THE WHY AND HOW OF SIRE REFERENCING[a]

Derrick R. Guy
Senior Genetics Adviser
Meat and Livestock Commission
Milton Keynes, England

Introduction

Breeders are beginning to hear about sire referencing. Some are doing it while others are contemplating it. This note is intended to set the scene and give those considering a sire referencing group a clear idea of the way ahead.

The detail of how and why sire referencing schemes work is given in the last section for those unfamiliar with the concept. Suffice at this stage to say that a team of reference sires (typically 3 or 4) is used across flocks in the same season. Their progeny have a quarter of their genes in common which is used as a benchmark or yardstick against which lambs or stock sires can be compared. The aim is that lambs from reference sires ('reference lambs') should be born at around the same time as lambs from the other stock sires in each flock.

Laparoscopic artificial insemination with frozen semen is normally required. Controlled transfer of rams around flocks may achieve the same ends but requires more care to ensure that flocks do not become genetically isolated from others.

The Meat and Livestock Commission's (MLC) Sheepbreeder Program and scanning records form the basis of the system. Edinburgh Genetics is currently the sole agency for an A.I. service, and the analysis of records across flocks is conducted by MLC in liaison with outside agencies under contract from time to time.

It is important for each group to develop its own procedures and timetables to suit. Table 2 (at the end of the paper) gives guidelines. The timing of the analysis depends upon the selection day, forthcoming sales and availability of resources at MLC.

What members have to do

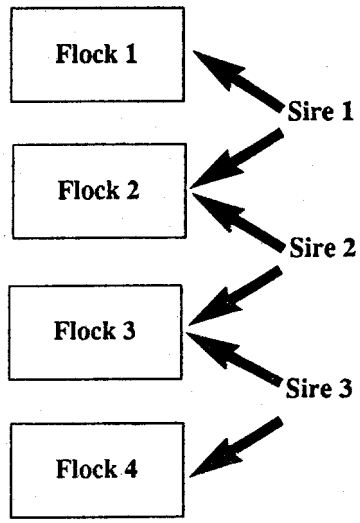
1. A steering group of members is found to be helpful in sorting out technical and procedural details. Obtaining breed society approval is usually a distinct advantage.
2. Decide the basis on which rams join the team of reference sires, how members are to reach a consensus, and how members' own interests are to be protected.
3. Decide on a team of sires to use for this year's breeding. In the first year, and perhaps the second, across flock evaluations will not be available when this decision is to be made. So it becomes more important to ensure members reach a consensus and are confident to use those rams offered. In the first and second years, stud rams in use in member flocks which are supported by good performance figures are good choices.

---

[a]Published in 1992 as MLC Genetics Newsletter, Series 1, Number 3. Reprinted in these proceedings with permission of the author. Minor modifications have been made to the original publication with permission of the author.

4. The number of reference sires needed depends on how matings are organized. Four is a good minimum. Each member should aim to use at least two from the team if possible. A good rule of thumb is that each member should be able to 'connect' to any other member by the smallest number of reference sires. For example, avoid the situation in Figure 1. In this situation, Sire 3 should also be used in Flock 1. If possible, replacing only half the team each year will help establish good links from year to year.

Figure 1



5. Current advice is to aim for at least 20 reference lambs on the ground in each flock going forward for scanning. In the end, whatever is available is used, but below five and the results may be visibly affected.
6. Decide deadlines (in the following order)
   i. Date and venue to inspect nominated rams.
   ii. By which date you need the results (MLC will try to comply but may need to negotiate).
   iii. When the last scanning visit is to take place.
   iv. Movement of rams or semen collection in preparation for the next breeding season.
   v. Frequency of progress meetings.
7. It is imperative that Sheepbreeder records are up to date well in advance of the scanning visit. This means correct pedigrees with lambing and eight-week weights processed and all queries cleared up.
8. Book a scanning visit for the appropriate time. The aim is for average lamb age on the day of scan to be around 147 days. Two visits may be appropriate. Some schemes currently require a second analysis later in the year to pick up late born lambs. We advise scanning both sexes, certainly all male lambs.
9. Contact your local MLC consultant if at all in doubt about filling in the Sheepbreeder records or the scanning visit. They will contact Chief Advisers at MLC Headquarters for clarification if necessary. Remember that errors in recording will affect everyone else as well.
10. Decide a strategy for publicity and marketing, even if it is some way in the future.

