EFFECTS OF LEVEL OF MODIFIED TALL OIL ON FINISHING PIG GROWTH PERFORMANCE AND CARCASS CHARACTERISTICS[1]

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Summary

A growth trial was conducted to evaluate effects of increasing levels of modified tall oil (MTO) on growth performance and carcass composition of finishing barrows. No effect of treatment was observed for ADG, ADFI, or feed efficiency (F/G) during any of the growth periods. However, pigs fed increasing MTO had less backfat, larger longissimus muscle area, and increased percentage muscle than control pigs not fed MTO. Additionally, carcasses from pigs fed MTO had decreased drip loss. The results of this trial indicate that although MTO has no impact on growth performance in barrows, it can improve carcass leanness. The optimal dose level for the MTO appears to be about .50% of the diet.

(Key Words: Barrows, Modified Tall Oil, Growth Performance, Carcass Merit.)

Introduction

Tall oil is a nonaqueous layer of rosin acids and fatty acids produced during the kraft (sulfate) paper process. In a pilot study (pg. 157), pigs fed modified tall oil (MTO) grew faster and consumed more feed than pigs fed conjugated linoleic acid (CLA). Additionally, pigs fed MTO or CLA had equal carcass composition indicating that, although MTO and CLA have similar intrinsic properties, their modes of action may be very dissimilar. Thus, a dose-titration assay was conducted to determine the optimal level of MTO to maximize pig growth performance and carcass composition.

Procedures

A total of 80 crossbred barrows (initially 74 lb; PIC L326 × C22) was blocked on the basis of initial weight and ancestry and randomly allotted to four dietary treatments with 10 replicate pens per treatment.

All diets were pelleted (3/16 in diameter). Diets were fed in two phases (75 to 160 and 160 to 260 lb BW; Table 1), and diets were changed when the average weight of pigs in a replication of pens reached 160 lb. Modified tall oil was substituted on a wt/wt basis for cornstarch in the experimental diets.

Pigs were housed in an environmentally controlled finishing barn with two pigs in each 4 ft × 4 ft pen with a totally slatted floor. Pigs were allowed ad libitum access to feed and water through one single-hole self-feeder and a nipple waterer. Pigs were weighed every 14 d in order to determine ADG, ADFI, and feed efficiency (F/G). The

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day before slaughter, plasma blood samples were collected from each pig for analysis of triglyceride (TG) concentrations following a 3 h fast. The TG results later were combined for each pen for statistical analysis.

Pigs were slaughtered when the average weight of pigs in a pen reached 260 lb. Standard carcass measurements; visual analyses of the longissimus for coloring, marbling, and firmness; longissimus drip loss, and Minolta colorspectrometry (Hunter L*, a*, and b*) were determined for each pig at 24 h postmortem (drip loss = 48 h postmortem). During fabrication of the carcasses (24 h postmortem), the bellies from the right sides of all carcasses were removed and evaluated for firmness.

Data were analyzed as a randomized complete block. Pen was the experimental unit for all calculations. The IML procedure of SAS was used to generate the necessary orthogonal polynomial contrast coefficients needed for the GLM procedures of SAS. Thus, despite the unequally spaced treatment design, all data were analyzed using the GLM procedures. Hot carcass weight was used as a covariate for the carcass analysis. Additionally, weight and length of the bellies were used as covariates for the analysis of belly firmness.

Results and Discussion

Growth Data. No effects of treatment (P>.15) were observed for ADG, ADFI, or F/G during any of the growth intervals (75 to 160, 160 to 260, and 75 to 260 lb BW; Table 2). We should note that all pigs had good growth performance despite the trial being conducted during the summer months of June to September.

Carcass Characteristics. Pigs fed increasing MTO had reduced (quadratic, P<.05) first, last, and tenth rib; last lumbar; and average backfat depths as compared to control pigs (Table 3). Pigs fed MTO also tended (quadratic, P = .07) to have larger longissimus muscle area. The reduced backfat and larger longissimus muscle area resulted in a higher (quadratic, P = .03) lean percentage for the MTO-supplemented pigs. Drip loss was reduced (quadratic, P = .04) by increasing MTO. These quadratic responses are due to a plateau effect where little or no benefit occurred from increasing MTO concentrations above 0.50% of the diet.

Pigs fed the control diet had longissimus muscles that were redder and more intensely colored (linear, P = .04) and more yellow (linear, P = .07) than those from pigs supplemented with MTO. Although these were linear effects, when they were plotted, they seemed to be due to the control diet producing different results than any of the MTO diets. Although not significant (P>.20), this same function appears to hold true for belly firmness. The average belly firmness was 18% greater for MTO-fed pigs than for the control-fed pigs. Carcass length and visual degree of muscling were decreased linearly (P≤.05) by increasing MTO, although this may not be practically important because of the small absolute differences.

Serum Chemistry. Feeding MTO to pigs did not affect (P>.35) fasted serum TG levels (Table 3).

The exact mode of action for the positive benefits of MTO upon the body are not fully understood. Research is currently underway to examine the multitude of beneficial roles that MTO may play in swine production.

The results of this trial indicate that, although MTO has no impact on growth performance in barrows, it can improve carcass leanness. The optimal dose level for the MTO appears to be about .50% of the diet.

