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Evaluation of different oil sources for nursery pigs

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Evaluation of Different Oil Sources for Nursery Pigs[1]

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Summary

A total of 210 pigs (PIC 327 × 1050, initially 28.9 lb BW) were used in a 21-d trial to evaluate the effects of increasing oil sources on nursery pig growth performance. The 2 oil sources included a commercial source of soybean oil and a proprietary source of corn oil originating from the ethanol industry (Corn Oil ONE, Feed Energy Co., Pleasant Hill, IA). The 5 experimental diets included: a control diet without added oil, diets with 2.5 or 5% added soybean oil, or diets with 2.5 and 5% added corn oil. Diets were formulated with an identical standardized ileal digestible lysine:calorie ratio and were fed in meal form. There were 6 pens per treatment with 7 pigs per pen.

Overall, from d 0 to 21, no oil source × level interactions were observed. Increasing corn oil or soybean oil had no effect on ADG or final BW. Increasing corn oil or soybean oil decreased (linear, $P < 0.05$) ADFI, which resulted in improved (linear, $P < 0.01$) F/G. Caloric efficiency was not affected by oil source or level. Feed cost per pig tended to decrease (linear, $P = 0.066$) for pigs fed increasing levels of soy oil. Cost per pound of gain decreased for both Corn Oil ONE (linear, $P = 0.032$) and soybean oil (linear, $P = 0.008$) as oil level increased. Value of the weight gain and income over feed cost was similar for pigs fed diets with Corn Oil ONE and soybean oil ($P = 0.833$).

This study shows the benefits of adding a dietary oil source in late-phase nursery diets to achieve improved feed efficiency. Corn Oil ONE is a suitable alternative for soybean oil, and cost and availability should dictate which source is used.

Key words: corn oil, growth performance, nursery pig, soybean oil

Introduction

Soybean or corn oil can be added to nursery pig diets as highly digestible sources of energy. Because of the high price of soybean or corn oil, feed manufactures have often chosen to include other less expensive fat sources in swine diets, but the recent adoption of fat extraction from dried distillers grains with solubles (DDGS) at ethanol plants has made corn oil more available and economical.

Corn Oil ONE is a proprietary source of high-quality, refined corn oil supplied by Feed Energy Company (Pleasant Hill, IA) that has lower concentrations of free fatty acids and waxes than crude corn oil. Corn Oil ONE is typically a more economical source of energy than soy oil; however, no data are available to compare the impacts on growth performance of pigs fed diets containing increasing levels of soy oil compared with

[1] Appreciation is expressed to Feed Energy, Des Moines, IA, for partial financial support and for donating the specialty corn oil source.

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Corn Oil ONE. Therefore, the objective of this study is to compare Corn Oil ONE and commercially available soy oil on nursery pig growth performance, caloric efficiency, and economics.

Procedures

The protocol for this experiment was approved by the Kansas State University Institutional Animal Care and Use Committee. This experiment was conducted in the nursery facility at the Kansas State University Swine Teaching and Research Center in Manhattan, KS. The facility is a totally enclosed, environmentally controlled, mechanically ventilated barn. Each pen contains a 4-hole, dry self-feeder and a nipple waterer to provide ad libitum access to feed and water. Pens have wire-mesh floors and allow approximately 3 ft^2/pig.

A total of 210 pigs (PIC 327 × 1050, initially 28.9 lb BW) were used in a 21-d trial. Pigs were randomly allotted to 1 of 5 dietary treatments with 6 pens per treatment with 7 pigs per pen. Pigs were weaned from 18 to 25 d of age with weaning age balanced across treatments and were fed a common diet before the start of the experiment. Pig weight and feed disappearance were measured on d 7, 14, and 21 of the trial to determine ADG, ADFI, and F/G. In addition, caloric efficiency was calculated by using the Kcal of ME consumed divided by Kg of gain. The energy values used for soybean (ME = 3,889 kcal/kg; NE = 3,422) and corn oil (ME = 3,891; NE = 3,424) sources were used to calculate the caloric efficiency.

All dietary treatments were corn-soybean meal–based and fed in meal form (Table 1). The 5 experimental diets were: (1) no added fat control diet, diets with (2) 2.5 or (3) 5% added soybean oil, and diets with (4) 2.5 or (5) 5% added corn oil. Diet samples were collected and analyzed for DM, CP, Ca, P, and oil (Ward Laboratories, Inc., Kearney, NE). All diets were balanced with an identical standardized ileal digestible lysine:calorie ratio. Current ingredient prices at the time of the study were used in an economic comparison with soybean oil at $0.40/lb and corn oil at 0.39/lb.

