Summary of Reports . . .
1966 Sheep and Wool Day

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Contents

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Feeding Early-weaned Lambs

D. C. Church and C. W. Fox

The practice of weaning or slaughtering lambs at relatively young ages has been followed for many years by some specialized European producers who are interested primarily in producing cheese. In this case, the cheese is the main product of interest and the lamb is a by-product, more or less. More recently there has been some interest in early weaning as related to multiple births, since many ewes do not have adequate milk production to grow out more than one lamb. Currently, there is quite a bit of interest in early weaning as related to lambing more frequently than once yearly. Regardless of what the particular interest is, early weaning and the greater care and/or higher feed costs required to get reasonably good growth rates is going to require more intensive sheep production practices. Intensification, of course, is one avenue by which a producer may be able to increase his net income.

Age to wean

The optimum age at which a lamb should be weaned is probably dependent upon several factors. From a physiological point of view, data indicate that rumen fermentation is similar to adults by 2-3 weeks of age. However, the lamb at this age is not capable of consuming and digesting enough food of a bulky nature to maintain a very rapid growth rate. Consequently, lambs weaned at very early ages will require higher quality feed or milk substitutes if rapid growth is desired. The breed of sheep will also be a factor, since the amount of milk produced and the persistency of milk production are usually related to breed. In addition, the availability of adequate forage or other feed at a time when the ewe should be producing maximum milk is an item to consider, especially if lambing at other times than the normal season.

It may be that your interest in early weaning is to remove one twin from a poor milking ewe; in this regard it has been observed that one lamb may become so accustomed to nursing one part of the udder that the other part may not be nursed if the other twin is removed.

The exact ages that we would recommend weaning are dependent upon these factors and others. Research data on lambs weaned over a wide range of weight and age indicate that a reduced growth rate due to weaning is to be expected, and it will probably be more severe on younger lambs. The effect is less with twins, as might be expected, and is less if lambs are accustomed to a creep feed. Gradual weaning would probably be preferred in young lambs, and limited data indicate that where weaning is practiced with artificially fed lambs, they can be weaned successfully at two to three weeks where concentrates are available. However, weaning at this age would not be recommended. When forage supply is restrictive or if more frequent lambing is the objective, data indicate that weaning can be accomplished successfully at about 50 pounds in weight or at about 60-70 days of age.

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Protein level

The problem of feeding early-weaned lambs economically is receiving quite a bit of study in the United States and other countries. From a practical point of view, the problem is to replace a very high quality food (milk) with lower quality and less expensive substitutes. On a dry basis, cow's milk contains about 25% protein, 28% fat, and about 35% sugar, all of which are highly digestible. The protein requirements of young animals, in general, are considerably higher by percentage than they are for adults. A couple of studies indicate that young lambs (about 4 to 12 weeks of age) probably require 20% protein in the total ration. Consequently, protein could easily be a limiting factor in obtaining rapid and efficient growth. Probably more protein would be recommended in the drylot than if lambs were given supplemental feed on high quality pasture. More information is needed, however, before firm recommendations can be made on the minimum amount of protein to feed.

In trials conducted at Oregon State University, lambs given free choice selection of an 18% protein pellet and alfalfa pellets have consumed a total ration containing about 15 to 16% protein; the lambs have done very well on such a mixture, but data are too limited to indicate if this is near optimum.

Ration preferences

Another problem in feeding is to formulate rations that young lambs will eat readily and will still promote rapid, economical gain. In some work reported from Missouri, suckling lambs had access to 20 different feed ingredients or mixtures. Soybean oil meal was the most acceptable single ingredient. Rations fed in pelleted form were consumed much more readily than meals. Sugar, molasses, or corn syrup increased feed consumption. In another trial it was found that a pelleted ration containing 60% ground corn, 30% soybean meal, and 10% wheat bran was the best of several compared.

Comparisons of lambs fed on pasture or in drylot generally indicate that performance has been similar if parasites are not a problem. If parasites are present, drylot feeding is preferred for young lambs, which are more susceptible as a rule. In the southeastern part of the United States, many producers feel that early weaning and feeding in drylot is particularly advantageous because of the parasite problem and because of the seasonal decline in pasture nutritional value.

In conclusion

In conclusion, we can say that early weaning has some potential in a number of situations, but the lambs will require more nutritious rations and more intensive care to achieve maximum growth. Nutritional needs are not well enough known to be certain that minimum recommendations for protein are adequate, but the recommendations appear to be satisfactory on the basis of limited data.

Results from Studies on Early Weaning of Lambs

C. W. Fox, E. F. Ellington, and D. C. Church

The Department of Animal Science has under way a research project, the objective of which is to study the feasibility of producing three lamb "crops" in a two-year period. The methods involve weaning all lambs at an age earlier than is conventional, with subsequent rebreeding of the ewes.

