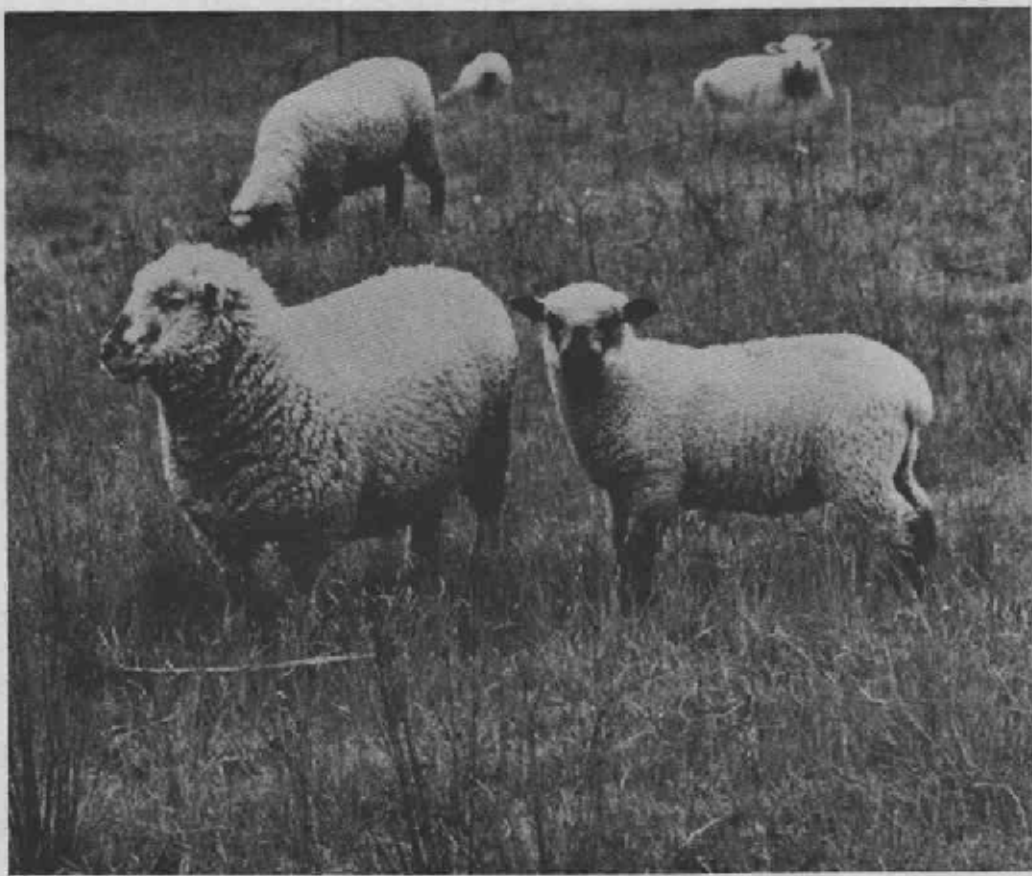


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Summary of Reports . . .

1975 Sheep and Wool Days



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RESPONSE OF VEGETATION AND ANIMALS TO THREE STOCKING INTENSITIES

By

Frank O. Thetford Jr.
and
William C. Krueger

INTRODUCTION

Livestock producers of the United States are seeking ways to increase the efficiency of red meat production from our rangelands. One means of accomplishing this goal is to increase the amount of red meat produced per acre. There are thousands of acres of dryland improved ranges in western Oregon, most of which have been seeded to subterranean clover (Trifolium subterraneum L.) and perennial ryegrass (Lolium perenne L.). Baseline stocking intensities on a year round basis have not been established by controlled research studies. This type of information is necessary to make management plans and to guide future research. The purpose of this project was to establish yearlong stocking rate guidelines for dryland improved subclover-ryegrass pastures in western Oregon. Stocking rates were three, four and five ewes per acre. The results were evaluated in terms of responses of both vegetation and animals. This report relates progress of the study to May, 1975.

STUDY AREA

The research was conducted on the Soap Creek Ranch, Adair Tract, about 12 miles north of the Oregon State University campus. The experimental pastures are on the lower part of a north facing slope of approximately 5%. Soils are Abiqua-like silt loam upslope from a McAlpin-like silt loam. These pastures were seeded to perennial ryegrass and subclover in 1960 and lightly used by cattle until 1968, when ten acres of ryegrass-subclover were cross-fenced to make one acre pastures and a watering system was established. These pastures have been fertilized each year with 200 pounds of single superphosphate. From 1968 through 1971, these ten pastures were used for a stocking rate study using two, four and six ewes per acre. From observations made on these pastures in late 1971 and early 1972, it was decided to narrow the range of stocking rate pressures to three, four and five sheep and their progeny per acre. Ewes were placed on the pastures in 1972 to establish effects of the new stocking rate on the pastures and the project was begun in 1973.

ANIMAL MANAGEMENT

Ewes were provided with free access to fresh water and trace mineralized salt. A health program was established to provide for control of common diseases and parasites. The breeding season was for 40 days each year and

the ewes were flushed with one pound of grain per head per day starting 21 days before the breeding season began and ending 21 days into the breeding season. In 1972 the ewes were bred in September-October for February-March lambs and in 1973 and 1974 the ewes were bred in August-September for January-February lambs. Suffolk ram lambs (7 to 8 months old) from the OSU sheep flock were used for breeding. The ewes were brought into a barn before lambing, shorn, kept in the barn during lambing and ewes and lambs were returned to pasture as soon as the pastures were ready in the spring. The sheep were weighed at 14 day intervals from the time they were returned to pasture until the lambs were weaned about July 1, and at 28 day intervals the rest of the grazing season.

Yearly variations in climate and vegetation growth caused differences in dates of stocking and removal from pastures. Sheep were removed from the pastures January 10, 1973, returned on April 7, and removed December 20, 1973. In 1974, the three and four per acre treatments were stocked April 23 but due to lack of forage in the five per acre pastures, this treatment was not stocked until May 23, which proved to be about 10 days too late. Due to ewe weight losses and apparent lack of satisfactory forage, data collection for 1974 was discontinued on November 3 and the ewes were supplemented with hay.

VEGETATION SAMPLING

Each stocking rate treatment was replicated three times. The vegetation was sampled at two week intervals from the start of the grazing period until grasses had formed hard seed and at monthly intervals thereafter. Vegetation was sampled to determine total dry matter available for each sampling period, amount removed during the period and botanical composition of the available forage and of forage removed. Sampling for total dry matter production and botanical composition without grazing was done in July after plant maturity but before seedhead shatter. Clipped samples were taken at each sampling date for laboratory analysis of crude protein, fiber, lignin, dry matter digestibility in vitro, and gross energy. Each year after fall growth had started, an estimation was made of the amount of standing overburden.

RESULTS and DISCUSSION

Permanent Plots:

Data from permanent plots reflect the growth and composition of vegetation without grazing disturbance the year sampled but should reflect changes caused by treatment during previous years (Table 1). In the three per acre treatment, total dry matter produced per acre decreased approximately 900 pounds from 1973 to 1974 but the four-and five-per acre treatments had an increase of about 500 pounds per acre from 1973 to 1974. The large amount of overburden (58%) on the three per acre pastures in fall, 1973, may have suppressed germination and growth of seedlings and reduced regrowth of perennial plants sufficiently to have caused the reduced 1974 yield. Overburden of 30% and 13% respectively for the four-and five-per acre treatments do not appear to have been detrimental to 1974 forage yields. In 1973, the three-and

Table 1. Botanical Composition and Dry Matter Yields of Permanent Plots and Percent Overburden.

	PERCENT COMPOSITION					Lbs. DM per acre	% Overburden
	Subclover	Other Forbs	Canada Thistle	Perennial Ryegrass	Other Grasses		
3/acre							
1973	0.7	1.7	1.2	58.5	38.0	6109.2	58.3
1974	2.1	0.8	1.8	54.6	40.7	5181.3	44.1
4/acre							
1973	1.0	0.4	3.8	53.4	41.3	5382.9	30.2
1974	1.3	0.7	5.1	51.1	42.0	5829.3	27.8
5/acre							
1973	1.3	2.1	4.6	58.3	33.8	6120.2	13.2
1974	2.0	0.7	1.2	52.2	44.1	6634.7	53.7

five-per acre treatments produced 6000 pounds of dry matter per acre but in 1974 the five per acre treatment produced about 1500 pounds more forage per acre than the three per acre treatment. Total dry matter yield per acre for the four per acre treatment was approximately 750 pounds less than the five per acre treatment for both years. The high amount of overburden on the five per acre pastures in 1974 is a result of stocking these pastures about ten days late in the spring.

There was a slight increase in the amount of subclover in all treatments between 1973 and 1974, but the content of subclover is very low in comparison to what is expected for these type pastures. The freeze in January 1974 was fatal to nearly all of the large clover crop which was present in the fall of 1973. There was a decrease in amount of other forbs in the three-and five-per acre treatments and an increase in the four per acre treatment between 1973 and 1974. Canada thistle showed a relatively large decrease in the five per acre treatment and an increase in the other two treatments. The production of ryegrass decreased in all treatments between years with the largest decrease of 6% in the five per acre treatment. For other grasses (99% annual grasses) there was an 11% increase in production in the five per acre pastures and a slight increase in the other treatments. Overall, the four per acre pastures appear to have remained relatively stable in botanical composition between years while the five per acre treatment had some rather drastic compositional changes between 1973 and 1974. The three per acre treatment was only slightly less stable than the four per acre treatment in botanical composition. As these data are for only two years, we cannot make definite conclusions but trends appear to have been established.

Seasonal Forage Availability and Removal:

Average pounds of dry matter per acre available for 1973 and 1974 and the average pounds of dry matter removed per ewe per day for each season are presented in Table 2. The amount of forage available to sheep decreased from spring to fall as did the pounds of dry matter removed per head per day. The high amount of forage removed per ewe per day for the spring season also includes that amount removed by the lambs. In the fall of 1973, the amount removed by the ewes was far below the average 2.5 pounds of dry matter required by a ewe for maintenance. There was less forage available during spring and summer on the three per acre treatment in 1974 than in 1973. The ewes removed an average 2.6 pounds per head per day more in spring 1974, than in spring 1973 but removed 2.6 pounds per head per day less in the summer of 1974 than in 1973. In the four-and five-per acre treatments there was more forage available in the spring and summer of 1974 than for the same two seasons in 1973. The sheep on the four per acre treatment removed 2.0 pounds forage per head per day more in the spring of 1974 than in the spring of 1973 but about 1.0 pound less in the summer. Consumption in the five per acre treatment remained about the same in 1974 as in 1973.

Overall, the sheep stocked at four per acre removed more forage in the spring of both years than did the sheep on the other two treatments. In summer and fall the three per acre ewes had the highest average consumption per head per day while the four-and five-per acre treatment animals were about equal for the two seasons.

Table 2. Average pounds dry matter per acre available and average pounds dry matter removed per sheep per day by season in 1973 and 1974.

