



Genetics and Breeding

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Sheep Breeding and Genetics

Genetics and the Environment

All characteristics (traits) of an animal that can be seen or measured are referred to as its phenotype. This includes height, weight, growth rate, wool colour, temperament, reproductive ability, disease resistance etc. An animal's phenotype for each of its traits depends on both genetics and environment. At conception, genetic material from the sperm and the egg merge, and the resulting fetus will contain 50% of its genes from the dam and 50% from the sire. These genes contain information regarding how each of the animal's traits will develop (genetic potential or genotype). The environment in which an animal develops will affect whether the full genetic potential will be achieved. For example, a lamb may have the genetic potential to achieve a maximum adult height of 90 cm. How tall the animal actually becomes depends on the environment in which it develops (i.e. food supply, protection from the elements, health care etc.). With optimum conditions the lambs will be 90 cm. Under natural circumstances, the lamb could never be taller than this as the genes it inherited from its parents have set the upper limit. If the lamb is raised under very poor conditions, with poor feed, heavy parasite load etc, its adult height will be much less, as growth will be limited by environment. However, even with the phenotypic adult height of 70 cm, it would still be able to pass the genetic potential for greater height to its offspring. The opposite is also true, and a favourable environment can mask poor genetics, just as good genetics may be masked by poor conditions. Sheep do not pass on their environment to their progeny - only their genes. Sheep that have been especially well fed and pampered may look exceptionally good at shows or sales. However, their genetics may not result in a similar phenotype if their offspring are raised under different conditions. Therefore, it may be worthwhile to purchase genetic stock proven to perform well under a management system similar to your own.

Selection and Heritability

Selection is the process of deciding which animals will be used as breeding stock, and which will not be used (castrated, sold, or slaughtered). Producers may base their selection decisions on various economically important traits of the stock, in the hope that the offspring will be profitable. Selecting and breeding rams and ewes that grew quickly as lambs, for example, should produce lambs with a genetic potential for fast growth. If the fastest growing lambs from the next generation are retained, the genetic potential for this trait should continue to increase. Selection over long periods of time for particular characteristics has led to the development of breeds with recognisable phenotypes.

Traits are not equally affected by the animal's genetics. The heritability of a trait is a measure of the relative importance of genetics and environment in developing the phenotype. Table 1 list a few examples of traits and their heritability. The genetic contribution to the phenotype of a trait with a low heritability is only ~10%, whereas with highly heritable traits genetics may account for approximately half of the final phenotypic result. Since the heritability of all these traits is greater than zero, selection will result in genetic improvement for that trait. However, improvement will be much faster (occur in fewer generations) for traits with high heritabilities.

Table 1: Examples of heritability of specific traits

Trait	Heritability	Percent influenced by genetics (Heritability)	Percent influenced by environment
Reproductive (e.g. prolificacy)	Low	5-15%	95-85%
Growth (e.g. growth rate, carcass)	Moderate	25-45%	75-55%
Fleece traits and conformation	High	45-60%	55-40%

Sheep Breeds:

'What breed should I choose?' is one of the first questions asked by people interested in getting into sheep production. The answer to that question will be based on many factors including:

- Management system (e.g. producers interested in lambing on pasture will probably steer away from the higher maintenance prolific breeds; accelerated lambing programs will run much smoother with breeds that have long breeding seasons etc.)
- Marketing Strategy (e.g. producers who wish to sell into the heavy lamb market will probably select a breed that will not over-fatten by the time the market weight is reached (heavy mature weight). Conversely, producers who are selling the majority of their lambs at less than 80lbs may find that the heavier breeds do not adequately fatten at lighter weights.)
- Breeding Strategy (e.g. pure bred vs commercial, see below)

Although individual breeds have unique characteristics, sheep can be grouped into several general classes (**for further descriptions of individual breeds see the pamphlet 'Canadian Sheep'**):

