*Summary of Reports . . .*

# 1977 Sheep and Wool Day

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# SHEEP FOOT ROT

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Bacteroides (Fusiformis) nodosus is an anaerobic bacteria that together with Fusobacterium necrophorum, another anaerobic bacteria, is instrumental in causing sheep foot rot. Fusobacterium necrophorum (Sphaerophorous necrophorus) is widely disseminated in the environment whereas B. nodosus can survive for long periods of time only in the hoof wall; hence it appears more feasible to control B. nodosus than F. necrophorum. Foot rot vaccines used in Australia, New Zealand and England are made from B. nodosus cultures.

Vaccination studies in Australia have shown that not all B. nodosus serotypes are cross-protective; that is, vaccination with Serotype A will immunize sheep against infection with Serotype A or B but not against Serotype C. Conversely vaccination with Serotype C will protect against challenge with Serotype C but not against Serotype A.

We conducted a field trial of a foot rot vaccine in 1975. This vaccine was produced on an experimental basis by an American firm; however, it was made in exactly the same manner as the Australian or English vaccines using Serotype A cultures of B. nodosus. Results from this trial indicated that the vaccine had a beneficial influence on the severity of foot rot in 3 of the 8 flocks. Interestingly, we identified Serotype B Bacteroides nodosus from these 3 flocks but not from any of the other 5 flocks. Thus, possibly the reason for the apparent beneficial vaccine influence in these 2 flocks was a cross-immunization effect of the Serotype A in the vaccine against the Serotype B infection in the flocks.

Ironically Serotype J was not isolated from any of the 8 flocks in the trial.

During the past year, we have serotyped over 50 B. nodosus isolates in our laboratory and have identified 10 different serotypes infecting Oregon sheep. Australian Serotypes A, B and C have been found but are not the most common serotypes.

Recent studies in Australia have indicated that the commercial vaccine failed to provide protection for much more than 6 weeks; consequently the license for the sale of this vaccine has been discontinued. The vaccine is still commercially available in New Zealand and England. Presently the consensus seems to be that the vaccine has more potential for farm flocks than it does for the huge flocks that are common in Australia.

Treatment of foot rot consists basically of paring the hoof to allow exposure to the air and contact with various chemicals. Formalin and copper sulfate solutions are widely used for hand treatment and foot baths. Formalin has the advantage of not discoloring wool or being so rapidly deactivated by organic material. Additionally, formalin does not pose a potential toxic hazard for sheep, which are extremely susceptible to copper poisoning. A 10% formalin solution (1 part formalin plus 9 parts water) is acceptable for hand treatment or occasional foot baths; however, if sheep are put through a foot bath once a week, a 5% formalin concentration (1 part formalin and 19 parts water) should be used. Excessive foot baths with 10% formalin or stronger solutions can lead to foot irritation and even corn formation.

Copper sulfate solutions of approximately 10% can be safely used for foot bathing 2 or 3 times per week and a 20% solution can be used on an occasional basis. Alcoholic solutions of chloramphenicol (10%) and oxytetracycline (5%) applied to the pared hoof at weekly intervals are also effective treatments. Parenterally administered (intramuscular) antibiotics, for example penicillin-streptomycin, have also been shown to be effective in treating foot rot. With any of the treatments utilizing application of chemicals to the hoof, it is important to keep the sheep on clean ground for an hour or two following treatment to allow time for the drug to act.

Control or eradication of foot rot is possible since it is spread by infected sheep which may be acutely or chronically affected; however, detection and elimination of the inapparent carriers is difficult. If eradication is attempted, a closed herd must be maintained with introduction of new sheep only after a strict quarantine period. It should be remembered also that goats and deer can develop the same disease as sheep and potentially could act as carriers. Cattle have also been shown to act as carriers; although classical foot rot in cattle is probably not caused by B. nodosus as it is in sheep. In at least one case, cattle on a farm were shown to cause reinfection of new sheep introduced onto the farm.

# RESEARCH FINDINGS ON THE UNITED STATES SHEEP INDUSTRY

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## INTRODUCTION

Since 1974 the Economic Research Service, U.S. Department of Agriculture has completed a number of studies related to the sheep industry. This discussion will summarize major findings of these studies which producers may not be acquainted with.

Much of the data for these reports were compiled through personal interviews with sheep producers. A 1974 survey on industry characteristics involved 1,461 sheepmen; a 1975 survey collected production, cost, and returns data on 911 sheep businesses; another survey in 1975 compiled 1974 sheep and lamb loss data from 8.910 western producers; in the northcentral states 1975 loss information was collected from 141 sheepmen; finally, a 1974-75 survey of 295 former sheep producers provided data on reasons for quitting sheep production. Published sources have been used to study price and demand relationships for lamb.

These studies by the U.S. Department of Agriculture, Economic Research Service were made at the direct request of western Congressmen. Special appropriations from Congress in fiscal years 1974 and 1975 funded the work.

The stimulus for this research on the sheep industry came primarily from sheepmen and environmental groups as a result of executive and legislative action to regulate predator control practices in the western states. A summary of these actions follows:

1971: Long a familiar sight to Western sheepmen, the coyote came into the national limelight in 1971 when the Cain Committee of the Interior Dept. stated, "Today's society places as high a value on prairie dogs, eagles and coyotes as does the grazing lessee on public lands or the owner of a ranch on his flocks of sheep."

1972: Executive order given that banned toxicants for use on federal lands. EPA prohibits interstate shipping of unregistered toxicants, citing destruction of non-target wildlife and possible human health threats as the reasons.

1974: Use of M-44 cyanide device on an "emergency basis"--when ranchers could show a 2-percent livestock loss to predators over 7 days or 8 percent over a season. The M-44 returned to public and private lands on this basis.

1975, July: Use of the M-44 widened to use on an experimental basis, and experimental use of sodium cyanide collars was approved.

1975, August: It is considered a violation of the Federal Insecticide, Fungicide and Rodenticide Act (P.L. 92-516) to distribute any cancelled or suspended pesticide either between states or within a state, under Section 3 of that Act.

1975, September: EPA immediately begins approving M-44 registration applications from states and federal agencies, with a stipulation that a private person only use the M-44 after training and supervision. And EPA approves sodium-cyanide collars on a 1-year experimental program.

1976, May: Executive Order is modified to change experimental use of the M-44 device to operational use.

1977: Possible implementation of Section 4 of Federal Insecticide, Fungicide and Rodenticide Act, which would restrict pesticide application to persons who were certified, if use of that pesticide is registered for restricted use. (Currently, federal law does not regulate the applicator of a pesticide, although some state laws do.) (1) 1/

Renewed interest in the sheep industry by researchers has been created by the predator controversy and much research money has been allocated to study its problem and potential. This discussion does not review work being done by other agencies of the government nor research by land grant Universities.

Economic Research Service Findings 2/

Characteristics of the Western Sheep Industry (2). About 80 percent of the sheep in the United States are raised in the 17 most western of the 48 contiguous States. In this region, extensive private and public ranges provide much of the feed for these sheep. Some of these ranges are better suited for grazing sheep than cattle. Sheep graze more readily on shrubs and brush, whereas cattle prefer the more palatable grasses and forbs. Also, sheep have less need for constant access to water than cattle and have more ability to traverse rough and steep terrain.

Sheep are raised on a small scale by many producers in the western States, but the bulk of the sheep are on large-scale operations. Of some 51,000 western farmers and ranchers with sheep, only 21,000 or 41 percent have commercial operations of 50 or more stock sheep. However, these commercial sheep producers (defined in this report as those with 50 or more stock sheep) own nearly 93 percent of all stock sheep in the region. Large-scale producers with 1,000 or more head make up only about 6 percent of the total sheep producers, but account for 63 percent of the region's stock sheep.

Two special sample surveys are undertaken to gather data on the status and characteristics of western commercial sheep operations. Principal findings and implications are:

1. About one-fifth of the current commercial sheep producers in the West are 60 years old and over. Many will retire in the next few years. Thus, a further decline in numbers of producers and sheep could occur unless there are more incentives than in the past to encourage family members or others to continue to take over the sheep operation. Lamb prices improved in 1975-76, which could provide some encouragement if not offset by other factors such as higher costs, shortage of good labor, and depredation.

2. Average equity positions of commercial sheep producers are good, suggesting that, in general, there is a history of profits. However, increased land values could also be a factor. Even so, a year or two of unprofitable operations would cause many producers, particularly the older ones, to become concerned about reduced retirement equity, and could cause some to shift to other enterprises or sell out.

3. Over two-thirds of commercial sheep operations are joint enterprises with cattle or goats. Some, particularly the smaller operations, also have crop income. Such diversification can reduce risk, permit better range utilization, and provide some flexibility to shift from sheep to other livestock or crops in line with changing prices, costs, labor availability, and predatory animal problems.

1/ Underscored numbers in parentheses refer to references listed at the end of the report.

2/ Copies of reports cited in this discussion can be obtained upon request from Kerry Gee, ERS-USDA, Economics Department, Colorado State University, Fort Collins, CO 80523.

4. Federal ranges are sources of feed at some time during the year for about one-fifth of the West's commercial producers and one-half of all commercial sheep. Overall, these producers and their sheep depend on Federal range for about one-third of their annual feed requirement. Among some of the largest producers, this dependence reaches one-half or more. Many of these producers would have few feasible alternative sources for this feed supply, and would have to curtail or terminate sheep operations if Federal range were to become unavailable or unprofitable to use because of high grazing fees, high losses to predators, or other reasons.

5. Sheep placed on Federal ranges (about one-half of all commercial sheep) are nearly all open-grazed (grazed on unfenced range) under the care of herders. In addition, about another 10 percent of the commercial sheep are open-grazed on private range, also requiring herders. Thus, lack of good herders or the financial capacity to pay wages which attract herders either results in curtailment of sheep placed on open ranges or higher sheep/herder ratios and increased animal losses. For most of these extensive ranges, fencing is not practical nor economically feasible.

6. Open pasture and range lambing is practiced by about one-half of all commercial producers, principally the larger ones, and involves nearly two-thirds of the ewes. This practice, in comparison with shed lambing, requires less facilities, labor, and other expenses, but usually results in higher lamb and ewe losses. For many large sheep operations, particularly migratory ones, shed lambing is simply not practical. For others, the cost and labor requirements are such that many would leave the business rather than make the investment.

7. Because of long distances between seasonal feed supplies, sometimes reaching several hundred miles, nearly 60 percent of all sheep on commercial operations must be moved either by truck or by trailing (driving) in herds. Currently, about one-half of the sheep moved are transported wholly or in part by truck, while the remainder are trailed. Although trailing was at one time the only method used, this practice has been declining due to increased traffic on roads, controlled access highways, greater distances moved, less open land with feed across which to trail, restrictions on use of popular driveways, and the overall convenience of truck transportation. Recent increases in transportation costs likely are causing some ranchers to reconsider trailing.