Within the last year, two trials have been completed which have involved weaning of lambs at an early age, feeding a high protein ration to the lambs in "dry" lot, and rebreeding the ewes following weaning. In an effort to reduce the cost of feeding these young lambs, an experiment was designed to test the effects from use of a synthetic estrogen (DES). Compared to nontreated lambs, the use of DES with lambs of older ages has indicated these responses might be expected: (1) an increase in daily growth rate; (2) an increase in utilization of feed; (3) an increase in appetite; (4) no significant change in the eating quality of the meat; (5) a reduction in fat deposition resulting in a lower dressing percent and lower carcass grade; and (6) the possibility of a vaginal or rectal prolapse.

Procedures

The 24 crossbred lambs involved in this experiment were born in late October and early November and were then weaned in late December 1965. Prior to weaning, the lambs had become accustomed to eating a creep feed supplemented with alfalfa hay. Following weaning, the lambs were changed to a ration which was less expensive than the creep feed, and the alfalfa hay was replaced with alfalfa hay pellets.

The ingredients and cost for these two rations are presented in Table 1. Average age and weaning weight data are presented in Table 2. After a period of adjusting to "dry" lot conditions and the different feeds, the lambs were randomly allotted by sex into two groups of equal number. One group was implanted in the ear with three milligrams of DES. The other group served as a control for those implanted. Every two weeks, individual body weights were obtained and also the feed consumption per group. All lambs weighing 87 pounds or above on March 23 were removed from their group, sheared, and two days later were slaughtered at a commercial abattoir. Federal carcass grades were obtained, and fat thickness and rib eye area were measured at the 12th rib. The kidneys and kidney fat were removed from each carcass. Specific gravity was determined on a seven-rib rack. Each rack will be cooked and served to a trained taste panel consisting of eight people.

Results

Any undue stress from weaning at an early age should be reflected in the gain in body weight immediately following weaning. Since the lambs were accustomed to a creep feed before weaning, all lambs exhibited an increase in body weight the first two

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Table 1. Composition of rations

Ingredients	Pelleted feed[1]	Hay pellet
	Lbs.	*%*
Alfalfa hay, 15% protein	293	95
Molasses	150	5
Alfalfa seed screenings	700	
Wheat flour screening	800	
Cottonseed meal	35	
Salt	20	
Antibiotic	2	

[1] Estimated crude protein, 18%. Estimated net energy, 0.411 megcal. Cost per ton delivered to Corvallis from Hermiston, Oregon: Pelleted feed, $53.50, Alfalfa hay pellet, $50.00.

Table 2. Average age and body weight of early weaned lambs

Number of lambs	24	
Weaning age, days, 12/27/65	55	(range, 38-59 days)
Weaning weight, lb., 12/27/65	38	(range, 24-51 lb.)
Sex of lambs		
Wether	9	
Female	15	
Daily gain first 2 weeks after weaning, lb.	.54	(range, .31-.60 lb.)

Table 3. Performance and carcass values

	Implanted[1]	*Nonimplanted*
Number of lambs	12	12
Initial weight,[1] lbs., 2/2/66	56	59
Final weight, lbs., 3/23/66	93	91
Daily gain, 48 days, lbs.	0.79**	0.68
Feed efficiency, lbs.	5.43	6.62
Number slaughtered[2]	6	6
Slaughter weight, lbs.,[3] 3/25/66	94.3	91.8
Cold carcass weight, lbs., 3/31/66	48.2	48.6
Dressing percent, %	51.1	52.9
USDA carcass grade	5 Prime 1 Choice	4 Prime 2 Choice
Rib eye area, sq. in.	1.98	1.86
Fat thickness 12th rib, mm.	7.3*	11.0
Specific gravity values	1.05597*	1.03767
Kidney + kidney fat, lbs.	1.20*	2.06

[4] Implanted 2/2/66—3 mg. DES.
[2] Equal number of wether and ewe lambs from each lot.
[3] Shorn and shrunk weight.
** $P < .01$
* $P < .05$

weeks following weaning. There was no significant difference in body weight between the two groups when the one group was given a 3-mg. implant of DES (see Table 3). From the time of implantation until March 23, the implanted lambs gained significantly faster than did the nonimplanted lambs. During this period of time the implanted lambs were 22% more efficient in utilization of their feed. All lambs produced a carcass which graded Prime or Choice. Compared to the nonimplanted lambs, those receiving DES had a lower dressing percentage, less external fat at the 12th rib, and a smaller quantity of kidney fat. The rib eye area of the implanted lambs was larger than for the nonimplanted lambs. The specific gravity values also indicated an increase in protein and a decrease in fat for the implanted lambs. During the course of the experiment, there was one ewe lamb which exhibited a slight vaginal prolapse. However, it was not sufficiently serious to warrant removal of the lamb from the experiment. The implanted lambs exhibited some stimulation of teat length in comparison to the untreated lambs.

