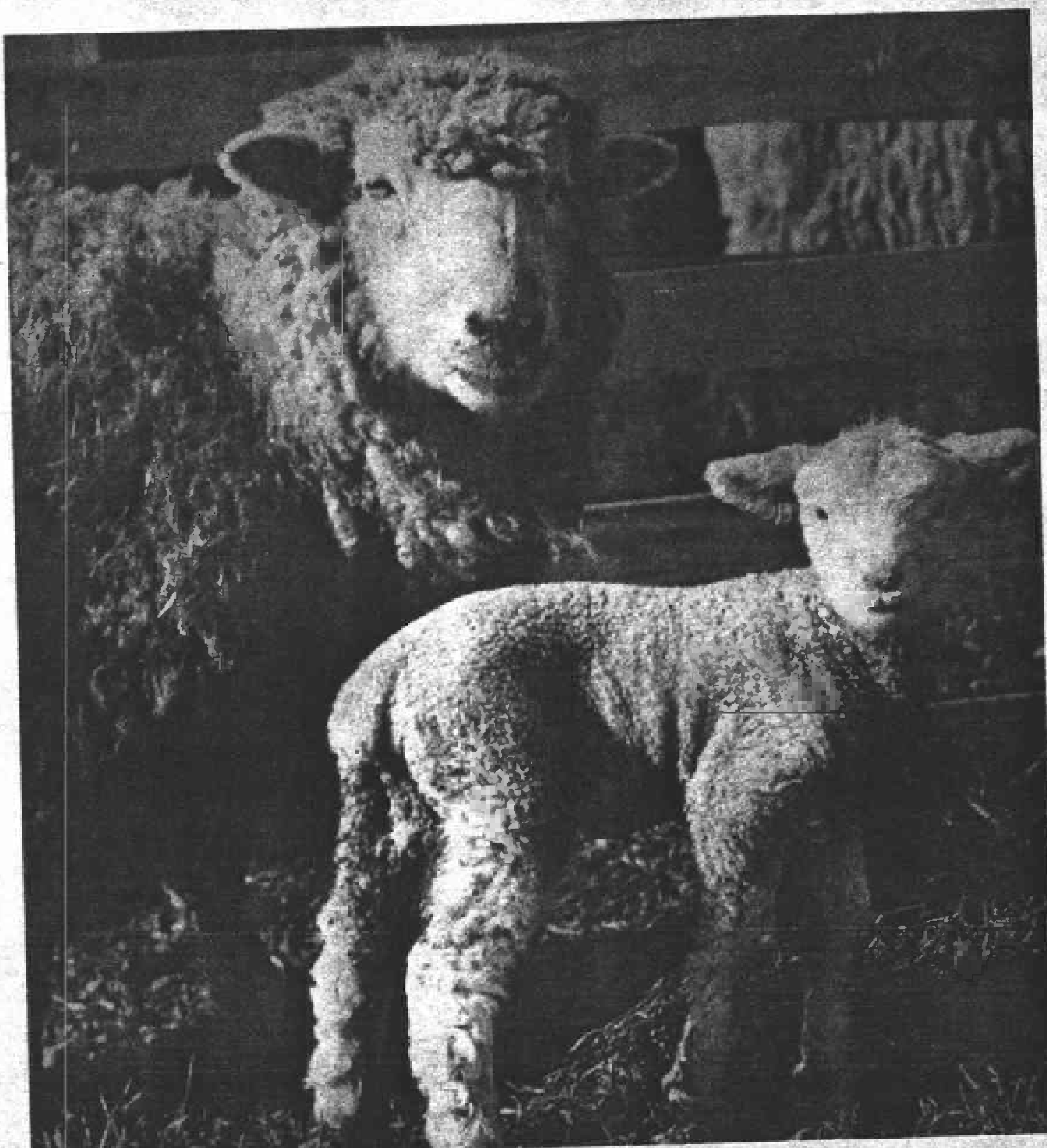
Summary of Reports . . .

1972 Sheep and Wool Day



Special Report 357

May 1972

Agricultural Experiment Station, Oregon State University, Corvallis

CONTRIBUTORS

Dr. Clifford C. Beck is Director of the Medical and Scientific Affairs Division, Parke-Davis and Company, Ann Arbor, Michigan.

Dr. William D. Hohenboken is Assistant Professor of Animal Science at Oregon State University, Corvallis, Oregon.

Dr. Clarence V. Hulet is Reproductive Physiologist, U. S. Range Sheep Experiment Station, Dubois, Idaho.

Dr. James E. Oldfield is Professor and Head of the Department of Animal Science, Oregon State University, Corvallis, Oregon.

CONTENTS

FLOCK HEALTH--MEDICINE OR MANAGEMENT?

C. C. Beck, D.V.M.

Introduction

The success of each and every sheep flock or enterprise is directly dependent upon the success of the reproductive and rearing program carried out.

Many "flock owners" assume that their main responsibility begins at lambing time. As "Shepherds" - we must come to realize that decisions, practices, and accomplishments during the 5-6 months prior to lambing are as significant, if not more so, than those carried out at lambing time and thereafter.

Secondly, flock owners assume that if sheep are apparently fat and eating, all is well. First of all, fleece may make animals 'appear' different than they in fact are. Obesity is not a measure of health (they may in fact be very protein deficient), and a ravenous appetite may not necessarily indicate health - it may indicate existence of some specific deficiencies in a ration. The old Zoo keeper concept of, "If they eat it, it shows they need it", is no more valid than a similar conclusion drawn from humans subsequent to passing a tray containing candy, alcohol and cigarettes!

It is my understanding that the following areas are being covered in other portions of the program:

1. Nutritional Management for Optimum Reproduction
2. Breeding Management for Optimum Reproduction
3. Factors Affecting Ram and Ewe Fertility

I have been asked to cover:

Health Management for Optimum Reproduction and the Prevention of Lamb Mortality.

Certainly there will be some repetition as the areas definitely overlap but repetition may serve to point out importance.

Pre-Breeding

The basic prebreeding consideration is one of having normal, healthy, potent and fertile parents or breeding stock.

Prebreeding reproductive exams to the extent and as conducted in bovine and equine areas are not possible nor economically feasible in the ovine.

As regards the ewe flock, normal, healthy ewes in moderate flesh maintained on a sensible, balanced ration not containing excessive estrogens or steroids, on a logical parasite control program, possessing evidence of 2 normal non-fibrosed udder segments, and free from abnormal vaginal discharges are in general good candidates for optimal reproductive performance.

As regards rams, normal healthy rams in moderate flesh, on a logical parasite control program, shorn at least 6 weeks prior to initiation of breeding season and free of infectious and contagious disease should be good candidates for optimal breeding performance. Where possible, a semen check of rams prior to breeding season is advisable. In it's absence, be sure to utilize a system of marking and check rams to assure a lamb crop.

Use of vasectomized or teaser rams or intact rams across the fence for approximately 2 weeks prior to desired start of breeding season has been shown to have a beneficial effect in initiation of cycling of ewes.

The fact that a ram is purebred or registered is not assurance that he is a breeder. In selecting rams, selection of a twin-born ram of demonstrated rate of gainability, possessing desirable conformation and traits will do much to assure the type of lamb crop you desire. The ram definitely appears to be a factor in twinning and also in livability and vitality of offspring.

Gestation

The gestation period of ewes we all know to be roughly 147-153 days. The marvels of embryological development are less well understood and less comprehended by the average sheepman.

Beginning with a normal healthy egg or ovum - this egg is released at the time of ovulation, which in sheep occurs spontaneously toward the end of the heat period. This egg, if not fertilized, dies in a period of less than 24 hours.

Normal healthy sperm are deposited in the female reproductive tract at the time of breeding. Sperm as ejaculated do not have the ability to fertilize the egg. A reaction known as capacitation must take place, whereby the sperm gain the ability to fertilize the ovum. Various factors, enzymes, etc., within the ewes reproductive tract facilitate this capacitation and it appears to require approximately 1.5 hours to accomplish. The life of sperm in the reproductive tract of the ewe is approximately 24 hours.

Once capacitation and fertilization have occurred a rapid successive chain of events takes place, resulting in the formation of an embryo with recognizable anatomical structure and functional organs at very early stages in gestation - less than 3 weeks. In fact, the heart begins beating by the 17th day. Thus, if a ewe misses a cycle, due to pregnancy, she is in fact carrying 1 or more fetii that by this time are very functional embryos with heartbeats.

Now that all sounds very complex and technical, and it is. You say, so what? The point I want to make is that there are some factors, which you may have control over, that have the potential for producing fetal damage and thus, abortion or later births of abnormal lambs. I will mention a few specifics for illustrations:

1. Poisonous plants

Dr. Binns and his group at Logan, Utah have identified and isolated the toxic factor in a number of plants which if eaten by the pregnant ewe or cow during the 3rd week of gestation (15-22 days) may produce hair-lip, cleft palate, abnormalities of the legs, etc.

