RESEARCHREPORT
ANIMAL SCIENCE

Title: Precision nutrition for pork niche markets: Characterizing feed intake, growth rate, and fat deposition of purebred Berkshire pigs housed in Iowa hoop barns **– NPB #12-116**

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Industry Summary

Niche marketing continues to grow in Iowa and the United States as the demand for high quality pork increases. Previous research on meat quality of pork has demonstrated that purebred Berkshires have advantages over most commodity based pork. Therefore a Certified Berkshire Pork program has developed and is a vital niche market that provides economic opportunity for a growing number of producers.

This early research also documented that Berkshires had a significantly poorer feed conversion than other breeds, thus raising their cost of production.

However, several years have elapsed since this first research and while the meat quality advantages of Berkshire pork is still evident, there exists a real need to better quantify the current feed intake and fat and lean deposition of current day Berkshires.

This has become of utmost importance as the price of feed has dramatically increased in recent years.

Understanding how feed programs and growth rates affect lean and fat deposition rates, and how to use this information to lower feed costs are critical aspects to these niche programs in order to maximize profitability and quality of the Berkshire pork products marketed.

This trial demonstrated that Berkshire pigs grow as fast but consume more feed than expected from traditional commodity genetic lines, resulting in a challenging feed conversion ratio. Barrows grow faster and consumed more feed than gilts, but gilts were more efficient converting feed to gain. Seasonal feed intakes differ for both sexes. This information can be used in designing rations and feed budgeting systems that can lower the feed costs for production of Berkshire pork.

From these two trials barrows averaged an inch of backfat between 200 and 240 lb body weight whereas gilts approached this backfat depth at heavier weights, usually between 260 and 300 lb. Therefore, it appears that lean deposition rates were different between barrows and gilts, and between trials. This difference is critical when selecting animals for marketing and achieving consistency in meat quality within a marketing system. The differences between barrows and gilts indicate it may be more critical that each are fed differently in commercial production systems.

Keywords

Swine, niche markets, growth, feed intake, composition, feed conversion, ration formulation

Scientific Abstract

The primary purposes of this study were to characterize growth, feed intake, feed conversion, and, fat and lean deposition rates in purebred Berkshire pigs housed in hoop barns in Iowa over summer and winter seasons. With the high cost of feed and the history of challenging feed conversion in purebred Berkshires it is very important to have accurate estimates of these parameters in order to formulate rations and feeding programs to minimize feed costs.

Barrows grew faster (2.04 versus 1.78 lb/day), reached targeted sell weight of 270 lb pen average at an earlier age (108 versus 119 days), consumed more feed (6.73 versus 5.70 lb/day) and were heavier than gilts for both trials averaging 275 versus 265 lb. Gilts were more efficient in converting feed to gain than barrows (3.20 versus 3.31) across both trials. Growth rates were similar between seasons; however, more feed was consumed during the winter than the summer period by both sexes.

Even though gilts averaged less backfat than barrows in both trials at first and last scanning (.34 versus .43 inches; .90 versus 1.26 inches respectively) , there were differences between the two trials from the initiation to the finalization of the studies. There was little difference between initial LEA scans of barrows and gilts for both trials, but at the end gilts averaged larger LEA (6.56 in^2) than barrows (6.19 in^2). As expected Berkshire hogs are not as lean as commercial lines, but the relative difference between barrows and gilts in percent lean were consistent with gilts averaging 50.5% versus 46.2% for barrows.

Barrows consumed 18% more feed than gilts across the seasons. While this is in agreement with traditional research, the difference is quite important as it pertains to ration formulation and feed program development. Growth rates were similar across seasons, but feed conversion was poorer in the winter replicate compares to the summer.

When feed intake, growth rate, and, fat and lean deposition curves were examined, the differences between the sexes were also seen.

Introduction

Previous work research evaluation on meat quality of pork has demonstrated that purebred Berkshires have advantages over most commodity based pork. Thereby a Certified Berkshire Pork program has developed and is a vital niche market in Iowa and the United States that provides economic opportunity for a growing number of producers. However, Berkshires have a reputation of being fatter and less efficient in feed conversion, and therefore these purebred Berkshires are not commonly raised in modern day pig production systems.

