

Keeping and Using Flock Performance Records

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Performance records serve as the cornerstone of any good livestock management program. Unfortunately, the task of collecting, maintaining and using performance records is the one area of livestock production in general that gets the least attention. This fact sheet provides ten reasons why all sheep producers need to keep performance records on their flocks. Then, some ways of maintaining and using those records are discussed.

First Things First

All recordkeeping systems begin with animal identification. Each animal in the flock, whether purebred or crossbred, must have a unique and permanent identification (ID) number. This is the first step in recordkeeping and, ultimately, in accurate estimation of genetic merit. “Antonio,” “Betty” and “Lambchop” indicate personalities (or destinations), but they don’t qualify as legitimate animal IDs. Each animal in the flock should be assigned a unique ID *number* at birth. For simplicity, scrapie flock IDs, which all animals (including wethers) must have upon movement from a flock, can be used as individual flock numbers. Or, producers may choose to use their own system of within-flock identification. It’s up to the producer; the main thing is that each animal has its own unique, numerical ID.

In addition to an individual ID, the following information should be recorded for every lamb:

- Sire ID
- Dam ID
- Birth date
- Sex



- Type of birth (for example, single or twin)
- Type of rearing (for example, single or twin)
- Breed or genetic type
- Weaning date
- Date of removal from flock and how disposed (for example, death, sale, slaughter)
- Scrapie identification number (if different from flock ID)

After the basic information is recorded, the type of performance records kept will be unique to a particular sheep enterprise and what is the most economically important in that production situation. Number of lambs born and number of lambs weaned are money traits in most flocks. Recording weights is also important. For example, 30-d weight is the most accurate measure of a ewe’s milking ability. Weaning weight and postweaning average daily gain (ADG) provide the opportunity for more accurate selection for growth traits.

Just getting started?

First, identify ewes already in the flock. It is essential to have ewes consistently identified to ensure that each ewe’s productivity can be calculated over her lifetime in the flock.

Second, determine the ages of ewes in the flock. If unknown, mouth the ewes or estimate as close as possible.

Third, record the breed of the ewes. If unknown, estimate the breed based on appearance. If a ewe appears to be predominantly of one breed, list her as a cross of that breed (for example, White Dorper-cross, Polypay-cross). If breed composition cannot be determined, simply list the ewe as a crossbred. This record is not essential, but it can provide information on how particular breeds perform under a particular management system.

Performance records are generally grouped into six major categories (Table 1).

Table 1. Six major performance record categories

Reproduction
Age at first lambing
Date of lambing
Ease of lambing
Number of lambs born alive
Number of lambs born and reared
Maternal Ability
Birth weight
30-d weight
Weaning weight
Type of rearing (single or multiple)
Attitude of ewe (good or bad mother?)
Ewe weight and body condition score
FAMACHA© score
Growth
Birth weight
30-d weight
Preweaning ADG
Weaning weight
Postweaning weight
Postweaning ADG
Market (slaughter) weight
Wool
Fleece weight (grease or clean)
Staple length
Fiber diameter
Carcass
Carcass weight
Fat depth
Quality grade
Loin eye area
Some measure of percent retail product
Lactation (Dairy Flocks)
Daily milk production
Length of lactation period
Fat and protein composition of milk

Source: *Sheep Production Handbook*, American Sheep Industry Assoc., Inc., 2002 ed., vol.7.

