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Seasonal Growth Performance of Barrows and Gilts Fed EitherSoybean Meal or Trapper Field Pea With Two Levels of Lysine

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Abstract

Two-hundred-twenty-four PIC (C-15 x 326) barrows and gilts were used to evaluate the affects of sex, protein supplement, lysine level, and season on growth and carcass performance.

Sex provided the most significant and consistent response for both growth and carcass performance. Gilts grew slower (P<.01), consumed less feed (P<.05), were more efficient (P<.10) and had lower feed cost/pound of gain (P<.10). Gilt carcasses were leaner (P<.05), but carcass yield, hot carcass weight and total carcass value were similar to that of barrows.

Pig performance, when fed either soybean meal or field pea, was similar for daily gain and feed to gain, but pigs consuming field pea ate less daily feed (P<.10), had lower feed cost/pound of gain (P<.05) and, subsequently, lower feed cost/head (P<.01). The overall lower cost of production for field pea was a function of more efficient growth and a lower cost for locally-grown pea grain.

Carcasss performance was not affected by protein supplement. No differences due to protein source were detected

for carcass yield, percent lean, hot carcass weight, fat depth, loin depth or total carcass value.

Increasing lysine concentration above normal levels did not improve pig growth or overall carcass performance, although carcass yield was lower (P<.10). The reduction in yield resulted in a total carcass value reduction of $3.32 per carcass. A protein source by lysine interaction suggested that it was unnecessary to feed additional lysine in these diets and that diets formulated with *Trapper* field pea should be both efficient and economical.

Pigs finished during the winter months were less efficient (P<.01), requiring more energy for maintenance than summer fed pigs. While winter fed pigs were less efficient, carcass yield was higher (P<.01) during the winter. Interactions between sex and season fed suggest that gilts were more sensitive during the summer and can be expected to eat less (P<.001) and gain slower (P<.001), but that efficiency between barrows and gilts, within a given season is likely to be similar. An interaction between sex, protein source and season was detected for feed efficiency, loin depth, and fat free lean index. The interaction suggested that both sexes were more efficient during the summer feeding period, that gilts can be expected to be leaner than barrows regardless of season, and that barrows and gilts, in this study, perform as well when fed field pea as they do when fed soybean meal.

Trapper field pea was shown to be a suitable replacement supplement for soybean meal when replaced on a percentage of protein basis within each growth phase from 75 to 265 pounds. With the exception of the phase-1 diet for 50 to 80 pound pigs, field pea, as tested in this investigation, contained sufficient lysine to maximize efficiency of feed utilization and carcass leanness. Seasonal increases in lysine levels for hot weather recommended in other regions of the country do not seem to be necessary in western North Dakota. This is probably because the window of hot temperatures is not long, evenings are cool, and pigs compensate during cooler hours of the day. Based on the results of the pigs tested, gilts would be expected to be leaner, eat less and gain slower, but be equally efficient as their barrow counter-parts.

Introduction

Field pea is an alternative crop being grown in North Dakota for multiple markets. The principal market is for human consumption, however, the crop is also being grown in rotations for soil fertility management, disease control in small grains and for livestock feed.

Lysine is generally accepted as being the first limiting amino acid in barley-soybean meal based growing-finishing diets for pigs. Seasonal variations in temperature on dietary lysine requirements have been reported, documenting variations in eating patterns as pigs encounter temperatures above and below thermal neutrality (Schenck et al., 1992). Ina cold environment, pigs normally eat more to compensate for increasing maintenance needs, whereas in a hot environment pigs reduce feed intake in an attempt to reduce the need to dissipate heat from digestion and metabolic processes (Holmes and Close, 1977, Close and Stanier, 1984).

Sex also affects lysine requirement. Generally, gilts require a higher level of protein to maximize performance and carcass leanness than barrows. Growth performance studies conducted by the NCR-42 Committee (Cromwell, et al., 1993) defined gilts as being more efficient, leaner, having larger loin-eye muscle area and greater percentage of carcass muscle. They were also more sensitive to low protein diets than barrows. In this large study, designed to evaluate the effect of lysine level on lean growth rate, barrows reached a plateau in perfor-mance relative to lysine supply at approximately 13% CP (.58% lysine). Gilts, however, continued to improve lean growth (but at a decreasing rate) up to approximately 17% CP (.87% lysine).