	3 per acre		4 per acre		5 per acre	
	1973	1974	1973	1974	1973	1974
SPRING						
Available - pounds/acre	2370	2262	1868	2210	1835	2850
Removed-pounds/head/day	7.3	8.9	8.4	10.4	7.8	9.0
SUMMER						
Available - pounds/acre	1817	1553	884	1280	716	1546
Removed-pounds/head/day	6.3	3.7	3.5	2.4	2.4	2.3
FALL						
Available - pounds/acre	701	---	350	---	289	---
Removed-pounds/head/day	2.5	---	0.8	---	0.7	---

Botanical Composition of Available and Removed Forage:

The botanical composition of the available forage and of that removed in 1973 is presented in Figure 1. These data are presented by season in each treatment.

Three Ewes Per Acre:

Perennial ryegrass provided 70% of the available forage in the spring for the three per acre treatment but then decreased to 63% and 53% of the available forage in the summer and fall respectively. The sheep appeared to select against ryegrass in spring but for it in the fall. The animals selected for the other grasses in the spring when they made up 26% of the available forage but selected against the other grasses in the fall when they made up only 17% of the available forage. In summer, the composition of the diets were closely related to composition of the available forage. Subclover, forbs and Canada thistle made up relatively minor portions of the available forage and of the diet in the spring and subclover and forbs were absent in the summer. Climatic conditions were favorable for the germination and growth of subclover in the fall of 1973 and subclover made up 33% of the available forage in the three per acre pastures but the sheep in this treatment appeared to select against subclover. It is interesting that as the amount of ryegrass in the available forage decreased as the season advanced in this treatment, the amount of ryegrass in the diets increased.

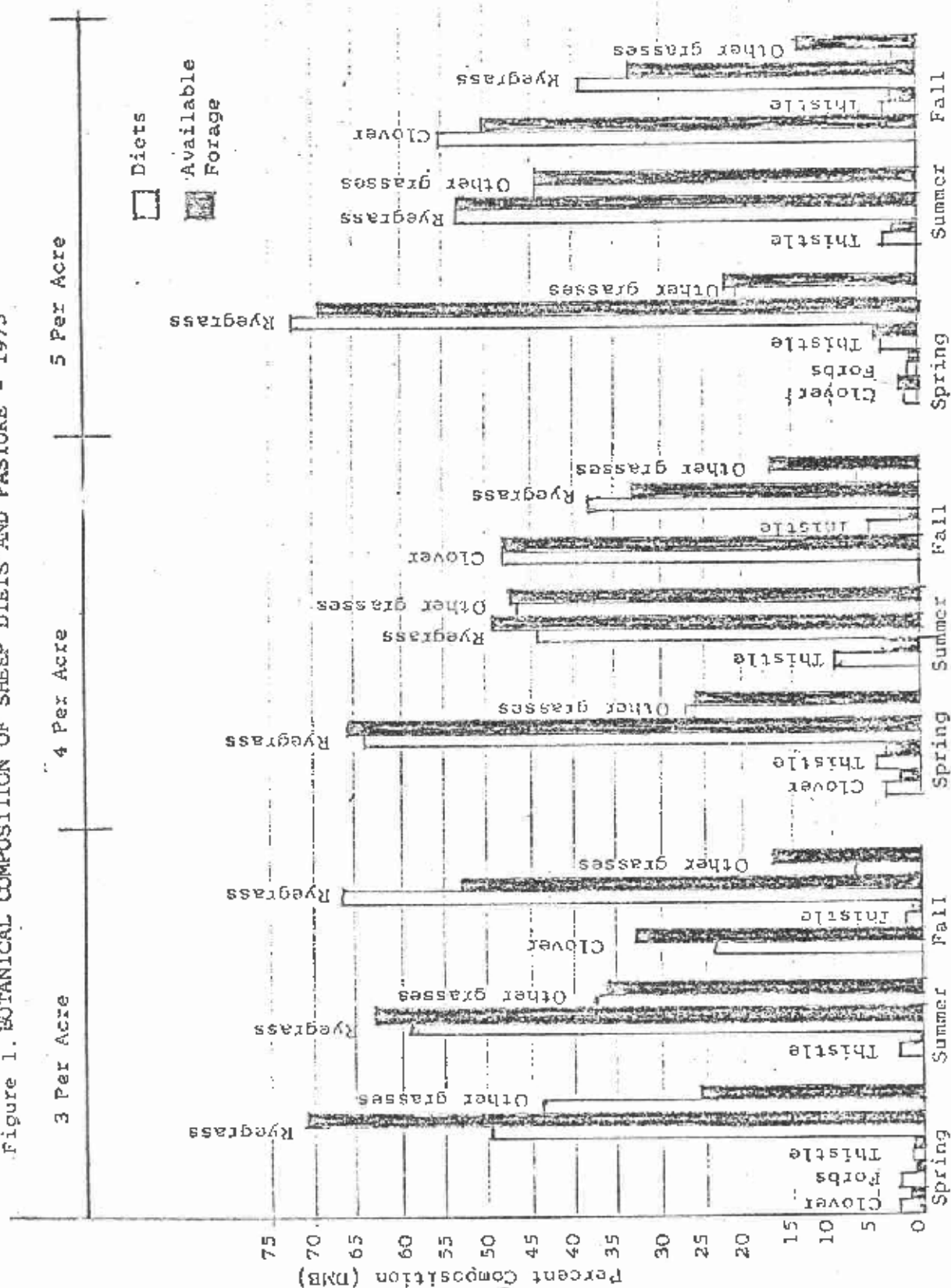
Four Ewes Per Acre:

The trends in botanical composition of available forage for the four per acre treatment in 1973 was the same as for the three per acre treatment. Ryegrass contributed 5%, 15% and 20% less to available forage in the four per acre treatment than it did in the three per acre treatment for spring, summer and fall, respectively. There was 10% more other grasses in the available forage in summer than in the three-per acre treatment but composition of other grasses for spring and fall was equal for the two treatments. Botanical composition of the diets was closely related to the composition of available forage for all seasons in the four per acre treatment except for Canada thistle in summer and fall. Canada thistle made up 10% and 7% of the diet in the summer and fall, respectively, when it contributed 5% and 3%, respectively, to the available forage. Also, sheep selected against other grasses in the fall. There was 48% subclover in available forage in the fall for the four per acre treatment which was about 15% more than in the three per acre treatment.

Five Ewes Per Acre:

The trends in composition of available forage in the five per acre treatment were the same as for the other treatments across seasons. The composition of the diets closely resembled those of the four per acre treatment except there appeared to be more selection for ryegrass in all seasons and there was less thistle in the diet. Also, animals in the five per acre treatment selected for subclover in the fall when it made up 50% of the available forage.

Figure 1. BOTANICAL COMPOSITION OF SHEEP DIETS AND PASTURE - 1973



Trends in the botanical composition of available forage followed the same patterns across seasons for all treatments though the relative amounts varied with treatment. There was a relatively low amount of subclover in the three per acre treatment when compared to the amount available in the four-and five-per acre treatments. This could be a result of excess overburden in these pastures which would have reduced total light reaching the ground. Subclover has a high light requirement for germination and growth.

Botanical composition of the diets varied more with treatment than with the composition of available forage within each treatment. The diet of the three per acre animals was very different from that selected by the four-and five-per acre animals. The four-and five-per acre treatment diets were quite similar except the five per acre diets contained more ryegrass in spring and summer than the four per acre diets.

1974 - All Treatments:

Botanical composition of available forage and the diets for 1974 is presented in Figure 2. Composition of available forage and diets of sheep stocked at three per acre for both spring and summer was nearly identical in 1973 and 1974. The summer 1974 data include all data collected from mid July until November when fall regrowth started. The fall data collection has not yet been summarized.

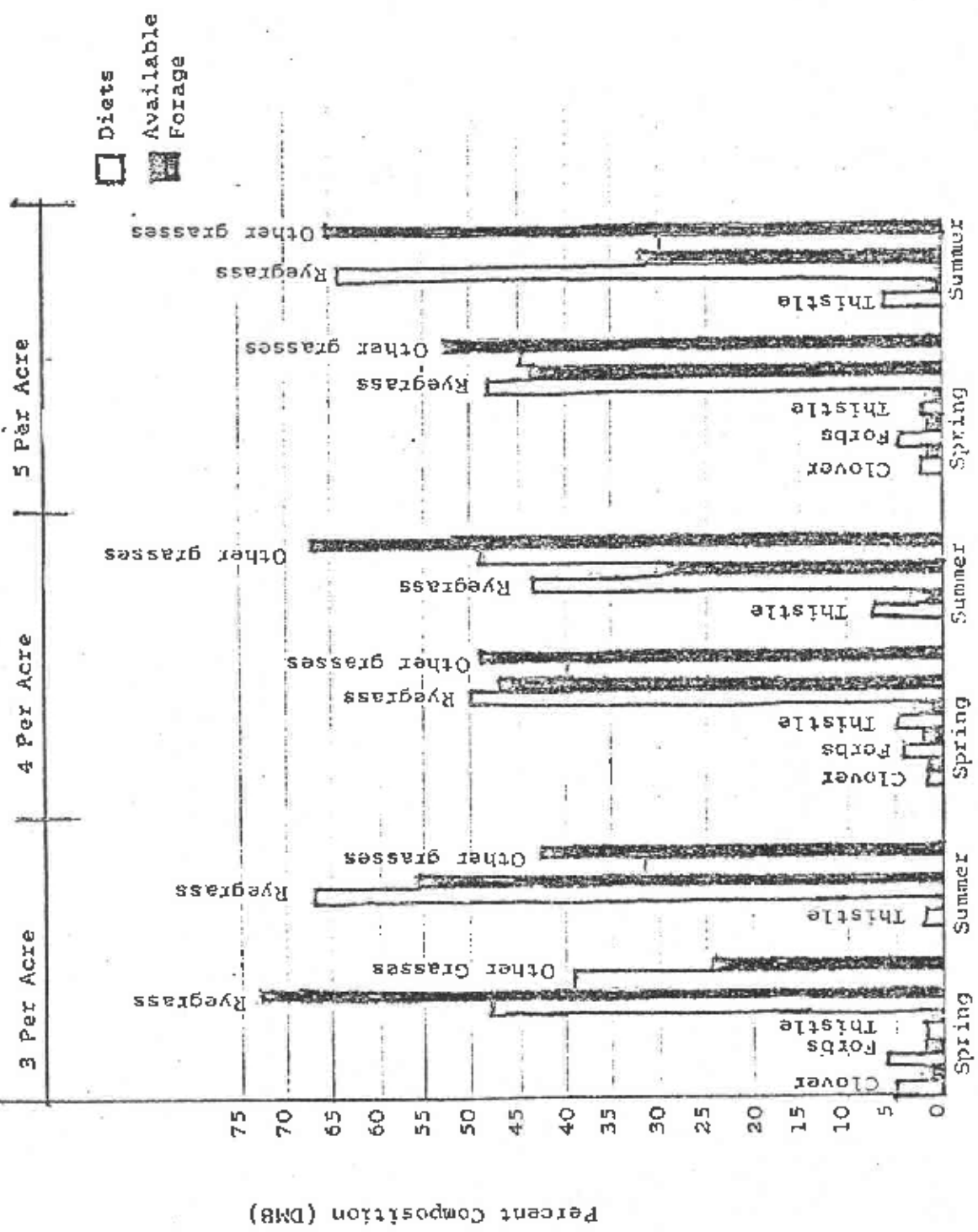
The four per acre treatment in spring 1974 had 20% less ryegrass available than 1973, and about 13% less ryegrass in the diet. For this same period and treatment there was 22% more other grasses available and 13% more in the diet than in 1973. In the summer of 1974 there was 20% less ryegrass and 20% more other grasses in the available forage than in 1973 but the diet composition of both components was approximately the same level for both years.