Ten Reasons for Keeping Performance Records

- 1. To develop a flock of sheep that will prosper under a particular management system and provide economic returns on investments.** The extent to which performance records are kept and used will define the level of success of a sheep enterprise. Good records will help producers know where they need to improve and set future goals.
 - 2. To evaluate ewe productivity.** Ewe productivity (number born, percentage weaned and pounds of lamb weaned per ewe) is the single most important factor in determining profitability of a sheep enterprise. Producers can improve their flocks by culling inferior, low-producing ewes and replacing them with ewe lambs from high-producing dams. This method requires records of previous performance.
 - 3. To select superior replacements from high producing ewes.** The goal in selecting replacement ewe lambs is to find healthy breeding ewes that will improve the genetic merit of the flock for traits that are economically important. Which ewe lambs are going to look best at weaning? They are going to be the older, single-born lambs raised by mature ewes. So, without some form of records, a producer may end up keeping singles and culling twins. And, if genetic progress is being made in the flock, it is the lambs out of yearlings and two-year old ewes, if their sires are superior, which should be best.
 - 4. To cull low producers.** Every producer has good intentions when it comes to making management decisions about their flock. They intend for culling to remove unproductive or problem ewes. However, by culling time (usually postweaning or sometimes just before breeding), it is generally not possible to recognize which ewes prolapsed or were bad milkers, and a producer may not remember which ones they were. Also, without records,
- a producer may end up culling a thin ewe that raised a pair of twins while keeping a better-conditioned (fat) ewe that raised a single.
- 5. To evaluate ram performance.** A ram's first job is to settle ewes. His second job is to sire functional and profitable offspring. Requirements for the latter may depend on whether the producer is selecting a terminal sire or a ram for producing replacement females. Without records, how can a producer evaluate a ram's breeding performance? How will the ram's effect on lamb weights be determined?
 - 6. To participate in the National Sheep Improvement Program (NSIP).** Genetic improvement programs such as the NSIP, with data evaluation by Meat and Livestock Australia's LambPlan, base genetic merit or breeding value of an animal for a specific trait on cumulative performance of the individual and relatives across years and flocks. Using genetic connections (common bloodlines) with other flocks allows genetic evaluations to be conducted on a breed-wide basis rather than simply making comparisons within a flock. These estimated breeding values (EBVs) are calculated for reproductive and maternal traits, weight traits, wool traits, carcass traits and parasite resistance. Estimated breeding values are the best genetic tools available to sheep producers today. They are the most accurate way to identify superior genetics for a specific trait.
 - 7. To monitor flock health and level of parasite infection.** The goal of every sheep producer should be to increase productivity of the ewe flock. Even animals with outstanding genetic merit for growth must be physically sound and healthy to be considered for breeding stock. Ewes with consistently high FAMACHA© scores that require repeated drenching for internal parasites must be identified and culled. This activity requires records.

8. **To keep track of genetic types and crosses and show differences in lambs' ability to gain weight.** Performance record-keeping allows sheep producers to compare which crosses or genetic types gain best under their management systems. These records also provide them with data for comparing offspring by different sires and helps identify which lambs should be kept as replacements.
9. **To provide permanent records.** Permanent records allow producers to track improvements in their flocks over time. They also allow producers to see where they still need to make changes in their flocks' genetics.
10. **To supplement visual appraisal and overcome bad memory.** Without records, all a producer will have is visual appraisal and memory to assist him or her in making selection choices and management decisions. The problem with this approach is that visual appraisal is not always a true indicator of an animal's genetic potential as a parent. An animal's performance (phenotype) is the result of its genes (genotype) and the effect of the environment in which it is raised:

Phenotype = Genotype + Environment

And, as noted by numerous others writing on this topic, a short pencil is more dependable than a long memory.

Production records are essential in evaluating performance of the ewe flock and aiding in making selection decisions. With accurate records, evaluations can be made on the reproductive, productive and financial status of the ewe flock. Then, producers can implement management and selection decisions to make improvements where necessary.

No matter why a producer chooses to keep performance records, there is no question that a good record-keeping system can elevate his or her manage-



ment ability to a level much higher than those producers who operate without performance information. In the end, the decision is one of operating a sheep enterprise as the business it is and protecting that business ... and way of life.

The Next Step

The next step is taking the information (weights, dates, observations and comments) that is collected on a day-to-day basis and putting it into a form that can be maintained and later used for making selection decisions.

Maintaining Performance Records

A recordkeeping system may begin with a clipboard that hangs in the barn (pencil attached) or with a small notebook that the producer carries along when working sheep. Information is recorded at lambing time, and lamb weights are added as lambs grow. Notations may be made as to a ewe's mothering ability, or lack thereof, as well as any other information that may be useful at culling time.

At some point, however, it is necessary to transfer "barn records" to a more permanent location. This transfer will assure that records will not be lost should the clipboard be left too close to a hungry sheep or the notebook is misplaced. Permanent records may be kept in a simple three-ring binder or on a set of index cards in the office. For the ewe flock, 3 × 5-inch index cards are simple and easy to use. A card is used for each ewe. Data from "barn sheets" or "barn notebook" are transferred to the card. Each ewe's record is updated after each lambing season. Data on the cards will be the primary information for keeping or culling ewes. As new ewes enter the flock, new cards are made. Computer-savvy producers may choose to save performance records electronically in either a spreadsheet (Excel®) or via a computer software program, such as FlockMaster®. A number of other commercial sheep records programs are available. Also, producers may choose to participate in NSIP. The latter is the preferable choice for producers with purebred flocks.

