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COMPARISON OF NORSE LT-94 (HERRING MEAL) TO OTHER PROTEIN SOURCES IN EARLY-WEANED STARTER PIG DIETS

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Summary

Two growth trials were conducted to compare Norse LT-94 to other protein sources in starter pig diets. In trial 1, 270 weanling pigs (initially 13.7 lb and 20 d of age) were used to compare Norse LT-94 (herring meal), select menhaden fish meal, and spray-dried blood meal as protein sources in the Phase II diet. Pigs were blocked by weight with six replications of three treatments and 15 pigs per pen. During Phase I (d 0 to 7 postweaning), all pigs were fed the same high nutrient density diet. During Phase II (7 to 28 d postweaning), pigs were fed one of three experimental diets. All Phase II diets contained 10% dried whey and were formulated to 1.25% lysine and .34% methionine. The positive control diet contained 2.5% spray-dried blood meal. Norse LT-94 (herring meal, 4.06%) and select menhaden fish meal (4.87%) replaced blood meal on an equal lysine basis to form the other experimental diets. No differences occurred in pig performance during Phase II, indicating that Norse LT-94, spray-dried blood meal, and select menhaden fish meal are interchangeable as protein sources when substituted on an equal lysine basis. In trial 2, 230 pigs (initially 18 d of age and 11.0 lb) were used to examine the influence of various combinations of spray-dried porcine plasma and Norse LT-94 on starter pig performance. Pigs were allotted by weight to six replicates of five treatments with six to 10 pigs per pen. Pigs were assigned to one of five dietary treatments with no replacement or 25, 50, 75, or 100% of the spray-dried porcine plasma replaced with Norse LT-94 (herring meal) on an equal lysine basis. Therefore, diets contained 8, 6, 4, 2, or 0% spray-dried porcine plasma and 0, 2.14, 4.29, 6.43, or 8.58% Norse LT-94, respectively. All Phase I diets were formulated to contain 20% dried whey, 1.5% lysine, and .44% methionine. These diets were fed from d 0 to 14 postweaning. From d 14 to 28 (Phase II), all pigs were fed a common diet. Replacing spray-dried porcine plasma with Norse LT-94 resulted in a linear decrease in average daily gain (ADG) and average daily feed intake (ADFI) during Phase I and for the overall trial. This response became magnified when greater than 25% of the plasma was replaced with Norse LT-94. Feed efficiency responded in a quadratic manner for the first week of Phase I and for the overall trial, with pigs fed the diet containing 6% spray-dried porcine plasma and 2.14% Norse LT-94 having the best feed efficiency. These trials indicate that Norse LT-94 (herring meal) can replace spray-dried blood meal and select menhaden fish meal in Phase II starter pig diets. However, Norse LT-94 (herring meal) cannot be used as a replacement for spray-dried plasma protein in the Phase I diet.

(Key Words: Starter, Fish Meal, Plasma Protein.)

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Introduction

Recent research at Kansas State University has evaluated several protein sources in diets for early-weaned pigs. These protein sources include spray-dried porcine plasma, spray-dried blood meal, skim milk, and various soy protein concentrates. Norse LT-94 is a high quality herring meal that has the potential to be used in early-weaned starter pig diets. However, Norse LT-94 is a relatively unknown product in the United States. Therefore, the objective of this research was to compare Norse LT-94 to the predominant existing protein sources in starter pig diets. Select menhaden fish meal generally is regarded as one of the highest quality fish meals available to the feed industry, and, thus, trial 1 was designed to directly compare Norse LT-94 with select menhaden fish meal in a manner in which these protein sources would be used by the feed industry. Spray-dried porcine plasma is an expensive, but high quality, protein source used in Phase I diets for the early-weaned pig. If Norse LT-94 could be substituted for a portion of the porcine plasma in the diet without affecting pig performance, diet cost would be decreased. Therefore, the second trial was designed to answer this objective.

