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BREEDING

Breeding time on a sheep farm is almost as much fun as lambing time because things really are happening. The rams start pacing along fences and may get into some head-butting matches as their hormone levels climb with the season. Placed with some ewes, a good ram will rush about sniffing rear ends and curling back his upper lip after the investigation, not unlike a wine lover evaluating the nuances of odor of a fine bottle. He will lift one front leg against the side of a ewe he favors and talk to her in throaty, gurgling sounds with his tongue hanging out. He will make attempts to mount his favorite, and failing that will try another and another. It is really quite a show.

EWES

Ewes who are not in heat will act irate and rush away from the ram. Those that are in heat are quite the opposite. They will face the ram, and if there is

a crowd of them they all stand around him in a little group. When the ram moves they follow him everywhere. They respond to his attentions with lots of body language and stand solidly for him when he tries to mount them.

Pity the ewes who are in heat when there is no ram around. They stop eating, stand about aimlessly, and stare hopefully in the direction of a distant ram, calling out with loud baas. For lack of a ram to follow, ewes in heat will commonly follow the shepherd (of either sex), a barn cat, or anything else that is handy. A ewe lamb who comes into heat without a ram around can show really strange symptoms. Some of them will display all of the vocal output of their elders, and they also run wildly around looking this way and that as the unfamiliar—and thus doubly distressing—feelings affect them. Don't panic and call your veterinarian; they'll all recover in a day or two.

Most breeds of sheep naturally come into heat or estrus in the late summer or fall of the year in north-temperate climates like those in the United States or Canada. In equatorial areas estrus is not highly seasonal. Studies of sheep many years ago in England, and more recently in France, have shown that the external factor that determines when a sheep begins sexual activity is the length of the daylight period (photoperiod). Many shepherds as well as animal scientists had concluded long ago that ewes were brought into heat by the shortening hours of daylight as fall approached. Recent research seems to suggest that the estrus cycle is set in motion by the long days of summer—specifically, the presence of light during the sixteenth hour after sunrise, and it is the long days of summer that set the timing for heat to begin in the short-day season of fall. Be that as it may, and scientists will disagree on points that seem irrelevant to the layman, all agree that length of daylight is the important control. A chemical called melatonin produced by the pineal gland changes in levels with changes in length of day, and seems to be an important factor. It is produced only during darkness, so levels increase as days get shorter. However, without prior long daylight, the increased melatonin does not seem to be effective.

There is a persistent rumor among sheep raisers that estrus is brought on by cool fall weather, and to hear folks talk, the first frosty nights of autumn bring on what appears to be an avalanche of cycling ewes. I have even read of a producer in the Midwest who thinks that ewes who spend the night in cold, low places come into heat before their cohorts who overnight on the hilltops. There is no scientific evidence whatsoever for these contentions. Sheep come into heat seasonally in regions that never get cold. Also, tens of thousands of

sheep summer in the mountains of the American West. In many of those areas, the nighttime temperature drops below freezing nearly every night, yet those ewes don't come into heat. This is not to say that cool weather doesn't favor an increased fertility and libido of rams, but it has nothing to do with starting estrus in ewes.

Another factor in inducing estrus is the presence of a ram (as mentioned in the chapter on flushing). Those of you who would attempt out-of-season breeding would be well advised to use both rams and control of lighting. To date, inducing out-of-season estrus with hormones alone has had very limited success, and that at the expense of prolificacy. Choosing suitable breeds is the best bet at present.

If you are breeding ewe lambs, you probably should separate them so they can be bred last. The more growing they can do before breeding the better. It is best to keep them separate from the main flock until lambing because they should receive a more nutritious ration during gestation to allow them to keep nourishing their own bodies as well as providing for the enlarging fetus or fetuses.

