COMPUTERIZATION OF SOW FEEDING AND ESTROUS DETECTION — TESTS UNDER LOW-INVESTMENT HOUSING CONDITIONS IN KANSAS[1]

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Summary

In Exp. 1, weight change, backfat thickness, and litter size were compared for gilts fed individually or with a computer-controlled electronic sow feeder provided by Osborne Ind., Inc. and NEDAP-Poiesz, B.V. Twenty gilts were fed by each method, and no treatment effects were observed. In Exp. 2, electronic monitoring of visits to a boar were studied to evaluate the potential of the data to predict time of estrus. A very good correlation between boar visitation and estrous behavior was obtained. The data indicate that gilts can be fed with computer-controlled equipment under outside housing conditions in Kansas. Further, there is potential for developing a computer controlled system to electronically detect estrus in pigs.

(Key Words: Pig, Electronic Feeding, Reproduction, Estrus.)

Introduction

This project's goal was to evaluate the ability of computer-controlled equipment provided by Osborne Ind., Inc. and NEDAP-Poiesz, B.V. to provide feed for, and detect estrus in, gilts when installed in outside lots in Kansas. The test conditions are similar to those used on many Kansas swine farms.

The Electronic Estrous Detection (EED) system is not presently marketed in the U.S., and equipment from the Osborne/Porcode feeding station was adapted to estimate the amount of time gilts spent visiting a boar.

Procedures

Exp. 1. Electronic Sow Feeding

The first experiment compared gilts housed in outside lots and fed either individually in a feeding stall (once/d) or with the Electronic Sow Feeder (ESF) system. A representation of the pens is provided in Fig. 1. Gilts were each fed 4.3 lb/d of a complete sorghum grain-soybean meal diet that met or exceeded all Kansas State University and National Research Council recommendations for breeding/gestating gilts. The weights of feed delivered with each auger turn by the ESF were .215 lb and .219 lb during pretrial testing 27 days and 15 days before the start of the experiment and .214 lb at 31 days after the start of the experiment. The software was programmed as delivering .215 lb/auger turn. Therefore, 20 auger turns were required to deliver 4.3 lb. Control gilts were fed once/d with a scoop that contained, when full, 4.3 lb of the same diet.

Training gilts to use the ESF. Training procedures were those recommended by Osborne/Porcode. On the first day, gilts were coaxed into the feeding station with feed sprinkled on the floor of the ESF. On subsequent days, only gilts that had not used the station were assisted. Individual gilts

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varied in the speed with which they began using the ESF without assistance. The majority began using the station by 3 days, and all but 1/20 (5%) gilts were trained by 7 days. The remaining gilt required 16 days before she routinely used the ESF unassisted.

Data collection. Gilts (20/treatment) were weighed when 30 to 35 days pregnant and moved to either the ESF or control pen. A collar with exponder that provided electronic identification was placed around the neck of each gilt assigned to the ESF pen. After 7 days (training period), all gilts were weighed a second time and probed ultrasonically for backfat depth at the last rib. Gilts were moved as a group to individual farrowing stalls on d 93 to 111 of gestation and fed individually 4 lb/d (1.8 kg) of the gestation diet until farrowing.

Replacement of lost collars. Gilts were checked each day for lost collars. All lost collars were found, although some were not found for a few days. Therefore, extra collars were available and placed on gilts whose collar could not be immediately found. Collars were occasionally lost in mud puddles and were later recovered by pigs rooting in the mud. Collars were lost on 44 occasions during the trial. Collar loss predominantly occurred for a few gilts, and in subsequent trials with sows, hardly any collar loss occurred. The relatively high incidence in this trial might be attributable to use of gilts or differences in collar adjustment by the different personnel conducting the two experiments.

Exp. 2. Electronic Estrous Detection

These studies were conducted to evaluate the efficacy of electronic monitoring of visits to the boar, a key behavior exhibited by estrous sows and gilts. The pen was arranged as depicted in Fig. 1 according to recommendations provided by Osborne Ind. An initial group of 18 sows was placed in the pen at weaning. A boar was placed in the estrous detection area on the third day after weaning, and data were recorded using a 12-h cycle. Sows were also checked for estrus once/d. These initial data indicated a close relationship between the first detection of estrus and the amount of time visiting the boar. For estimating boar visitation, an antenna identical to that used in the feeding station was installed at the only place sows could see the boar. The feed interval was set at 6 sec, the calibration at .1 lb/dispense and the total feed at 10.0 lb. Therefore, even though no feed delivery equipment was present at this station, the computer reported a feed balance that could be converted to minutes visiting the boar.

