fed Neoterramycin ate more (KE-01 \times Neoterramycin interaction, $P < 0.05$). Pigs fed diets

containing KE-01 tended to have improved F/G ($P < 0.07$), compared with that of pigs fed diets without KE-01. Overall, d 0 to 35, pigs fed diets containing Neoterramycin had increased ADG and ADFI ($P < 0.01$), compared with those of pigs fed diets without Neoterramycin. In addition, pigs fed diets containing KE-01 had similar ADG and ADFI to those of pigs fed diets without KE-01. Pigs fed diets containing KE-01 had improved F/G ($P < 0.03$), compared with that of pigs fed diets without KE-01. In summary, the probiotic, KE-01, did not significantly increase ADG or ADFI, but did improve F/G because it slightly lowered feed intakes. Neoterramycin improved ADG, ADFI, and F/G, compared with those of diets without Neoterramycin in this study.

(Key Words: Antibiotics, Pigs, Probiotic, Weanling Pigs.)

Introduction

Previous experiments at Kansas State University have demonstrated that adding a feed-grade antimicrobial (Neoterramycin, Mecadox, or Denagard CTC) to the nursery diet consistently increases ADG and improves F/G. KE-01 is a novel strain of Lactobacillus casei. In an initial field trial, feeding KE-01 improved weight gain and bacterial detach-

¹The authors thank Probiionex, Salt Lake City, UT, for partial financial support and providing the KE-01 used in this study.

²Food Animal Health and Management Center.

ment. An oral dose of KE-01 also has been shown to reduce sulfide and ammonia compounds in feces in pigs. Initial field trials with KE-01 look promising, but growth responses must be verified in controlled experiments. This study was conducted to evaluate the effectiveness of the probiotic KE-01 to enhance nursery pig performance.

Procedures

A total of 168 weaned pigs (PIC, initially 13.7 lb and 21 ± 2 d of age) were blocked by weight in a 35 day growth study. Pigs were randomly allotted to one of four dietary treatments in a randomized complete block design. Each pen contained six pigs per pen, with seven replicates (pens) per treatment. Pigs were housed at the Kansas State Swine Research and Teaching Center. All pens (4×5 ft) contained one stainless steel self-feeder and one nipple waterer to allow ad libitum access to feed and water.

Pigs were fed one of four experimental diets, arranged in a 2×2 factorial consisting of antibiotic (none or neomycin, 140 g/ton and oxytetracycline, 140 g/ton) or probiotic (none or KE-01, 0.35%). Experimental diets were based on corn-soybean meal and were fed in meal form for the 35-day trial. The phase 1 diet (1.55% lysine) was fed from d 0 to 14, and phase 2 diet (1.45% lysine) was fed from d 14 to 35 post-weaning (Table 1). Diets did not contain growth-promoting amounts of zinc oxide. Also, no water antimicrobials were administered throughout the trial. Pigs were weighed, and feed disappearance was measured on d 0, 7, 14, 21, 28, and 35 to determine ADG, ADFI, and feed efficiency (F/G). Data were analyzed as a randomized complete-block design with pen as the experimental unit by using the Mixed procedure of SAS.

Results and Discussion

From d 0 to 14, no interactions were observed ($P > 0.53$); therefore, the treatment main effects are presented in Table 2 and the interactive means are shown in Table 3. Pigs fed diets containing Neoterramycin had improved ADG, ADFI, and F/G ($P < 0.01$), compared with those of pigs fed diets without Neoterramycin. Pigs fed diets with KE-01 had similar ADG, ADFI, and F/G ($P > 0.12$) to those of pigs fed diets without KE-01.

From d 14 to 35, a KE-01 by Neoterramycin interaction was detected for ADFI ($P < 0.05$). This was because of a slight reduction in ADFI in pigs fed KE-01; Neoterramycin increased ADFI. Pigs fed diets containing Neoterramycin had increased ADG and ADFI ($P < 0.01$) compared with those of pigs fed diets without Neoterramycin. Adding KE-01 to the diet had no effect on ADG and ADFI ($P > 0.59$), but tended ($P < 0.07$) to improve F/G.

For the overall treatment period (d 0 to 35), a tendency for an interaction was observed on ADFI ($P < 0.08$). Pigs fed diets containing Neoterramycin had greater ADG and ADFI ($P < 0.01$), compared with those of pigs fed diets without Neoterramycin. Pigs fed diets containing KE-01 had similar ADG and ADFI ($P > 0.45$) to those of pigs fed diets without KE-01. But pigs fed diets containing KE-01 had improved F/G ($P < 0.03$), compared with that of pigs fed diets without KE-01.

In agreement with many previous trials, this study found that feeding diets containing an antibiotic such as Neoterramycin to nursery pigs resulted in improved growth performance. The probiotic, KE-01, did not improve ADG or ADFI, but slightly improved F/G.