Many Berkshire Pork niche markets require access to bedding and limit the use of antibiotics and feeding of animal-proteins. In Iowa, producers of Berkshire Pork often raise their pigs in bedded hoop barns because this type of system matches with the housing requirements of their market. Housing influences the thermal environment that pigs experience and thus influences growth rate and nutritional requirements of growing pigs.

Better understanding intakes, growth rates and lean and fat deposition are needed for these purebred pigs. Establishing parameters for each of these benchmarks would enables nutritionists to more closely match diet formulations with needs of growing pigs. Precisely matching the nutrient profile of diets with nutritional needs of growing pigs is needed to reduce excretion of nutrients into the environment. Delivering the

correct nutrient profile to support growth and development while avoiding delivery of excess nutrients will also help minimize feed costs. The starting point for developing a precise nutrition program for Berkshire Pork is to accurately know the feed intake and growth rate of purebred Berkshire pigs from weaning until market weight. Better characterizing how purebred Berkshire pigs grow in bedded hoop barns will enable more accurate feed formulation for this type of pig raised in bedded systems. The purpose of this project is to characterize typical growth rates and body compositional changes of purebred Berkshire pigs in bedded hoop barns in Iowa.

Objectives

This project will begin to characterize growth and performance of purebred Berkshire pigs housed in hoop barns in Iowa. The traits measured will be feed intake, growth rate, feed conversion ratio, and composition as measured by real-time ultrasound estimates of backfat, loin depth and percent lean. From this information more precise feed formulation should be possible by the niche pork producer, better matching the nutrient requirements of the Berkshire pig with the rations provided by the producer. This project will thus, provide key information to producers seeking to minimize feed costs and environmental impact while supporting lean muscle growth.

Materials and Methods

This study was conducted at the Iowa State University Castana Research farm. Two distinct trials, summer and winter, were conducted in order to include the environmental extremes of Iowa's climate. In each trial 36 Berkshire feeder pigs (18 gilts; 18 barrows) were purchased and housed in three bedded mini-hoop barns.

The targeted weight range was from 50 to 270 pounds of live weight. Due to the variation in size and weight, pigs were allotted by sex and weight (light, medium, and heavy) of 6 pigs per pens; 2 pens per hoop. Gilts and barrows of similar weights were housed in one of three mini hoops which were divided in two for 12 pigs per hoop. Pigs were fed ad libitum a six phase feeding program of corn-soybean meal based diets that met or exceed amino acid requirements. Weight breaks for diet changes were 90, 135, 180, and 225 lb average pen weight. At 21 day intervals pigs were weighed and feed consumption was recorded until the pens averaged 270 +/- 5 lb to characterize growth and intakes. Ultrasonic measurements were recorded for backfat depth and loin eye area (**LEA**) of each pig at each weigh period beginning when the trial average was 90 to 100 lb average and continued until each pen reached 270 lb. Ultrasonic estimate of percent lean was calculated by the equation: %Lean = (0.833*gender - 16.498*Backfat + 5.425*LEA + 0.291*BWt-0.534) / BWt; (gender: barrows=1; gilts=2). Indoor and outdoor temperatures were recorded during each trial period. Pen averages were used in the regression analyses for feed intake, growth rate, feed efficiency, backfat depth, LEA and percent lean curves.

Results and Discussion

Table 1 summarizes the growth performance of the two trials (1-winter; 2-summer) and shows the weight by sex pen grouping. Barrows grew faster (2.04 vs 1.78 lb/day), reached targeted sell weight of 270 lb pen average (108 versus 119 days) at a younger age, consumed more feed (6.73 versus 5.70 lb/day) and were heavier than gilts for both trials averaging 275 versus 265 lb. Gilts were more efficient in converting feed to gain than barrows (3.20 versus 3.31) across both trials. Growth rates were similar between seasons; however, more feed was consumed during the winter than the summer period by both sexes.

Although not presented in table 1, growth rates were the same between weight classes within sex, but feed disappearance appeared to increase as the weight allotment increased for both trials. In comparison of this performance data with the previous work (Lean Growth Trial, NPPC, 2000), these Berkshires grew considerably faster and were marketed at heavier weights.