Procedures

Trial 1. A total of 270 pigs (initially 20 d and 13.7 lb) was used in this 28-d growth trial to compare Norse LT-94, select menhaden fish meal, and spray-dried blood meal as protein sources for the early-weaned pig. Pigs were blocked by weight and allotted to each of three dietary treatments with a total of 15 pigs per pen and six replicate pens per treatment.

The trial was divided into two phases. During Phase I (day 0 to 7 postweaning), all pigs were fed a common diet. This diet contained 10% spray-dried porcine plasma and 25% dried whey and was formulated to 1.6% lysine, .44% methionine, .9% Ca, and .8% P (Table 1).

The Phase II experimental diets were fed from d 7 to 28 postweaning. These diets contained 10% dried whey and were formulated to 1.25% lysine, .34% methionine, .9% Ca, and .8% P (Table 1). The control diet contained 2.5% spray-dried blood meal. Norse LT-94 (4.06%) and select menhaden fish meal (4.87%) replaced spray-dried blood meal on an equal lysine basis to form the other experimental diets. Soybean meal was maintained constant (22.63%) in all diets.

Pigs were housed in an environmentally controlled nursery in 4 × 8 ft pens. Pigs were allowed ad libitum access to feed and water. Pigs were weighed and feed disappearance was measured on d 7, 14, 21 and 28 after weaning to determine average daily gain (ADG), average daily feed intake (ADFI) and feed efficiency (G/F).

Data were analyzed as a randomized complete block design. General linear model procedures of SAS were used with initial weight serving as the blocking factor. Single degree of freedom contrasts were used to separate treatment means. Pig weight at the end of Phase I (d 7) was used as a covariate for Phase II growth performance.

Trial 2. A total of 230 pigs (initially 18 d and 11.0 lb) was used in this 28-d trial to compare Norse LT-94 and spray-dried porcine plasma in the Phase I starter pig diet. Pigs were blocked by weight and allotted to each of five dietary treatments with a total of six to 10 pigs per pen and six replicate pens per treatment.

Similar to trial 1, trial 2 was divided into two phases. The experimental diets were only fed during Phase I (d 0 to 14 postweaning). All pigs received a common diet during Phase II (d 14 to 28 postweaning). The Phase I, experimental diets were formulated to contain 1.5% lysine, .44% methionine, .9% calcium, and .8% phosphorus (Table 2). The control diet was corn-soybean meal-based and contained 8% spray-dried porcine plasma (SDPP) and 25% dried whey. Norse LT-94 was absent or replaced 25, 50, 75, or 100% of the porcine plasma on an equivalent lysine basis to form the experimental diets. Therefore, diets contained 8, 6, 4, 2, or 1% spray-dried porcine

plasma and 0, 2.14, 4.29, 6.43, or 8.58% Norse LT-94, respectively. Soybean meal level remained constant in all diets.

On d 14, all pigs were switched to a common Phase II diet containing 10% dried whey and 2.5% spray-dried blood meal and formulated to 1.25% lysine (Table 2). Pigs were fed this diet for the remainder of the experiment.

Pigs were housed in an environmentally controlled nursery in 4 × 6 ft pens. Pigs were allowed ad libitum access to feed and water. Pigs were weighed and feed disappearance was measured on d 7, 14, 21, and 28 after weaning to determine average daily gain (ADG), average daily feed intake (ADFI), and feed efficiency (G/F).

Data were analyzed as a randomized complete block design. General linear model procedures of SAS were used with initial weight serving as a blocking factor. Linear and quadratic polynomials were used to detect the response to replacing spray-dried porcine plasma with Norse LT-94.

Results and Discussion

Trial 1. When all pigs consumed the same diet during Phase I, pigs gained .32 lb/d, consumed .45 lb/day, and had a feed to gain (F/G) ratio of 1.51. During Phase II, no differences ($P > .21$) occurred in ADG, ADFI, or F/G among pigs fed diets containing Norse LT-94, select menhaden fish meal or spray-dried blood meal for any week of the trial (Table 3). These results indicate that Norse LT-94 can replace select menhaden fish meal and spray-dried blood meal on an equal lysine basis in starter pig diets with no influence on performance.