8. Lambs are marketed primarily through packer buyers and order buyers, while wool moves primarily through wool dealers and wool pools. The principal marketing problem is the few numbers of buyers bidding on lambs.

Sheep and lamb losses-western States (3)

Special sample surveys of farmers and ranchers in the western United States were made by mail and personal interviews to help determine the level and scope of sheep and lamb losses to predation and other causes in 1974. These data were compared with other available data on losses to identify trends. Also, statistical analyses were made to identify factors related to predation. Principal findings and implications are:

1. Predation, principally by the coyotes, was the major cause of sheep and lamb deaths during 1974 in the western United States, according to farmers and ranchers. Losses attributed to coyotes in 1974 numbered 728,000 lambs and 229,000 adult sheep, representing a third of the total lamb deaths to all causes and a fourth of the adult sheep deaths.

2. Lambs were much more subject to predation than were adult sheep. Overall losses to coyotes were 8 percent of the lambs and 2.5 percent of

the sheep.

3. Geographically, loss rates of lamb and sheep to coyotes predation were highest in States with public range grazing and mountainous terrains. Comparatively few deaths due to coyotes occurred in the Plains States of Kansas, Nebraska, and North and South Dakota.

4. Lamb loss rates to all causes have been increasing in the western States, including the Plains States, while sheep loss rates have been declining slightly. Available data for a few States suggest predation has been the principal cause of the increasing lamb death rate.

5. The gross economic loss suffered by farmers and ranchers from coyote predation in 1974 was estimated at $27 million (excluding control costs) while the benefits lost by consumers because of higher prices and reduced quantity were estimated at $10 million, for a total of $37 million. Reduction of these gross economic losses would require additional expenditures for or changes in predator control, which would have to be weighted against the economic benefits. Also environmental and social impacts would have to be considered, along with regulatory constraints.

6. Rates of loss to coyotes in 1974 varied considerably among farmers and ranchers. While most of the large-scale sheep operators reported losses ranging from less than 5 to more than 20 percent; many small-scale producers had no predation problems at all. Hardest hit by coyote predation were some 5,000 sheep ranchers, about one-tenth of the West's total sheepmen, who reported losses exceeding 10 percent of lambs born. Among these, the average loss in foregone lamb sales in 1974 was about $4,000.

Sheep and lamb losses-Northcentral States (4) This report presents survey data on lamb and stock sheep losses in the northcentral states for 1975. Causes and magnitude of loss are estimated. Comparisons are made with similar data collected in 15 western states for 1974. Important findings are as follows:

1. Weather and disease are the major sources of identified lamb deaths between birth and marketing. After docking, disease is the dominant factor. Dogs are also important. Many causes of lamb losses go unidentified, 37.5 percent for the entire production period and 24.7 percent after docking.

2. About 70.0 percent of all lamb losses to weather and to unidentified causes occur between birth and docking. Nearly all dog and other predator losses are after docking. Losses to disease are also most serious after lambs are docked.

3. In 1975, 13.5 percent of lambs born were lost to various causes. Losses after docking were 6.5 percent of lambs docked.

4. Major known causes of stock sheep losses were weather, disease, and dogs in decending order of importance. About 20.0 percent of all losses were unidentified.

5. Total 1975 stock sheep losses were 8.3 percent of January 1 inventories.

6. Disease and dogs were much more serious problems among lambs in the northcentral region than in the western region. There were also more unidentified losses. In contrast, predators and particularly coyotes were the major problem in the west. Weather also tended to cause more lamb deaths in the western states. A comparison of stock sheep losses between the two regions indicates that weather, disease, and dogs caused most losses in the northcentral region while predators were most important in the west.

7. The magnitude of losses relative to lambs born was higher in the west, 23.0 percent compared to 13.5 percent in the northcentral region.

Total stock sheep losses relative to January 1 inventories were higher in the west than in the northcentral region, 10.4 percent compared with 8.3 percent.

Factors in the decline of the western sheep industry (5). This report evaluates data from a sample of sheep producers in the states of Utah, Wyoming, Texas, and Colorado who sold their herds in the years 1968 and 1974. The purpose is to identify factors that contributed to their decision to leave the sheep business.

1. Sheep men who sold their herds were older on an average than producers still in business. Over 40 percent had passed sixty years of age in all states except Colorado and 55 percent or more were beyond fifty years of age in all four states. In Wyoming 71 percent of those who sold their sheep were past fifty. The age of the owner was ranked fairly high (fourth or fifth) by producers among the reasons they left the business. Among producers over 60 years, age was rated as the most important reason in their decision to quit sheep in all states but Wyoming where it was rated second by this group.

2. The equity position of former sheep producers was good, averaging at least 70 percent for each category: real estate, livestock, and equipment. In some cases owner equity was much higher. For example, in Wyoming the average equity for real estate was 85 percent and for equipment 96 percent. These numbers are not descriptive of business with financial difficulties. Although part of the value of these assets at the time the sheep were sold was due to inflated prices, particularly in the case of land, a favorable historical income position must have occurred on many operations to build such an equity position. This hypothesis is supported by two pieces of data. First, there were no producers in Utah and Texas who indicated that problems of obtaining capital to finance their sheep operation contributed to their decision to stop production, and in Wyoming and Colorado, credit was rated as only a minor problem. Second, productivity on sheep operations that were sold appeared to be similar to those still in business.

3. Five-year-average losses to predators on the operations of former producers were lower than average losses sustained by current producers during 1974. However, practically all former producers sustained some losses, which differs from distributions of current producers, where significant numbers have no predator losses. Losses due to predation rank first among reasons given by former producers for selling their sheep in Texas, Colorado, and Wyoming, and was second to labor in Utah. Based on the data, there is little doubt but that predation was a serious problem for many former producers. On some it was probably the single most important factor in the decision to quit the sheep business.

4. Labor has been a continual problem with sheep men for many years. As far back as the 1950's, producers reported difficulties finding people willing to work with sheep. Foreign countries, chiefly Spain and Portugal which have been providing much of the labor supply, in recent years have reduced the number they will let come to the United States as sheep herders, which has created the need to find new sources. The enforcement of labor regulations upon sheep producers by the U.S. Department of Labor and safety standards by the Occupational Safety and Health Agency have added to the problems of labor management. Former producers in Utah rates labor problems above all others as affecting their decision to leave the sheep business. Those in Texas and Wyoming rated it second while those in Colorado rated it third.

5. Former producers in the four states rated low lamb and wool market prices as significant problems. Wyoming and Colorado producers rated lamb prices as particularly important in their decision to quit the sheep

business. In Colorado, low wool prices was considered as important as predators by former producers.

6. The data in this study indicate that sheep operations in the states of Utah, Wyoming, Texas, and Colorado that were sold between 1968 and 1974 are similar to those still in business with regard to ownership patterns, management practices, and productivity. The one exception is Wyoming where there were some differences in management and certain measures of productivity.

7. Producers who sold out appear to have had acceptable alternatives to sheep production. Even though sheep may have been providing an adequate livelihood, problems associated with this enterprise made former producers look for favorable alternatives for their production resources. Many had cattle in conjunction with sheep or had previous experience with cattle, which made it easy to shift resources to this enterprise. Although few could have made this shift with an expectation of greater profit, it is generally true that labor, management, and predator problems are usually less with cattle which contributes to their desirability. Some former producers had sufficient private land holdings and an equity position such that their land which had been in sheep production could be leased or sold and the proceeds provide them with an adequate income. Many of those who retired or shifted to non-farm businesses were probably in such a position and did not think it worth the effort to continue facing the problems associated with the sheep business.

8. In summary, it appears that specific problems with labor or predation have been sufficient to cause some producers to leave the business. But in most cases the combined effect of these and other problems, such as the age of producers, equity position, and the availability of acceptable alternatives interacted to bring about the decision to sell out.

Sheep production, costs, and returns (6)

The 17 western states have been divided into production subregions based on common geographical characteristics and management practices. These subregions can be seen in figure 1. The proportion of the region's stock sheep inventory for 1974 represented by each subregion is as follows:

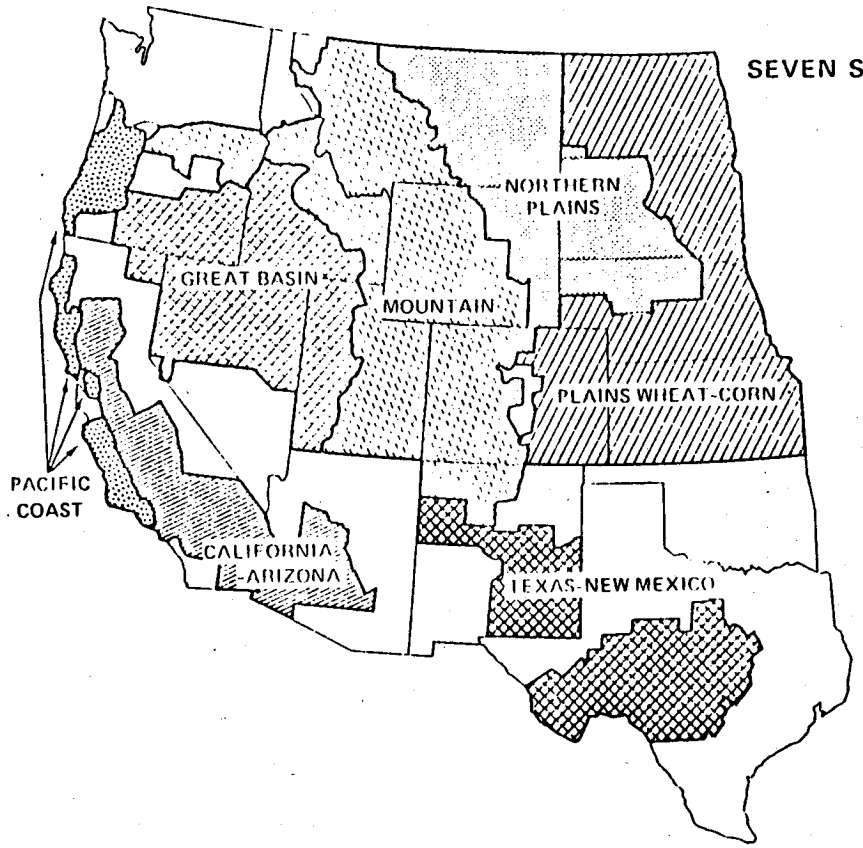
| Subregion | Stock sheep percent of 17 western states, 1974 |
|---|---|
| Northern Plains | 14.0 |
| Plains wheat-corn | 11.8 |
| Texas-New Mexico | 22.4 |
| Mountain | 24.9 |
| Great Basin | 6.7 |
| Pacific Coast | 3.5 |
| California-Arizona | 7.7 |
| Total | 91.0 |
| Excluded areas and producers with under 50 head | 9.0 |
| Total 17 western states | 100.0 |

Data on production, costs, and returns for these subregions are based on a sample survey made in the spring of 1975 of western sheep producers with more than 50 head of sheep. A detailed summary of the survey data is reported in the ERS unpublished report, Enterprise Budgets for Western Commercial Sheep Businesses, 1974.

