

Management and recording guidelines for accurate and reliable breeding values

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Introduction

A question frequently asked by breeders is: “What can I, as a breeder, do to optimise the genetic evaluations of my herd (and breed), i.e. to make sure the breeding values of my animals are accurate and reliable?”

The aim of these guidelines is to assist breeders in applying good management and recording practices to optimize their herds’ genetic evaluations, i.e. to optimize the amount, correctness and effectiveness of your herd’s data that is used in a BLUP analysis. (Remember that the accuracy value, reported with each breeding value, only reflects the amount of data available to predict a specific breeding value. It does not reflect the correctness of the data used for the prediction).

Farmer-dependent factors influencing the accuracy of genetic evaluations

For all types of recordings, there are two basic aspects of importance, namely:

- Correct (and honest) recording; and
- Complete recording.

Farmer-dependant management practices that can have an influence on the accuracy of breeding values can be categorised under the following headings:

- Animal recording
- Parentage recording
- Performance recording
- Contemporary groups
- Genetic linkages

We will discuss each of these practices and give some guidelines for “best management practices” for each. Some of the practices, which may appear obvious, are the ones causing the most common mistakes. Others (particularly genetic linkages) are fairly new, but very important.

Animal recording

Animal details, particularly the correct sex and birth date, are essential for assigning an animal to the correct group (e.g. sex) and for applying the correct correction factors (e.g. age) in the genetic evaluation (BLUP) model.

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Best management practices for animal recording include:

- Ensure all calves (including calves that are born dead – for the sake of the dam’s calving record) are recorded at birth.
- Ensure that all animal details (particularly birth date and sex) are recorded correctly.
- Ensure that birth notifications are submitted on time for all calves.

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Parentage recording

Assigning the correct parents to a calf is one of the most important factors for genetic evaluations, because this is the basis of all genetic relationships of that particular animal. Incorrect parentage recording not only influences the accuracy of the breeding values of the particular animal, but also of all its relatives. The more performance-tested relatives of an animal included in the BLUP analysis, the more accurate the breeding value predictions of that animal will be.

Best management practices for parentage recording include:

- As far as possible, make use of single sire matings or, if multiple sires are used, do parentage confirmation by means of DNA analyses.
- Record mating groups correctly and ensure that these records are kept in a safe place.
- Record AI sires correctly from the semen straws.
- If AI is followed with mating within 28 days of the last AI date, parentage confirmation should be done by means of DNA analysis.
- For all calves born from embryo transplants, do parentage confirmation by means of DNA analysis.
- Mark calves and record calves' particulars, including the dam and sire, as soon as possible after birth.

Performance recording

In general, guidelines on animal performance recording are aimed at identifying – as far as possible – environmental (non-genetic) effects that may have influenced the performance of a specific animal.

Best management practices for performance recording include:

- Ensure that all selected traits are recorded for the group, because recording of a specific trait will enhance the accuracy of other correlated traits. (E.g., the recording of yearling weight will increase the accuracy of weaning weight and vice versa).
- Ensure that the weighing/measuring instrument (e.g. your scale) is in good working order and calibrated correctly.
- Weighing procedures:
 - Weigh all animals of a contemporary group on the same day or, if not possible, on consecutive days, i.e. avoid weighing animals of a contemporary group on dates that are far apart. This is to eliminate weighing date effects (e.g. quality and/or quantity of pastures which may change from one weighing date to the next, etc.).
 - Weigh all animals after being withheld from food and water for 12 hours. This practice will decrease weight variation due to gut fill.
 - Ensure that an animal is correctly identified – preferably before the weight is recorded.
 - Ensure that the weight is correctly observed and recorded.
 - Reset the scale's zero, if needed, with regular intervals when weighing a group of animals.
- Compare the recorded weight with (recent) previous weights of the animal. If any discrepancy is observed, weigh the animal again to make sure the correct weight is recorded.
- Check for reading/writing errors when recorded data is transferred to your computer or input documents.

Contemporary groups

One of the most important issues in animal recording, for genetic evaluation purposes, is properly defined contemporary groups. Poorly or wrongly defined contemporary groups are probably the most important source of low prediction accuracy in genetic evaluations.

A contemporary group can be defined as a group of animals born in the same year/season (similar age range), at the same location (same herd or farm), of the same sex, and managed alike from birth to the time of measurement (same feeding regime, date of measurement, etc.). Of these factors, poorly or wrongly defined seasons, extended age ranges, restructured contemporary groups due to animals moving from one

group to another and animals assigned to the wrong management groups, are the most common sources of poorly or wrongly defined contemporary groups.

In general, guidelines on contemporary or management groups are aimed at ensuring that any contemporary group is defined in such a way that all (or at least all significant) environmental effects - except for those that are corrected for in the evaluation model, e.g. dam age – are the same for all animals within a particular group. This (combined with good genetic links between groups) will ensure that BLUP can effectively separate genetic and environmental effects within any particular group.

