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FACTORS CAUSING A REDUCTION IN INDIVIDUAL FEED INTAKE DATA OF GROUP-HOUSED PIGS RECORDED WITH ELECTRONIC FEEDERS

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SUMMARY
Individual feed intake data were recorded using electronic feeders for 278 animals in a commercial group-housed environment. A reduction in feed intake compared to the expected was observed. Factors influencing this reduction in feed intake are described. Recommendations are made for using these factors in the operation of electronic feeders to minimise the reduction in feed intake.
Keywords: Pigs, feed intake, feeding behaviour, electronic feeders.

INTRODUCTION
Pig breeders often select animals based on feed conversion ratio and lean meat growth. However, selection based on these traits can cause a correlated decrease in daily feed intake levels (Hall 1997; Labroue *et al*. 1994). A decrease in feed intake levels may cause a long-term decrease in growth rate (Labroue *et al*. 1994). Therefore, the emphasis placed on daily feed intake has increased in selection programs. Electronic feeders were developed to record feed intake in a commercial group-housed environment. Much of the literature available discusses feeding patterns and feeding behaviour of pigs under experimental conditions. The individual feed intake data in this analysis was collected as part of an ongoing experiment at the commercial nucleus herd of Bunge Meat Industries (BMI). The animals are in groups with multiple electronic feeders, producing a large volume of data that may be of value in genetic analysis. The aim of this paper is to describe factors that can be used to identify problems with individual feed intake events and recommend ways to reduce the error rate in the future.

MATERIALS AND METHODS
Description of data collection. The data used in this analysis were collected between February and August 2000, consisting of five groups, each made up of two pens with approximately 30 animals per pen. Each pen contained three electronic feeders, each being separated by a race. The raw data set contained 107,127 feeding records for 278 animals. The electronic feeders began operation when an animal entered the feeder and a laser beam was broken. This in turn triggered an antenna that read the animals electronic identification number. The feeding event ended when the animal broke the laser beam on exit. The BMI electronic feeder operation has the capability to allocate animals to one of three feeding levels (*ad libitum*, semi-restricted and restricted). Feeding levels were calculated based on a typical pig's maintenance requirement. Animals were randomly allocated to feeding levels at the start of the test period. When an animal reached its daily allowance, the feeders did not dispense any more feed, even if the animal was in the middle of a feeding event. Visits by an animal where no feed

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was given on the basis that it had already reached its daily limit were not recorded. The feeding levels were increased each week to allow for extra maintenance requirements. A unique feature of this electronic feeder operation is the 'credit' system in which any feed not eaten in a day is added to the allowance of the next day. This was accumulated within a week and any credit of feed was lost when the allowed feed intake was changed for the next week. Animals were exposed to the electronic feeders for a period of six days, *ad libitum*, before going on test for seven weeks.

Description of traits analysed and first editing procedures. Each record included the pen number, feeder number, date and start time of the feeding event, the electronic identification of the animal, the amount of feed eaten and the length of the feeding event. The variables used in the study were the amount of feed eaten at a feeding event, the length of the feeding event, rate of feeding, rate of feeding on a weekly basis, the difference between the actual amount of feed eaten and the allowed amount of feed, number of visits per day, number of visits per week and weight at start of test (Table 1). The rate of feeding is defined as the feed eaten divided by the time spent feeding. A rate of feeding greater than 1.5 g/sec indicated a weighing error because the feeder could not deliver feed at such a high rate. Therefore, for all rate of feeding values greater than 1.5 g/sec, the value for feed was decreased to equal the time, ie rate of feeding equals 1 g/sec.

Table 1. Trait definitions, abbreviations (Abbrev), units, means, standard deviations (Std) and minimum (Min) and maximum (Max) levels, after adjustment period removal

Definition	Abbrev	Units	Mean	Std	Min	Max
Number of feeding events / day	NFEDAY[1]		7.12	10.9	1	198
Number of visits / day	NVDAY[2]		5.71	5.20	1	58
Amount of feed / visit	FEED[2]	grams	364	452	1	3401
Length of visit	FEEDTIME[2]	seconds	472	586	1	4821
Rate of feeding	ROF[3]	g/sec	0.74	0.17	0.20	1.10
Total weekly feed intake	TWFI[3]	kilograms	13.4	4.0	0.024	26.0
Actual feed – allowed feed / week	DIFF[3]	kilograms	-3.10	3.80	-21.0	10.0
Rate of feeding / week	WROF[3]	g/sec	0.76	0.11	0.45	1.05
Number of visits / week	NVWEEK[3]		35.9	28.5	1	307
Weight at start of test	STWT[3]	kilograms	73.0	6.70	50	90

[1]Before time editing; [2]After time editing; [3]After time and ROF editing

Any feeding event where FEED or FEEDTIME equalled zero was set to missing. Missing records totalled 0.3% and 0.4% of the feeding records. The adjustment period was excluded from the analysis because the animals had no feed restriction during this period and were possibly demonstrating 'adaptive' behaviour, such as visiting the feeders more often than they would typically. The feeding events for this period would not be indicative of 'normal' feeding behaviour in this environment. Removal of the adjustment period decreased the data set to 91,273 feeding records.

Investigation of the data showed many feeding events by the same animal at the same feeder in quick succession, that were possibly the same feeding event. Therefore, all the consecutive feeding events for the same animal on the same day and the same feeder that were less than two minutes apart were classed as one feeding visit, rather than event, and the feed amounts and feeding times were added together. The aim of this procedure was not to define 'meals', which was deemed to be arbitrary, but to utilise as much of the data as possible. After consecutive feeding events were grouped, 73,226 feeding visit records remained. The time editing procedure reduced the mean, standard deviation and maximum of NVDAY in comparison to NFEDAY (Table 1). Other traits were not influenced by this procedure.