You and I as shepherds have a responsibility and role in assuring that our ewe flocks are in fact receiving quality nutrition, not just quantity.

2. Environmental temperature

The subject of hairy lambs has long been attributed to genetics. Shelton and co-workers in Texas demonstrated several years ago that high environmental temperature on the pregnant ewe may be a factor responsible for embryonic damage to the primordial wool follicle with the end result of hairy lambs.

Other workers have demonstrated embryonic mortality due to high environmental temperature so that ewes that were in fact pregnant, come back in cycle later in the season because they suffered embryonic death and fetal reabsorption or abortion because of excessive environmental heat.

California workers in 1971 added another factor, which appears to be some transmissible agent that can cause hairy lambs.

The point I'm making is that there are a variety of factors which may transpire during gestation which can be detrimental to optimal reproductive performance.

3. Disease or immunization procedures for specific disease during pregnancy.

The best example of this is Blue tongue. It has been demonstrated that an outbreak of Blue tongue amongst pregnant ewes or immunization of ewes during early pregnancy may result in birth of abnormal lambs - hydrocephalus.

It is suspected that certain bacteria or viral agents may be involved in mummification but the real factors involved in this process are really unknown. Bear in mind, however, that for certain diseases we specifically vaccinate during pregnancy, for example Virbriosis and Enterotoxemia. Thus recommendations vary with the specific disease.

4. Adequate nutrition through a balanced diet which meets the ewes nutritional requirements.

I will not dwell on this, as it will be covered in other presentations but such things as iodine deficiency may result in goiterous woolless lambs; selenium or alpha tocopheral deficiency may result in congenital white muscle disease; inadequate or improper nutrition of the ewe can result in pregnancy disease; and there is evidence that nutritional deficiencies, minerals, especially Ca may be a contributory factor to the incidence of vaginal prolapse and failure of the cervix to dilate.

Thus, I hope I have impressed you as Shepherds, with the fact that there are factors with potential influence on the ewe's reproductive performance that you can influence during the gestation period and that you therefore have great responsibility prior to lambing time.

Preparing for Lambing

It has been appropriately stated that
Those who fail to prepare,
Are preparing to fail.
This advice should not go unheeded in the sheep industry.

Preparation for lambing should begin approximately 6 weeks prior to the expected arrival of the 1st lambs.

1. Facilities: The lambing barn or shed need not be new, modern, or fancy to be a good facility. It should, however, be clean, dry, well ventilated and reasonably well lighted. Hawkins demonstrated years ago that cleaning the lambing shed mid-winter, prior to lambing was an effective step in parasite control as regards the new lamb crop. The ewe's egg count based upon fecal examination is low at this time. Thus, by removing the manure pack, providing a clean dry bed and then shearing the ewes, much of the potential parasite egg exposure will be removed for the lambs.

2. Shearing is of multifold advantage. Many people shiver at the thought of shearing ewes pre-lambing in our northern climates. Those who oppose it the most - have never tried it.

   a. Shear with a comb that leaves some stubble fleece (9-tooth comb).
   b. Shorn ewes require much less barn and feeder space.
   c. Shorn ewes do not sweat, thus do not have moist fleeces and are less prone to pneumonia than full fleeced ewes.
   d. Shorn ewes do not attempt to lamb outside or lead young lambs outside in adverse weather.
   e. Shorn ewes are much easier to monitor and predict as to expected lambing time.
   f. Shorn ewes are easier to lamb out.
   g. It is much easier for the lamb to nurse, the udder is cleaner, the lamb is not going to be sucking filthy wool tags and thus intake of parasite eggs and bacteria is markedly reduced. Wool sucking may result in wool balls which cause "stretchy" lambs and digestive disturbances.
   h. That shorn ewe still has more protection than the newborn lamb due to her stubble fleece, body fat

and heat production potential of her ruminant digestive system.

<u>Granted</u> the shorn ewes will expend some feed energy in heat production but this is a small price to pay for a healthier lamb crop.

3. <u>DO NOT Overconfine</u> the ewe flock. Provide ample opportunity for fresh air and exercise. Close confinement in damp poorly ventilated facilities is a definite predisposing factor to pneumonia.

4. In flocks where pneumonia of lambs is a problem in addition to steps 1-3, consider the use of sulfanomide therapy added to the pre-lambing grain ration of the ewes as follows:

Use sulfamerazine or sulfamethazine at the rate of 1 pound per 45 pounds of grain ration or 45 pounds per ton of grain ration (Ground).

Feed this ration at the rate of 1/2 pound/ewe/day for 5 days, then unmedicated feed for 3 days. Repeat medicated feed for another 3 days. This procedure should be carried out within 2 weeks of expected lambing date for maximal effect. Thus grouping of ewes as to expected lambing time is an expedient procedure.

This program is no substitute for correction of poor ventilation and dampness, or failure to cull chronic coughing, nasal discharging ewes who may be a real menace to the young lamb crop.

5. Grain ewes to prevent pregnancy disease.

6. Include a source of selenium in the ration to prevent W.M.D. or take appropriate substitute measures.

7. Give consideration to justifiable and feasible vaccinations which may be indicated on a flock basis:

a. Vibriosis? (Should have been done earlier)
b. Enterotoxemia
c. Tetanus
d. Contagious ecthyma - Sore Mouth

8. Have adequate supply of hurdles (5' x 5') ready. Place ewes in hurdles when lambing is eminent and thus prevent problems of failure to own lambs, orphan lambs, etc. Efforts in this direction appear more rational to me than the present emphasis and effort toward use of synthetic rations for orphan lambs.

9. Heat lamps have a place and should be available but overuse, beyond the point of drying off the lamb, may well be a predisposing factor to pneumonia. Once a lamb is dry and has nursed, there is little rationale for further use of heat lamps.

10. Have essential supplies on hand:

a. 1% Iodine
b. Scale to weigh lambs
c. Ear tags
d. Equipment for docking and castration

Lambing and Rearing

Observe expectant ewes closely. Normally, once active labor has begun, the lamb should be born in an hour or less. There is no substitute for experience and judgment in lambing practice and procedure. An assist in time can save lambs. Roughness and excessive or premature traction can cause damage. Failure to be sanitary may result in tetanus and other disease complications.

Ewe lambs, lambing for the 1st time, will require more assistance than older ewes who have lambed previously. Under normal circumstances, the greater % of the ewes should not require assistance but a watchful eye, common sense and judgment are always in order.

In those instances wherein a Cesarean is indicated - for best results - that decision must be made early in the best interest of the ewe and the lambs. No one is happy with dead lambs, a fatigued traumatized ewe, and a bill. Exercise judgment.

Once the lamb is born, be sure normal breathing is established. If the lamb is slow in beginning to breathe, hold lamb by head and neck, dunk body in cold H_2O. This causes reflex inspiration - a gasp - which fills the lungs and is very effective in stimulating respiration. Then dry lamb off thoroughly, weigh and apply I_2 to the navel.

Colostrum is a must. Removal of teat plugs and assistance in nursing is a good way to get a lamb started on a successful life. A refrigerated or frozen supply of colostrum should be maintained.

Each lamb should be identified at the time of weighing and appropriate records kept. Train yourself to look for such things as Entropion, which is usually present at birth if it is going to be a problem at all. Immediate correction can prevent permanent eye damage.

Observe lambs for the 1st few days and be on the lookout for such things as very sharp teeth that are lacerating the ewe's udder. Once ewe and lambs have become acquainted and lambs are nursing well, the ewes with lambs can be placed in groups in preparation for creep feeding of lambs.

Lambs should be docked and castrated prior to being released from lambing pens. In flocks where tetanus is a problem, and ewes have not been vaccinated, use of tetanus antitoxin (150 to 200 units) at the time of docking and castration may be indicated. This is especially important where elastrators are used.

Ewes that fail to drop the placenta should be observed carefully. Appetite is the best barometer. If the ewe is eating and permitting lambs to nurse, the best course is usally to be patient. If appetite is depressed, and the ewe is febrile, antibiotic therapy is certainly indicated.

By 10-14 days of age, lambs can be safely vaccinated for enterotoxemia in preparation for creep feeding. I utilize the Toxoid type of vaccine which only requires a 2 cc. dose.

Provide access to creep to all lambs as soon as they leave the lambing pens. Most lambs will start to nibble creep by 2 weeks of age. A second or booster dose of vaccine is administered 2-3 weeks later.

Lambs are extremely curious. Be careful to avoid pitfalls which may cost a lamb it's life. Such losses due to human neglect or error are indeed regretable.

Observe ewes and lambs frequently. Pay attention to the ewe's udder. An enlarged segment of udder may be a clue to mastitis or a sick lamb that is not nursing. Early detections and prompt treatment is imperative to success. Ewes with non-responsive cases of mastitis should be marked for culling.