Production

Production levels by subregion and for the total western states are reported in table 1. Lambs produced per ewe and lamb weights are highest in the Mountain and Great Basin subregions and lowest in Texas-New Mexico. Fleece weights are highest in the mountains and lowest along the Pacific coast. In overall productivity the Mountain subregion exceeds all others.

Figure 1




SEVEN SHEEP PRODUCING AREAS OF THE WESTERN STATES

TABLE 1. Average production reported by western commercial sheep producers, 1974.

| Subregion | Lambs born per ewe | Lambs docked per ewe | Slaughter lamb weight[1/] | Feeder lamb weight[1/] | Fleece weight |
|---|---|---|---|---|---|
| | Head | Head | Pounds | Pounds | Pounds |
| Northern Plains | 1.17 | 1.09 | 95 | 74 | 9.5 |
| Plains Wheat-Corn | 1.17 | 1.16 | 102 | 81 | 9.1 |
| Texas-New Mexico | .94 | .81 | 94 | 73 | 7.6 |
| Mountain | 1.41 | 1.30 | 103 | 92 | 9.7 |
| Great Basin | 1.36 | 1.26 | 103 | 87 | 8.9 |
| California-Arizona | 1.01 | .94 | 99 | 71 | 8.2 |
| Pacific Coast | 1.08 | .95 | 100 | 74 | 6.7 |
| All Subregions | 1.18 | 1.09 | 98 | 80 | 8.8 |

[1/] Some producers did not have separate weights on slaughter and feeder lambs since they were not sorted at the time of sale. Therefore, average weights reported here reflect some mixed sales. Slaughter lamb weights also include some lambs fattened on crop residues and in feedlots.

1974 costs and returns -- a regional average.

An average 1974 sheep enterprise budget for the 17 western states is summarized in table 2. It illustrates the relative importance of various items in a sheep business. Lamb sales are the most important source of revenue representing 74 percent of gross sales. The importance of wool to the business is of primary concern in this report. In 1974 wool contributed an average of about 23 percent to gross sales with wool sales 18 percent, shorn wool incentive payment 4 percent, and unshorn lamb payment 1 percent.

Important costs are interest on total investment including land, feed, and labor which account for 35 percent, 24 percent, and 15 percent respectively of total costs. All other cost items contribute 26 percent to the total. When ewe and wool sales are subtracted from total costs, the residual may be treated as cost of producing lambs marketed. Lamb prices necessary to cover various costs are:

| Costs included | Break even lamb price per cwt. needed to cover the specified costs, 1974 |
|---|---|
| Cash costs | 25.01 |
| All costs except interest on invested capital | 37.90 |
| All costs | 60.94 |

With a lamb price in 1974 of about $35 per hundred weight, producers were not covering all costs. In fact, they realized no return on invested capital and were paid only partially for their labor.

Table 2 -- Average production, operating expenses, and returns per breeding ewe, western commercial sheep operations, 1974.

| Item | Head | Weight/ head | Weight sold | Price | Value |
|---|---|---|---|---|---|
| | number | pounds | pounds | dollars | dollars |
| Production | | | | | |
| Slaughter lambs 1/ | .48 | 98 | 47.1 | 34.58 | 16.29 |
| Feeder lambs | .33 | 80 | 26.4 | 34.58 | 9.13 |
| Ewes 2/ | .11 | | | 13.63 | 1.50 |
| Wool | | | 10.5 | .59 | 6.21 |
| Shorn wool incentive payment 3/ | | | | | 1.35 |
| Unshorn lamb incentive pmt 3/ | | | | | .37 |
| Gross income | | | | | 34.85 |
| Operating expenses | | | | | |
| Cash costs: | | | | | |
| Replacement ewes purchased | | | | | 2.08 |
| Feeder lambs purchased | | | | | 1.69 |
| Range and pasture | | | | | 3.31 |
| Supplementary feeds | | | | | 9.31 |
| Veterinary and medicine | | | | | .43 |
| Hired trucking | | | | | .30 |
| Shearing | | | | | .87 |
| Predator control | | | | | .41 |
| Vehicle and equipment operation | | | | | .63 |
| Hired labor | | | | | 1.58 |
| Taxes | | | | | 2.24 |
| Insurance | | | | | .29 |
| Miscellaneous 4/ | | | | | 2.18 |
| Interest on operating capital 5/ | | | | | 2.12 |
| Total | | | | | 27.44 |
| Depreciation, machinery | | | | | 1.86 |
| Depreciation, rams 6/ | | | | | 1.30 |
| Total | | | | | 3.16 |
| Total cash costs and depreciation | | | | | 30.60 |
| Value of family labor 7/ | | | | | 6.32 |
| Interest on total capital invested 5/ | | | | | 16.93 |
| Total operating expenses | | | | | 53.85 |
| Returns | | | | | |
| Return above cash costs | | | | | 7.41 |
| Return to family labor and invested capital | | | | | 4.25 |
| Return to invested capital | | | | | -2.07 |

1/ Feeder lambs purchased for resale comprise 17 percent of slaughter lambs sold.
2/ Ewes sold include some for breeding as well as culls for slaughter.
3/ The shorn wool payment is based upon a rate of 21.8 percent of wool sales. The unshorn lamb payment is based on lamb sales of 73.5 pounds and a payment rate of .52 per cwt of lambs sold.
4/ Miscellaneous expenses include marketing costs, utilities, lamb promotion, organization dues, legal and accounting fees, wool storage, and ram death loss.
5/ Interest on operating capital is 9.0 percent and on capital investment 7.0 percent.
6/ Depreciation on ewes is accounted for through the sale of culls and retention of of replacement lambs produced or purchased.
7/ Family labor is valued at the same rate as hired labor.

1974 costs and returns -- averages for major subregions.

Differences in 1974 costs and returns occurred among western production subregions (table 3). Total operating costs per breeding ewe varied from a low of $46.36 in Texas-New Mexico to a high of $65.92 in the Mountain area. Gross income was also lowest in Texas-New Mexico, $23.87 per breeding ewe. Highest gross income per head occurred in the Great Basin and Mountain subregions, $43.54 and $43.62, respectively. Average return above cash costs per head ranged from $4.42 in the Pacific coast area to $12.50 in the Great Basin. All subregions had average returns sufficient to cover both cash costs and depreciation. Family labor, however, did not receive a return equal of its value, except in the Texas-New Mexico area where labor requirements are minimal. That subregion was also the only one where sheep businesses averaged a positive return to invested capital in 1974.

Average estimated income for western sheep producers 1970-75 can be seen in table 4.

Price and demand for lamb (7).

What factors affect lamb consumption and prices? This is a vital question concerning the sheep industry of this country. Between 1960 and 1975 production of lamb and mutton fell 44 percent, per capital consumption dropped 58 percent, while farm level lamb prices rose 135 percent. During this same period, population in the United States increased 18 percent (1).

This analysis identified lamb price characteristics and quantifies price-demand relationships for lamb. Findings are summarized below:

1. An upward trend has occurred in annual average lamb prices since 1961 (figure 2). From 1950-60 prices fluctuated, with a high of $31.00 in 1951, a low in 1955 of $18.40, followed by another peak in 1958 of $21.00 before dropping to a $15.80 minimum in 1961. Between 1961-75 lamb prices increased more than two and one-half times, rising to $42.10.

2. Patterns of lamb production are the inverse of farm level lamb price movements (figure 2). Historically, when production increased, prices fell; and when production decreased, prices rose. Prices usually adjust to a level that will clear the market of all lamb produced. It appears that expanded production between 1951-61, except for a short period around 1957, forced lamb prices to extremely low levels. Per capita consumption was high, possibly indicating an increase in number of people eating lamb as well as an increase in consumption by established lamb consumers. Starting in 1961, production began falling which has continued to the present. Reduced supplies, and therefore lower total consumption, caused per capita consumption to fall. Consumer bidding on a smaller quantity of lamb forced a continual rise in prices during this period. The reduction in per capita consumption of lamb between 1961-75 implies a loss of market.

3. There are definite seasonal patterns in farm level lamb prices (figure 3). Prices rise during spring months, reaching a peak in May. After declining through the summer and fall, a minimum is reached in December. This pattern is caused by the highly seasonal nature of lamb production in which most lambs are marketed in the fall.

4. A statistical analysis of demand for lamb at the farm level indicates that lamb prices are highly dependent on quantity of lamb marketed. They are affected to a lesser extent by supplies of other meats entering the market and by the level of per capita income in the United States. Producers can expect that for each 1.0 percent change in lamb produced there will be an approximate .6 percent change in price in the opposite direction. A 1.0 percent change in pork supplies will result in about .2 percent change in

Table 3. Average cost and return summaries per breeding ewe by subregions, with wool payment, western commercial sheep businesses, 1974.