Given the affect that sex, season and dietary protein/energy source can have on growth perfor-mance, this growing-finishing experiment was de-signed to evaluate summer and winter lean growth performance among split-sex fed barrows and gilts when *Trapper* field pea replaced all of the soybean meal.

Materials and Methods

Two-hundred-twenty-four PIC (C-15 x 326) barrows and gilts were allotted in a 2x2x2x2 factorial arrangement of treatments in a growing- finishing experiment to evaluate the affect of sex, protein supplement, lysine level and season on growth and carcass performance. Two pen replicates were used per treatment with seven pigs per pen.

Four-phase, barley-based growing-finishing diets supplemented with either soybean meal or *Trapper* field pea were fed. Diets were formulated to contain two levels of lysine. Formulations of the diets for each feeding phase and calculated nutrient analysis are shown in Table 1. Synthetic lysine was added to provide equal lysine concentrations across diets within each phase. DL-methionine was added as necessary to provide a minimum of .49, .46, .46 and

.43% methionine+cystine in phases 1, 2, 3 and 4, respectively. All other amino acids were provided for by dietary ingredients and their suggested balance, with respect to lysine, either just met or exceeded NRC recommendations (NRC, 1988).

The winter group of pigs had heavier starting weights, therefore, the phase-1 diet was not used. A sample of pigs from each sex were weighed on a weekly basis as the time for a phase change approached. When the average of the sample pigs most closely matched the phase's ending weight, the diets were changed to the next phase. Both barrows and gilts were fed to a weight constant end point range between 260 and 270 pounds. Pigs were weighed and identified for shipment to John Morrell Packing, Sioux Falls, SD, the week prior to expected slaughter. Then, approximately 24 hours before slaughter each pig was back tattooed to the left of the mid-line with an ID number and shipped to John Morrell Packing via the Southwest Shippers Association. Carcass data was collected by John Morrell, entered into a database and returned for analysis.

Data was analyzed for main effects [sex (barrows vs. gilts), supplement source (soybean meal vs. *Trapper* field pea), lysine level (low vs. high), season fed (winter vs. summer)] and all possible interactions using GLM procedures of SAS (SAS, 1988).

Results And Discussion

Cumulative growth and carcass performance is summarized in Table 2. Among the main effects, sex provided the most significant and consistent response for both growth and carcass performance. Gilts grew slower (P=.003), consumed less feed (P=.055), were more efficient, requiring less feed/pound of gain (P=.085), and had lower feed cost/pound of gain (P=.081). With respect to carcass characteristics, gilt carcasses were leaner [higher percent lean (P=.0001), less backfat depth (P=.0001) and greater lean tissue depth (P=.0001)], but carcass yield, hot carcass weight and total carcass value were similar for barrows and gilts.

Pig performance, when fed either soybean meal or field pea, was similar for daily gain and feed to gain, but pigs consuming field pea ate less daily feed (P=.068), had lower feed cost/pound of gain (P=.008), and subsequently, lower feed cost/head (P=.01). The overall lower cost of production for field pea was a function of comparable growth efficiency and a lower cost for locally-grown pea grain.

Carcass evaluation, following field pea or soybean meal supplementation, suggests that carcass performance is similar with either supplement, since no differences for carcass yield, percent lean, hot carcass weight, fat depth, loin depth or total carcass value were detected.

Increasing lysine concentration above normal levels did not improve pig growth or carcass performance. Feeding higher lysine increased the cost of production and lowered carcass yield (P=.081) resulting in a lower total carcass value of $135.99, as compared to a carcass return of $139.31 when normal lysine levels were fed. A protein source by lysine interaction suggested that it was unnecessary to feed additional lysine and that diets formulated with Trapper field pea can be both efficient and economical.

Pigs finished during the winter months were less efficient, requiring more energy for maintenance than summer fed pigs. Comparing summer and winter performance, daily gains for the seasons were similar, however, daily feed intake during the summer was lower (P=.0001) and feed efficiency was improved (P=.0001). Summer and winter carcass performance was similar for most aspects. The one exception was carcass yield. Although winter fed pigs were less efficient, their carcass yields were higher (74.6% vs. 72.9%) (P=.0001). Total carcass value was higher for summer pigs. The documented increase was not entirely due to improved carcass performance, but more likely was due to better hog prices, which increased dramatically between the two seasons.

