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Summary and Implication

An experiment was conducted to determine the effect of dietary feather meal level, as well as whether or not start weight influenced feather meal effects in growth performance and carcass traits of barrows. Dietary feather meal additions tended to decrease the final body weight variation of barrows. Barrows fed diets containing 20 percent feather meal from 80 pounds to slaughter had decreased average daily gain, average daily feed intake, digestible lysine intake, energy intake, daily lean gain and backfat depth. Barrows fed diets containing 10 percent feather meal from 190 pounds to slaughter had decreased average daily gain, average daily feed intake, digestible lysine intake, energy intake and backfat depth. The reduction in daily lean gain appears to be caused by decreased digestible lysine intake. Overall, feather meal can be used to reduce barrows feed intake, however, the dietary digestible lysine content should be adjusted.

Introduction

As more producers adopt all-in-all-out (**AIAO**) systems, the growth potential difference between barrows and gilts becomes a concern. Typically, barrows eat more feed, grow faster and reach market weight 10 to 14 days before littermate gilts. Because barrows and gilts have similar protein growth potential in the finishing phase, barrows have fatter carcasses than gilts at the same live weight. Producers may be able to improve profitability if barrows growth rate can be modified to be similar to that of gilts. Improving carcass leanness of barrows is another potential profit opportunity. The greater backfat for barrows compared to gilts results in a lower price because the market systems use backfat as a predictor of carcass lean. Research has demonstrated that feather meal (a high-protein, low energy feed ingredient) reduces feed intake in finishing pigs. This article describes a experiment conducted to examine the optimum level and timing of dietary feather meal additions to barrow diets. The overall objective was to slow down the growth rate and to improve the carcass leanness of barrows.

Procedures

A pool of 224 crossbred, high lean gain potential feeder pigs (196 barrows and 28 gilts) were purchased from a single source. At arrival, all pigs were weighed, eartagged and assigned randomly to experimental treatments on the basis of four weight outcome groups. Within outcome group, barrows were randomly assigned to one of seven treatment groups and gilts were assigned to control gilt group.

The experiment was conducted at the University of Nebraska Haskell Agriculture Laboratory at Concord. The facility is a fully slatted, double-wide, naturally ventilated barn with fresh water under-slat flushing for manure

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removal. One nipple drinker and two feeder spaces were provided in each 7 ft x 8 ft pen with a total of four pens per treatment combination. There were seven pigs in each pen with floor space of 8 ft^2/pig.

The control barrows (**CB**) and gilts (**CG**) were fed diets containing no feather meal from purchase to slaughter (Tables 1, 2 and 3). Treatment groups were two levels of dietary feather meal (**FM**, 10 and 20 percent), fed from three different starting weights (**SW**, 80, 135 and 190 pounds). Barrows were fed the same corn-soybean meal diets as the CB group before they reached the assigned starting weights, 80, 135 and 190 pounds. The CB group served as a benchmark to evaluate treatment effects. The CG group served as a benchmark to evaluate the performance of barrows.

Diets were formulated to contain similar metabolizable energy densities and the digestible lysine (the first limiting amino acid) concentrations used were derived from the Nebraska and South Dakota Swine Nutrition Guide. All pigs were fed a common corn-soybean meal diet formulated to contain 1 percent lysine from arrival until 80 pounds. Diets were switched on the week pigs weighed 80, 135 and 190 pounds. Pens of pigs were slaughtered the week the average pen weight was 240 pounds or greater.

Carcass lean was measured on individual pigs at slaughter using total body electrical conductivity (TOBEC) at SiouxPreme Packing Co., Sioux Center, Iowa. Backfat depth was measured at the tenth rib 2 inches off the midline by Renco LeanMeter five days prior to slaughter. Lean percentage was calculated on a 5 percent fat basis.

Table 1. Composition of diets from 80 to 135 pounds (as-fed basis).