Using Performance Records

Ultimately, performance records are collected and maintained so they can be used to make management and selection decisions that will increase the economic viability of the sheep enterprise (**reason 1**, listed earlier). An initial step in the process of using performance records is to adjust them for known environmental and management effects. This adjustment allows for fair comparisons among sheep in the flock.

Adjusted Weaning (and Prewearing) Weights

Unadjusted or *actual* weights can be misleading. A lamb that is heavier at weaning may be better than one that is lighter, but actual weights don't tell the whole story. For example, did the lambs weigh the same at birth? Are they the same age at weaning? Are they both out of mature ewes? Are they the same sex? Are they singles or twins? Older lambs are expected to be heavier at weaning than younger lambs. Mature ewes usually produce lambs that perform better than lambs from younger ewes. Males are generally heavier than females, and singles typically outperform twins. Thus, to be used fairly in the selection process, all lamb weights need to be adjusted to a common basis.

Table 2. Weaning (and preweaning) weight adjustment factors derived from NSIP data

Item	Class	Adjustment Factors*
Ewe age	1 yr	1.14
	2 yr	1.08
	3-6 yr	1.00
	>3 yr	1.05
Lamb sex	Ram	0.91
	Wether	0.97
	Ewe	1.00
Type of birth and rearing	Single/Single	1.00
	Single/Twin	1.17
	Twin/Single	1.11
	Twin/Twin	1.21
	Triplet/Single	1.19
	Triplet/Twin	1.29
	Triplet/Triplet	1.36

*Factors not breed specific (generic).

Source: *Sheep Production Handbook*, American Sheep Industry Assoc., Inc., 2002 ed., vol. 7.

Calculating Adjusted Weights

Consider the following two lambs:

	Lamb 1	Lamb 2
Actual Weaning Weight (WW), lb	70	52
Birth Weight (BW), lb	14	8
Weaning Age, days	84	55
Prewearing Average Daily Gain (ADG)*	0.67	0.80
Ewe age, yr	2	4
Lamb sex	Ewe	Ewe
Type of birth and rearing	Single/Single	Twin/Twin

*Prewearing ADG = (Actual WW - BW) ÷ Weaning Age

Step 1: Adjust weaning weights for lamb age. Assuming lambs in this flock are weaned at an average age of 60 days, the weaning weights below will be adjusted to a standard age of 60 days.

Lamb 1

$$\begin{aligned} \text{Age-adjusted WW} &= \text{Prewearing ADG} \times \text{Standard Age} + \text{BW} \\ &= 0.67 \times 60 + 14 \\ &= 54 \text{ lb} \end{aligned}$$

Lamb 2

$$\begin{aligned} \text{Age-adjusted WW} &= \text{Prewearing ADG} \times \text{Standard Age} + \text{BW} \\ &= 0.80 \times 60 + 8 \\ &= 56 \text{ lb} \end{aligned}$$

Notes:

If the birth weight is not known, use the following formula instead:

$$\text{Age-adjusted WW} = (\text{Actual WW} \div \text{Weaning Age}) \times \text{Standard Age}$$

Weights of lambs weaned at average ages other than the standard 60, 90 or 120 days should be adjusted to the nearest standard age. For example, weights of lambs weaned at an average age of 70 days would be adjusted to a standard age of 60 days.

Step 2: Make final adjustments for the factors (f) listed in Table 2.

Lamb 1

$$\begin{aligned} \text{Adjusted WW} &= \text{Age-adjusted WW} \times \text{Ewe Age (f)} \times \text{Lamb Sex (f)} \times \text{Birth/Rearing (f)} \\ &= 54 \times 1.08 \times 1.00 \times 1.00 \\ &= 58 \text{ lb} \end{aligned}$$

Lamb 2

$$\begin{aligned} \text{Adjusted WW} &= \text{Age-adjusted WW} \times \text{Ewe Age (f)} \times \text{Lamb Sex (f)} \times \text{Birth/Rearing (f)} \\ &= 56 \times 1.00 \times 1.00 \times 1.21 \\ &= 68 \text{ lb} \end{aligned}$$

If actual weaning weights are used as the selection criteria, lamb 1 will be favored in the selection program. However, lamb 2 has superior performance, as shown by the adjusted weaning weights, and is the genetically superior choice.