RAMS

Shepherds manage breeding according to their goals and needs. Many commercial sheep raisers just put a bunch of rams in with the ewes and let nature take its course. This method is fine in some ways, but it leaves the shepherd pretty much in the dark as to the parentage of the lambs. It also eliminates any possibility of identifying the characteristics of any individual rams, such as fertility and transmission of genetic traits. I am not saying that this method is no good, but it is not my cup of tea. Since I am curious by nature, I want to know what an individual ram can do rather than what a committee can do.

A difficulty can arise with the use of a group of rams: the problem of the dominant ram. If, in a group, there is one ram that is very aggressive and is constantly trying to exercise his dominance over the others, two problems may surface. First, the dominant ram will repeatedly emphasize his superiority over his colleagues by fighting with them. This results in injury, even death, and all of the participants expend energy on fighting that should be spent on breeding ewes. The situation encourages competition among the rams—not what the sheep breeder wants at all. The breeder wants the ram's

entire attention given to the ewes. Many a human female has encountered similar problems with a man who does his dominance sparring with other men in the form of bowling, softball, tennis, or some similar ritual instead of paying attention to her.

Second, the dominant ram may prevent the other rams from mounting any of the ewes in heat. Having done so, the job is left to him, and he has problems. First, having fought all of the other rams, he has expended much more effort than any one of them. He's pooped. Worse, if he does have enough energy to mount and impregnate all of the ewes he has fought for and won, then he expends a tremendous amount of semen. His sperm supply and fertility may have been fine at the outset of breeding, but because of his servicing every ewe, his sperm count begins to fall, with the result that there are fewer settled ewes, and fewer multiple fertilized ova among those that do settle.

If things are this bad, you ask, how do some breeders get away with it? They do if there is not a strongly dominant ram in the bunch. If they are all a group of fairly easy-going characters, they will spend their time with the ewes rather than trying to prove how tough they are. It helps in a ram pool to have all the rams of about the same age and breeding. The more equal they are, the less they will feel obligated to prove themselves.

In some settings, the dominant ram is so busy fighting with other rams, that some less combative rams breed ewes while the bigshots are fighting.

I don't mean to imply that rams stand around thinking all this over and make reasoned decisions as to whether to fight or not. However, a mixed group means mixed personalities. Different breeds of sheep have quite different psyches as do rams of different ages. A fun-loving young Lincoln is a far cry from a grouchy old Karakul, especially if the Karakul has a short male complex. In contrast, two of our mostly-Finn rams thought that they were the toughest kids on the block, and were promptly killed after picking fights with rams twice their size.

My preference is to put a single ram in with a group of ewes that he is able to handle comfortably. That way there is no fighting, and the sire of the lambs is known. Rams of superior performance can be identified as can those who don't quite do the job. A sterile ram will show up quickly, whereas in a ram pool you could support a sterile individual for years without even knowing about it. In the same way, rams with undesirable genetic traits can hide in a ram pool, but the bad characteristics they transmit can be traced directly to them in the sole-ram situation.

The size of a breeding group depends on a lot of factors. To test a ram lamb or to use an old, decrepit fellow you might use a handful of ewes. At the other end of the spectrum is the question of the maximum number of ewes that a single ram can settle. Various sources suggest from forty to sixty ewes, which is certainly in the right ballpark. A number like that is not the whole story, however. No one ram could possibly handle forty ewes that all came into heat on the same day. Thus, if estrus cycles have been synchronized by some method, the ewe/ram ratio needed is quite different from when estrus is spread out over many days or weeks. With synchronized ewes, the breeder either should place very small groups of ewes with each ram or should use a ram pool. If the ewes' heats are spread out, then a single ram can settle a large number of ewes. One year we used a single ram on ninety ewes and he settled every one — over a four-week period.

After a ewe has been bred once by a ram she will probably settle. This is not always the case, and most shepherds will leave ewes with the ram for at least another cycle. Another option is to use a ram to generate replacement ewes for the first cycle, then replace him with one to make growthy market lambs for the second cycle. That way your replacement ewes come from mothers who cycle early and easily.