| Item | Northern Plains | Plains Wheat Corn | Texas New Mexico | Mountain | Great Basin | California Arizona | Pacific Coast | All Sub Regions |
|---|---|---|---|---|---|---|---|---|
| Average herd size breeding ewes, head | 430 | 234 | 498 | 445 | 619 | 1,052 | 126 | 402 |
| Lamb price, $/cut | 30.29 | 36.37 | 33.13 | 33.55 | 34.78 | 41.86 | 39.82 | 34.63 |
| Average wool price, ¢/lb. | 60.2 | 58.7 | 57.2 | 58.9 | 59.6 | 60.7 | 56.7 | 59.1 |
| Shorn wool payment, % | 21.8 | 21.8 | 21.8 | 21.8 | 21.8 | 21.8 | 21.8 | 21.8 |
| | | | | Dollars | | | | |
| Income | | | | | | | | |
| Shorn wool | 6.14 | 6.28 | 5.37 | 7.23 | 6.20 | 6.23 | 4.84 | 6.21 |
| Lambs | 19.99 | 29.86 | 15.37 | 31.37 | 33.46 | 30.35 | 25.68 | 25.42 |
| Ewes | 1.52 | .83 | 1.72 | 2.95 | 2.03 | 1.44 | .67 | 1.50 |
| Total | 27.65 | 36.9 | 22.46 | 41.55 | 41.69 | 38.02 | 31.19 | 33.13 |
| Shorn wool payment | 1.34 | 1.37 | 1.17 | 1.58 | 1.35 | 1.36 | 1.05 | 1.35 |
| Unshorn lamb payment | .34 | .43 | .24 | .49 | .50 | .38 | .34 | .37 |
| Total | 1.68 | 1.80 | 1.41 | 2.07 | 1.85 | 1.74 | 1.39 | 1.72 |
| Gross income | 29.33 | 38.77 | 23.87 | 43.62 | 43.54 | 39.76 | 32.58 | 34.85 |
| Operating expenses | | | | | | | | |
| Cash costs | 21.31 | 32.06 | 17.49 | 33.32 | 31.04 | 31.51 | 28.16 | 27.44 |
| Depreciation | 3.47 | 2.93 | 3.34 | 3.01 | 3.55 | 3.15 | 3.07 | 3.16 |
| Total | 24.78 | 34.99 | 20.83 | 36.33 | 34.60 | 34.66 | 31.24 | 30.60 |
| Value of family labor | 6.16 | 6.77 | 1.54 | 9.67 | 9.07 | 7.77 | 4.98 | 6.32 |
| Interest on invested capital | 19.36 | 17.38 | 13.88 | 18.93 | 14.93 | 14.06 | 18.15 | 16.94 |
| Total operating expenses | 50.30 | 59.14 | 46.36 | 65.92 | 57.59 | 55.48 | 54.37 | 53.85 |
| Returns | | | | | | | | |
| Return above cash costs | 8.02 | 6.71 | 6.38 | 10.30 | 12.50 | 8.25 | 4.42 | 7.41 |
| Return to family labor and invested capital | 4.55 | 3.78 | 3.04 | 7.29 | 8.95 | 5.10 | 1.35 | 4.25 |
| Return to invested capital | -1.61 | -2.99 | 1.50 | -2.38 | - .12 | -2.67 | -3.63 | -2.07 |

Table 4 -- Estimated income, operating expenses, and returns per breeding ewe, western commercial sheep businesses, 1970-75

| Item | Year[1] 1970 | 1971 | 1972 | 1973 | 1974 | 1975 |
|---|---|---|---|---|---|---|
| Lamb price, dollars per cut | 27.12 | 24.54 | 28.58 | 33.24 | 34.63 | 42.13 |
| Average wool price, cents per pound | 35.5 | 19.4 | 35.0 | 82.7 | 59.1 | 44.7 |
| Shorn wool payment rate, percent[2] | 102.8 | 271.1 | 105.7 | 0 | 21.8 | 61.1 |
| | | | Dollars | | | |
| Income | | | | | | |
| Shorn wool | 3.80 | 2.08 | 3.75 | 8.68 | 6.21 | 4.74 |
| Lambs | 19.93 | 18.04 | 21.01 | 24.40 | 25.42 | 30.93 |
| Ewes | 1.10 | 1.07 | 1.22 | 1.44 | 1.50 | 1.77 |
| Total | 24.83 | 21.19 | 25.98 | 34.52 | 33.13 | 37.44 |
| Shorn wool payment[3] | 3.91 | 5.64 | 3.96 | 0 | 1.35 | 2.90 |
| Unshorn lamb payment[4] | 1.10 | 1.54 | 1.11 | 0 | .37 | .83 |
| Total | 5.01 | 7.18 | 5.07 | 0 | 1.72 | 3.73 |
| Gross income | 29.84 | 28.37 | 31.05 | 34.52 | 34.85 | 41.17 |
| Operating expenses | | | | | | |
| Cash costs | 17.56 | 18.38 | 19.48 | 23.32 | 27.44 | 29.91 |
| Depreciation | 2.02 | 2.12 | 2.24 | 2.69 | 3.16 | 3.44 |
| Operator and family labor | 4.61 | 4.80 | 5.12 | 5.56 | 6.32 | 6.76 |
| Interest on total Invested capital[5] | 10.33 | 11.17 | 12.53 | 14.39 | 16.93 | 20.15 |
| Total operating expenses | 34.52 | 36.47 | 39.37 | 45.96 | 53.85 | 60.26 |
| Returns | | | | | | |
| Return above cash costs | 12.28 | 9.99 | 11.57 | 11.20 | 7.41 | 11.26 |
| Return to operator, family labor and total invested capital | 10.26 | 7.87 | 9.33 | 8.51 | 4.25 | 7.82 |
| Return to total invested capital | 5.65 | 3.07 | 4.21 | 2.95 | -2.07 | 1.06 |

[1] 1974 data are from a field survey. Estimates of income for other years are based on published prices while costs and production are based on adjustments in 1974 numbers by means of published indices and production data.

[2] Difference between the support price of 72 cents per pound and the average market price received by producers as a percent of the average market price.

[3] Income from wool sales multiplied by the shorn wool payment rate.

[4] Total live weight of lambs marketed by the producer multiplied by a fixed payment rate. This rate is determined by taking 80 percent of the difference between the support price for shorn wool and the average farm price for the year and multiplying it by five.

[5] Invested capital per ewe for 1974 is estimated at $150 for land and $55 for livestock and facilities making a total of $205. The interest rate for 1974 is 7 percent.

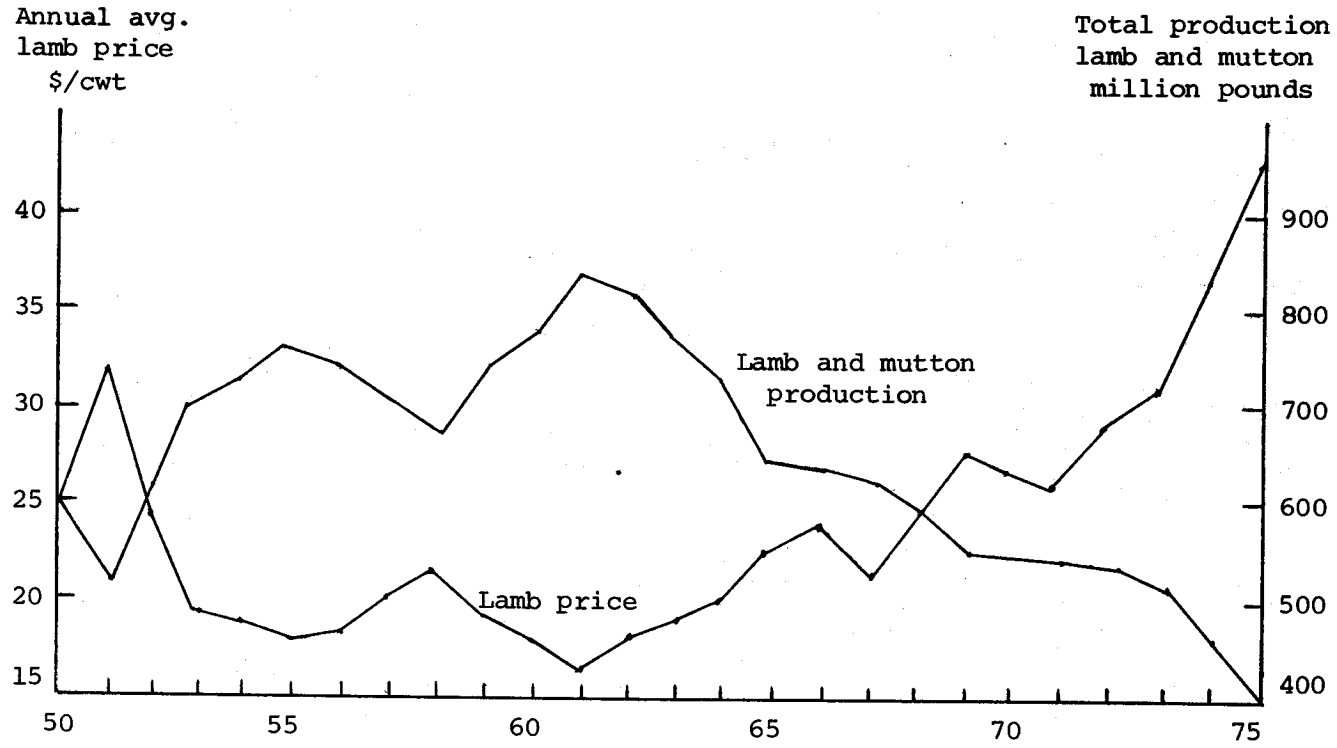



FIGURE 2. Annual average lamb price and total lamb and mutton production, United States, 1950-75.

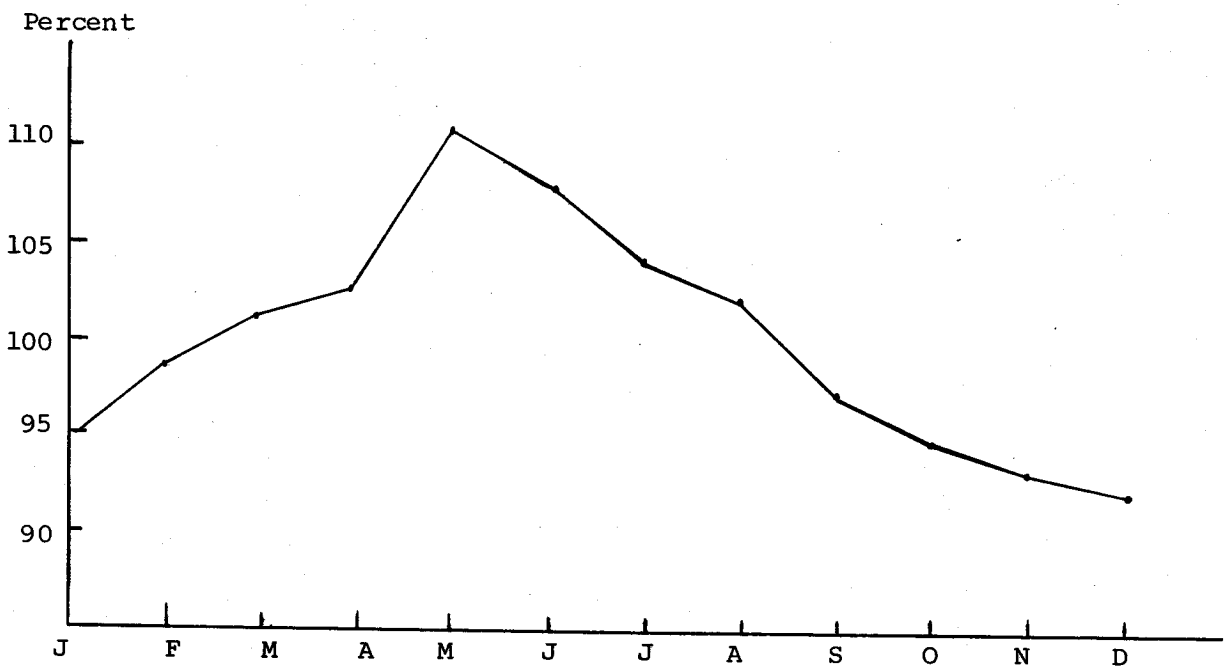



FIGURE 3. Average seasonal index numbers of slaughter lamb prices, 1957-75.

lamb price in the opposite direction. If per capita income in the U.S. rises 1.0 percent, lamb prices might be expected to rise about .2 percent.