Table 1. Diet Composition (As-fed Basis)^a

Ingredient, %	Phase 1 ^b	Phase 2 ^c
Corn	48.13	59.99
Soybean meal, 46.5% CP	29.00	35.01
Spray-dried whey	15.00	-
Select menhaden fish meal	3.75	-
Test ingredient or starch ^d	1.00	1.00
Monocalcium phosphate, 21% P	1.15	1.60
Limestone	0.70	1.10
Salt	0.30	0.35
Vitamin premix	0.25	0.25
Trace mineral premix	0.15	0.15
L-Lysine HCl	0.30	0.30
DL-Methionine	0.15	0.13
L-Threonine	0.13	0.13
TOTAL	100.00	100.00
Calculated Analysis		
Lysine, %	1.55	1.45
Isoleucine:lysine ratio, %	61	61
Leucine:lysine ratio, %	120	120
Methionine:lysine ratio, %	33	32
Met & Cys:lysine ratio, %	57	58
Threonine:lysine ratio, %	65	65
Tryptophan:lysine ratio, %	17	18
Valine:lysine ratio, %	68	71
ME, kcal/lb	1,473	1,478
CP, %	21.7	21.4
Ca, %	0.90	0.85
P, %	0.80	0.75
Lysine:calorie ratio, g/mcal	4.78	4.45

^aAll diets fed in meal form.

^bFed from d 0 to 14 post-weaning.

^cFed from d 14 to 35 post-weaning.

^dNeoterramycin (neomycin 140 g/ton and oxytetracycline 140 g/ton), KE-01 (Lactobacillus casei, 0.30% and 0.35%, phase 1 and 2, respectively) replaced corn starch to provide additional dietary treatments.

Table 2. Main Effects of KE-01 and In-feed Neomycin/Oxytetracycline on Growth Performance of Nursery Pigs^a

Item	KE-01 ^c		Neoterramycin		SE	P - value		
	0	0.35% ^d	0	140 g/ton		KE-01	Neoterramycin	KE-1 * Neoterramycin
Pens ^b	14	14	14	14				
Day 0 to 14								
ADG, lb	0.63	0.62	0.57	0.68	0.024	0.77	0.01	0.56
ADFI, lb	0.73	0.70	0.67	0.75	0.027	0.38	0.01	0.53
F/G	1.15	1.12	1.17	1.11	0.018	0.12	0.01	0.98
Day 14 to 35								
ADG, lb	1.35	1.35	1.29	1.41	0.024	0.77	0.01	0.11
ADFI, lb	1.91	1.89	1.80	1.99	0.034	0.59	0.01	0.05
F/G	1.41	1.39	1.40	1.41	0.010	0.07	0.54	0.36
Day 0 to 35								
ADG, lb	1.06	1.06	1.00	1.12	0.020	0.94	0.01	0.15
ADFI, lb	1.43	1.41	1.35	1.50	0.027	0.45	0.01	0.08
F/G	1.35	1.33	1.35	1.33	0.009	0.03	0.15	0.39
Final Weight, lb	50.81	50.9	48.74	52.97	0.709	0.91	0.01	0.15

^aDiets fed in meal form, with phase 1 fed from d 0 to 14 and phase 2 fed from d 14 to 35.

^bComparison of two diets with, versus two without, KE-01 and two with, versus two without, Neoterramycin.

^cA novel *Lactobacillus casei* strain.

^dKE-01 fed at 0.30% phase 1 and 0.35% phase 2, respectively.

Table 3. Effect of Probiotic, KE-01, and In-feed Neomycin/Oxytetracycline on Growth Performance of Weanling Pigs^a

Item	Control	KE-01 ^{bc}	Neoterramycin	KE-01 and Neoterramycin	SED	P-value			
						Treatment	KE-01 *Neoterramycin	Med vs. non-Med	KE-01 vs. No KE-01
Day 0 to 14									
ADG, lb	0.57 ^d	0.58 ^d	0.69 ^e	0.67 ^e	0.034	0.01	0.56	0.01	0.77
ADFI, lb	0.68 ^d	0.67 ^d	0.77 ^e	0.73 ^{de}	0.038	0.04	0.53	0.01	0.38
F/G	1.19 ^d	1.16 ^{de}	1.12 ^{ef}	1.09 ^f	0.025	0.01	0.98	0.01	0.12
Day 14 to 35									
ADG, lb	1.26 ^d	1.31 ^d	1.43 ^e	1.40 ^e	0.034	0.01	0.11	0.01	0.77
ADFI, lb	1.78 ^d	1.83 ^d	2.04 ^e	1.95 ^e	0.048	0.01	0.05	0.01	0.59
F/G	1.41	1.40	1.42	1.39	0.02	0.19	0.36	0.54	0.07
Day 0 to 35									
ADG, lb	0.99 ^d	1.02 ^d	1.14 ^e	1.11 ^e	0.029	0.01	0.15	0.01	0.95
ADFI, lb	1.34 ^d	1.37 ^d	1.53 ^e	1.46 ^e	0.038	0.01	0.08	0.01	0.45
F/G	1.35 ^d	1.34 ^{de}	1.35 ^d	1.32 ^e	0.013	0.07	0.39	0.15	0.03
Final weight, lb	48.16 ^d	49.33 ^d	53.46 ^e	52.48 ^e	1.00	0.01	0.15	0.01	0.91

^aDiets fed in meal form, with phase 1 fed from d 0 to 14 and phase 2 fed from d 14 to 35.

^bA novel *Lactobacillus casei* strain.

^cKE-01 fed at 0.30% phase 1 and 0.35% phase 2, respectively.

^{d,e,f}Means having different superscript letters differ P<0.05.