At that point ewes can be placed with a cleanup ram to try to settle them or they can just be put with a teaser equipped with a crayon to identify the open ones. An older ewe who comes into heat after breeding should probably be shipped. You may wish to wait a little and give her a pregnancy check in a few weeks because pregnant ewes can come into heat again, although that is unusual. (I'm assuming a normal fall breeding season.) A ewe who doesn't settle in June should not be blamed.

If breeding time takes place during hot weather, the rams should be removed from the ewes during the hot part of the day and given a cool, shaded place to rest up for night breeding. This is more work, but you will be repaid by getting more out of the rams than if they were working in the hot sun.

Marking Crayons

The best way to use a ram to his maximum potential is to put ewes in with a teaser who wears a harness and marking crayon. As the ewes come into heat, they can be pulled off in small groups and put with the fertile ram. This way, the shepherd has quite a bit of control and can utilize facilities like lambing barns to their maximum by planning lambing days for groups of ewes of a

size that suits the barn's capacity. The ewes can be put with the fertile ram as soon as they are marked by the teaser or they can be held over for the next heat, or even the next after that. The fertile ram should also wear a harness and crayon of a contrasting color so that the date of breeding is known. All of these details may seem like a lot of time-consuming work, but it is more than repaid at lambing when the shepherd knows the approximate birthing dates for each ewe. Also, the lambings can be spread out over a period of time without the boom-and-bust succession that typifies so many lambing seasons.

Marking crayons or blocks fit in a harness on the ram and leave a colored mark on the rump of a ewe when she is mounted and bred. Raidex, Stayfix, and Sire-Sine are three of the brands. Generally any given brand will only fit in that brand's harness. Some come in different grades for hot or cool weather. Effectiveness depends a lot on the weather and type of wool on the ewe.

For some unknown reason, the red crayons seem to mark much better in cold weather than the other colors. Black crayon marks are too easily confused with dirt or with grease rubbed off from a piece of farm machinery to be useful in all settings.

Instead of using crayons, paint or grease can be wiped onto the ram's brisket every day, but that is more of a nuisance. The crayons are not maintenance-free, however, and should be cleaned off with a pocketknife every day or two if they cease to give clear marks.

Important note: some colors of crayons will not wash out readily, so the marked part of the fleece is spoiled. Worse yet, some red crayons will tint the whole fleece when it is washed unless the marked part is removed before washing.

Fencing

Breeding is a time when your fences will be tested for soundness and effectiveness. A ram with sex on his one-track mind will view a forty-inch fence with scorn and sail over it like a deer as he responds to the siren call of a ewe in heat. Rams who are built for power rather than leaping ability will simply smash through and flatten a woven-wire fence as if it were made of wet spaghetti. We had a stubby, ornery, powerful half-Karakul ram who was separated from some ewes by a sturdy fence and a two-acre lake. One late summer day he could tolerate no more celibacy, and he just wiped out the woven wire, ran and leapt into the lake, and proceeded to swim clumsily but persistently till he finally reached the ewes. Another ram bred a ewe through a combina-

tion woven-and-barbed-wire fence without bothering to jump it. Not only did he breed and settle her, but he left a clear crayon mark on her rump. Never underestimate the inventiveness of a ram in pursuit of a ewe.

The moral is to get out and around the farm before breeding; tighten fences and keep checking them because they may get torn up. A sagging woven wire is an invitation to a ram on the move. If the fences are topped with barbed wire, be sure that the top wire is high enough to discourage jumping. A ram who leaps and misses can injure his underside pretty badly, with obviously unwanted results.

With small groups, the problem of a ram's leaving is lessened by placing the group in a small pen without enough space to give him a run at the fence. Small pens made with cattle panels are satisfactory. Whether the groups are large or small, it is never a good plan to have groups directly adjacent to one another. The rams will usually fight through the fence, messing up both themselves and the fence in the process. Ram lambs will sometimes behave in adjacent pens, but don't ever trust the older ones.