The greatest lamb mortality occurs between birth and 2 weeks of age. Lamb mortality is our major problem in the industry. It far exceeds the parasite problem. Once lambs are 2 weeks of age, they should be well on their way to rapid growth and eventually market or maturity.

In closing, let me dwell just a moment on the value of necropsy. The only value that I see in a dead lamb or sheep is in the lesson we can learn from that cadaver. Nothing is gained by adding them to the heap. A necropsy, and where necessary - supplemental diagnostic work - can serve as a barometer, an indicator of problems existent in a flock. Is this an individual problem, or is it the start of a flock problem? If the latter - what measures can we take to prevent further losses or steps that can be taken in subsequent years to prevent similar happenings.

In my judgment, a necropsy well may be one of the most valuable veterinary services of which you can avail yourself.

One word of caution! Many flock owners decide to have an orphan, a runt, a cull necropsied in hopes of finding an answer to a flock problem. Such animals are usually not typical representatives of a flock problem. Results are usually discouraging and negative. Select truly representative cases for necropsy for maximal value.

Lastly, a word on records. The industry is in dire need of a simplified record system. The best set of records are of no benefit without analysis. Thus, periodically review records, determine what are your major problem areas and then set out to concentrate, reduce, or remove that problem from your flock, thereby assuring maximal returns and hopefully enjoyment.

I hope that you will draw the conclusion with me, there is no easy simple solution to flock health problems. It's the constant attention to detail, the daily observation and attention and the judgment in evaluation of situations as they arise that can prevent disaster. Early detection and diagnosis are paramount. I am personally convinced that a Sharp Shepherd is more important than a Sharp Needle!

BREEDING MANAGEMENT FOR OPTIMUM REPRODUCTION

W. D. Hohenboken

Higher levels of reproduction in both commercial and purebred flocks would allow more lambs to be marketed per ewe bred. This would provide a greater volume of product over which the year's fixed costs could be distributed and would provide the producer a powerful weapon in his fight against the cost-price squeeze. This paper will discuss breeding management as it influences reproductive efficiency of the flock. Three questions, a what and two hows, will be considered in addressing this topic.

What is optimum reproduction?

The birth of a live lamb climaxes the reproductive process, but much, much more is involved in any discussion of optimizing reproduction. Each of the following is a contributing factor.

1. Prospective parents, both ram and ewe, must have reached sexual maturity. This poses no management problem unless breeding of ewe and/or ram lambs is done, a practice increasing in popularity in Oregon.

2. Prospective parents, both ram and ewe, must have the ability and desire to mate. For rams, this means anatomical soundness (feet and legs and sex organs) and possession of adequate sex drive or libido. For ewes it means they must be exhibiting fertile, behavioral estrus during the mating season desired by the breeder.

3. Prospective parents, both ram and ewe must be fertile. For rams, this means the ability to produce large quantities of viable motile sperm with a low proportion of dead and abnormal cells. This ability can be predicted from a semen test. For ewes it means that behavioral estrus must be accompanied by ovulation and that uterine anatomy and environment must be such to allow copulation, fertilization and implantation and development of fertilized ova.

4. The optimum number of viable ova must be shed from the ovaries of the ewe. This determines prolificacy which I will define as the number of lambs born per ewe lambing.

5. Fertilized eggs must survive gestation to lambing and lambs must be born alive and survive to market weight and grade.

The above five points contribute to successful reproduction. They do not, however, define <u>optimum</u> reproduction.

Optimum reproduction, in fact, defies precise and lasting definition. For the Corn Belt producer operating on expensive crop land with ewes confined the year around, "optimum" could mean large litters and twice a year lambing. For a desert range operator trailing long distances, twins could be a liability. They were consciously selected against by the Spanish shepherds who developed the Merino breed. For the western Oregon producer, some level of prolificacy between these two extremes is optimum, but again actual goals will differ from ranch to ranch.

One point of agreement will exist. For no operation are dry ewes profitable. Also it is safe to conclude that the more intensive an operation from a management standpoint, the higher level of prolificacy is necessary and desirable.

Let's assume for the sake of this discussion that the four factors we may want to change in the flock are:

1. Age at puberty
2. Level of fertility - the proportion of dry ewes.
3. Level of prolificacy - the number of lambs born per ewe lambing.
4. Survivability of lambs.

How might selection influence reproductive efficiency?

Breeding management to change the level of performance for any characteristic means exploiting genetic variation. Genetic variation is differences between individuals caused by differences in their hereditary makeup. All other variation is environmental; that is, it is caused by differences in ration, disease exposure, and other environmental factors under which the stock develop. Genetic variation falls into two categories, that which exists within breeds and that which exists between breeds. An example of the latter type is that, on the average, Rambouillets have fewer multiple births than Suffolks. Within breed variation means that Rambouillets differ between themselves in inherent level of prolificacy, as do Suffolks. Though the breeds differ on the average, the most prolific Rambouillets have more twins than less prolific Suffolks.

Mating systems, to be discussed in the next section, are manipulated to take advantage of genetic variation between breeds. Selection is the tool which is used to exploit genetic variation within breeds.

Selection means that the breeder determines which rams and which ewes will and will not reproduce. In selecting flock replacements, we choose some individuals over others and thereby hope to alter the level of performance of the characters considered in selection in future generations. In culling on performance, a form of selection, we terminate a ram or ewe's productive life before its natural end. We prohibit the culled individual from leaving more progeny and influencing performance of future generations.

What does selection have to offer in changing the four components of reproductive efficiency?

1. Age at puberty. Ch'ang (1967) and Hulet (1968) have reported that ewes which exhibit estrus their first fall or winter have a greater lifetime reproductive rate than ewe lambs which do not show heat the first year. This was true regardless of whether they were bred as ewe lambs or not. Thus a young age at puberty may be important even apart from operations breeding ewe lambs. Workers in Isreal have shown that dairy cattle will respond to selection for younger age at puberty. Direct experimental evidence in sheep is lacking, but the results from cattle are probably valid. Ewe lambs could be scored for age at puberty rather easily by running either intact or vasectomized rams with marking harnesses with the band of potential replacements. Ewe lambs not marked could be drafted off for slaughter and replacements selected from the remainder. As heavier lambs tend to reach puberty at a younger age, selection for early sexual maturity will probably increase body size and growth rate slightly. Likewise, selection for growth rate will likely reduce the age at puberty. Fortunately, the genetic association between these two traits is favorable.

2. Level of fertility. Culling ewes for failure to lamb constitutes selection for fertility. This practice may have economic merit in that open or dry ewes need not be fed and maintained until the next lambing season. Since, however, early pregnancy diagnosis is not yet practicable in sheep, cheap feed is usually available soon after it can be determined that a ewe is open. Thus the direct monetary savings may not be great. (In this same report, Hulet discusses a possible break-through in early pregnancy diagnosis in sheep. Thus, economic effects of culling could soon change.)

The genetic effects on future performance from culling open ewes depends on the repeatability and heritability of failure to bear a lamb. Repeatability answers whether failure to lamb once indicates that the ewe is likely to be open in future years. Heritability measures how much of the total variation in fertility is genetic variation which will respond to selection. Both heritability and repeatability of fertility in ewes are near zero (Turner, 1968). This means that a ewe failing to lamb this year is very little more likely to be open next year than her flock mates which did lamb normally. Some few, of course, will be permanently barren. In some cases, it may be possible to identify these by anatomical examination. Most of the differences between ewes in fertility - the ability to reproduce - are environmental rather than genetic in origin. Consequently culling open ewes will have little impact on future productivity of the flock and cannot be recommended based on its genetic effects.

3. Level of prolificacy. Traditionally, research

workers in animal breeding have reported that prolificacy was low in heritability and would not respond to selection. More recent evidence, however, indicates that this was a premature conclusion. Prolificacy can and has responded to selection directed towards it. Turner (1966) reported that response per year to selection for twinning in an Australian Merino flock had averaged 2.3 more lambs per 100 ewes bred. Not only prolificacy but also fertility increased. The proportion of open ewes in the selected flock decreased as selection progressed. Thus it appears that fertility will not respond directly to selection against barrenness but will respond, indirectly, to selection for prolificacy. An experiment conducted by Wallace (1964) utilized the New Zealand Romney. In that experiment, both fertility and prolificacy responded favorably to selection for twinning rate. The annual rate of progress was 1.1 more lambs born per 100 ewes bred.

Given that prolificacy will respond to selection, how might the selection best be applied? There are several theoretical possibilities. First, ewe and ram replacements could be selected from among multiple births. This procedure would be expected to increase prolificacy and would be fairly easy to carry out. However, the heritability of lamb number from a single lambing is low. Also the age of the dam and other environmental factors influence twinning. Thus a twin from a yearling ewe probably would have greater genetic merit for prolificacy than a twin from a five year old ewe in the prime of her life. Selection of replacements from among twin births would be expected to increase prolificacy, but would not be the optimum system.