Table 2 summarizes the initial (90 lb group average) and final (270 lb average) ultrasonic measurements for the two trials. Even though gilts averaged less backfat than barrows in both trials at first and last scanning (.34 versus .43 inches; .90 versus 1.26 inches respectively) , there were differences between the two trials from the initiation to the finalization of the studies. There was little difference between initial LEA scans of barrows and gilts for both trials, but at the end gilts averaged larger LEA (6.56 in^2) than barrows (6.19 in^2). As expected Berkshire hogs are not as lean as commercial lines, but the relative difference between barrows and gilts in percent lean were consistent with gilts averaging 50.5% versus 46.2% for barrows.

Figures 1, 2, and 3 represent the regression analyses for comparison of intake, gain and feed efficiencies for barrows and gilts between the two trials. The intake curves for both barrows and gilts were curvilinear over the grow-out period for the winter trial (Figure 1), whereas the summer intakes were linear, which was unexpected with the summer heat. Weight gain curves were curvilinear with similar shapes (Figure 2), but significant differences for regression intercepts, with the winter gains greater than summer and barrows greater than gilts for both trials. The differences in intake curves and similarity in gain curves resulted in feed efficiency (Figure 3) being significantly different between the winter and summer trials.

Figures 4, 5, and 6 depict the regressions by trial and sex for backfat, LEA and percent lean, respectively. Although the backfat intercepts were similar at 70 lb, the slopes were different between barrows and gilts and between trials (linear regressions). This would suggest there are genetic differences between the two trials and may warrant additional study of the genetic composition from the pig source. In comparison quadratic LEA regressions were almost identical between genders and trials from 70 to 280 lb. The calculated percent lean were different as well between barrows, gilts and trials. The intercepts were very different, however the slope of each line were similar for barrows between trials as were the slope of the line for gilts when linearly regressed. Again this suggests there may have been a change within the source herd for backfat between the breeding of pigs of the first trial compared to the second trial. While one may contribute this to a seasonal response (winter versus summer), review of the different slope responses for backfat negates this as a source of variation.

Table 1. Growth performance of Berkshire

Trial	Wt-Sex*	Initial Wt	Final wt	Days	ADFI	ADG	F:G
1	Lt-G	41	262	127	5.75	1.74	3.30
	Lt-B	47	273	112	6.57	2.02	3.26
	Md-G	56	265	118	6.05	1.77	3.41
	Md-B	55	277	112	7.22	1.99	3.63
	Hy-G	66	273	118	6.12	1.76	3.49
	Hy-B	69	278	104	7.33	2.01	3.65
2	Lt-G	46	258	117	5.18	1.81	2.86
	Lt-B	43	270	111	6.31	2.05	3.08
	Md-G	52	261	117	5.40	1.79	3.02
	Md-B	53	278	111	6.41	2.02	3.17
	Hy-G	60	272	117	5.68	1.82	3.13
	Hy-B	64	271	97	6.54	2.13	3.06
1	G	54	267	121	5.97	1.76	3.40
	B	57	276	109	7.04	2.00	3.51
2	G	52	264	117	5.42	1.81	3.00
	B	53	273	106	6.42	2.07	3.10
Overall	Trial 1	56	271	115	6.51	1.88	3.46
	Trial 2	53	268	112	5.92	1.94	3.05
	Gilts	53	265	119	5.70	1.78	3.20
	Barrows	55	275	108	6.73	2.04	3.31
	All pigs	54	270	113	6.21	1.91	3.26

* Lt= light, Md= medium, Hy = heavy weight; G = gilts; B = barrows;

The initial lightest & heaviest gilt = 37 & 82 lb; Lightest & heaviest barrow = 39 & 92 lb;

