PERFORMANCE OF GROWING PIGS FED USING ELECTRONIC VERSUS COMMERCIAL FEEDERS

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INTRODUCTION

Feed is the largest variable cost in pork production. Although selection for growth and leanness has resulted in increased feed efficiency (Sather and Fredeen 1978), further improvement requires measurement of feed intake on individual pigs. Measurement of individual feed intake on pigs housed in groups can be accomplished by electronic feeders (Young and Lawrence 1994). Electronic feeders are single-space feeders that offer protection from competition, depending on the design of the feeder. In contrast, multi-space feeders that offer no protection are used in commercial herds. There are also design differences that may result in differences in feed wastage. Knowledge of performance of pigs fed using electronic versus commercial feeders is needed to detect genotype by environment interactions and to ensure that genetic progress achieved in selection herds is realized at the commercial level.

Previous studies that compared single- versus multi-space feeders found that growth rate, feed intake, feed efficiency, and backfat thickness were not different (Kay *et al.*, 1989; Walker 1990). Morrow and Walker (1994) and Nielsen *et al.* (1995) found that increased protection from competition while eating had no effect on growth rate, feed intake, feed efficiency, and backfat thickness. Hyun and Ellis (2001) compared electronic versus single-space commercial feeders and found no differences in growth rate but a decrease in feed intake and an improvement in feed efficiency from pigs on electronic feeders. They hypothesized that differences in feed intake were caused by differences in feed wastage or underestimation of intake by electronic feeders. Only one study was found that compared the combined effects of feeder space, protection, and feeder design (electronic versus commercial feeder) (Hyun *et al.*, 1998). No differences were found for growth rate, feed intake, and feed efficiency. Their study used a two-space commercial feeder whereas most feeders in commercial herds have four or more spaces. To further evaluate the impact of electronic feeders, the objective of this study was to compare performance and growth and feed intake curves of Yorkshire boars and gilts fed using electronic versus five-space commercial feeders.

MATERIALS AND METHODS

Purebred Yorkshire boars and gilts (n=475) were used. Littermates were randomly split into single-sex pens that contained either a single-space FIRE electronic feeder (Osborne Industries Inc.) or a five-space SMIDLEY stainless steel feeder, for a total of 40 pens. FIRE feeders were equipped with full-length races (Nielsen *et al.*, 1995). Number of pigs per pen averaged 12.8.

Pigs began test at an average age of 92 d (ONAGE). Body weight (BW) was recorded weekly, beginning and ending at average weights of 39 and 116 kg. Backfat thickness and loin muscle area were measured once every two weeks using an ALOKA real-time ultrasound machine.

Amount of feed put in each feeder and feed remaining at the end of each two-week period were measured for both feeder types. Body weight, backfat thickness, and loin muscle area measurements at the start (ONWT) and end (OFFWT, BF, LMA) of test were used to calculate average daily gain (ADG) and changes in backfat thickness and loin muscle area (DBF, DLMA). The traits ONWT, ONAGE, and OFFWT were averaged for each pen (PONWT, PONAGE and POFFWT). Amount of feed used by each pen was used to calculate average daily feed intake per pig per pen for each two-week period (PDFI) and for the whole test period (PADFI). Pen feed conversion ratio (PFCR) over the whole test period was calculated for each pen as kg feed/kg gain. Pen residual feed intake (PRFI) was predicted as the error term for PADFI from a model that included group (based on beginning test date, n=7) and the covariates PONWT, PONAGE, POFFWT, floor space per pig, and pen ADG and DBF pre-adjusted for PONWT, PONAGE, and POFFWT. The experimental unit was pig (n=475) for ADG, BF, LMA, DBF, DLMA, and BW but pen (n=40) for PADFI, PFCR, PRFI, and PDFI.

The traits ADG, BF, LMA, DBF, DLMA, PADFI, and PFCR were analyzed with a model that contained the fixed effects of sex, feeder type, sex by feeder type interaction, group, and the covariate floor space per pig. ONWT, ONAGE, and OFFWT were used as additional covariates for ADG, DBF, and DLMA. OFFWT was also used as a covariate for BF and LMA. PONWT, PONAGE, and POFFWT were used as covariates for PADFI and PFCR. PRFI was analyzed with a model that contained the fixed effects of sex, feeder type, and sex by feeder type interaction.

Random regression models were fit to serial measurements of BW and PDFI to evaluate differences in growth and intake curves. The model included the fixed effects of sex, feeder type, sex by feeder type interaction, group, and the covariates ONWT, ONAGE, and OFFWT for BW, and PONWT, PONAGE, and POFFWT for PDFI. Cubic and quadratic regressions on test day (day) and their interactions with sex, feeder type, and sex by feeder type interaction were fit as fixed effects for BW and PDFI, respectively. For PDFI, interactions of day^2 with sex by feeder type and with feeder type were not significant (P>0.10) and were dropped. Random quadratic and linear regressions on day were fit for BW and PDFI, respectively, using a heterogeneous first-order autoregressive covariance structure (Littell *et al*., 1996) for BW and an unstructured matrix for PDFI. The residual covariance matrix was structured as variance components for BW and as heterogeneous Toeplitz (bandwidth=2) for PDFI. First derivatives of the fixed BW curves were used to obtain curves for daily gain (DG).

RESULTS AND DISCUSSION

Least squares means for traits measured over the whole test period are listed in Table 1. Feeder type did not significantly (P>0.05) affect ADG, BF, LMA, DBF, and DLMA. Pigs on electronic feeders used less feed (-0.08 kg/day), converted that feed more efficiently (-0.09 kg feed/kg gain), and had lower PRFI (-0.07 kg/day) than pigs on commercial feeders. Similar results were found for electronic versus single-space feeders by Hyun and Ellis (2001), who compared feed intake recorded by the electronic feeder with feed put into single-space feeders and suggested that differences in feed intake were caused by feed wastage or underestimation of feed intake by the electronic feeder. In this study, feed use was measured as the amount deposited for both feeder types and thus differences in feed intake were probably due to differences in feed wastage.

