Effects of Feeding Iowa-Grown Field Pea on Finishing Pig Performance

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Introduction

Field peas (*Pisum sativum L.*) are a valuable and versatile nutrient source for a range of livestock species in several regions of the world. Interest in growing field peas as a feedstuff for livestock is increasing in the upper Midwest. Peas are a relatively new crop in Iowa where corn and soybean meal are the primary ingredients of swine diets. The growing season, seed characteristics, and other agronomic factors influence the nutrient content of peas. Hence, it is important to understand the nutrient levels of locally grown peas before incorporating them in swine diets.

Unlike soybeans, pea seeds after harvesting can be ground and incorporated in swine diets without further processing. The nutrient profile of field peas is intermediate between corn and soybean meal with a similar digestible energy to corn. The objective of this study was to investigate Iowa-grown field peas as a feedstuff for finishing pigs.

Materials and Methods

Peas. Field peas (winter, spring, and summer types) grown in southeast Iowa during 2005 and 2006 were sampled and analyzed for nutrient content.

Diets. The four diets were: 1) winter pea 30% of the total diet (by weight), 2) summer pea 30% of the total diet (by weight), 3) spring pea 30% of the total diet (by weight), and 4) corn-soybean meal as the control. The three pea diets contained corn but no soybean meal. Each of the four diets had 0.64% lysine based on calculated analysis (Table 1). In the winter and summer pea diets crystalline lysine, tryptophan and threonine were added. In spring pea diet only crystalline tryptophan and threonine were added. The control diet had no crystalline amino acids added. All the diets were formulated to meet or exceed NRC nutrient recommendations for finishing pigs. Prior to mixing the diets, the grains were ground with a hammer mill using a 4.8-mm screen and presented in meal form.

Animals and Facilities. Finishing pigs, barrows (n = 64), offspring of PIC 336 terminal line bred to PIC Cambrough 227 sows all from the same farm were used in the experiment. A pen of four pigs composed an experimental unit. Pens were randomly allotted to one of the four treatment diets. Pig body weight and ancestry were equalized across the treatments. In each pen, a two-hole feeder and a nipple water drinker were installed. The pens were 1.8 m × 2.7 m with a half concrete slatted floor. There were four replicate pens per treatment group. The pigs were housed in an environmentally- controlled building at the ISU Swine Nutrition Farm, Ames, IA. Prior to the start of the experiment, all pigs were fed corn-soybean meal grower diets as a large group.

The pigs started on the experiment after attaining body weight of approximately 80 kg and were fed the experimental diet for 39 d. Pigs were weighed individually at the start, at 14-d interval, and at the end of the experiment. The feed was weighed before it was placed in the feeders. The pigs had *ad libitum* access to feed, however the feeders were adjusted regularly to minimize wastage. On the final day of the experiment, the feed that was left in the feeders was weighed and feed disappearance from each pen was calculated. Average daily feed intake (ADFI) was calculated for each pen and treatment group. ADFI = feed disappearance divided by the number of pigs per pen divided

by the number of days on the experiment. Pig body gain (BG) and average daily gain (ADG) was calculated for each pen and subsequently for each treatment group. BG = start weight minus end weight. ADG = BG divided by number of days on experiment. Feed:Gain ratio (F:G) was calculated for each pen. FG = ADFI divided by ADG.

Scanning. At final weighing, each pig was scanned by a certified technician using an Aloka 500-V SSD ultrasound machine fitted with a 3.5-MHz, 12.5cm linear array transducer. A sound-transmitting guide placed on the pig's back was used to collect image measurements off-midline for BF and LMA at the tenth rib. Vegetable oil was used to provide better conductivity between the skin and the probe. The ultrasonic measurements were used to determine fat-free lean weight of the live pigs (FF lean). The FF lean weight divided by the carcass weight = FF lean percentage (FFL%).

Statistical analysis. Data were analyzed using the PROC MIXED procedure of SAS. CLASS statement was treatment and pen. The pen was the experimental unit for performance data. Data for carcass leanness evaluation was also pooled within pen. The model contained treatment, ADFI, ADG, BF, and LMA. The LSMEANS statement and the PDIFF option were used to separate the means. To test significance, an alpha value of $P < 0.10$ was used in the analyses.

Results and Discussion

Pig Performance. Initial body weights did not differ between dietary treatments, as part of the experimental design. There was no difference in final weight for pigs in the four treatment groups. Likewise there were no treatment effects on ADG ($P = 0.22$) across dietary treatments (Table 2). The ADFI was influenced by dietary treatments ($P < 0.10$). Pigs tended to consume less corn-soybean meal and spring pea diets than the winter and summer pea diets, with ADFI of 4.0, 3.8, 3.5 and 3.4 kg/d for winter, summer, spring, and the control diets, respectively. The G:F and F:G ratios were not different among the treatment groups.