1. Terminal or Sire Breeds: These breeds are generally characterized by rapid growth, muscularity, and good carcass traits. Reproductive performance may be somewhat lower than in the maternal breeds. Some examples of terminal breeds are: Texel, Suffolk, and Charollais
2. Maternal Breeds: These breeds tend to have higher fertility, increased number of multiple births, higher milk production, increased longevity, and mothering ability. However, they tend not to be as large or well muscled as the terminal breeds. Some examples of maternal breeds are: Dorset, Outaouais Arcott, and Romanov
3. Dairy Breeds: These breeds have been specifically selected for high milk production. The milk from ewes is mainly used to produce cheeses, such as feta, ricotta, and Camembert. Examples of dairy breeds are: East Friesian and British Milk Sheep.
4. Wool Breeds: Different breeds have different types of wool (see Chapter 9). Although the production of various items requires the use of different types of wool, some breeds have become known as 'wool breeds' in light of the fact that their wool may be highly valued in specialty markets. Examples of these breeds are: Icelandic, Merino, and Shetland

In spite of the fact that these categories have been listed, please keep in mind that all breeds have lambs, will grow, have wool, produce milk, and have a carcass! There is considerable variation both within and between breeds and paying close attention to the breeders reputation for quality genetics, as well as the breed that they are selling, is an important part of making the correct decision when buying breeding stock.

Breeding Strategies:

Pure breeding (Straight cross)

This is the simplest type of breeding system, as all the sheep (rams and ewes) are the same breed. As noted above breeds have generally been selected for a specific aspect of their production (e.g. fast growth, strong maternal characteristics etc.). However, in a commercial lamb operation the number and quality of market lambs are important, so both terminal and maternal characteristics need to be incorporated into the breeding strategy. Therefore, purebred producers often supply 'seed stock' to commercial producers, who will use the purebreds as a foundation for a crossbreeding program.

Crossbreeding Strategies:

As the name suggests, crossbreeding is the mixing of two or more breeds together. There are two main benefits to crossbreeding.

Hybrid vigour or heterosis: Hybrid vigour refers to the fact that crossbred offspring often out-perform the average of their parents. Hybrid vigour decreases as the heritability of a trait increases. Therefore, it is often used to improve performance for low heritability traits. For example, two maternal breeds may be crossed to further improve reproductive performance in their offspring. This greatly benefits fertility traits, which are of low heritability and do not respond well to selection. Crossbred ewes are generally more fertile, productive, and long-lived than purebred ewes. For example, if a prolific breed (produces 3

lambs on average) is crossed with a less prolific breed (1.6 lambs on average), the cross is expected to produce $(3+1.6)/2 = 2.3$ lambs on average. However, the crossbred ewe might well produce 2.5 lambs on average. The extra production over the average of the parental breeds ($2.5 - 2.3 = 0.2$ lambs) is due to hybrid vigour or heterosis.

Breed Complementarity: This refers to the crossing of two dissimilar breeds in order to combine the best traits of both breeds. An example of this would be crossing a well-muscled Texel ram with highly fertile Rideau Arcott ewes to produce a large crop of high quality lambs. Although the lambs may not be as heavily muscled as straight Texels, the lambing percentage will be much higher with the Arcott influence. This type of strategy is likely to produce better results than trying to select for highly fertile, heavily muscled animals within one breed.

Types of Crossbreeding Strategies:

Two Way Cross

In this case, rams of one breed are used to breed ewes of a second breed, resulting in crossbred lambs. This strategy takes advantage of hybrid vigour and/or breed complementarity in the offspring. Breeding is relatively simple as you are only dealing with one breed of ewes and one breed of ram. However, since the offspring are crossbred, all replacements must be purchased.

Three-Way Cross

This strategy mates the two-way crossbred ewe lambs ('F1' lambs) to a ram of a third breed. The resulting progeny are a mix of three different breeds. This strategy takes advantage of hybrid vigour in the crossbred ewe as well as in the three-way crossed lambs. However, all replacement ewes still need to be purchased. Some producers specialize in producing crossbred ewe lambs for this type of system.

Three-Way Rotational Crosses

Similar to the three-way cross, the three way rotational cross starts with mating a crossbred ewe to a ram of a third breed. The crossbred ewe lambs are kept as replacements rather than being sold. These three-way cross ewe lambs are then mated to one of the two breeds in the first cross, and the process continues in the same manner. The following table illustrates the system.