As a second possible technique, direct mass selection could be applied by breeding all potential replacements as lambs or yearlings and scoring them for lamb production for first or later lambings. Several factors argue against this method. First the monetary salvage value of ewes culled on production would generally be less than their replacement cost. Also since production increases with age, ewes would be culled as they entered their prime of life. Third, the heritability of number of lambs at the first lambing is virtually zero. Prolificacy at the second, third and fourth lambing is moderately heritable while heritability of the average of several lambings not including the first is moderate to high. Waiting this long to make final selections, however, would be expensive, would lengthen the generation interval and thereby reduce genetic change per unit of time and would alter the age structure of the flock to too many younger ewes at the expense of fewer older ewes.

A third technique, and the most efficient from the genetic standpoint, utilizes information from relatives to predict genetic merit of individuals to be selected. This method, of course, can be applied to both rams and ewes. It does require individual identification and a fairly sophisticated record keeping system. Thus, it may not be justified for most commercial producers but should be feasible for registered, purebred or stud breeders.

Information on the lamb producing ability of the dam is the most useful source. More confidence can be placed in ewes with multiple lambings than in ewes with only one record. Table 1 is adapted from Turner (1968) and shows relative values for estimated genetic merit of ewes with variable opportunities to lamb and various numbers of lambs born. From the table, a ewe bearing four lambs in four opportunities to lamb would score 102 or near average. A Suffolk ewe from our OSU flock has had four sets of triplets from four opportunities to lamb. She would score 177 (12 lambs from 4 lambings). Turner's table was prepared using genetic parameter estimates and age effects from data on Australian Merinos, but it will suffice until comparable data are available from U.S. mutton and dual-purpose breeds. To apply selection using this system, all potential ewe and ram replacements can be ranked based on the estimated relative genetic merit of their dams. As stated, the technique requires extensive individual records, but it should pay off in increased prolificacy and hopefully fertility as well.

The fourth possible technique is to practice indirect selection for some characteristic that is related genetically to prolificacy. Then, as the character selected for changes, there is a correlated response in twinning rate. Three traits may be included in this category.

Woolblind ewes have been shown to have lowered prolificacy. However, there has been little difference in lambing rates between open-faced and moderately covered ewes. Thus selection against severe face covering is warranted. In fine-wooled breeds, a high degree of skin wrinkling has also been implicated in lowered male and female fertility and in lowered prolificacy. It should be considered in selection schemes for those breeds. Shelton and Menzies (1968) reported a negative genetic correlation between prolificacy and wool production. Thus selection for greater lamb production may be accompanied by a drop in wool production, but this is not likely to be severe.

Body weight and lambing rate are positively correlated genetically. Thus selection for one will likely cause correlated increases in the other. The genetic correlation is low, however, and response in prolificacy will be greater and more rapid from direct selection on prolificacy rather than indirect selection on body weight.

4. Survivability of lambs. Research indicates that most of the variation between individuals in viability, vigor and survivability is environmental rather than genetic in origin. Thus, selection within breeds for survivability will likely be ineffective. There is, of course, natural selection for survival without the breeder being involved in it. Lambs which don't survive, can't reproduce! Mother Nature has selected against them for us.

How might mating systems influence reproductive efficiency?

Selection decisions determine which individuals will be parents of the next generation. Mating systems determine specifically how the parents are to be combined. There are three possibilities. In random mating, matings are made without regard to the genetic relationship of rams and ewes. Purebred breeders use random mating when they raise ewe replacements but buy their replacement bucks. Coupled with selection, this system is effective in bringing about permanent and favorable genetic change in the population.

Inbreeding is mating individuals together that are more closely related than normal for the population. Mating sire with daughter or full brother and sister are the most intense forms of inbreeding possible in sheep. Progeny from such a mating would be 25% inbred. They would be heterozygous for one quarter fewer pairs of genes than lambs from random matings. On the average, this increase in homozygosity brings with it a decline in performance for some important economic characteristics. This deterioration is called inbreeding depression. Some characteristics, such as wool production and carcass merit, are little effected by inbreeding. Others, however, and factors contributing to reproductive efficiency are among them, suffer drastically from inbreeding depression. Growth rate and milk production are affected but not as severely as fertility, prolificacy and survivability. Inbreeding as a mating system has its place in sheep breeding and improvement, but its place definitely is not in increasing reproductive efficiency.

The third type of mating system is outcrossing or crossbreeding, mating rams and ewes together because their genetic relationship is less than average in the population. Thus it is the opposite of inbreeding. Within breeds this system is sometimes called linecrossing. Mating individuals of different breeds, of course, is crossbreeding. Level of performance for many characters is improved in the crossbred offspring over the average level of performance of the parents. This difference of crossbred performance from that expected based on the average of the two parent breeds is called heterosis or hybred vigor. It is important for the same traits which deteriorate under inbreeding depression; fertility, prolificacy and survivability and to a lesser extent growth rate and milk production. Traits high in heritability, such as carcass quality and wool production are little affected by heterosis.

Of the three mating systems, crossbreeding has the most to offer to the commercial producer of market lambs, from the standpoint of improving reproductive efficiency. How might crossbreeding affect the four components of reproductive efficiency cited previously?

1. Age at puberty. Direct experimental evidence on the effect of crossbreeding on age at puberty is lacking. It is known that crossbreeding increases growth rate and weight per day of age. Due to the favorable association between size and age at sexual maturity, crossbreds would be expected to cycle somewhat earlier than the average of the breeds contributing to the cross. Some breeds, particularly the fine wools, are notoriously late in reaching puberty. By the time many of these ewe lambs are ready to begin cycling, increasing day length has brought on seasonal anestrus. The producer planning to breed ewe lambs can expect some heterotic response in age at puberty but should avoid a high proportion of fine wool breeding in his crossbred ewes.

2. Level of fertility. Straightbred ewes bred to produce crossbred lambs are more fertile than straightbred ewes carrying straightbred lambs. Sidwell and Miller (1971) reported an average of 6% heterosis for ewes lambing of ewes bred. In other words, when straightbred rams were crossed on straightbred ewes there were six fewer open ewes per 100 ewes bred. This difference most probably reflects lower embryonic mortality of the crossbred fetus. This study involved 1900 ewes and 2200 lambs and included all possible crosses between 5 breeds of sheep.

Fertility should be even higher from systems utilizing crossbred ewes. These systems would utilize crossbred advantage in the ewe and crossbred advantage in the lambs. This expectation is based on research in dairy cattle, beef cattle and swine. Based on other species and limited reports from sheep, another 5% decrease in percent of open ewes can be expected from using crossbred ewes. Well designed experiments to verify this prediction in sheep are in progress at Beltsville, Maryland and at Clay Center, Nebraska.

3. Level of prolificacy. Like fertility, prolificacy is enhanced by crossing two breeds. Sidwell and Miller (1971) reported 3% heterosis for lambs born per ewe lambing. There is no reason to expect a higher ovulation rate from ewes simply because they are mated to a ram of a different breed. Thus, the effect most probably resulted from lower embryonic mortality,

as did the response for proportion of open ewes. As with fertility, an even greater response could be expected from using crossbred ewes in a specific three breed cross or in a rotational cross.

4. Survivability of lambs. Sidwell and Miller found marked heterosis for lamb survivability in two breed crosses. For lambs born alive of the total number of lambs born, heterosis was 3%, but for lambs weaned of lambs born the figure was 9%. Advantages in fertility, prolificacy and survivability combined to give a massive advantage in overall reproduction, 20.6% more lambs weaned per ewe bred. Almost 21 more lambs available for market per 100 ewes in the breeding flock would be possible from crossing the ewes to another breed of ram. Other investigations are yielding similar results. From a progress report of the U.S. Meat Animal Research Center at Clay Center, Nebraska, it was possible to compute that straightbred ewes (of 7 breeds) weaned 15% more lambs when bred to rams of other breeds as when bred to rams of their own breed. This question of effects of crossing two breeds on overall reproduction will be one of the first things investigated in the OSU crossbreeding experiment when it terminates this summer.

Well designed and executed experiments are currently being conducted to determine effects of crossbred ewes on overall reproduction. From research in other species and limited data in sheep, it is safe to conclude that the response will be even greater. My own prediction would be that heterosis for lambs weaned per ewe bred would be in the neighborhood of 30%.

A detailed discussion of specific crossbreeding schemes is beyond the scope of this discussion. A few general observations can be made, however. Crossing schemes are of two general kinds: a specific three breed cross (straightbred ram mated to a crossbred ewe of two different breeds with all progeny marketed) or a two, three or four breed rotational cross.

The specific cross is optimum genetically. It allows maximum heterosis in the ewe and in the lamb and allows use of breeds with good maternal characteristics to be used only on the female side of the pedigree. The job description for good ewe breeds would include hardiness, longevity, prolificacy and milk production. Breeds superior for growth rate and carcass merit can be used as sires. Though this system is optimum from a genetic standpoint, it may not be optimum economically. It requires someone to maintain three pure breeds, either the producer himself or a reliable source of replacement rams and crossbred ewes.

