

**Bacterial and Yeast Preparations for Starter  
and Grower Rations**

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BACTERIAL AND YEAST PREPARATIONS FOR  
STARTER AND GROWER RATIONS

E. T. Kornegay and H. R. Thomas<sup>1</sup>

The antibacterial activity of Lactobacillus acidophilus was reported a number of years ago (Wheater, Hirsch and Mattick, 1951; Vincent, Veomett and Riley, 1959) and L. acidophilus cultures have been widely used in attempts to control undesirable intestinal microflora in children (Winkelstein, 1956). King (1968) reported increased body weight gains and improved efficiency for growing pigs fed 2 grams of L. acidophilus preparation for 5 days at the start of the experiment.

The objective of these trials was to evaluate certain bacterial and yeast preparations as growth stimulants for weaned and growing pigs.

Experimental Procedure

Trials 1 and 2. Two hundred and forty-four Yorkshire pigs (116 pigs in trial 1 averaging 11.2 lb. and 128 pigs in trial 2 averaging 12.1 lb.) were used in two similar trials. Twelve litters in each trial were allotted treatments at random. Two weeks before the pigs were weaned, half of the litters received Lactobacillus acidophilus milk<sup>2</sup> mixed with the starter ration (table 1). The other half of the litters received the normal starter ration without the milk. After pigs were eating well (about 1 week before weaning), each litter was receiving 3/4 quart of milk per day mixed with the starter ration. The milk was discontinued 2 weeks after the pigs were weaned. The pigs were weaned at 6 weeks and left in the farrowing house for the remainder of the test. The length of the test period was 39 and 34 days, respectively, for trials 1 and 2. Body weights were taken weekly. Feed consumption was determined only in trial 2.

Trial 3. Two hundred and seventy Hampshire-Yorkshire pigs, averaging 19.0 lb., were allotted to treatments from outcome groups based on weight, sex and litters. The pigs were fed the basal ration (table 1) plus the following additives: 1) none, 2) 0.5% Streptococcus facium

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<sup>2</sup>Provided by Walker-Gordon Farms, Plainfield, N.J.

preparation, 3) 2.5% S. facium preparation, 4) 12.5% S. facium preparation, 5) 110 ppm neomycin sulfate and 110 ppm oxytetracycline. The S. facium preparation was prepared by mixing 0.2 lb. S. facium concentrate<sup>3</sup> with 99.8 lb. of ground corn. The pigs were housed in an enclosed building with pens having totally slotted floors. Records were kept of body weight, feed consumption, and scouring incidence and its severity.

Trials 4, 5 and 6. Crossbred pigs (80, 100, and 48 averaging 27.6, 55.7 and 27.8 lb. in trials 4, 5 and 6, respectively) were fed the basal ration (table 2) with the following additives: 1) none, 2) 110 ppm chlortetracycline, 110 ppm sulfamethazine and 55 ppm penicillin, 3) Alfazume<sup>4</sup>, 4) Lacto-plus or Lacto-bran<sup>5</sup>, 5) mineral-vitamin premix with yeast culture<sup>6</sup>. In trials 5 and 6, bran was used instead of alfalfa meal as a carrier for the bacterial preparation used in ration 4. In trial 5, 0.5% of the lacto-bran was added along with 1.25% of dehydrated alfalfa meal. In trial 6, 1.5% of lacto-bran was added to the 18% crude protein ration which was fed to the pigs until they reached 40 pounds. Then, the level of lacto-bran was reduced to 0.5%. Dehydrated alfalfa meal was continued at 1.5%. The lacto-plus and -bran premixes were kept under refrigeration until just prior to the mixing of the ration. All rations were self-fed, and water was available at all times. A rectal swab was taken in trials 4 and 6 for qualitative analyses of bacteria. Standard laboratory methods were used.

Pigs were assigned to rations from outcome groups based on body weight, sex, and litter. The pigs were housed in an enclosed building with partially slotted floors. The data were statistically analyzed, using the analysis of variance and Duncan's (1955) multiple range test.

#### Results and Discussion

In trials 1 and 2, L. acidophilus milk added to the starter ration before and after weaning, resulted in a significant improvement in average daily gain (table 3). Feed intake was significantly improved

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<sup>3</sup>Supplied by A. B. Cernelle, Engelholm, Sweden.

<sup>4</sup>Supplied by Hildum Fermentation and Processing Co., Shirmanstown, Pa. 17901.