Matings in a Three-Way Rotational Cross		
Generation	Ram	Ewes
1	Suffolk	Rideau Arcott x Dorset
2	Rideau Arcott	1/2 Suffolk x 1/4 Rideau Arcott x 1/4 Dorset
3	Dorset	5/8 Rideau Arcott x 2/8 Suffolk x 1/8 Dorset
4	Suffolk	5/8 Dorset x 1/4 Rideau Arcott x 1/8 Suffolk
5	Rideau Arcott	5/8 Suffolk x 1/4 Dorset x 1/8 Rideau Arcott

This method of breeding helps maintain hybrid vigour and eliminates the problem of having to buy in replacements. However, the breeding season can get complex since there is a need for three separate breeding flocks each year for the three different breeds of rams. Accurate record keeping and animal ID are critical with this system.

Roto-Terminal Crossing

This type of breeding program combines three-way crossing and the rotational crossing programs. In this system, a percentage of the Rideau Arcott x Dorset ewes from generation 1 (table above) would be bred in a two-breed rotational system using a Rideau Arcott or Dorset ram. All of the ewe lambs from this breeding would be kept as replacements. The remaining portion of the Rideau Arcott x Dorset ewes would be bred to a terminal sire, such as a Suffolk ram, and these lambs would be marketed.

This strategy produces replacements within the system and retains hybrid vigour in the ewe flock. However, three separate breeding groups are required each year to accommodate the three different breeds of ram, which requires reliable animal ID and record keeping systems

Selecting Breeding Stock

Sources of Replacement Stock:

Carefully considering where to buy new animals will help ensure your new stock is healthy and will help improve the genetic potential of your flock. It is always best to buy breeding stock from breeders who are known for providing productive, healthily animals.

1. *Public auctions:*

Buying breeding stock from auction marts is not generally a good idea. Although prices may be low, there is a good chance that the animals are culls. This means that they may be poor producers and/or have health problems. As well, if they are being sold as culls it is likely that few precautions were taken to avoid their contact with other animals, which means there is an increased risk that they have been exposed to various diseases.

2. *Purebred sales:*

Purebred sales, such as those conducted by breed organizations or the Purebred Sheep Breeders of Ontario, are significantly different from auction marts in that animals are sold specifically as breeding stock. Therefore, the breeder's reputation is at stake if poor quality or diseased animals are sold. An advantage of attending a sheep sale is the opportunity to observe and compare sheep coming from a variety of breeders at one time. The main disadvantage is an increased risk of disease transmission from one flock to another, even if precautions are taken to avoid direct contact between animals.

3. *Private sales:*

Buying through private sales helps to further minimize the risk of purchasing diseased sheep, since the new stock will be taken straight from the breeder's farm to its new flock. Visiting the breeder's farm, will give you an opportunity to discuss flock health history and to look at the parent stock. Producers selling stock privately will often advertise in agricultural publications, such as Ontario Sheep News, Ontario Farmer, Better Farming, etc. The Purebred Sheep Breeders of Ontario or the Canadian Sheep Breeders Association also maintain a list of producers selling stock.

4. *Within flock replacements*

Many sheep producers raise their own replacement stock, particularly ewe lambs. This helps minimize the risk of introducing new diseases, as fewer animals are brought into the flock. However, to introduce new genetics and prevent inbreeding, it is necessary to bring in some new stock (often rams).

5. *Artificial insemination and embryo transfer:*

An increasing number of producers, generally purebred breeders, have a closed flock system. This means that no new animals are brought into the flock and any animals that have left the flock are not re-introduced. As this would eventually cause inbreeding problems, artificial insemination and (to a lesser extent) embryo transfer are used to bring new genetics into the flock. Artificial insemination is also an excellent means of introducing very high quality genetics without having to purchase a top quality ram.

Selection Criteria:

Economically Important Traits

Decisions regarding which stock to buy or which lambs to retain for replacements will depend on how pleased you are with your flock's present level of productivity. Naturally, not all traits have equal economic value. For example, the number of lambs born per ewe, lamb survival, and weaning weights are very important when it comes to profitability, and provide a direct reflection of the quality of your ewes. Post weaning average daily gain is important for producers who retain ownership of the lambs until slaughter. Fleece traits generally have a smaller effect on profitability on most sheep operations in Ontario. If your flock is weak in certain areas of production, try to choose new stock that will improve the overall performance for this trait.

