



1

BUILDING AND REBUILDING

There is a period before the breeding season when the flock has a quiet time. The lambs have been weaned and are thriving on solid food. They run and cavort in frenzied packs, then eat, then rest, then play again, as if thoroughly enjoying being lambs. The rams are together in their own pasture in a male-only group. The ewes are mostly pretty thin and worn out from the demands of motherhood, and they are eager to eat and put back the weight that was lost during lactation. The experienced shepherd admires the really skinny ones in the bunch because they are usually the ones that are the best milkers and raise the biggest, healthiest lambs. Ewes that come out of lactation in good flesh are viewed with suspicion. They weren't doing their job or they would be as thin as the ones that gave of themselves.

The flock will change before the rams are put back with the ewes. The best ewes will rebuild their bodies. Some of the older ones will be culled from the group. Some ewe lambs—the ones with the right ancestors, or the fast growers, the twins and triplets, and others who are special for some reason—will be saved to join the flock as replacements. They are the new members of the

club who will be given a chance to prove themselves, and who may become permanent members. The flock is built and rebuilt in this way every year, evolving little by little toward a goal of perfection that exists in the shepherd's mind.

Some would-be sheep raisers will buy their first sheep at this time — usually summer — when older ewes are rebuilding and ewe lambs are growing to sexual maturity. Each shepherd will have different reasons and different goals.

BUYING SHEEP

Selecting a Breed

When I first thought about writing this book I told myself that one thing I would leave out was advice on buying sheep, since each buyer's needs are unique. I've since changed my mind, because I thought back to when we bought our first sheep and decided that we could have used some suggestions, even if we didn't follow them, simply because suggestions get one thinking.

Before buying sheep, consider why you want them at all. Do you want to raise fast-growing lambs for a fat lamb market, produce specialty wool for handspinners, or have a few sheep to trim the lawns and keep brush under control, for pets, for 4-H projects, or for show stock? If you are sufficiently organized to know what you want, then you are probably familiar with sheep to some extent. Otherwise, start looking at sheep in your area and talk to sheep raisers at fairs and on their farms. Write to the secretaries of the various breed associations (see appendix 6) for literature that describes the various breeds. Read about different breeds and crossbreeds in magazines and books. You will feel overwhelmed with information at first, but after a bit you'll begin to form your own ideas.

A few suggestions might help you decide on a breed. If you are going to show sheep, or if youngsters in the family want to do so, then you should visit shows and see what classes of sheep are shown in your area. For example, you wouldn't want to raise Lincolns or Cotswolds if there were no long-wooled class at local and state fairs. You wouldn't want black or colored sheep if a whites-only rule prevented them from competing. Talk to the winners and the judges to get their views. You'll find the winners only too eager to sell you some high-priced stock, but keep your wallet in your pocket until you have

accumulated some knowledge. If you choose Suffolks, be sure to ask the breeder about “spider lambs,” which are lambs with unusually long legs—who generally do not survive. The spider gene appeared in some show flocks when breeders bred for tallness. John Beever, USDA research fellow at the University of Illinois, developed a blood test for the spider gene.

If you want to raise specialty-wool sheep, talk with spinners, weavers, and other fiber artists, and learn how to spin so that you can understand the needs of a handspinner. Also, ask yourself if you are willing to do the marketing of such wools: There are no established channels for selling handspinning fleeces unless you can contract with a shop to take your entire production. Are you prepared to maintain a standard of wool cleanliness that is virtually impossible for the average wool producer but essential to the handspinners’ market?

Perhaps you just want a few sheep around as pets and decorative lawn mowers. The Cheviot breed was supposedly developed to look attractive on the lawns of the queen’s summer castle, Balmoral, in Scotland. You may agree with this royal taste. We have had people buy black sheep from us for pets just because they wanted something a bit unusual. If you don’t want to bother with breeding and lambing, you might even consider getting a few attractive wethers to keep around. They usually have good dispositions and make fine pets.

If you are going to try to raise sheep for a profit, then your choice automatically becomes a little more limited. You then want a breed that produces a lamb that is acceptable to lamb buyers and packers so you can command a top market price. You also want a breed that gives lambs that reach market weight quickly on a minimum amount of feed. Not only that, you want a breed that produces plenty of lambs by either having lots of multiple births or by breeding more often than once a year, or both.

Good carcass traits are found in most major breeds, though you may find that your local buyers have strong preferences and prejudices. Some breeds, Finnsheep and Karakul, for example, may not have good carcass conformation. In contrast, Columbias, Hampshires, and Suffolks are common meat breeds in all parts of the country. Many shepherds select a type of ewe for a given set of traits and choose a ram of a meat or mutton breed to sire market lambs.

Fast growth is encouraged by a number of management factors, but genetics is also significant. Suffolks are the acknowledged champions of growth rate, with Columbias a close second. Other breeds generally trail somewhat,

at least insofar as purebreds are concerned. Characteristics such as fast growth are usually traceable to individual sheep, and the selection of replacements on the basis of growth rate can produce crossbreeds that equal or exceed the purebreds. Even with crossbred sheep, however, some of the purebred characteristics come through. In a group of mutton-type crosses with one-quarter Finn blood, we found that the growthiness of the Suffolk and Oxford crosses was better than that of the Hampshire crosses when taken as a group. One could, of course, choose other individuals and reverse the order.

Considering only such factors as lambing percentage and rate of gain may lead to an incorrect conclusion as to which breeds are the most productive. What matters is the number of pounds of lamb that reaches the market from each ewe. A breed that gives lots of twins and triplets is valuable only if they all live to be marketed. In the same way, a fast-growing lamb is of value only if it survives to shipping weight. G. E. Dickerson and others reported in 1981 on a study made at the U.S. Meat Animal Research Center in Clay Center, Nebraska, that bears on this question. They compared lamb production from sires of the three blackfaced breeds: Suffolk, Hampshire, and Oxford. The lambs sired by Suffolks excelled in rate of growth and in boned cuts per lamb, as might have been expected. However, the survivability of Suffolk-sired lambs was low, and the Oxford sires actually produced more pounds of boneless cuts per ewe than either Suffolk or Hampshire. In another comparison, they looked at performance of crossbred ewes by breed of dam (all the ewes were half Finn and half some other breed). In terms of lambing percentage the Suffolk-cross ewes were tops, but in terms of lambs weaned the Dorset, Targhee, and Rambouillet crosses beat the Suffolk crosses, with Corriedale and Hampshire crosses bringing up the rear.

A comparison of ewe breeds made at the Colby, Kansas, Agriculture Experiment Station by Frank Schwulst in 1982 sheds some light on the Suffolk survivability question. Purebred Rambouillet, Rambouillet \times Dorset, and Rambouillet \times Suffolk ewes were bred to Suffolk sires. Table 1 summarizes the results for fall 1980 lamb crops.

If you think these overall lambing percentages are low, remember that these are fall lambs, born out of the regular lambing season. The lambs with the most Suffolk breeding were the ones with the lowest survivability. In spite of the higher average market weight of the lambs from the Suffolk-cross ewes, the better livability of those from the purebred Rambouillets gave them a full 25 percent advantage in terms of weight of lambs actually marketed.

Table 1 Survivability of Suffolk-Sired Lambs

Ewe breed	Rambouillet	Rambouillet × Dorset	Rambouillet × Suffolk
Lambs born weaned (%)	91	88	80
Lambs born marketed (%)	89	88	72
Avg. market weight (lb.)	107	108	110
Lbs. lamb mkt'd/ewe lambing	114	104	91

Because of studies such as these, and based on our own experience comparing lambs sired by Suffolk with those sired by Lincoln and Finn × Lincoln rams, we stopped using Suffolk as a sire breed. The lambs just don't survive as well. On the other hand, just to confuse things, we have a ewe who is three-quarters Suffolk × one-quarter Finn and strictly outstanding. She and her daughters, and even her granddaughters, are among the most productive ewes in our flock, which points up the importance of individual traits as a factor. The point that I want to make is that you shouldn't be influenced too much by advertising that emphasizes a single factor, such as rate of growth, because there is more to the story than that.

For multiple births the Finnish Landrace, or Finnsheep, reigns. The closely related Romanov even exceeds Finns in some settings, with the disadvantage that the wool has no commercial value. Purebred Finn and Romanov ewes produce litters of a half dozen and more, but their carcass and growth characteristics are mediocre at best. Crossbred ewes of about one-half to one-quarter Finn are a delightful compromise, however, offering the best qualities of both breeds. Such crosses will give lamb crops averaging 200 percent and up (in other words, there is an average of two or more lambs per ewe over the whole flock) and will still produce lambs that grow rapidly and provide a good meat-type carcass. Some sheep raisers criticize Finn crosses, and packers complain about poor carcass quality, but a grader from a large livestock cooperative didn't realize that some of our quarter-Finn lambs had any Finn in them. One sheep raiser comments that the people who criticize Finns are the ones who have never tried them. This is not to say that other breeds and crosses cannot compete with the Finn crosses in prolificacy, but they do so only after many generations of selection and culling. If you are fortunate enough to be able to buy sheep from such a high-production flock, that's fine,

but if not, the introduction of some Finn blood is the quick and easy route to a higher percentage of lambs born per ewe.

Finn crosses have the added advantage of producing unusually vigorous lambs. Lambs with one-quarter-or-more Finn blood are on their feet and sucking within moments after birth, and seem to just get down to the business of being healthy and aggressive lambs without hesitation. They also reach sexual maturity very early, which is an important factor if one wishes to breed ewes as lambs. I should add that this can be a nuisance if you have uncastrated ram lambs mixed with ewe lambs, because some of the ewes will get bred at four to six months, so the producer has to get the rams out of the lamb flock early.

A different, and equally useful, route to prolificacy is the Booroola gene, which was discovered in a Merino flock in Australia. The Booroola gene can be bred into any sheep breed. With Finns and Romanovs the prolificacy is related to a whole groups of genes, so the effect is tied to the amount of Finn or Romanov heritage in a ewe. In contrast, the Booroola prolificacy is tied to a single pair of genes.

A sheep can have two copies of the Booroola gene (BB), one copy (B+), or none (++). On average a BB ewe will have approximately 1.5 lambs more than the non-Booroola breed; B+ ewes will have .8 to 1.1 lambs more than the non-Booroola breed. A flock of BB ewes would produce too many lambs to be practical in most settings, but a flock of B+ ewes would be almost ideal for a farm flock. To get that ideal flock one need only breed all ++ (no Booroola gene) ewes to a BB ram. Then all the offspring would be B+. What next, though?

Here's how Janet McNally manages her Tamarack Booroola Dorset flock in Minnesota. The B+ ewes are bred to purebred Dorset rams. In that case, on average, 50 percent of the lambs would be expected to be B+. Then Janet retains twice as many ewe lambs as she needs for replacements, and they are bred. Next lambing, those who produce twins are assumed to be B+ ewes and those who produce single lambs are assumed to be ++ ewes and culled. The procedure is not 100 percent accurate, but on average 90 percent of the retained ewes will really be B+ ewes. DNA testing can be used to produce precise analysis of the ewe's B-gene status, but the cost is not justified in most instances.

In Janet's own words: "The nifty thing about this gene is it can be introduced into any breed or type of sheep, and after back crossing with your fa-



Here is a Tamarack Farm mostly Dorset ewe (who has one copy of the Booroola gene) with her triplets. Email tamarack@pinenet.com for information.

vorite breed for a number of generations, you will now have a sheep that exhibits the traits of your favorite breed, but now produces nearly one more lamb than it did before.”

Out-of-season breeding honors go to the Dorset and its crosses, with Rambouillets and Merinos coming in second. Some of the newer breeds such as Morlam and Polypay are also highly touted in this arena. Management schemes that include year-round breeding make better use of facilities and labor and even out the work load on a sheep farm. Year-round lambing is especially well suited to flocks kept in confinement. You should be choosy about where you get Dorsets: there has been some introduction of genetics from other white-faced breeds into the “purebred” Dorsets, which diminishes their ability to come into heat in off-season times.

For the person who is completely new to sheep and can afford to experiment a bit, I would recommend buying a few reasonably priced crossbred ewes of known ancestry to learn from. It is foolish for the novice to invest a

lot of money in registered stock. In any case, crossbred ewes generally perform better on all counts than purebreds; this has been demonstrated by the long experience of producers and has been confirmed scientifically by J. A. Vesely's research at Agriculture Canada's Manyberries Research Substation in Alberta. Crossbred vigor (or heterosis) is a fact, and crossbred ewes will cost less.

As to age of the ewes you purchase, I suggest that you get ewes who have already lambed at least once but are not over four or five years old. Lambs are pretty wild and skittish and tough for the beginner to handle, especially at lambing. At the other extreme, an old ewe with half her teeth gone needs the experience in handling that the new shepherd does not have. A healthy two- or three-year-old is an ideal beginner's ewe.

