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Evaluation of soybean oil additions in starter pig diets

Abstract

Two trials involving 420 weanling pigs (21+3 d) were conducted to determine the effects of additions of soybean oil (SO) on starter pig performance. Soybean oil additions of either 0, 1, 2, 3, 4, or 5% were made to the 1.25% lysine corn-soybean meal-dried whey basal diet. In each trial, there were 7 pigs/pen and 5 replications. Data from the two trials were pooled except for feed efficiency (F/G) at 2-weeks, where a trial x treatment interaction existed. Average daily gain (ADG) and average daily feed intake (ADFI) were not affected by SO additions at 2 weeks but gains were numerically higher when 3% SO was added to starter diets. Feed efficiency in Trial 1 improved linearly ($P < .001$), whereas a cubic response ($P < .05$) in F/G with added levels of SO was observed in Trial 2. At 35 days, SO additions caused a linear improvement in ADG ($P < .01$), ADFI ($P < .05$) and F/G ($P < .0001$), with the highest numerical response in gain and feed intake at the 3% SO level. Metabolizable energy (ME) intake was not affected by dietary treatment, but was optimized at the 3% SO inclusion level. Based on these data, it appears that 21-d old pigs can utilize fat, and soy oil additions of between 3 and 5% are beneficial to starter pig performance.; Swine Day, Manhattan, KS, November 20, 1986

Keywords

Swine day, 1986; Kansas Agricultural Experiment Station contribution; no. 87-133-S; Report of progress (Kansas State University. Agricultural Experiment Station and Cooperative Extension Service); 507; Swine; Soybean oil; Starter pig

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EVALUATION OF SOYBEAN OIL ADDITIONS
IN STARTER PIG DIETS

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Summary

Two trials involving 420 weanling pigs (21 \pm 3 d) were conducted to determine the effects of additions of soybean oil (SO) on starter pig performance. Soybean oil additions of either 0, 1, 2, 3, 4, or 5% were made to the 1.25% lysine corn-soybean meal-dried whey basal diet. In each trial, there were 7 pigs / pen and 5 replications. Data from the two trials were pooled except for feed efficiency (F/G) at 2-weeks, where a trial x treatment interaction existed. Average daily gain (ADG) and average daily feed intake (ADFI) were not affected by SO additions at 2 weeks but gains were numerically higher when 3% SO was added to starter diets. Feed efficiency in Trial 1 improved linearly ($P < .001$), whereas a cubic response ($P < .05$) in F/G with added levels of SO was observed in Trial 2. At 35 days, SO additions caused a linear improvement in ADG ($P < .01$), ADFI ($P < .05$), and F/G ($P < .0001$), with the highest numerical response in gain and feed intake at the 3% SO level. Metabolizable energy (ME) intake was not affected by dietary treatment, but was optimized at the 3% SO inclusion level. Based on these data, it appears that 21-d old pigs can utilize fat, and soy oil additions of between 3 and 5% are beneficial to starter pig performance.

Introduction

Research from the early 1960's indicated that supplementing starter diets with fat did not enhance performance. However, changes in weaning age, environment, genetics, and nutrition necessitate a re-evaluation of fat supplementation to starter diets. With pigs being weaned at an earlier age, feed intake becomes a limiting factor. Additions of fat not only improve palatability, but also increase caloric density, which is necessary in preventing a postweaning "lag." Also, if the calorie:lysine ratio is a concern, the energy level should be considered, since the dietary lysine level has increased substantially in the past 2 decades.

Many references have been made to the idea that the young pig cannot digest and/or utilize fat. However, recent research at Kansas State University has shown that fat digestability is quite high for the 21-d old pig (88.5% and 87.1% for corn oil and choice white grease, respectively). Supporting work at Clemson has shown that dietary additions of corn oil improved performance and caloric intake of 21-d old pigs over a 5-week period. Therefore, the objectives of this study were to determine if fat additions enhance pig performance, and also to determine an optimum level of fat to be added to a 1.25% lysine corn-soybean meal-dried whey diet.

Experimental Procedures

Two trials were conducted in the environmentally controlled nurseries at the KSU Swine Research Center. Four hundred twenty weanling pigs (21 ± 3 d) were utilized, and seven pigs were allotted to each pen based on weight, sex, and ancestry. Average pen weight ranged from 7.3 to 13.5 lbs. The six dietary treatments examined were additions of either 0, 1, 2, 3, 4, or 5% SO to a 1.25% lysine, corn-soybean meal-dried whey diet (Table 1). Feed and water were offered ad libitum, and pig weights and feed consumption recorded weekly. Identical treatments were used in both trials, so the data were pooled (10 replications) except for F/G at 2 weeks, where a trial x treatment interaction was observed (5 replications / trial).