## Literature Cited


(1) American Sheep Producers Council, Blueprint, Clearing hurdle to profit with sheep, July 1976.

(2) Gee, C. Kerry and Richard Magleby, Characteristics of Sheep Production in the Western United States, U.S. Dept. Agr., Econ. Res. Serv., Agr. Econ. Rpt. No. 345, August 1976.

(3) _____, and others, Sheep and Lamb Losses to Predators and Other Causes in the Western States, U.S. Dept. Agr., Econ. Res. Serv., Agr. Econ. Rpt. (unpublished).

(4) _____, Lamb and Stock Sheep Losses in the Northcentral States, U.S. Dept. Agr., Econ. Res. Serv., CED, working paper, March 1977.

(5) _____, and others, Factors in the Decline of the Western Sheep Industry, U.S. Dept. Agr., Econ. Res. Serv., Agr. Econ. Rpt . (unpublished).

(6) _____, Enterprise Budgets for Western Commercial Sheep Businesses, 1974, U.S. Dept. Agr., Econ. Res. Serv., Agr. Econ. Rpt. (unpublished).

(7) _____, and Mohammad Usman, Characteristics of Price and Demand for Lamb in the United States, unpublished report.

# Breeding Ewe Lambs: Data from the Union Station

M. Vavra, W. D. Hohenboken, R. L. Phillips and M. M. Wing

Sheep production has become much more intensive today than in past years. The main goal in a sheep operation is lamb rather than wool production as was the case historically. As one method to improve efficiency commercial sheep producers have started to breed ewes as lambs rather than waiting until they are yearlings. There has been some question as to whether this actually is beneficial or if breeding ewes as lambs has a detrimental effect on annual and lifelong production. Also there is some question as to the future production of a ewe exposed to breeding as a lamb and does not conceive; then bred later as a long yearling. This study was conducted to evaluate the influence of lambing first as a yearling versus lambing first as a two-year old. The effects on lamb production as a two-year old, lifetime production, culling and death rate, and wool production were compared. Additionally, ewes exposed to rams at 7 months of age were categorized according to whether they did or did not lamb successfully at one year of age. The two groups were compared for the same production variables as mentioned above, to determine whether ewe lamb fertility was predictive of future lamb or wool production.

## Materials and Methods

Grade Columbia and Targhee ewes born during 1966 through 1970 were used in the experiment. Each year, ewe lambs were selected at weaning on the basis of type of birth and age-adjusted weaning weights. In September of each birth year, the ewes were randomly divided within breed into two groups: mated to lamb first at one year of age or mated to lamb first at two years of age. Ewes that were exposed to the ram as lambs were then classified into two groups--those that lambed as yearlings and those that did not. Nutrition and management of all the ewes was similar among groups except during the period following lambing when dry ewes were separated and fed less than those lactating. Annual production of lamb and grease wool was recorded for each ewe through 1974 or until she died or was culled.

Ewes were managed as a typical intermountain area farm flock. Ewes bred at seven to eight months of age were exposed to Cheviot or Dorset rams from September 20 to November 1 each year. For all matings of yearling and older ewes, rams of the same breed as the ewes (Columbia and Targhee) were used with mating from August 15 to November 1. Lambing was from January through March. Lambs were weaned at approximately 90 days of age, although there was some variability from year to year. The different breed and age groups were always managed alike within years, however. Throughout most of the year, both ewes and lambs were run on dryland or irrigated pastures or on hay stubble. Supplemental feeding of hay or hay plus grain was necessary during late gestation and early lactation.

## Results and Discussion

Of ewes exposed to rams at seven months of age, 58 percent of Targhees and 67 percent of Columbias lambed. Conception rate of ewe lambs, then, was much lower than that expected from mature ewes.

Table 1 presents data on production at two years of age for ewes mated to lamb first at one vs. two years of age. There was no difference in twinning rate between the two groups, but the early lambing ewes raised slightly more lambs and pounds of lamb than the later bred group. The greater production of ewe lambs can be attributed to better mothering ability and increased milk flow as two-year olds because of "experience" gained in the first lamb crop and mammary development of a previous lactation.

Table 1. Means for the age at first lambing effect on ewe production at two years of age.

| Group | No. of Lambs Born | No. of Lambs Weaned | Lb. of Lamb Weaned | Lb. of Wool Produced | Ewe Weight (lb.) |
|---|---|---|---|---|---|
| Ewe Lambs | 1.31 | 1.14 | 83.3 | 11.2 | 160.5 |
| Yearlings | 1.31 | 1.02 | 75.0 | 11.5 | 159.4 |

Cumulative production based on the number of ewes entering the experiment from 2½ through 6½ years of age is presented in table 2. The ewe lambs produced and weaned more lambs and more pounds of lamb but slightly less wool than did the yearlings.

Percentage of ewe lambs versus yearlings entering the experiment and still present after 2½ through their final year of potential production in the study were calculated. For 1967, 1968 and 1969, there was no consistent difference between culling and death rate of ewe lambs versus yearlings. The 1970 birth year group had the fewest years potential. The yearlings in this age group were removed from the study at a slightly faster rate than the ewe lambs. Only in the 1966 birth year group did the yearlings have a lower attrition rate than the ewe lambs. The data in table 2 then, is biased at 6½ years because of the influence of the 1966 group and the lack of influence (they were too young) of the 1969 and 1970 groups.

Table 3 lists performance of ewes able versus unable to lamb at one year of age (based on the number of ewes entering the experiment). Ewes that did lamb as yearlings ("Yes Group") produced more lambs per year through four years of age than those that did not ("No Group"). Also, the "Yes Group" weaned more lambs and pounds of lamb than did the "No Group". Ewes lambing as yearlings were the best wool producers as well. Data for number of lambs born, weaned, pounds of lamb weaned and pounds of wool produced were then divided by the number of ewes present at lambing. Ewes in the "Yes Group" again produced more lamb and pounds of lamb than the other group. Ewes not lambing as yearlings did produce slightly more wool.

These data indicate that the ability of a ewe to lamb as a yearling is an excellent selection tool. Ewes that are unable to lamb as yearlings produce less lamb throughout their lives and are culled or die at a more rapid rate than those lambing as yearlings. An ideal management situation is to expose ewe lambs to rams and then pregnancy test at the appropriate time and sell open ewes as old crop lambs.

## Summary

Managing ewes to produce lambs at one year of age has proven to be a feasible practice. Conception rate of ewe lambs is lower than that of mature ewes so approximately 40 percent more ewe lambs should be kept as replacements through the breeding season. After breeding, the ewes can be pregnancy tested at the appropriate time and those that are open can still be sold as old crop lambs. The ewe lamb group in this study produced more lambs and pounds of lamb than the yearling group through the production years studied. Wool

production was similar between groups through 4½ years and from then on favored the yearling group. Of ewes exposed to the ram as lambs, those that lambed as yearlings were consistently better producing ewes throughout their lives and were culled or died at a slower rate than those exposed as lambs but not conceiving. Changes in management strategy of a sheep flock are in order where ewes are bred as lambs. Considerations include pregnancy testing, improved nutrition of young ewes, and more intensive management when the yearlings are lambing.

Table 2. Means for the effect of age at first lambing on lamb and wool production from 2½ through 6½ years of age.

| | 2½ | 3½ | 4½ | 5½ | 6½ |
|---|---|---|---|---|---|
| Number of lambs born | | | | | |
| ewe lambs | 2.13[a] | 3.27 | 4.27 | 5.08 | 5.63 |
| yearlings | 1.29 | 2.41 | 3.51 | 4.34 | 5.21 |
| Number of lambs weaned | | | | | |
| ewe lambs | 1.78 | 2.68 | 3.55 | 4.13 | 4.52 |
| yearlings | 0.96 | 1.80 | 2.65 | 3.39 | 4.06 |
| Pounds of lamb weaned | | | | | |
| ewe lambs | 104.7 | 174.8 | 242.1 | 287.7 | 315.7 |
| yearlings | 70.5 | 143.3 | 202.6 | 264.3 | 313.6 |
| Pounds of wool produced | | | | | |
| ewe lambs | 20.7 | 31.5 | 37.5 | 40.1 | 44.8 |
| yearlings | 20.5 | 30.4 | 37.5 | 42.3 | 49.2 |

[a]Means are expressed cumulatively on a per ewe entering the experiment basis.

Table 3. Effects of ability vs. inability to lamb at one year of age on ewe productivity per ewe entering the experiment.

| | Number of Lambs Born | | | | Number of Lambs Weaned | | | | Pounds of Lamb Weaned | | | | Pounds of Wool Produced | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2[b] | 3 | 4 | C | 2 | 3 | 4 | C | 2 | 3 | 4 | C | 2 | 3 | 4 | C |
| Yes[a] | 1.30 | 1.20 | 1.17 | 3.78 | 1.10 | 1.09 | 1.05 | 3.24 | 79.59 | 82.89 | 81.35 | 243.83 | 11.02 | 10.58 | 8.38 | 29.98 |
| No | 1.30 | 1.04 | .77 | 3.20 | 1.10 | .71 | .59 | 2.40 | 80.03 | 58.64 | 44.75 | 183.42 | 11.90 | 8.38 | 6.39 | 26.68 |
| Overall Average | 1.30 | 1.12 | .97 | 3.49 | 1.10 | .90 | .82 | 2.82 | 79.81 | 70.77 | 63.05 | 213.6 | 11.46 | 9.48 | 7.50 | 28.44 |

[a]Yes and no denote ability vs. inability to lamb at one year of age, respectively.

[b]2nd, 3rd, 4th production years and cumulative observed through fourth production year.

# GRASS STRAW IN FINISHING RATIONS FOR LAMBS AND CATTLE

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## Use of Ryegrass Straw in Lamb Finishing Rations

Straw is a roughage that is not commonly fed to sheep in many areas and only very rarely has straw been used in finishing rations for lambs. The reason, of course, is that straw is not especially palatable to sheep and it is not highly digestible. As a result, the animal does not obtain much energy from it and performance is apt to be poor.