	Diets[a]			
Ingredient, percent	CG	CB	FM 10-80	FM 20-80
Corn	71.80	73.85	63.95	54.25
Soybean meal, 44% CP	25.75	23.65	21.30	18.90
Feathermeal	——	——	10.00	20.00
Tallow	——	——	2.30	4.55
Premix[b]	2.45	2.50	2.45	2.30
Formulated composition[c]				
CP, %	17.40	16.60	23.30	29.90
Ca, %	.65	.65	.66	.65
P, %	.55	.55	.55	.55
ME, Mcal/lb	1.49	1.49	1.49	1.49
Amino acids, %				
Lysine	.93(.75)[d]	.88(.71)	.95(.71)	1.02(.71)
Tryptophan	.21(.16)	.20(.15)	.23(.16)	.26(.18)
Threonine	.67(.49)	.64(.46)	.93(.66)	1.20(.87)
Methionine+Cystine	.61(.50)	.59(.48)	.90(.68)	1.21(.88)
Analyzed composition				
CP, %	16.80	16.50	22.80	28.40
Ca, %	.68	.58	.69	.62
P, %	.53	.53	.51	.50
GE, Mcal/lb	1.75	1.78	1.88	2.11

[a]CG=control gilts; CB=control barrows; FM=feathermeal level and 80 is the starting weight, lb.
[b]The premix contained limestone, dicalcium, salt, vitamin, and mineral premixes.
[c]CP=crude protein; Ca=calcium; P=phosphorus; ME=metabolizable energy; GE=gross energy; DM=dry matter.
[d]The values in parentheses present apparent digestible amino acid percentage in the diet.

Table 2. Composition of diets from 135 to 190 pounds (as-fed basis).

	Diets[a]			
Ingredient, percent	CG	CB	FM 10-80	FM 20-80
Corn	74.10	79.70	69.85	60.05
Soybean meal, 44% CP	23.65	18.00	15.60	13.25
Feathermeal	——	——	10.00	20.00
Tallow	——	——	2.30	4.55
Premix[b]	2.25	2.30	2.25	2.15
Formulated composition[c]				
CP, %	16.60	14.60	21.20	27.90
Ca, %	.60	.60	.60	.60
P, %	.50	.50	.50	.50
ME, Mcal/lb	1.50	1.50	1.50	1.50
Amino acids, %				
Lysine	.88(.71)[d]	.73(.58)	.84(.58)	.91(.58)
Tryptophan	.20(.15)	.17(.12)	.20(.14)	.23(.15)
Threonine	.64(.46)	.56(.40)	.85(.60)	1.14(.81)
Methionine+Cystine	.59(.48)	.56(.44)	.85(.64)	1.15(.84)
Analyzed composition				
CP, %	16.60	14.90	21.40	27.40
Ca, %	.75	.50	.62	.65
P, %	.43	.48	.50	.42
GE, Mcal/lb	1.76	1.77	1.88	2.01

[a]CG=control gilts; CB=control barrows; FM=feathermeal level and 135 is the starting weight, lb.
[b]The premix contained limestone, dicalcium, salt, vitamin, and mineral premixes.
[c]CP=crude protein; Ca=calcium; P=phosphorus; ME=metabolizable energy; GE=gross energy; DM=dry matter.
[c]The values in parentheses present apparent digestible amino acid percentage in the diet.

Results and Discussion

The coefficient of variation of final weights is an expression of the body weight variation within each pen at time of slaughter. Barrows fed 10 percent FM from 190 pounds and 20 percent FM from 135 pounds tended ($P < .1$) to have smaller coefficient of variations at the end of the experiment (Table 4). This observation suggests dietary FM could be used to reduce the final body weight variation of barrows.

The CB group had the greatest average daily gain (Table 4). Barrows fed 20 percent beginning at 80 pounds had reduced (P 05) ADG than control groups. Barrows fed 10 percent FM from 190 pounds and 20 percent FM from 80 pounds had slower

Table 3. Composition of diets from 190 to slaughter (as-fed basis).