Results and Discussion

ADG, ADFI, and ME were not significantly affected by dietary treatment during the first 2 weeks, but all three were optimized at the 3% soy oil level (Table 2). In trial 1, F/G improved linearly ($P < .001$) with soy oil additions, which is the response most researchers observe. However, the SO effect on F/G in trial 2 was cubic. This atypical response could be attributed to a scours outbreak between Weeks 1 and 2, when pigs fed the 4% SO diet seemed the most severely affected. Pigs appeared to compensate by 5 weeks, since no trial x treatment existed, and F/G was linearly improved ($P < .001$) with SO supplementation. ADG ($P < .01$) and ADFI ($P < .05$) also improved linearly with SO additions, and the highest values were observed at the 3% oil level. Metabolizable energy intake at 5 weeks was unaffected by treatment, but maximized at the 3% SO treatment.

It can be concluded from this study that fat supplementation is efficacious to the young pig. Improvements in performance attest to the fact that a 21-d old pig can utilize fat. Additions of 3% soy oil appeared to be optimum for 5-week gain, but F/G still improved at the 5% inclusion rate (Figure 1). Metabolizable energy requirement of the young pig, based on gain and intake, appears to 1508 kcal/lb, which is in the range where Clemson researchers observed maximum gain and intake (1500 to 1600 kcal/lb). Therefore, soy oil additions between 3 and 5 % to corn-soybean meal-dried whey diets will improve starter pig performance.

Table 1. Percentage Diet Composition.

Item	Soybean Oil (%)					
	0	1	2	3	4	5
Corn	53.23	52.10	51.01	49.92	48.82	47.72
Soybean meal (44% CP)	33.17	33.30	33.38	33.47	33.56	33.65
Dried whey (edible grade)	10.00	10.00	10.00	10.00	10.00	10.00
Soybean oil	0.00	1.00	2.00	3.00	4.00	5.00
Monocalcium phosphate	1.32	1.32	1.35	1.35	1.37	1.38
Limestone	1.03	1.02	1.01	1.01	1.00	1.00
Salt	.30	.30	.30	.30	.30	.30
Trace mineral mix ^a	.10	.10	.10	.10	.10	.10
Vitamin mix ^b	.25	.25	.25	.25	.25	.25
L-Lysine HCl	.10	.10	.10	.10	.10	.10
Selenium premix ^c	.15	.15	.15	.15	.15	.15
Copper sulfate ^d	.10	.10	.10	.10	.10	.10
Antibiotic mix	.25	.25	.25	.25	.25	.25

^aPercentage composition was Fe, 10; Zn, 10; Cu, 1; I, .3; Co, .1.

^bComposition per lb premix: vitamin A, 800,000 IU; vitamin D₃, 60,000 IU; vitamin E, 4000 IU; riboflavin, 900 mg; menadione, 310 mg; pantothenic acid, 2400 mg; niacin, 5000 mg; choline chloride, 92,200 mg; vitamin B₁₂, 4.4 mg.

^cDiet contains .3 ppm selenium.

^dAntibiotic contained 20 g chlortetracycline, 20 g sulfamethazine, and 10 g penicillin per lb.

Table 2. Two and Five Week Performance Summary.^a

Item	Soybean Oil (%)					
	0	1	2	3	4	5
2-Week						
ADG	.45	.46	.46	.49	.43	.49
ADFI	.67	.68	.66	.69	.63	.66
ME Intake, Kcal/d	965	994	980	1038	962	1022
F/G (Trial 1) ^b	1.36	1.44	1.30	1.27	1.22	1.20
F/G (Trial 2) ^c	1.68	1.52	1.66	1.57	1.84	1.56
5-Week						
ADG ^d	.83	.81	.84	.88	.85	.86
ADFI ^e	1.47	1.40	1.41	1.47	1.37	1.38
ME Intake, Kcal/d	2107	2037	2094	2205	2085	2137
F/G ^b	1.78	1.73	1.68	1.67	1.62	1.60

^aTrial X treatment interaction for F/G at 2 weeks (P<.01).

^bLinear soy oil effect (P<.001).

^cCubic soy oil effect (P<.05).

^dLinear soy oil effect (P<.01).

^eLinear soy oil effect (P<.05).

FIGURE 1. SUMMARY OF FIVE WEEK GAIN AND FEED EFFICIENCY.