NUTRITION

During breeding the comparatively high feed levels of flushing should continue. Ewes need to be on a generous ration in order to come into estrus and in order to produce the multiple ova that will produce those valuable twins and triplets in five months. If pastures or crop residues were used for flushing, be sure to check them to see if they are still providing enough nutrition. If they have been depleted, provide supplements in the form of grain or a balanced feed mixture. A field of cornstalks with the grain all gone won't do the job, and even standing alfalfa may require some supplemental energy from grain to make a balanced ration.

If in doubt about your feeds, you can always have lab analyses made of the actual materials your sheep are eating. Feed analysis is usually available at your state's agricultural college, so ask your local extension agent. Also, many feed companies provide free analysis; inquire at your elevator or feed store. However, feed analyses may not really tell you much about the nutritional value of a given product. Chopped chicken feathers in a feed would show as protein, but they wouldn't contribute to the sheep's nutrition. The only analytical instrument that is of true value is a sheep. E. W. Crampton and L. E.

Harris in the second edition of their book *Applied Animal Nutrition* (San Francisco: W. H. Freeman, 1969) give an instructive example in which the lab analysis of a grass hay is compared with the analysis of the feces from a cow fed the same hay. The protein content of the feces is higher than that of the hay. This does not mean, of course, that we should be feeding cow pies to the stock; it means that analyses don't tell us all we need to know about the nutritional value of the material analyzed.

Perhaps the easiest route is to stick with conventional feeds like hay or hay plus grain until experience is gained with other possibilities from actual feeding trials. An experienced stockman in your area is probably the best source of information. Our pastures are pretty well shot by breeding season, so we feed about three pounds of hay and a pound of corn to our medium-sized ewes.

The flock will need fresh water, as always. If grain is fed, the sheep can get their water ration at the same time and place as their grain. Bringing sheep to the water is always easier than the other way around. This is especially true in cold weather when tanks are freezing at night. One central tank is a lot easier to keep thawed than several scattered all over the farm. Salt or a 50:50 salt and dicalcium phosphate mixture can be provided with the water. There are no special vitamin or mineral requirements during breeding, but do remember to add 1.0 to 1.5 percent limestone to the grain ration to correct the calcium and phosphorus ratio. Limestone can also be added to the salt mixture. Assume that the sheep will eat about one-third of an ounce of salt mixture daily; add limestone accordingly. I want to emphasize the need for the calcium from the limestone, because rams are in with the ewes and they are the ones who are susceptible to water belly, aka urinary calculi.

When breeding season is over — a decision that is made by the shepherd rather than the sheep — the feed levels should be reduced. During early gestation the nutritional needs of a ewe are little more than during the rebuilding period. Do not abruptly withdraw the grain or other highly nutritious components of the feed. While taking away grain is not as touchy as adding it to a ration, the rumen flora still have to adjust to a new melange of materials. This change in the proportions of various microorganisms takes a little time. The ewes will complain loudly when you reduce their grain, of course, but turn a deaf ear to their entreaties. Some authorities state that too rapid a reduction in feed levels after breeding results in poor implantation of the fertilized ova on the wall of the uterus, resulting in open ewes or fewer twins and triplets, so be sure to change proportions slowly.

During breeding season the rams are the busiest individuals, and as a result they burn more calories than the ewes. A really good ram, constantly checking the ewes, is at a very high level of activity. For this reason be sure the ram gets enough food. If a given ram is no gentleman (gentleram?) and bullies competing ewes away with his head when eating grain, you can probably rest assured that he is getting his share. If he's a perfect gentleram and eats just his share, you probably should hand-feed him some extra grain in a bucket. Remember that the ram weighs nearly twice what a ewe does and would need more nutrition for that reason alone, not to mention his extra energy expenditures. Look at the NRC tables to see what he requires, then give him 25 percent more to allow for his extra work load. You will find that some rams get so involved with romancing the ewes that they will not want to eat. This is fine, provided they came into breeding with enough flesh to be able to live partly off their own tissues. If a ram on this fasting regimen begins to look too thin, remove him from the ewes for a few hours a day so he can get his attention away from sex and onto food. Rams are basically hedonists, and it is just a matter of directing their pleasure-seeking in the right direction. An advantage in giving the ram a little extra food each day is that it presents an opportunity to examine his gear and adjust a harness or clean a crayon without having to chase him all over a pasture or yard.