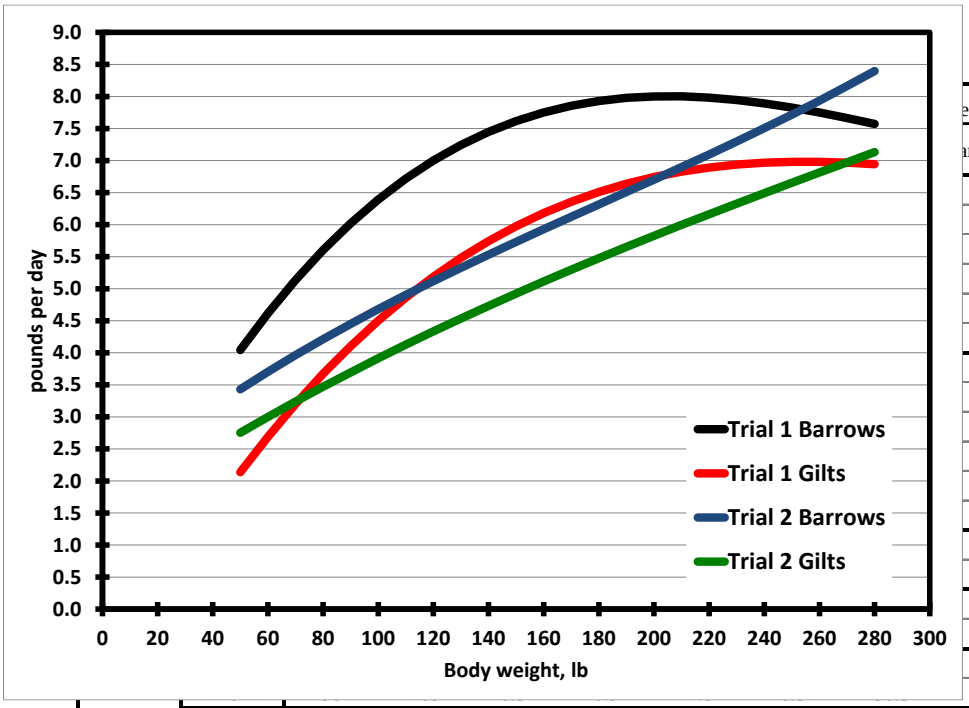
At temination lightest & heaviest gilt = 213 & 317 lb; Lightest & heaviest barrow = 233 & 310 lb;

to

These datasets and regressions will be used for not only benchmarking Berkshire performance, but, other niche market genetics as a means improve management and financial practices.

Note in the Figures 1 – 6, average pen weights were used in the regression analyses for the two trials.

Figure 1. Average daily feed intake of Berkshire pigs from 50 to 280 lb average



Overall	Gilts	86	265	0.34	0.90	2.52	6.56	37.4	50.5
	Barrows	92	275	0.43	1.26	2.57	6.19	34.2	46.2
	All pigs	89	270	0.39	1.08	2.54	6.38	35.8	48.4

* Lt= light, Md= medium, Hy = heavy weight; G = gilts; B = barrows; Lightest pig = 61 lb Heavest pig 317 lb
** Carcass percent lean estimated at 74% of the off-test live calculation
*** %Lean = (0.833*gender - 16.498*Backfat + 5.425*LEA + 0.291*BWt-0.534) / BWt