A sex by season interaction was observed for ADG and daily feed intake as shown in Table 3. Gain and feed consumption were similar during the winter for barrows and gilts, but summer fed gilts were more sensitive to summer warmth than barrows. Gilts consumed less daily feed (P=.0003) and grew slower (P=.0001) than the barrows. Summer feed efficiency was improved as compared to winter efficiency, but within a given season feed efficiency was similar. A sex by protein source by season interaction was detected for feed efficiency, loin depth, and fat free lean index. Comparing feed efficiency for barrows and gilts, gilts fed field pea during the winter were the most efficient, whereas gilts fed soybean meal were the most efficient during the summer. The interaction detected for loin depth did not differ for barrows fed either protein supplement in either season. Gilts, however, were inconsistent between seasons. During the winter period, gilts fed soybean meal had greater loin depth, but during the summer, gilts fed field pea had greater loin depths. With respect to fat free lean index, gilts had consistently higher values during both seasons when either of the protein sources was fed. The greatest fat free lean index was detected among gilts fed field pea as a source of protein.

Based on the pigs' metabolic response to temperature fluctuations that increase or decrease eating desire, a season by lysine interaction was anticipated, but none was detected. It is the feeling of the authors, that the window of hot temperatures in the drier regions of the northern plains is not long enough to anticipate a reduction in intake, thus, do not warrant higher than normal lysine levels. Although summer temperatures of 100 F do occur, the duration is usually short, and any given group of pigs would have opportunity for compensatory growth and efficiency.

Implications

Trapper field pea was shown to be a suitable replacement supplement for soybean meal when replaced on a percent of protein requirement basis within each growth phase from 75 to 265 pounds. The data also suggests that, with the exception of the phase-1 grower diet, sufficient lysine is present in field pea such that no additional lysine is needed in the 2nd, 3rd and 4th dietary phases. Therefore, the *Trapper* field pea tested had sufficient protein (lysine) needed to maximize efficiency of feed utilization and carcass leanness for both barrows and gilts. Seasonal increases in lysine level, suggested for other regions of the U.S., above normal recommendations for hot humid weather are not necessary in western North Dakota to compensate for warm summer weather. Of the pigs tested, gilts would be expected to eat less and gain slower, but be equally efficient as their barrow counterparts.

Table 1. Composition and Calculated Analysis of Diets fed.																
	PHASE 1 (50-80 LBS.)				PHASE 2 (80-140 LBS.)				PHASE 3 (140-190 LBS.)				PHASE 4 (190-265 LBS.)			
	Hi Lysine		Low Lysine		Hi Lysine		Low Lysine		Hi Lysine		Low Lysine		Hi Lysine		Low Lysine	
	SBM	PEA	SBM	PEA	SBM	PEA	SBM	PEA	SBM	PEA	SBM	PEA	SBM	PEA	SBM	PEA
INGREDIENTS, %:																
Barley	81.3	56.3	81.6	56.5	86.1	57.5	86.2	57.7	86.8	57.6	86.9	57.7	86.9	63.1	87.1	63.1

Field Pea (*Trapper*)	0.0	40.0	0.0	40.0	0.0	40.0	0.0	40.0	0.0	40.0	0.0	40.0	0.0	35.0	0.0	35.0
Soybean Meal	15.0	0.0	15.0	0.0	11.5	0.0	11.5	0.0	11.0	0.0	11.0	0.0	11.0	0.0	11.0	0.0
Lysine	.55	.43	.3	.17	.4	.16	.23	0.0	.35	.09	.2	0.0	.28	.1	.12	0.0
Methionine	0.0	.2	0.0	.2	0.0	.2	0.0	.2	0.0	.2	0.0	.2	0.0	.1	0.0	.1
Vitamin/Mineral Premix	3.12	3.12	3.12	3.12	2.05	2.1	2.05	2.1	1.9	2.1	1.9	2.1	1.8	1.8	1.8	1.8
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Analysis, %:																
Crude Protein	17.6	17.6	17.4	17.4	16.5	16.5	16.5	16.5	16.3	16.3	16.3	16.3	16.3	16.0	16.2	16.0
Lysine	1.2	1.2	1.0	1.0	1.0	1.0	.87	.87	.95	.95	.84	.84	.90	.90	.77	.77
Tryptophan	.22	.18	.22	.18	.20	.18	.20	.18	.20	.18	.20	.18	.20	.18	.20	.18
Methionine + Cystine.	.49	.50	.50	.50	.46	.50	.46	.50	.46	.50	.46	.50	.46	.43	.46	.43
Calcium	.57	.57	.57	.57	.60	.60	.60	.60	.54	.60	.53	.60	.50	.50	.50	.50
Available Phos.	.42	.40	.42	.40	.28	.26	.28	.26	.26	.26	.26	.26	.26	.24	.26	.24
Energy, kcal ME/lb.	1.38	1.38	1.38	1.38	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40
Lysine, gms./Mcal of ME	4.0	4.0	3.3	3.3	3.3	3.3	2.8	2.8	3.1	3.1	2.7	2.7	2.9	2.9	2.5	2.5