Buying Ewes

Many people buy their first sheep at a local auction, have big problems with them, and are soured on sheep forever. Most stock at local auctions are the culls from flocks and should go into the freezer rather than into a breeding flock. You are much better off buying from an ethical breeder. Expect to pay about 150 to 200 percent of what a 105-pound market lamb is worth for a quality crossbred ewe of one to three years old. You may find bargains if you nose around a bit. For example, we cull good ewes from our flock every year if they don't produce twins. They are otherwise excellent sheep, and we sell them at a bargain to producers who understand why we are getting rid of them.

If you don't want to deal with a ram at first, bred ewes are available in the fall in most parts of the country. Usually the seller knows the parentage, at least to some degree, and some will even guarantee that the ewes are bred. If you know and trust the seller, this is a good way to start because supporting a ram for a small flock is poor economy. Be sure the seller really knows the time of breeding so you can plan for lambing.

When buying sheep, your best bet is to take an experienced person with you. Offer to pay for the help, as you would for any business consulting. While you are at it, consider that person's advice on what kind of sheep to start with.

Lacking an experienced person's advice, the novice can check quite a few factors with confidence. The sheep should look alert and healthy. Avoid ewes with runny noses, inflamed eyes, untrimmed hooves, scruffy wool, swayed

backs, or other obvious defects. Check the mouths. A sheep should have all eight incisors (the front teeth) on its lower jaw. These incisors should meet the pad on the upper jaw squarely, not touching behind it or hanging out in front. The molars should not be worn down to the gums or decayed. The age of a young sheep can be judged from the incisors. A lamb has a full set of small teeth. At a year, the center two are replaced by larger teeth. Then each year another pair of the permanent teeth is added, one on each side of the previous ones, until at age four the ewe has a full set of large permanent incisors. After that time the gums recede, and teeth are lost and broken as the sheep ages.

You might want to have a veterinarian look over the prospective flock members, although the cost might be more than you could justify. If you do use a veterinarian's services, consider having the vet draw blood samples (5 cc) from each ewe, and have them tested for a disease called Ovine Progressive Pneumonia (OPP), unless the source flock is certified OPP free. The preferred test is called a PCR test and is done at Colorado State University (questions should be directed to Jane Carman at 970-491-1281 or jcarman@vth.colostate.edu) as well as some other locations. This disease has no symptoms in young ewes but will seriously affect the flock as the sheep get older. This is a useful precaution in order to avoid starting off a new flock with one or more carriers; there is no known treatment for the disease.

Another chronic disease in sheep is scrapie. It is a slow-developing, wasting disease that is difficult to diagnose. The USDA's Animal and Plant Health Inspection Service (APHIS) is attempting to eliminate scrapie in the United States. This will involve inspection and certification of flocks as scrapie free, with the hope of eventually eliminating the disease. The program is in its infancy but will become more important. A link to keep informed is at www.aphis.usda.gov/oa/pubs/fsscrapie.html. Also check with your state veterinarian to see if a program exists in your state. Eventually, having a certified scrapie-free flock will increase the market value of breeding stock from your flock. There is a genetic test for determining how susceptible a sheep is to scrapie. Check with your veterinarian. Tests for the presence of the disease are in the works too. All else being equal, if you are able to buy sheep from a certified scrapie-free flock, go for it.

Check the udder to be sure it has two teats. Also, feel the bag with your hand and fingertips to see if there are lumps or hard regions. The whole bag should feel soft and pliable. The ewe's body should be free of lumps on the

skin. Be sure she isn't blind. Check the feet for any evidence of foot rot or other lameness; any soft or odorous parts should be viewed with suspicion. Listen to the breathing by putting your ear to the sheep's nose to see that the lungs sound quiet, not rattly. When you buy the sheep, get a guarantee of sound health if you can. (Some sellers of bred ewes will offer to replace any that do not lamb, and others may offer to replace a ram that proves to be infertile. However, as a general rule, it is "buyer beware.")

The most reliable source of breeding ewes is a sheep raiser who has been around for a long time and has built a reputation for honesty and quality stock. That person may be hard to find, but do some asking. Breeders who advertise consistently in trade publications will be careful to protect their reputations and are more likely to be trustworthy. One good place to buy sheep is at a regional sale held by an association or other group. The sale managers usually have a screening program for both the sellers and their sheep in order to protect the reputation of the sale; this gives the buyer an extra measure of protection too.

Buying a Ram

When buying a ram check the same areas you would with a ewe, except that in lieu of feeling the udder, feel the testicles. They should feel firm but not hard, and there should be no prominent lumps at the bottom. The testicles should be large, and both of them should have descended into the scrotum.

If you are buying a ram lamb, take along a tape measure. A study reported in *Iowa Veterinary News* showed that at an age of 150 to 160 days, infertile rams had a scrotal circumference of 25 cm (10 in.) or less. Fertile rams had scrotums with a circumference of 32 cm (12.5 in.) or more at the widest part. Scrotal size is no guarantee of fertility, but it is an important indication.

The ram should have a masculine appearance, at least to some extent. A ram with prominent, muscular shoulders will look very masculine but may also produce offspring that are built like him, and the packers want lambs with small shoulders and big rear legs. Get a ram with large rear legs and a wide loin. Put your outspread hand across the loin. With a yearling or older ram it should be as wide as the distance between your thumb and middle fingertip (about seven to eight inches).

If you can afford it, get a ram from a line that has the qualities you want. That means buying from a breeder who keeps good records and has a reputation for producing quality rams. For most shepherds it does *not* mean buying

a fancy registered animal from a purebreeder who is big on the show circuit. Excellent rams can be had for a far more acceptable price from commercial sheep breeders who raise their own replacement rams than from the breeder with the \$20,000 ram named Mr. Wonderful. If you do buy a purebred ram, ask if the flock is enrolled in the National Sheep Improvement Program (NSIP). See www.nsip.org for up-to-date information. Don't overlook crossbred rams in your searching. The hybrid vigor effect is not quite as strong as the so-called first cross, but a crossbred ram on a crossbred ewe has a slight advantage over the purebred ram, all else being equal.

Choose rams carefully, because, unless you are shipping all lambs to market, the genetics of the ram will persist in your flock for a long time in the replacement ewes you retain. Some producers use one ram for market lambs and a different one for replacement ewes.

Try to get a guarantee of fertility from the seller, but don't really expect it. You can buy a yearling that was used as a lamb, although that doesn't really assure that he will still be fertile as a yearling. We always use retained ram lambs on a handful of ewes their first year so that we or a prospective buyer have some idea of their potential. Also, one doesn't have any way of knowing how many ewes a ram can service until he has been tried, although large testicles are strongly suggestive of a high sperm count and sperm supply. Many breeders use about one ram for every 20 to 25 ewes. One year we used a Finn × Lincoln ram on 90 ewes and he settled every one; the ewes produced more than a 200 percent lamb crop, which suggested that his sperm count was high all the way through.

All new stock should be quarantined for at least a month if possible. Be alert for any signs of foot rot or other disease. It would not be out of order to vaccinate for vibriosis, sore mouth, or other diseases of local importance. Don't introduce a carrier into your flock if you can help it. Treat all new stock for internal and external parasites (keds, lice) before putting them with the main flock.

NUTRITION

For sheep raisers who operate on a conventional schedule of once-a-year lambing in late winter or early spring, the rebuilding time is an interval when pastures are used as the principal or sole source of feed for the ewes and rams.



Nothing like a midday snooze with a few friends to make a hot summer day tolerable.

Actively growing grass and other pasture plants are a highly palatable and nutritious feed for sheep, and they'll begin to restore their depleted bodies in short order. In fact, the shepherd should be alert to the possibility that some of the ewes will become overweight during the rebuilding time. Once they are at optimum weight, they require the equivalent of only about two and a half pounds of hay per day to maintain that weight. The shepherd's job is first to make sure that gains are being made and then to guard against some of the flock getting too fat.

Pasture Feeding

There are a number of ways to adjust the amount of feed to a flock on pasture. The easiest way is to have the size of the flock and the size and productivity of the pasture matched in such a way that there is a stable equilibrium between plant growth and sheep grazing. This approach is favored by many, and some studies support the idea that pasture utilization is most efficient when the sheep are just left alone to eat at will. In less than ideal situations the flock may become overfat and underutilize the pasture; or, conversely, they can be left short of feed and may destructively overgraze.

Another way to use pastures is to control the amount of time that the

sheep are allowed access for feeding. Some estimates indicate that the carrying capacity of a pasture can be doubled by this method. This gain in efficiency of utilization is made at the cost of the labor required to move the flock to and from their active pasture and at the expense of providing a drylot area for the sheep when they are not feeding. In addition, a large share of the manure and urine accumulates in the yard, where it is a nuisance, instead of on the pastures, where it is needed. The disadvantages notwithstanding, I like the limited-access approach. The shepherd has a daily opportunity to observe the sheep, and they remain accustomed to being handled and moved about. They also appear to utilize the varied flora of the pasture in a much less wasteful way. Every shepherd will notice that sheep prefer to feed on the part of the pasture where they have been feeding previously, ignoring other parts. They do so because they find actively growing plants more palatable than mature ones. The sheep will ignore the mature grasses and herbs and clip a few areas until they graze them almost out of existence. Overgrazing is avoided when they are given only a few hours a day in the pasture. They learn very quickly that they have a very short time to fill their rumens, and they stop being picky. They eat everything in sight as fast as they can put it away. As a result, the pasture gets grazed down almost everywhere more or less equally. The sheep fill up in a short time and are readily moved to a lounging area.

The move to a drylot is made especially easy if no water or salt is provided in the pasture. The sheep will know that plenty of fresh water is waiting for them and will need little urging to leave the pasture, especially in the heat of a summer day. Provide some shade for them, and they'll be content in their yard until grazing time the next day.

Many producers have found that they can not only double their pasture's carrying capacity but even take a cutting of hay from a pasture before turning the sheep in. Removing a hay crop not only makes good economic sense but also, if done early in the season, gets rid of old, mature plants that the sheep would ignore if given the choice.

Sheep and cattle can also be grazed together. That practice often increases utilization because sheep and cattle eat different plants. Studies have shown increases of 10 to 30 percent in pasture output with mixed species grazing.

If the flock is subdivided into groups that require different amounts of food, the limited-access method permits the shepherd to put out each group at different times for different lengths of time. Alternately, supplemental hay can be provided in a drylot for the sheep that require it.

If the rebuilding time does not coincide with pasture season, the ewes are easily maintained on hay or silage. About two and one-half pounds of average quality hay (10 percent protein) will sustain an average-sized (150 lb.) ewe. If rapid rebreeding is to be attempted, feed can be increased to give a steady weight gain until the breeding condition is reached. In this case, the feeding of grain or a pelleted supplement might be considered. A ewe can eat only at most 3 to 3.5 percent of her body weight in hay each day, so potential gains are limited by her filling up. A concentrated feed allows her to get more nutrients into her body and to recover from lactation more quickly.

Grain Feeding

In summer, the sheep raiser should take note of grain prices and crop prospects. Prices fluctuate over a fairly wide range, and the shepherd should try to buy cheaply. Prices are reported in newspapers or on radio or TV in rural areas. You'll find that the price you have to pay a neighbor or the local elevator or feed store will not be the one listed in the reports because of a cost differential reflecting the expense of transportation or lack thereof. In grain-producing regions the prices will be generally lower than the quotes from terminals.

Consideration should also be given to income tax angles because it might be advantageous to buy grain before the end of a tax year in order to balance income against the expense of the grain. You need not have on-farm storage to do that in many areas. You can buy grain and store it at the local grain elevator for a fee. If the elevator has excess storage capacity, it will probably cost you less to store it there than to build your own facilities. Once again, everyone has to do some figuring, using local prices. You don't actually have to take any grain to the elevator for storage. You simply buy grain from the elevator when you think the price is right and pick it up as needed. Needless to say, any grain stored at an elevator is mixed with other grain of the same type. You won't get your own grain back when you pick up a truckload a few months later, so if your grain is a special kind or is grown in an uncommon way—without the use of chemicals, for example—you'll have to store it elsewhere to be sure of getting the same grain back. This is especially important for sheep raisers who are trying to sell organically produced lambs, because they must be able to prove that the lambs' feed meets organic criteria set by a state regulatory agency or by a specialty buyer.