<sup>5</sup>Supplied by Biochemical Corp., Salem, Va. 24153

<sup>6</sup>Supplied by Vigortone Products, Co., Cedar Rapids, Iowa 52406.

(trial 2) when the L. acidophilus milk was added to the starter ration. This suggests that the improvement in daily gain may have been due mainly to an increased feed intake. S. facium added at various levels was ineffective in improving average daily gain, feed intake or feed efficiency in trial 3. A combination of oxytetracycline and neomycin did significantly improve average daily gain and feed intake, with a small nonsignificant increase in feed efficiency.

In trials 4, 5, and 6, average daily gain was increased 7 to 19% when the antibiotic combination was added to the basal ration (table 4). Differences were not always significant. As reported previously, feed intake was consistently improved when the ration contained the antibiotic combination, with the response to feed efficiency being variable. The yeast preparation plus the antibiotic combination produced about the same response as did the antibiotic combination alone. Alfa-zyme, which contained a yeast preparation, did not significantly influence average daily gain, feed intake or feed efficiency. Lacto-Plus, which contained L. acidophilus, did not consistently improve gains, although in phase II of trial 6, there was a significant improvement in feed intake with a concurrent increase in average daily gain; however, feed/gain ratios were poorer than for pigs fed the basal diet. Hines and Koch (1971) have reported no benefit from the addition of L. acidophilus preparation to growing and finishing rations. The preparation that Hines and Koch (1971) used was produced by a different company.

In trials 4 and 6, there were no differences in the fecal bacterial obtained by swabs (table 5).

#### Summary

Lactobacillus acidophilus milk, when added to a starter ration before and after weaning, resulted in an improvement in average daily gain and feed intake, but a Streptococcus facium preparation was ineffective.

Although results are not conclusive, it appears that the two commercial products, alfa-zyme and the yeast preparation, were ineffective as growth stimulants. The experimental preparation, Lacto-Bran, produced a slight improvement in average feed intake.

In agreement with previous reports, antibiotic combinations were effective in stimulating growth, with the major effect being upon feed intake.

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TABLE 1. PERCENTAGE COMPOSITION OF BASAL RATIONS. TRIALS 1 THROUGH 3.

Ingredients	Trials	
	1 & 2	3
Corn, ground	65.72	69.90
Soybean meal <sup>1</sup>	16.00	27.10
Corn sugar	5.00	---
Defluorinated phosphate	1.40	2.10
Limestone	0.50	---
Swine trace-mineral salt <sup>2</sup>	0.50	0.50
Vitamin premix	0.50 <sup>3</sup>	0.40 <sup>4</sup>

<sup>1</sup>Soybean meal contained 49% protein in trials 1 and 2, and 44% protein in trial 3.

<sup>2</sup>Contained (%): 0.01 Co, 0.08 Cu, 0.01 I, 0.14 Fe, 0.8 Mn, 1.0 Zn and 95.9 NaCl.

<sup>3</sup>Supplied (per lb. of ration): 3.3 mg. riboflavin, 6.6 mg. pantothenic acid, 15.4 mg. niacin, 16.5 mg. choline chloride, 8.3 mcg. vitamin B<sub>12</sub>, 1240 IU vitamin A and 246 IU vitamin D.

<sup>4</sup>Supplied (per lb. of ration): 1.1 mg. riboflavin, 5.6 mg. pantothenic acid, 5.6 mg. niacin, 8.7 mcg. vitamine B<sub>12</sub>, 182 mg. choline chloride, 1091 IU vitamin A, 182 IU vitamin D, and 2 IU vitamin E.

TABLE 2. PERCENTAGE COMPOSITION OF DIETS. TRIALS 4 THROUGH 6  
(18% crude protein)<sup>1</sup>

	Rations				
	1	2	3	4	5
Antibiotic comb. <sup>2</sup>	0	+	0	0	+
Alfa-Zyme <sup>3</sup>	0	0	+	0	0
Lacto-Plus <sup>4</sup>	0	0	0	+	0
Yeast Culture <sup>5</sup>	0	0	0	0	+
Ground corn	72.45	72.20	67.80	71.00	70.95
Soybean meal (50%)	23.10	23.10	24.00	23.30	23.30
Defluorinated phosphate	2.20	2.20	2.20	2.20	---
Swine T.M salt <sup>6</sup>	0.50	0.50	0.50	0.50	0.50
Vitamin premix <sup>7</sup>	0.50	0.50	0.50	0.50	---
ASP 250 <sup>2</sup>	---	0.25	---	---	0.25
Alfa-Zyme <sup>3</sup>	---	---	5.00	---	---
Lacto-Plus <sup>4</sup>	---	---	---	2.50	---
Deyd. alfalfa meal	1.25	1.25	---	---	---
Vigortone #3 <sup>5</sup>	---	---	---	---	5.00

<sup>1</sup>In trial 6, the level of crude protein was reduced to 16% when pigs weighed 40 lb.