Table 2. Combined Seasons Cumulative Performance.

	LOW LYSINE				HIGH LYSINE				SE
	SBM		PEA		SBM		PEA		
	Barrow	Gilt	Barrow	Gilt	Barrow	Gilt	Barrow	Gilt	
Growth Performance:									
Initial Wt., lb.	76	75	76	74	76	73	77	76	--
Final Wt., lb.	273	260	265	262	267	265	268	266	--
Daily Gain, lb.[a]	2.19	2.0	2.08	1.96	2.11	2.02	2.09	2.01	.04
Daily Feed, lb.[a,d,f,g]	8.22	7.35	7.41	6.88	7.67	7.11	7.72	7.20	.223
Feed:Gain, lb.[a,f,g]	3.75	3.67	3.57	3.51	3.64	3.53	3.69	3.58	.065
Carcass Performance:									
Fat Depth, in.[b]	.88	.78	.91	.68	.89	.73	.97	.61	.048
Loin Depth, in.[b,j]	1.99	2.15	1.93	2.07	2.00	2.09	1.95	2.16	.041
Hot Carcass Wt., lb.	199	188	194	185	186	190	190	186	3.47
Percent Yield, %[e,f,j]	74	75	74	74	73	74	74	72	.59

Percent Lean, %[b,i]	51	53	50	54	50	54	49	54	.73
Fat Free Lean Index, %[b,i,j]	48	49	47	50	47	49	46	50	.53
Economics:									
Feed Cost/Lb. of Gain,$[a,c,e,g]	.301	.293	.279	.275	.300	.290	.295	.287	.005
Feed Cost/Head, $[b,c,h]	59.29	55.20	52.83	51.46	57.21	55.70	56.16	54.34	1.50
Carcass Value, $	141.5	138.5	140.2	136.9	132.6	139.3	135.1	136.8	--
Return Over Feed, $	82.22	83.39	87.39	85.49	75.45	83.66	78.96	82.49	---

a Sexes differ (P<.10). b Sexes differ (P<.05).
c Protein supplement differs (P<.01).
d Protein supplement differs (P<.10).
e Lysine level differs (P<.10).
f Season differs (P<.0001).
g. Protein supplement x lysine level interaction (P<.05).
h Protein supplement x lysine level interaction (P<.10).
i Sex x lysine interaction (P<.10).
j Sex x protein supplement (P<.05).

Table 3. Performance interactions for sex x season and sex x protein source x season for selected criteria

SEX x SEASON		
	Gilts	Barrows
ADC, lb.[a] :		
Winter	2.06	2.05
Summer	1.95	2.16
SE = .028		
Daily Feed, lb.[a] :		
Winter	7.91	7.93
Summer	6.60	7.63
SE = .157		
Feed To Gain, lb.:		
Winter	3.83	3.86
Summer	3.39	3.52
SE = .046		

SEX X PROTEIN SOURCE X SEASON				
	Gilts		Barrows	
	SBM	PEA	SBM	PEA
Feed To Gain, lb[c] :				

Winter	3.95	3.70	3.85	3.86
Summer	3.34	3.43	3.58	3.47
SE = .065				
Loin Depth, in.[b]:				
Winter	2.17	2.05	1.93	1.94
Summer	2.08	2.18	2.06	1.94
SE = .041				
Fat Free Lean Index, %[d]:				
Winter	49.5	49.5	46.8	46.8
Summer	48.5	50.3	48.3	46.8
SE = .53				

[a] Sex x season interaction (P<.01). [b] Sex x protein source x season interaction (P<.01).
[c] Sex x protein source x season interaction (P<.05).
[d] Sex x protein source x season interaction (P<.10).

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