Summary

Twenty-four lambs ranging from 38 to 59 days in age and from 24 to 51 pounds in weight were weaned, placed in "dry" lot, and given free access to a pelleted ration and alfalfa hay pellets. Two weeks after weaning, none of these lambs had failed to increase in body weight. Five weeks following weaning, one group of 12 lambs received a 3-mg. implant of DES. At the end of 48 days, the implanted animals had made a 16% faster gain and required 22% less feed than the nontreated group. At this time, six lambs from each group were slaughtered. All 12 carcasses graded Prime or Choice. The implanted lambs had a lower dressing percent, and they contained a smaller amount of backfat and kidney fat. However, these lambs had a slightly larger rib eye area. Specific gravity values indicated the same trend of more protein and less fat from the implanted lambs. One treated ewe lamb had a tendency to exhibit a vaginal prolapse, and the treated lambs showed some stimulation in teat length.

Problems and Potentials of Subterranean Clover Pastures

M. D. DAWSON

Present productivity of about 1½ million acres of hill land in western Oregon could be conservatively quadrupled by planting them to improved pastures. Subterranean clover is an excellent plant to include in any hill land improvement program. Recent studies conducted by agronomists at Oregon State University have indicated that the success in subclover establishment on these hill soils depends on a number of key factors. Certainly, climatic conditions are important in influencing the ease of establishing subclover. Planting in October usually provides a good chance of fall rains and mild temperatures soon after sowing, which aids in good seedling emergence. Hill land includes many different soils, though from the standpoint of the potential subclover producer, these soils share some common properties. Table 1 presents soil test results of typical locations on these hill lands. In the first place, such soils are usually quite acid, often low in bases like calcium, sometimes low in sulfate, and almost universally low in phosphates. These conditions frequently cause major problems in subclover establishment.

Establishment problems

The nature of hill lands is such that seedbed preparation is frequently very costly and sometimes prohibitive. Fortunately, minimum preparation of soil for subclover will suffice, and a good firm seedbed, which is so necessary for many crops, is not required for subterranean clover. The key to successful subclover establishment lies in providing conditions necessary to induce effective nodulation of the subclover roots. Research data indicate that a suitable environment for effective nodulation in proximity to the seed is essential in these acid, infertile hill soils. To provide this suitable local environment around the seed, it is necessary to: (1) inoculate the seeds adequately, (2) minimize dessication of seed after planting, (3) provide a neutral or basic condition (pH near 7) adjacent to inoculated seed, and (4) ensure adequate phosphate and sulfate nutrients.

More than 20 field trials have been conducted in coastal Oregon and on hill soils in the Willamette Valley to determine the best methods of establishing subterranean clover. These experiments have been conducted on numerous soil series at locations as far apart as Washington, Polk, and Coos counties.

Certain treatments included in field trials between 1962 and 1965 at the various locations have resulted in superior stands of subterranean clover pasture during the establishment year. Table 2 presents data from four widely separated locations and on contrasting soils.

It is apparent from this data that the drilled lime-superphosphate mixture was the most successful method of establishing subclover. Several large-scale trials have been made on farmers' fields using this method of establishment, and it has been highly successful in all instances. Subterranean clover seeds banded in contact with superphosphate or magnesium ammo-

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Table 1. Soil tests from selected subterranean clover experiment sites

Location	pH	P	K	K	Ca	Mg	Total bases
		lbs./A	*lbs./A*	*me/100g*	*me/100g*	*me/100g*	
Adair	5.4	7	280	0.36	9.3	5.0	14.6
Pedee	4.9	18	140	0.18	1.0	0.5	1.68
Washington Co.	5.3	9	280	0.36	3.4	1.8	5.56
Coos Co.	5.5	6	764	0.98	2.9	1.6	5.48

Table 2. Percent effective nodulation of subclover (average of three replications) according to treatment at selected sites

No.	Treatment	Percent effective nodulation			
		Adair	Pedee	Washington County	Coos County
		%	%	%	%
1	Uninoculated drilled[1]	14	2	3	3
2	Inoculated drilled[1]	14	2	44	5
3	Lime-super mixture drilled[2]	72	96	100	79
4	Dolomite-super mixture drilled[2]	....	71	61	....
5	Magnesium ammonium phosphate drilled	....	0	12	10
6	Two-ton lime drilled, P banded	29	5–7	65	....
7	Lime pelleted seeds broadcast[1]	....	65	91	4
8	Lime-super pelleted seeds broadcast	....	....	63	5
9	Seed drilled with super	8	2	0	0

[1] In these treatments 300 pounds of 20% superphosphate were broadcast prior to drilling seed.
[2] These mixtures were prepared 10 days prior to drilling by mixing 300 pounds of lime with 300 pounds of 20% superphosphate.

nium phosphate have been unsuccessful, as has the drilling of inoculated seed without fertilizer or lime. T. L. Jackson has found banded superphosphate, not in contact with the inoculated seed, to be satisfactory in soils less acid than those reported in this paper. In instances where inoculated seed was drilled into soil that had received a two-ton application of lime and where 20% superphosphate had been banded, only moderately successful establishment was recorded.