Poor quality roughages such as straw can be used in larger amounts when rations are pelleted. The reason for this is that the roughage is more dense after pelleting, particle size is smaller, and animals will eat more when roughage is pelleted because they like the physical texture of pellets and the material passes through the stomach more rapidly, thus allowing greater consumption. Experiments with pelleted rations made up of alfalfa, barley and molasses or similar ingredients have shown that maximum gain can be achieved when pelleted rations contain about 25-30% concentrate. Feed conversion may be improved with more concentrate, but gain normally will not be any greater.

### Experiment I, Pelleted Rations

Data were not available on rations which included pelleted grass straw; consequently, an experiment was designed and carried out to evaluate high levels of straw with two different protein supplements.

The rations which were used in this experiment are shown in Table 1. The control ration (#1) contained 60% annual ryegrass straw. The other ingredients, such as barley and molasses, are more or less standard items. Some wheat millrun was added to enhance the binding properties of the mixture since it is almost impossible to make good pellets from rations that contain high percentages of roughage, such as straw, and ruminant animals normally will not eat the fines unless forced to do so.

No supplemental protein was added to the control ration and the crude protein level (8.1%) is definitely too low for maximal lamb performance on rations containing much less roughage. This ration, as well as the others, was processed and pelleted into 1/2 inch pellets at the O.S.U. Experimental Feed Mill.

Ration #2 contained the same ingredients as #1 except that soybean meal was added to increase the protein level. Enough soybean meal was added initially to bring the protein level to 13.4% for the first three weeks. For the remainder of the feeding trial the amount of soybean meal was reduced to give a ration with about 11% protein. Similarly, ration #3 contained added urea to give 13.4 and 10.9% rations. After addition of the soybean meal in ration #2, straw made up 51.0-55.2% of the ration; in ration #3, straw made up 58.6-59.2% of the ration.

The lambs used in this experiment were typical of western Oregon feeder lambs. Most were Suffolk or Suffolk cross wether lambs. Some had lung worms. All lambs were drenched with Thibenzole before the experiment began and all lambs had been shorn recently. Lambs were allotted to treatment on the basis of body weight. There were 20 or 21 lambs on each ration.

Data on gain and feed conversion are shown in Table 2. In this table, gain and feed conversion are shown on the basis of live weight and as calculated when using a final weight

obtained by dividing carcass weight by 0.5. The value of 0.5 was used because a rather typical carcass yield for a lamb when slaughtered is about 50% of live weight.

Lambs consuming high roughage rations such as these normally have a tremendous fill in the stomach and gut as compared to lambs fed rations with moderate amounts of roughage or good quality roughage. Thus, if actual final weight is used, it tends to exaggerate the gain and greatly improve feed conversion. Consequently, the data derived by using carcass weights are probably more realistic values.

As shown in Table 2, lambs fed ration #1 gained less and had the poorest feed conversion of the three groups although the differences in gain were not statistically different because of the variation within the different treatments. This poor response is a reflection of an inadequate protein consumption. In addition, there were more lambs (4) which did very poorly on this particular ration. When the basal ration (#1) was supplemented with soybean meal (ration #2), gain was improved appreciably and feed conversion was much better. Supplementing with urea improved gain and feed conversion, but less than with soybean meal. There were no appreciable differences in carcass quality as most lambs graded USDA Choice.

On the basis of the feed prices which prevailed at the time (1973), the costs of gain were (carcass basis): #1, $21,38; #2, $24.55; and #3, $16.90. Thus, even though the urea-fed lambs did not do as well as those supplemented with soybean meal, the cost was much less. Unfortunately, no comparative data are available on similar lambs fed more typical finishing rations. However, these costs would have been very competitive at that particular time and the results suggest that moderate to medium levels of straw could well be used in pelleted rations for finishing lambs.

Experiment II, Cubed Rations

An experiment was initiated in the summer of 1976 to evaluate high straw rations for finishing Western Oregon lambs. The composition of the rations is shown in Table 3. A ration containing 30% ground barley and 70% chopped alfalfa hay was used for comparative purposes. The other rations contained 50% straw or processed straw. Dried whey was added as a binder, cottonseed meal as a source of supplemental protein and phosphorus, and barley was added for additional energy.

A simplified cubing machine* was available for making cubes 2" square and all rations used were mixed and cubed with this machine by Straw Utilization Center personnel. These cubes, although of a satisfactory size for cattle, were too large for the lambs or, if some of the concentrate was inadequately mixed, they were too hard. Consequently, the cubes were put through a forage harvester to break them up without further reducing particle size of the processed feed. It was necessary to hammermill part of the rations during the latter part of the feeding trial. When this was done, consumption was reduced.

In ration #2, untreated perennial ryegrass straw was added at a level of 50% of the total ingredients. In ration #3, part of the straw (8% of total ration) was replaced by defiberized straw. This material is produced by moistening and heating the straw and grinding it in a machine which has a rotating disk. The straw passes between the disks and is then collected and dried or mixed wet with the remainder of the straw before grinding and mixing. This process breaks up the cells of the straw and should result in increased digestibility by the lambs.

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*The cubing machine was an experimental model produced by the California Pellet Mill Co. based on a South African design.

It also increased the bulk density of the cubed feed by 15-20%.

In ration #4 the straw was treated with a 30% solution of sodium hydroxide (lye). The amount was equivalent to adding 4% of the dry weight of the straw. A number of different reports have shown that this process increases digestibility by a substantial amount, sometimes as much as 50%.

The lambs which were used in this experiment were fairly typical of Western Oregon feeder lambs. They were a mixture of wethers and ewe lambs and most were Romney or Romney x Suffolk crosses. They ranged in size from 47 to 90 lb. with an average of about 71 lb. Some had lung worms. Before the experiment started all lambs were drenched with Thibenzole for stomach worms and they were shorn. Lambs were randomly allotted to pens and pens to rations. They were two pens of 12 or 13 lambs on each ration. Lambs were weighed at weekly or biweekly intervals and they were topped out when they were judged to be fat enough to grade choice. The lambs were slaughtered and processed at the O.S.U. Meat Sciences Laboratory where data were collected on carcass weights, fat cover over the loin and percent kidney fat.

Some of the data collected on the lambs are shown in Table 4. The performance of the lambs on the alfalfa-barley mixture was rather disappointing. It was anticipated that they would gain more than 0.4 lb. per day on this ration, but consumption was low and performance suffered as a result. Moisture from a damp summer harvest is a likely cause, although precautions were taken to dry the ration after cubing.

Differences in gains between the three straw rations (2,3,4) were not statistically different because of the great variability within the different treatments. Lambs on the untreated straw (#2) gained less and feed conversion was the poorest, but this type of performance was anticipated since the digestibility of straw is low and the lambs simply could not eat enough to gain at a high rate. A few lambs did very well as indicated by the upper level on range in liveweight gain (0.463 lb/day).

The addition of 8% of the defiberized straw resulted in a slight improvement in gain and an improvement in feed conversion, but the improvement would not be nearly enough to pay for this type of processing. Treating the straw with lye resulted in the best gains (avg. 0.393 lb/day) and the highest gain of any individual lamb (0.617 lb/day) as well as a considerable improvement in feed conversion.

There was not much difference in thickness of back fat, although the straw-fed lambs had less than the controls (alfalfa-barley) but their carcass weights were lower also. Kidney fat was less in lambs on ration #2 (untreated straw).

No unusual problems were encountered with this ration or any of the others, although water consumption was much higher by lambs receiving the lye-treated straw. Several lambs had rectal prolapses, but there was not any indication that any particular ration caused more than others.

Data on feed costs and cost per lb. of gain (Table 5) are rather high. With a more normal feed conversion for the alfalfa-barley mixture, feed costs per lb. of gain would have been 45-50¢. The high feed conversion coupled with the rather poor gains resulted in very high costs for all of the rations containing straw, particularly for the two which did not contain hydroxide-treated straw.

There was a fair amount of waste, so the feed conversion values are exaggerated. In the previous experiment in which a 60% straw ration was pelleted, feed conversion for the ration with adequate protein was better than any of these rations except the

hydroxide-treated straw. Less waste may have been one reason.

It is likely, although unsubstantiated, than an amount more on the order of 20-30% grass straw would be more suitable for use with lambs. A recent report from Washington (Hackett et al., J. Anim. Sci. 41:335) gave data on lambs fed pelleted rations containing 100% alfalfa; 75% alfalfa, 25% wheat straw; 50% alfalfa, 50% wheat straw; and 25% alfalfa, 75% wheat straw. Daily gains reported were, respectively: 0.37, 0.31, 0.19 and 0.18 lb/day. This report, thus, indicates that 25% wheat straw could be used in pelleted rations for lambs without causing much reduction in daily gain.

It also seems likely that it would be feasible to utilize some hydroxide-treated straw at a level of 20-30% in finishing rations. This ration produced rather good results, as compared to the others, and it has been demonstrated that digestibility of hydroxide-treated straw is much improved over untreated straw. Overall, the feasibility of using hydroxide-treated straw will depend on the processing costs and the total cost as compared to alternates such as alfalfa hay.

Table 1. Ration composition of high-straw pelleted rations.

| Ingredient | Ration No., lbs. | | |
|---|---|---|---|
| | 1 | 2 | 3 |
| Ryegrass straw, gr | 1200 | 1200 | 1200 |
| Alfalfa hay, gr | 100 | 100 | 100 |
| Barley, gr | 350 | 350 | 350 |
| Wheat mill run | 200 | 200 | 200 |
| Molasses, cane | 150 | 150 | 150 |
| Soybean meal | --- | 350-170* | --- |
| Urea | --- | --- | 40-21* |
| Mineral supplement | --- | 3 | 7 |
| Antibiotic (TM-10) | 1 | 1 | 1 |
| Total | 2001 | 2354-2172 | 2048-2026 |
| Estimated Composition | | | |
| Crude Protein, % | 8.1 | 13.4-10.9 | 13.4-10.9 |
| Ca, % | .53 | .49-.51 | .52-.53 |
| P, % | .32 | .39 | .39 |

*Rations with greater amounts of SBM or urea were fed for three weeks and the others for the remaining feeding period (max. of 49 days).