The available forage in the five per acre treatment for spring 1974 was composed of 26% less ryegrass and 30% more other grasses than in 1973. The composition of the diets for ryegrass and other grasses followed the same patterns as the available forage in the spring between years. In the summer of 1974 there was 20% less ryegrass and 20% more other grasses available than in the five per acre treatment for 1973. But the summer 1974 diets contained 12% more ryegrass and 14% less other grasses than the 1973 summer diets. There was less Canada thistle in the five per acre treatment in 1974 than in 1973 but thistle composition remained approximately the same between years for the three-and four-per acre treatments.

Forage Quality - 1973

In 1973 crude protein was sufficient to meet the needs of a lactating ewe until about June 10 when grasses became deficient and remained so until fall regrowth started in September (Figure 3). Canada thistle contained sufficient crude protein to meet requirements of a dry ewe even in the dry summer. Subclover contained a large amount of crude protein but was not available to the animals from June 15 until late September. It appeared the amount of crude protein in the available forage was sufficient to meet the needs of gestating and lactating ewes during the normal periods of these reproductive functions but became deficient in mid June and did not meet the requirements for dry ewes during the summer.

Figure 2. BOTANICAL COMPOSITION OF SHEEP DIETS AND PASTURE - 1974



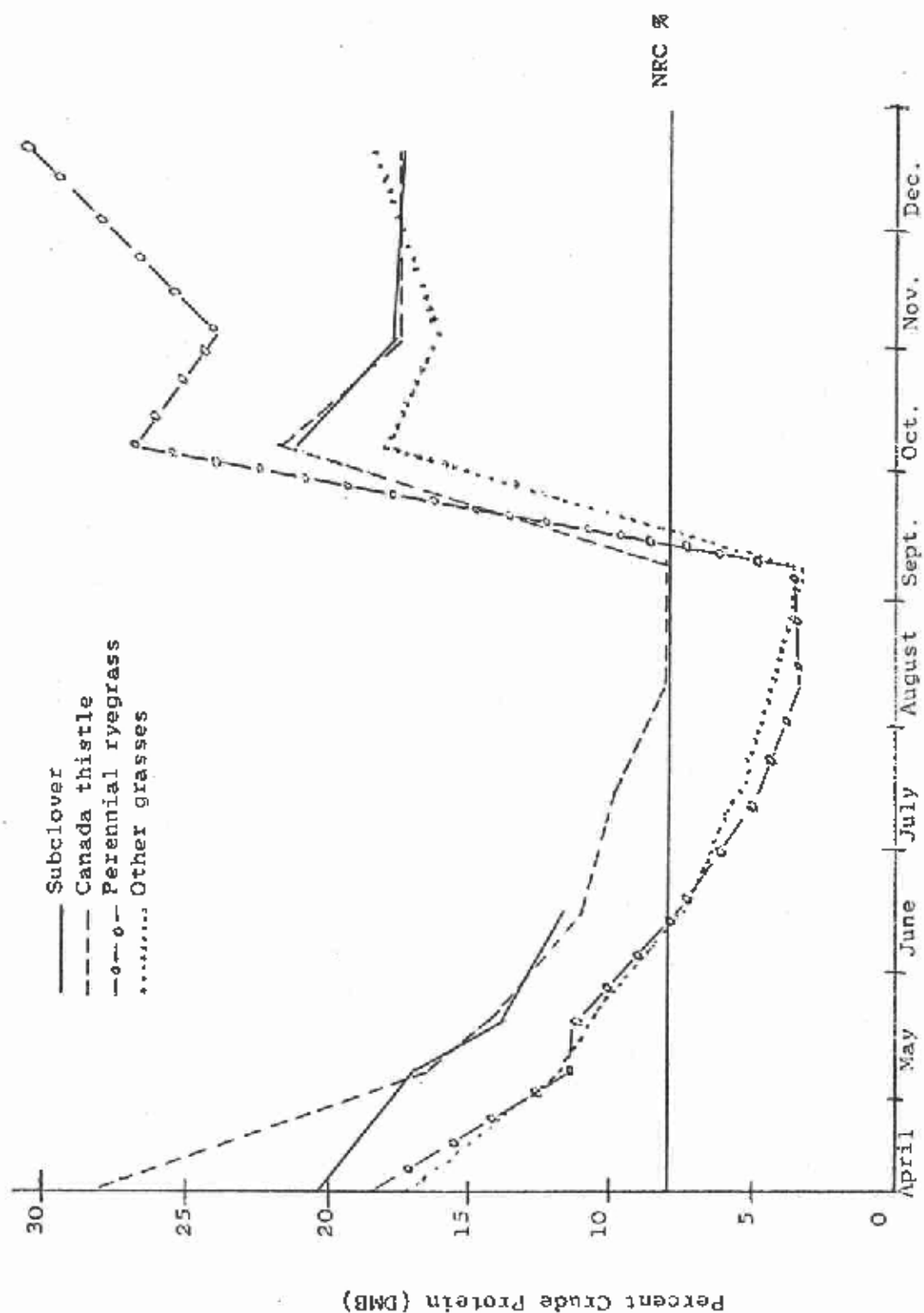


Figure 3. Percent Crude Protein (Kjeldahl N X 6.25) (DMB) 1973.

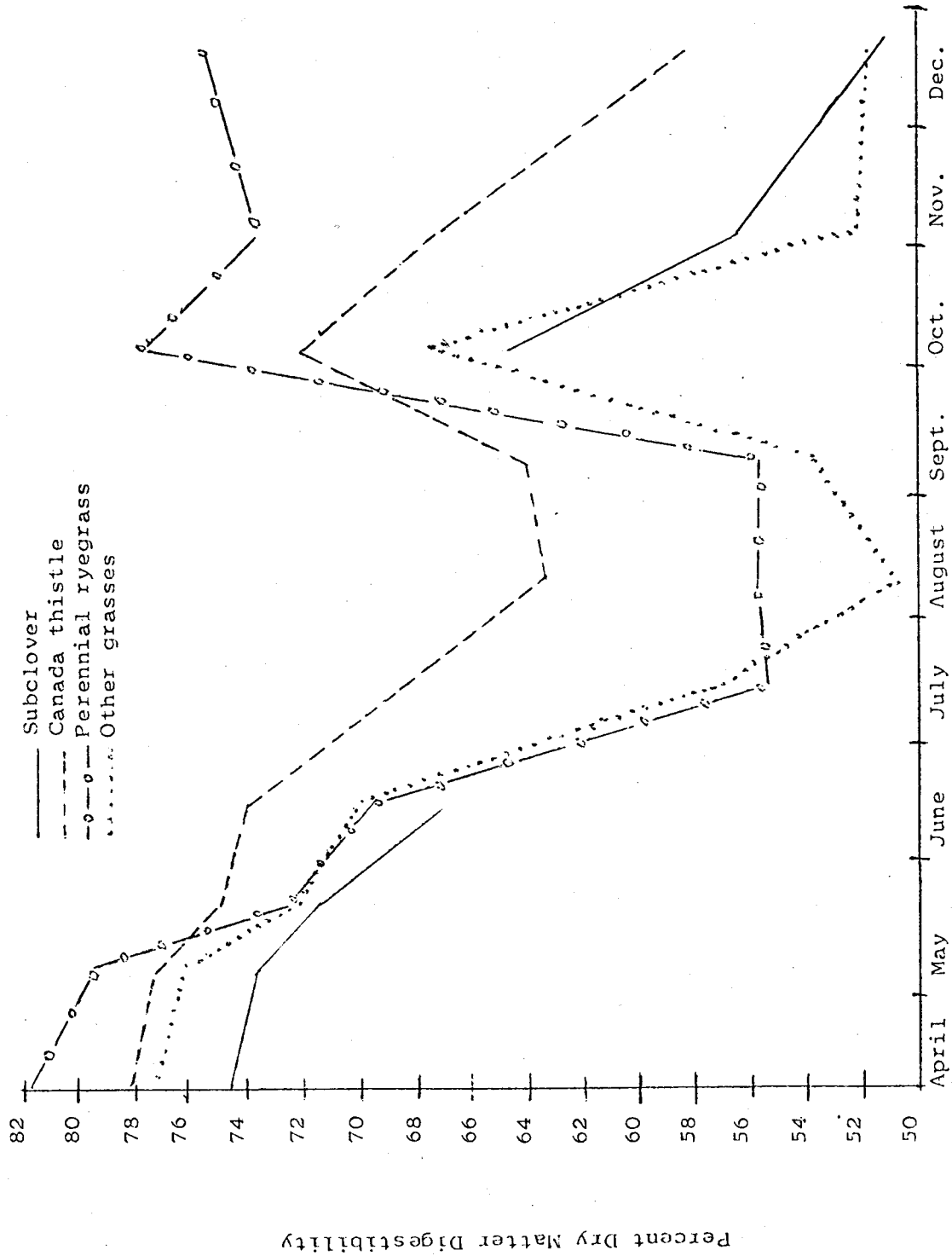


Figure 4. Percent Dry Matter Digestibility, in vitro (Tilley & Terry) - 1973

The dry matter digestibility of all vegetation in 1973 was high until mid June when the digestibility of grasses dropped very rapidly as they matured (Figure 4). During summer the grasses were about 50-55% digestible. Digestibility of Canada thistle was about 65% during the summer and there was a drastic drop during the fall from 72% digestible in October to 59% in mid December. The digestibility of subclover and other grasses also dropped during fall, particularly between October and November. This was probably caused by a killing frost in late October.

ANIMAL DATA

Ewe Weight Changes:

The sheep were placed on pasture April 7, 1973, and the ewes gained weight rapidly until the first part of May (Figure 5). The weights of ewes on all treatments remained relatively stable throughout the rest of the year except the three per acre ewes which started gaining again in October. The four-and five-per acre ewes ended the grazing season in December about 17 to 18 pounds above their initial spring weights while the three per acre ewes were 34 pounds above their initial spring weights.

In 1974, the three-and four-per acre treatments were stocked on April 23 and the ewe weights followed the same pattern of rapid gain and leveling off as occurred in 1973 (Figure 6). But in August 1974, the ewes began to lose weight very rapidly and the three per acre ewes ended the grazing season in November 1974 just four pounds above their initial spring weight. The four per acre ewes ended the grazing season 12 pounds below their spring weight. The five per acre ewes were not placed on pasture until May 23. These ewes gained weight only moderately until mid June when they began a moderate decline in weight. In September the five per acre ewes began to lose weight rapidly and ended the 1974 grazing season 20 pounds below their initial spring weights. This may have been caused by stocking the pastures about 10 days late and these ewes did not make their early spring gains as did ewes on the three-and four-per acre treatments.