To date, surface methods of broadcasting variously pelleted seeds have proved rather disappointing. Lime pelleted inoculated seeds broadcast on phosphate fertilized areas have occasionally been satisfactory in establishing subclover.

There are at least two plausible reasons for the success of the drilled lime-superphosphate mixture method of establishment. The first is the neutral reaction of the phosphate mixture adjacent to the inoculated seed, and the other is probably due to the small amount of soil which covers the seed as the sod seeder traverses the field.

Production potentials

Yields of dry matter equivalent to 6,000 pounds per acre have been recorded in some of the subterranean clover trials. Where production from the lime-superphosphate mixture has been compared with the two or three ton lime per acre treatment, no advantage to the latter has been noted. In one location where the soil test for magnesium was very low dolomite-superphosphate mixture was superior. Subterranean clover pastures are recognized to be succulent and high in protein. Dry matter yields which approach 6,000 pounds per acre should fatten three to four ewes with lambs per acre. Since a subclover pasture's growth cycle corresponds fairly well with the period of lamb fattening, namely, April-May-June, it provides excellent feed during this period. It is difficult to overgraze subclover pastures. In fact, such pastures are more likely damaged by undergrazing and subsequent favoring of grasses which shade the clover.

Few regions in the United States offer greater potential for expanded fat lamb production than do the Pacific Northwest hill lands when planted to subclover. The sod seeder probably offers the most economical and successful methods of establishing such pastures. Aerial seeding of pelleted subclover seeds provides another possible method of establishment which deserves further study in Oregon.

Forage Preferences of Sheep on Two Western Oregon Improved Pasture Mixtures

T. E. Bedell

Intensive, intelligent management plays an essential and integral part in present-day livestock operations. Sharing equal importance with the high production of forage is its efficient harvesting and use by livestock. A pilot study has been under way at Oregon State University since 1964 to assess the dietary preferences of both sheep and cattle throughout the spring-summer grazing season from two improved pasture mixtures, perennial ryegrass-subclover and tall fescue-subclover.

The objectives of this work include evaluation of various botanical and nutritive characteristics of both the diet and the forage upon which the animals graze. In addition, the effects of heavy versus light grazing on dietary preferences were assessed in 1965. This work is being continued in 1966.

In order to obtain forage samples which may be representative of that consumed by grazing animals, esophageal-fistulated cattle and sheep are used. An esophageal fistula is obtained by cutting a hole (fistula) in the esophagus and suturing the esophageal tissue to the skin. A removable plug allows the animal to subsist normally. With the plug removed, most of the food ingested passes out through the fistula rather than down the esophagus. When the plugs are removed and screen-bottomed canvas bags are attached to the animals' necks, freely grazing animals collect the dietary samples.

Dietary and forage samples are col-

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lected at biweekly intervals throughout the spring and at monthly intervals in summer. The botanical or species composition of each sample, its crude protein content and estimated digestibility as determined with an artificial *rumen* in the laboratory are minimum data collected on each sample.

Results with sheep

The pastures were well-established in 1964, and subclover was abundant in mixture both with tall fescue and perennial ryegrass. Contrarily, in 1965 subclover was virtually absent, due in great part to freezing temperatures during germination and subsequent severe moisture stress during the spring growing period. An annual species of fescue (*Festuca myuros*) constituted a large part of the 1965 forage in some pastures. In 1966, subclover is again abundant.

1964. Both pasture mixtures produced more forage than was utilized, as grazing pressure was only two AUM's per acre from mid-April to early September. Yields of forage exceeded 5,000 pounds of oven-dry matter per acre in early June in both pasture mixtures.

Sheep preferences were similar in both pasture mixtures during the early season even though the percentages of subclover in the available forage were different (Table 1). However, when both ryegrass and subclover had matured and dried in late June, tall fescue, although maturing, remained green, and preferences were different. Sheep selected more subclover than that available to them in early spring in both pasture mixtures. However, in mid-spring and throughout June sheep did not actively reject ryegrass. During summer, sheep showed a strong preference for subclover in the ryegrass-subclover pasture but preferred the green tall fescue to dry subclover in the fescue-clover pasture mixture. Tall fescue contained more moisture than subclover in summer, which may have influenced the choice of forage.