The rotational crossing schemes approach the specific cross in maternal and lamb heterosis. They do not allow breed complementation, though, as all breeds in the cross are used eventually on both the male and female side of the pedigree. It does allow the producer to raise his own replacements and may be advantageous economically for that reason.

Other observations are that, as in straightbred flocks, inferior parents will produce inferior progeny. Crossbreeding does not diminish the importance of selection. It should still be done. Also, in general, the more distantly related two breeds are, the greater will be the heterosis from their cross. For example, crossing Suffolks and Rambouillets should result in a higher % heterosis than from crossing Suffolks and Hampshires. However, the breeds chosen for the cross should have excellent performance for the traits the breeder is interested in. This would be a more important consideration than selecting breeds simply because they were genetically dissimilar.

A discussion on breeding management for optimum reproduction should not end without mention of the place for exotic, imported breeds, principally the Finnish Landrace. Research has established that they are highly prolific and that a portion of their superiority for the trait is inherited by their crossbred offspring (Boylan and Rempel, 1970 and Hulet in this report). They are, however, deficient in several characteristics, notably growth rate, ability to fatten, wool quantity and quality, and perhaps adaptability to range conditions (Bradford, 1968). Identification of their place in the domestic sheep industry must await research in progress at Clay Center and elsewhere.

Conclusion

This paper has attempted to describe how selection programs and crossbreeding schemes can influence age at puberty, level of fertility and prolificacy, lamb survivability and overall reproduction. Other parts of the program have examined other approaches to the same problem. To achieve optimum reproduction, however it is defined for a particular enterprise, requires attention to all of these facets - breeding, health, nutrition and physiology. Ignoring any one could easily negate efforts in the other three areas.

TABLE 1

RELATIVE MERIT OF PROGENY BASED ON DAM'S RECORD FOR NUMBER OF LAMBS BORN, WHERE DAMS MAY HAVE VARYING NUMBERS OF LAMBINGS

Number of lambs	Number of lambings 1	2	3	4	5	6	7
1	102	91	82	74	68	63	59
2	117	103	92	84	76	70	66
3	132	116	103	93	85	78	72
4	147	128	114	102	93	85	79
5		141	125	112	101	93	86
6		153	135	121	110	100	93
7		166	146	130	118	108	100
8		178	157	140	126	115	106
9			167	149	134	123	113
10			178	158	143	130	120
11			189	168	151	138	127
12			200	177	160	145	134
13				187	168	153	140
14				196	176	160	147
15				205	184	168	154
16				215	193	175	161
17					201	183	168
18					210	190	175
19					218	198	181
20					226	205	188
21						213	195

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NUTRITION MANAGEMENT FOR OPTIMAL REPRODUCTION

J. E. Oldfield

The theme of this Field Day rightly identifies reproductive performance as a key item of importance to the future success of the sheep industry, and certainly nutrition is an important contributor to reproductive efficiency. Nutritional problems represent a two-edged sword attacking the sheep man's economic returns: on one side, nutritional deficiencies in either quantity or quality of diet may result in deficiency disease such as pregnancy ketosis, while on the other, excessive nutrition may be wasteful, cost-wise, and may also interfere with normal pregnancy and increase lamb losses. Our aim should be, then, to improve our understanding of the reproductive process in sheep so that we can provide the necessary nutrient support as economically and efficiently as possible.

There are numerous indications that reproductive performance in sheep is not as good as it might be, and therefore could be improved. Blaxter (1956) in Scotland, prepared an interesting survey of death losses of the young of various species, data from which are summarized in Table 1.

Table 1. Pre- and Post-natal Losses in Animals and Man

Species	Area	Stillborn %	Early post-natal deaths, %
Human	Scotland	2.5	1.9
Pig	England	2.2-6.4	23-31
Sheep	Ireland	4.9	13
Cattle	Scotland	6.4	11.1

These figures are averages and are susceptible to all the misinterpretations of averages in specific circumstances. Figures for Oregon are not available for comparison, but one would expect that they, too, would indicate potential for improvement. Blaxter drew attention to losses from infectious disease and to physical losses caused by accident, but implied that inadequate nutrition was a significant contributor and that, within the area of nutrition, supply of insufficient food energy to the pregnant ewe was probably most important.

There are two general areas in which reproductive failure may occur, and faulty nutrition can be involved in each:

(1) The breeding process, which may include failure of the ewe to come in heat or failure to conceive and (2) Lamb losses, which may occur prenatally and give rise to stillbirths, or failure of the young lambs to survive after birth.

Nutrition and Breeding

Much of the investigation of nutritional effects on successful breeding in sheep has centered on the practice known as "flushing", which is bringing the ewe into the breeding season on a rising plane of nutrition to increase the lambing percentage. Much of the information on flushing has been gained by questionnaire-type surveys, and unfortunately in many cases the details of both quality and quantity of the feed given are incomplete.

Summarizing the evidence available, it appears that fertility is high in ewes that are on a good-to-high total level of feed intake, or in ewes that are gaining in weight at breeding time from an earlier thin state. Underfeeding does not apparently delay the breeding season, but it does shorten the cycle length and tends to increase so-called "silent" or false heats and result in poorer reproductive performance. It is easier for sheep to be exposed to an inadequate diet than it is for animals which obtain a smaller proportion of their feed by grazing, because it is often difficult to estimate the actual nutrient intake of ewes under range or pasture conditions. Sheep men usually insure against undernutrition at breeding time by either reserving a particularly good pasture area to turn the ewes into, or by supplementing poorer pasture with dry feed, either good-quality hay or a simple grain ration. The Sheep Sub-Committee of the National Research Council has not differentiated between the ewe's requirements prior to breeding and those for early gestation and has set them at about 3.5 lbs. of dry feed daily for a 150 lb. ewe.

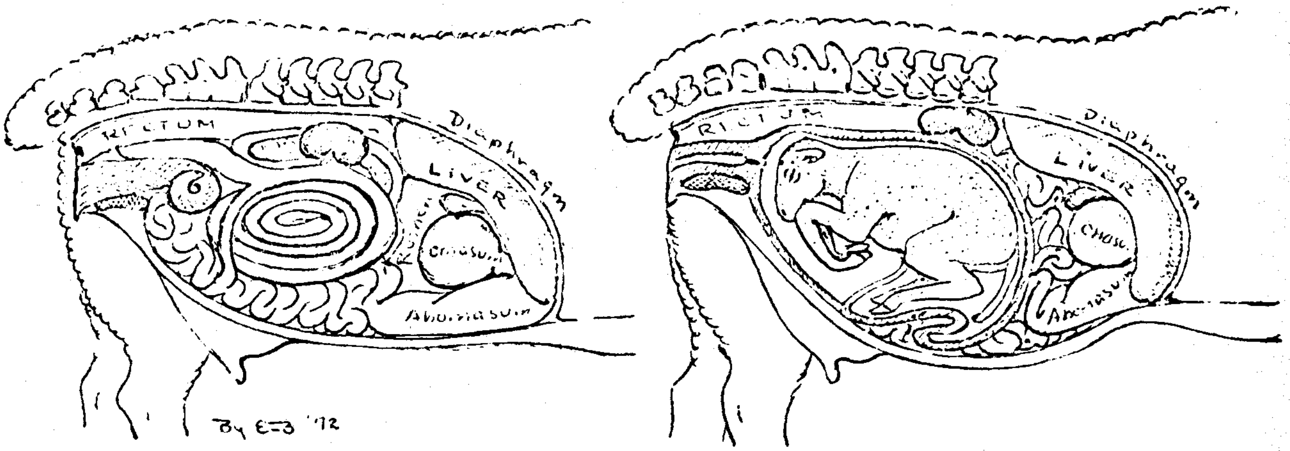
The effectiveness of good pasture as a flushing tool depends to a considerable extent upon the type of pasture used. Research beginning in Australia and continued in this country has identified estrogenic substances, particularly coumestrol, in certain plants in concentrations high enough to interfere with reproduction and, in extreme cases even to cause permanent sterility. Such materials appear to be more prevalent in legumes than in other pasture forages, although they are certainly not restricted to them. In Australia, the greatest difficulty has occurred in ewes grazing subclover pastures, however there are great strain and varietal differences in this plant, and we have little reason to believe that the subclover pastures in Oregon suffer from this problem. Much of the problem in Australia was cumulative: that is, it was related to continued grazing of high-estrogen subclover pasture for six months or more. Over a five-year period on such pasture, the lambing percentage of grazing ewes declined progressively (Barrett, et al., 1965). There has probably been some reproductive interference by short-term exposure of ewes to estrogenic pasture forages (Morley et al., 1963) during mating, but the extent of this is difficult to assess with accuracy. Under certain conditions both red clover pasture and alfalfa pellets have been implicated in Oregon sheep fertility problems, although the latter were brought in from out-of-state.