Lamb Data:

In 1973, there were 89%, 108% and 93% lamb crops born respectively, to the three, four-and five per acre treatment ewes (Table 3). The lambs were on pasture for 84 days before they were weaned. There is essentially no difference among weaning weights. In terms of pounds of lamb produced per acre from pasture, the four per acre treatment produced the highest with 174 pounds followed by five per acre at 150 pounds and three per acre at 128 pounds.

In 1974 percentage of lambs born was 56%, 50% and 60% in the three, four and five-per acre treatments, respectively. The cause of this has not been determined but it may have been due to possible high estrogenic properties in the large subclover crop of fall 1973 or to the type of rams used. The three per acre treatment had the highest weaning weights of 86 pounds and produced the most pounds of lamb per acre with 67. The four per acre treatment

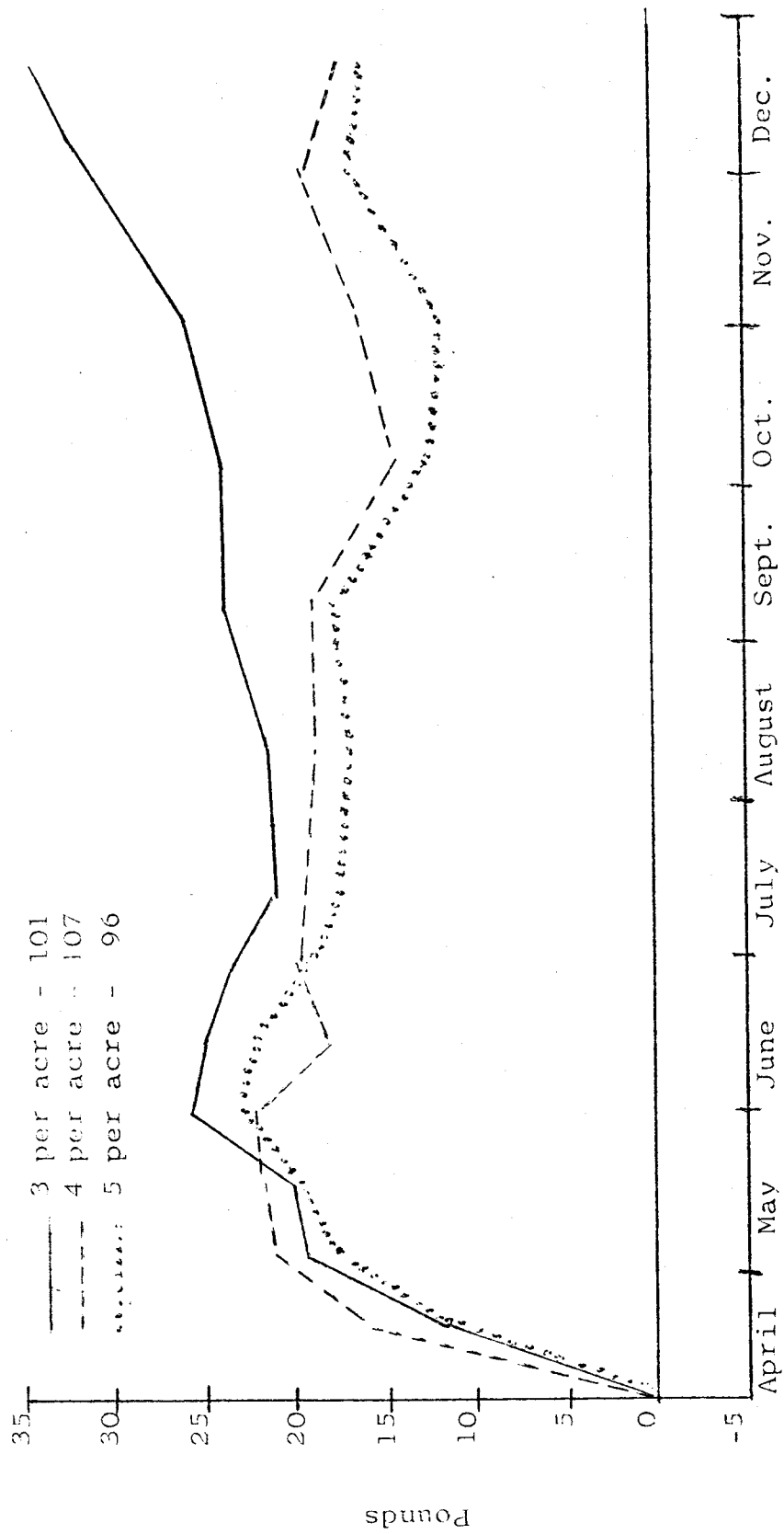


Figure 5. Average Ewe Weight Changes on Pasture - 1973.

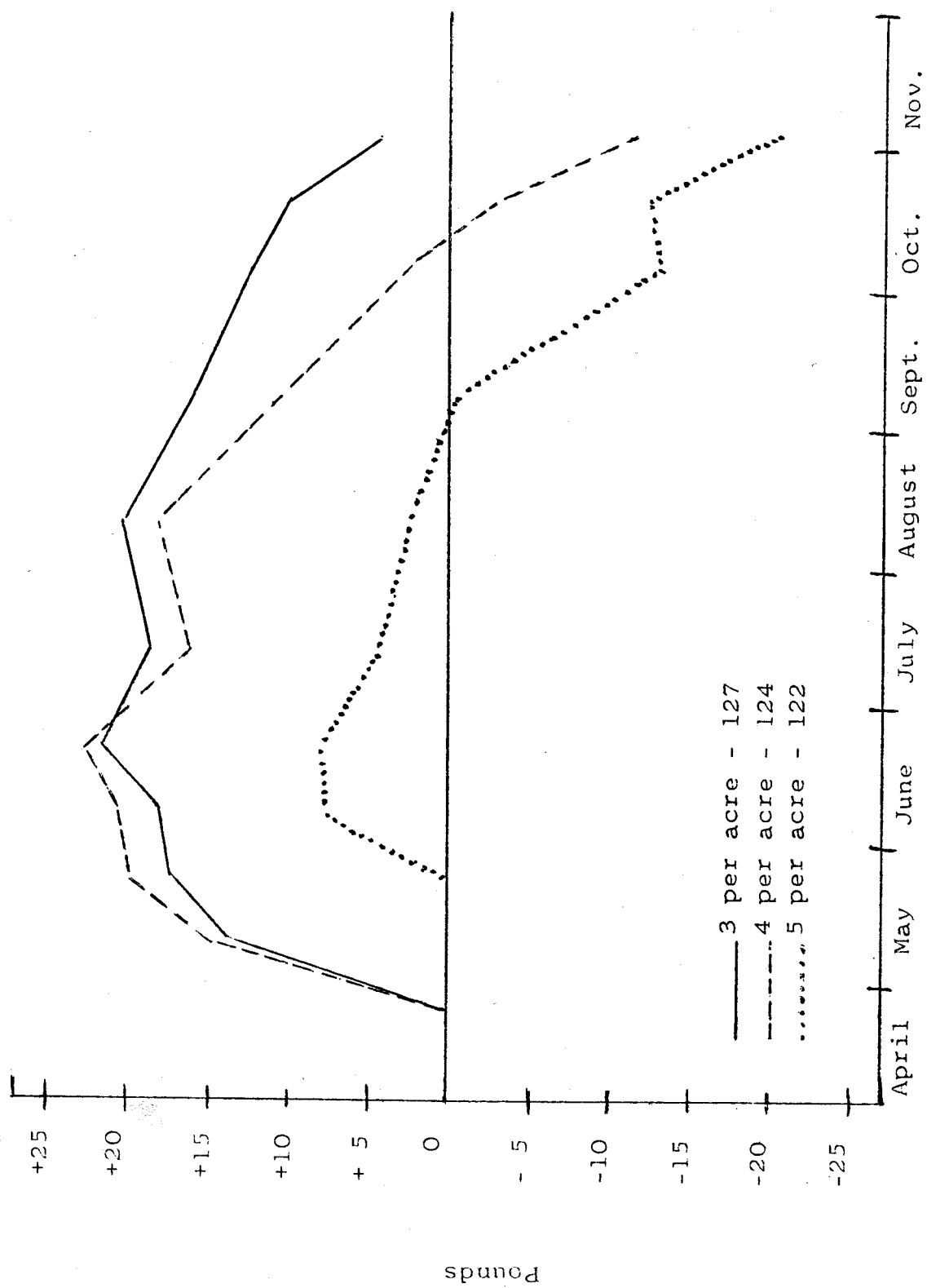


Figure 6. Average Ewe Weight Changes on Pasture - 1974

Table 3. Lamb Data

Year	Stocking rate	% lambs born	Days on pasture	lbs. lamb per acre from pasture	Avg. weaning wt. per lamb
1973	3	89	84	128	76 (9)
	4	108	84	174	78 (13)
	5	93	84	150	78 (12)
1974	3	56	80	67	86 (6)
	4	50	80	57	80 (7)
	5	60	50	26	76 (7)
1975	3	156			
	4	108			
	5	93			

produced 57 pounds of lamb per acre and had weaning weights of 80 pounds per lamb. There were only 26 pounds of lamb produced per acre in the five per acre pastures with weaning weights of 76 pounds per lamb, representing only 50 days on pasture versus 80 days for the other two treatments, and going onto pasture 30 days later than the other treatments.

In 1975, a 156% lamb crop was born to the three per acre treatment ewes and 108% and 93% lamb crops born to the four-and five-per acre treatments, respectively. The lamb numbers born in the four-and five-per acre treatments were exactly the same as born in 1973 for each treatment.

SUMMARY

From the information which was presented in this paper, on the responses of the animals and vegetation to the three stocking pressures, it appears that the proper guideline stocking rate for a year long grazing operation on dryland improved ryegrass-subclover ranges will be approximately four ewes per acre. It must be realized that these data are for only two years and although the beginning of trends may be distinguishable, it takes several years to establish the true responses in this type of research.

IMPROVEMENT OF REPRODUCTIVE EFFICIENCY IN SHEEP

Maurice Shelton

All livestock producers are in the process of merchandising their available resources through livestock, and efforts should be directed toward maximizing the efficiency of utilization of these resources. This is both a moral responsibility and good business management. Within a single specie, such as sheep, there is little indication or expectation that major differences will be identified in the ability to digest feedstuffs or in the efficiency of the physiological function involved in the productive processes. However, there appear to be some important gains to be made through the control of what use is made of products produced from the feedstuffs ingested. Since lamb is the primary product produced from the sheep industry in most areas, one might logically be concerned with doing the most efficient job of producing lamb meat. The two primary factors affecting efficiency of lamb production are level of reproduction and sale weight of lamb relative to weight of the ewe which produced that lamb. The relationship of these two variables to nutrient cost for lamb production is shown in Figure 1. These data apply only to the set of conditions under which they were calculated. However, they are no doubt illustrative of the general situation for the industry. These data confirm a major opportunity for greater efficiency through improvement in reproductive efficiency. An additional factor affecting efficiency of lamb production is the amount of nutrients expended in wool production or conversely the proportion of the maintenance cost of the ewe which can be returned through wool income.

