ORGANISING YOUR RECORDING SYSTEM TO OPTIMISE MANAGEMENT DECISIONS

Keith Hammond

1. WHAT IS PERFORMANCE RECORDING?

- The **systematic** measuring and recording of performance or indicators of performance traits. These records may be taken **on- and off-farm** at central test or slaughter points. They can be combined with other whole herd production, economic and marketing data into a data bank. Upon proper manipulation and analysis this **information** is used to aid the many **breeding and other management decisions** involving individual animals, groups of animals and the herd as a whole. We use the term "breeding" to mean all genetic improvement operations.

  Hence, the fundamental reason for performance recording is to (enable!) **improve decision-making**, i.e. it provides a Decision Support System for the herd.

  Performance recording is also variously called performance testing, record of performance, herd testing, herd recording, or whole herd recording. It forms the herd's information system.

- **Maximising the information content per unit of investment** in performance recording operations should be emphasised. This means addressing:

  - Which animals to identify?
  - What identification system?
  - What measurements (including visual scores) to take, how to take them (e.g., weight or score birth weight), how frequently?
  - What other data should be recorded (e.g., birth date, management groups, mating data)?
  - How should all data be managed (data management covers a range of operations from measurement, through checking, transferring, storing, retrieving, and again editing data; input/output report design and use; and arranging for regular analyses for presenting the results of these timely and in forms which simplify your regular decision processes.
  - How should management groups be structured?
  - What are random and systematic errors, and how to minimise these?

2. REMEMBER IDA - INFORMATION, DECISIONS, ACTIONS!

- That's what recording, breeding and management is all about! What information, and how is information content maximised? What actions? What decisions?

- Ideally, **the decision support system for the herd should be designed to aid all decisions**, breeding and other management and marketing decisions. Classically, performance recording has been associated with breeding operations only. Increasingly the records themselves will become part of the information system for the herd, involving animal performance, feeding, financial, marketing and other farm information, to be used in the range of day-to-day decision-making processes and for other purposes (e.g., advertising == for decisions by buyers).

- **Automation** will become increasingly important to performance recording, for generating on- and off- (e.g., carcase) farm information. Automation includes computing, communications, identifying animals, controlling animal and environment, feeding, measuring, recording and advanced analyses to summarise the information ready for use in decisions.

- Notice also in the opening definition of performance recording the use of the word "systematic". Careful planning up front is critical to maximising the information content of records for both breeding and other management decisions.

- Recognise that these large data sets of herd records are highly unbalanced in their structure (e.g., unequal representation of sires, of dams, of age groups, of animals within particular feeding or other treatment groups, unequal representation across years, only some animals being measured for some traits, etc). **Rule**: As data sets become more unbalanced 'information content' is increasingly reduced, sometimes dramatically! Message: **Endeavour to achieve as much representation within and across groups as practical management and economic constraints permit**.

- The final recording **system used must be tailored** to the individual property and herd management procedure.

- **Watch for the false economies!** Be realistic when evaluating the costs and benefits of changes to the recording system. Some small investments have the potential to achieve appreciable savings/returns from the breeding herd.

- **Recording is not a spare time job!** It is vital that time be allocated in the daily and weekly work schedule for recording purposes.

- **GIGO operates!** Remember: Garbage In, Garbage Out! Accurate recording of animal identification, management groups, and accurate measurement and recording of each trait is necessary for obtaining the best summary decision aids. Remember also: the PIGBLUP procedure simultaneously utilises the majority of the information contained in the complete data set of individual animal measurements, i.e. all years of records, all animals and measurements are analysed simultaneously. Errors in pedigree and in other parts of the animal's record unintentional or otherwise, will impact throughout the analysis, year after year, the extent of this depending upon the amount of use made of the animal whose record is incorrect. Of course, as this record becomes ancient it will have less influence.

- **Labour requirements** are a significant variable cost in recording and breeding operations, and of course these place additional demands on the nature or type and quality of this labour, its management and the amount required. A number of operations associated with your breeding program may well be capable of being varied to reduce demands on labour without reducing the effectiveness of the program.