Nutrition and Pre-Natal Lamb Deaths

In the past, it has been generally accepted that fetal growth of lambs can be significantly affected by the level of feeding of the ewe after 90 days of gestation, but that there is little effect of nutritive level prior to this. Studies in South Australia, with Merino ewes, however, have tended to refute this. When 36 head of these ewes were fed so that their weights either increased by 25% during pregnancy (or by 12% during the first 90 days), there were significant differences in both the size and development of their fetuses at 90 days (Everitt, 1964). Wisconsin experiments with Columbia and Hampshire yearling ewes, on the other hand, suggest that continued high-plane feeding past the flushing period may be detrimental. While they verified the value of flushing in increasing ovulation rate, they showed that continued full feeding appeared to cause some embryo mortalities, nearly all of which occurred within 25 days after breeding (Foote, et al., 1959).

This evidence of early losses notwithstanding, there is little question that one of the most serious single causes of prenatal lamb loss is pregnancy toxemia, ketosis, pregnant-ewe paralysis or so-called "twin lamb disease," which occurs in late pregnancy. It may be inaccurate to refer to this as a single cause, although it does relate primarily to undernutrition in late pregnancy, because there are a number of contributing factors. Obviously, as the size of the unborn lamb or lambs increases, so must the nutritional demand on the ewe. Over 75% of the total weight increase of the lamb fetuses occurs in the last two months of pregnancy, and the growth of the ovine fetus is faster than that of many other species -- twice as fast as that of the human fetus, for example.

At this time, when the ewe's nutritional needs are increasing, her intake of nutrients frequently decreases. In late pregnancy the gravid uterus takes up considerable space in the body cavity, exerting pressure on the stomach and alimentary tract, and the appetite of the ewe declines (see Figure 1). This is particularly troublesome if the ewe is being fed no concentrates, but only bulky, less-digestible roughage.



Drawing by Dr. J. F. Bone

Figure 1: Reproductive - Digestive Tract Interference

The critical nature of undernutrition in late pregnancy is thus fairly clear cut. There is some evidence that this undernutrition may be aggravated by too high a level of feeding earlier: partly because of the additional competition of the body fat mass for space within the body cavity: voluntary feed intake of roughage by very fat twin-bearing ewes has been observed to fall about one-third during the last month of gestation. Incidence of pregnancy toxemia is greatest when fat ewes are underfed during late pregnancy. Ewes that are fairly thin going into the fourth month of gestation are much less susceptible to ketosis.

Another critical factor in the ketosis syndrome is environmental stress, to which sheep are particularly susceptible. Sudden periods of cold and wet weather may predispose poorly-fed ewes to pregnancy toxemia. There is some evidence also that moving ewes in late pregnancy to unfamiliar surroundings may add to the stress that gives rise to ketosis.

In the ewe which is undernourished in late pregnancy, the blood sugar (glucose) level falls and the adrenal gland is stimulated to secrete hydrocortisone which, in turn, causes the production of glucose from the maternal tissues. This hormone, when produced in excess, affects the skin follicles and depresses wool growth. In extreme cases it causes a "break" in the wool to occur, and this may be used as a danger sign or indicator of possible problems of pregnancy toxemia.

Parry has summed up the practical control of pregnancy toxemia as "essentially a problem of management." He suggests the following sequence of events: (1) some restriction in feeding until shortly before breeding, (2) flushing at a higher nutritional level, (3) again some restriction until about 8 weeks before lambing, when ewes should be started on about 1/4 lb. grain per head daily and gradually increased to about 2 lb. at lambing.

Nutrition and Early Post-Natal Lamb Losses

Some of the problems of nutrition during pregnancy are not evidenced in sheep until after the lambs are born. In general terms, the overall plane of nutrition of the ewe during late pregnancy determines the birth weight of the lamb, and increased birth weight appears to be positively correlated with survival. These effects seem to be more marked in twins than in single lambs. Underwood et al., (1943) summarized data relating weight gains in the ewe to birth weights of the lambs, and these have been excerpted in Table 2.

Table 2. Relationship of Ewe Weight-Gains to Birth-Weights of Lambs

Change in Body Weight of Ewe, lb.	Birth Weights of Lambs, lb. Singles		Twins	
	M	F	M	F
23	10.9	10.1	9.8	9.2
0-5	9.9	9.2	7.4	6.4

Unfortunately, these weight-change figures are not accompanied by mortality data. It has been estimated that the weight of the lamb fetus at term is only about 60% of the total products of conception, including the membranes and fetal fluids. This would mean that the birth of a 10 lb. lamb would result in a total loss of weight to the ewe of over 16 pounds. When one adds even a small increment for wool production during gestation, it is obvious that many ewes actually lose net body weight during pregnancy.

It is difficult to be specific about overall energy requirements for the ewe during late pregnancy, because they vary with the breed and individual size and with the weather. Ewes should be fed well enough to produce a good, strong lamb that will be able to withstand a certain amount of adverse winter weather.

Beyond the matter of overall plane of nutrition, there are some specific nutrient deficiencies that can and do cause early lamb losses. One of the most common in Oregon is white muscle disease, caused by a deficiency of selenium (Oldfield, et al., 1960). This myopathy, which has been described at earlier Sheep and Wool Day programs, damages some of the skeletal muscles of lambs, or the heart muscle. Either may result in mortality - the former through stiffness and difficult movement and consequent exposure; the latter from heart failure. White muscle occurs most commonly in ewes fed solely on forages from selenium-deficient areas. The critical level of selenium is very low: only about 0.02 parts per million parts of forage dry matter. The disease may be completely prevented by administration of an injectable selenium-vitamin E preparation -- the only currently legal control method. Some studies in New Zealand suggest that selenium deficiency can interfere with reproduction during gestation, as evidenced by significantly higher numbers of "empty" ewes when unsupplemented on Se-deficient pasture (Hartley and Grant, 1961) however in our experience ewes have lambed at a reasonable rate even on very Se-deficient feed. Although cures of selenium deficiency by administering selenium are dramatic, the results of overdosing are no less so. Selenium in excess is highly toxic and it must be given with great caution.

Another specific cause of early losses usually following shortly after birth of small, weak lambs, is a deficiency of iodine. In fact, reproductive failure has been described as the outstanding manifestation of iodine deficiency. Either the female or the male can be affected. Soils and water of the Pacific Northwest are generally inclined to be iodine deficient, so supplementation, usually be means of iodized salt is usually recommended. In recent years some organic iodine preparations have become available and are effective in overcoming deficiencies but must be carefully handled to avoid overdosage. There has been some suggestion that certain crops may be goitrogenic, i.e. feeding them may aggravate an iodine deficiency. New Zealand white clover has been implicated in such a situation (Butler, et al., 1957) but to date no similar evidence has been presented in Oregon.

These few examples may suffice to illustrate that nutrition management is an important factor in assuring high reproductive performance in sheep. Adequate nutrition must be interpreted in the light of various items, including the age, breed and size of the ewe, the stage of pregnancy and stresses imposed by external factors, especially the weather. Problems may relate to overall plane of nutrition, or energy level, or to insufficiencies or excesses of specific nutrient substances. As knowledge is being accumulated, control or prevention of many of these problems is becoming a reality.

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EXCITING NEW DEVELOPMENTS IN LAMB PRODUCTION

C. V. Hulet

The sheepman must have enthusiasm before he will effectively use the tools now available for improving efficiency in lamb and wool production. Exciting things are happening in the sheep industry. This excitement will generate the optimism and enthusiasm necessary to motivate the good sheepman to more effectively use these tools.

What's so exciting? There are at least four new developments. These include (1) breeding ewe lambs to lamb at 12 months of age (2) cross breeding for 160 to 200% lamb crops (3) pregnancy testing and (4) twin testing.