Feed Requirements

Probably the most common error made by sheep raisers is to use the wrong amount of feed or the wrong kind. Obviously, feeding too much is costly because of waste, and feeding too little results in poor performance of the sheep and lambs. In addition to quantity of feed, the ration must be balanced with respect to the energy content (expressed in millions of calories), the amount of protein, and the amounts and proportions of vitamins and minerals. The requirements are unequal for different stages in the ewe's cycle and are not the same for growing lambs or for rams. Calculating a suitable ration is not difficult. The National Research Council's book *Nutrient Requirements of Sheep* contains tables that list the feed requirements for sheep of a variety of weights and at different stages of growth. One section describes overall nutritional needs of sheep, and tables of composition of common feedstuffs are given. Using the tables, one can calculate what combination of available feeds meets the tabulated needs of the sheep. A portion of the NRC tables is reproduced in appendix 5, and examples are given to illustrate the arithmetic involved in the calculations. The complete book can be ordered or even read at www.nap.edu/books/0309035961/html/index.html.

I will include feed recommendations for each stage of the ewe's cycle. These are based on average-quality hay and shelled corn to give some rough guidelines, but each shepherd should spend some time with a pencil, paper, and calculator to evaluate his own sheep-feeding program. An important principle to keep in mind is that the growth and general health of the animal will be governed by that part of the total diet that is in shortest supply. In other words, if the diet contains adequate or even excess protein, vitamins, calcium, and phosphorus but is deficient in carbohydrates, then the sheep will not thrive, performance being limited by a lack of calories in the diet. They need what the feed salesman calls a balanced diet.

If you are tempted to buy complete feeds and supplements from a feed salesman, take the time to sit down and calculate what it would cost you to provide the same levels of nutrition from a homemade mixture. I think you will decide to prepare your own feed unless the convenience factor is of overriding importance. There are no magic ingredients in the commercial feeds. If you have no grinding or mixing facilities, you can have your own formula put together at a grain elevator or feed store for a nominal price.

Salt

In summer you do not need to provide your sheep with anything but pasture for adequate nutrition, unless the ewes are in late gestation or lactating. Sheep like salt, which should be given free choice in loose form because sheep can break their teeth on salt blocks of the common type. The salt can be either iodized or of the type called trace mineral (TM) salt. Many shepherds mix the salt with an equal amount of dicalcium phosphate to provide supplemental calcium and phosphorus.

It is very important that sheep have access to salt at all times. Have an adequate number of salt stations and keep them filled. Salt is an essential part of a sheep's diet. Don't try to save money by withholding salt. The commercial weather-proof feeders are probably the best investment. Sheep will consume $\frac{1}{4}$ to $\frac{1}{2}$ ounce of salt mix per day per head. The mixture does not need to contain molasses or protein.

Most TM salts also contain copper because they are designed for cattle rather than for sheep. Unfortunately, sheep have a limited tolerance for copper and can be poisoned by an excess. There are special copper-free mineral mixes made especially for sheep, but they can be costly. You are possibly safe in giving some ordinary TM salt to sheep, free choice. I have used one part TM salt to three parts white salt with no problems. Never mix a copper-containing salt with feed. To include salt in feed, use plain salt or iodized salt.

Trace Elements

If you are concerned about the copper levels in your sheep and their feed, you can have some analyses made. Your veterinarian can give you the address of a diagnostic laboratory that can do the analyses. You will need samples of the liver from a few sheep and some representative specimens of feed from your farm, including pasture grasses. You need not kill a number of sheep just to get liver samples. Just save half a dozen fist-sized portions of the livers from sheep that either died or were butchered.

The copper level in the livers should not exceed about 100 to 500 parts per million (ppm). If your results are above that level, you should try to discover the source of the copper and eliminate it. The feeds should be expected to contain about 5 to 10 ppm copper. You might even find that your sheep are deficient in copper, a rather uncommon situation in North America but one that can be brought about by an excess of the trace element molybdenum in some areas, notably in western Canada. Molybdenum interferes with the ab-

sorption of copper by the sheep. Conversely, extremely low levels of molybdenum can generate excess copper absorption.

If you experience copper toxicity, instead of treatment, focus on trying to find the reason and source and remove it. Surviving animals can be treated with ammonium molybdate in their feed for three weeks or so. Valuable animals can be treated with an expensive human drug called D-penicillamine to help get copper out of the liver. Consult your veterinarian.

Another trace element that the shepherd should be concerned with is selenium. In many areas of the western plains and Rocky Mountains selenium is sufficiently abundant in soils as to cause toxic levels in forage plants. The toxicity of selenium has been known since the days of alchemy, but it was only in the 1950s that some veterinarians in the Pacific Northwest discovered that selenium was an essential nutritional element, and that a deficiency in selenium in the diet had highly adverse effects on sheep and other species. Since then, shepherds and veterinarians have found that selenium deficiencies exist in many parts of the United States and Canada. These deficiencies are readily corrected by providing supplemental selenium in the form of sodium selenite or selenate mixed with free-choice salt or as part of a feed mixture. The legal maximum level of selenium in a salt mixture is 90 ppm (or grams per ton) selenium.

How do you know whether you have a selenium problem? There is no simple answer, because the distribution of selenium in rocks and soils is so spotty and localized that one cannot define even broad areas where excesses or deficiencies can be expected for certain. While one suspects that selenium deficiencies exist in many places—including the Pacific Northwest, northern California, the northern Midwest, New England, and Florida, as well as much of Canada—there is no way to know in advance whether or not a problem exists on a given farm, and neighbors may face quite disparate situations. One solution is to ignore the problem until deficiency symptoms appear. As I will mention again in the chapter on lambing, selenium deficiencies result in weak lambs and a condition called white-muscle disease in which parts of the muscle tissue die, crippling the lamb, and ultimately resulting in its death. This disease is an indication of a selenium deficiency, commonly found together with a lack of vitamin E.

For the curious who want to spend the money, blood samples can be analyzed by a laboratory to check on selenium. The blood should contain about 0.1 ppm selenium, with levels up to five times that amount considered quite

safe insofar as toxicity is concerned. Levels below 0.02 ppm will result in clear clinical symptoms such as crippling, and less obvious effects can occur for any levels below 0.1 ppm.

Most other trace elements seem to be present in satisfactory amounts in pastures and in hay from nonirrigated land. Feeding supplements of manganese, iron, cobalt, zinc, and other elements is probably not critical, although each element appears to have one or more important roles. Iron is abundant in most feeds, though I'll mention the need for a supplementary source for lambs later. Cobalt deficiencies are common in parts of England and Australia but are unusual in North America. Sheep mineral mixes provide these elements, as does TM salt.

In inland parts of the country some iodine supplementation is appropriate. Sheep mineral mixes, TM salt, or iodized salt can be used. Be sure to use ordinary iodized salt with 0.01 percent potassium iodide (which translates into about 0.005 percent iodine) and not one of the medicated iodine salts that contain much more. An iodine content of up to 0.02 percent is recommended by some and is perfectly safe.

It is important to understand that there are no hard rules as to what trace elements (minerals) are needed by a given flock in a given region. Different breeds need different amounts, and the soil chemistry and feed compositions are different in different regions.

ENVIRONMENT

Fencing

I'm a firm believer in keeping the sheep outdoors as much as possible. During a sheep's rebuilding period, pastures are the usual feed source, and except for the western ranges, that means fences. The old saw about good fences making good neighbors makes a lot of sense. Your sheep grazing in someone else's crops or garden may create a lot of havoc and can cost friendship or money. Not only that, if your sheep eat a neighbor's alfalfa, you'll not only strain a friendship, but you may lose some sheep to bloat as well. Also, a fence that lets sheep out will just as readily let dogs in. Dogs can maim and kill a lot of sheep very quickly, and losses can be disastrous. The solution is good perimeter fencing. A sharp eye and a rifle might be a solution, but local laws and customs, as well as relations with neighbors, must be considered.

Besides, a shepherd cannot be watching the flock all of the time. Fences are better.

There are as many styles of fences as there are brands of candy bars, but some principles apply to all of them. They must be close enough to the ground to prevent animals scooting under, in either direction; they must be high enough to discourage sheep, dogs, or coyotes from jumping over them; and they must have wires, boards, or other fencing material spaced close enough to keep animals in or out.

Wooden fences are built by shepherds at both ends of the economic scale. The wealthy build neatly painted board fences or picture-book split-cedar rail ones. The poor build fences of cut poles, brush, old stumps, and anything else that can be scrounged for free. Most sheep, however, are confined by wire fences of one sort or another. Fences made only of barbed wire are seldom effective for sheep because they can usually push between the wires and make good their escape. The shepherd's choice is really between an electrified fence and one that combines wire mesh and barbed wire.

According to the people who sell them, electric fences are cheaper than other types if one compares the cost of all-new materials. Electric fences typically have one part of the electric circuit as the ground or earth and the other, or "hot" part, as the fence wires, so a sheep or predator touching the wires will feel a shock from the electricity passing through the body. The electricity is provided by an energizer that delivers brief pulses of thousands of volts to the hot wires. The energizer is powered by power line electricity or batteries, and some even have solar panels to keep batteries charged. Line sources are generally preferred if power is available. The ground connection to the charger should be very good, usually made of several long ground rods that reach moist soil or earth at depth. The preferred type of energizer is called a low-impedance type. Older fence "chargers" are not suitable. Popular brands are Intellishock, Speedrite, Gallagher, and Maxishock. Be sure to include lightning protection devices in your design, because a quick lightning strike can destroy an expensive energizer in microseconds. Sellers of electric fencing equipment usually have excellent booklets about how to build good fences. See Premier Sheep Supplies, p. 309.

Fence posts must be of non-conducting material, or insulators must be used to hold the wires. On the other hand, savings are made because smooth wire is cheaper than barbed, no wire mesh is needed, and the fence posts can be placed much farther apart because the type of wire that is used (called

high-tensile wire) is very strong and can be stretched very tightly so as to prevent sagging. The advantage of wide post spacing is largely lost on uneven ground, and the choice of electric or nonelectric fencing must be made with the terrain of the farm in mind, because advertised cost figures assume smooth ground.

If the soil below the fence becomes very dry, it will no longer conduct electricity, and the fence loses its effectiveness. A solution to this problem is to make the fence of alternating ground and "hot" wires, so that no matter where an animal pokes its head through, it will receive a shock. There should be a ground wire down at almost ground level to shock animals trying to go under the fence during dry weather.

Electric fences have a couple of advantages other than cost. They seem to discourage dogs and coyotes more than a plain wire fence, so if predators are a problem in your area, this is a big plus. Another advantage is the almost unbelievable fact that one doesn't need a gate in order to drive a vehicle through the fence. The long, unsupported sections of the fence have stays that keep the wire spacing correct. If the front of a vehicle is smooth, it will push and rotate the stay and wires flat to the ground as the vehicle passes over, after which the fence springs back into place. I recently read of a driver in the West who woke up after losing control of his car only to find himself in a fenced pasture. Seek as he did, he couldn't find a gate, and both he and the law enforcement officials decided that he must have sailed over the fence and miraculously landed unscathed in the field. Closer inspection showed that he had just driven through a high-tensile wire fence that snapped up behind him.

Disadvantages of electric fencing include the statutory requirement in some areas that it be marked with warning signs, and the hazard that older types of fence chargers may start fires in dry grass or brush that touches the wire. That is not a serious problem with low impedance energizers. Fences can lose their shocking ability if the wires become shorted by contact with conducting materials, including wet grass, but attention to trimming the grass can prevent that problem. Also, low impedance chargers are not as strongly affected by such "shorting." The power source can be interrupted or a battery can go dead, so routine checking is useful. One should use monitoring lights and a special voltmeter for checking. In an emergency just hold a three-to-four-inch piece of grass in the hand and use the grass to probe the fence. You'll feel a mild shock through the grass to tell you the fence is functioning.

Be aware, too, that high-tension fencing is very unforgiving of sloppy

workmanship. The pull of the taut wires on fence corners and intermediate posts and braces is very great, and the supports must be placed deep in the earth and be well braced. Use the suggestions for electrified sheep fences available from dealers in fencing supplies.

Temporary electric sheep fencing is also available. It is made of plastic mesh with embedded wires and is attached to lightweight posts that push in easily. This fencing can be erected and taken down quickly, and, while it is relatively costly, it offers a convenience and flexibility that justify the expenditure. Temporary fences can be made around grazing areas that otherwise would be unusable, small groups of sheep can be separated, and other uses may come to mind once you think about the possibilities. I used this sort of fencing for years with no mishaps. Others have had sheep tangled in the fence, and all sorts of disasters. I guess it depends on the sheep. Under no circumstances depend on such fencing to keep a ram from the ewes.

Wire Mesh Fences

Until the advent of modern electric fences, wire mesh was the fencing of choice for sheep. The wire mesh is usually the type called woven wire, available in heights of 26, 32, 39, and 47 inches in most brands. A typical fence consists of a single strand of barbed wire an inch or two off the ground, followed by woven wire, usually the 32-inch variety. This is followed in turn by another strand of barbed wire an inch or two above the woven wire and is topped off with additional strands of barbed wire at three-to-five-inch intervals to the top of the post. A height of four feet for the top wire will discourage, though not prevent, predators from jumping in.