Ranking Ewes

Adjusted records should also be used when ranking ewes based on productivity (pounds of lamb weaned). For example, suppose the following ewes are to be compared:

	Ewe 1		Ewe 2	
	2	4	4	4
Ewe age, yr				
Type of lamb birth and rearing	Twin	Twin	Twin	Twin
Sex of lambs	Ewe	Ewe	Ram	Ram
Lamb birth weights, lb	8	10	9	12
Lamb weaning weights, lb	45	49	60	65
Lamb age at weaning, days	55	55	75	75

Using actual weights, ewe 1 weaned 94 lb (45 + 49) of lamb while ewe 2 weaned 125 lb (60 + 65) of lamb and appears to be the higher producer. However, adjusted weaning weights are 63 and 69 lb for the lambs out of ewe 1 and 55 and 60 lb for the lambs out of ewe 2. Using these adjusted weights, pounds of lamb weaned are 132 lb (63 + 69) and 115 lb (55 + 60), respectively. Now, ewe 1 ranks higher than ewe 2 in terms of productivity.

Contemporary Groups

A **contemporary group** is defined as *a uniformly managed group of animals of similar genetic type, age and sex*. Because the environmental component of an animal's phenotype is not transmitted from parent to offspring, it should be separated from the animal's genotype. Some environmental factors are known and can be accounted for using adjustment factors (as just described for ewe age, lamb sex and type of birth and rearing). However, other factors such as health, weather, nutrition and management may affect performance but cannot be accounted for very easily. These factors are referred to as unknown sources of environmental variation. The best method to account for unknown environmental effects is to compare animals within a contemporary group that are subjected to the same management and environment. The contemporary group concept as a means of adjusting for unknown nongenetic effects is basic to genetic improvement.

Trait Ratios

Participating in NSIP/LambPlan allows purebred producers to get the most genetic information from their records. If a producer is not enrolled in this program, he or she might want to use **trait**

ratios as a means of identifying superior individuals in the flock. This is a useful and easy calculation:

Trait ratio = (individual's record for a trait ÷ contemporary group average) × 100

A trait ratio compares the performance of an individual to its contemporaries. An animal that is average for a given trait has a ratio of 100. An animal that is superior for the trait will have a ratio greater than 100 and a below average animal will have a ratio less than 100. Ratios can be ranked from top to bottom. An animal's superiority or inferiority relative to its contemporaries can be quickly identified. Animals with ratios above the average (100) are candidates for replacement.

By comparing performance of each individual animal in a contemporary group (animals of the same age and sex) to the average of its contemporaries, a more precise estimate of the genetic merit can be obtained than by using individual performance. For example, consider a ram lamb whose adjusted weaning weight is 92 lb while the average adjusted weaning weight of his contemporaries is 85. His ratio would be $(92/85) \times 100 = 108$. The average ratio is always 100. Therefore, this lamb is 8 percent heavier than his contemporaries. Another ram in the same contemporary group has an ad-

justed weaning weight of 75 lb. His ratio would be 88, meaning he is 12 percent lighter than his contemporaries. Ratios based on adjusted records should only be used to compare animals within a contemporary group.

Ratios can also be used to rank ewes on productivity. The two ewes that were compared previously weaned 132 and 115 pounds of lamb, respectively, after adjusting for known environmental effects. If the flock average is 125 lb, these two ewes have ewe productivity ratios of 106 and 92, respectively. We now know how these two ewes rank in the flock. The first ewe is 6 percent above average and is a "keeper"; the second ewe is 8 percent below average and is a candidate for culling.

The Last Word

Performance records can be a good management tool, helping producers make educated management decisions that will increase the efficiency and productivity of their flocks. Equally important, performance records can be good diagnostic tools to help producers identify potential problems within their flocks. Recordkeeping does not have to be a complicated or time-consuming process. To start keeping records, all it takes is a sharp pencil, some paper and the discipline to get into the routine.

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