Use of electronic recording systems in pig breeding

Jon Mercer

Independent Breeding Consultants, Harrybum Stables, Lauder, Scotland

Introduction

There is a widely quoted statistic that around 10% of all human births are pedigreed incorrectly. Without going into the reasons for this, it is obvious that if this is the case in man, then there is also considerable scope for error in animal pedigrees as well, particularly where matings take place naturally. Whilst I am sure that mistakes are never made on any of your farms, of course, reading the identification of a sow and boar electronically, and subsequently recording this without having to write anything down certainly removes some of the opportunities for errors. Collection of further data using electronic means is the next step in improving the quality of data recorded.

The importance of a good recording scheme in a breeding programme cannot be stressed too highly. There are three aspects to this that may be considered:

1. The quality of the data collected
2. Turning that data into information
3. How well that information is used in decision making

This talk primarily deals with the first point, through use of radio frequency (RF) transponder tags and handheld loggers to collect sound information. Use of tags is not mandatory, however. Alternative technologies such as 2-D bar codes are being developed, and use of loggers on their own to record data without the need for writing things down on paper is a positive step in its own right.

Advantages of electronic data capture

There are several advantages to capturing data electronically, which can be summarised as follows:

- IDs are quick and easy to collect
- Information only has to be written / entered once, which saves on time and reduces errors through transcription
- Pedigree information can be collected accurately.
- The error variance is reduced in breeding value estimation. This essentially relates to differences in performance between pigs which cannot be accounted for by any specific factor, and has a direct bearing on the rate at which improvement is made. At present it is thought that pedigree errors can reduce the accuracy of breeding values by at least 10%, which limits the potential selection response. Further reduction in accuracy will come about if incorrect values for performance traits are recorded.
- Better quality of information has a direct impact on PIGBLUP users in that less time is spent on sorting out problem data.
- The use of electronic identification systems has a growing importance in allowing traceability of animals and their products. This is extremely useful in

quality assurance schemes and is very much associated with food safety issues.

Identification systems

There are several different types of electronic recording systems on the market, at various stages of development. Most of the major tag manufacturers now offer some type of RF transponder tag in their product portfolio, and some will allow various alternative transponder chips to be integrated. Essentially most transponders are now passive, in that they do not require an active power source to deliver a signal. They consist basically of a coil of wire and a chip which stores the number. Simple chips used industrially (for example the tags which are attached to garments to prevent them being stolen from a clothes shop) all have the same number, whereas those used in animal identification have a unique, usually complex code. In the last couple of years a concerted effort has been made to develop a standard method of storing this code on the chip - which has led to the so-called ISO-tag. One of the fields on the ISO-tag contains a manufacturer's code, so that the origin of tags can be traced. The ISO-tags can in theory be read by any standard decoder, and therefore allows producers to buy tags from different manufacturers, without having to also buy new hardware. There are still two different approaches to chip design, however, involving either full-duplex or half-duplex technology. The former is more common, whilst the latter is said to have a longer read range, but slower recognition time. A greater read-range is not necessarily a good thing, as depending on the application there can be interference between tags which may mean that the wrong pig is sometimes picked up. Readers have been developed which can pick up signals from both types of tag.

The chip is usually embedded in resin and/or plastic, which forms an integral part of a tag, usually the female piece. Designs vary, both as to the type of material used and the size of the tag. Prices currently vary tremendously ranging from about $A6 to $A30. It is hoped that as volumes of tags produced increase, that the price will come down, to less than $A3. To date no tag has been produced which is immune from losses. Given a determined pig, even the most securely attached tag can be chewed or pulled out of the ear! This can often be a form of vice similar to tail biting, with a similar aetiology. Acceptable losses are still at around 5% per cycle. Most lost tags cannot be recovered. There is a conflict of interest in when to apply the tag. Ideally piglets should be assigned their unique ID as soon as possible and in any event prior to fostering, so that the pedigree can be easily validated. Tags are generally too large to apply to newly born piglets, however, and if placed very early the hole in the ear tends to grow bigger, increasing the chance of losses. An acceptable compromise is to tag pigs prior to weaning, before much information is recorded on the individual piglet. This also means that tags are not assigned to non-viable pigs, most of the pre-weaning mortality taking place in the first couple of days post farrowing.