Woven wire is available in two spacings of the vertical wires, six and twelve inches. The twelve-inch spacing will not confine lambs or keep out small predators. However, it is the choice of many shepherds because the sheep can exercise their usual propensity to eat through the fence and still be able to withdraw their heads without either strangling or being stuck for a long time. The smaller stay spacing will confine lambs, but now and then a sheep will get caught or killed because, although it can jam its head through, it is often incapable of figuring out how to get it out again. We have lost only one ewe to strangulation in a fence, but I have pulled plenty of pretty tired ones out. Lambs get stuck frequently as they grow up, but most of them eventually learn to stay out of fences or finally figure out how to extract themselves without assistance.

My own preference is to use the six-inch stays for perimeter fencing and the twelve-inch for cross fences. That way there is maximum security between the sheep and the outside world, and the risk of a sheep's strangling is balanced by the increased safety of the flock from predation or escape. The twelve-inch mesh for cross fences lets the lambs roam a bit, but they seldom stray far from their mother, so that usually is not a problem. For interior fences I prefer the 32-inch woven wire with no barbed wire at all. If the sheep are well fed, they will make no attempt to jump the fence, and it is very convenient to be able to step over the fence without tearing pants on a barb or two.

The cost advantage that is claimed by the electric-fence advocates is often reduced by the fact that one can obtain used fencing at auction sales, both steel posts and wire being common items. The buyer should be wary of rolled-up woven wire, though, as the core may be junk. Posts are easier to check, and bargains can be had. I acquired hundreds of used steel posts at half the new price by placing a single classified ad in an area advertiser. If the posts are rusty the rust will migrate to your new fence wire and shorten its life. Paint the posts with a good rust-preventive paint where the wires contact the post. The rust problem is an argument in favor of wooden posts with heavily galvanized staples.

Corners and intermediate bracing should be sturdy, though they need not be as rugged as those for high-tensile fences. Tightly stretched fences will remain useful for years if made properly. Studying good-looking fences or working with an old hand will help you learn the tricks of the trade. Even the tightest fence needs periodic maintenance, especially in snow country where the settling of the snow pack through the winter leaves the wire dragged down in festoons when the snow melts. A fence tightener that restores the crimp to the wires will tighten a sagging fence quickly and easily in the spring.

Gates

Gates for either sort of fence are limited only by the builder's imagination and pocketbook. Purchased aluminum gates usually have openings that a small sheep can squeeze through, but woven wire can be attached to them or additional metal strips can be added. Combinations of woven wire and boards make attractive and durable gates. For seldom-used openings the simple Western gate or Texas gate made of woven wire or woven plus barbed wire with skinny wooden posts at each end, held in place by wire loops, works well, although children or lightly muscled persons may have trouble

opening and closing them. Welded steel cattle panels or hog panels make effective gates too. For electric fences the gate is usually not electrified, the hot wire being an insulated cable that is buried underground across the gate opening.

PASTURE ECOSYSTEMS

The pastures that are enclosed by the fences should be treated as a valuable asset and taken care of almost as well as the sheep that use them. As mentioned earlier, pastures can be utilized in continuous grazing, or sheep can be moved, or rotated, in and out of individual pastures. There are arguments in favor of each method, but some general principles apply to most situations. An overriding consideration is the strongly seasonal growth of most grasses. Cool-season grasses—bluegrass, quackgrass, brome grass, and crested wheatgrass—have their main growth period in spring and early summer. After the rapid early growth they go to seed, and for practical purposes almost stop growing for the balance of the season except for a short growth period in the cool days of fall. In some parts of the country there are warm-season grasses such as switchgrass, indiangrass, bluestems, sideoats grama, and sudangrass, for instance, that have their maximum growth in the hot part of the summer. A few other species such as orchardgrass and reed canarygrass grow more or less throughout the season. The legumes, such as alfalfa, clover, sweet clover, and birdsfoot trefoil, grow all season as long as sufficient moisture is available.

The net result of the seasonal growth pattern of most grasses is that no pasture that is populated by a single species or by a number of species of similar seasonal growth pattern can be expected to provide summer-long grazing. It will be underutilized during the peak growth season and overgrazed at other times of the year. Continued occupation of such pastures at high stocking rates will kill off the grasses or at least thin them to the point at which undesirable species will fill the gaps and compete for water and nutrients with the valued species. This is particularly true for the warm-season grasses and some of the legumes, especially alfalfa.

Heavy grazing without an interval for regrowth will kill off forage plants quickly. The native warm-season grasses of the Great Plains, after having provided buffalo feed for millennia, were largely wiped out by heavy stocking of

cattle by cattlemen. Cool-season grasses withstand heavy grazing better, but even they suffer.

It is important to keep in mind that the quantity of roots of a grass is proportional to the amount of plant material above ground. With continued close grazing the reserve of food in the roots is depleted, and with tops constantly taken off there is no resupply. The root mass shrinks in both size and number of rootlets. When grazing is stopped, regrowth is slow because the plants must rebuild their mass by manufacturing food from scratch rather than calling on reserves held in the roots. If heavy grazing is continued right up to winter in cold regions, there will be a heavy winter kill of the roots.

The only way that continuous grazing can be nondestructive is with low stocking rates. Either a small number of sheep are placed in a pasture, or the sheep are moved from time to time to lower the effective stocking rate. Pasture rotation at its simplest uses two pastures, leaving the sheep in one while the other recovers, rotating as often as needed. This system can be improved upon by using three or four pastures, rotating in sequence among the various units, all of which have more or less the same species of forage plants. Rotation helps not only by giving plants a regrowth period; it also cuts down on the population of internal parasites such as worms because many of the larvae in the grass die off before being ingested by a sheep host. The larvae are at a special disadvantage in an eaten-down pasture because they are exposed to sunlight and drying winds without the protection of plant cover.

Grazing should also be timed according to the growth habits of the grasses. Jointed grasses like brome grass, quackgrass, and some of the wheatgrasses have a growing point that is near the surface of the ground in the early stages and that moves upward as the grass grows. If the growing point is removed too early by grazing or mowing, the growth is effectively stopped. On the other hand, if the grass is allowed to go to the so-called boot stage, when the seed head has formed inside the stem but has not emerged, then cutting or grazing encourages rapid regrowth. If the seed head is allowed to emerge, dormancy is induced.

Bluegrass, junegrass, orchardgrass, and Russian wildrye form only a few jointed stems that develop seed heads. The growing points of the other stems stay near ground level, and heavy grazing doesn't stop growth unless root reserves are seriously depleted. In other words, the latter group of grasses produces the most if grazed more or less continuously during their active grow-

ing phase. The other group should be allowed to go to boot stage before removal of the tops.

A more elaborate system of rotation can be devised if the species composition is not uniform. For example, if one had a bluegrass pasture and a bromegrass pasture, good timing of their use would maximize their yield. The bluegrass pasture could be grazed first and grazed continuously until the bromegrass reached boot stage. Then sheep could be turned into the bromegrass to eat it down to a two- or three-inch length. At that point, the sheep could be put back on the bluegrass until the bromegrass reached boot stage again, and so forth, as long as the cool weather lasted.

For midsummer, the warm-season grasses can be planted in some areas, but seed is expensive and establishment difficult. Also, these grasses will be retarded or killed by early grazing. An alternative is to plant orchardgrass or a legume. Orchardgrass-alfalfa mixtures are popular, or birdsfoot trefoil alone can be used. Pastures of these species can be grazed during the hot months, provided they are not grazed continuously. A period of regrowth must be allowed after removal of the tops.

On our farm we use a bluegrass to quackgrass-bromegrass rotation for early grazing. Then the flock is alternated between an alfalfa-orchardgrass pasture and a birdsfoot trefoil pasture for the warm season, with a return to the cool-season grasses for a short period in the fall. I usually can get a cutting of hay from the trefoil and orchardgrass-alfalfa before the sheep get to them. With this plan one can graze ten ewes to the acre and also put up some hay from the same pastures, usually about a ton to the acre in years with enough spring rain. This sort of approach is applicable to the northern tier of states and Canada with minor modification. In the southern parts of the country grazing seasons are extended, and different plant species are appropriate. Suggestions from soil conservation service and extension personnel are very helpful for designing a grazing program using suitable regional species.

Pasture Modification

Existing pastures can be improved by a variety of methods. The most obvious is reseeding. If a pasture can be tilled to prepare a seedbed, then virtually anything can be planted by conventional methods. Clean tillage is a necessity with some species such as birdsfoot trefoil, which competes very poorly with other plants. Once established it does very well and will reseed itself if left to go to seed once a year, preferably in the summer rather than fall. The sheep

will plant the seed with their feet when they graze the pasture later in the year. Properly managed, trefoil will take over a field when once established.

If tillage to a clean seedbed is not possible, a pasture can be intentionally overgrazed, then seeded after breaking up the surface with a disk or toothed harrow. Seeding rates should be roughly doubled because much of the seed will not germinate. Small seeded plants such as alfalfa and clover can be seeded in this way. Grasses with large seeds, such as orchardgrass, are more difficult to get into the soil without a seed drill. There are also seed drills that are designed for planting seed into existing sod, and in some areas these may be available on a lease basis from a soil conservation district or some similar organization. Many of these drills apply a herbicide at planting to reduce competition for the new seedlings. Herbicides can be applied or burning used to reduce competition before planting.

Pastures can be changed in character—without planting anything—by the timely use of grazing. If a given species is to be favored, the pasture should be grazed hard during or just prior to its period of maximum growth. For example, if a pasture was mixed bluegrass and quackgrass, and you wanted to favor the quackgrass, the sheep should be put in the pasture when the quackgrass is in boot stage and the pasture grazed heavily. When the sheep are removed, the pasture should also be mowed to get rid of any plants that the sheep missed. The quackgrass, or a similar species, will grow back rapidly and shade the other grasses and herbs, gaining an advantage for itself. If this is done year after year, the quackgrass will take over.

If one wanted to favor the bluegrass in the same pasture, grazing or mowing should be done before the quackgrass is in boot stage; this would send it into dormancy and favor the bluegrass, which would keep right on growing.

Warm-season grasses that are grazed only in midsummer will gradually take over from other species, provided overgrazing is scrupulously avoided. The warm-season grasses can also be encouraged by heavy grazing of pastures in the late fall when they have become dormant, but then the cool-season grasses continue growing to store up root reserves. This will leave the cool-season grasses short of food with a resulting winter kill and a slow start in the following spring for the survivors, giving the warm-season grasses less competition in the early growth stages.

Pastures can benefit from applications of fertilizer. Costs should be considered carefully before applying nitrogen because the expense is high. You will need to know typical responses of pastures to fertilizer in your area in

order to make a rational decision. Either consult someone locally or do limited experiments of your own. Needless to say, cleanings from the barns and drylots belong on the pastures too. Fertilizer can also be used to aid in changing the species makeup of pastures. For example, quackgrass responds to an application of nitrogen much more than does bluegrass, so fertilization favors the quackgrass in the long run.

One of the best and least expensive pasture improvement and maintenance tools is a mower. If time permits in a busy summer schedule, a pasture should be mowed as soon as sheep are taken out of it. The mowing not only removes mature grasses that the sheep won't eat anyway, but also kills or retards weeds such as thistles, burdock, mullein, milkweeds, and many other nonforage species. I have managed to virtually eliminate mullein and Canada thistle from our pastures by mowing, but I'm still losing the war with another thistle species because I'm usually too busy to mow when I should.

Species with burrs that get into the wool, such as burdock, should be hunted down like escaped felons and uprooted and burned. The same is true for any poisonous species that may be present in your area. Sheep will usually avoid poisonous plants if they have sufficient other feed, but may eat them in hard times. I recall a friend in Kansas telling me of sheep raisers losing a lot of sheep to water hemlock in their area one summer when other feed was short because of drought conditions. Any undesirable plant can be eliminated by spot application of herbicide early in the season, but it is a continuous battle because of reseeding by airborne seeds, weeds in hay, and the like.

Summer Camp

Sheep can sometimes be sent away for the summer, as one would send youngsters away to camp. Some farmers have pasture for rent on a regular basis and will even water and care for the flock for a fee. All that is really needed is a fence to keep the sheep in and predators out, and a supply of water. Of course someone has to check on them once in a while, but summer is a time of few problems for the ewes. Every locality will offer different opportunities for putting the sheep out, and I know of sheep summering in such diverse places as the lawns of a municipal sewage plant and the outer reaches of military installations. Lawns around microwave relays, junkyards, government establishments, factories, corporate headquarters, schools, football stadiums, power substations, racetracks—any of these locations can be suitable for sheep. We put a small flock on a neighbor's place one summer at his request

to keep some brush and weeds under control. Among the group was an older ewe with a chronic hacking cough who we figured would probably never last out the summer. She returned from her vacation as fit as if she had been to a health spa. The mixed diet must have contained something that was just what she sorely needed. That was years ago; she was a productive member of the flock for many years, and that's her face you see as the frontispiece of this book.