MANAGEMENT OF BREEDING

Synchronization

If synchronization of heat (estrus) is part of your plans, now is the time, provided it was not done during teasing. The most common way to synchronize a flock is to use the hormone progesterone or a compound that mimics progesterone (progestogens). Progesterone is a natural hormone that prevents cycling in a pregnant ewe. The usual way is to place a hormone preparation on a plastic sponge that is inserted into the vagina of the ewe. The hormone is absorbed slowly by the ewe and prevents estrus. Alternately an implant of Syncromate can be placed in the ewe's ear. When the shepherd wants the ewe to cycle, the sponge tampons are removed by a string attached to them, or the syncromate is removed through a small cut, and the ewes come into heat in about forty-eight hours.

For the sponge method, the progestogen solution is soaked into the sponge,

and the sponge is allowed to dry for a couple of days before use. The sponges can be the cylindrical ones used for some kinds of home permanents, although a veterinarian friend of mine told me he made some dandies by sharpening one end of a piece of one-inch electrical conduit and used it to cut cores out of two-inch-thick polyfoam cushion material. A piece of fishing leader is threaded through the center of the cylinder and left hanging out of the vulva after insertion into the ewe's vagina. Syncromate is inserted with a special tool.

When the sponge or implant is removed, the ewe is given an injection of FSH (follicle stimulating hormone) or PMSG (pregnant mare serum gonadotropin) to bring on estrus.

There is also a product on the market that is a chemical analog of another type of hormone called a prostaglandin, sold under the name Lutylase and made for use with cattle. Some experimental use of this product with sheep in Ireland has not been encouraging, but researchers at Agriculture Canada's Animal Research Institute report results comparable to progestogen-impregnated sponges. Trials of prostaglandin PGF_{2a} at the Colby, Kansas, Agriculture Experiment Station by Frank Schwulst showed that it was effective for synchronizing already cycling ewes, especially older ones. Lutylase is given to cycling ewes as a single injection, or in some cases two injections, and they are immediately placed with the rams. This is a great deal handier than the sponge technique, but the cost of the hormone is presently much higher than that of the progestogens used with the sponges.

Note: None of the above synchronization methods is approved for sheep. However, you can work with a veterinarian and use the materials off label with the vet's supervision.

Progestogen-impregnated sponges are also used to make ewes superovulate, that is, to produce more ova than usual. For superovulation, PMSG is injected into the muscle after removal of the sponge. The ewe is then bred as usual after a delay of about forty-eight hours. Later, fertilized ova are flushed out of the ewe's uterus or removed surgically and are implanted in other ewes to continue their development. This procedure is strictly for professionals at present and is, as you might suppose, expensive. Transplanting of ova is widely used with cattle, especially dairy cows, to generate high-producing animals in larger quantity, faster than can be done with ordinary breeding. Because of the high cost, applications in sheep breeding are not yet common except in special instances with very valuable purebreds. In Australia, ova

transplanting has been used to increase numbers of rare breeds threatened with extinction. Doubtless the technique will become more popular as costs diminish.

Artificial Insemination

Artificial insemination (AI) is used with sheep, but not as extensively as with cattle. Ram semen does not seem to store as well as that of bulls and also cannot be placed through the cervix of a ewe as easily as this job is done with the much larger cow. AI is used with sheep, but is a job for professionals. Dr. Martin Dally, University of California, Davis, mrdally@ucdavis.edu, is widely respected. Elite Genetics (see appendix 6) is a well-known firm that does AI in sheep, or ask your vet for recommendations. AI is often used with imported semen or semen collected from rare-breed rams or rams with unusually desirable characteristics.