<sup>2</sup>Contained 20 gm. chlortetracycline, 20 gm. sulfamethazine and 10 gm. penicillin (from procaine penicillin) per lb. of premix.

<sup>3</sup>Supplied by Hildum Fermentation & Processing Co., Shirmanstown, Pa. 17091.

<sup>4</sup>Prepared by Biochemical Corp., Salem, Va. 24153. In trials 5 and 6, bran was used instead of alfalfa meal as a carrier for the bacterial preparation. In trial 5, 0.5% of the Lacto-bran preparation was added per ton along with 1.25% of dehydrated alfalfa meal. In trial 6, 1.5% unit of Lacto-bran was added to the 18% crude protein ration which was fed until the pigs reached 40 lb. Then, the level was reduced by 0.5%. Dehydrated alfalfa meal was added at a level of 1.25% to the rations 1 and 2.

<sup>5</sup>Supplied by Vigortone Products Co., Cedar Rapids, Iowa 52406.

<sup>6</sup>Contained (%): 0.8 Mn, 0.4 Fe, 0.08 Cu, 0.01 Co, 0.01 I, 1.0 Zn and 95.9 NaCl.

<sup>7</sup>Supplied (per lb. of ration): 3.0 mg. riboflavin, 15.5 mg. pantothenic acid, 15.5 mg. niacin, 24.0 mg. vitamin B<sub>12</sub>, 500 mg. choline chloride, 3000 IU vitamin A, 500 IU Vitamin D and 5 IU vitamin E.



TABLE 3. AVERAGE DAILY GAIN, FEED INTAKE AND FEED PER GAIN OF PIGS FED L. acidophilus AND S. facium. TRIALS 1 THROUGH 3.

Trials <sup>1</sup> & Treatments	No. of Pigs	Criteria		
		Daily <sup>2,3</sup> Gain	Feed Intake	Feed/Gain <sup>2</sup>
		lb	lb	lb
Trial 1				
Basal ration	52	0.75(0) <sup>b</sup>	--	--
<u>L. acidophilus</u>	64	0.88(18) <sup>c</sup>	--	--
Trial 2				
Basal ration	64	0.70(0) <sup>b</sup>	0.84 <sup>b</sup>	--
<u>L. acidophilus</u>	64	0.81(16) <sup>c</sup>	1.32 <sup>c</sup>	--
Trial 3				
Basal ration	54	0.70(0) <sup>b</sup>	1.21 <sup>b</sup>	1.72(0)
0.5% <u>S. facium</u>	54	0.73(3) <sup>b</sup>	1.25 <sup>b</sup>	1.71(0)
2.5% <u>S. facium</u>	54	0.70(0) <sup>b</sup>	1.28 <sup>b</sup>	1.83(6)
12.5% <u>S. facium</u>	54	0.75(6) <sup>b</sup>	1.28 <sup>b</sup>	1.70(-1)
110 ppm Oxy and 110 ppm Neo	54	0.92(31) <sup>c</sup>	1.50 <sup>c</sup>	1.63(-6)

<sup>1</sup>The length of trial and initial weight of pigs were 39 days and 11.2 lb., respectively, for trial 1; 34 and 12.2 for trial 2; 42 and 18.0 for trial 3.

<sup>2</sup>Values in parentheses are the percentage changes from the basal ration.

<sup>3</sup>Means within trials and in the same column with different superscript letters are significantly different (P<.01).

TABLE 4. AVERAGE DAILY GAIN, DAILY FEED INTAKE, AND FEED PER GAIN OF PIGS FED RATIONS CONTAINING VARIOUS BACTERIAL AND YEAST PREPARATIONS TRIALS 4 THROUGH 6.