Rams are ideal candidates for sending off to camp. Find them a cool place with adequate feed and they'll be content. Rams are basically lazy, so let them loaf around away from the ewes, building up their sperm count to earn their keep come breeding season.

Dogs

Dogs are part of the sheep's environment for most shepherds. The dogs might be herding ones, guarding dogs, or predatory ones. In an ideal world, none of these types of dogs need be around, but in real life, one or more is part of the scene. Dogs and sheep are not necessarily inseparable in sheep raising. A friend of mine returned from a geological expedition to Morocco and observed that in that country the dogs stayed home and slept on the front stairs while the men trailed the sheep over the sparse grazing and the wives stayed home to do all of the work around the house. His theory was that the Moroccans could be pretty prosperous if the dogs were used with the sheep, and most of the men could stay home and do some useful work. I'm afraid my friend didn't consult with the Moroccan shepherds about this idea, nor does he understand the delights of sheep watching.

Herding dogs are almost as much a part of sheep raising as the sheep themselves. A good sheep dog is certainly the greatest labor-saving device I know of, with the possible exception of a corkscrew. One can raise sheep without a dog, but it sure is easier with one. The border collie is the classic sheep dog, and I personally would not even bother to try another breed. A border collie is born already programmed to herd sheep. All the handler has to do is teach a set of simple commands to direct what the dog wants to do instinctively. Teach the pup some simple commands, give it some love, and you've got a sheep dog.

Most border collies have a natural instinct to go away from the shepherd, encircle the sheep, and move them back toward the shepherd. With new pups, let them do that as you teach them some commands to go with their in-



A Sharplaninac puppy investigates a hay feeder in the pen it shares with some lambs. It will grow up to be a flock guard dog.

instincts. Be sure they learn commands to drop (such as Down!) and to stay there (such as Stay!), and enforce those commands. Then teach separate commands to go gather the sheep from your right and from your left. Most dogs will crowd too closely at first, but will usually learn on their own to give the sheep more room. After some weeks, one can start to teach the dog to herd along with the herder. That is contrary to their instincts, so be patient. One expert trainer comments that the average person trying to train the dog doesn't know how to make the stock move—and therefore is not qualified to tell the dog what to do.

Naturally, there will be individual dogs that are no good at all and others that are great. I'm also assuming that you get a dog from a line of working dogs, not show-ring types. Their whole interest is herding. They'll herd chickens, ducks, geese, soccer balls, small children, cats, anything. John Holmes in *The Farmer's Dog* recommends training them by using confined ducks, an

idea I have not tried, but a good one. A sheep dog should be used frequently to keep it in good habits, but otherwise it is almost no trouble and is a pleasant companion as well.

When left alone, a sheep dog should be confined or on a leash, because some of them will herd the sheep on their own and can cause problems by pushing them into a fence corner or over a cliff, as described in Hardy's *Far from the Madding Crowd*.

Guard dogs are a fairly recent addition to the sheep industry in this country. They have been used for hundreds or thousands of years in southern Europe and adjacent parts of Asia Minor. The breeds have wonderful names, such as Great Pyrenees, Komondor, Anatolian, Akbash, Maremma, Kuvasz, Tchouvatch, and Sharplaninac. A guard dog's purpose is to stay with the sheep, warding off potential predators, usually coyotes. It is not a herding dog. Guard dogs protect sheep by patrolling, barking, scent-marking, and pursuing—even killing—a predator when the sheep are threatened. Guard dogs have proven to be very effective protection against predators in many environments, and are widely used even in range operations. In a survey in Colorado a total of 174 of 182 producers (96 percent) would recommend use of guard dogs to other producers. Any sheep raiser with predator problems should think seriously about getting a guard dog.

Donkeys and llamas are also used as protectors, but are really effective only in fenced pastures of less than a couple of hundred acres. With guard dogs or other animals, fencing costs can often be reduced, because predator exclusion is less of an issue.

The dogs are usually raised together with the sheep from about two months of age so that they form social attachments with them and work out their aggressive tendencies by protecting the flock. It is best to place a new pup with lambs, so it is not attacked by aggressive ewes. A guard dog should be taught to obey some limited commands, especially Down! Stay! and No! and learn to walk on a leash, but never treated as a pet. Feed the pup when you feed the lambs. Correct the pup if it chases or bites sheep, and praise it for desired behavior. If the dog leaves the sheep, return it to them immediately. Praise it for staying with the sheep. Guard dogs will be ready for guarding at six months to two years of age. If one guard dog is useful, you should consider adding more. In range conditions guard dogs work best with breeds of sheep having strong flocking tendencies, such as Rambouillets or Targhees, and not as well with less gregarious sorts such as Suffolks.

Most guard dogs will attack an unfamiliar human approaching the flock as readily as they would a coyote or a stray dog, so strangers must be warned to stay away, because these are big dogs that could do a lot of damage to a person. If you get a guard dog, be sure that neighbors know about it so some “helpful” oaf doesn’t shoot it to protect your sheep, or a neighbor get attacked by your dog. Check www.ext.colostate.edu/pubs/livestk/publive.html and www.flockguard.org for current information.

Be sure that both herding and guarding dogs are protected against rabies by vaccination. In some states owners can buy and administer the vaccine, whereas in others a vet must do it. You can also consider getting yourself and anyone else who works with dogs and livestock vaccinated against rabies too. Even sheep can contract rabies.

Predatory dogs, whether wild or domestic, mean trouble for a shepherd. Coyotes, and even wolves, are a big problem in some parts of the country, but the domestic dog is the worst offender, especially in heavily populated areas. Our place is in a pretty much strictly farming area, but there are a few non-farmers and others who let dogs roam. A phone call has been sufficient to take care of dogs with known owners, although a load of number-six shot from a distance has a very salutary effect too. For dogs in packs, a loaded rifle is the only reasonable solution.

Check on local laws, and if they are not strong enough, work to get them changed. Dog owners must be made to understand that they are responsible for their dogs’ actions. Proof is often difficult to establish unless the dog is observed chasing the sheep and then confined until the local law officials and the owner can be called. In our state, according to the laws, a dog in pursuit of farm animals can be shot. Owners almost never believe that their dog would harm anything, and a quick, accurate shot followed by a quiet burial is often the pragmatic solution. If you prefer not to kill, get a paint ball gun and mark the dog. The owner will have to admit that the orange-spotted dog was on your place.

If you have guard dogs, that will help, but be sure your neighbors understand that the guard dogs may kill their dogs if they stray into the property. This is a situation in which you need to be on good terms with the dog-owning neighbors. If you shoot their dogs, they may just shoot your very valuable guard dog in return payment.

You can carry insurance to cover losses from predators. If you insure your sheep, be sure that their value is established before you try to collect on the

policy. Insure your guard dogs too. Most companies will try to pay as little as possible and may want to pay you only for what a cull ewe sells for at a local market. Itemize your sheep as individuals or by breed and assign a value to them that your insurance company accepts. If you get caught short with your insurance adjuster or are trying to collect damages from a dog owner, you can use your sales records to establish the value of your sheep. One raiser on the Pacific coast recently used asking prices for black sheep in *Black Sheep Newsletter* classified ads to establish the value of her sheep. A friend of mine in Massachusetts had moderately good results with the same technique. Good fences are still the best solution to most problems, although a neighborhood vigilante committee is sometimes needed. When someone in my area spots a dog pack, lots of phone calls are made to alert everyone, and rifles are loaded although we are the only sheep raisers for miles. Nobody likes a dog pack.

MEDICAL

Preventive medicine is the key to flock health, and the time between weaning and flushing is a good time to be sure that the flock is in fit condition. Good health of the sheep is encouraged by exercise, suitable diet, cleanliness, and prevention of infection.

In an ideal world the flock should be supervised at all times, but of course that rarely really happens in America, where shepherds generally do other things such as farming, taking care of other animals, working at an outside job, or writing poetry. The days when a shepherd and dog watched the flock on a round-the-clock basis are pretty much gone except in the West. Still, the shepherd should try to observe the flock at least once a day if possible. This check might consist of simply looking out the window at the sheep, or taking a break by walking over to them for a little relaxation. One reason that I favor moving the sheep to and from pasture each day is that it gives the shepherd two chances to observe them and their environment.

If you don't already know one, get to know a veterinarian soon after you acquire your sheep. Choose a vet who knows about sheep or is willing to learn. Some vets are interested only in dairy cows, or cats and dogs, so check around. Find someone whom you can work with and learn from, preferably someone you like. Keep in mind that you as a shepherd will have to learn to do a lot of veterinary care yourself, because the value of an individual sheep

commonly does not justify the expense of a visit by your veterinarian. So, you'll need a vet who will teach you some techniques to do yourself, rather than insisting that only someone with a veterinary degree can do the job. Most vets are very good about this, but not all.

Work with your DVM to establish a schedule of preventive vaccinations and other measures to head off disease problems before they surface in your flock. Talk with your vet too about your nutritional program if you have any doubts. The veterinarian is a lot more objective than the representative of a feed company.

Throughout this book I will discuss some common sheep health problems, but don't get the idea that sheep are sick all of the time. They are fundamentally healthy animals that will rarely fall sick if treated sensibly. Always try to ward off sickness by prevention rather than waiting to fight a raging illness outbreak. Rebuilding is generally a time when very few health problems arise so it is a good time for you to learn.

Be sure to have a few basic health equipment items. First of all, buy a good thermometer. The electronic ones meant for people work fine with sheep and are inexpensive and accurate. You will also need a stethoscope and hypodermic syringes and needles as noted below.

Administering Medications

You will have to learn to give your sheep medications usually either by injection or orally. I'll describe how to give medicines to your sheep, but do get your vet or another expert to show you how at first hand.

There are two common sorts of injections, named after the injection site. The first of these is the intramuscular (IM) injection, so called because it is given in the flesh or muscle. I use a one-inch, 16- or 18-gauge (ga) needle mounted on a disposable syringe. For sheep, syringes with a capacity of 3 cc and 12 cc will handle most needs. The disposable needles and syringes are much to be preferred over reusable types because few of us have suitable facilities for proper sterilization and storage. Note: disposable syringes with the needle already attached are usually cheaper than buying the two parts separately, so read catalogs carefully.

After the syringe is filled, the needle should be inserted into a heavy muscle in the neck, shoulder, or rear leg. Avoid hitting a bone or a major blood vessel such as those located under the neck. After the needle is in place, withdraw the plunger to see if blood appears. If so, try another site because you do not

want to inject directly into a blood vessel. For market lambs the rear leg should not be used for any injection that will discolor the flesh or cause an abscess. The IM site is mostly used for antibiotics, for which flesh discoloration is generally not a problem.

The other common site is under the skin or subcutaneous (called subcute, SQ, or SC). Pinch a bit of skin between thumb and forefinger and lift to form a small tent shape. Insert the needle into the elevated skin and slide it under the skin. Do not make just a shallow IM, but try to get the needle between the skin and the muscle. The best place for a subcute injection in a sheep is above the ribs. If long wool makes that site awkward, use the bare patch of skin just rearward of the front leg. As with the IM injection, be sure to withdraw the plunger to make sure you don't get blood.

To fill the syringe for a single injection, just shake up the contents of the bottle and withdraw the needed dose. If you are going to give injections to a number of sheep, you should not reinsert the needle into the container of medication after you have used it because you can contaminate the remaining contents. The recommended way to refill a syringe is to use two needles. Leave one in the bottle top, and use the second one to enter the sheep. To refill the syringe take the needle off and insert the syringe into the needle that is in the bottle. Fill the syringe, then remove it, leaving the needle in the bottle. Reattach the injection needle and go to the next sheep. This method does not totally prevent contamination of the contents of the bottle, but it is much preferred to using a single needle. Before putting a needle into the sheep, hold the syringe with the needle up and flick the needle end of the syringe with a finger to get the air bubbles to the top, and squirt out any excess air.

You also need a bottle of epinephrine to give in case an animal goes into shock after an injection. Never give an injection without having the epinephrine handy. You may never need it, but when you need it, you need it immediately. Give IM or SC 0.5–1.0 ml of the 1:1000 solution per 100 pounds body weight. May be repeated at fifteen-minute intervals as needed.