The grouping of animals is done basically in two areas, namely:

- Automatically e.g. breed, herd, calving year and season, sex, birth status (single/twins), etc.;
- Farmer supplied (or influenced) management groups, e.g. weighing date, calf age, rearing status and feeding status.

A farmer can do little about the automatic grouping aspects and therefore it will be discussed very briefly:

Automatic grouping

- **Herd:**
Only calves bred and weighed in the same herd or locality can be compared. The locality (farm or test centre) where a group (herd or test group) of animals is kept at a specific point in time is called the “keeper”. If a farmer has more than one farm where the animals (within breed) are managed as independent, separate herds and/or the climate, veld type, management or quantity and/or quality of forage differ substantially (e.g. one farm in the highveld region and another farm in the lowveld), these farms should preferably be handled as two “keepers”. On the other hand, animals of different owners that are run and managed together can be handled as one “herd” or keeper to enlarge contemporary groups.
- **Calving year & season:**
 - Only calves born in the same calving year and season can be compared. (The maximum allowed variation in birth dates in the ARC’s National Beef Recording and Improvement Scheme is 100 days).
- **Sex:**
 - Only calves of the same sex can be compared.
- **Birth status (single/twins):**
 - Only calves of the same birth status can be compared. Single calves are not compared to twins. While twins can be compared with other twins, the low occurrence of twins usually does not facilitate this.
- **Embryo transfer calves:**
 - Embryo transfer calves are not compared with calves suckling their own dams.

Farmer supplied (or influenced) management groups

The assigning of animals to management groups is obviously the area where the farmer can play a major role in optimising the genetic evaluations of his herd. All calves assigned to different rearing status and/or feeding status groups within a particular test, will be evaluated separately.

The two golden rules regarding grouping of calves are:

- Keep groups large, but homogeneous.
- Do not mix or split up groups unnecessarily.

Best management practices for management groups include:

- The most obvious management practice is to use one (or two, depending on your circumstances) short breeding season instead of running the bulls with the cows for extended periods or even the entire year. Breeding seasons should be a maximum of 90 days, preferably shorter, e.g. 75 or 63

days. This will ensure large contemporary groups based on the birth dates of calves. In the National Beef Recording and Improvement Scheme, only calves born within a period of maximum 100 days can be compared.

- Ensure that all animals in the particular group fit into the age limits for that particular phase/recording (e.g. 151 to 250 days of age for weaning weight).
- Try to weigh all calves in a particular group on the same day or, if not possible, within the same week.
- Ensure that **all** animals in a particular group are recorded, i.e. no selective recording should be done. (E.g. do not only record birth weight for big calves or difficult births – such recordings are of no value and may actually be misleading).
- Ensure that all animals in the group had the same treatment from birth to a particular weighing.
- Animals weighed at 12- and 18 months should be grouped, as far as possible, in the same groups as they were at weaning (except if some animals' management/feeding differed or they were sold, in which cases those animals should be grouped separately). There are two reasons for this:
 - Firstly, it accounts for bias due to culling or selection at weaning; and
 - Secondly, it accounts for bias due to management and nutrition at weaning.
- All calves that were fed concentrates before weaning should be assigned to a separate feeding status group, even for post weaning weights.
- Bulls tested post weaning on concentrates (e.g. Phase C – Central Performance Tests) should **not** be grouped together with pasture raised bulls for 12- and/or 18 months weights.
- Calves from first parity cows should not be evaluated in separate contemporary groups from older cows, unless the first parity cows received preferential nutrition and/or management, in which case it should be indicated as such.
- Weigh all calves at weaning and, as far as possible, do not mix calves of different weaning groups for any post weaning weights.
- Rotate groups across camps to minimise the camp effect on any particular group. If this is not possible, and the quality and/or quantity of the pastures in different camps differ significantly, assign different feeding status codes to these groups.
- Assign the appropriate rearing status codes to all calves, e.g. calves raised by foster dams, etc.
- Assign the appropriate remark codes to all “abnormal” calves, e.g. sick calves, injured calves, etc.
- Participation in competitive showing of cattle is discouraged, because such cattle get preferential feeding and management and should therefore be evaluated in separate groups. This applies not only to young animals, but also to calves whose dams are showed.
- If castration is done, try to postpone it until weaning weights have been recorded.

Genetic linkages

The concept of genetic linkages is still new to many breeders. It actually only became an issue with the introduction of BLUP technology for genetic evaluations to predict breeding values. However, genetic linkages are such an important issue that all breeders should take notice of management practices to optimise it.

Genetic linkages enable BLUP to benchmark the genetic merit of animals from different herds, birth years, seasons and management (rearing and feeding) groups. Sires contribute by far the most to genetic linkages. A link sire can be defined as a sire having performance recorded progeny in other herds, years, seasons and/or management groups. If, for example, all calves in Group 1 are from sire A and all calves in Group 2 are from sire B (and the cows from group A are unrelated from the cows in group B), benchmarking the genetic merit of these two groups will be impossible. Genetic linkages determine the “effective progeny” of a sire in a contemporary group.