Performance Information

To make genetic improvements efficiently, you must have an idea of your flock's current productivity and be able to compare it with the productivity of stock from other sources. Therefore, record keeping and precise animal identification records are very important for genetic improvement programs. Data such as the type of birth (single, twin, etc.), weaning weight, and postweaning growth rate, are essential in assessing the genetic merit of your sheep. If you market your lambs directly to the packing plant or abattoir, it may be possible to receive carcass trait (rail grade) information. Alternatively, some producers measure indicators of the lean meat yield in live animals using ultrasonography (e.g. backfat and ribeye measurements). As these traits are moderately heritable, selection of breeding stock based on these measurements can result in rapid improvements in lamb quality.

Genetic improvement programs, such as the Sheep Flock Improvement Program, compare data collected on individuals to data measured on relatives and other sheep in the flock. Using genetic connections (common bloodlines) with other flocks allows genetic evaluations to be conducted on a province or industry wide basis, rather than simply doing comparisons within a herd. These evaluations ('estimated progeny differences' or EPD's) are the best genetic tool available to livestock breeders today (see page 75).

When considering how much emphasis to put the performance of past generations, remember that an animal has 50% of its genes in common with each parent, 25% of its genes in common with each grandparent, 12.5% of its genes in common with each great-grandparent, etc. As a result, ancestors that appear many generations back in the pedigree make only a tiny genetic contribution to the present generation.

Health and Conformation

Even animals with remarkable genetic potential must be physically sound and healthy to be considered for breeding stock. Many aspects of the animal's conformation are highly heritable, and therefore, will likely be passed to their lambs. The vast majority of infectious diseases that pop up in otherwise clean flocks originated with purchased breeding stock. Taking time to review a breeder's flock and production history will more than pay off if a persistent and costly disease is avoided. Take the same precautions when purchasing goats, as they are affected by many of the same diseases as sheep.

Flock Health:

Visiting the farm of a breeder, will give you an opportunity to have a first hand look at the flock for possible health problems and to ask about the general management of the flock (i.e. vaccination and deworming schedule, Maedi-Visna status, Ontario Sheep Health Program certification).

When looking at the flock watch carefully for lame sheep, signs of caseous lymphadenitis, sore mouth, excessive coughing, laboured breathing and the general body condition of the flock. Ask about history of abortions in the flock, or if any other outbreaks of disease had occurred in recent years. The conformation and condition of sheep in heavy fleece will be difficult to assess, and may require a 'hand's-on' appraisal.

Individual Animals:

Conformation: The 'ideal' conformation for sheep will vary among breeds. Generally, however, any aspects of the conformation that would affect growth, reproductive performance, or longevity must be considered before using an animal for breeding.

Legs: Animals that have poor legs (e.g. crooked legs, weak pasterns, over at the knee etc.) will tend to have fewer productive years and will need to be culled at an earlier age. Look for sheep that have short, strong pasterns and straight legs. If possible, look at the animal straight on (front and back) and from the sides to detect any deformities. Watching the animal move will provide an indication of stiffness or discomfort.

Body: Generally speaking, look for an animal with a wide chest, smooth shoulders, deep through the heart area, long body (particularly from the last rib to the tail), and has a well-muscled hindquarters.

Type of Birth (single or multiple): Your first choice should always be sheep from a multiple birth.

Age and Teeth:

Purebred animals will have letters tattooed in their ears, indicating the year of birth (see Chapter 4). In the case of a crossbred or other non-registered animals, the appearance of the animal and examination of the teeth will give you a general idea of the age of the animal. Adult sheep have 3 sets of premolars and 3 molars on each side of the mouth on both the top and bottom jaws (24 in all). The front of the lower jaw is equipped with eight incisor teeth. As with all ruminants, sheep do not have teeth on the front of the top jaw, but a hardened pad that intercepts with the bottom teeth. Although changes occur with the molars during growth, it is generally the incisor teeth that are examined to determine the age of live animals. By three weeks of age, lambs will have eight incisor milk teeth. The milk teeth are significantly smaller and narrower than the permanent incisors. With each successive year, a pair of milk teeth is replaced by permanent ones. When the sheep is four years of age, it will have eight permanent incisors. After four years of age it is more difficult to determine the exact age, however, wear and condition of the teeth will be an indication of whether the animal is worth buying. Sheep that have been well cared for and properly fed will often maintain a full mouth until they are seven to nine years of age. In less optimum conditions, sheep may begin to lose their teeth at five to six years of age. Sheep with “broken mouths” (missing teeth) should not be considered as breeding stock. They may have a difficult time maintaining condition, as they will be less able to efficiently utilize feed.