What we will do

Sire referencing employs additional resources over routine services, and we are devoting considerable efforts to these initiatives. Liaison is through MLC Consultants with individual members and direct to Milton Keynes where helpful. Members are free to contact MLC staff at any time.

Certain aspects can be complicated, and we try to provide support by way of advice, discussion, presentation or reference documentation, etc. on request. Our offices at Winterhill are available for meetings if this would be helpful.

Results will be delivered to agreed timetables, and provision is made for contingency action to ensure results are available when needed. However, it must be emphasized that recording data that require amending or are submitted late can seriously jeopardize the deadlines. The analysis to rank this season's lambs must wait until data from all members are present and correct.

Some degree of flexibility and understanding is advisable in the early stages of new schemes since some experience is required before optimum mating structures and A.I. conception rates, etc. are known.

The MLC charge to cover resources needed above normal Sheepbreeder and scanning services is £90 per flock on delivery of the final end-of-season report. This fee is currently negotiated over all schemes. Income is reinvested to fund supporting research into optimizing the mating structures and tailoring the data analysis for particular breeds and groups.

What you will get

The analysis of scanning data over the whole group results in the calculation of estimated breeding values (EBVs) for every animal that we know about from the Sheepbreeder records (lambs, sires, dams and ancestors).

The EBV is a direct estimate of the superiority (or inferiority) of the animal's genes. There is an EBV for each trait measured (56-day weight, scan weight, muscle depth and fat depth) in the unit that the trait was measured in.

EBVs for the last three traits (not 56-day weight) are then combined (following the same procedure as the scanning index) to produce a single value on which all animals are ranked. This is called the Scheme Index and has a range from 0 to 200 with an average of 100 points. An example is shown in Table 1.

Table 1. Scheme Index for Two Sires with different EBV's for Individual Traits.

	EBV's	
Trait	Sire 1	Sire 2
21-week weight (kg)	2.41	-0.04
Muscle depth (mm)	0.55	0.72
Fat depth (mm)	-0.12	-0.18
Scheme Index	166	147

This information is presented with the actual measurements originally recorded and pedigree data. Further help to interpret the results is given out at the time, and each member's MLC Consultant will have a copy of their member's results.

Typically members see their own results (latest crop of lambs, and their sires and dams) while everyone gets a copy of the latest ratings for the reference sires. It is for the group to decide whether members' individual results get more widely distributed across the group. All results are confidential to the membership, to the extent that MLC will require a written authority to divulge data between members as well as outside the group.

The summary report at the end of the season can give the results of any rerun plus estimates of sex differences and genetic trends that might be of interest and guidelines for the next season.

And finally

The object of the exercise is to locate those rare animals that have exceptionally good records and which look good from a breeder's point of view. They may then join the team of reference sires or be used within members' flocks or used to some other advantage.

Once going, the scheme provides a focus and framework for further development. For example, incorporating carcass information, a visual classification, recording of defects, or investigation of inbreeding levels. Eventually a tie-in with the other schemes within the breed might be considered. The scheme also provides a sound technical base for group promotions and sales, etc. The possibilities are there for the taking.

The Basics of Sire Referencing

The problem

Readers will already appreciate that an individual flock working independently of all others has severe limitations over what it can achieve. Flock size is often small, making it difficult to get good genetic comparisons between animals. When the time for selection comes around, the choice is often restricted - the animal with all the desirable qualities we are looking for may simply not be there. We may be forced to select an animal that is not quite right in the hope that it will turn out better than expected. Alternatively, we could look outside for new blood. In which case we have the problem of who to go to, the uncertain genetic merit of the supplying flock relative to our own, along with the risk that the (often expensive) addition to the flock will not live, or rather breed, up to our expectations.

An objective recording scheme such as MLC's Sheepbreeder can go a long way to help ensure that relevant traits are objectively recorded, processed to extract the maximum amount of genetic information and presented in a way that helps us make the necessary selection decisions. The rating or rankings of animals remain, however, essentially 'within flock'. There is nothing to tell us whether an animal from another flock is genetically better or worse than anything we have bred ourselves. The only option is to try it and see - by which time the damage, if any, has been done.

The solution

The first step towards a solution is to get together with other 'like-minded' breeders. Coming together with others to agree on common aims and objectives, sharing problems and looking for common solutions is without doubt the most important step an individual breeder can take. The confidence this gives opens up possibilities that are beyond the means of individuals.