There is almost universal agreement that a great potential exists for improvement in reproduction in sheep, and it is this potential that gives this species a major advantage over cattle, their major competition for available resources. Realizing that this potential exists, many in the industry have been frustrated by the lack of progress or slow progress on a national or industry wide basis in realizing this potential. It is the purpose of this report to attempt to review some of the options available to accentuate the improvement in reproductive efficiency.

An obvious first step is to optimize or maximize the environmental variables or management factors known to affect reproduction. The environmental variables that producers should be thoroughly familiar with include such factors as temperature, season, age of ewe, size or condition of the ewe and level of nutrition and flushing. On a national basis, high environmental temperature has a major sapping effect on productive efficiency in sheep, but we will assume that this is not a problem in Oregon and will not deal with it at this time.

The effect of season on reproduction is very important in sheep. We can breed Rambouillet sheep in Texas at any time of the year, but the level of reproduction varies markedly. We recently completed a cooperative study with the U.S.D.A. at Dubois, Idaho looking into the effect of location and season. Since Dubois is located on a comparable latitude to much of Oregon, it may be of interest to look at the results. The data (see Figure 2) were obtained

from Rambouillet ewes maintained in drylot on the same feed at both locations. These data confirm a marked season and location effect which can apparently be explained by variation in photo period length (see Figure 3). These results also suggest other points of interest. If accelerated lambing is to be practical without the use of hormones, it is more likely to be successful in Texas than in the Northwest. In this study, the ovulation rates at the most optimum times in Idaho approached 200% (170-190). If producers are not realizing a lamb crop somewhere in this range, it seems pertinent to ask where the loss is occurring. We are in the process of trying to partition these losses under Texas conditions, but of course each area would be expected to differ in this respect.

In the absence of more specific information, it is known that death losses of the lambs produced is a major source of loss. Protection from inclement weather at lambing or from predation losses later are areas of interest. In addition, good husbandry practices during lambing can contribute markedly to reduced lamb losses.

Age and condition (level of nutrition) of the ewe are important factors affecting reproduction. Since replacements must be provided, the producer has few options in respect to age of the ewe. One decision which must be made is the age at which to cull. It is generally uneconomical to cull ewes from the commercial flock for any reason except failure to produce a lamb. Generally older ewes should be kept as long as they are capable of raising a lamb. However, the culling practice for older ewes has relatively little influence on the flock average for production because at advanced ages they represent a very small part of the flock.

Generally, better nutrition has a favorable effect on reproduction; however, this is not a totally linear relationship, as reproductive performance often tends to turn down at extremely heavy weights. A marked improvement in level of lamb production occurs with increases in ewe weight up to what may be considered physiological maturity or optimum for the breed involved. In the case of the Rambouillet, this is on the order of 125 pounds. The degree to which weights above this are detrimental may be related to the degree of heat stress.

Previous culling practices have an effect on reproduction. The primary point of interest relates to culling dry ewes. It is highly recommended that dry ewes be identified, and that two year dry ewes be culled. The decision about culling the first time a ewe is dry is not nearly so simple. If there are relatively few dry ewes it is usually advisable to cull these, especially if they are old ewes or younger ewes under good conditions. If conditions are poor and there are a large number of open ewes, the time is better spent in finding out why they are dry. If lack of development or poor nutrition is the explanation, the open ewes are likely to have superior performance the next year.

In addition to the ewes as a source of variability in lamb production, recent studies have suggested that far more attention should be paid to the ram than has been done in the past. Rams may vary greatly in the amount of libido (or the reverse of this, sexual inhibition), in physical capability

to serve ewes and also in the fertilizing capacity of the germ cells produced. Recent studies have shown that many ewes which were mounted by rams were actually never served by them. At least the first two attributes mentioned above can be appraised by observing the rams for a short period of time when they are first placed with cycling ewes. Recent observations suggest that selection for libido in rams may be a simple way to select for fertility in ewes.

If a producer is successfully implementing the practices suggested earlier and approaching the indicated potential, he is well above average. He may also be asking how he can make still further improvements. In this case, some of the following practices might be considered; breeding ewe lambs, pregnancy diagnosis, selection within or between breeds or strains for improvement in fertility, the use of hormones or accelerated lambing. We have made an effort to look at all these practices on a research basis.

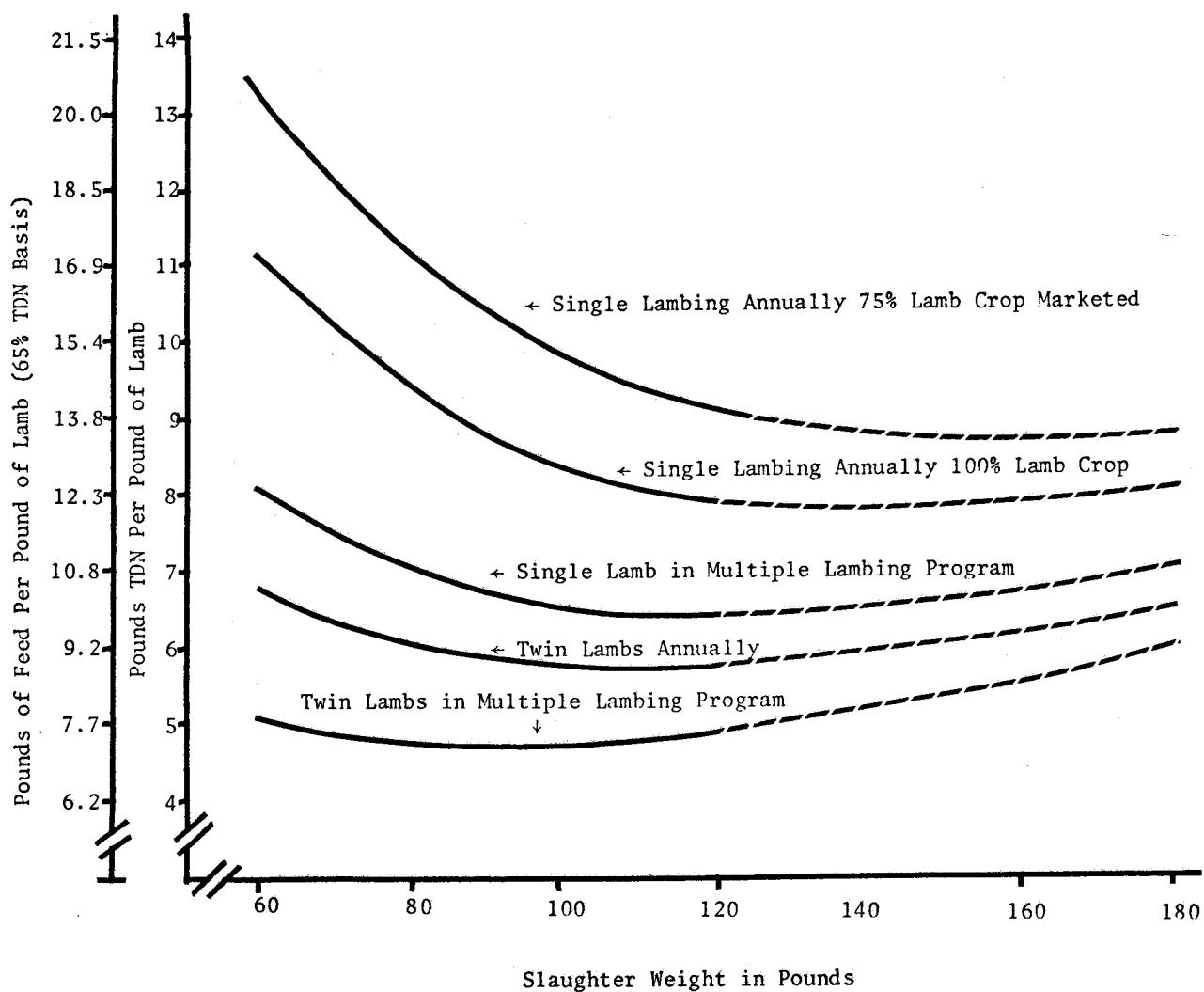
Under Texas conditions, ewe lambs seldom grow out sufficiently well to breed their first season to lamb at one year. However, under Oregon conditions, I assume that this would often be possible, especially if Finn breeding is involved. If this is the case, producers might wish to adopt the practice used by some cattle breeders of exposing more ewe lambs than one expects to need and keeping only those which breed and settle in a short period of time. The remainder would be sold as market lambs.

Pregnancy diagnosis with sheep appears to have approached the practical or usable phase. One often overlooked practice is that of allowing the ram to tell us which ewes have been bred and which are still cycling after the breeding season is over. We find that under our conditions, running a marked ram (either intact or epididymectomized) with the ewes for a few weeks after the end of the breeding season will identify most of the open ewes. If this has not been done or does not yield satisfactory results, the next opportunity is palpation, either by use of a rod in the rectum or directly through the abdominal wall after approximately 100 days. It is my experience that testing the entire flock by this method presents more work than many will be willing to devote to this cause. However, if the open ewes can be concentrated in some manner, such as chute cutting for udder development, then palpation of the reduced number does become practical.

In retrospect, it is clear that the failure to select for improved fertility in our sheep flocks has been a major shortcoming. From this point forward, the institution of selection programs designed to improve reproductive efficiency is certainly indicated. Realistically, however, expected progress would be slow; whereas the sheep industry over much of the U.S. needs dramatic results. Dramatic results of the type needed (by means of genetics) can be obtained only by introduction of new gene sources by cross-breeding. The introduction of Finn sheep is an example of these efforts. They certainly do possess some of the desired traits (see Figure 4) but in the area with which I am concerned, they represent serious adaptability problems. On a world basis, there are other types that hold great interest, and I hope the sheep industry will support efforts to introduce and evaluate some of these.

Accelerated lambing programs with or without the use of hormones hold a lot of interest for researchers. Research over a period of several years at Texas A&M has shown that these practices have the potential of increasing lamb production by 40-50 percent. However, the practices have not been adapted to any significant extent in the state. This is apparently explained by the fact that these programs require more management skills, are more labor intensive and require a greater use of harvested feeds. In the latter case, supplemental feed for the ewe as well as rations for early weaned lambs are involved. The high feed cost in recent years has largely negated interest in this program, but prior to this, substantial interest was developing. With the Rambouillet in Texas, accelerated lambing can be practiced without the use of hormones. However, with a different sheep at the latitudes of the Northwest, successful implementation of accelerated lambing would appear to require their use. In earlier programs, workers here in Oregon have reviewed the methodology of endocrine control of reproduction, and no effort will be made to do so at this time.