Fertilized ova or embryos are also imported for transplantation into ewes, avoiding the need to ship whole sheep from far-off places. Also, embryo import may be allowed, whereas imported sheep would be forbidden or subject to long quarantines. Be warned that importing anything (sheep, embryos, or semen) from the United Kingdom or Europe is very tricky because of disease questions.

If you want to import genetics, do consider a whole ram as an option instead of semen. Or, import embryos, and then you will have several purebred sheep to breed naturally. Importing semen, embryos, or sheep is expensive, so compare all the costs over several years before you decide on one approach.

Year-Round Breeding

One intensive management scheme is to try to breed ewes on a year-round basis. This means selecting out the open ewes and running them through breeding again until they do settle. Most breeders do not literally want to breed and lamb continuously, but still might want to have two, three, or more lambing times per year. A rational way to start such a plan is to place ewes with a teaser permanently, and pull off breeding groups as they come into heat, starting with the least likely time of year. Why the least likely? Because you want to identify the ewes who will come into heat outside the normal season and breed them then to take advantage of their unusual trait.

Ewes can be returned to the pool as soon as their lambs are weaned, and thus produce more than if they were given a recuperation time. Breeding groups can be taken out every four months, or every three months, or every

month, as suits your plan. With lambing taking place more frequently, facilities are more fully utilized, with resulting economies, at least on paper.

Such a scheme should probably include synchronization of heats so that lambings can be completed in compact time periods. Lambing can be chemically induced to space birthings even closer together; this will be discussed in chapter 5. In a French experiment, inducing was used to cause all lambs to arrive during the week so employees could have weekends and feast days off.

I mention such ideas just for you to think about. I do not suggest that a novice attempt to embark on a year-round lambing plan at the outset. Such a management scheme is strictly for the experienced, so learn first before you jump into more action than you are prepared for. Also, you may find that labor costs outweigh the gain in total lambs for the year, because you have two or three lambings to deal with. Think before you leap.

If such a program sounds interesting, check with Cornell University's Animal Science Department about the STAR system of sheep breeding: www.ansci.cornell.edu/ and search for star system or write to Department of Animal Science, Cornell University, Ithaca, N.Y. 14853-2801.

Inbreeding

Before breeding groups are assembled and put with a ram, be sure to make a last-minute check on the ancestry of all the ewes to assure they are not being bred by their sire or by a sibling. It is easy to let this happen accidentally. In the normal course of things, close inbreeding is not a good practice. Lambs from such matings are usually of low vigor and may exhibit recessive traits that were not expressed in either dam or sire. Once in a while such traits are just what the breeder is looking for, but mostly they are traits like dwarfism, blindness, aberrant wool, and even bizarre features like single eyes, no lower jaw, ears that leak milk when the lamb sucks, and so forth.

There are instances when the breeder wishes to inbreed closely to emphasize a trait. When inbreeding is intentional it is dubbed line breeding. A good example of this is the breeding of black (and colored) sheep to try to emphasize the black wool trait. The black wool gene is a recessive one for most sheep breeds, with the notable exception of the Karakul, which does carry a dominant black gene. Thus, a breeder may wish to breed a black sire to black daughters in order to bring out the recessive black trait. The genetics of wool color is very complex and far beyond the scope of this book. The Natural Colored Wool Growers Association is a good place to start to learn more. See

appendix 6. (In addition, you might want to go to groups.yahoo.com and search for *sheep-color-genetics*, and subscribe to that mailing list.)

Such a breeding program is fine except that other recessive traits may be emphasized that are not desirable. A result of this line breeding of sheep for color is that a disproportionate number of black sheep are small or even dwarfy compared to their white counterparts.