Now, looking at these individually they are not as exciting as when put together into combinations to enhance effectiveness. For example, it is now an established practice in the beef cattle industry to breed heifers to calve as two's. Sixty to 90 days after breeding the heifers are pregnancy tested. The nonpregnant heifers go to market as choice beef at good prices. This has increased to a remarkable degree the efficiency of beef production. No more carrying open or boarder heifers through the winter. Older cows are also coming under the test and many go to market before winter feeding starts if they are open. With a simple, rapid accurate rectal-abdominal palpation technique for testing pregnancy in sheep we can do the same thing with lambs. Lambs are pushed for continued rapid growth following weaning and are bred at the regular breeding season. Fifty to sixty days after breeding the lambs are palpated. The pregnant ewes are saved and the open ewes are sent to market as soon as possible as fat lambs. Table 1 shows the lamb production of range lambs bred when 6 to 7 months of age at the Sheep Station in Idaho. They were kept growing by supplementing their dry fall pasture with 1.75 lbs of alfalfa pellets per head per day following weaning so that they continued to gain 1/4 lb per day. Overfeeding in drylot can lead to rectal and vaginal prolapse. Underfeeding leads to too many nonpregnant ewes. You will notice that the production of the Finnsheep x Rambouillet crossbred ewe lambs is much above the other breeds and breed crosses. Rambouillets consistently perform the poorest. Hormone therapy could boost production in the Rambouillets. Dr. Foote of Utah State University has done some successful work in this area. We are now practicing the suggested procedure recommended from the experiments shown above. Thus, nearly 100% of the saved ewe lambs lamb and 80 to 123% lamb crops are being weaned at about 80 to 90 days under range conditions. The ewe lambs require slightly more attention at lambing time than mature ewes but essentially pay their own board bill or even produce a little profit as contrasted to the high costs of carrying dry replacements the first winter. There is also an added selection bonus. It has been discovered that ewe lambs which conceive or even show heat their first winter are more productive the rest of their lives than their contemporaries who fail to lamb or show heat their first winter. There also is obviously a genetic component which will be handed down to the next generation giving a small but permanent advantage in production.

The average lamb crop produced in the U.S. is about 95%. Table 2 shows the lambing rates for 2-year-old Finnsheep x Rambouillet crossbreds. Incidentally five of these ewes lambed in the fall of 1971 and so have completed three lambings by the time they have reached 2 years of age. The accumulative lamb production for this group of crossbred ewes to 2 years of age is about 348% born and an estimated 296% weaned. Compare this with the usual 80 to 90% lamb crop of 2-year-old western white-faced range ewes. An estimated figure is used above because we don't have weaning information at the 2-year-old age as they have just recently lambed, but judging by their production as ewe lambs shown in the first table they should approach a 165% lamb crop weaned under fenced range conditions. They should really get to producing as three and 4-year-olds. The growth rate of these crossbred lambs is also very satisfactory. They reach market weight and condition earlier than straight bred Rambouillets. For commercial lamb production Suffolk rams used on the Finnsheep crossbred ewe should produce an excellent market lamb. You may wonder why we crossed the Finnsheep on the Rambouillet. We are conducting research aimed at helping the range operator. He needs a ewe with flocking instinct. The Rambouillet provides this component along with hardiness, longevity and crossing ability. A farm flock operator may want to cross the Finnsheep on Polled Dorsets or on Suffolks. Research is being conducted on these crosses at other locations. Future plans at the Sheep Station include testing Finnsheep x Targhee and Finnsheep x Columbia crosses in addition to the Rambouillet cross. We have a Finnsheep x Rambouillet x Polled Dorset x Targhee four-way cross which we are starting to select and test which might have some ability to produce extra lamb crops as well as early production and high twinning capacity. This group along with four other breed and breed crosses are also being selected for response to hormone therapy for six-month lambing intervals. Figure 1 shows some purebred Finnsheep rams, fig. 2 Finnsheep x Rambouillet ewe lambs at 6 to 7 months of age and fig. 3 12-month old Finnsheep x Rambouillet ewes with twin lambs.

In our excitement about Finnsheep crosses we shouldn't forget about other potentially highly productive crosses. Research at Utah has shown the Targhee x Suffolk crossbred ewes outproduce straight Targhee ewes by as much as 50%. U.S.D.A. studies have shown that four-way crosses among selected breeds tend to outproduce two-way crosses.

How does the twin testing fit in? Ewes carrying twins need more feed to produce good strong lambs, yet one can't afford to feed single bearing ewes at the same rate. Also the high level of feeding to single bearing ewes can result in difficult birth and high lamb mortality in the first few days after birth as a result of injuries sustained during the birth process. Therefore, to save feed, get stronger better twins, smaller healthier singles, and allow closer attention to twin producers, twin testing can pay off. This also provides an opportunity to cull out the nonpregnant ewes at the same time before putting them through a long winter of high cost feeding. Further it has been found in studies conducted in New Zealand that 10 to 15% of all lambs born under pasture lambing conditions are claimed and raised by "granny" ewes or ewes other than their true mothers. Therefore, if one is selecting for twinning, fewer errors and greater progress would be made if the ewes were separated in twin bearing groups and single bearing groups before birth.

Techniques for Pregnancy Testing and Twin Testing

It may surprise you but there are several techniques for pregnancy testing and twin testing. Ultrasonic Doppler instruments have been used quite successfully in pregnancy testing. Simple single finger laparotomy (simple surgery) technique also allows early and accurate diagnosis. However, our recent discovery of a rectal-abdominal palpation technique provides us with a method which is simpler, much more rapid and as accurate or more accurate than the other techniques available. This technique can also be used for diagnosing twinning.

X-ray and ultrasonic scanning can both be about 90% accurate in detecting twin bearing ewes, yet both are either too expensive or too slow for satisfactory commercial application. The palpation technique promises to give close to 90% accuracy and yet is simpler and faster.

Early evaluation indicates that when proper handling equipment has been devised ewes can be pregnancy tested by palpation at a rate of up to 200 per hour and twin tested at a rate of 80 to 100 per hour. Ewes which are 60 to 110 days postbreeding and have been fasted overnight are placed on their backs in a comfortable horizontal position. The area of the cradle supporting the loin area of the ewe should be relatively flat and the rear end must be unobstructed to allow for manipulation of the palpation rod described below. The hind legs should be held in such a position that the stomach muscles of the ewe are relaxed. A plastic rod 0.6 in (O.D.) x 20 in with a bullet shaped tip is lubricated and inserted into the rectum by gentle forward and backward motion until it has reached a depth of about 12 to 14 in.

If the rod is initially inclined toward the back bone insertion appears to be much easier. After insertion, the palpating rod is pressed gently but firmly upward in the posterior abdominal region where the pregnant uterus is characteristically located. The free hand is used to feel and identify the relatively solid form of the foetus. If the solid form and shape of a foetus is felt the ewe is pregnant. If no fetus is felt after examing from the extreme left to the extreme right of the posterior abdominal cavity the ewe is nonpregnant. The rod can be clearly palpated through the abdominal wall in the nonpregnant ewe. Care should be taken to avoid sliding the rod between the ventral surface of the uterus and the abdominal wall which could lead to an error in observation. Twin testing requires more detailed observations. The shape and distribution of the pregnant uterus is evaluated by drawing the palpation rod across the surface next to the ewe's back from one side of the uterus to the other while applying firm positive pressure against the uterus with the rod and on the lower abdomen with the operator's other hand. A dorsal-ventral rocking motion of the rod appears to facilitate this examination. Next the palpation rod is gently but firmly pressed up against the uterine complex at short spacial intervals from left to right using the same rocking motion. The other hand is held on the lower abdomen in order to distinguish more accurately the location, size and shape of solid palpable objects. Fig. 4 shows a cross-section through the loin area of a pregnant ewe carrying twins (one on the left and another on the right). The rectum can be seen next to the back between the two lambs. In most cases involving twins it appears that one lamb occupies each uterine horn. It is usually possible to bring the palpation rod to a position between the uterine horns so that the rod can be clearly palpated through the abdominal wall from its tip to a position immediately anterior to the udder. When this can be done and there is still clearly an object the size, shape and consistancy of a fetus on the left and right of the rod, the ewe is carrying at least twins. Not all twins are this ideally located. Errors are made and a considerable degree of training and experience will be required for a high degree of accuracy.

Yes, we have several new tools to work with but let us also recognize the importance of using all the tools available to us in the sheep industry to greatly improve the efficiency of lamb and wool production and consequently profitability. If we could become efficient enough to sell lamb at a profit for a lower price per pound than beef we would have a growing industry. Per capita consumption of lamb and mutton in New Zealand is considerably greater than the consumption of beef. This is primarily due to its lower price.

Let me recommend that the sheepman who is serious about improving his industry and making a profit purchase, study and use the "Sheepman's Production Handbook" produced by the Sheep Industry

Development Program, Inc., 200 Clayton St., Denver, Colorado 80206. It is the most up to date and scientifically oriented handbook available today.

In conclusion, the future of the sheep industry in the United States is dependent upon the agressiveness with which sheep farmers will adapt more efficient methods of production. This is the age of imagination and innovation. Without these we can soon be overwhelmed by more efficient competition.

TABLE 1. REPRODUCTIVE PERFORMANCE OF YEARLING EWES BRED AT 7 TO 8 MONTHS OF AGE

Breed[1/]	No. of ewes	Ewes pregnant	Ewes lambing	Lambs born[2/]	Lambs weaned[2/]
		%	%	%	%
R	18	17	11	11	11
T	27	52	48	52	41
D x T	26	92	90	108	77
F x R	66	100	97	158	123
D x T x F x R	6	100	83	100	67

1/ R = Rambouillet, T = Targhee, D = Dorset, F = Finnsheep.

2/ Lambs born or weaned of ewes bred.