To gain more insight into the diurnal pattern of boar visitation, we next set the feed cycle at 6 h to provide a report every 6 h. Estrus was checked once/d.

Results and Discussion

Weight and backfat data are presented in Table 1. Twenty gilts were initially assigned to each treatment. One gilt in each treatment returned to estrus and was removed from the experiment. There were no ($P > .4$) treatment effects on gilt weight or backfat depth.

Farrowing and litter traits are presented in Table 2. No treatment effects were detected ($P > .80$). Individual pig birth weights and the deviation from the mean birth weight for each pig (Levine's test) are given in Table 3. No treatment effects ($P > .80$) on pig birth weight were observed. The deviations in birth weight may represent a trend ($P = .13$) for decreased deviations in birth weight for litters farrowed by ESF gilts. However the difference is small (.09 lb). An experiment to demonstrate statistical significance with the variation observed in this experiment would require 50 to 60 litters/treatment. Therefore, no conclusions about the uniformity of birth weights can be drawn from this experiment.

Results for the second and third estruses after weaning are represented in Figs. 2 and

3, respectively. Data are centered on 12:00 h of the day when estrus was first detected. There is an obvious correlation between visitation time and estrus. Fig. 5 illustrates the variation in boar visitation among sows by providing data on extremes in boar visitation. Inspection of the data suggests a correlation between the amounts of boar visiting at second estrus and at third estrus. That is, a sow tended to spend similar amounts of time visiting the boar at the two estruses. This should be evaluated further to gain insight into estrous behavior as reflected in the EED data. Perhaps the sows that only visit the boar for a few minutes show only a low intensity of estrous behavior, or perhaps these particular sows didn't like the boar penned in the detection pen. The possibility of competition for access to the boar pen should be evaluated, also.

Work is required to evaluate the fertility of gilts or sows mated based on their electronically detected boar visiting. Data so far suggest that sows might be considered in estrus when the accumulated boar visiting exceeds 9 min per day. Mating on that day and the subsequent days until the boar is no longer accepted might achieve good fertility. However, it is clear that sows begin visiting the boar before they are in estrus; therefore, some sows might not be in estrus when first scheduled for mating by the rule suggested above. Therefore, if a sow doesn't accept the boar even though she has accumulated 9 min of boar visiting, she could be rechecked at 24-h intervals until she accepts the boar and then mated at 24-h intervals until she no longer accepts the boar.

In conclusion, electronic Sow Feeding and Estrous Detection were tested under low-investment, outside housing in Kansas. Both systems performed well. Further monitoring of the ESF in outside lots with a variety of production systems and environmental conditions should be undertaken to determine the full application possibilities. EED should receive more in-depth evaluation. It may be the first real innovation in estrous detection for handmating and could significantly impact swine production systems.

Table 1. Weight and Backfat Depth of Gilts Fed with an Electronic Sow Feeder (ESF) or with a Scoop

		Weight, lb			Backfat depth, in	
Treatment	n	Initial	After training	Before farrowing	After training	Before farrowing
Control	19	297	296	375	.86	.92
ESF	19	299	294	379	.81	.87
Pooled standard error		4.1	3.5	5.3	.04	.04

Table 2. Farrowing and Litter Traits for Gilts Fed with an Electronic Sow Feeder (ESF) or a Scoop

			Total pigs farrowed		Live pigs farrowed	
Treatment	No. of pregnant gilts assigned[a]	No. of gilts farrowing	No.	Litter wt, lb	No.	Litter wt, lb
Control	20	19	9.3	28.0	8.7	26.0
ESF	20	19	9.1	26.6	8.8	26.1
Pooled standard error	—	—	.62	1.7	.59	1.6

[a]Assigned on d 30 to 35 of pregnancy.

Table 3. Birth Weights of Pigs Farrowed by Sows Fed with an Electronic Sow Feeder (ESF) or Scoop during Gestation

Treatment	No. of litters	Birth weight, lb	Deviation from mean birth weight for the litter, lb
Control	19	2.94	.43
ESF	19	2.96	.34
Pooled standard error	—	.11	.04