	Diets[a]			
Ingredient, percent	CG	CB	FM 10-190	FM 20-190
Corn	81.40	84.55	74.50	64.75
Soybean meal, 44% CP	16.50	13.25	11.10	8.70
Feathermeal	——	——	10.00	20.00
Tallow	——	——	2.30	4.55
Premix[b]	2.10	2.20	2.10	2.00
Formulated composition[c]				
CP, %	14.10	13.00	19.70	26.30
Ca, %	.55	.55	.55	.55
P, %	.45	.45	.45	.45
ME, Mcal/lb	.50	1.51	1.51	1.51
Amino acids,%				
Lysine	.69(.54)[d]	.60(.47)	.68(.47)	.75(.47)
Tryptophan	.16(.12)	.14(.10)	.17(.12)	.20(.13)
Threonine	.54(.38)	.49(.35)	.79(.55)	1.00(.76)
Methionine+Cystine	.53(.43)	.50(.40)	.80(.60)	1.11(.80)
Analyzed composition				
CP, %	14.80	12.40	18.90	25.20
Ca, %	.55	.62	.59	.59
P, %	.48	.40	.40	.36
GE, Mcal/lb	1.77	1.75	1.86	2.01

[a]CG=control gilts; CB=control barrows; FM=feathermeal level and 190 is the starting weight, lb.
[b]The premix contained limestone, dicalcium, salt, vitamin, and mineral premixes.
[c]CP=crude protein; Ca=calcium; P=phosphorus; ME=metabolizable energy; GE=gross energy; DM=dry matter.
[d]The values in parentheses present apparent digestible amino acid percentage in the diet.

(P < .05) average daily gains than control harrows and their average daily gain was similar to CG. The control gilts had the lowest average feed intake among all treatment groups, and harrows fed 20 percent FM from 80 pounds had similar feed intake as CG. Barrows fed 10 percent FM from 190 pounds and 20 percent FM from 80 pounds consumed less (P 05) feed than control barrows. Feed efficiency was not affected by dietary FM additions.

The daily digestible lysine intake of CG and CB were greater (P < 05) than harrows fed 10 percent FM from 190 pounds and 20 percent FM from 80 pounds. Barrows fed 10 percent FM from 190 pounds and 20 percent FM from 80 pounds had less (P 05) daily metabolizable energy intake than the control harrows, with energy consumption similar to the control gilts. The control barrows and control gilts had similar daily lean gains. Twenty percent dietary FM fed from 80 pounds reduced (P < 05) the daily lean gain of harrows. Barrows fed 20 percent FM from 80 pounds had similar average daily gains and average daily feed intakes similar to control gilts. Pigs in this group needed seven additional days to reach market weight when compared to control harrows.

The control gilts had the least backfat and the control harrows had the greatest backfat depth among treatment groups. Barrows fed 10 percent FM from 190 pounds and 20 percent FM from 80 and 190 pounds had reduced (P < .05) backfat depth compared with control harrows. There was a significant effect of SW (P < .05) on backfat depth, suggesting that the timing of FM additions is more important than dietary concentration to reduce barrows backfat. In this study, barrows

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Table 4. Performance and carcass criteria of barrows and gilts.