Table 2. Performance data of lambs fed pelleted high-straw rations.

| Lamb performance | Ration No. | | |
|---|---|---|---|
| | 1 | 2 | 3 |
| Daily gain, lb/day | | | |
| Live basis | .468 | .635 | .631 |
| Carcass basis,* | | | |
| all lambs | .258 | .413 | .318 |
| very poor doers out | .304 (4) | .413 (0) | .334 (1) |
| Av. feed/day | 4.21 | 4.49 | 4.36 |
| Feed conversion | | | |
| Live basis | 9.00 | 6.70 | 6.62 |
| Carcass basis | 16.51 | 10.64 | 13.06 |

*Final live weight was calculated by dividing carcass weight by 0.5.

Table 3. Rations fed to experimental lambs.

| Ingredient | Ration Number, % composition | | | |
|---|---|---|---|---|
| | 1 | 2 | 3 | 4 |
| Alfalfa hay | 70 | | | |
| Barley, gr. | 30 | 28.75 | 28.75 | 28.75 |
| Dried whey | | 2.5 | 2.5 | 2.5 |
| Cottonseed meal | | 18.0 | 18.0 | 18.0 |
| Limestone | | 0.75 | 0.75 | 0.75 |
| Untreated perennial ryegrass straw | | 50.0 | 42.0 | |
| Defiberized ryegrass straw | | | 8.0 | |
| Hydroxide-treated ryegrass straw* | | | | 50.0 |

*Sodium hydroxide (lye) was added as a 30% solution, equivalent to 4% hydroxide of the weight of straw.

Table 4. Performance data on lambs finished on high straw rations.

| Roughage source in rations | No. of lambs | Live weight, lb | | Cold carcass weight, lb. | Days on feed | Daily gain* | | Av. feed consumption, lb. | Feed conversion | Back fat, in. | Kidney fat, |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Initial | final* | | | Av. | Range | | | | |
| Alfalfa | 25 | 71.0 | 94.2 | 47.1 | 83.6 | .278 | .128-.390 | 3.77 | 13.6 | .285 | 3.35 |
| Untreated ryegrass straw | 25 | 73.4 | 88.8 | 44.4 | 61.9 | .249 | .064-.463 | 4.97 | 20.5 | .218 | 2.56 |
| Straw + defiberized straw | 23 | 71.2 | 90.3 | 45.1 | 64.1 | .298 | .083-.500 | 4.73 | 16.3 | .223 | 2.89 |
| Hydroxide-treated straw | 25 | 69.9 | 92.5 | 46.2 | 57.4 | .393 | .154-.617 | 3.65 | 9.7 | .223 | 2.86 |

*Final weight was calculated from carcass weight by dividing by 0.5; daily gain was calculated using data obtained in this manner. This procedure eliminates wide differences in stomach and gut fill which are common on rations of this type.

Table 5. Costs of rations fed to lambs (July 1976).

| Ingredient | Unit Cost $/cwt | Ration number, $/cwt | | | |
|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 |
| Alfalfa | 3.60 | 2.52 | | | |
| Barley, gr. | 7.20 | 2.16 | 2.07 | 2.07 | 2.07 |
| Cottonseed meal | 11.75 | | 2.12 | 2.12 | 2.12 |
| Dried Whey | 6.00 | | .14 | .14 | .14 |
| Limestone | 2.50 | | .02 | .02 | .02 |
| Untreated perennial ryegrass straw | 1.25 | | .63 | .53 | |
| Defiberized ryegrass straw | 10.72 | | | .86 | |
| Hydroxide-treated ryegrass straw | 2.26 | | | | 1.13 |
| Cubed bulk density, | lb/CF | 15 | 14 | 19 | 19 |
| Total ingredient cost, | $/cwt | 4.68 | 4.98 | 5.74 | 5.48 |
| | $/ton | 93.60 | 99.60 | 114.80 | 109.40 |
| Estimated production cost | $/ton | 10.00 | 10.00 | 10.00 | 10.00 |
| Total cost at plant, | $/ton | 103.60 | 109.60 | 124.80 | 119.40 |
| Feed conversion, lb. feed/lb. gain | | 13.6 | 20.5 | 16.3 | 9.7 |
| Ingredient cost of gain, $/lb. | | .70 | 1.12 | 1.02 | .58 |

# MARKETING FORAGE THROUGH SHEEP

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Managing pastures using sheep as a primary grazing animal holds great potential in western Oregon. The forage and sheep production pattern and the market for spring lambs all combine well most of the time. Consistently obtaining market-ready lambs before forage quality and price both decline are major objectives of sheep producers. Achievement of these objectives requires sound management skill in integrating one's forage and sheep management program.

Let us assume that the objective is to have lambs reach 100 pounds or more live weight at choice grade by or before June 15. And, to the greatest extent possible, forage should be utilized in the program. This does not mean that lambs would not be creep fed or that early weaning would not be practiced with or without continued supplementation. To meet this kind of objective, lambs have to be born early and grow rapidly. Ewes must milk well and long. Thus, usable abundant forage is desirable from shortly after birth to market time.

About 50% of the seasonal forage growth occurs in May with little or no rapid growth before early March in southwestern Oregon and early April in the Willamette Valley. Lambs have the capability to reach market weight and finish on forage alone. Also, they can very efficiently convert high energy feeds to growth at young ages. Thus, finishing programs using other feeds along with forage can also be designed to take advantage of this capability.

Matching animal demand and seasonal forage supply is an objective that is difficult to do on a year around basis from grazed pasture forage alone. Several different approaches can be taken to obtain optimum use of the pasture resource with productive animals. Most programs incorporate supplemental feeding of ewes on pasture during late pregnancy and ewes and young lambs prior to going on to spring pasture. Supplemental feed ranges from hay cut from the pastures the previous year to purchased feeds of all kinds (hay, crop byproducts, concentrates, molasses, as examples). At least three alternatives exist to winter feeding: (1) renting pastures such as grass-seed fields, (2) growing supplemental forage such as annual ryegrass and (3) reducing stocking rates on pasture in winter.

Pastures must be composed of nutritious, rapidly-growing species in order for sheep to make maximum gains. Subclover and, on some sites, white clover, are the keys to high pasture production unless one wishes to resort to annual nitrogen application. Associated preferred perennial grasses such as perennial ryegrass and orchardgrass provide a productive environment for sheep raising.

Currently, no perennial forage species or subclover makes sufficient winter growth to provide as much forage as is required for January and February born lambs stocked at other than low levels. Need exists for such plant species.

Unimproved pastures can have an important role in a year around sheep operation but do not support good lactation. Grazing to obtain good resource use would be confined to the post-weaning to prelambing period, about 7 months. Special care would be necessary during flushing and breeding to insure high conception rates.

Productivity of improved pastures varies widely, but production of forage is not generally the major problem. Being able to make efficient and effective use of the forage that is produced is far more important. Consequently, designing programs which take advantage of the seasonally humid western Oregon environment offers great challenge to the enterprising sheep producer.

Grazing animals are both tools in forage management and producers of products usable for man. With sheep, the ewes and lamb phase is critically important in order to obtain maximum monetary return. This phase should be scheduled to take maximum advantage of growing season. During the remainder of the year, except for breeding season, dry ewes can be very successfully used as forage management tools.

A primary program ingredient is stocking rate high enough to safely utilize all the forage produced, yet allow the sheep to make optimum growth when needed. From a practical viewpoint this means something different each year since weather fluctuations determine how much and when forage will be produced. Since each set of circumstances is different, only two will be contrasted. Both embody the same general thesis: that forage should be managed so that subclover can germinate and establish well each fall. This means that most all of the forage crop will be removed by early to mid-October so that subclover can re-establish itself over the maximum proportion of the pasture. Newly-germinating subclover seedlings must receive high amounts of light or will not become successfully established.

Yearly fluctuations in germinating times have to be considered (contrast the fall conditions in 1974, 1975, 1976).

The two sets of circumstances refer to the manner in which the growing and non-growing season forage supply is managed. Most ranches are composed of varying proportions of land which can be hayed. With a high proportion, the producer should cut enough hay to leave that amount of pasture necessary to carry ewes from haying time to October. One rather simple and straight forward way of doing this is to graze all pastures until early to mid-April. At that time decide how many pastures should be "closed" to stock and left for hay. Double up on stock numbers in the remaining pastures since this is the middle of the growing season and forage will be growing more rapidly than it can be consumed. If by haying time conditions have significantly changed,

more or less hay than planned could be cut. This will put extra hay in the barn or for sale in some years and vice versa in others. It should give maximum flexibility to a forage operation.

Many owners have only a small portion of their holdings that can be hayed and these areas are usually cut each year. If one assumes that the hayland is producing at its maximum, what other practices could be used to add management flexibility? In most circumstances, moderate to steep hill pastures constitute the remainder of the land and forage resources. Excess forage must be removed by mid-October for the clover to germinate and establish. One can either: (1) stock with sheep high enough to use most all of the forage by October and then supply a greater amount of fall to spring feed or (2) stock at a lower rate with sheep and either graze the excess with cattle in summer or burn it off just before fall rains. Dry cows which will fall calve would work well. Dry summer forage will provide adequate nutrition for dry cows but not for nursing cows or yearlings. Some provision must be made for winter nutrition regardless of the stocking level used.

At present, very little is known about effect of fall and winter grazing on subsequent growth of pasture. Research near Corvallis on stocking rates (reported in the 1975 Sheep Day Proceedings) concluded that 4 ewes per acre on subclover-perennial ryegrass could safely be carried from spring through fall. However, at a heavier rate, 5 ewes per acre, the turn-out date in spring became progressively later each year. Carbohydrate accumulation studies on perennial ryegrass roots and crowns did show lower total carbohydrate levels on the heavily-stocked pastures. There was a tendency for fall-protected plants to have higher carbohydrate amounts, but the difference was not clear cut.

Since early spring forage growth is probably the most valuable of the season, management to produce this effect needs to be developed. Limited success has been attributed to nitrogen applications but cost-benefit relationships are not consistent. Special purpose pastures such as annual ryegrass, turnips or other brassica crops can provide forage in March when conditions are favorable. Many ranches, unfortunately, do not have sites conducive to this.

The forage production pattern of subclover and perennial grasses can be capitalized upon with grazing sheep. Much room exists for innovative management, but the rewards will make it worthwhile.

# BRUSH CLEARING ON SOUTHWESTERN OREGON HILL PASTURES WITH SILVEX

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and
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## INTRODUCTION

Brush invasion of hill pastures is a major problem encountered by southwestern Oregon livestockmen. About 200,000 acres of hill land in the two-county area (Coos and Curry) is used for grazing and is subject to brush invasion.

The climate of the area is mild, allowing 12 month grazing with a minimum of livestock supplemental feeding. Rainfall averages 65 inches annually with over 90 percent falling from October through May.