Trials <sup>1</sup> & Treatments	Criteria		
	Daily Gain lb.	Feed Intake lb.	Feed/gain lb.
Trial 4			
Basal ration	1.42(0) <sup>2</sup>	3.29 <sup>3</sup>	2.32(0) <sup>2</sup>
Antibiotic comb. <sup>4</sup>	1.56(10)	3.77	2.42(4)
Alfa-Zyme <sup>5</sup>	1.43(0)	3.54	2.47(6)
Lacto-Plus <sup>6</sup>	1.49(5)	3.50	2.35(1)
Yeast and Ant. <sup>7</sup>	1.51(6)	3.49	2.31(0)
Trial 5			
Basal ration	1.66(0)	4.40	2.64(0)
Antibiotic comb. <sup>4</sup>	1.78(7)	4.78	2.68(2)
Alfa-Zyme <sup>5</sup>	1.72(4)	4.48	2.60(-2)
Lacto-Plus <sup>6</sup>	1.73(4)	4.39	2.53(-4)
Yeast and Ant. <sup>7</sup>	1.69(2)	4.27	2.52(-5)
Trial 6, Phase I			
Basal ration	0.88(0)	1.94 <sup>a</sup>	2.21(0)
Antibiotic comb. <sup>4</sup>	1.05(19)	2.34 <sup>bc</sup>	2.25(2)
Lacto-Bran <sup>6</sup>	0.91(3)	2.15 <sup>ab</sup>	2.33(5)
Yeast and Ant. <sup>7</sup>	1.06(20)	2.60 <sup>c</sup>	2.53(14)
Trial 6, Phase II			
Basal ration	1.34(0)	3.10 <sup>a</sup>	2.32(0)
Antibiotic comb. <sup>4</sup>	1.48(10)	3.60 <sup>b</sup>	2.43(5)
Lacto-Bran <sup>6</sup>	1.41(5)	3.56 <sup>b</sup>	2.53(9)

<sup>1</sup>Length of test (days), pigs per treatment (number) and average initial weight (lb.) were 51, 20 and 27.6 respectively for trial 4; 28, 16 and 55.7 for trial 5; 56, 12 and 27.8 for trial 6.

<sup>2</sup>Values in parentheses are the percentage changes from the basal ration.

<sup>3</sup>Means in the same trial within column with different superscript letters are significantly different (P<.05).

<sup>4</sup>Contained 20 gm. chlortetracycline, 20 gm. sulfamethazine and 10 gm. penicillin (from procaine penicillin) per lb. of premix.

<sup>5</sup>Supplied from Hildum Fermentation & Processing Co., Shirmanstown, Pa.

<sup>6</sup>Prepared by Biochemical Corp., Salem, Va. 24153. In trials 5 and 6, bran was used instead of alfalfa meal as a carrier for the bacterial preparation. In trial 5, 0.5% of the lacto-bran preparation was added per ton along with 1.25% of dehydrated alfalfa meal. In trial 6, 1.5% units of Lacto-bran was added to the 18% crude protein ration which was fed until the pigs reached 40 lb. Then, the level was reduced to 0.5%. Dehydrated alfalfa meal was added at the level of 1.25% to control rations.

<sup>7</sup>Supplied by Vigortone Products Co., Cedar Rapids, Iowa 52406.

TABLE 5. CLASSIFICATION OF FECAL BACTERIA FROM PIGS FED RATIONS WITH VARIOUS BACTERIAL AND YEAST PREPARATIONS. TRIALS 4 AND 6.

Trials & Classification	Rations <sup>1</sup>								
	1	2	3	4	5				
Trial 4	F <sup>2</sup>	F	F	F	F				
Classification, no. of pigs in which observed									
No. of pigs used	8	8	7	8	8				
<u>Staphylococcus</u>	5	1	4	3	5				
<u>E. coli</u>	4	3	4	3	3				
<u>Diplococcus</u>	1	2	1	1	2				
<u>Streptococcus</u>	4	5	3	5	1				
<u>Corynebacterium</u>	0	0	3	1	0				
<u>Bacillus subtilis</u>	3	1	2	0	2				
Trial 6	I <sup>2</sup>	F <sup>2</sup>	I	F	I	F	I	F	
Classification, no. of pigs in which observed									
No. of pigs used	12	12	12	12	-	12	12	12	12
<u>Staphylococcus</u>	0	4	2	5	-	1	8	1	0
<u>E. coli</u>	11	6	10	9	-	11	8	11	10
<u>Streptococcus</u>	0	2	1	3	-	2	3	1	4
<u>Bacillus subtilis</u>	1	0	1	0	-	2	0	1	2
<u>Proteus</u>	1	1	1	1	-	1	1	0	1
<u>Hem. E. coli</u>	1	0	1	0	-	0	0	1	0
<u>Hem. Streptococcus</u>	2	0	0	1	-	0	2	1	2

<sup>1</sup>See Table 2 for treatments.

<sup>2</sup>Initial - I and final - F.