Treatment[k]	CG	CB	10% FM			20% FM		
Item[e]			80	135	190	80	135	190
Initial wt., lb	59.2[a]	46.6[b]	46.5[b]	46.8[b]	46.8[b]	46.7[b]	46.6[b]	46.8[b]
Final wt., lb	249.4	256.3	259.3	260.5	249.0	251.8	256.9	248.4
Final C.V.[1]	6.8[xy]	9.1[x]	6.6[xy]	7.9[xy]	5.8[y]	8.6[xy]	6.2[y]	7.0[xy]
ADG, lb[g]	1.82[d]	2.01[a]	1.98[a]	1.98[a]	1.87[bcd]	1.84[cd]	1.95[ab]	1.93[abc]
ADFI, lb[g]	5.28[c]	5.76[a]	5.83[a]	5.78[a]	5.41[bc]	5.31[c]	5.60[ab]	5.59[ab]
Feed/Gain	2.90	2.87	2.94	2.92	2.89	2.89	2.87	2.90
DDLI, g/d[g]	15.8[a]	15.4[ab]	15.6[ab]	15.4[ab]	14.7[cd]	14.4[d]	15.2[bc]	15.2[bc]
EI, Mcal/d[g]	17.25[d]	18.84[ab]	19.05[a]	18.89[ab]	17.68[cd]	17.35[d]	18.30[abc]	18.27[bc]
DLG, lb/d[g]	.70[a]	.70[a]	.70[a]	.68[a]	.67[ab]	.63[b]	.66[ab]	.69[a]
Backfat, mm[h]	11.4[c]	15.7[a]	14.7[ab]	14.4[ab]	12.9[bc]	13.8[b]	14.8[ab]	13.5[b]
HC, lb	182.9[ab]	186.0[ab]	188.8[ab]	180.8[ab]	183.4[ab]	185.4[ab]	179.7[b]	
Lean %[ij]	51.51[a]	48.32[bc]	48.55[bc]	47.77[bc]	4908[b]	47.57[bc]	47.00[c]	48.53[bc]

[abcd]Means in the same row without a common superscript differ (P < .05).
[c]ADG=average daily gain; ADFI=average daily feed intake; HC=hot carcass weight; DLG=daily lean gain; DDLI=daily digestible lysine intake; EI=energy intake, metabolizable.
[f]Coefficient of variation of within pen weight at time of slaughter.
[g]FM x SW interaction (P < .05).
[h]Main effect of start weight (P < .05).
[i]Containing 5 percent fat.
[j]Main effect of start weight (P = .07).
[k]CG=control gilts; CB=control barrows; FM=feathermeal and 80, 135 and 190 are starting weights, lb.
[xy]Means in the same row without a common superscript differ (P < .1).

fed dietary FM (10 and 20 percent) from 190 pounds had a significant backfat reduction. None of the FM treatments reduced the backfat to the same depth as control gilts.

We acknowledge the lean percentage of these high lean gain pigs appears low. We checked the equation used in conjunction with TOBEC readings, and discussed the results with the packer, but did not find any reason to explain this observation. The lean percentage values in Table 4 are based on 5 percent added fat. They are surprisingly low, given the backfat measurements and visual appraisal at time of slaughter. The SW tended (P = .07) to affect the lean percentage. The control gilts had the highest lean percentage. Dietary FM did not improve the lean percentage of barrows to equal that of the control gilts in this study.

Barrows fed 20 percent FM from 80 pounds had similar average daily gain, average daily feed intake and energy intake as control gilts, but the daily lean gain and lean percentage were less than control gilts. An explanation for this situation is a reduction in daily digestible lysine intake. The reduction of digestible lysine intake may have limited the daily lean gain of the barrows. When compared to the barrows fed 10 percent FM from 190 pounds, the barrows fed 20 percent FM front 80 pounds had numerically more backfat and less carcass lean. This indicates that feeding 20 percent FM from 80 pounds may help manipulate the growth performance of barrows to resemble that of gilts, but the lean growth and carcass lean percentage will decrease if the dietary digestible lysine intake is not adjusted. These results suggest that feeding 10 percent FM during the late finishing phase and adjusting dietary digestible lysine concentration to meet the maximum lean growth requirement may slow daily gain and improve carcass leanness of barrows.

Conclusion

Feather meal reduces barrows average daily gain and average daily feed intake. The dietary digestible lysine content should be adjusted to meet the maximum lean growth if FM is used to slow growth rate and improve carcass leanness of barrows.

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