FIGURE 1. INFLUENCE OF REPRODUCTIVE RATE AND SLAUGHTER WEIGHT ON EFFICIENCY OF LAMB MEAT PRODUCTION



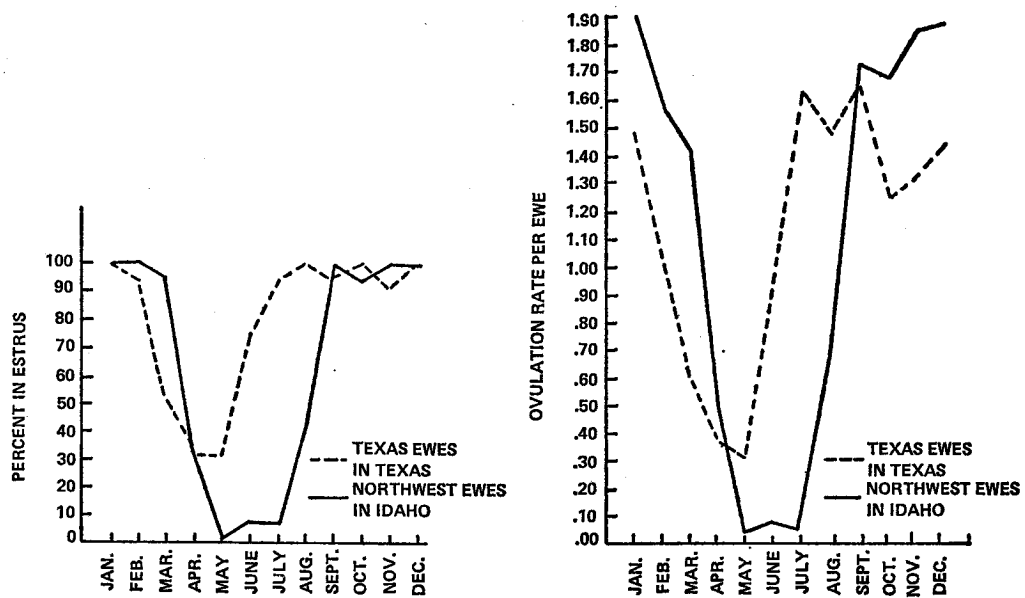


Figure 2. Influence of source and location on number of ewes showing estrus and on ovulation rate.

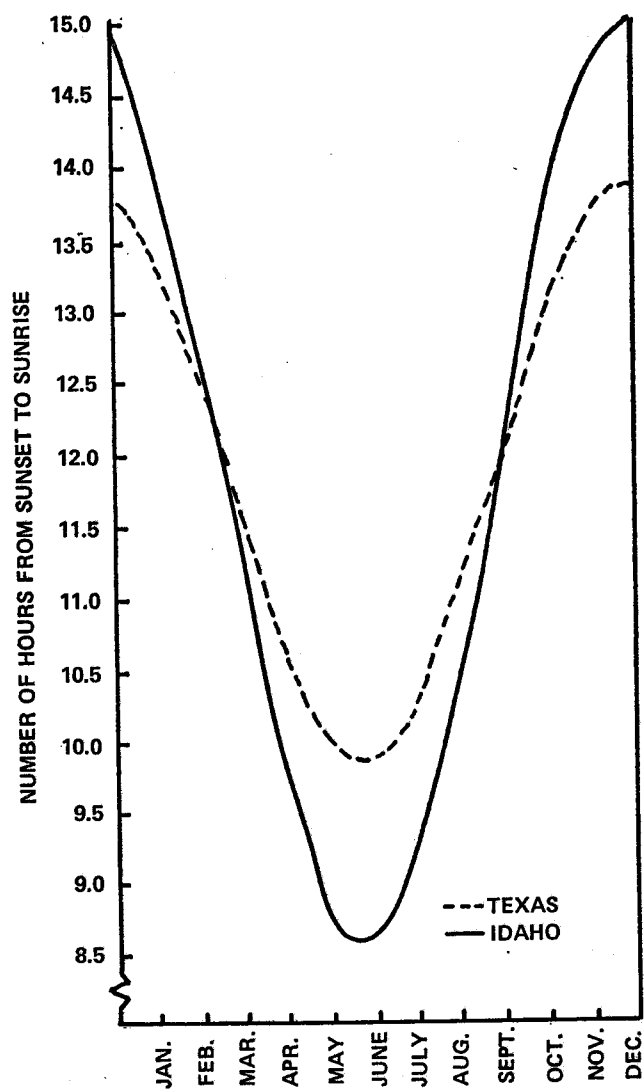
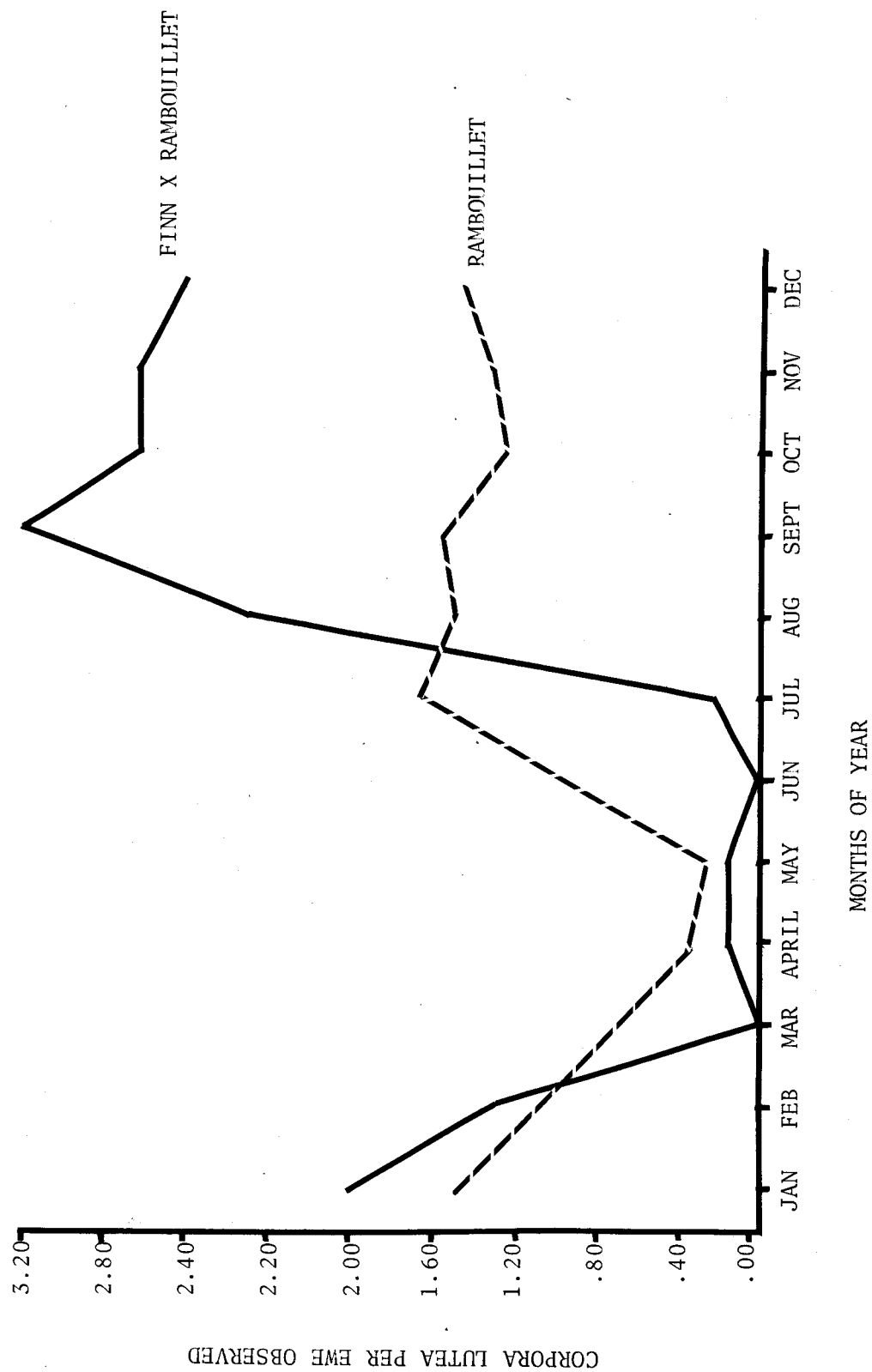


Figure 3. Number of hours of darkness at the two experimental locations.

FIGURE 4. EFFECT OF SEASON ON THE OVULATION RATE OF FINNISH LANDRACE X RAMBOUILLET EWES



WETHER REPORT

Summary of OSU Sheep Breeding and Management Research

William D. Hohenboken

In this paper, I will describe resources supporting teaching and research in sheep at Oregon State University and present progress reports for completed and ongoing research projects.

RESOURCES

Animal. Purebred Hampshire and Suffolk flocks number 32 and 48 ewes, respectively. Individual Hampshire breeders and the Oregon Purebred Suffolk Breeders Association are working with us on the improvement of these flocks. They support undergraduate teaching and furnish animals for breeding, feeding, management and behavior research. My breeding experiment has 423 ewes from eight crossbred groups split between irrigated and hill pasture environments. These ewes are in their first or second year of production. An experiment was begun at the OSU Hill Pasture last fall to study the effects of flushing systems during breeding and of creep feeding during lactation on the efficiency of lamb production. The 102 grade black face ewes assigned to the experiment are on loan from Superior Packing Company of Ellensburg, Washington, whose cooperation is gratefully acknowledged. Our reproductive physiology section has 20 sheep used in their research, and the Rangeland Resources program run some 75 ewes on grazing system and stocking rate experiments at Camp Adair north of Corvallis.

Physical. We have available for sheep work some 675 acres in several separate tracts. The Wilson Farm is 250 acres of improved hill pasture located northwest of Corvallis. The Hill Farm contains some 180 acres of marginal to good pasture, 160 acres of woodland and 30 acres of wheat. These areas are undergoing improvements in fencing and livestock water development. Management has been designed to improve botanical composition of pastures, to increase stocking rates and to lower feed costs per unit of lamb meat production. The Hill Pasture is under joint development of animal and range scientists. Thirty five acres of improved, irrigated pastures are located south of Corvallis. Finally, 20 acres of grass pasture in several small paddocks, is adjacent to the main sheep barn. It has 22,000 sq. ft. in 16 pens. Bulk feed storage, a shop, a lab and an office are available. The barn is used for lambing and for various feeding, behavior and management experiments throughout the year. Four other barns, some of them parts of old farmsteads occupied by the University, are located on outlying tracts. They range from "marginally acceptable" to "imminent danger of collapse."

Personnel. Animal and range science faculty working on sheep problems or using sheep to solve problems in animal agriculture include myself and Drs. Dave Church, Fred Stormshak, Arthur Wu, Peter Cheeke, Jim Oldfield, Al Winward and Bill Krueger and Mr. Glenn Savelle. At least 12 graduate students use sheep in their thesis research. We have two full time civil service shepherds, Bob Klinger and Lloyd Westcott. They help to plan, to set priorities among, and to implement programs of preventive health management,

and maintenance and improvement of physical facilities. They also support our undergraduate teaching of sheep production. Students are hired for additional labor, especially during seasons of peak work load.

RESEARCH PROGRESS REPORTS

Heterosis for reproduction and lamb production from ewe lambs. Cross-bred ewes from all possible reciprocal combinations among Hampshires, Suffolks and Willamettes were compared to contemporary straightbreds for reproduction and maternal productivity as ewe lambs. (The Willamette was a synthetic strain developed at OSU from 50% Columbia, 25% Border Cheviot and 25% Dorset Horn ancestry.) The ewes had been raised to weaning on dryland hill pasture or on irrigated valley pasture. After weaning, they were grown out on dryland hill pasture and supplemental grain. At about seven months of age, all were exposed to Shropshire rams; so all their progeny were two or three breed crosses.