An alternative method of introducing the RF chip is to use injectable implants. These are commonly available in the pet market, in which there has been massive growth in the use of transponders. The chip itself is encased in a glass capsule, and injected subcutaneously or into a muscle mass. The capsule is fragile, however, and can be broken. For this reason it seems unlikely that implants will ever be used on a large scale in packing plants, because of the risk of glass fragments entering the human food

chain. Work on implants has largely ceased in this field. However, at least one semen manufacturer includes an injectable transponder in semen tubes. This has great potential for accurately identifying the sire used in any service (particularly in dairy cattle), but at present is a very expensive option with limited application in pig breeding.

An interesting, and potentially cheaper option is the development of 2-D bar codes. Standard bar codes have not been used successfully on animal tags to date because of the problems of reading them when dirty. On a 2-D bar code the identifying code is represented by a motif of raised dots which is repeated many times in a small area. It is claimed that as much as 70% of the code can be obscured by dirt and the identification still remains legible. If this technology realises its potential then it may be possible to electronically identify animals for not much more than the cost of a standard tag. The use of conventional bar codes for marking semen tubes quickly and cheaply is a development which is taking place, and probably deserves consideration in pig breeding programmes.

Reading and Recording

Electronic tags and/or bar codes need to be read by a decoder, in the first case with an attached aerial. The simplest of these are static readers, as might be found in electronic feed recording stalls. These rely on the animal putting its head in close proximity to the aerial, which can then interrogate the chip. More commonly a portable reader is necessary, and there are several different guns and wands are available on the market, most of which have a communication port to send information to a computer or logger. A number of loggers have integral readers, which allows them to be operated with one hand. Generally the separate reading devices have a longer read range, and are therefore more suitable for certain circumstances (such as outdoor sows, where the operator may not be able to get very close to the animal). In theory at least, it is possible to have more than one reading device (for example an RF reader and a bar code reader) attached to the same logger. The more peripheral devices there are, however, the less practical the operation becomes and the more likely communication errors become.

Essentially, for the electronic ID to be of value, it then has to be captured and stored electronically. A number of industrial loggers are now available which allow the ID to be captured via a reader and data to be entered on to a screen. Outside of robustness, and lack of sensitivity to a pig environment, there are two main approaches to logger design.

1. *Notebook*

These are loggers which are really just used for collecting information on to pre-designed screens, with limited memory and complexity. The advantages are that operation is simple, and the logger can be built to be more robust (and relatively cheap). The Nedap logger is a good example of this. Battery life allows up to a day's worth of information to be entered and then downloaded onto a central computer. Apart from very limited error checking for valid field ranges, all of the data validation then has to take place on the central computer. Although this can be thorough, the

process may involve to-ing and fro-ing with the farm. A typical cost might be in the order of $A 1500 per unit (including an integral reader).

2. *Computer*

The new generation of loggers are more like mini computers, which of course, are becoming more powerful and flexible all the time. Here at least part of the main database can be stored on the logger, and data validated against existing information before it is stored. Most of the data processing is already carried out on the logger, and errors (such as mistyping or entry into the wrong field) can be trapped there and then. Care has to be taken in checking the operating system employed by these loggers, as Windows-based applications may not be readily ported on to the logger. This may require specialist programming for data to be transferred to and from a standard pig recording system such as PigCare. Psion, for example, who currently offer the cheapest and most flexible option, have a non standard operating system, whereas Husky, who offer an up-market and expensive logger, use Windows CE, and can therefore more or less take any existing applications straight away. One possible drawback with the mini-computer is that keyboards tend to be small and complex, which may be difficult for some stockmen to operate. Alternative interfaces include 'virtual keyboards5, which can be operated via a mouse or even a pencil and 'Newton Boards' which allow the operator to write directly on the screen. The standard Psion Workabout retails for around $A 600, but the cost of a reader at a further $A 400 or so has to be added to this. The Husky with integral reader retails at an equivalent of around $A 4500.

Portability is also an essential feature of both types of logger. Ergonomically the logger has to fit well in the hand without the operator rapidly becoming tired. Despite this the batteries have to be sufficiently powerful to allow data entry for at least half a day, before recharging. The more processing that is done, the shorter the battery life.

Other electronic applications

There are a number of other electronic devices from which data can and should be captured automatically on most nucleus farms.

The first and most obvious of these is the electronic weigh head. Weights can be captured automatically from a weigh head by a logger through simple connection with an RS232 port. This can easily be combined with RF identification of the animal.

Electronic feeders such as the FIRE (Feed Intake Recording Equipment) system, ACEMO and Hokofarm allow the individual feed intake of each pig in a pen to be monitored, and may also have automatic weighing platforms attached. These should be capable of using the same tags as are used to identify the pigs elsewhere.