Best management practices to ensure good genetic linkages include:

- Make use of widely used AI bulls. This is by far the easiest and most effective way to establish genetic linkages.

- Establish a system of exchanging bulls between herds. This is particularly helpful to establish genetic linkages between herds if AI is not used.
- Use more than one bull per season in your herd, including at least one (preferably two or more) AI bull.
- Have calves from as many sires as possible (at least two) in each management group. Where all calves in a specific contemporary group are the progeny of one sire, this information is of no value in calculating this sire's breeding values. The reason for this is that the number of effective progeny for that particular sire is zero, which implies that the genetic (sire) effect cannot be effectively separated from the environmental (contemporary group) effect. It is a common practise in some herds to mate a specific sire only with heifers. If all calves from such a sire are evaluated in a separate contemporary group, the number of effective progeny from this sire is zero.
- Try to have a mix of AI bulls and own bulls' calves in each management group.
- Try not to replace all bulls in the same year. If you have to, at least try to use some of the previous year's AI bulls.
- Buy bulls (and females) from (and sell to) performance recorded herds.
- After the mating season has ended, run cows in one big group. If this is not possible, regroup the cows to ensure that cows from at least two (preferably more) mating groups are represented in each new cow group. After the mating season has ended, avoid keeping the mating groups intact and separate.
- Avoid mating the same group of cows to the same bull year after year, i.e. regroup the mating groups from year to year. The best time for this is at weaning to ensure that they are familiar to their new group before they start calving.
- Ensure that the extended pedigrees of imported semen/bulls are recorded on the central database (INTERGIS).

The following example will illustrate how linkage sires can separate genetic from environmental effects:

Example: Let us assume that the same AI sire (the link sire) has progeny in three herds. Herd A has a good season, Herd B has an average season and Herd C has a bad season. Let us further assume that the genetic potential of the cows in the three herds is the same and that there are a reasonable number of progeny per sire in each herd.

Average weaning weight of sire's progeny (kg)

Herd	Herd A	Herd B	Herd C
Linkage sire:	220	200	180
Home-bred sire 1:	210		
Home-bred sire 2:		200	
Home-bred sire 3:			190
Difference between link and home-bred sire	+10	0	-10

From the above presentation it should be clear that home-bred sire 3 is the superior sire of the four sires for weaning weight.

Summary of the important management practices

Parentage recording:

- Use single sire matings.
- If multiple sires are used, AI is followed with mating within 28 days of the last AI date or calves born from embryo transplants, do parentage determination by means of DNA analyses.

Management groups:

- Use a short breeding season - maximum 90 days, preferably 75 or 63 days

- Ensure that all animals in the particular group fit into the age limits for that particular phase/recording.
- Try to weigh all calves in a particular management group on the same day.
- Ensure that all animals in a particular group are weighed.
- Ensure that all animals in the group had the same treatment from birth to a particular weighing.
- Animals weighed at 12- and 18 months should, as far as possible, be grouped in the same groups as they were at weaning.
- All calves that were fed concentrates before weaning should be assigned to a different feeding status group, even for post weaning weights.
- Bulls tested post weaning on concentrates (e.g. Phase C) should **not** be grouped together with pasture raised bulls for 12- and/or 18 months weights.
- Calves from first parity cows should **not** be evaluated in separate contemporary groups from older cows, unless the first parity cows received preferential nutrition and/or management, in which case it must be indicated as such.
- Weigh all calves at weaning and, as far as possible, do not mix calves of different weaning groups for any post weaning weights.
- Rotate groups across camps/paddocks to minimise the camp effect on any particular group. If this is not possible, and the quality and/or quantity of the pastures in different camps differ significantly, assign different feeding status codes to these groups.
- Assign the appropriate rearing status codes to all calves, e.g. calves raised by foster dams, etc.
- Assign the appropriate remark (reason for unreliable) codes to all “abnormal” calves, e.g. sick calves, injured calves, etc.

Genetic linkages:

- Make use of widely used AI bulls. This is by far the best and easiest way to establish genetic linkages.
- Establish a system of exchanging bulls between herds, in particular if AI is not used.
- Use more than one bull per season in your herd, including at least one (preferably two or more) AI bull.
- Have calves from as many as possible (at least two) sires in each management group.
- Try to have a mix of AI and own bulls’ calves in each management group.
- Do not replace all bulls in the same year. If you have to, at least try to use some of the previous year’s AI bulls.
- Buy bulls from performance recorded herds.
- After the mating season has ended, run cows in one big group. If this is not possible, regroup the cows to ensure that cows from at least two (preferably more) mating groups are represented in each new group.
- Avoid mating the same group of cows to the same bull year after year, i.e. regroup the mating groups from year to year.
- Ensure that the extended pedigrees of imported semen/bulls are recorded on the integrated database.