Some medications are given orally as a liquid or drench, using a special syringe called a drench gun or drench syringe. The end of the tube is inserted into the sheep's cheek alongside the molars, and the dose is given by pushing a plunger or squeezing a handle. The sheep's head should be held level, not elevated, so as to prevent the liquid from getting into the lungs.

Other oral medications are given in the form of big pills called boluses. The easiest way to give a bolus is to use a pair of forceps made for that pur-

pose. The bolus should be placed over the hump of the tongue and the mouth closed. If the sheep spits it out, try again. If you have a helper, so much the better. The helper can straddle the sheep's neck, facing in the same direction as the sheep. The helper pushes his forefingers into the cheeks to force the jaws open. The sheep can't close her mouth without biting her own cheeks. After the bolus is behind the tongue the forceps and fingers can be removed. You will find it also helps to coat larger boluses with mineral oil to help them slide down.

Let me emphasize that you should get all of this demonstrated to you by an experienced person. There is no substitute for seeing something actually done correctly before you attempt it yourself.

If you are administering a drench or injection to a large number of sheep in a chute, it is important to do it in the right way to save your back and use the sheep's natural instincts. Do not lean over the side, because that will twist your back, and the sheep will back away or jump. Instead, get in the chute with the sheep, straddling them, and work from the back to the front. The sheep will generally back into you and between your legs and you can hold each under the chin as you work. If you try this from the front, the sheep sees you coming and will try to flee—right through you. You may get bruised or dumped and some sheep may miss their medication in the confusion.

Internal Parasites

Internal parasites—mainly worms—can be a big problem during the rebuilding time because there is a sharp rise in the activity of worms at lambing and during lactation. With timely worming, the problem is greatly diminished. Otherwise the ewes will come out of lactation with a heavy load of worms, and they will proceed to spread their eggs with their feces. The life cycle of sheep roundworms begins when the oocysts (eggs) are deposited on the ground. They then hatch, go through several larval stages, and attach themselves to plants that will be ingested by a sheep, starting the cycle all over again. Interruption of this cycle is the key to control.

Worming around lambing time (which will be discussed in the chapters on late gestation and lambing) is the most satisfactory approach for reducing the worms in the ewes. If this has not been done, an attempt should be made to disrupt the life cycle of the worms. If the ewes are not reinfected, their worm load will remain low for weeks.

Not to confuse the issue, but the biggest reservoir of worms on the farm is

in the pastures rather than in the sheep. Larvae will hatch from eggs that survived the winter, and last year's pasture will be rich with newly hatched larvae as soon as the weather warms up. Those larvae will die off within three weeks, or if the pasture can be cut for hay, it will be relatively clean of worm larvae.

It is well to realize that there is no such thing as a worm-free pasture if sheep have been on it within the previous couple of years. Cold, dryness, and sunshine are the enemies of the worm larvae and the allies of the shepherd and sheep. A winter sun on bare pastures is an effective worm larvae killer, but eggs survive. Likewise, sunny, dry days in late summer when the grass is short are tough on larvae. Neither condition will destroy all of the larvae because the microclimate at ground level may be humid and pleasant to the worms, although it feels dry and dusty at the level of a farmer's face.

A useful strategy is to keep the ewes off pasture during lactation, supporting them on hay and grain. That can maximize milk production and prevent both reinfection of the ewes and, more important, infection of the pasture and the lambs.

With a pasture system, the worming strategy is one that minimizes worm larvae in the pasture. The cycle of egg to the next crop of eggs is about three weeks for common worm species. If pastured sheep are wormed at lambing, then at three weeks and at six weeks, that will help to reduce the number of larvae in the pasture. If possible, after worming, sheep should be held off pasture for twelve to twenty-four hours to prevent dropping of live eggs in the pasture. After the series of wormings, the pasture load will be reduced and also the ewe's immunity to worms will have recovered from a low point at lambing. In warm climates, an additional one or two wormings at three-week intervals can be useful.

Worminess in sheep will make its presence apparent by diarrhea, weight loss, unthriftiness, depression, loss of appetite, and other indications of poor health. In serious infestations, the skin beneath the ewe's eyelids (pull down the lower lid) and gums may be pale from anemia, and there may be swellings under the jaw (bottle jaw). If anemia is so severe that you find pale eyelids and gums, the ewe should be given 2 ml of iron dextran (a pig medication) to aid recovery. If you are butchering an animal for home consumption, the digestive tract can also be examined by a veterinarian. If worms are found, the sheep flock can be wormed and kept in a drylot or turned into a worm-free pasture or field—if you have one.

As far as what wormer (anthelmintic) to use, personal preference and custom often dictate a choice. There are a number of wormers on the market

that are approved for use with sheep. The common ones are the benzimidazoles (thiabendazole, albendazole), levamisole (Tramisol, Levasole, Ripercol), and ivermectin (Ivomec). Most are for oral drenching, although levamisole is available as tablets too. Levamisole and ivermectin are available as injectables for cattle, but those forms are not approved for sheep. Read about drug approval in appendix 3.

When using a benzimidazole or ivermectin drench or paste, hold the ewes off feed for twelve to twenty-four hours before giving the oral dose to increase absorption. Do not do this with ewes in late gestation.

Some shepherds and veterinarians use wormers intended for horses. These are not approved for use with sheep, which does not mean that they are not safe and effective. I have never used any of these myself.

Most researchers today agree that tapeworms have little if any adverse effect on sheep or lambs. We stopped treating for tapeworms and found no ill effects in our lambs for almost two decades after stopping.

There is one tapeworm called *Echinococcus granulosus* that is a cause for some attention. The life cycle of this species includes a stage in which dogs are the intermediate host. In ruminants and in humans a larval stage lives in the liver, lungs, and other internal organs, where the worms can do great damage—even causing death. These pests can be controlled by interrupting their life cycle. Never feed raw sheep offal to dogs or let carcasses lie around where dogs can get to them. This is another good reason to keep stray dogs off your property. Pet dogs or farm dogs can be checked by fecal examination and wormed until free of *E. granulosus*. This worm is an especially serious risk if there are infants around who play with the dogs. Children may ingest the tiny eggs or egg-bearing worm segments when they put their fingers in their mouths. This is fortunately not a common problem, but be alert, and keep your dog wormed.

Resistance

Worms develop resistance to the wormers if they are used improperly. There are several practices that will reduce build-up of resistance. Perhaps the most important practice is not to use anthelmintics more often than necessary. Do not treat until clinical signs appear or fecal examinations show heavy infestation. The worming every three weeks mentioned above has its downside, because each worming increases the proportion of resistant worms in the total worm population. Never worm more often than every three weeks.

Wormers should be switched from one group to another every two to three years, or when one group becomes ineffective.

Dosage should always be at the recommended level. A safe practice is to weigh the largest sheep in the flock, and dose at that rate for all the ewes, unless you are able to weigh each ewe. Err on the side of too much anthelmintic.

There is a big Catch-22 factor at work here. After worming, one should not return sheep to the same pasture full of larvae, because the sheep will quickly become reinfested. However, one also should not move freshly wormed sheep onto a truly wormfree pasture such as a newly planted area, or one that has not had sheep on it for many years. The reason for that is that the freshly treated ewe will contain almost entirely wormer-resistant worms, and will infest the pasture with eggs from nothing but those resistant worms from that time forward.

For those who lamb in spring, a better strategy is to hold lactating ewes off pasture until the old crop of larvae has mostly died, then give the ewes pasture access after weaning. Then the pasture worm population will be a mix of resistant and nonresistant worms. If that is not possible, grazing of a pasture by nonlactating ewes, or even cattle, before turning the sheep in will help to reduce the total number of larvae.

External Parasites

The flock should be examined for external parasites. Confine the sheep in a small area, or use a sorting chute if you have one. Part the wool and look at the skin carefully. Sheep keds, often incorrectly called sheep ticks, are easy to spot. They are about the size of a housefly and are found mostly on the sheep's flanks and hips, although a badly infested animal may have them everywhere. Keds have six legs whereas real ticks have eight.

The other pest to look for is lice, and they are not as easy to spot. They are about half the size of a pinhead and the common species is a pale buff color that does not stand out well against the skin color of a sheep. The best way to check for lice is with a 10× magnifying lens that can be purchased at a college bookstore or a good optical shop. Examine the sheep's skin or, better yet, scrape the skin with a pocket knife and put the scrapings on a piece of dark paper or cloth, and use the lens. If you are in doubt, get a veterinarian to examine the flock for you.

A shorn sheep is easier to treat than a woolled one. Shearing not only readily allows any pesticides to get onto the sheep's skin, but lots of the eggs,

pupae, and adult keds and lice are removed along with the wool. This is particularly true of lice in summer because they glue their eggs to the wool fibers well away from the skin in hot weather.

The shorn sheep can be treated with a number of pesticides. The rebuilding time is especially suitable because there is no chance of the poisons injuring a fetus or nursing lamb. Powders can be used on shorn sheep, and we have had good results from malathion louse powders and even with garden rotenone dust. You will find that most of the pesticide powders make no mention of sheep on the label, so seek advice from a veterinarian or a sheep raiser.

If the sheep cannot be shorn for some reason, there are other options for pest control. The traditional treatment was to dip the sheep, immersing them entirely in a trough or pool filled with the sheep-dip material. Usually one or more people are stationed with special crooks to push the heads under briefly. Most of us do not have facilities for dipping.

The alternate method is to spray the sheep. Check with your vet for recommendations and availability of these materials, because what is approved and what is not seems to change on almost a monthly basis. There is risk to both the sheep and the shepherd with these potent chemicals, so consult experts and take proper precautions. Few pesticides are labeled for use with sheep because the relatively small number of sheep in the United States does not justify the expense involved to the manufacturer in getting formal approval.

Some people say that one can confine the sheep and apply spray solutions with a garden sprinkling can. I have never tried this because I couldn't imagine that long-wooled sheep could be completely soaked—a necessary element in pest control. A good way is to use a sprayer. You need a pump, sprayer wand and associated hoses, and a big drum to hold the spray mixture. You can use a pump powered by a tractor or get a more expensive self-powered type. The sheep can be moved through a chute with open sides and wetted completely on both sides and over the back by the jet. A suitable chute arrangement can be assembled from a few hog panels and steel fence posts for temporary use. With such spraying, be careful not to be so vigorous as to partly felt or cott the wool.

Another option is to use a systemic poison, meaning a chemical that is absorbed by the sheep so that when a ked or louse sucks a meal of blood it gets a lethal dose of the pesticide. A systemic poison is applied by pouring a



Sorting pens and chutes such as this commercially available British type make the shepherd's job a lot easier and faster.



This yearling ewe weighed only eighty pounds—far less than her flock mates—because of this heavy infestation of sheep keds. (This ewe was not from my flock.)



Treating woolled sheep for external parasites can be done in a temporary chute using a tractor-powered sprayer rig.

diluted mixture down the sheep's back, by applying a paste, or by placing a small amount of a concentrated material on the sheep's skin. Dosage to the sheep must be carefully regulated, and the shepherd must take precautions to avoid contact with them. They are readily absorbed through the skin, so rubber gloves should be worn and contaminated clothing washed immediately after use. Ectrin is a pour-on approved for sheep.

It is important to remember that these chemicals may kill the sheep along with the lice and keds if they are not used correctly, so check with local experts. Unhappily, most of the pesticides are not approved for use with sheep by the Environmental Protection Agency, so the sheep raiser is left without official guidelines. Ask your vet, and take care with unapproved versions.

Dentistry

During the rebuilding period and before pastures begin to get a little sparse, the sheep's teeth ought to be examined to see if they are badly worn or missing. This ovine dental examination is called *mouthing*, and it is a simple thing to do. Dump the sheep on her rump or confine her to a crush or chair. To dump a sheep I hold her with my left hand under her chin, her left flank against my leg, and my right hand grasping her right rear leg in the wool-free

area (the "leg pit"). Push down and back with your right hand as the sheep's head is turned back and to the right, and most sheep will sit down without a fight.

If sheep refuse to cooperate, grab them around the chest under the front legs. As they try to run away from you they will walk into an upright position on their rear legs. Then just sit them down. Don't you lift them up—let them do it. You can also back them into a 15"–16" junk tire or commercial sheep chair.

Once you have them controlled, lift each sheep's lips and look at the teeth. If a lot of them are missing, you should consider culling the ewe because she won't be able to compete on pastures that are cropped short. You can provide such a ewe with extra feed if you want to keep her. If the sheep has only one or two incisors left, it will do better if the remaining teeth are pulled; you can do this using a pair of pliers. Then the ewe can gum her grass if it is long enough for her to get a grip. Don't stop there; look at the molars too. If the molars are badly worn, there isn't much one can do except cull.