Ewes:

Age: Buying ewes that have lambed before provides an opportunity to gather information on their fertility and the quality of their lambs. However, high quality ewes may be expensive and many people buy replacement ewes as yearlings (ewe lambs). As well, ewes generally reach peak productivity at four to six years of age and buying young ewes will help ensure they have many productive years ahead of them.

Udder: If ewes have lambed previously, check their udders to be sure there are no lumps or hard areas indicating past bouts of mastitis. Look for ewes with udders held close to their bodies. Ewes with low udders are more prone to injury and mastitis. Teat size and shape is also important. Very large teats may create nursing problems for newborn lambs.

Rams:

Age: As you will be relying on one ram to breed upwards of 35 ewes, it is important to have an indication of his past breeding performance. As with ewes, good quality, proven rams will generally be more expensive than unproven yearlings. Ram lambs should not be expected to breed as many ewes as a mature ram.

Fertility: Semen tests, if available, are useful in detecting rams that are sterile or have impaired fertility.

Many producers check the testes size as an indication that the reproductive system is functional.

Check testis for any abnormalities, such as lumps etc, to avoid buying a ram with epididymitis (see Chapter 8). If the ram is very expensive, you may wish to have an official health check performed by a veterinarian.

Wool: Although wool is not often the primary reason for raising sheep, if given the choice select sheep with dense, uniform, high quality fleeces, with no dark fibres to help increase the overall quality of your wool. The appearance of a sheep’s wool also gives some clues regarding its overall health. If the wool looks patchy or rubbed suspect external parasite (keds, lice), or if the wool looks ‘bloomless’ the animal may be suffering from malnutrition, vitamin deficiencies, or a subclinical disease.

After purchase:

Take precautions to reduce stress and the risk of injury while transporting your sheep. Avoid overcrowding animals and check the truck/trailer for any sharp objects. Used ample bedding to prevent animals from slipping. If the vehicle has been used to ship animals from other flocks, be sure it is thoroughly cleaned and disinfected before loading. Once your new animals have arrived on your farm, you may wish to vaccinate them for common diseases and treat for parasites. If you already have sheep on your property, quarantine the new sheep for a few weeks and watch them carefully for any signs of disease or lameness before mixing them with the rest of the flock.

Maintaining a Productive Flock - Culling

Culling animals is essentially a 'de-selection' process, which helps to ensure the economic viability and health of your flock. All of the points you look for when picking breeding stock should be applied on a regular basis to the animals already in your flock. Most producers make culling decisions between weaning and the next breeding season, but you may also notice animals that should be culled at shearing, deworming or foot trimming. An advantage you have during the culling versus selection process is that you should have an extensive history on each animal's lifetime productivity and past health problems. Records are one of the best management tools that you can use to increase the efficiency of your operation. Sample records are shown in Chapter 4. There is also a computer management program called EweBytes that is designed for use on sheep farms (contact OSMA for details).

Culling decisions are based on genetic contribution (lamb performance) and on management considerations (i.e. structural unsoundness, temperament, or poor health). Not every farm will have the same objectives for flock improvement. Therefore, the exact culling criteria may vary widely from farm to farm, and measures of productivity will depend on your end product (e.g. replacement stock or commercial lambs). Although there are many considerations to take into account, some basic factors to keep in mind are listed below.

Ewes

Production:

To determine how productive an individual ewe is, the producer must record information such number of lambs born per exposure to the ram, how many lambs survive to weaning, and lamb weight gain from birth to weaning. If you are trying to breed out of season, breeding and lambing dates will be particularly important. Maintaining on-going records for each ewe will help determine where she fits relative to the flock average.