- **Is whole herd recording justified for breeding/management decisions?** For effective evaluation of traits such as female reproduction and survival, whole herd recording is essential, as is the need to record the fate of all animals, e.g., animals sold for slaughter or for breeding. The power of PIGBLUP is based particularly on using information from all measurements and all relatives and other animals in the herd simultaneously - the more records, the more information at the same level of recording efficiency. Decisions are based on information; the better the information the better the decisions providing the information is correctly used.

- Now to breeding. **Performance recording is the central operation to the breeding program.** The planning and conduct of performance recording is often disregarded as trivial when this is definitely not so.

3. WHAT ARE THE KEY DECISION AREAS?

- The nine key decision areas applying to seed-stock producers are:

(i)	To breed or buy replacement stock?	
(ii)	Which breeding enterprise to pursue?	o For example, straightbreeding and/or production of crossbred boars or sows.
(iii)	What is improvement?	o In terms of maximising profit? (This is the breeding objective for the herd).
(iv)	What recording system?	o A complex of questions/ decisions, as already mentioned.
(v)	What to cull?	o To maximise gains from the current herd.
(vi)	What to select?	o To maximise genetic gains in progeny, grand progeny, etc.
(vii)	What to mate?	o Including age at first mating, mating structure and the use to be made of artificial breeding technologies.
(viii)	How effective is the whole breeding program?	o In terms of maintaining cash flow and maximising long- term return on investment.
(ix)	How to merchandise the results?	

- These decisions are not independent, and they need to be addressed repeatedly initially, and throughout the life of the breeding operation.

- The imperative for the **seed-stock buyers** differs somewhat. The above decision areas, 1, 3 to 7 and 9 still apply, with some changes in emphasis, and areas 2 and 8 combined into a new question: **Where to buy?** Seed-stock buyers may place different levels of emphasis on some traits to seed-stock breeders.

- A breeding information service needs to recognise the different imperatives of the seed-stock producer and buyer. Of course, the seed-stock producer's long- term breeding direction, or breeding objective, should be based primarily on his clients cost structures.

- The decision aids obtained from your data bank of performance records for breeding can be grouped into three components, viz. the **breeding direction** (breeding objective), **genetic evaluation** (the EBVs), and the overall structure of the **breeding program** (design). We will come back to these in discussing "Putting it all together", later.

- For good breeding decisions, **management group structure** is very important in performance recording. There are three critical areas:

  (i) Fair treatment
  - Always try to identify animals separately that have been treated differently, otherwise no form of analyses to produce EBVs will be able to remove the treatment different bias amongst the measurements.

  (ii) Large group size
  - Maximise the number of equally treated animals within each group to maximise accuracy of the EBVs.

  (iii) Strong linkage
  - The better the balance of sires and dams across equally treated groups the more accurate will be the EBVs.

4. MAXIMISING INFORMATION CONTENT PER $ INVESTED

- **Recording systems must evolve**. This is often not appreciated. Careful planning from the outset will simplify system evolution.

- Following is an extended list of matters to consider in maximising information content per unit of investment in your decision support system.

4.1 What animal identification?

- When is it needed? To collect information over time and space.
- What are the pros and cons of each system?
- Should there be one system?
- When to identify?
- Which animals to identify? Whole herd?

4.2 What measurements?

- To aid: Management? Breeding? Marketing? decisions - Note the special place of reproduction in breeding for genetic improvement.

- Compare: Mental, Manual and Automated measurement procedures. Visual scoring systems need greater than 4 stable and mutually exclusive categories, and all categories must be then used properly.

- Understand the different requirements of measurements when used for pricing slaughter stock (price decision is based on measure of each trait taken on the animal itself) vs breeding decisions based on PIGBLUP (each measure on the same and other animals contributes to each EBV of all animals and **ranking** of EBVs is now the key concern).

- Understand the desirable characteristics of measurements used for breeding decisions. Variable, heritable and associated with one or more of the economic traits, taken early in life and in both sexes.

- Develop for yourself standard protocols for making and recording each measure, and ensure that all staff are aware of and use these.

- What place has "marker" traits for indirect selection? For example, liveweight for carcase weight, and p2 backfat for carcase lean.

- Measuring some versus all animals. For example, live animal vs direct carcase measures, reduced numbers to measure at each stage of multi-stage selection, sex limited traits.