Bloat

Bloat may occur when sheep are turned into a new pasture, especially alfalfa. Bloat can also be brought on by stressful incidents such as being chased by a dog. I have even seen it happen when a helper unfamiliar to the flock was catching some sheep for me to shear. Mostly though, it is caused by overeating on fresh, green feed, especially alfalfa or clover. Gases become trapped in the rumen, usually in a foamy mass, the rumen swells, compressing the lungs, and the sheep may die from suffocation. Prevention is the key in this situation. Sheep turned into a new pasture that contains a lot of alfalfa should first be fed their fill of dry hay to limit their intake and then be allowed only a short time in the new pasture. As little as fifteen minutes the first day, thirty the next, and so forth might be appropriate.

Treatment of bloat is difficult, especially if a lot of sheep bloat at about the same time, because many will die while you are still treating the first ones. The traditional treatment is to cut a hole in the rumen to let the gases escape; this is called sticking the sheep, and there is a dramatic description of it (see facing page) in Hardy's *Far from the Maddening Crowd*. There is a special tool called a trochar made for this purpose; it punctures the rumen and then maintains the opening so the gases can get out. Cutting a hole with a pocket knife is seldom effective because the hole doesn't stay open.

Bathsheba, with a sad, bursting heart, looked at these primest specimens of her prime flock as they rolled there —

Swoln with wind and the rank mist they drew.

Many of them foamed at the mouth, their breathing being quick and short, whilst the bodies of all were fearfully distended.

“O, what can I do, what can I do!” said Bathsheba, helplessly. “Sheep are such unfortunate animals! — there’s always something happening to them! I never knew a flock pass a year without getting into some scrape or other.”

“There’s only one way of saving them,” said Tall.

“What way? Tell me quick!”

“They must be pierced in the side with a thing made on purpose.”

“Can you do it? Can I?”

“No, ma’am. We can’t, nor you neither. It must be done in a particular spot. If ye go to the right or left but an inch you stab the ewe and kill her. Not even a shepherd can do it, as a rule.”

“Then they must die,” she said, in a resigned tone.

“Only one man in the neighbourhood knows the way,” said Joseph, now just come up. “He could cure ’em all if he were here.”

“Who is he? Let’s get him!”

“Shepherd Oak,” said Matthew. “Ah, he’s a clever man in talents!” . . .

Gabriel was already among the turgid, prostrate forms. He had flung off his coat, rolled up his shirtsleeves, and taken from his pocket the instrument of salvation. It was a small tube or trochar, with a lance passing down the inside; and Gabriel began to use it with a dexterity that would have graced a hospital-surgeon. Passing his hand over the sheep’s left flank, and selecting the proper point, he punctured the skin and rumen with the lance as it stood in the tube; then he suddenly withdrew the lance, retaining the tube in its place. A current of air rushed up the tube, forcible enough to have extinguished a candle held at the orifice.

It has been said that mere ease after torment is delight for a time; and the countenances of these poor creatures expressed it now. Forty-nine operations were successfully performed. Owing to the great hurry necessitated by the far-gone state of some of the flock, Gabriel missed his aim in one case, and in one only — striking wide of the mark, and inflicting a mortal blow at once upon the suffering ewe. Four had died; three recovered without an operation. The total number of sheep which had thus strayed and injured themselves so dangerously was fifty-seven.

— thomas hardy, *Far from the Madding Crowd*

Surprised but helplessly under control is the only suitable description for a ewe in a well-designed cradle.



A better way to treat bloat if the time is available is to use a three-foot length of half-inch garden hose with the edges smoothed to prevent cuts. The hose can be lubricated and slipped down the sheep's throat into the rumen, permitting the sheep to swallow it as it goes. If the bloat is caused by blockage of the esophagus, the hose will shove the obstruction aside and the gas may escape with some speed through the hose (and the wise shepherd stands to one side). If nothing comes out, suck gently on the free end of the hose to draw a sample of the stomach contents into the hose. Place a thumb over the free end and withdraw the hose and sample. If there is a sudsy liquid in the hose, frothy bloat is the problem, and bloat treatment liquid is needed. Mix some bloat remedy, generically poloxalene (one brand is called Therabloat), according to directions on the bottle, reinsert the hose, and pour in an appropriate amount. Before pouring in the remedy, you might blow into the hose. If the sheep coughs you are in its lung, so try again. The hose can be turned gently to mix in the remedy and help break up the foam. You can also inject this directly into the rumen if you know what you are doing. Ask your



Sheep are easily restrained in this position—even if they do look pretty silly.

vet for instructions. If you have no frothy bloat remedy, a few tablespoons of vegetable oil and about a quart of warm water may help. Mineral oil can be used, but it does not have the antifoam properties of vegetable oils.

A bloated sheep is not only swollen—as the name suggests—but will look glassy eyed and have shallow breathing. Sometimes sheep eat so much that they look swollen. This condition is not fatal as long as the sheep has a chance to digest the rumen contents. Sometimes, though, a sheep will lie down when full and be unable to get up again. If a sheep lies down with her legs uphill, she won't be able to get up again with a full rumen, and she doesn't have sense enough to roll over and get up from the downhill side. Alternately, a sheep can roll into a ditch or depression and be unable to get to her feet. This is no laughing matter because the weight of the rumen can bear on the lungs and suffocate the sheep. If you see a sheep that cannot get up, run—don't walk—to her and set her up on her feet. She will stand there puffing and shaking her head for a few moments, then run off baa-ing to rejoin the flock as if nothing had happened.

Because a ewe will swallow a length of garden hose readily, the shepherd can easily check rumen contents for bloat or administer fluids or medication.



Escaping Sheep

Always glance at the fences and listen for distant bleats to check whether one of your beauties is stuck in a fence. Go over and get her out before she strangles herself. Grab her by one back leg and pull, and she'll pop out of the fence like a cork.

Sheep don't always get stuck in fences—sometimes they get through them. Some individuals are more talented at that than others, and they usually have what business schools call leadership ability—they take the whole flock with them. The solution to this problem is to fix the fences, or get rid of the offending individuals. Checking that the flock has not flown is a serious matter because you want to avoid offending your neighbors and letting the sheep bloat, but there are other concerns as well. Most insurance does not cover losses of animals that simply escaped through a weak fence or open gate. You are also liable for any damages caused by your sheep, and those damages might be considerable. If a driver swerved to avoid hitting your sheep and had a collision, you would be responsible. If bodily injury or death were involved, you could be out of the sheep business forever, especially near

urban areas where judges and juries commonly tend to favor the city dweller over the rural.

Legs and Foot Problems

Look for animals with a limp and check any to see what the problem is. It may just be a rock jammed in the hoof or a pulled muscle. If the leg is seriously damaged, take the animal from the flock to recover or it will painfully follow the flock everywhere, in which case healing will be delayed and the condition may worsen. Put it in a small pen with another sheep for company, and let it mend.

If the hoof is odorous and has soft places the problem is probably foot rot. The affected sheep should be isolated because the disease is highly contagious. Treatment consists of severe trimming of the hoof to remove dead tissue and to expose the actively infected portions to the air. The hoof can be treated topically (i.e., at the site) with a 5 percent Terramycin ointment.

If possible, the whole flock should be treated by using a footbath of 10 percent zinc sulfate in water. Ideally all hooves should be trimmed before the footbath is used, and each sheep should be forced to use the footbath several times a day or to stand in it for an hour. Many veterinarians also recommend giving zinc orally at a rate of a half gram of zinc sulfate per head per day in the feed, or feeding a commercial product containing zinc methionine called Zincpro at the rate of one ounce per day for 100 to 130 head of sheep. It makes common sense to undertake any of these treatments with the advice of your veterinarian.

Foot rot in sheep is caused by two bacteria called *Bacteroides nodosa* and *Fusobacterium necrophorum* that exist synergistically, that is, in a cooperative relationship. They are both anaerobes (they live in the absence of air), which explains why trimming of the hooves is so important. *F. necrophorum* is a normal resident of sheep's digestive tracts and is usually present in barnyards and pastures. If *B. nodosa* is transmitted by an infected sheep it invades the soft tissues of the foot. Then the normally harmless *F. necrophorum* follows and causes an intense inflammation and a limping sheep, often to the point where the animal will walk on its knees to lessen the pain.

As with so many health problems, prevention is the key. Foot rot is very difficult to cure. Don't be overeager to return "cured" individuals to the flock. Be sure to quarantine any new animals, and if you visit a farm where animals have foot rot, clean your boots thoroughly so you don't bring it home to

plague your flock. Also, keep any area formerly occupied by infected sheep free of any sheep for a week before using it for sheep again.

There is a vaccine available for foot rot that has had some success. It is certainly worth trying if your flock has a recurring problem.

More rarely, *F. necrophorum* acts as a synergist with *Corynebacterium pyogenis*, whose species name means pus former. The two bacteria enter the region just above the hoof and cause inflammation and swelling. Treatment consists of paring the hoof and draining the pus, plus topical application of penicillin as well as IM injections of penicillin. Have your veterinarian do this for you the first time so you can learn the proper procedure.

Flies and Health

Flies can cause problems in summer, apart from just annoying the animals. Not that the annoyance factor isn't important, because it is. Older sheep huddle together to protect one another from flies, and lambs go off feed if flies are present in large numbers. Barnyard sanitation is the only way to control flies, at least partially.

Flies will sometimes lay eggs in wet or dirty parts of a sheep's fleece or in skin folds that retain moisture. The larvae—maggots—cause irritation and death of tissue, and they live on the dead tissue and exudates from the wound. The maggots enlarge the cavities they occupy to the point that the sheep can die.

Control of fly strike—as this condition is called—consists of not giving the flies suitable places to lay their eggs. Tail docking and trimming of wool around the anus and vulva are useful preventives. Already infested sheep can be treated by first clipping off wool with scissors or shears, then applying a suitable insecticide that penetrates and reaches the maggots. A repellent should also be used to prevent reinfestation. If the maggots are deep into the tissue, a hydrogen-peroxide solution can be poured into the crevice. The foaming action will float out maggots as it cleans the wound.

One species of fly, *Oestrus ovis*, lays larvae near the nostrils of sheep. The larvae crawl into the nasal passages and sinus cavities to grow, causing considerable irritation. The larvae, called nasal bots, cause a sinusitis with a persistent mucous discharge from the nostrils. The adult flies also annoy the sheep greatly by crawling around their nostrils. Affected sheep hold their heads close to the ground and stamp their front feet, sometimes seeking cool, shady places to escape the flies. Bots are an annoyance rather than a serious prob-

lem, but can cause sheep to lose appetite and optimum health. Insect repellents sprayed around the nose area are of some help.

Eye Problems

Eye infections, commonly lumped under the general term pinkeye, can occur any time of year but are most prevalent in warm weather, when flies are active to serve as carriers (vectors) of the disease-causing organisms. Pinkeye in sheep is usually caused by one or more microorganisms in the groups called mycoplasma, chlamydia, or bacteria. Dust, wind, and strong sunlight are contributing factors. The eye or eyes are runny with tears, the membranes get red and swollen, and as the problem advances the eyeball gets a bluish haziness and ulcers form on the eyeball, which may protrude or even rupture. Both eyes are usually affected.

Affected animals should be kept out of strong sunlight, and topical salves, ointments, or powders should be applied to the eyeball. Eye drops of a home-made 5 percent solution of zinc sulfate in distilled water are effective for some pinkeye. One producer likes Cloxacillin Benzathine (Orbenin), which is a teat treatment for cattle—ask your veterinarian for approval. We found it very useful also to give an injection of an antibiotic, according to label instructions. Penicillin has been effective for one type of pinkeye we have encountered. For severe cases, an antibiotic can be injected into the eyelid, using a small-diameter short needle. Get your veterinarian to demonstrate this to you. An older treatment that is still favored by some veterinarians is to inject some sterile milk IM. The sterile milk can be prepared by dissolving a freshly opened packet of dehydrated milk in boiled, distilled water, and then boiling the solution for five more minutes. The solution should be cooled and used immediately. The milk protein stimulates the immune reaction in the eye and helps the sheep's body fight the infection. The same protein can, however, cause anaphylactic shock, a severe allergic reaction. The treatment for this rare event is an injection of epinephrine (adrenaline) according to label directions. Such a reaction can occur from any injection, so the shepherd should always have a bottle of epinephrine on hand just in case when giving an injection of anything at all.

In general, learn to spot a limping sheep or one with stiff legs. Look for any who are not eating eagerly or are lagging behind the flock. Check the one that hangs around the water trough more than normal. Be alert for a blind sheep or one with impaired eyesight. You may think that a blind sheep would



Eyes almost closed and drooping ears tell you this is a sick sheep. She recovered nicely after receiving some bloat medicine.

be simple to recognize, but you'd be amazed how well a blind one can get along by following the sound of the flock. Watch the ears too, for a sheep with drooping ears is probably a sick sheep that needs your help.