Health and soundness

Ewes should be evaluated for soundness (feet, legs, and mouth) at least on a yearly basis. The ewe's body condition should be monitored every time she is handled (e.g. during shearing, vaccinating etc.). See the Code of Practice at the back of this binder for details on condition scoring. If a large portion of your flock has poor body condition, review your feeding practices and feed quality. If a small portion of the ewe flock is chronically thin, even with sufficient feed, try to determine the cause before culling. By simply writing these animals off as suffering from old age or just 'poor-doers', you may be missing the signs of a sub-clinical disease in your flock that is dramatically draining your profits. Check the ewe's mouth for lost teeth or other problems that may be interfering with chewing. If there isn't an obvious reason for weight loss, talk to your veterinarian about testing for common wasting diseases, such as Maedi-Visna, Johne's disease, and Caseous Lymphadenitis. This may involve having a postmortem performed at a veterinary pathology lab.

Udder

The soundness of a ewe's udder will be important for her future productivity. Low hanging, pendulous udders may be a problem for lambs finding the teats for the first time and are more prone to injuries, which could lead to mastitis. As well, there is some indication that as an udder breaks down, the blood flow becomes restricted and milk production decreases. Some ewes have very large teats, which become particularly swollen at lambing. This makes it very difficult for newborns to nurse, and the ewe will need to be milked by hand for a time after lambing to help decrease teat size. Ewes should be checked annually for any signs of lumps or hardness of the udder. This indicates that the udder has been injured or that the ewe had mastitis during her last lactation. If both sides of the udder are uniformly hard, consider having the ewe tested for Maedi-Visna (See Chapter 8). 'Hard-bag' mastitis is often the only obvious sign of this disease, which can dramatically reduce milk production and weaning weights.

Lambing complications:

Any complications during gestation or lambing should be recorded for future reference. This may include abortions, prolapses, assistance during lambing, genetic defects in lambs, or weak lambs. Remember that problems such as lambing difficulties due to large lambs or genetic defects may also be traced to the ram.

Maintaining records of which ewes are bred to which rams will help pinpoint problems originating from rams.

Temperament

Ewes that are overly flighty, or that reject or harm their lambs are candidates for culling. Some leniency should be shown to ewes lambing for the first time, as they will often be more settled with subsequent lambings. Ewes that are perpetually difficult to handle (jumping fences or frantic in the handling system), will tend to disturb the entire flock.

Age

Productivity generally declines after ~6 years of age. However, many producers judge ewes on an individual basis, placing more emphasis on their production records and physical soundness than strictly on age. Some ewes will remain highly productive until 10 years of age or more, while others may decline much sooner.

Rams

Although lambs will receive 50% of their genes from the ewe and 50% from the ram, the overall contribution of the ram is much higher, as he will be mated to many ewes each year. Therefore, particular care should be taken in monitoring ram productivity and the type of lambs that are being sired by each ram.

Production:

Maintaining records of the lambing percentages and lambing details of the ewes bred to each ram is important in determining whether to keep the ram and which ram to keep replacement stock from. Difficulties at lambing due to genetic defects or overly large lambs may be traced to the ram. The exact production traits that you are looking for will depend largely on the objectives of your breeding program. For commercial flocks, weight gain from birth to market and lamb carcass traits are important measurements of the ram's genetic merit regarding to lamb feed efficiency and growth. For replacement breeding stock production, the productivity of a ram's daughters may be a factor that you should consider. Obviously, the entire lamb crop from a given ram will not contain lambs of uniform quality. However, if a high percentage of the lambs are not meeting your breeding objectives, replacing the ram should be considered.

Breeding performance

Maintain records regarding when ewes lamb relative to the start of the breeding season (ram turnout). This will provide information on whether the ram is breeding most ewes on the first estrus or later in the season. Monitoring rams during the breeding season (brisket markers) helps to determine breeding behaviour as well (e.g. does the ram stay with one ewe throughout her estrus or will he breed several ewes etc.)

Health and Soundness

As with ewes this is a very important consideration in rams. Especially monitor for any signs of foot or leg problems, as pain or instability may inhibit breeding behaviour. Thin rams should be checked for dental problems or disease.

Testicle size and soundness

Scrotal measurements should be taken a few times during the year. The measurement will be smallest during the spring and largest in the fall. If the measurement does not increase between spring to the fall (and especially if it is smaller) the ram may have fertility problems. Just prior to breeding, the ram should also be examined for any signs of lumps or deformities of the testicles or scrotum, as this may be an indication of injury or brucellosis infection (see Chapter 8). Also check that the sheath and penis appear healthy and are free of infections.