4.3 What other data to record?

- Management groups.
- Dates of birth and post-birth measures. Age and performance are related for many measurements!
- Mating data for boars, gilts and sows.

4.4 What data management system?

- Measurement and entering.
- Checking - incorporate simple checks at each point – remember GIGO!

- Transferring
- Storing
- Retrieving
- Editing
- Analysing
- Reporting
- Interpreting
- Operational plans for above, particularly timing and on- farm vs. central data banks.

4.5 What design for the Input/Output system?

- Establish how the reports are to be used and by whom.
- Then establish the necessary design conventions for I/O:
  - What information is really required - more is not necessarily better?
  - How is it best presented - many issues.

4.6 How to best arrange management groups?

Think about the management groups for each different type of measurement, i.e. the grouping that will result in fair comparison of a large number of animals and in strong links between groups, for each trait measured.

- We recognise that measurements are used to create information for use in the decisions and actions for:

(i) Breeding decisions and actions.
(ii) Management operations on and off the farm.
(iii) Transaction purposes, i.e., for marketing breeding stock and slaughter stock.

- **What makes a measurement useful?** The criteria for a measure to be useful for decisions about genetic improvement to a **seed-stock producer** are:

(i) Variable (the more the better).
(ii) Heritable (the higher the heritability the better, but remember PIGBLUP has greatest impact for measurements that are less heritable). Note: sometimes several measures are taken and averaged to increase precision, although now the heritability of the average should be used or preferably each separate measure could be used in analyses as a repeated measure.

(iii) Correlated with the economic traits (the higher the association the better).

(iv) Able to be taken early in life (preferably prior to reproductive age, or even to any culling/castration), and

(v) It is preferable that the measurement can be taken on both sexes.

- These are the criteria that control the contribution of a particular measure to the rate of genetic progress in economic performance. No measurement is perfect and many different combinations of the above criteria exist in practise and will prove useful. Of course, taking the measurement is more palatable if this can be done easily and cheaply, but beware of false economics as already mentioned.

- The criteria for a measurement to be economically valuable to a **seed-stock buyer** are:

(i) Variable (the more the differences between animals the more important the measure).

(ii) High observed correlation with profit in the current crop of piglets (even if lowly heritable).

(iii) Repeatable (for traits that are expressed repeatedly such as farrowing success).

(iv) Measurable prior to reproductive age.

(v) Measurable in the sex of direct interest.

(vi) Low cost of measuring.

As you can see the criteria differ from the seed-stock breeders and the seed-stock buyers perspective.

- **Introducing new measurements** to performance recording and genetic evaluation operations involves:

(i) Development of on- and off-farm protocols for all aspects of:

- Measuring.
- Entering, transferring, editing and storing.
- Reporting.

(ii) Analyses to:

- Establishing the analytical models to be used in summarising the data - what are the systematic (biases) and random effects.
- Estimating adjustment factors for standardising the measurements prior to analysis - there is a range of methods for adjusting data.
- Estimating the (co)variances - heritabilities, genetic correlations etc., which describe the biology of the difference between the animals measured.
- Designing and running the EBV (prediction) system - in this case PIGBLUP.

(iii) Training/Education:

- On the original system and on the upgrades.

5. ACROSS-HERD PERFORMANCE RECORDING AND GENETIC EVALUATION

- In graduating from within- to across-herd recording, either within the same company or among operations what are the issues?

(i) **Genetic linkages** - how strong and how to strengthen these where several AB and central testing operations may be involved.

(ii) **What are the important traits and where can these be measured**, centrally or on-farm (there is a strong trend internationally to emphasize on-farm recording). Does linkage exist for all traits measured?

(iii) **Does a suitable identification system exist**, i.e. can each AI sire always be identified as the same in all herds involved, and does much transfer of breeding stock occur between the herds involved?

(iv) **Is there an organisation** capable of implementing/maintaining the additional logistical complexities in the field and at the central data processing facility?

(v) **What is the (perceived) importance of genotype by environment interactions** (e.g. changes in sire ranking between herds) for each of the traits measured?

(vi) **How to accommodate crossbred/grade/introduced animals** in the analyses?

NOTES