On both pasture mixtures sheep consumed a higher crude protein diet than that contained in the total forage of the respective mixtures (Table 2). Dietary crude protein values were high throughout the spring period when consumption of subclover was high. However, the high percentage of subclover contained in the summer diets of sheep grazing ryegrass pastures contributed to higher protein diets on this mixture

Table 1. Seasonal percent subclover in forage and in diets of sheep grazing tall fescue-subclover and perennial ryegrass-subclover pastures, 1964

Season	Fescue		Ryegrass	
	Forage	Diet	Forage	Diet
	%	%	%	%
Late April	45	63	45	65
Mid-May	43	80	55	60
Early June	40	87	60	70
Mid-June	40	73	59	60
Early July	35	28	55	58
Early August	33	12	55	85
Late August	30	13	50	80

Table 2. Seasonal percent crude protein (dry matter basis) of forage and in diets of sheep grazing tall fescue-subclover and perennial ryegrass-subclover, 1964

Season	Fescue		Ryegrass	
	Forage	Diet	Forage	Diet
	%	%	%	%
Late April	13.4	22.1	17.5	23.1
Mid-May	10.1	20.8	14.6	16.6
Early June	11.8	20.2	12.4	16.1
Mid-June	8.7	14.1	10.2	13.7
Early July	7.4	10.9	11.7	14.9
Early August	5.7	11.0	9.8	15.0
Late August	5.7	10.0	8.9	14.0

than on the tall fescue mixture. On both pasture mixtures dietary protein content was consistently above that required by ewes for maintenance.

No digestibility information was available for diets in 1964 except that forage indicated no difference between tall fescue-subclover and ryegrass-subclover throughout the season. Estimated dry matter digestibility declined from approximately 65% in late April to 45% in late August.

1965. Grazing use on the heavier grazed pastures was fairly comparable to that practiced in commercial operations, slightly over 6 AUM's per acre in the tall fescue mixture and $5\frac{1}{2}$ AUM's per acre in the ryegrass mixture. On the lightly grazed tall fescue mixture, grazing use was approximately $2\frac{1}{2}$ AUM's per acre and on the ryegrass, $1\frac{1}{2}$ AUM's per acre.

Available forage in the heavily grazed tall fescue mixture averaged about 1,000 pounds of oven-dry matter per acre, almost all of which was tall fescue (> 97%). Subclover made up less than 1% of the available forage by dry weight in all sheep-grazed pastures.

In the lightly grazed tall fescue mixture, maximum available forage exceeded 4,000 pounds of oven-dry matter per acre. Annual grasses constituted up to 11% of the fescue (> 87%).

Forage production in the ryegrass mixture was much less in 1965 than in 1964. Under heavy grazing, approximately 500 pounds oven-dry matter per acre was available to animals, but under light grazing the maximum yield was 1,700 pounds per acre. Annual grasses made up an increasing proportion of the forage as the grazing season advanced, reaching a maximum of 80% by dry weight in early July for both stocking rates.

Sheep sought out the sparse amounts of subclover in both pasture mixtures but could not find enough of it to make up a substantial proportion of their diets. On the tall fescue pastures, sheep took fescue because little else was available to them, especially under heavy grazing. Sheep grazed fescue readily through late April, then preferred annual grasses and the small amount of ryegrass (invaded) in the pastures in May and June, and returned to tall fescue in July. This pattern was more apparent under light grazing where animals had more choice of forage. The summer preference for tall fescue in 1965 followed the same pattern as in

1964. Fescue seed heads were preferable foods in June as the seed matured.

Sheep grazing on ryegrass-subclover pastures exhibited no consistent pattern of preference between ryegrass and annual grasses until early July. Also, sheep tended to react similarly under both intensities of grazing. They preferred ryegrass over annual grasses during July and early August, with up to 86% of their diet consisting of this species under heavy grazing. However, up to early July, no strong preference for either ryegrass or annual grass was observed, even though slightly over one-half of the diet was ryegrass during most spring sampling periods.

Sheep grazing both pasture mixtures at both intensities of use selected diets containing more crude protein than that contained in the forage available to them. Grazing intensity had very little effect on forage protein content (organic matter basis) except that heavily grazed ryegrass forage was lower in content than that of lightly used ryegrass early in the season and higher later in the summer. Data in Table 3 indicate that forage and dietary crude protein levels on the tall fescue and ryegrass pastures averaged across grazing intensity.

Although the forage was of very poor quality after early June as measured by crude protein content, sheep diets contained adequate percentages of crude protein for maintenance except for the early August period.

