MATING SYSTEMS FOR WOOL AND MOHAIR

L.P. Jones
Animal Research Institute, Werribee, Vic. 3030

Once the breeder has selected his replacement sires and dams, he has to decide what mating system to use. Systems that can be considered include:

- Random mating
- Like-to-like (technically called assortative) mating
- Corrective (disassortative) mating
- Inbreeding
- Linebreeding
- Crossing of lines or breeds

The merits of these systems will be considered briefly. The same principles apply to both sheep and goats, so goats will be referred to only where they have special problems.

RANDOM MATING

This is the simplest approach and is often the best. Each ram is mated to a random group of ewes, and none are shown any preference. Rams can be mated individually or as a syndicate. Individual mating ensures a more even use of rams, and enables us to use progeny or pedigree information in selection. However, it is more costly, as it requires a number of mating paddocks, and the odd sterile ram or poor worker can reduce the number of lambs. The latter problem can be reduced by semen testing the rams and using harnesses.

If we use progeny information, random mating is essential to ensure that each ram is given an equal chance to demonstrate his worth. Mating must be random as to the age and merit of the ewes. It is also important that ewes be run separately at mating and lambing for as short a time as is possible, so that management differences are minimized.

If we are not progeny testing, the only advantage to random mating is its simplicity.

LIKE-TO-LIKE MATING

The best ram is mated to the best group of ewes, the next best to the next group, and so on. Like-to-like mating increases the genetic variation between progeny groups, and so can increase the response to selection. Baker (1973) suggested that for most situations, the extra response from using like-to-like mating would be less than 10%.

An open nucleus system can be considered as a form of like-to-like mating in that the best group of males (those in the nucleus) are mated to the best group of females. Hopkins (1978) showed that an extra response to 10 to 15% is possible with an open nucleus. This figure is higher than
that suggested by Baker (1973), but as well as being a form of like-to-like mating, steps are taken in an open nucleus to ensure that the optimum proportions of individuals are chosen from each level of the hierarchy.

CORRECTIVE MATING

The aim of corrective mating is to reduce the genetic variation of the progeny and so increase uniformity. This would only be of any value for a character where uniformity might have an economic advantage, e.g. fibre diameter. However, it can be shown that even continued use of corrective mating will reduce the variation by less than 10%, so will hardly be worth the effort. This may surprise some, but it should be remembered that over half the variation is non-genetic anyway and your mating strategy won't affect this variation.

Use of corrective mating would require that females can be assessed with reasonable accuracy. The degree to which diameter can be assessed visually limits the effectiveness of corrective mating in most situations.

Corrective mating for fibre diameter can be used without affecting the selection differential for other characters, whereas trying to increase uniformity by culling extremes reduces selection differentials without being very effective.

The only time corrective mating is likely to be useful is when a flock is being started from a mixture of types. Uniformity could be improved if matings are arranged so that most sheep have the same mixture of types.

If corrective mating is used for a character that we wish to change, the small reduction in variance will reduce the rate of response to selection slightly.

INBREEDING

Inbreeding reduces the hardiness of all livestock so should be kept to a minimum. A producer will want to know how big a flock needs to be before it can be closed. There is no simple answer but we can get some idea from the inbreeding coefficient. This is a measure of the level of inbreeding. The rate of inbreeding per generation is $1/8M + 1/8F$, where $M$ and $F$ are the numbers of males and females used per generation. It is easy to show that the number of males is the critical factor. With a generation length of 4 years and 4 new males per year, the rate of inbreeding would be about 0.8% per generation. This would probably be acceptable but it wouldn't want to be much higher. A reduction of between 0.5 and 1% in overall productivity is likely for each 1% increase in inbreeding coefficient.

With inbreeding, the frequency of undesirable types such as black lambs and cryptorchids increases. At the same time, a more serious but less obvious reduction in productivity occurs.

The above calculations assume that rams are used more or less equally. If a few rams are used more widely than the rest the rate of inbreeding will be greater. It is also likely to be greater with syndicate mating where some rams will mate more ewes than others.
The simplest approach to minimize inbreeding is to turn sires over quickly and use them equally. The producer will need to balance the aim of maximizing rate of progress with the need to minimize inbreeding.

There will be few herds of goats that are big enough to close. Consequently, producers will need to introduce sires regularly. The main thing will be to purchase sires from those producers with similar goals and sound programs. There is no sense wasting your own effort on a breeding program if purchasers from inferior herds will dilute your gains. Cooperation between goat breeders is essential if the Angora breed is to improve substantially.

**LINEBREEDING**

Linebreeding is a form of inbreeding where we try to make the flock related to an outstanding individual. If a selection program is improving the flock, there is little to be gained by going back to some past individual. In any case, it will increase the inbreeding of the flock and so reduce productivity. It is a practice I wouldn’t recommend.

**CROSSINGS OF LINES OR BREEDS**

Crosses of Merino ewes to British breed rams produce daughters which wean more progeny than either parent breed. Crosses of Merino and Corriedale wean about 10% more lambs than the average of the parent breeds but are only equal to the performance of the Corriedale for this character (Iwan et al, 1971). At Werribee, we are measuring the level of hybrid vigour in crosses among Merino strains, but have insufficient data so far. It is unlikely that the amount of hybrid vigour would be high enough to exploit by continued crossing. The main relevance of the results will be in comparing rams of different types. Progeny of introduced rams will be hybrids so the value of such rams will be overestimated if hybrid vigour occurs.

Hybrid vigour will be of interest to goat breeders who are grading up from bush or milch goats. Early crosses will benefit from hybrid vigour but this effort will reduce as the pure Angora is approached.

**IMPLICATIONS OF ARTIFICIAL INSEMINATION**

A.I. can increase the rate of genetic improvement by increasing selection differentials. However, A.I. will also increase the rate of inbreeding as fewer sires are needed each year. As pointed out earlier, it is the number of males that determines the rate of inbreeding. If we decide to use at least 4 new sires each year, A.I. would be worthwhile only in flocks with more than 2,000 ewes. A.I. could also be used to spread genetic material from a nucleus or parent stud to daughter flocks more rapidly.

A.I. has considerable use with goats in the wide use of males over bush goats. However, care must be taken to ensure that the breed does not concentrate on too few individuals as inbreeding must be minimized.
INBREEDING IN NUCLEUS SCHEMES

In a closed nucleus the rate of inbreeding depends only on the size of the nucleus. Just as lower levels of the hierarchy lag behind the nucleus in genetic merit, so too do the lower levels lag in inbreeding.

Opening the nucleus to genetic material from a base flock reduces the rate of inbreeding. While the rate of inbreeding depends on the amount of introduction from the base flock, the rate of inbreeding in typical schemes is about half of that in a closed nucleus of the same size (James, 1976). The size of the base flock has only a small effect on the rate of inbreeding in such schemes.

CONCLUSION

The mating system used will only have a small effect on the productivity of a Merino flock. It is more important that care be taken to ensure that the best sheep are selected as replacements.

The major concern will be to ensure that the rate of inbreeding is minimized.

REFERENCES