Location in which the ewes were raised affected only ewe weight at mating. The irrigated pasture ewes were two pounds lighter. Heterosis, or crossbred advantage, for ewe lamb fertility was 25%. Fifty six percent of straightbred ewes and 70% of crossbred ewes lambed. Crossbreds were 10% above straightbreds in twinning rate. Heterosis was 14% and 30%, respectively, for pounds of lamb weaned per ewe lambing and pounds of lamb weaned per ewe bred. Of the total advantage of crossbred ewes over straightbred ewes for pounds of lamb per ewe bred, 58% was attributable to heterosis for fertility, 23% to heterosis for twinning rate, 19% to heterosis in milk production and other maternal productivity traits, and 0% to heterosis for lamb survival. Former graduate students Phillip Cochran and Dennis West assisted in the conduct and analysis of this experiment.

Effects of flushing and creep feeding on hill pasture sheep production. One hundred and two mature grade blackface ewes were divided into three groups to examine the effects of flushing management during mating on reproductive performance. Group I was kept in drylot from 17 days before mating began through the first 17 days of the mating season. They were fed one pound of alfalfa hay and 0.5 lb. of barley per day plus grass-clover hay free choice. Ewes in group II were in the same lot on the same ration, but they were moved to dry hill pasture the same day they were marked by a ram. Group III ewes spent the entire pre-mating and mating season on dry pasture. Our rationale was that flushing in drylot should increase ovulation rate and that transferring the ewes to pasture after mating should reduce embryonic mortality. Thus the best lambing rate was expected from group II. Body weight was recorded and blood samples were collected at two week intervals throughout mating.

Results are presented in table 1. Feeding method from 17 days before to 17 days after mating began did not affect weight change or amount of blood protein. All groups maintained a weight of about 150 lbs, and all groups increased and then stabilized in level of blood protein as the breeding season progressed. Fertility was high in all groups (97%), but lamb crop percentage favored group II ewes.

TABLE 1. EFFECTS OF FLUSHING MANAGEMENT ON WEIGHT CHANGE, BLOOD PROTEIN LEVEL AND REPRODUCTION.

Trait	Group I	Group II	Group III
Number of ewes	34	34	34
Weight:			
Begin flushing 9-10			
Rams in 9-30	155.4	152.2	150.6
End of flushing 10-18	150.1	151.8	154.4
End of mating 11-5	155.9	154.4	155.2
	155.8	150.9	152.5
Blood protein level (gm/100 ml.)			
9-10	9.0	9.1	9.2
9-30	10.6	10.6	10.4
10-18	11.1	11.0	10.6
11-5	10.2	10.6	10.1
Fertility %	97	97	97
Lamb crop %	161	182	167
Average birth date within lambing season	9	9	8

After lambing, each group was split at random into creep-fed vs. non creep-fed categories. As our bulletin goes to press, the effects of creep feeding have not been measured, but creep-fed lambs look healthier and heavier. Whether their apparent advantage will be maintained and whether the practice will prove to be beneficial economically will be reported later. Again, the assistance of Superior Packing Company is gratefully acknowledged. Mr. Bolaji Taiwo, a graduate student in animal production, is conducting the experiment for his Master of Science thesis project.

Breed effects on age at first estrus. Ewe lambs from eight crossbred groups (Dorset, North Country Cheviot, Romney, or Finnsheep rams x grade Suffolk or whiteface, Columbia-type range ewes) born in 1973 and 1974 were scored for age at which they first exhibited behavioral estrus. The ewes had been raised to weaning in June under typical hill pasture management conditions. They were summered on irrigated pastures with access to supplemental alfalfa-grass-barley pellets. Starting about mid-August, they were run with vasectomized marker rams and checked three times a week for raddle marks. The heavier ewe lambs were exposed to fertile rams starting about October 1 each year. Their reproductive and maternal performance haven't been summarized and will be reported at a later time.

Average age at first estrus for the entire group was 206 days or just under seven months. Average weight at first estrus was 84.3 lbs. The 1973 ewes were 18 days younger at sexual maturity than the 1974 ewes. Breed of the ewe's dam was an important source of variation. Ewe lambs with Suffolk mothers cycled at an average age of 201 days; ewes with Columbia mothers cycled at 211 days of age. Also 18% of Columbia crossbred ewes vs. 2% of Suffolk crossbred ewes were not marked by a ram during the entire testing or mating season. It was assumed that they did not or will not cycle until the following year. The Columbia breed resulted from Lincoln x Rambouillet crosses, and both of these breeds are late to reach sexual maturity. Therefore the difference in favor of the Suffolk breeding was not unexpected.

We were surprised that breed of the ewe's sire did not affect age at first estrus. The four breeds differed by only three days; Finn and Dorset sired ewes were slightly younger, while Cheviot and Romney sired ewes were slightly older.

Another surprising result was that ewes born later in the lambing season reached sexual maturity at a younger age and at a lighter weight than ewes born earlier in the lambing season. Upon reflection, however, this result is reasonable. Ewes born early in the season were probably physically and physiologically mature enough to show estrus before the shortening day length of approaching autumn triggered or allowed the response to be shown. Ewes born later in the season reached the weight and the physical and physiological maturity to show estrus and about the time that environmental conditions (shortening day length) allowed them to express this potential. At least this is our current interpretation.

Miss Rose Mary Cedillo aided in the analysis of this project. She is working on a Master of Science degree in animal breeding and genetics.

Breed effects on wool characteristics. Evaluation of wool quantity, quality and value was completed on 196 ewe lambs from the same eight crossbred groups described in the previous section. Ewes were sheared and side and britch samples were collected in March, 1974. They had been sheared the previous July, so fleeces represented 8½ months' growth. Samples were evaluated for length, grade, medullation, soundness and faults. Core samples from each crossbred group were measured for clean wool yield. A market value in dollars per pound of clean wool was assigned based on grade, length and medullation discount. Clean price x clean yield x fleece weight estimated dollar value of 8½ month wool growth per ewe.

Results are presented in table 2. For both side and britch fleece grade, Dorset crosses had the highest (finest) spinning count, followed by Cheviot crosses, Romney crosses and Finn crosses. For side sample fleece grade, whitefaces crossed with Dorsets, Cheviots and Romneys were only slightly finer (about ½ spinning count grade) than Suffolks crossed with the same three sire breeds. Finn x whiteface crosses were two full grades finer than Finn x Suffolk crosses. For staple length, crosses ranked in approximate reverse order to their ranking for spinning count. However, although Suffolk crosses consistently scored coarser than corresponded whiteface crosses, they did not consistently have longer staple length. Crossbred groups tended to rank similarly for staple length and percent clean wool yield. Except for crosses with Cheviots, whiteface crosses yielded higher than Suffolk crosses. Thirty one and 22 percent of Finn x Suffolk and Finn x whiteface fleeces, respectively, were observed to be cotted in the side and/or britch sample. There was no coting observed in any of the other six lots. Medullation was most severe in the two North Country Cheviot crossbred groups closely followed by the two Romney groups. Both Finn cross groups were low in proportion of samples in which medullation was cited. There was a tendency for greater medullation from whiteface than from Suffolk crosses.

Dorset x whitefaces produced the most valuable fleeces, due to a combination of heavier fleece weight, above average yield and high value per pound of clean wool. Finn x Suffolk and Cheviot x Suffolk crossbred ewes produced the least valuable fleeces, due mostly to low fleece weight. The remaining five crosses were intermediate and essentially equal for fleece value. Whiteface crosses exceeded Suffolk crosses for fleece value in each of the four ram breed comparisons, but only in the case of the Dorset crosses was the difference very large. Generally both fleece weight and price per pound of clean wool were higher for whiteface crosses.

We thank Pendleton Woolen Mills, Portland, Oregon, for supporting this work and also gratefully acknowledge the assistance of the Wool Laboratory at Montana State University, Bozeman. Hugh Tellaria and Clint Krebs, OSU agriculture students, assisted in data collection for this project.

Rhythmic behavior patterns in feedlot lambs. Fifty six crossbred feeder lambs were maintained in simulated feedlot conditions from mid July to mid September, 1973. Each lamb was allotted 20 sq. ft. of lot area and two inches of self feeder space. Water was available at all times, but shade was provided only by the perimeter fence. The number of sheep engaged in five categories

TABLE 2. AVERAGES FOR WOOL QUALITY, QUANTITY AND VALUE TRAITS OF CROSSBRED EWE LAMBS.

Crossbred Group	Average Side Grade	Average Britch Grade	Average Staple Length	Average Percent Yield	Average Grease Fleece Weight	Boston Clean Price	Medullation Discount	Net Clean Price	Average Fleece Value
Dorset x Suffolk	58	56	2.4	58	3.9	1.00	-.02	.98	2.23
Cheviot x Suffolk	57	54	2.9	64	3.6	.85	-.03	.82	1.91
Romney x Suffolk	55	52	3.2	62	4.4	.83	-.02	.81	2.25
Finn x Suffolk	52	51	3.1	68	3.5	.77	.00	.77	1.81
Dorset x Whiteface	59	57	2.9	64	4.9	1.05	.00	1.05	3.29
Cheviot x Whiteface	57	54	2.8	60	4.8	.78	-.03	.75	2.18
Romney x Whiteface	55	53	3.1	66	4.5	.81	.00	.81	2.37
Finn x Whiteface	55	52	3.4	69	4.1	.83	.00	.83	2.32

of behavior was tallied each 30 min for periods of 28 hours during seven of the weeks the lambs were on feed. The five categories were eating, drinking, lying, standing inactive or lethargic, and standing active or alert.

We found that peaks and depressions for the different categories of behavior were repeatable from day to day. The three behaviors that indicated purposeful activity (eating, drinking and standing active) peaked at about the same time (figure 1). These peaks of activity followed sunrise and bracketed the time of sunset.

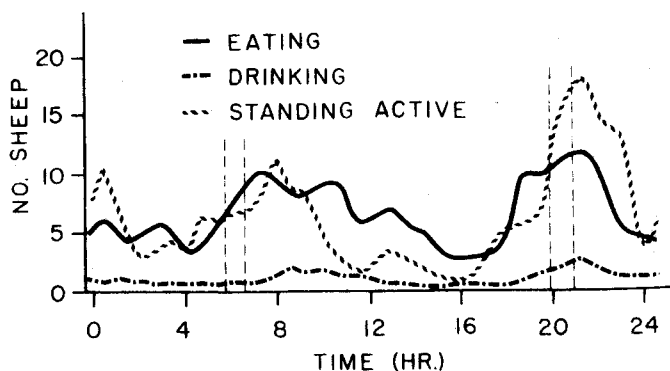


Figure 1. Rhythmic behavior patterns for eating, drinking and standing active categories of lamb behavior.