We discovered a serious negative trait in a line of black sheep we used to have. They all carried both a recessive and dominant black gene, which was just great. However, they also showed a tendency to short legs and a propensity to die of congestive heart failure at an early age. We got out the records and traced the ancestry of the short-legged ones to a single sire. The ones that hadn't taken care of the problem themselves by dying of heart attacks were given the ultimate cure—a trip to market as culls.

Another example of close inbreeding that had a more positive outcome was carried out by Professor Leroy Boyd of Mississippi State University. He tried to develop sheep that are well adapted to the hot and humid conditions of the deep South. He had noted that animals with greater development in the loin and rump, thicker skin, and deep rather than wide bodies tended to have a greater heat tolerance. Starting with a Dorset flock, Dr. Boyd selected and bred back close relatives. His present flock at the Mississippi Agriculture and Forestry Experiment Station includes a large number of what he calls adapted animals. The entire adapted flock is traceable to four ewes and a single sire. The lambing rate of the adapted Dorset ewes is 2.5 lambs/ewe/year, almost twice that of the nonadapted Dorsets. The adapted flock is also more resistant to worms as well as being free from heat-associated sterility and abortion problems.

This “miracle” flock didn't come easily; many lambs were born defective or died from various causes, and many ewes and rams were shipped because they did not show superior characteristics. The result was a unique flock. Boyd has also established adapted flocks of Suffolks and Hampshires by the same careful selection and ruthless culling procedure. Rams from the three flocks have been sold to breeders in many states, and Boyd states that “we have not been requested to refund the purchase price or exchange animals because of reproductive failure. Many ask what we did to make them so active and fertile.”

A breeder attempting to develop a specialized flock should realize it is a long and frustrating task that requires keeping only a few and losing many lambs before they ever reach market weight and return any income. The

process requires money and nerve to do it right, and it is not for everyone by any means. We can all be grateful that there are a few people like Leroy Boyd who are brave enough and have the resources to try it.

HANDLING

Medical Care

Both ewes and rams should have been examined prior to breeding and treated for any disease. Breeding is not an appropriate time to handle the sheep much. Treatments for internal or external parasites should be avoided because the potent chemicals used may have adverse effects on the sheep's reproductive capacity. If some of the animals are parasitized during breeding, that's bad, but treating them at this time may be worse.

Similarly, vaccinations should have been done prior to breeding, although boosters at breeding are commonly given. If you have not already done so, you might consider vaccinating against a virus called parainfluenza-3 (PI-3) to aid in the reduction of respiratory diseases. The idea is to protect the animal against a viral infection in the upper respiratory system that sometimes precedes invasion by bacteria. There are both nasal and injectable vaccines against PI-3, most of which are combined with vaccines against other viruses that mostly affect cattle. These vaccines are not approved for sheep, so consult with your veterinarian before using them. The injectable vaccine causes a general viremia that can trigger abortion, so it should not be used with pregnant animals. The nasal vaccine can be used any time.

Removing Rams

The rams will have been handled a bit during breeding, but the big day is removing them from the ewes and putting them back together. They will still be excited from breeding and will take turns trying to mount one another or fight. This hassle will settle down with time, but in the meantime you don't want one or more of them injured or killed. The best solution is to confine them closely so they cannot get enough of a run at one another to do much damage. One clever suggestion by Gary Jones of Peabody, Kansas, is to put all the rams in a pickup truck with a stock rack and leave them together for a day or so. One can also pen them closely and put a bunch of old tires lying flat in the pen to trip up any ram who tries to get a run at another. There are also

masks that can be put on the rams so they cannot see forward, and so can't butt. These are very effective in preventing fighting. However, when they are removed, even months later, the rams may fight immediately, so caution is advised.

Feeding

As always, be on the lookout for sheep who are off their feed. Being off feed during breeding is probably nothing serious, though. Some rams will devote themselves to their work even to the exclusion of eating. Ewes will frequently not eat just before or during their heat cycle. Don't relax altogether, however, because an isolated ewe, especially an older one, may bully her way into some extra grain and get acidosis. Treat such cases with sodium bicarbonate drenches as described in the chapter on flushing.