Trial 2. Replacing spray-dried porcine plasma with Norse LT-94 resulted in linear reductions ($P < .006$) in ADG and ADFI during Phase I (d 0 to 14) and for the overall trial. The depression in performance became more evident when greater than 25% of the spray-dried porcine plasma was replaced with Norse LT-94. Feed to gain increased in a linear ($P < .01$) fashion during Phase I and for the overall trial as the level of Norse LT-94 increased in the diet. Feed efficiency improved with the first substitution of Norse LT-94 for spray-dried porcine plasma (6% plasma, 2.4% Norse LT-94); however, as larger portions of plasma were replaced, F/G increased rapidly.

Although small differences in ADG and ADFI occurred from d 14 to 21, no differences were observed between the five experimental treatments for the entire Phase II period (d 14 to 28). Thus, any difference in performance at the end of Phase I was maintained for the duration of the experiment. In summary, Norse LT-94 can replace only a small portion of the spray-dried porcine plasma in the Phase I diet without causing large reductions in pig performance.

In conclusion, these trials indicate that Norse LT-94 can replace spray-dried blood meal and select menhaden fish meal in Phase II starter pig diets. However, Norse LT-94 cannot be used as a replacement for spray-dried plasma protein in the Phase I diet.

Table 1. Composition of Diets (Trial 1)

Ingredient, %	Phase I[b]	Experimental protein sources[a]		
		Blood meal	Norse LT-94	Menhaden fish meal
Corn	37.18	57.47	56.32	56.11
Soybean meal (48% CP)	18.69	22.63	22.63	22.63
Porcine plasma	10.0	—	—	—
Spray-dried blood meal	—	2.5	—	—
Norse LT-94	—	—	4.056	—
Select menhaden fish meal	—	—	—	4.872
Soybean oil	5.0	3.0	3.0	3.0
Dried whey	25.0	10.0	10.0	10.0
Monocalcium phosphate	1.77	1.95	1.95	1.33
Limestone	.63	.82	.82	.49
Antibiotic[c]	1.0	1.0	1.0	1.0
Copper sulfate	.08	.08	.08	.08
L-lysine HCl	.10	.10	.10	.10
DL-methionine	.15	.05	—	—
Vitamin premix	.25	.25	.25	.25
Trace mineral premix	.15	.15	.15	.15
Total	100.0	100.0	100.0	100.0

[a]All Phase II diets were formulated to contain 1.25% lysine, .9% Ca, .8% P, and .36% methionine.
[b]The Phase 1 diet was formulated to contain 1.6% lysine, .44% methionine, .9% Ca, .8% P.
[c]150 g/ton apramycin in Phase I and 50 g/ton carbadox in Phase II.

Table 2. Composition of Experimental Diets (Trial 2)[a]

Ingredient, %	Plasma protein, % : Norse LT-94, %					
	8:0	6:2.14	4:4.29	2:6.43	0:8.58	Phase II
Corn	38.63	38.72	38.81	38.86	38.92	57.47
Soybean meal (48% CP)	19.28	19.28	19.28	19.28	19.28	22.63
Porcine plasma	8.0	6.0	4.0	2.0	—	—
Norse LT-94	—	2.14	4.29	6.43	8.58	—
Spray-dried blood meal	—	—	—	—	—	2.5
Soybean oil	5.0	5.0	5.0	5.0	5.0	3.0
Dried whey	25.0	25.0	25.0	25.0	25.0	10.0
Monocal. phos., 21% P	1.74	1.58	1.43	1.27	1.11	1.95
Limestone	.64	.60	.56	.52	.48	.83
Antibiotic[b]	1.0	1.0	1.0	1.0	1.0	1.0
Copper sulfate	.08	.08	.08	.08	.08	.08
L-lysine	.10	.10	.10	.10	.10	.10
DL-methionine	.13	.09	.06	.06	.05	.05
Vitamin premix	.25	.25	.25	.25	.25	.25
Trace mineral premix	.15	.15	.15	.15	.15	.15
Total	100.0	100.0	100.0	100.0	100.0	100.0