Table 1. Composition of Basal Diets (As-Fed Basis)

Ingredient, %	Grower[a]	Finisher[b]
Corn	68.76	78.08
Soybean meal (46.5% CP)	27.50	18.43
Limestone	1.05	.88
Cornstarch[c]	1.00	1.00
Monocalcium phosphate	.86	.78
Salt	.35	.35
Vitamin premix	.20	.20
Trace mineral premix	.15	.15
Antibiotic[d]	.13	.13
Total	100.00	100.00

[a]Grower diets were fed from 75 to 160 lb BW and were formulated to contain 1.00% lysine, .65% Ca, and .55% total P.
[b]Finisher diets were fed from 160 to 260 lb BW and were formulated to contain .75% lysine, .55% Ca, and .50% total P.
[c]Modified tall oil was substituted for cornstarch on an equal weight basis at .25, .50, and 1.00% of the diet to provide the three experimental treatments.
[d]Provided 100 g/ton tylosin.

Table 2. Growth Performance of Barrows Fed Increasing Modified Tall Oil[a]

	Modified Tall Oil, %					Probability Values	
Item	0	.25	.50	1.00	CV	Linear	Quadratic
75 to 160 lb							
ADG, lb	2.38	2.35	2.40	2.35	6.64	.77	.73
ADFI, lb	5.23	5.12	5.09	5.17	5.87	.40	.51
F/G	2.20	2.19	2.12	2.20	4.81	.57	.21
160 to 260 lb							
ADG, lb	2.17	2.15	2.18	2.14	7.82	.85	.89
ADFI, lb	6.59	6.52	6.53	6.31	6.51	.93	.43
F/G	3.04	3.05	2.99	2.96	6.02	.70	.29
75 to 260 lb							
ADG, lb	2.27	2.23	2.28	2.23	5.74	.71	.79
ADFI, lb	5.98	5.89	5.89	5.80	5.67	.79	.44
F/G	2.64	2.64	2.58	2.60	4.54	.88	.19

[a]Values are means for two pigs/pen and 10 replicate pens/treatment.

Table 3. Carcass Characteristics of Barrows Fed Increasing Modified Tall Oil[a,b]

	Modified Tall Oil, %					Probability Values	
Item	0	.25	.50	1.00	CV	Linear	Quadratic
Shrink loss, %	1.99	2.03	2.03	2.09	5.12	.71	.20
Backfat, in.							
First rib	1.51	1.52	1.44	1.47	8.61	.74	.13
Tenth rib	.88	.83	.76	.77	17.17	.82	.04
Last rib	.96	.99	.91	.91	9.50	.19	.04
Last lumbar	.85	.80	.76	.74	12.34	.75	.02
Average[c]	1.10	1.10	1.04	1.04	7.73	.60	.02
LMA, in^2	6.39	6.51	6.73	6.74	7.45	.80	.07
Lean %[d]	51.79	52.52	53.59	53.69	3.69	.83	.03
Dressing %	74.29	73.63	73.69	73.31	1.09	.27	.11
Visual color[e]	2.35	2.53	2.35	2.39	11.38	.19	.49
Firmness[e]	2.40	2.65	2.63	2.64	12.73	.21	.27
Marbling[e]	2.18	2.38	2.30	2.39	13.34	.30	.41
Hunter L*[f]	55.08	53.78	53.49	55.03	4.80	.22	.52
Hunter a*[f]	13.95	12.25	11.92	13.27	13.67	.04	.12
Hunter b*[f]	12.13	8.47	8.27	9.50	39.65	.07	.14
Hue angle[f]	48.05	48.37	48.11	50.41	12.76	.87	.75
Saturation index[f]	19.21	14.91	14.53	16.34	24.37	.04	.09
A:B ratio[f]	1.39	1.46	1.47	1.41	7.07	.16	.40
Drip loss, %	5.17	4.99	3.60	4.95	32.63	.64	.04
Carcass length, in	33.35	32.70	32.86	33.02	1.80	.03	.42
Muscling	2.55	2.45	2.50	2.50	4.05	.05	.73
Belly firmness							
Initial[g]	9.24	11.05	10.88	11.92	27.16	.39	.23
1 min[g]	8.60	10.30	10.12	11.16	27.29	.39	.22
5 min[g]	8.05	9.70	9.01	10.09	29.98	.36	.53
Triglycerides[h]	29.50	28.12	31.36	30.42	24.88	.64	.39

[a]Values are means for two pigs/pen and six replicate pens/treatment.
[b]Hot carcass weight was used as a covariate in the statistical analysis.
[c]Average backfat is the average of the first and last rib and last lumbar fat depths.
[d]Lean percentage was derived from NPPC equations with 5% fat.
[e]Scoring system of 1 to 5: 2 = grayish pink, traces to slight, or soft and watery; 3 = reddish pink, small to modest, or slightly firm and moist; and 4 = purplish red, moderate to slightly abundant, or firm and moderately dry for color, firmness, or marbling, respectively.
[f]Means were derived from three sample readings per loin. Measures of dark to light (Hunter L*), redness (Hunter a*), yellowness (Hunter b*), red to orange (hue angle), or vividness or intensity (saturation index).
[g]Belly firmness scores refer to the degree of droop (inches) when the bellies were centrally suspended by a bar. Thus, larger values indicate firmer bellies. Belly length and weight were used as covariates for this portion of the statistical analysis.
[h]Values represent the pooled results of both pigs/pen bled the day before slaughter and triglyceride levels are expressed as mg/dL.