BREEDING AND LAMBING DATES

Breeding is the time for the shepherd who uses marking crayons to be out with notebook and pencil every day to see which ewes have been marked. It takes only a few minutes while the ewes are eating. It helps to note which ewes are standing with the ram even though they are not yet marked. If a ewe is seen consorting with the ram one day and is not marked the next, you'd better catch the ram and check his crayon.

The lambing dates will be about 146 days from the marking dates. Finn crosses have a slightly shorter gestation, and longwool breeds a slightly longer one. Knowing the approximate lambing time for each ewe is very convenient. You may find that when lambing comes there will be breaks in the sequence to give you a day or two off to sleep late or go to town. The convenience factor is not to be overlooked, because a day off during lambing can be a mighty welcome time.

In addition, there are times when knowing the lambing date can be very important. There are health conditions of the ewe that may require removing the lamb either by Cesarean section or by inducing lambing with hormones. If the ewe is known to be near term, a simple injection or two may allow you to save both the lamb and the ewe. If the ewe is not yet ready to lamb on her own, then hormones won't work, and the decision has to be made whether to remove the lamb surgically. The point is that knowing the lambing date allows the shepherd and the veterinarian to make a decision based on solid

information rather than wild guesses. When you are tempted not to use marking crayons or other methods to identify breeding dates, think twice because you might regret it later if you don't take the time now.

That said, you may find that as you gain more experience, the use of crayons becomes unnecessary. As your eyes get tuned to the signs of impending lambing, you will probably give up the nuisance of crayons and the like.

THE LAMBS

Replacement ewe lambs should be taken away from the rest of the lambs so they can eat more roughage and be kept away from eager ram lambs. At this point many lambs will be ready for market, and those of you who have had lambs on a highly nutritious ration will have already shipped quite a few to start bringing in some income. Lambs raised on pasture will just now be starting to be ready. This is a time to start checking lambs for finish (see appendix 2) and for shipping when ready. Once a lamb is up to market weight and finished to grade Choice or Prime it should be moved out. It will not convert feed very efficiently after it has reached market size, so your profit margin begins to slide if you keep lambs around. Also, be sure you don't let lambs get overweight or overfinished for your local market, because you might get a lower price for them.

Many shepherds will bring ewes off pasture in the fall with lambs at their sides. Those lambs will be separated from the ewes and graded for finish. In exceptional years, range lambs may be finished to Choice condition right off the grass but usually not. When I say a range operation, I don't necessarily mean only a flock of 20,000 ewes that summers in the high mountains of the Rockies. A flock of 25 ewes that spend the summer with their lambs in Vermont or Arkansas can also fall into this category. The distinguishing feature of a range operation is turning out the ewes to fend for themselves between lambing and the next breeding season. The lambs tag along and are weaned by the ewes as they start to eat grass.

When the lambs are separated out they will either be shipped as feeders, or put onto feed by the owner to get them to market condition. If you are going to feed out your own lambs, be sure to vaccinate them against enterotoxemia using the *Clostridium perfringens* vaccine. At their age, the type D is probably sufficient. If the lambs were vaccinated previously, a single booster is suffi-

cient. If not, they should receive a second vaccination in about two to four weeks. The vaccine for both types C and D doesn't cost much more than the plain type D if you want to be cautious.

The lambs should doubtless be wormed also before being placed on full feed. Take a fecal sample to your vet to be sure, but lambs that have been with ewes for a few months will almost certainly be carrying a worm load. You'll never convert four pounds or less of feed into a pound of lamb if you are trying to support a few thousand worms too.

Apart from worminess, and possibly infestation with lice and keds, lambs coming off the range will probably be in far better general health than if they had stayed around the home place for the summer because the opportunity for disease transmission is so much lower in the wide open spaces. Just remember to build up their feed gradually and keep an eye on them for the first few days. Then watch 'em grow.