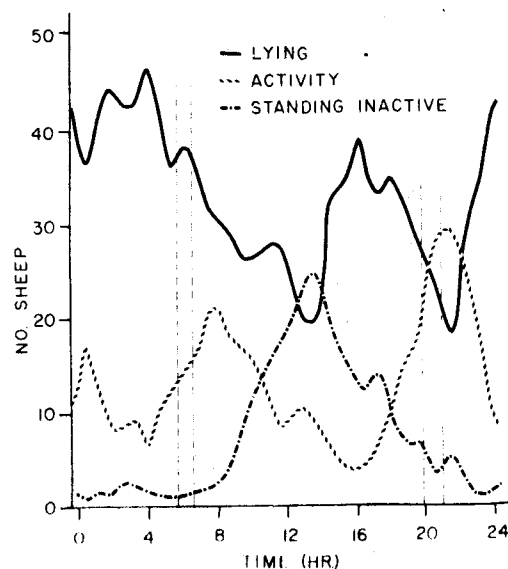


Figure 2. Rhythmic behavior patterns for lying, standing inactive, and activity (defined as the sum of eating, drinking and standing active) categories of lamb behavior.

Standing inactive or lethargic was restricted essentially to daylight hours between the activity peaks of morning and evening (figure 2). The number in this category was highest at 1:30 p.m. PDT which corresponded to the time of maximum solar elevation. As many lambs as the west perimeter fence would accommodate would be standing beside it, usually shading their heads beneath a horizontal board. The rest of the lambs would be clustered in groups, facing inward, usually shading their heads under the body or flank of another sheep. The number of sheep lying down was highest at night and in late afternoon preceded the activity peak at sunset.

Mrs. Carol Shreffler, a doctoral student in animal genetics, was instrumental in the conduct and analysis of this experiment.

Measurement of appetite in sheep and its relationship to gainability. Appetite was measured in 44 Hampshire and Suffolk ram and ewe lambs. Our objectives were to determine how best to measure appetite and to determine whether appetite had any value in predicting an animal's genetic merit for rate of gain. If it were closely related to gainability, it might be feasible to save both time and expense by performance testing rams for appetite rather than for gain.

During the three week test period, the 10-12 month old lambs were confined to individual 4 x 12 foot pens. They were allowed one week to acclimate to test conditions and to a pelleted ad libitum diet. Six appetite trials followed at two day intervals. For each trial, feed was taken away from lambs at 4:00 pm and was reintroduced at 8:00 am the following day. Consumption was recorded after 30 min, after 60 min, and after 24 hours. Appetite was estimated as the proportion of 24 hour consumption eaten in 30 min (FC30), the proportion eaten in 60 min (FC60) and the average daily feed consumption (based on the entire test period) per unit of body weight (F/W). Average values for FC30 and FC60 were 21% and 29%, respectively. Feed consumed as a percentage of body weight averaged 3.9% for rams and 4.3% for ewes. FC30 and FC60 were positively related to one another, indicating that it would not be necessary to measure both. Neither was closely related to F/W, however. Thus the two types of measurements of appetite were not estimating the same biological characteristic. None of the appetite measures was even moderately correlated with weaning weight, weight at the beginning of the appetite test or (for rams) average daily gain on performance test the previous summer.

Thus our results at this stage are not too encouraging. A problem may have been that the lambs were measured at 10-12 months of age - past traditional market weights and past their most rapidly and efficiently gaining stage of life. Results might have been different had they been measured sometime between four and seven months of age. Future plans call for testing some lambs at those ages and also for testing other methods of appetite measurement.

Mr. Joe Ngam, an animal breeding graduate student, completed this project as a portion of his thesis research.

Other work. Phase I of my crossbreeding study has been completed. It was the experiment that generated the ewe lambs whose age at sexual maturity and wool production were described earlier. Our results from phase I will be analyzed, interpreted and reported during the coming year.

We will also be reporting on reproduction and lamb production from the crossbred ewes as ewe lambs.

COMMENTS ON THE PROBLEM OF COYOTE PREDATION

Maurice Shelton

Texas Agricultural Experiment Station

Losses to predatory animals: a problem which has plagued the sheep industry almost from the time these animals were first domesticated. It also tends to be a worldwide problem. Over much of the world, the large human population in respect to land area or sheep numbers largely prevents predation from being the problem that it is in the U.S. at the present time. If predation has been with us since domestication of the sheep, why has it become such a serious problem in this country in recent years? The answer appears to be largely sociological and is beyond more than a brief consideration at this time. No doubt one major factor has been the migration of people away from rural areas. Those left lead a much more mobile and complicated life style. As a result, they have less time for and expertise in activities likely to result in suppression of the predator population.

At the same time, we have an increasing urban population which is at least one generation removed from any realization of or sympathy for rural problems. Unfortunately the typical urban dweller is not neutral on the issues of predator control. He has been brainwashed by the electronic media in recent decades. Wildlife oriented programs make good television copy, and these almost always present erroneous or partly incorrect information. For instance, I recently saw a program on a national network which incriminated predator control efforts as a major cause of the decline of the Bighorn sheep. The hypothesis presented suggested that if predators had not been controlled, the coyotes would have removed the sick or defective animals thereby improving the vigor of the population. This is simply not the explanation for the limited numbers of wild sheep.

Assuming that you have a coyote problem, as most sheep producers do these days, what options are open to the producer? The options may be generally classified as follows:

1. Absorb the losses,
2. Place some type of barrier between the two species,
3. Remove the coyote from the scene.

Unfortunately, a fourth option also exists, and that is to go out of the sheep business. A disturbingly large number of producers have been taking this course of action in recent years.

If one believes the ecologists that only an occasional coyote will kill an occasional sick or lame sheep, then the sheep industry should indeed be able to absorb the losses. In fact, the ecologists have been reading their own text books too long. They are almost totally wrong on both counts. A large amount of money has been spent on damage assessment in the last two or three years. The data at best applies only at the time and place where

it is collected. In practice, losses to predation are largely a function of the relative densities of coyotes and sheep, the degree of interface between them, and the manner in which losses are expressed (in total losses or % of flock). Other factors only modify this principle. In the case of sheep the amount of protection provided by man is the major modifying factor. Loss data available range from 1 to 3% in parts of the Northwest, where control is practiced and sheep are run in rather large bands under herd, to losses which can approach 100% in areas where small numbers of sheep or goats are set stocked in areas of potentially high coyote density. Other data fall intermediate between these extremes on a predictable scale depending on the conditions. Although considerable research effort is being expended to develop aversive agents to be applied to sheep to prevent predation, coexistence (joint occupancy of the same area at the same time) between the two species by tolerating the resulting losses is not a viable alternative to the sheep industry.

If sheep producers cannot simply absorb the losses and program them as a part of the cost of doing business, a second alternative is to protect the sheep by barrier fencing or night lotting. I have generally concluded that under the conditions in which the Texas sheep industry operates at present these are not viable alternatives, but they may very well be acceptable in parts of Oregon. The major controlling factors are stocking rate or density of sheep to be protected and size of areas to be fenced. As these two variables increase, the cost per ewe protected goes down markedly. In the author's opinion, refencing of sheep pastures is realistic only where large areas are to be fenced or where stocking rates approach one animal unit of sheep to the acre. However, this is assuming that complete new fencing is required and that the total cost is to be charged to the sheep flock as a protection against predators. If new fencing is being constructed for another reason, the additional cost required to upgrade against coyotes is a modest cost. Also many existing fences may be upgraded to give protection. In any case one might logically inquire of the type of fencing required.

Any good net wire fence will deter many coyotes and either protect sheep directly or assist in control by other methods. However, once a coyote becomes experienced in dealing with fences and develops a pattern of killing in a certain area, then he can bring to bear a considerable amount of ingenuity to gain passage. Methods of entry may include jumping, digging under, climbing or hunting holes in fence. This suggests that efforts should be made to prevent the initial entrance into sheep pastures. Once a coyote has established a killing pattern, he can be much more difficult to control. To have a reasonable chance of success, net wire with a maximum opening (in at least one dimension) of 4" should be used. A minimum height of 5' would be necessary to exclude an experienced jumper. We have had coyotes jump 5 1/2' but not 6' fences. The coyotes or canines in the area involved are larger than most, and this may have resulted in a greater height requirement than is necessary in most areas. The degree to which digging under is a problem is highly variable depending on terrain, soil type and the amount of coyote traffic outside the fence in question. We have not found it to be a major problem where the ground is dry and hard and the fence is tightly stretched on ground level

and perhaps covered for a few inches by soil or vegetation. An apron made of old or new wire or a tightly stretched barb wire outside the existing fence are good deterrents. The cost of the type of fence suggested here or the cost of night lotting could be calculated with reasonable accuracy by most producers.

Night lotting for most of our range operators is not even possible, much less feasible, as it is not possible to gather the sheep in one day. The limited sheep industries of Oklahoma and Kansas have existed for several years by utilizing the practice of night lotting. Some producers may not be aware that normally sheep can be penned in any location in any type of construction with generally good results. Only an occasional coyote will go into a pen to kill sheep. However, confinement may only make it simpler for dogs or dog-coyote hybrids to kill, as they are not so inhibited.

Removal of the coyote remains the most logical choice for most producers under the extensive conditions of the West where most sheep are found. If this could be a one time practice, the problem would be simple. However, most sheep today are found in isolated pockets of production in a sea of coyotes. The invasive process is a continuous one, and it is this element that is the root of most problems. Thus the removal process must be a continuous one, and when one producer becomes isolated on a peripheral position (as someone must always be) it is difficult for him to resist the pressure over a long period of time. This invasive process, the greater losses in the peripheral areas, and the consequent decrease in sheep numbers can be conclusively demonstrated as it applies to the Edwards Plateau of Texas. This is one of many instances in the sheep industry when cooperative efforts are beneficial.

In an area such as parts of Oregon it would appear advisable to consider or to establish barrier areas to prevent coyote invasion of important centers of sheep production. However, it would appear to be necessary that all the producers benefiting should share in this effort with the various state or federal agencies. Fencing should be one of the methods to be considered in establishing such a barrier.

Actual or potential methods of coyote removal are almost endless. These include dogs, traps, guns, snares, aircraft and toxins. In the area with which I am familiar the removal of toxins was not the cause of the predator problem, as the build up in numbers was occurring before the removal of the toxins. The Executive Order simply removed one of the most effective tools at a very critical time. I have never known a sheep producer who was proud of the use of poison or would condone its use if other effective methods were available.

In the area with which I am familiar the primary methods of coyote removal are helicopters, snares, M-44, traps and accidental or incidental removal by guns in the hands of the general public or automobiles on highways. The use of helicopters has become an increasingly important tool in recent years. It is also reasonably economical to the producer since most of the cost has been borne by the Fish and Wildlife Service. However, they tend to be used in peripheral areas with high coyote density and are of value to

the sheep industry only in cutting down on drift. Aerial hunting has generally proved an expensive way to hunt for individual coyotes that have invaded sheep flocks. If fences are in reasonably good repair, the use of snares is an important means of coyote removal. This procedure is sufficiently simple and inexpensive that it can be used by almost anyone.

Trapping, by the rather large professional trapper force, is an important means of coyote removal. It serves the function of being one of the primary means of attack on individual coyotes which have successfully invaded sheep producing areas. However, it is an expensive procedure. Few producers have the experience or temperament to successfully trap coyotes without a period of training, and even then they may train more animals to be trap shy than they remove from the environment. Under a variety of programs the M-44 is in use in many areas today. This is an important, safe and selective tool. However, I am concerned that the extensive public and official involvement in the authorization to use this tool may give the impression that if or when this procedure is authorized the predator problem will be solved. Actually, it is only one of the many tools which must be employed to secure relief from this problem.