A technical possibility is progeny testing. In its day, progeny testing has much to commend it.

i. It provides the direct comparison of sires from across flocks so difficult to obtain otherwise.

ii. Sires that are about to be used widely will have 'proved' themselves already with progeny on the ground.

iii. Because the progeny are commercial, information on slaughter traits can be obtained.

The down side is:

i. Resources limit the number which can be tested so the focus is always on a very small group of candidates.

ii. There is a limit to how much influence a 'proven' ram can have.

iii. Rather complicated analysis of results is required to ensure fair comparisons of tested rams.

iv. Considerable delay is experienced in turning over replacements.

Nevertheless it is a rather sure, if slow, method of making genetic progress.

What is needed is a system of progeny testing where the whole operation is scaled up. Where all stock sires over all flocks can be compared with each other. Where the progeny are produced in the members' own flocks so that they are themselves available for selection. Where all animals can be compared with each other, irrespective of which year or in which flock they were born. In effect, treating the population across the whole group as a single large 'superflock'. A sire reference scheme is exactly that.

How does sire referencing work?

Sire referencing uses a team of common sires over a group of flocks. The reference sires leave lambs in one flock that are therefore related to lambs being born at around the same time in other flocks (Figure 2). The lambs are half-sibs having a quarter of their genes in common and, to a certain extent, will have similar performance. These can be used as a standard or 'benchmark' against which lambs from other homebred sires can be compared.

When lamb performance is analyzed, it allows us to rank all the lambs, sires, dams and even ancestors on the same list without worrying about which year they were born or in which flock.

Each member will know where their stock rank in the list. Those rare outstanding animals that have both good performance and all the other attributes members are looking for, can be identified and located, and by agreement used.

To function properly, the system has had to await the development of three technologies:

i. A base of good objective recording for economically important traits. For terminal sire breeds, this means Sheepbreeder with scanning.

ii. The use of artificial insemination to ensure reference lambs are born in the same season in different flocks (this condition may be relaxed in particular cases).

iii. Analysis programs that make proper adjustment for genetic pedigree and flock environment to enable the benchmarks to operate. These have only very recently been developed from their original use in dairy cattle and very recently beef cattle schemes.

All breeds have had some measure of 'ram sharing', whether deliberately or through sales from one member to another. These too can provide 'genetic links' across flocks. However, it must be remembered that reference lambs have only a quarter of their genes in common and relationships more remote than this will produce a less effective benchmark ('weaker link'). Hence our current

launch of sire referencing with the major groups involves laparoscopic A.I. using frozen semen.