Polioencephalomalacia

Don't worry, you can call it PEM. PEM is a condition brought on when something goes wrong in the ewe's rumen where the "B vitamin" thiamin is produced. From a feed change or other cause, microorganisms that produce thiaminase, a chemical that destroys thiamin, become abundant and the sheep runs out of thiamin. This causes neurological effects—they look sort of drunk, become blind, and eventually go down and die. Affected animals do not have a fever. The treatment is thiamin. Get a bottle from your vet to have on hand. The affected animal should receive a big IM dose—10 cc or more. If PEM is the problem, recovery will be dramatic, with symptoms lessening in a matter of a few minutes. However, symptoms will recur in a few hours, so be prepared to treat repeatedly until the sheep fully recovers. If your vet does not have thiamin, use B-complex at higher dosage.

LAMBS

If the rebuilding time is a portion of the cycle when the ewes need minimal attention, that is more than made up for by the amount of care needed by the growing, weaned lambs—your big cash crop. It is important to change the lambs' environment as little as possible. For most of them the loss of their mother's companionship and built-in dairy bar is a severe change that will set back their growth and general health somewhat anyway, so all other factors should be kept the same.

Pasture or Feedlot?

A serious decision that has to be made is whether to allow the lambs onto a pasture. Pasture is a tempting alternative to a feedlot because grazing appears to be free, whereas the feed costs money out of pocket. Don't be fooled by this apparent difference, though. That pasture costs you money in a variety of ways. It is a fixed cost in the sense that you have money tied up in it and you pay taxes on it whether you use it or not. I'm not arguing that it be left idle, but it might make better sense to graze older sheep on it or to cut it for hay.

There are a lot of factors to consider in the feeding of lambs, but two stand out. First is the management of worm populations. If the lambs have been kept in a drylot so far, you can probably assume that their worm loads are pretty low. Remember that grass in a pasture is the natural habitat of the larval stage of sheep roundworms, so it makes little sense to put lambs there. Lambs compared to adult sheep have a very low resistance to worms, because the lambs' immune systems are not as well developed as the adults'.

The other factor is that lambs will not gain weight as fast on pasture as they will on a grain mixture. Pastures provide plenty of digestible feed with lots of protein, but the feed is low in energy compared to grain mixtures. We tried the full spectrum of lamb-raising schemes and concluded that the best way, for us at least, is to feed a high growth-rate mixture free choice and give only enough hay to keep the rumen working properly (about a quarter-pound a day per head). We use a mixture of grain and soybean meal similar to a creep feed (the name given to feed provided to lambs in the creep area; see chapter 7) to give about 14 percent protein with 0.5 percent salt and 2 percent limestone, as with the creep mixture. In keeping with lambs' conservatism, don't change their feed very much.

As mentioned in the chapter on lactation, you can give the lambs pelleted

feeds from a manufacturer if you are willing to pay the higher cost. Make sure the feed is not too high in phosphorus because of the urinary calculi (“water belly”) problem in rams and wethers. Using sufficient limestone in the grain ration is the best prevention. If urinary calculi are still a problem, addition of up to 2 percent ammonium chloride (an approved feed additive) to the feed will help. If a ram lamb has urinary calculi, sometimes it can be encouraged to pass out by snipping off the thread-like appendage at the end of the penis, then giving an oral drench of an ounce (28 g) of ammonium chloride dissolved in water, followed by daily drenches of 7 g of ammonium chloride dissolved in water. This treatment is usually ineffective, but will work often enough to be worth a try. Individuals can be treated by surgical amputation of the plugged urethra. It is usually more costly than it is worth to have a veterinarian do this, but the producer can learn the procedure if the incidence of water belly is high enough to require it.

Healthy lambs will gain about three-quarters of a pound to over a pound a day on a palatable grain-based ration and will convert the feed at a rate of about 3.3 to 4.0 pounds of feed for a pound of gain. You’ll have to use local feed costs to decide whether intensive feeding of a grain mixture is the best economic move for you.

We found that our lambs do not finish well on hay and pasture alone. In regions of abundant pasture and low stocking rates, lambs can come off pasture in market condition in favorable years, though not always. We found that lambs fed hay after the pasture season gain very poorly and waste feed. Finishing without a concentrated feed is tough. The finishing feed need not be grain, of course, but it could be cull peas or beans, stale bread, dried potatoes, or a host of feeds peculiar to a given geographic area. Lambs can also be finished on crops planted especially for that purpose. See suggestions for flushing ewes in the next chapter for some suggested crops.

Many shepherds do not like to feed replacement ewe lambs on a straight grain diet because of damage to the rumen from the lack of roughage and a presumed shortening of their useful life and milking ability. We keep the replacements on a high grain diet until they get close to one hundred pounds, after which we increase the hay or pasture available to them.

Selecting Replacements

Most shepherds save some of the best ewe lambs for flock replacements or for selling as breeding stock. As a rule you will want to save lambs that come

from proven ewes who are good milkers, have multiple births, and who have the traits you are trying to perpetuate in your flock. Some growers will say to save only twins and triplets. Others will select the ewe lambs that are the fastest growers. Selection on this basis may mean that more of the ewe lambs will settle their first year, but you may also be selecting for large mature size in the bargain. What the grower should be selecting for is productive ewes of a modest size who produce many pounds of good growing lambs. A big ewe may just eat more than a smaller one and yet not necessarily be more productive. Select ewes that come from the best mothers in terms of both prolificacy and milking ability. From that group you can then select individuals on the basis of their particular traits. You have to know which ewes are your most productive, which is why you need to keep good records for each ewe and her offspring over the years.

If you are saving rams for your own use or for sale, you probably should choose the fast growers. The ram has a big influence on the whole lamb crop, and you do want growthy lambs. A ram from a productive ewe and a large sire who is himself a fast grower is a good choice. Obviously, a big ram eats more and is harder to handle, but his lambs will probably earn you more money than a smaller ram. The ideal flock is made up of moderate-sized, productive ewes and big, growthy rams. Yes, another Catch-22—the big ram's genetics will become embedded in your flock if you save replacement ewes from him.

One cautionary tale—studies by J. J. Zenchak and others (*Applied Animal Ethology* 7 [1981]: 157–67) indicate that ram lambs raised in a male-only group show much less interest in ewes when they are used for breeding, so you should raise ram lambs that are to be used as breeders with a few ewes. The last thing a sheep breeder needs is a gay ram.

Health Problems

A few health problems apply only to fast-growing lambs. One of these (discussed in the chapter on lactation) is their susceptibility to *Clostridium perfringens*. The type-C strain causes scours in very young lambs but evidently is not a serious danger to older ones. The type-D variant is a danger almost throughout the lamb's active growth period, particularly when it is on highly nutritious rations. All lambs should have been vaccinated for both the C and D types at three to four months, or earlier if their mothers were not immunized in late gestation.

Lambs are also susceptible to infestations of internal parasites called coccidia, protozoans that inhabit the intestines of most sheep in small numbers. A least a dozen species are known in sheep. In range or pasture conditions, coccidia rarely cause problems, but in crowded lots outbreaks are frequent and extensive. The life cycle is similar to that of worms in that eggs are passed with feces. The eggs (oocysts) then sporulate and become infective in a day or two, after which they can cause infection of the lambs. The oocysts are highly resistant to heat, cold, and dryness, and they persist in lots and yards for long periods. Preventing reinfection by cleanliness is the best approach theoretically, but outbreaks happen even in seemingly spotless facilities.

The traditional treatment is to use sulfa drugs, which are generally given in the drinking water. Like most microorganisms, coccidia have developed resistance to drugs used against them, and the sulfas are pretty ineffective. Other coccidiostatic drugs that were originally developed for the poultry industry have been used on lambs with promising results. One of these, amprolium (Corid), is added to drinking water, and is reported to give control in some flocks. Two others, monensin (Rumensin) and lasalocid (Bovatec), are effective as feed additives. Lasalocid is approved for use with lambs, but monensin is not. Experiments have shown that about 10 g/ton monensin or 25 to 100 g/ton lasalocid in feed is effective in controlling coccidia (*American Journal of Veterinary Research* 42 [1981]: 57). Aureomycin, which is approved for use with sheep, fed at 10 g/ton of feed reduces coccidia oocyst output and improves weight gains. In studies in Canada by G. M. J. Horton it was found that monensin not only controlled coccidia but also improved feed conversion and allowed feeding a lower-protein feed mixture that gave gains equal to mixtures with 2 percent higher protein. Horton found 10 g/ton of monensin in feed to be optimal (*sheep!* 3, no. 1 [1981]: 18–19).

It is widely believed that a veterinarian can prescribe monensin to be added to feed. That is not true in the United States, because monensin is considered to be a feed additive rather than a drug. It is true in Canada.

For lambs on pasture it is more difficult to devise a preventive treatment for coccidiosis. Lasalocid has been mixed with salt at the rate of 0.75 percent (7.5 g/ton) and given free choice to pastured lambs. Treated lambs gained thirteen pounds more than untreated ones from weaning to market in a recent trial (*American Journal of Veterinary Research* 42 [1981]: 54).

Preventive action by treating ewes before lambing to reduce the spread to lambs is a wise move. Ewes can be treated in their feed or, in a pasture setting,

decoquate (Decox) in the mineral/salt mix for one month prior to lambing works well.

When any medication is given to a lamb, the animal should not be shipped for slaughter until enough time has elapsed for residues of the antibiotic or other chemical to disappear from the tissues. Approved drugs all have legal withdrawal times when used according to directions. The drug must be administered in the correct dose, by the correct method, in the correct site, all as directed on the label. Be sure to follow directions and do not ship until enough time has elapsed. Terramycin injectable lasts only 15 days, LA-200 28 days, and so forth. Read the label or ask your veterinarian if the label does not have this information or if it is unclear to you. You are responsible for the residues if they are found, and spot checks are made. Wormers and pesticides also have withdrawal times set by regulation. You can do pretty much anything you want with a breeding animal because it is not going to slaughter and nobody will ever know, but follow the rules with lambs or you may have a representative from FDA or a state agency knocking on your door. Remember that if you treat a lactating ewe the lamb will get a dose too. See appendix 3 for more details.

FLOCK EVALUATION

At some point during the rebuilding period it is a good idea to get out the records from lambing and weaning and evaluate the ewe flock for possible culling. Those that didn't give you any lambs are prime candidates for shipping. If a ewe bred as a lamb didn't settle, you may well opt to give her another chance, but it is unwise to keep an older ewe who missed. She is unlikely ever to settle again. There is one exception to this rule. If a ewe has a sufficiently valuable fleece she might be retained. We have a few who produce fleeces that sell for ten dollars a pound, so they would pay their way even without lambs.

The ewes with broken mouths (i.e., missing lots of teeth) should go unless they are special for some reason, and I'd put the fence jumpers and other escape artists on the list too. Go through the records and seek out the ones with low lambing percentages. In today's market a ewe that produces only a single lamb is about a break-even proposition, and why should you go to all that work for a net profit of zero?

If you weighed your lambs frequently, you'll be able to identify the ewes that grow their lambs out well and those that don't. Any ewe that produces slow-growing, weak lambs is a liability to your flock and should be culled. Even a ewe that gives twins and triplets is not of much use if she cannot raise them. If a ewe has lost half of her bag to mastitis, she won't pull her weight. There are always exceptions, of course; we have a ewe with half a bag who always twins and raises both lambs.

If your flock is small, you may have some favorites that you are reluctant to send off for slaughter. At the very least you may not be very objective about culling if you have an emotional attachment to some of the animals. To prevent this pitfall you can rank your ewes numerically. Use a computer program if you have one available, or do some longhand arithmetic for a small flock. Decide on some categories that you think are important such as prolificacy, lamb-raising ability, general health, fleece quality, genetic background, or other meaningful characteristics. Then assign a percentage of importance value to each characteristic. As an example, let's say you broke down the list above as: prolificacy, 30; lamb raising, 30; health, 10; fleece, 10; genetics, 20. Then look at your records, and in the context of your flock, give a ranking of 0 to 3 for each category, with 0 meaning poor and 3 excellent. Multiply each ranking by the percentage assigned to each category and add up the total, which will range from 0 to 300. In the above example, if you ranked a ewe 2, 3, 2, 1, and 3 respectively, the arithmetic would be $(2 \times 30) + (3 \times 30) + (2 \times 10) + (1 \times 10) + (3 \times 20) = 240$. If you prefer percentages, divide the sum by 3 to get 80 percent. You may find that some of your favorites end up with distressingly low rankings and should be culled. If you haven't the heart to ship them, get a sheep-raiser friend to come over and talk you into it. It isn't in your long-term interest to keep them.