Carcass Evaluation. Pigs fed winter peas had greater BF than pigs fed spring peas or the control diet, and pigs fed summer peas were intermediate and did not differ from the other treatments ($P < 0.10$) (Table 3). There were no differences between dietary treatments for LMA; although the pigs fed spring peas had numerically smaller loin muscle areas. There were no differences in the overall fat-free lean values.

In this study, the results showed no decrease in performance of finishing pigs at the inclusion rate of 30% field peas in a corn-based diet. There was no adverse effect on growth rate or feed conversion among the treatment groups. The 30% field pea inclusion rate was enough to replace all the soybean meal and reduce the corn. In the diets containing peas, synthetic lysine, tryptophan and threonine were added to the pea diets to avoid deficiencies (Table 1).

Field peas are an important crop to consider for Iowa pork production, because of their nutritive value, chemical composition, and agronomic characteristics. Peas are easy to handle on-farm, only requiring basic processing before feeding. Results from this study indicate that Iowa-grown field peas fed at 30% inclusion rate can replace all soybean meal and part of corn in diets for finishing pigs without negative effects on performance. Essential amino acids should be balanced to avoid their deficiency.

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Table 1. Composition of field pea-based diets fed to finishing pigs, as fed basis.

Ingredient, %	30% Winter peas[1]	Summer peas[1]	Spring peas[1]	Control[2]
Corn	67.70	67.66	67.73	83.90
Peas	30.00	30.00	30.00	0.00
Soybean meal (48% CP)	0.00	0.00	0.00	14.00
Dicalcium phosphate	0.82	0.82	0.82	0.65
Limestone	0.82	0.82	0.82	0.87
Salt	0.33	0.33	0.33	0.33
Vitamin premix[3]	0.17	0.17	0.17	0.17
Mineral premix[4]	0.08	0.08	0.08	0.08
Synthetic lysine	0.02	0.05	0.00	0.00
Synthetic tryptophan	0.035	0.035	0.03	0.00
Synthetic threonine	0.025	0.035	0.02	0.00
Calculated analysis				
Crude protein %	11.70	11.10	11.60	13.60
Lysine %	0.64	0.64	0.64	0.64
Tryptophan %	0.13	0.13	0.13	0.14
Threonine %	0.44	0.44	0.44	0.50
Met + Cyst %	0.40	0.39	0.40	0.50
Calcium %	0.54	0.54	0.54	0.54
Available. P. %	0.18	0.18	0.18	0.18
Total P. %	0.46	0.46	0.46	0.45
Met. Energy kcal/lb	1487.00	1487.00	1488.00	1516

[1]Pea diets, no soybean meal added.
[2]Corn-soybean meal.
[3]Premix supplied vitamins to meet or exceed NRC (1998) requirements.
[4]Premix supplied minerals to meet or exceed NRC (1998) requirements.

Table 2. Performance of finishing pigs fed Iowa grown winter, spring, and summer field peas compared with corn/soy-based diets.[1]

Item	Winter peas	Summer peas	Spring peas	Control[2]	SEM	P-Values
Pens	4	4	4	4		
Pigs on trial	16	16	16	16		
Days on test	39	39	39	39		
Start wt, kg	81.0	80.7	80.3	80.9	2.5	1.00
End wt, kg	126	124	119	122	3	0.63
ADFI, kg/d[3]	4.01[a]	3.80[ab]	3.52[b]	3.44[b]	0.15	0.08
ADG, g/d[3]	1161	1103	1004	1041	53	0.22
F:G[3]	290	290	285	303	7	0.31
G:F[3]	3.45	3.45	3.53	3.31	0.08	0.34

[1]Data are means of four observations per treatment (16 barrows per treatment group).
[2]Control = Corn soybean meal diet for finishing pigs.
[3]ADFI = Average daily feed intake; ADG = average daily gain; F: G = Feed-to-gain ratio; G: F = Gain-to-feed ratio.
[a,b]Values in the same row with differing superscripts differ ($P < 0.10$).

Table 3. Carcass evaluation of finishing pigs fed Iowa-grown winter, spring, and summer field peas compared with corn/soy-based diets.[1]

Item	Winter peas	Summer peas	Spring peas	Control[2]	SEM	P-Values
BF, mm[3]	22.9[a]	20.0[ab]	18.9[b]	19.3[b]	1.1	0.09
LMA, cm^2	44.3	44.0	40.9	43.9	1.5	0.39
FF Lean, kg	47.0	47.0	44.9	46.6	1.3	0.65
FF lean, %	50.4	51.2	51.0	51.6		

[1]Data are means of four observations per treatment (16 barrows per treatment group).
[2]Control = Corn soybean meal diet for finishing pigs.
[3]BF = Back fat; LMA = Loin muscle area; FF lean = Fat free lean.
[a,b]Values in the same row with differing superscripts differ ($P < 0.10$).