Figure 2. Average daily gain of Berkshire pigs from 50 to 280 lb average

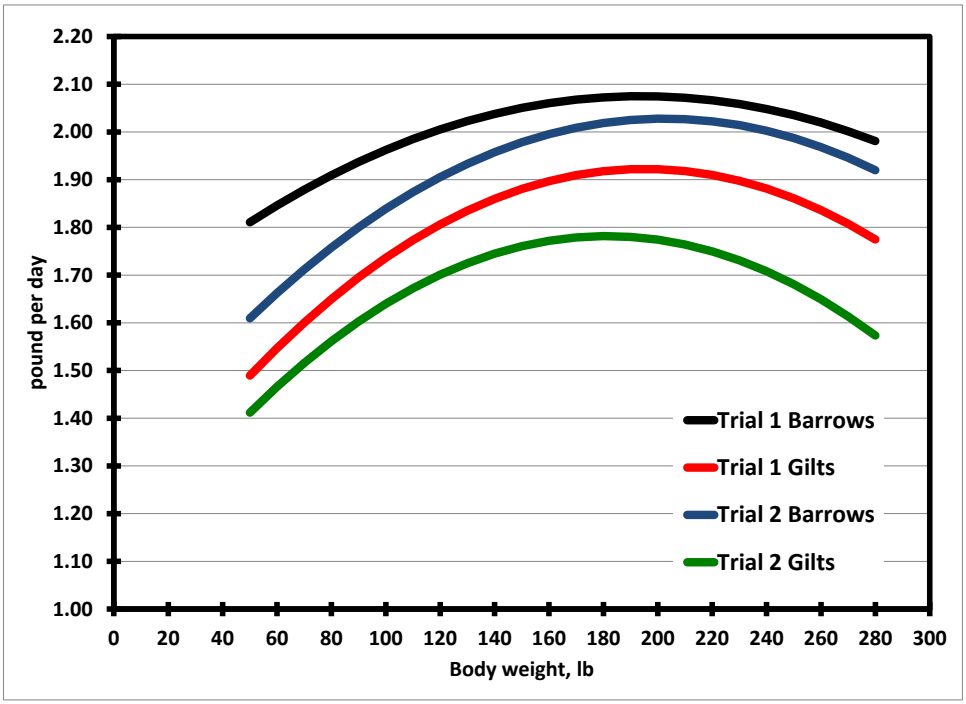


Figure 3. Feed efficiency of Berkshire pigs from 50 to 280 lb average

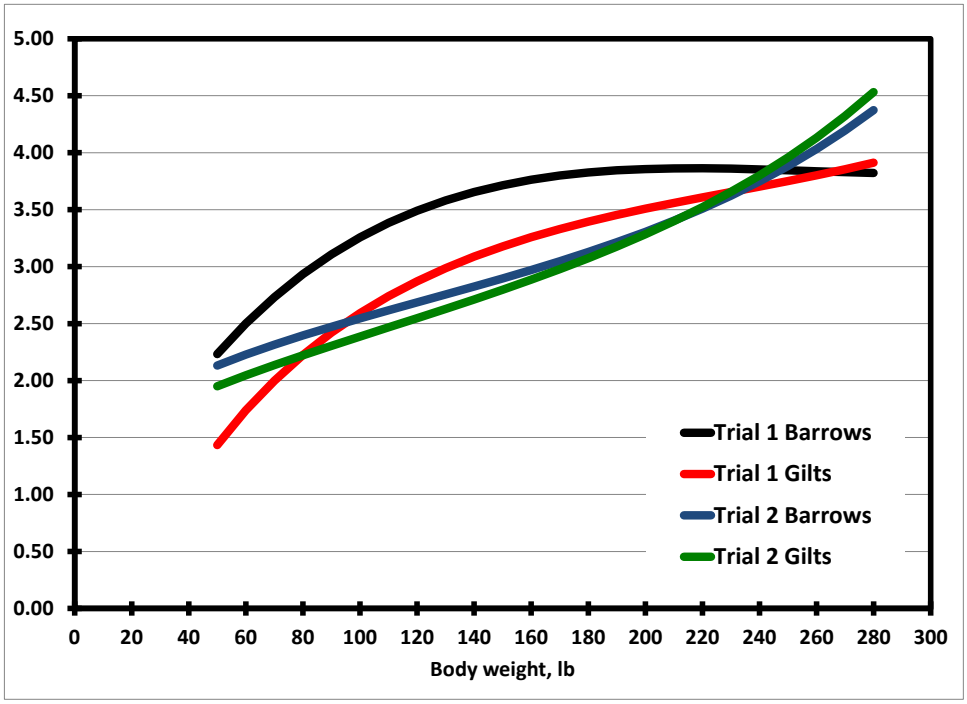


Figure 4. Average backfat depth (inches) of Berkshire pigs from 70 to 280 lb average