Ultrasound data is often captured directly onto a PC in the off test area. Addition of an RF reader allows animal IDs to be captured at the same time.

Increasingly, there is a need to consider growth curves in both genetic and commercial piggeries for correct feed formulation to take place. Use of static weigh platforms in each house can enable a sample of pigs to be weighed automatically, on a regular basis. If this information is directly linked to a computerised wet feeding system then rations

can be changed according to how the pigs are growing. As breeders, we are often pioneering, and this sort of application might be first developed at nucleus level.

An area which has hardly been touched to date is that of environmental monitoring. Many farms are now equipped with automatic heating, lighting and ventilation systems. Little is done, however, to tie in some of this raw data with performance. Again, from a breeders' perspective it would be useful to quantify the effects of measurable environmental fluctuations on performance, and then use this information to optimise performance on test. There is a great opportunity to fit some of the pieces of the jigsaw together using electronic data capture, and see the whole picture.

Where should we be capturing electronic data?

Essentially there is no limit to where data can be recorded electronically on the farm. It is important to recognise that nucleus applications are not just limited to collection of conventional test data. Key areas for collection of logger data on the nucleus are:

- gestation barns
- farrowing rooms
- nursery
- test houses
- selection area
- isolation barns

There is tremendous scope for extension of this list to other locations, however, particularly where the breeder is concerned. The ultimate goal would be to have every slaughter pig identified, its parentage recorded, and age, weight, carcass composition and meat quality information recorded automatically via a transponder. The more information we have on the end product, the easier it is to adjust our breeding programmes to meet changing market objectives. In order of priority, therefore, other parts of the pork chain must be targeted for a better recovery of data which can help to determine breeding and crossbreeding values of our pigs.

- AIStud
- Multiplication sow barns - reproductive data
- Commercial sow barns - reproductive data
- Commercial Growing/Finishing pig barns - growth and environmental data, gross feed information
- Packing Plants - carcass and meat quality data

Costs

Some of this work might sound futuristic and expensive, but costs are coming down as the price of tags becomes less, and so it is feasible to consider electronic recording as a desirable objective. Essentially for a 300 sow nucleus farm the following requirements will have to be met:

Approximately 4000 tags (re-usable), with an allowance of 10% (400) per year after initial investment @ $A 4.50 per tag = $A 18,000

10 loggers including spare (one for almost each man) @ $A1500 = $15,000

PC with communications software $A 1000

Training - one day on use of loggers $A 1000

Programming up to $A 5000, but probably rather less, as more recording schemes are adapted to take information from loggers.

This gives a total of around $A 40,000 initial investment. If a 10% increase in accuracy can be achieved, then this corresponds to a 10% increase in $INDEX - potentially around $2.00 per litter per year. So a relatively modest investment can soon be recouped in better performance from stock sold from your programme.

Bell Farms

To give you an idea of how this works in practice, here are the key features of the breeding programme at Bell Farms, in the US, which has been designed to record information electronically:

- Piglets tattooed within 24 hours of birth
- Transponder tags allocated at 14 days, when litter weaning weight is recorded
- Weighed individually into and out of the nursery, pen details retained
- Cohort system of testing, using three sites, so all movement and recording is on an all-in, all-out basis
- Pigs weighed individually onto test, and twice off test
- Boar feed intake and growth curve information collected via FIRE system
- Real time ultrasound data collected via Auskey system (images captured and interpreted automatically)
- Linear type traits (12) and selection information collected on loggers
- All movement in and out of isolation barns recorded
- Breeding stock retain electronic IDs
- Service, farrowing and weaning information, collected directly on loggers
- Death and cull information logged at all stages
- Allows full inventory control of all stages of pig
- Operates on 1800 sows plus progeny

Conclusions

The use of electronic recording equipment appears to be both economical and viable in a nucleus context, providing tags can be bought at a reasonable price. A workable system from farrow to finish has been developed at Bell Farms in the US. It has taken effort to develop a fully integrated system, but in the long term the data available for PIGBLUP should be intrinsically correct, and result in a greater accuracy.

Use of electronic recording equipment at nucleus level is only the first step in the process to allow full traceability of commercial animals and their meat products. This is true in a genetic as well as a quality assurance sense. Use of accurate commercial data, individually recorded and pedigree verified will enable us as breeders to make

great strides in improving the commercial performance of stock. For those who see molecular technologies as an integral part of future breeding plans, it is almost even more important to ensure that pedigree information is of the highest integrity. Those of you who are seriously involved in breeding should look very closely at using this technology now.