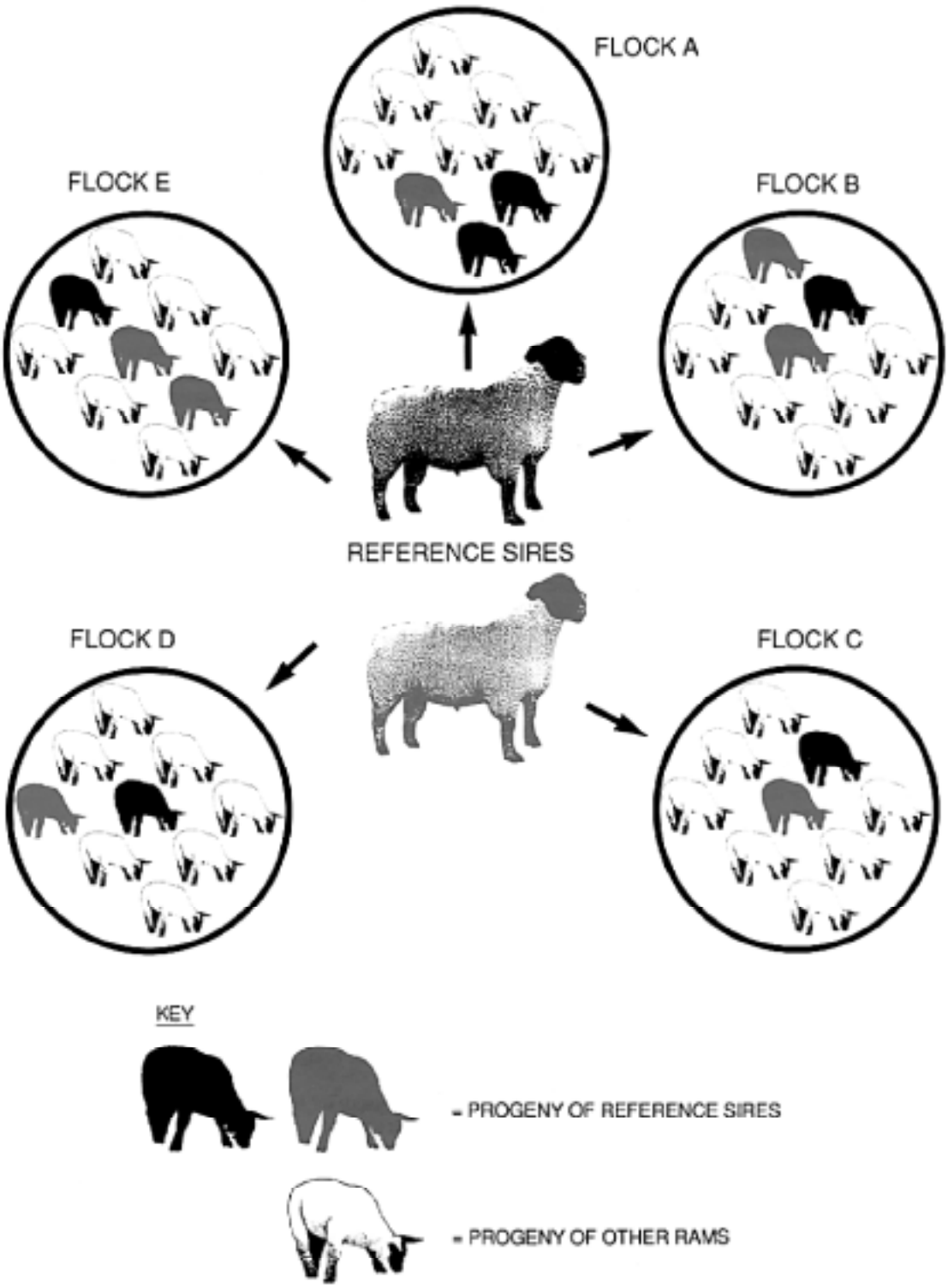
In the medium term, the intention is to make the across flock analysis available as a routine with the Sheepbreeder service. Structured groups that already exist will be in a position to take full advantage of all the benefits available while breeders pursuing a strictly within flock breeding policy will have more precise and accurate genetic evaluation of their animals than currently obtained.

These initiatives are innovative, soundly based technically and open up possibilities never before available to the livestock breeding sector. It is up to breeders to grasp the opportunities. MLC will do all it can to assist.

Table 2. Order of Activities with Possible Months When They Would Take Place.

What happens	When (for a January-lambing flock)
1. At the start and throughout, members need to discuss and agree on breeding objectives for the whole group.	
2. Members record the season's lambing on Sheepbreeder.	January
3. Eight-week weights are submitted and records (pedigrees, sexes, weights, etc.) checked for accuracy.	March
4. Scanning visit on-farm: within-flock results are produced on-farm. Details are sent direct to Milton Keynes by scanner operator.	June
5. Analysis of all records for the sire referencing group is performed within a week of the last scan visit (the deadline for this is negotiable with the group).	June
6. Selection list of lambs, sires and dams (ranked in order of genetic merit) is sent direct to members.	June-July
7. Members shortlist ram lambs as potential stock sires or reference sires.	July
8. Ram lambs, yearlings or stock sires (as appropriate) are nominated to go forward for consideration as reference sires by other members.	July
9. A Ram Selection Day is organized where nominations are inspected, opinions given and voting carried out with successful rams going forward to join the team of reference sires.	July
10. The team of reference sires (with possibly ram lambs from this year) are set to work, either at an A.I. center for semen collection or sires are distributed to farms. Promising ram lambs could be tried out as stock sires in the owner's flock.	August
11. Late lambing flocks and late born lambs within flocks, if required, can be scanned on a later visit, data sent to MLC and all results re-analyzed, incorporating the new data.	October
12. A summary report is prepared on the year's run and delivered to each member.	November
13. Various progress meetings of the members are held throughout the year, at least one over the winter.	December

Figure 2



SCHEMATIC DIAGRAM OF A SIRE REFERENCING SCHEME