Ontario Sheep Flock Improvement Program

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Introduction

The Sheep Flock Improvement Program (SFIP) is a home testing genetic improvement program designed to assist Ontario purebred and commercial sheep producers in the evaluation of potential breeding stock and to provide a measure of the comparative productivity of ewes in the flock.

The SFIP program provides information that producers can use to improve the genetic merit of their flock and monitor performance, and maintains a large database of the performance records of tested sheep breeds in the province.

The performance of an animal that you see and measure is a result of both the genetics of the animal and the animals' environment. For example, animals with exactly the same genetics will perform differently if they are fed differently and animals that are fed exactly the same will perform differently due to genetics.

The program evaluates the differences between animals caused by genetics. Therefore, groups of animals must be treated or managed the same in the same environment to attempt to see the differences caused by genetics. This is called a contemporary group or a management group. A management group consists of lambs that were born within 30 days of each other, are located in the same place and have received the same care and management.

In order to participate in the program, you must collect some basic information on your animals - sire, dam, foster and lamb identification, lamb birthdate, breed of sire and dam, sex of lamb, born as and raised as. All animals must be individually identified by tag or tattoo. The weight information is optional. Weights can be collected at birth, 50 days (35-65) and 100 days (85-115). Lambing reports are issued after the 50 and 100 day weighings.

The weighing portion of the SFIP program is divided into a supervised and unsupervised program. The program operates exactly the same except that in the case of the supervised program an official weighperson supervises the weighing of the lambs and in the case of the unsupervised program, producers weigh the lambs themselves. In either case, the producer must have available an accurate scale suitable for the weighing of sheep. It is recommended that producers selling breeding stock be enrolled on the supervised program. The supervised program provides increased credibility particularly with people from other countries and when an animal has an exceptionally good weight.

Enrolment

To enroll, write to the Ontario Ministry of Agriculture, Food and Rural Affairs, Agriculture and Rural Division, Sheep Flock Improvement Program, 1 Stone Road, 3rd Floor NE, Guelph, Ontario N1G 4Y2 or call (519) 826-3240 for more information. There is no cost to join the program. There is a fee for supervised weighing which is paid to the Ontario Sheep Marketing Agency (OSMA) district.

Following enrolment, producers receive a package of information including forms for the recording of data.

Reports Available

50 Day Lamb Report

This report calculates adjusted 50 day weights and a ewe index. The 50 day weights are adjusted for age and sex of lamb, age of dam and type of birth and rearing (single, twin, triplet, etc.). This adjustment means that adjusted weights on all lambs in the management group can be compared directly within the management group and within breed. The adjusted 50 day weight is influenced to a major degree by the milking ability of the dam and to a lesser degree by the genetic gaining ability of the lamb itself. All actual weights of lambs are adjusted to a standard age of 50 days and are also adjusted to the equivalent of a ram lamb raised as a single from a mature ewe, four (4) or five (5) years of age.

The ewe index ranks each ewe according to the total adjusted weights of her lambs within the management group and within breed. The ewe index does not take into account any information on the ewes previous lambings; it is only relevant for the one lambing.

Chapter 5: Genetics and Breeding - Sheep Flock Improvement Program

A 50 day Estimated Progeny Difference (EPD) Lamb Report is also produced which lists the EPD values for all lambs in the group. This report is in the same order as the 50 day lamb report and can be lined up with the basic information to provide the average performance information on one line. EPDs are provided for the following traits: birthweight direct and maternal, 50 day gain direct and maternal, number born per lambing and number weaned per lambing.

Also provided at 50 days is an inventory of all the breeding animals in the group, their updated summary information and their updated EPDs.

Using the 50 Day Lamb Reports

The 50 day lamb report is primarily used for culling ewes and initial selection of replacements.

CULLING EWES

The best time for culling ewes is shortly after weaning. Ewes should first be culled for physical soundness e.g., udders, prolapses, etc. An average cull rate is 10-20% of your flock. The inventory summary and EPD report can be used for culling ewes on production. By culling some of the poor producing ewes there is room in the flock to keep genetically superior replacements and increase the average performance of the flock over time. The ewe index will assist with the identification of ewes that are not milking well or looking after lambs poorly.

SELECTING REPLACEMENTS

Use the information available from the 50 day lamb reports as a first step in identifying potential replacements. The reason for making some preliminary selections is that you may wish to start marketing lambs before the 100 day weighing and this way the best replacement animals will not be marketed by accident.