Data were analyzed as a randomized complete block design using PROC MIXED in SAS (SAS Institute, Inc., Cary, NC) with pen as the experimental unit. Weaning age was included in the model as a random effect. The effects of increasing oil within source were determined by linear and quadratic contrasts. In addition, a comparison was made between the diets containing added oil from either corn or soybean oil. Treatment differences were considered significant at $P \leq 0.05$ and a tendency from $P > 0.05$ to $P \leq 0.10$.

Results and Discussion

Quality attributes of the two oil sources (Table 2) were similar to expectations and did not differ meaningfully between sources. Complete diet analysis (Table 3) was similar to formulated expectations.

Overall (d 0 to 21), no oil source × level interactions were observed (Tables 4 and 5). Increasing soybean or corn oil had no effect on ADG or final BW. Average daily feed intake decreased (linear, $P < 0.03$) with increasing oil source, which resulted in an improvement (linear, $P < 0.01$) in F/G. Caloric efficiency was not influenced by oil

source or level, indicating that the energy values assigned to each oil source (NE = 3,422 kcal/lb and NE = 3,383 kcal/lb for soybean oil and corn oil, respectively) were accurate. Total feed cost per pig tended to decrease (linear, $P = 0.066$) for pigs fed increasing soybean oil, but cost per pound of gain decreased $P < 0.032$) for both oil sources. Value of the weight gain and income over feed cost was similar among pigs fed corn oil and soybean oil.

In conclusion, adding the dietary oil sources used in this study improved F/G. There were no differences in performance among pigs fed either soybean oil or corn oil. The source of corn oil (Corn Oil ONE) used in this study is a suitable alternative for soybean oil, and cost and availability should dictate its use.

Table 1. Diet composition (as-fed basis)[1]

Item	Control	2.5% Oil	5% Oil
Ingredient, %			
Corn	63.58	58.56	53.52
Soybean meal (47.5% CP)	32.65	35.20	37.75
Oil source[2]	--	2.50	5.00
Monocalcium phosphate	1.30	1.28	1.28
Limestone	1.08	1.08	1.05
Salt	0.35	0.35	0.35
L-lysine-HCl	0.32	0.31	0.30
DL-methionine	0.13	0.14	0.15
L-threonine	0.12	0.12	0.13
Trace mineral premix	0.15	0.15	0.15
Vitamin premix	0.25	0.25	0.25
Phytase[3]	0.08	0.08	0.08
Total	100.00	100.00	100.00
Calculated analysis			
Standardized ileal digestible (SID) amino acids, %			
Lysine	1.23	1.28	1.33
Isoleucine:lysine	62	63	63
Leucine:lysine	128	126	124
Methionine:lysine	34	34	34
Met & Cys:lysine	57	57	57
Threonine:lysine	63	63	63
Tryptophan:lysine	18.4	18.7	19.0
Valine:lysine	68	68	68
Total lysine, %	1.38	1.43	1.49
ME, kcal/lb	1,478	1,536	1,594
NE[4], kcal/lb	1,089	1,137	1,186
SID lysine:ME, g/Mcal	3.78	3.78	3.78
CP, %	21.3	22.1	22.9
Ca, %	0.73	0.73	0.73
P, %	0.68	0.68	0.68
Available P, %	0.45	0.45	0.45

[1] Experimental diets were fed for 21-d beginning approximately 42 d after weaning.
[2] Corn Oil ONE™, Feed Energy, Des Moines, Iowa.
[3] Natuphos 600 (BASF, Florham Park, NJ) provided 204.3 phytase units (FTU)/lb, with a release of 0.09% available P.
[4] NRC. 2012. Nutrient Requirements of Swine, 11th ed. Natl. Acad. Press, Washington, DC.

Table 2. Chemical analysis of oil sources[1]

Item	Soybean oil	Corn Oil ONE
Free fatty acids, %	0.46	1.29
Initial peroxide value (meq/kg)	14.0	16.9
Moisture, %	0.32	0.64
Insoluble impurities, %	0.18	0.04
Unsaponifiables, %	0.41	1.52

[1]Samples were analyzed by Midwest Laboratories, Inc. (Omaha, NE).

