Use of visual image analysis for the management of pig growth in size and shape

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Introduction The purpose of an integrated management system is to optimise both pig performance and environmental protection. A major impediment to this process has been the inability to measure and control the production process in real time, for specific and contemporary pig batches. Optimisation thus requires in-line measurement of pig growth performance, together with the means to change performance with adjustments to feed quantity and quality. This report deals with the use of visual image analysis (VIA) to provide the first of these; measurement of growth. VIA determines, continuously and in-line, the size and shape of the plan view of the pig as it stands at the feeder. Three seminal questions are here addressed. (i) can VIA be used to provide a reliable measure of pig weight, and (ii) how many days are required to elapse before a change in size can be reliably determined and how does the VIA system compare with daily weighing by a conventional weigh-scale, and (iii) can VIA sort pigs according to their shape?

Materials and methods Forty pigs each of three commercial pig types (50% Landrace, 50% Pietrain, 25% Meishan) from Large White × Landrace mothers were placed onto trial as part of a serial slaughter experiment from 25 to 115 kg live weight. The pigs were fed *ad libitum*. Visual imaging and live weight data were collected daily from an electronic feeding station (FIRE Feeder, Osborne Europe, Ltd) adapted to carry the visual imaging hardware above it. An ANCOVA model determined the relationship between live weight and pig plan area for all data, to test for type effects.

Results The model of live weight (kg) on plan area of the pig (A4, cm^2) showed a robust relationship ($P<0.001$), and that there were significant differences between the pig types in constant but not slope ($P<0.05$). Differences are presumed due to type differences in shape and conformation.

"Landrace type"	Live weight = 0.049(0.0005) × A4 – 29.8(0.74)
"Pietrain type"	Live weight = 0.052(0.0004) × A4 – 38.5(0.67)
"Meishan type"	Live weight = 0.052(0.0004) × A4 – 32.8(0.63)

The model had an r^2 of 0.905 and the residual standard deviation was 6.22 kg.

The pigs grew daily an average of 14.9 cm^2 A4 and 0.829 kg live weight. The number of days required to find with 95% confidence that a pig has changed its size or weight is given by determination of the point at which the accumulated increase in weight divided by the standard error of the difference is greater than 1.65. For the "Landrace", "Pietrain" and "Meishan" types, the number of days so computed were: for conventional weighing 10, 11 and 12 days, and for VIA A4 measurement 13, 11 and 14 days.

A radial basis function neural network was employed to determine if the three pig types could be sorted into groups according to their visually imaged characteristics of size and shape. A subset of the data was used for training. Effectiveness of true sorting according to type (excluding the training dataset) was 64% for the "Landrace" type, 81% for "Pietrain" and 81% for "Meishan".

Conclusions The general relationship between VIA measurement and live weight is good, with differences between pig types consistent with a proposition that VIA can distinguish between pigs of differing plan area at any given weight. Given the equations presented VIA is a realistic alternative to the weigh scale to monitor pig performance. Visual imaging required two more days (13 vs 11) than daily weighing to detect a change in size or weight with a high degree of confidence. The interval for VIA is considered acceptable for real-time growth control within an integrated management system, and it is suggested that VIA may be operationally easier to manage than conventional weighing. The apparent ability of visual imaging to sort the three commercial pig types into their appropriate groups may be taken to suggest that the technique may have much to offer with regard to live sorting according to pig shape and conformation. This option is, of course, not available with conventional weigh scales. The relationship between visual image and carcass value is presently under further exploration.

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