The 50 day report can also be used to monitor flock management of the lambing group. Basic data such as average number born and weaned, mortality and average 50 day adjusted weight can be used to evaluate changes in management techniques and ensure that you are maintaining and hopefully improving the performance of your flock.

100 Day Lamb Report

This report is exactly the same as the 50 day report with 100 day information added. 100 day adjusted weight, average daily gain (ADG), 100 day index and multi-trait index are provided. The 100 day adjusted weight adjusts the actual 100 day weights for the same factors as the 50 day weighings, and as if the lambs were 100 days of age. The adjusted 100 day weight is calculated by adding the 50 day weight gain ($ADG \times 50$) and the adjusted 50 day weight. The average daily gain is the gain from 50 to 100 days adjusted for sex.

INDEXES

The 100 day index ranks the 100 day adjusted weights against the average 100 day adjusted weight for the group. The multi-trait index combines 100 day adjusted weight with a factor for number born and reared and compares this against the average for the group. The indexes produced by SFIP at this time are strictly for the specific lambing compared against the rest of the animals in the group. Over the next couple of years these will be replaced with EPD selection indexes which will be across group and flock.

A 100 day EPD lamb report is also produced which lists the EPD values for all lambs in the group as at 50 days. This report includes updated EPDs for all of the traits provided at 50 days plus an EPD for 100 day gain.

Using the 100 Day Lamb Reports

The 100 day lamb report and lamb EPD report are used for final selection of replacement ewe lambs and selection of flock sires. The lamb report provides the information necessary to easily identify the best gaining animals in the group and the best gaining lambs from multiple births in the group by using the 100 day and multi-trait indexes.

The EPD report ranks animals using all of the available data for each trait from the animal itself and its relatives. This report can be used to monitor your average flock EPDs for each trait so that when

purchasing animals you can ensure that you get a flock improver. Also, it can be used to select animals based on specific traits particularly maternal traits which are difficult to select for only using the index information.

Always try to select a group of animals perhaps double the number needed using the performance information on the animals and their parents. Then go to the barn, sort off the group and select from that group based on physical soundness and appearance. This helps to prevent the selection of a single lamb from a mature ewe that only lambs occasionally.

Other Reports Available from the Program

FLOCK INVENTORY REPORT

This report lists all of the breeding animals in the flock with their average performance information listed on one line. There is also an EPD inventory report which lists the EPDs for all of the breeding animals.

These reports are useful for identifying the best ewes and sires in the flock as well as those ewes that should be culled due to poor performance. It is also a good reference when choosing replacement animals to check age at first lambing, lambing interval, etc. of dams

FLOCK EVALUATION REPORT

This report summarizes the average performance of the flock for a year by breed. The current year is broken down by age of ewe as well as a total average for the flock and the average of the previous year.

The primary function of this report is to monitor flock performance. Particularly in larger flocks it is difficult to notice small changes in things like average lambing interval, number of lambs weaned per ewe and percentage of stillborns. This report compares the current year to the previous year so that these changes can be identified.

EWE AND RAM CERTIFICATES

The ewe certificate shows the pedigree and ewe performance as well as listing each of the ewes' lambs and its performance. The ram certificate shows the pedigree and ram performance as well as the average performance of progeny and the average performance of the lambs of daughters kept from that ram.

Certificates are useful for comparing stud rams and breeding ewes in the flock. Progeny information illustrates which ram sires the most productive ewes in the flock and which ram sires the fastest gaining lambs. Certificates are also useful for passing on performance information to a buyer.

Data Submission

Data can be submitted in a written form by mail or fax or by electronic format. If you have your data on a computer, you may be able to send your data electronically and should inquire with the SFIP office.

Ewebyte is an on-farm computer system for sheep management. Data collected in EweByte can be emailed or sent on disk to the SFIP system and the EPDs sent back. If you are already enrolled on SFIP, your historical data can be downloaded to be put into EweByte or a spreadsheet and sent via email or disk.

Future

The Ontario Record of Performance (ROP) Sheep Advisory Committee is responsible for making recommendations regarding development and continuing the changes needed in the program in Ontario. The committee consists of an elected group of five producers and three employees from the Ontario Ministry of Agriculture, Food and Rural Affairs