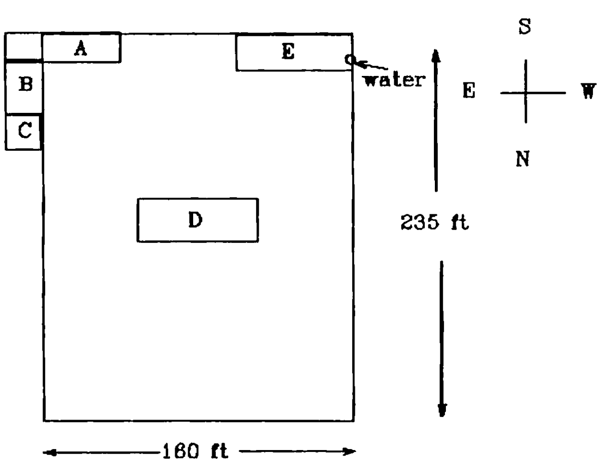


Figure 1. The configuration of the pen used for testing the Electronic Sow Feeder (ESF) and Electronic Estrous Detector (EED). A. Estrous detection pen (11.5 × 54 ft); B. Boar pen (9.2 × 11.5 ft) equipped with antenna for EED; C. Boar house (6 × 9.2 ft); D. Cement pad with 2, 11 × 18 ft houses for gilts; E. Cement pad (18 × 43 ft) with ESF station. The ESF station is covered by a two-sided shed, open to the east and south.

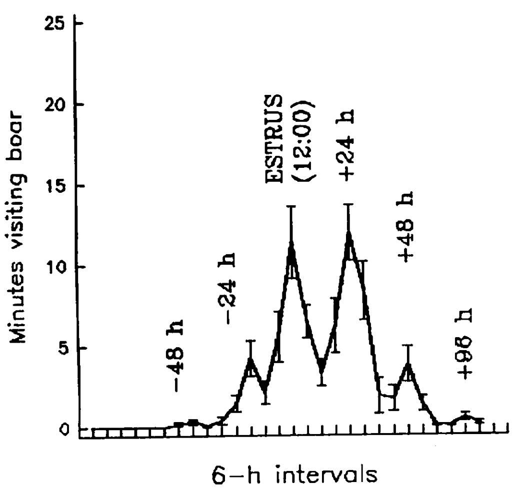


Figure 2. Boar visitation during the second post-weaning estrus. Data are centered on 12:00 h of the first day of estrus. The x-axis represents 7 d in 6-h intervals.

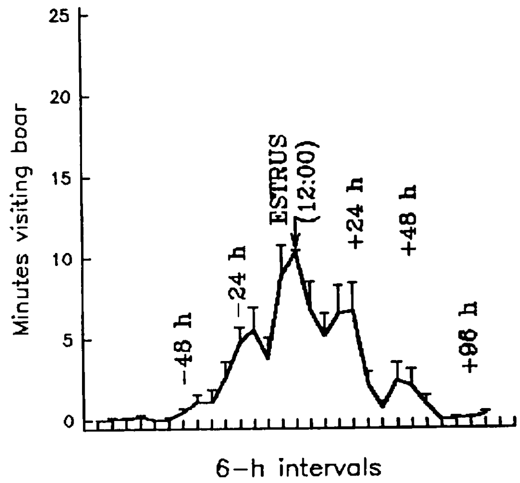
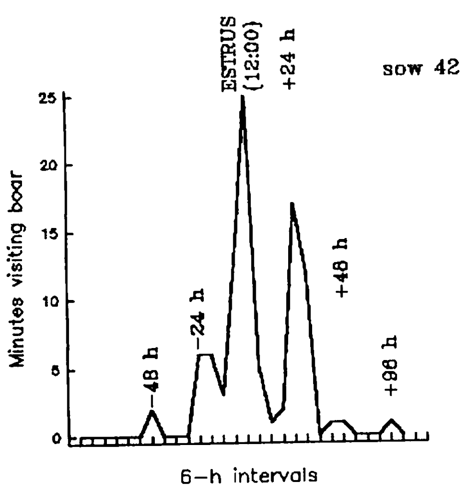


Figure 3. Boar visitation during the third post-weaning estrus. Data are centered on 12:00 h of the first day of estrus. The x-axis represents 7 d in 6-h intervals.



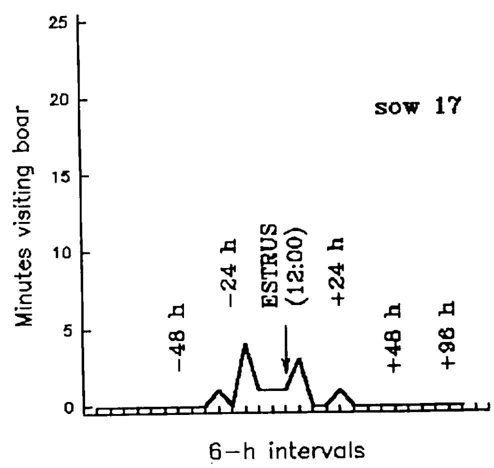


Figure 4. Boar visitation by two sows that illustrate the most (sow 42) and least (sow 17) amount of visiting. Data are centered on 12:00 h of the first day of estrus. The x-axis represents 7 d in 6-h intervals.