Estimated dry matter digestibility of forage and diets as measured in an artificial rumen is shown in Table 4. The data are averages of both grazing intensities. In 14 dietary comparisons

Table 3. Forage and dietary crude protein content (organic matter basis) in sheep-grazed tall fescue and perennial ryegrass pastures, 1965

Season	Fescue		Ryegrass	
	Forage	Diet	Forage	Diet
	%	%	%	%
Late April	11.8	17.6	11.5	18.8
Mid-May	7.6	15.8	7.7	14.6
Mid-June	4.7	12.2	5.3	11.9
Early July	3.5	12.0	4.2	10.3
Early August	2.9	8.3	3.2	9.9

Table 4. Estimated dry matter digestibility (24-hour *in vitro*) of forage and diets in sheep-grazed tall fescue and perennial ryegrass pastures, 1965

Season	Fescue		Ryegrass	
	Forage	Diet	Forage	Diet
	%	%	%	%
Late April	50	50	57	55
Mid-May	55	54	60	60
Mid-June	48	50	50	54
Early July	34	49	46	50
Early August	29	48	36	47

of light and heavy grazing, only three significant differences occurred due to grazing intensity; two of the three were of higher digestibility in the heavier grazed pastures. The same pattern was true of estimated forage digestibility.

Dietary estimated digestibility was not greater than the respective forage from which it was grazed until after mid-June. However, estimated digestibility of sheep diets on ryegrass forage exceeded those of sheep on tall fescue through mid-June. Also, perennial ryegrass forage estimated digestibility exceeded that of tall fescue forage for the entire season.

Conclusions

Due to the great difference between the growing conditions of 1964 and 1965, valid comparisons between years cannot be made. Nevertheless, some tentative conclusions may be proposed. Although ample amounts of subclover were available in both pasture mixtures in 1964 and none in 1965, sheep preferred tall fescue during summer in both years. When sheep had a choice between dry subclover and dry ryegrass in 1964 or between dry annual grasses and dry ryegrass in 1965, preferences were for the subclover in 1964 but for the ryegrass in 1965.

Effects of the two grazing intensities in 1965 were more pronounced on forage than on dietary characteristics, i. e., possible changes in estimated digestibility and botanical and chemical composition of forage due to grazing intensity could be overcome by the selectivity of the sheep. Dietary protein percentage was greater than forage protein content in both years even though forage preferences and species composition were different.

This trial will be concluded following the 1966 grazing season. Based upon data from two widely different years, either pasture mixture appears favorable for sheep. An important factor appears to be the relative preference for subclover in relation to the grass species it is growing with and the season in which it is being used. These factors should be further clarified during 1966.

Reproductive Performance of Ewes Following Early Weaning and Subsequent Hormonal Treatment

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Early weaning followed by hormonal control of breeding offers potential in increasing the efficiency of lamb production. Simplified methods of hormonal administration, effective control of estrus, and high fertility following breeding at the controlled estrus are prerequisites for the applied use of hormonal materials for the control of breeding. Presently, hormonal materials having a progesterone-like activity offer the greatest promise in meeting these prerequisites. Possible avenues for improvement include the study of new hormonal materials and new treatment procedures.

The present study was designed to investigate reproductive performance of ewes following early weaning and subsequent intravaginal treatment with hormone-impregnated pessaries. The hormonal material in the pessaries was fluorogestone acetate, a new compound produced by G. D. Searle and Company. Three different types of treatments utilizing the impregnated pessaries were employed.

Procedure

A total of 48 crossbred ewes which had been separated from their 2- to 3-month-old lambs on April 19, 1965, were utilized in this study. On May 5, 1965, the ewes were allotted to four groups of equal size and treated as follows: (1) control; (2) impregnated pessaries intravaginally placed for a 16-day period; (3) treatment same as group 2 plus 750 i. u. equine gonadotropin subcutaneously at the time of pessary removal; and (4) treatment given group 2 plus an additional 9-day treatment with impregnated pessaries after an 8-day pause.

One-half of the control ewes received a single treatment (as in groups 2 and 3) with unimpregnated pessaries, and the other half received a double treatment (as in group 4) with unimpregnated pessaries. Impregnated pessaries contained 25 mg. of fluorogestone acetate per pessary. Pessaries used were small cylindrical polyurethane plugs with attached drawstrings, as shown in Figure 1. Pessaries were placed in the anterior vagina by use of a tube speculum.

Treatments were so arranged that breeding would start at approximately the same time for all groups. Thus, June 7, 1965, was the last day of the treatment period and the day that ewes were placed with rams. Breeding was by natural means, utilizing four rams that had been semen tested. To avoid complications associated with variations in ram fertility, an equal number of ewes from each group was placed with each ram. Ewes returning to estrus were rebred to rams differing in breed from those of the previous services.

Results and discussion

The reproductive performance of the ewes subsequent to the treatment period is summarized in Table 1. It can be seen that the majority of the

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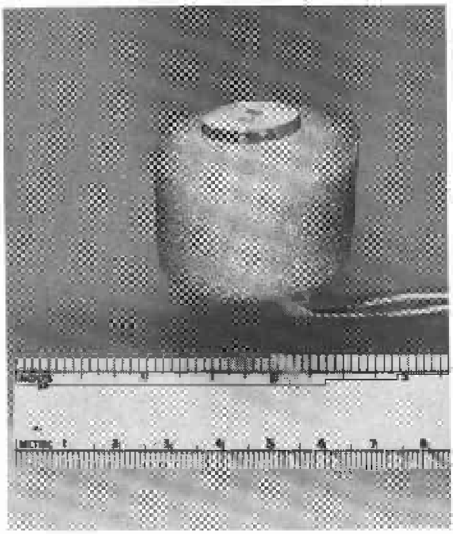

Figure 1. A polyurethane pessary of the type used in the intravaginal treatment.

ewes showed estrus. Of special interest is group 3, in which 11 of the 12 ewes began expressing estrus within a 2-day period. In the other groups, either fewer ewes and/or a greater number of days were involved.