Sex differences were found for all traits except DBF and PADFI (Table 1). Boars grew faster, had less fat, smaller LMA, a smaller change in LMA, were more feed efficient, and had lower PRFI. Group was significant (P<0.01) but floor space per pig was not (P>0.10) for all traits. Feeder type by sex interaction was not significant for any trait but approached significance (P<0.10) for ADG, PADFI, and PRFI.

Table 1. Least squares means for the effects of sex and feeder type on traits[A] measured over the whole test period.

Trait	Boars electronic	Boars commercial	Gilts electronic	Gilts commercial
ADG (kg/day)[B]	0.857^{a}	0.846^{a}	0.793^{b}	0.810^{b}
BF (mm)	16.4^{ab}	16.3^{b}	16.9^{ab}	17.2^{a}
LMA (cm^2)	41.4^{b}	41.6^{b}	44.7^{a}	44.8^{a}
DBF (mm)	9.0^{a}	8.7^{a}	9.5^{a}	9.2^{a}
DLMA (cm^2)	25.7^{b}	25.9^{b}	27.5^{a}	27.8^{a}
PADFI (kg/day)	2.18^{b}	2.22^{ab}	2.15^{b}	2.27^{a}
PFCR (feed/gain)	2.62^{c}	2.73^{b}	2.81^{ab}	2.88^{a}
PRFI (kg/day)	-0.039^{c}	0.008^{b}	-0.036^{c}	0.063^{a}

[A] ADG = average daily gain, BF = backfat thickness at end of test, LMA = loin muscle area at end of test, DBF and DLMA = difference in backfat thickness and loin muscle area between the start and end of test, PADFI = pen average daily feed intake, PFCR = pen feed conversion ratio, PRFI = pen residual feed intake.

[B] Means within a row that do not share a common superscript letter differ (P<0.05).

Feed intake and growth curves from the random regression analyses are plotted in Figure 1. Curves for boars fed using electronic and commercial feeders overlapped. Boars on both feeder types used the same amount of feed and grew at the same rate throughout the entire test period. Gilts on electronic feeders used less feed throughout the test period. They also grew slower, except at the end of the test period, which suggests that feed intake limited growth through most of the test period. This result indicates that the differences in feed intake between the different feeder types observed in Table 1 are not solely explained by differences in feed wastage, as suggested earlier. These graphs clearly show the interaction between sex and feeder type.

CONCLUSIONS

Boars fed using electronic feeders do not perform differently than those fed using commercial feeders. However, gilts do eat less and grow slower when on electronic feeders. This potential genotype by environment interaction should be considered when using electronic feeders.

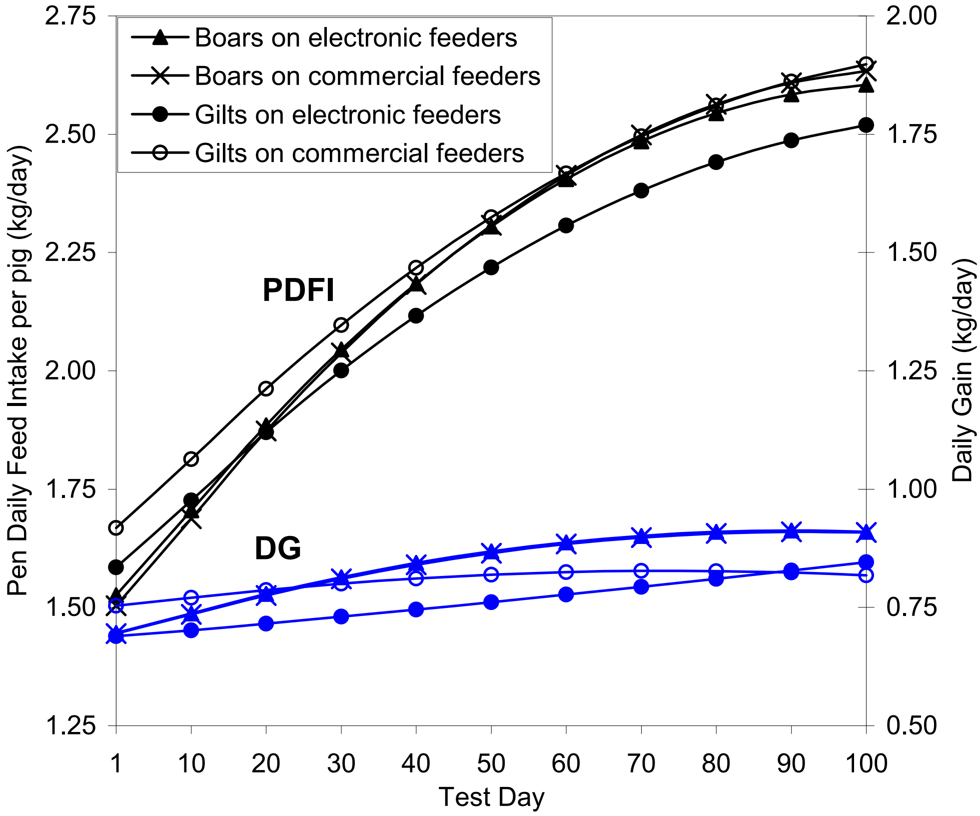

Figure 1. Pen daily feed intake per pig (PDFI) and daily growth (DG) curves for boars and gilts fed using electronic and commercial feeders.

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