Rate of Feeding. Feed was continuously dispensed in a feeding event and the ROF was manually set on the electronic feeders. The accepted range for ROF was 0.2-1.1 g/sec. Internal trials at BMI showed that animals were able to feed comfortably within this range. Values for FEED, FEEDTIME and ROF for the feeding events outside this range were set to as missing.

Description of analysis. Due to the animals being able to accumulate feed allowance over a week, it was decided to analyse feed intake on a weekly basis. A new trait (DIFF) was defined as the difference between the observed feed intake and the feed allowance (Table 1). The feed allowance was determined by the feeding level. Values for DIFF above zero were included in the analysis although they should not have arisen. The trait was analysed using PROC GLM in SAS (1988). The fixed effects tested were week, feeding level, STWT (classed into 5kg intervals), pen, NVWEEK (classed into 10 visit intervals) and WROF (classed into 0.05 g/sec intervals).

RESULTS AND DISCUSSION

All effects were highly significant for DIFF and the model described 41% of the variation. Feeding level had the largest effect on DIFF. Least square means (LSM) were -6.8 kg (±0.5), -4.8 kg (± 0.5) and -2.9 kg (± 0.5) for the *ad libitum*, semi-restricted and restricted feeding level, respectively.

The magnitude of DIFF was larger for very low NVWEEK (Figure 1a). Very low NVWEEK would identify any animals that were sick or that lost an ear tag. The magnitude of DIFF was also large when the NVWEEK increased (Figure 1a). This pattern indicates a disturbance during the feeding event.

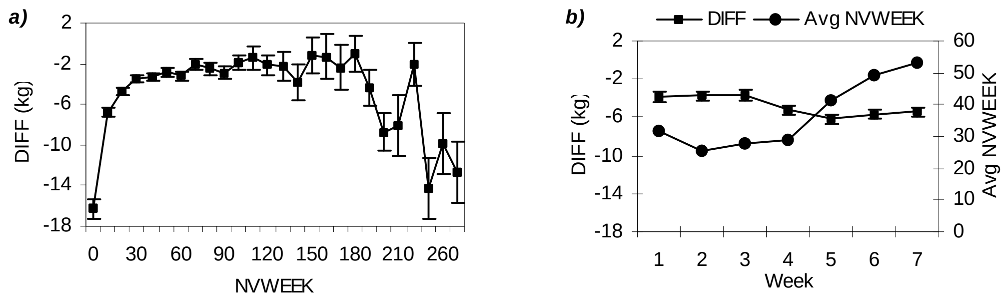

Figure 1. Least Square Means of the difference between actual and allowed feed intake (DIFF) for (a) the number of visits per week (NVWEEK) and (b) week-along with the average NVWEEK.

An indication of a disturbance is also observed in Figure 1b where a drop in DIFF beyond week 3 corresponds to an increase in the average NVWEEK. Causes of the interference could be that the animals are growing and are becoming heavier and taller. As a result the laser beam breaks more often. A further cause could be due to social interactions between the animals leading to more interruptions during feeding events. The data indicated that the desired range for NVWEEK is 30-150 visits/week.

Figure 2a shows that as WROF increases the magnitude of DIFF becomes smaller. However, there was a drop in DIFF at 1 g/sec. Some of these 1 g/sec values for ROF would have been created in the original data set when ROF exceeded 1.5 g/sec and the feed amount was reduced to equal time. This procedure recorded less food than was actually eaten and could be the cause of the drop at 1 g/sec observed in Figure 2a. The absolute value of DIFF became smaller as the STWT increased (Figure 2b). This was as expected because animals that have a higher starting weight would have higher energy maintenance requirements and are expected to eat more.

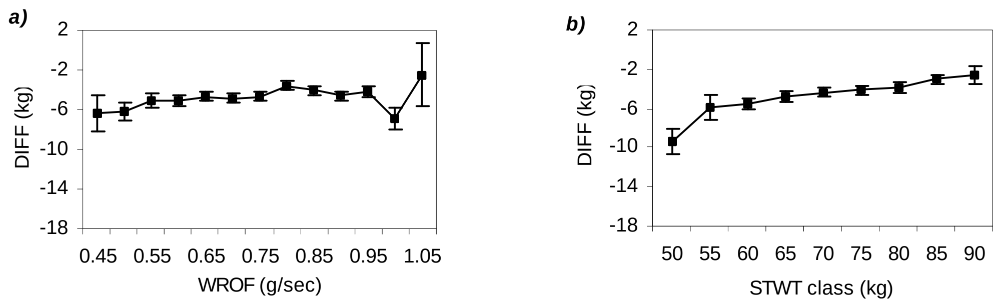

Figure 2. Least Square Means of the difference between actual and allowed feed intake (DIFF) for (a) the weekly rate of feeding (WROF) and (b) the starting weight class (STWT).

Recommendations. In order to minimise the magnitude of DIFF, it is recommended that 1) causes of the breakages of the laser beam, which create large NVWEEK and large magnitudes of DIFF, be investigated and the cause be corrected where possible; 2) the ROF be monitored regularly and be consistent over the test period; 3) editing of feed values where ROF exceeds 1.5 g/sec not be carried out; 4) the variation in starting weight be reduced as much as possible; and 5) differences in individual maintenance requirements, as indicated by STWT, be taken into account when deriving feed allowances.

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