[a]All Phase I diets were formulated to contain 1.5% lysine, .9% Ca, .8% P, and .44% methionine. Experimental diets were fed from d 0 to 14 postweaning. All pigs received the Phase II diet from d 14 to 28 postweaning. The Phase II diet was formulated to 1.25% lysine, .9% Ca, and .8% P.
[b]150 g/ton apramycin in Phase I and 50 g/ton carbadox in Phase II.

Table 3. Comparison of Protein Sources in the Phase II Diet (Trial 1)

Item	Protein source: Spray-dried blood meal	Norse LT-94 (herring meal)	Select menhaden fish meal	CV	P value
d 7 to 14					
ADG, lb	.36	.29	.34	22.5	.39
ADFI, lb	.75	.71	.73	8.2	.53
F/G	2.25	2.73	2.63	25.9	.48
d 14 to 21					
ADG, lb	.86	.96	.87	11.5	.26
ADFI, lb	1.08	1.09	1.06	6.01	.80
F/G	1.28	1.12	1.32	18.5	.38
d 21 to 28					
ADG, lb	1.09	1.08	1.14	8.2	.59
ADFI, lb	1.72	1.75	1.70	4.9	.63
F/G	1.58	1.62	1.51	7.0	.34
d 7 to 28					
ADG, lb	.76	.77	.78	5.7	.89
ADFI, lb	1.18	1.18	1.16	4.3	.74
F/G	1.54	1.52	1.49	2.6	.11

[a]Means represent 6 pens/treatment with 15 pigs/pen. All pigs were fed a common Phase I diet from d 0 to 7 postweaning. Pig weight at d 7 was used as a covariate for Phase II growth performance.

Table 4. Effect of Replacing Plasma Protein with Norse LT-94 (herring meal) on Starter Pig Performance (Trial 2)[a]

Item	Plasma Protein, % : Norse LT-94, % 8:0	6:2.14	4:4.29	2:6.43	0:8.58	CV	P Values: Linear	Quadratic
d 0 to 7								
ADG, lb	.34	.32	.28	.17	.17	23.6	.001	.41
ADFI, lb	.44	.38	.38	.35	.32	13.6	.001	.81
F/G	1.28	1.18	1.40	2.23	2.00	23.5	.001	.06
d 0 to 14								
ADG, lb	.51	.48	.43	.37	.31	16.7	.001	.56
ADFI, lb	.57	.50	.48	.46	.42	11.8	.001	.58
F/G	1.11	1.06	1.12	1.25	1.46	18.5	.006	.10
d 14 to 21								
ADG, lb	.72	.70	.84	.71	.76	9.8	.41	.25
ADFI, lb	1.12	1.10	1.14	1.12	1.11	6.4	.94	.70
F/G	1.57	1.59	1.38	1.63	1.46	8.1	.26	.58
d 14 to 28								
ADG, lb	.93	.93	.96	.90	.90	6.9	.36	.34
ADFI, lb	1.44	1.43	1.43	1.39	1.39	4.9	.11	.75
F/G	1.56	1.54	1.50	1.55	1.54	4.4	.73	.32
d 0 to 28								
ADG, lb	.72	.70	.70	.64	.61	8.1	.001	.36
ADFI, lb	1.00	.97	.96	.93	.90	5.5	.002	.93
F/G	1.40	1.38	1.38	1.46	1.50	8.7	.01	.10

[a]Means represent 6 pens per treatment with 6 to 10 pigs/pen depending on block. Pigs were fed one of the experimental diets d 0 to 14 postweaning, and all pigs were fed a common Phase II diet d 14 to 28 postweaning.