Table 3. Chemical analysis of experimental diets[1]

		Added oil, %			
	Control	Soybean oil		Corn Oil ONE	
Item	0	2.5	5	2.5	5
DM, %	89.59	89.64	90.52	89.97	90.05
CP, %	23.7	23.9	25.1	24.1	24.5
Ca, %	0.91	0.96	0.91	0.83	0.91
P, %	0.78	0.73	0.73	0.69	0.71
Oil, %	2.9	5.1	7.4	4.6	7.1

[1] Samples were collected, homogenized, and subsampled for analysis at Ward Laboratories, Inc. (Kearney, NE).

Table 4. Comparison of soybean oil vs. corn oil on nursery pig performance[1]

		Added oil, %					Probability, $P <$				
	Control	Soybean oil		Corn oil			Soybean oil		Corn oil		Soybean oil
Item	0	2.5	5.0	2.5	5.0	SEM	Linear	Quadratic	Linear	Quadratic	vs. corn oil
d 0 to 21											
ADG, lb	1.42	1.44	1.40	1.42	1.41	0.028	0.600	0.314	0.936	0.861	0.965
ADFI, lb	2.18	2.16	1.96	2.08	2.01	0.052	0.007	0.164	0.033	0.837	0.805
F/G	1.54	1.50	1.40	1.47	1.42	0.019	< 0.01	0.225	<0.01	0.574	0.711
BW, lb											
d 0	29.0	29.0	29.0	29.1	29.1	1.16	0.995	0.994	0.935	0.989	0.929
d 21	58.7	59.2	58.3	58.8	58.8	1.42	0.812	0.656	0.982	0.946	0.965
Caloric efficiency[2]	1,672	1,704	1,664	1,667	1,686	48.9	0.798	0.194	0.654	0.653	0.735
Feed cost,$/pig	11.54	11.65	10.77	11.22	11.04	0.282	0.066	0.159	0.223	0.840	0.766
Feed cost, $/lb gain	0.39	0.39	0.37	0.38	0.37	0.005	0.008	0.219	0.032	0.582	0.636
Gain value[3], $/pig	25.00	25.44	24.63	25.08	24.94	0.496	0.600	0.314	0.936	0.861	0.965
IOFC[4], $/pig	13.47	13.79	13.86	13.86	13.90	0.295	0.354	0.734	0.300	0.627	0.833

[1] A total of 210 pigs (PIC 327 × 1050) were used in a 21-d study with 7 pigs per pen and 6 pens per treatment.
[2] Caloric efficiency = Kcal of NE per pound of gain ((ADFI × NE/lb) /ADG).
[3] Gain value was calculated using (Final BW × $84.00/cwt) – (initial BW × $84.00/cwt).
[4] Income over feed cost = carcass gain value – feed cost.
[5] Ingredient cost, soybean oil $0.40/lb, Corn Oil ONE $0.39/lb, corn $0.14/lb, and soybean meal $0.25/lb.
[6] There were no significant source × level interactions.

Table 5. Main effects of oil source and level

	Oil source		Oil level, %				Probability, $P <$ Level	
Item	Soybean oil	Corn Oil ONE	0	2.5	5	SEM	Linear	Quadratic
d 0 to 21								
ADG, lb	1.42	1.42	1.42	1.43	1.41	0.020	0.727	0.437
ADFI, lb	2.06	2.05	2.18	2.12	1.99	0.036	0.006	0.430
F/G	1.45	1.44	1.54	1.48	1.41	0.014	< 0.01	0.663
CE[1]	1,684	1,676	1,671	1,685	1,675	34.641	0.912	0.570
BW, lb								
d 0	29.02	29.10	29.03	29.04	29.08	0.94	0.966	0.989
d 21	58.74	58.79	58.71	59.03	58.50	1.06	0.901	0.736
Feed cost, $/pig	11.21	11.13	11.54	11.44	10.90	0.199	0.079	0.422
$/lb gain	0.38	0.37	0.39	0.38	0.37	0.004	0.007	0.649
Gain value[2], $/pig	25.03	25.01	25.00	25.26	24.79	0.351	0.727	0.438
IOFC[3], $/pig	13.82	13.89	13.47	13.83	13.88	0.209	0.258	0.589

[1] Caloric efficiency = Kcal of NE per pound of gain ((ADFI × NE/lb) / ADG).
[2] Gain value was calculated using (Final BW × $84.00/cwt) – (initial BW × $84.00/cwt).
[3] Income over feed cost = carcass gain value – feed cost.