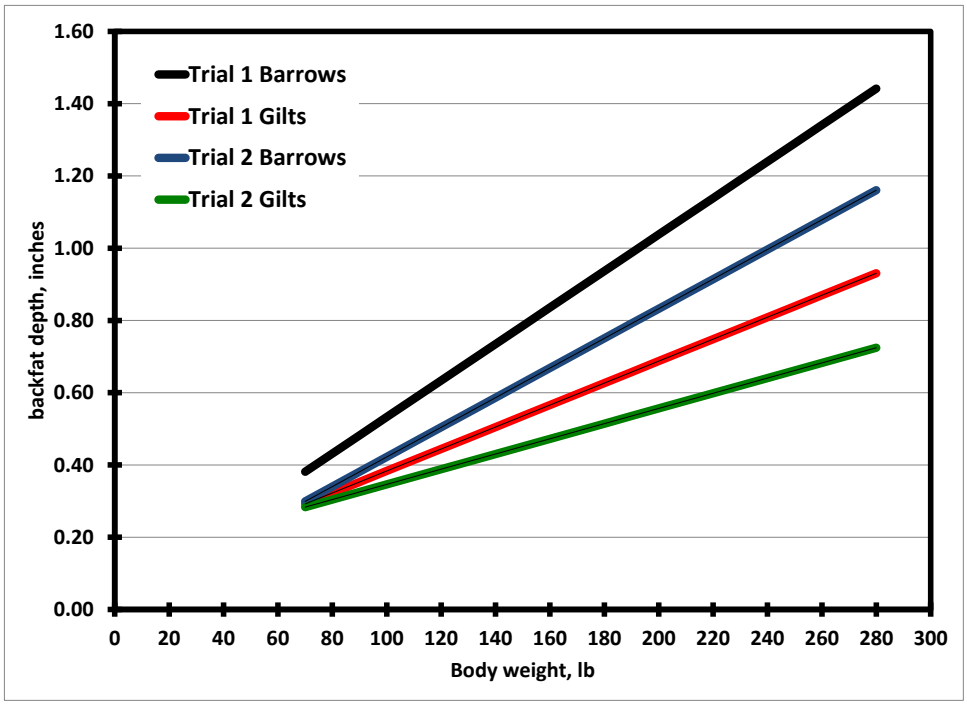


Figure 5. Average loin eye area of Berkshire pigs from 70 to 280 lb average

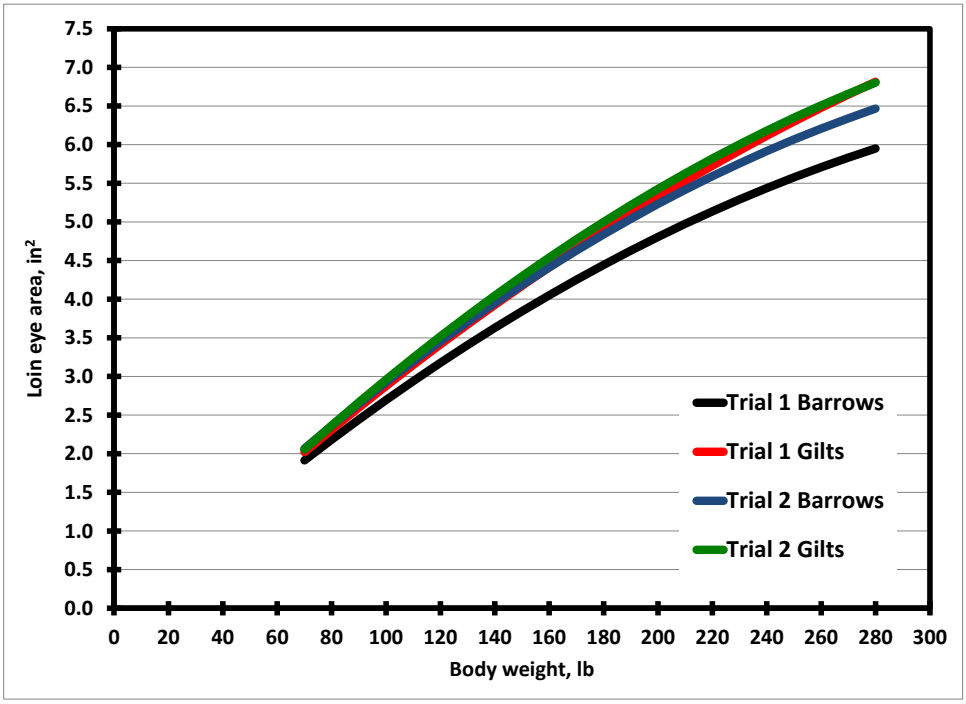


Figure 6. Calculated average percent lean (live basis) of Berkshire pigs from 70 to 280 lb average