TABLE 2. FINNSHEEP X RAMBOUILLET CROSSBRED EWE LAMBING RECORDS - 1972

Age	No. of ewes	Number lambing	Number of ewes having				Lambs born1/	Live lambs born1/
			Abortions	Singles	Twins	Triplets	%	%
1	25	25	1	15	9	0	138	132
2	48	48	1	11	30	6	191	179

1/ Lambs born or live lambs born of ewes bred. Note lambing is incomplete so figures are subject to change.

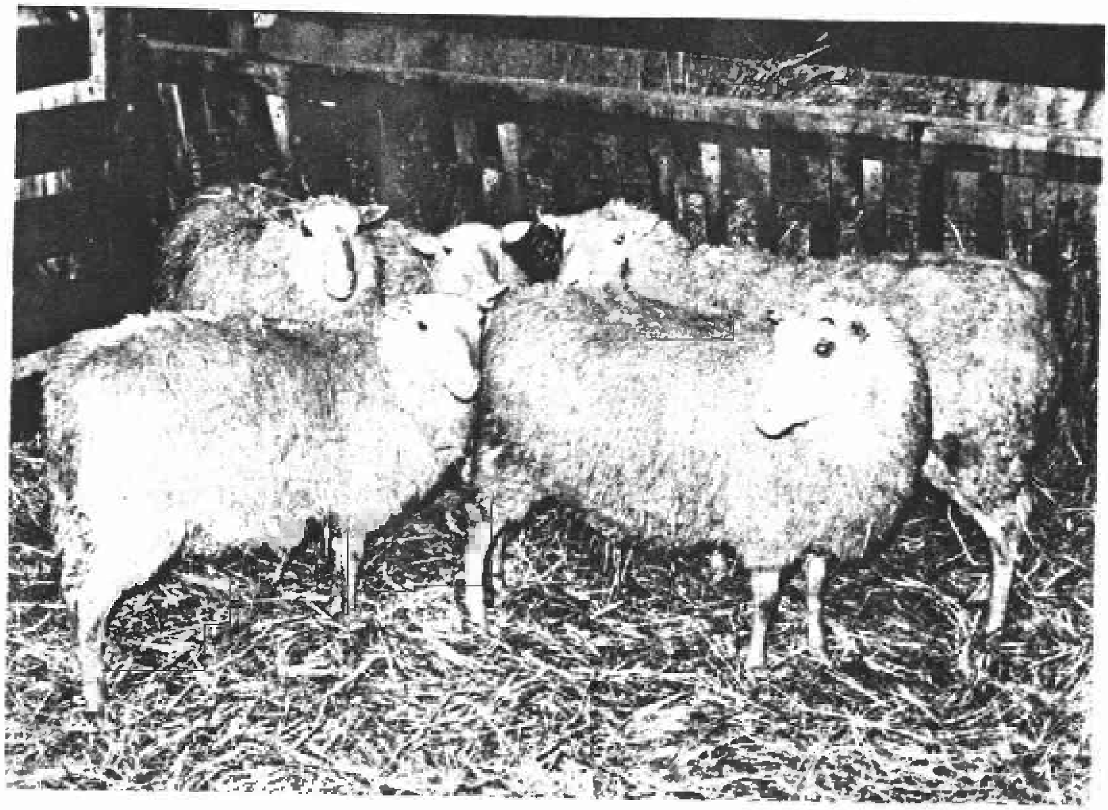

Figure 1. Finnsheep yearling rams

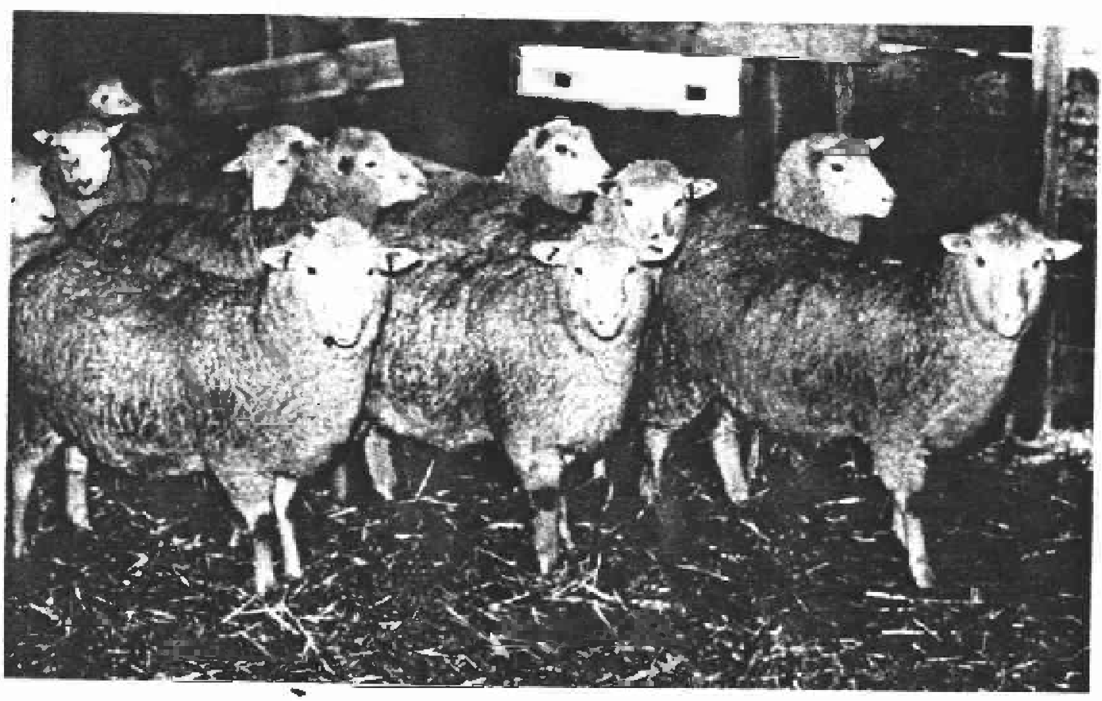

Figure 2. Finnsheep x Rambouillet crossbred ewe lambs about 7 months old

Figure 3. 12-month old Finnsheep x Rambouillet ewes with twin lambs

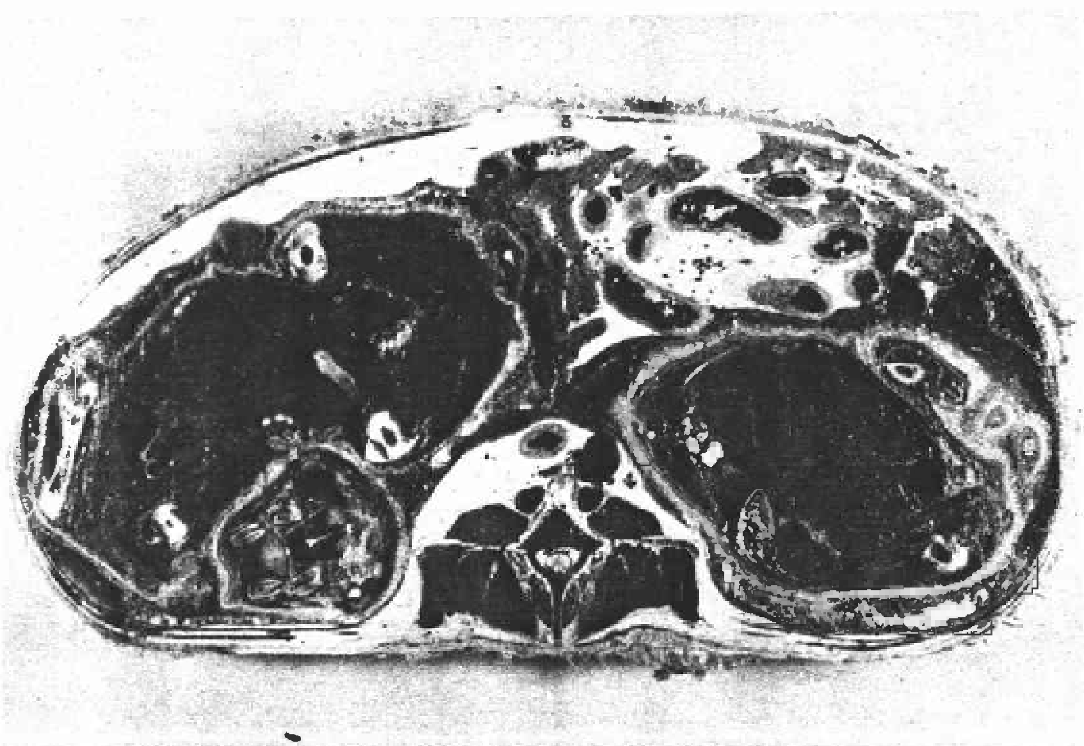

Figure 4. Cross-section through the loin area of a pregnant ewe carrying twins. Note one lamb on each side and rectum in center next to back bone.