Group 3 also appears superior in terms of lambing performance. Nine of the eleven ewes that were bred lambed to the breeding at the first post-treatment estrus, and a total of 18 lambs were produced. The double treatment group (group 4) appears to be the next best group in terms of lambing performance. Group 2, which in design is similar to "conventional" treatments for hormonal control of breeding, performed poorly in that only two ewes lambed.

It is of interest to note that one-half of the control ewes showed estrus, but none of these ewes conceived when bred at their first post-treatment estrus. One control ewe did conceive, but to the breeding at the second post-treatment estrus. Of all lambs born, this was the only one that did not result from conception to breeding at the first post-treatment estrus.

Certain problems were encountered in using vaginal pessaries. Five of the 48 ewes lost their pessaries. Frequently, at the time of pessary removal, the pessary appeared more firmly attached to the vaginal wall than was desired. Removal of the pessaries was usually accompanied by discharge of vaginal fluid.

Summary

It appears that hormonal materials have much potential in terms of controlling the time of breeding of ewes.

Table 1. Reproductive performance of ewes subsequent to treatment with fluorogestone acetate-impregnated pessaries

		Estrous activity		Lambing activity	
Group	Ewes	Ewes showing estrus	Days involved[1]	Ewes	Lambs
	No.	*No.*	*No.*	*No.*	*No.*
1	12	6	6	0	0
2	12	10	8	2	3
3	12	11	2	9	18
4	12	8	6	6	6

[1] Refers to the number of days required for the number of ewes in the preceding column to start showing estrus.

The present study supports the idea that improvement is possible by modifying previously used methods. Plans include a continuation of the work in this direction, with the goal being the development of simplified methods for effective control of breeding with resulting high fertility.

Winter Pasture for Sheep

William S. McGuire

The cheapest source of feed for sheep should come from pasture. The quantity and quality of pasture, stocking rate and utilization, and the length of the grazing season greatly influence net profit per acre or per farm. The greatest shortage of pasture feed is during the winter and early spring.

It is believed that many livestock men, particularly those feeding little or no hay, limit livestock numbers in accordance with feed available during the season of greatest feed shortage. This largely accounts for low stocking rates and unused surplus in spring.

Pasture production

One objective in the pasture research program in recent years has been the investigation of potential pasture production for use from December to early April. Production during that period will be with grass forced into autumn and winter growth with nitrogen fertilization. The legumes are dormant in winter, and any feed accumulated during the autumn is susceptible to frost damage and deterioration.

Investigations have included use of annual grasses and cereals as well as perennial grasses. Sod-seeding has been used as well as prepared seedbeds. Use of nitrogen fertilizer for grass production in autumn and winter has been found necessary. Irrigation in mid-September enables grass to take advantage of 2 to 3 weeks of additional autumn growing season and the most favorable temperatures.

A sod-seeding experiment in 1960 showed that, even in a good stand of subclover, cereals or annual ryegrass made little fall growth without nitrogen. Abruzzi rye was the most productive under those conditions.

Forty-five pounds of nitrogen per acre more than doubled the production and returned 24 pounds dry forage per pound of nitrogen, equivalent to buying good hay for $11 per ton. With irrigation in mid-September and nitrogen fertilization, there was a ton of forage (oven-dry basis) available by November 14.

It was found, too, that with annual ryegrass present in a good stand, it was as productive as local varieties of wheat, rye, or oats.

In a later study, it was sought to determine if any cereal varieties, including spring varieties from the South, were more productive than our own. Results showed again that our annual ryegrass was very close in yield to spring grains. The best winter-growing Southern cereals of oats and wheat were subject to frost damage in the leaf and even to loss of stand

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Table 1. Summary of annual ryegrass production, 1964[1]

Harvest dates	Jan. 2	March 24	April 28	June 10	July 13	Aug. 12	Sept. 21	Total
	Lbs./A	*Lbs./A*	*Lbs./A*	*Lbs./A*	*Lbs./A*	*Lbs./A*	*Lbs./A*	*Lbs./A*
Westerwolth 4N	1,100	1,930	2,290	3,120	2,730	2,040	2,140	15,350
Trifolium Elite Ital.	560	1,940	2,900	3,310	2,740	1,990	1,870	15,310
Oregon annual	900	1,850	2,730	3,380	2,530	1,870	1,640	14,900
Italian 4N	330	1,300	3,150	2,910	2,550	1,950	2,590	14,780
Gulf	800	2,240	2,570	3,360	1,410	720	890	11,990
						L.S.D.	$P < .05$	1,630
							$P < .01$	2,370

[1] Irrigated; 33 pounds N/A per cutting.

with 10° F. Abruzzi rye was slightly more productive than annual ryegrass; even though it withstood the cold, it lodged badly by early January.

Another test compared annual ryegrasses, including some tetraploids, with Oregon annual. The results shown in Table 1 include total annual production to show the productiveness of annual ryegrass with irrigation and nitrogen fertilization. Oregon annual compared favorably in winter and total production.

Annuals and perennials

The disadvantage of annuals for pasture is the expense of annual seeding plus less firm ground resulting from seedbed preparation. A perennial grass would be advantageous if it responded favorably to nitrogen and provided suitable frost-resistant growth.

A field test was established to compare the best winter-growing annuals and perennials; the winter annuals were used in a double-cropping system. The results for three winters are shown in Table 2. The autumn production in 1964 was lost by freeze, snow, and flood in late December. Plots were cleaned and fertilized in mid-February. The next harvest was on April 22, 1965, the result of growth in March and April.

Among the tall fescues, the Mediterranean strains No. 1000 and one from Tunis are good winter growers. Excellent winter production was obtained from hardinggrass and sunol grass, but like the Mediterranean fescues, they are susceptible to low temperatures. A drop to 10° F. left these four grasses unusable, while the lesser winter growers were damaged less. If the best winter growers are used, the growth should be consumed in late fall and December as insurance against possible total loss.

Best production in February-March has been with Goar tall fescue, followed by the new Fawn fescue, which during the rest of the year out-yielded Goar.

The best distribution of feed throughout the year was obtained by double-cropping of annuals; that is, annual

Table 2. Winter and early spring production of perennial and annual grasses[1]

Harvest dates	Jan. 2, '64	Mar. 25, '64	Apr. 22, '65	Jan. 17, '66
	Lbs./A	*Lbs./A*	*Lbs./A*	*Lbs./A*
Fescue, Alta	380	760	3,170	2,100
Fescue, Goar	420	1,480	4,400	1,840
Fescue, Fawn	300	930	3,890	1,740
Fescue, 1000	990	1,300	2,140	3,100
Fescue, Tunis	1,190	840	1,420	3,070
Orchard, Penmead	0	0	750	2,100
Ryegrass, Linn	770	390	1,560	1,740
Ryegrass, H-1	970	1,340	1,610	......*
Ryegrass, Annual	880	1,870	3,050	2,770
Hardinggrass	1,340	1,850	1,250	2,740
Sunol grass	990	750	1,040	2,820
Rye, Abruzzi-Sudan	990	230	2,520	2,950
Oats, Moregrain-Sudan	1,260	2,240	......†	

[1] Irrigated September 15; 60 pounds N/A in September and 35 pounds N/A in January or February.
* Depleted stand.
† Not planted.

ryegrass followed by sudangrass. Total production was comparable to that from perennials, but the cost of seeding should be considered.

Orchardgrass has been unsuitable for winter pasture. The quality is reduced by frost, wet weather, and disease, and it makes little winter growth. The best winter growers, annual or perennial, are capable of providing from 1 to 1½ tons of forage (dry basis) per acre by January 1, if irrigated in September, or about two-thirds that amount in average years without irrigation. In any case, approximately 50 to 60 pounds of nitrogen per acre should be applied in September.

At a ration of four pounds (dry matter) per ewe per day, the early-started autumn-saved pasture could support 16 ewes per acre during January or double that amount if supplemented with dry feed.

Experience has shown that grasses in a grass-clover mixture, forced into autumn and winter growth with nitrogen and saved during the autumn for winter use (autumn-saved pasture), will rapidly eliminate the clovers, either white or subterranean clovers. Therefore, it is suggested that the winter pasture be planted to straight grass at a high seeding rate as a special purpose pasture. Then high rates of nitrogen can be used, pasture accumulated, and trampling in winter tolerated without bother of clover loss. Surplus feed in spring can be utilized as silage, hay, feed for cows and dry stock, or even for seed production (already in practice by grass seedgrowers of several grass species). The high seeding rates are not consistent with sustained yields of grass seed, but the purpose of the pasture is for winter feed with hay or seed supplemental. In any case, sod-bound conditions can be alleviated by various means if necessary.

A recent test with kale and root crops showed that with June planting to sudangrass, swedes and kale produced one ton of dry feed per acre by January and turnips produced two tons per acre. If sudangrass was irrigated (three times), production was doubled, and one variety of turnips yielded over six tons per acre. This is an excellent build-up of winter feed, but utilization presents a problem.