Unimproved pastures of the area support less than one-half ewe per acre per year. Hill pastures seeded to subclover (Trifolium subterranean) and perennial ryegrass (Lolium perenne), where fertilized with phosphorus, sulfur and molybdenum, are capable of supporting 2 to 3 sheep per acre per year. Air dry forage production can exceed 5000 pounds per acre annually. Heavy grazing pressure on well managed hill pasture will control weed and brush species in early stages of growth.

## METHODS AND MATERIALS

Brush spraying trials on the Jack Warner ranch near Gaylord in 1969, in cooperation with Rex Warren, Oregon State University Extension weed specialist, demonstrated that picloram as Tordon 212 and Tordon 22K and silvex as the propylene glycol butyl ether ester (low volatile) provided excellent control of brush species common to the area. Silvex was preferred because it had no adverse effect on subclover growth during the growing season following spraying.

Information available indicates brush invasion of well established subclover hill pastures can be controlled by: 1) spraying with silvex to kill competing brush species, 2) fertilizing to promote maximum pasture growth and 3) fencing so grazing pressure can be applied to prevent regrowth. To demonstrate this technique, a 30 acre site on the Jack Warner ranch was selected for the project. Brush species on the pasture included poison oak, Rhus diversiloba; chapperal broom, Baccharis pilularis; willow, Salix lasiandra; Pacific Madrone, Arbutas menziesii; blue blossom, Ceanothus thyrsiflorous; Himalaya blackberry, Rubus procerus; tansy ragwort, Senecio jacobaea; and California Hazel, Corylus cornuta.

Silvex at the rate of 2 2/3 pounds per acre in ten gallons of spray per acre was applied to the area on June 17, 1973. Chemical for the trial was provided by Dow Chemical USA through Van Waters and Rogers, Inc., Eugene, Oregon. Rancher Jack Warner provided the land and agreed to fence and plan a fertilizer program with Lynn Cannon, Coos County Extension Agent, to control brush regrowth and utilize forage grown.

In 1973 120 lbs. of 0-36-0-20S plus molybdenum fertilizer was applied aerially. Annual application of 100 lbs. of 0-36-0-20S has been made in the fall beginning in 1974.

To obtain complete utilization of forage grown and prevent brush reestablishment, two to three hundred head of sheep were grazed on the area each year during the period May to mid-July. For the remainder of each year, the area was rotationally grazed with 30 to 100 ewes.

The pasture was burned in September, 1974, 15 months after spraying. Following burning the area was seeded with a mixture of perennial ryegrass (Lolium perenne)and tall fescue (Festuca arundinacea var. Fawn). No clover was included because the soil contained an ample amount of subclover, (Trifolium subterraneam),seed.

The area is fenced from the adjoining 160 acre pasture. The total grazing area in the farm is about 700 acres.

## RESULTS

TABLE 1 - Carrying capacity of range pasture in Coos County before and after brush control, seeding and fertilizing.

| Year | Management Practice | Ewes/Acre |
|---|---|---|
| 1972 | Before treatment | 0.83 |
| 1973 | Treated June 19 | 0.83 |
| 1974 | Burned, seeded, controlled grazing | 1.02 |
| 1975 | Fertilized, controlled grazing | 1.54 |
| 1976 | Fertilized, controlled grazing | 1.85 |

The increased carrying capacity obtained by the brush control program resulted in $67.00 more income per acre for the 3 year period. The 1976 income per acre reached $69.00 per acre, a $38.00 per acre increase over untreated land.

Evaluation of the effects of the spraying and burning were made in 1975. The spray was more than 95 percent effective against poison oak (Rhus diversiloba),chapparal broom (Baccharis pilularis),and blue blossom (Ceanothus thyrsiflorous). Control of Pacific madrone (Arbutas menziesii) was less than 50 percent.

Field days for farmers to observe the results of the spraying, fertilizer, and grazing management have been held each year. As a result of this work six ranchers sprayed 500 acres of brush subclover hill pasture land in June, 1976. Additional acreages will be sprayed as livestock market conditions improve.

## CONCLUSIONS

Brush control was excellent throughout the area except in spots that were missed in the aerial application. The few skips in the application illustrated the effectiveness of the herbicide on brush. The subsequent management plan of the pasture, which included burning followed by heavy grazing, increased the carrying capacity of the area 2¼ times over its previous capacity. The cost of less than $18.00 per acre for spraying was more than returned to the farmer from the increased carrying capacity after two years.

Because of their different forage preferences the use of both cattle and sheep gives the best utilization of the forage and control of brush regrowth.

The fencing of the pasture and removal of the brush greatly improved the ease with which livestock can be managed in the total ranch operation. The importance of fencing for grazing management cannot be over-stressed. The combination of spraying, fencing, fertilizing and heavy grazing is necessary if the control effort is to be successful.

This system of pasture development involves a minimum of effort and expense and can be incorporated into the existing operation without major changes.

# FORAGE MANAGEMENT WITH SHEEP ON THE HIATT FARM

Robert C. Hiatt
Washington County Sheep Producer

Like everyone else, I, with all sheepmen, am in a cost squeeze. In 1960 my wife and I, along with our family started our sheep operation in a serious manner. I had 125 ewes, and had been keeping less than 40 since starting in 1950. We felt that expansion was possible, even though I would stay fully employed off the farm. Remember, wheat prices were low in the early sixties. I was challenged to produce income comparable to my neighbors' wheat income on a per acre basis with sheep. My farm has 40 acres of prime Tualatin valley farm land.

I believe the key to money in sheep is harvesting the maximum production per acre and using crop bi-products that make sheep feed. First, a farmer growing the maximum forage per acre; and second, a sheep rancher harvesting this forage in the most efficient way possible.

With this philosophy in mind, let's look at some of the management techniques I used to work towards this accomplishment. To increase forage per acre, I consulted the O.S.U. Extension Service. We used soil test recommendations to improve soil fertility and established new pastures with recommended forage varieties. Most pastures have required applications of between one and two tons of lime per acre. However, small amounts if any, of additional fertilizers are needed; particularly phosphorus and potassium. The reason for the lack of additional fertilizers is felt to be, that the annual nitrogen cycle brought about by the intensification and high stocking of sheep, has finally started to show its effect.

Since 1960 we have built our flock from 125 to the present 320 ewes. This increase was made possible due to the addition of irrigation. With the increased stocking rate, this has also increased the amount of urine and dung returned to the soils.

As we have continued soil tests, we have consistently noted a gradual increase in phosphorus and potassium levels. O.S.U. Soil Specialists cooperating with John Leffel, our Extension Agent, have conducted a number of fertilizer and grazing trials on our farm. In a trial five years ago, using high rates of nitrogen, in an attempt to get grasses started earlier in the spring; the main deficiency observed was sulfur. Since that time, I have followed an annual application of approximately 40 lbs. of nitrogen and 20 to 30 lbs. of sulfur, either using ammonium sulfate or urea-sol. I'm also using some 16-20.

I plow up old pastures as they become less productive; and seed an annual forage crop, such as rape, and annual rye grass, or rape and sudan grass, or sudan grass alone. After two seasons of annual cropping, I reseed my pastures using varieties such as, New Zealand white clover, sub-clover, fawn fescue, orchard grass, and perennial rye. I usually seed this pasture mix in early May, including about 2 lbs. of rape seed per acre.

I am able to use this annual

crop combination with permanent pasture establishment because I have irrigation. We only have enough water for 15 to 20 acres so I utilize the irrigated pastures for lamb feed. By the 4th of July we have lamb feed on the newly seeded pastures. With careful grazing, fertilization and irrigation we have a lot of lamb feed and a well-established pasture by fall.

Three years ago I started feeding cull onions and tops. I am now noticing an increase in fertility where I've spread residues from the onions. Onions require high fertility to grow, and with this bi-product I get some of the onion growers topsoil along with the onion waste on my pastures.

In order to make the best use of my pastures, I have divided our acreage into 2 1/2 and 5 acre plots. This enables us to better utilize the pastures, as well as better management of the sheep. During the spring's lush growth I put a large number of ewes and lambs on one of these pastures, eating it off quickly, in about two days, and then rotate to the next strip. About 2 weeks later we have 4 to 6 inches of new growth ready for the sheep again. We have 15 pastures on our farm. Total acres in the farm are 48.5 including building site, woodlot, and swamp.

The pastures are divided with electric fence, consisting of 3 smooth wires, all hot, spaced at 9, 18, and 27 inches above the ground. I use as hot a fence as Oregon law allows.

I am replacing old perimeter fence with 39 inch woven wire with a 4 point barbed wire below it. This keeps the fence off the ground and discourages predators from crawling under it. I use steel posts spaced 12 ft. apart with pressure-treated posts for ends. We use 3 posts with 2 top rails for each end.

I have a small section of gaucho fence we put up as an experiment which cost about 1/2 that of the woven wire. It seems to be satisfactory.

A progressive sheepman should take advantage of all sources of feed available. In our case we are feeding onions, thus greatly reducing hay and grain feeding. I have made 15 to 20 tons of hay each year in recent years and I'm accumulating it in the barn. I have designed and built an onion feeder to keep onions clean and dry while being fed. The initial cost of feeding onions has been high. I've purchased 2 gooseneck trailers and a wheel-skid loader to handle the onions. My sheep eat some wheat and rye grass straw while on onions.

We also rent a dike for summer and fall ewe pasture, enabling us to get the bulk of our ewes off the home place so we can use our irrigated pastures for lamb feed.

In order to beat the cost squeeze we also try to maintain productive ewes. We are weaning over 150% lamb crop from ewes exposed at breeding time. My Finn-cross ewes do better than this. Prior to breeding most of our ewes are not flushed. They are bred on the dike pasture chich really isn't flushing feed. At breeding time the sheep are put on the best section of dry dike. I haven't justified the cost and haven't found time to do any supplemental feeding to flush. The dike is located 2 miles over the Chehalem mount-

ain from our home farm.

We lamb in February. This means we don't have to confine our lambs so long before spring pasture growth starts.

Our pastures do not have sufficient drainage to allow heavy winter grazing so the onions are the main source of feed during this time. We divide the flock as they lamb; ewes with twins; ewes with singles. I lamb about 55 ewe lambs each year beginning in March. These are kept in another flock so they can be properly fed to maintain the young ewes growth.. Twin lambs and the yearling ewes' lambs are creep fed while confined to the barn. Lambs are weaned in May and June and left on the best pasture. Ewes are confined in a dry lot for a few days after weaning and then taken to the dike pasture where we try to keep them thin.

Intensive grazing on irrigated pastures does require worming more often. Lambs are wormed each month. Phenothiazine salt is kept before lambs and ewes at all times. Booster shots for enterotoxemia are given at weaning time. Selenium intake is also managed carefully.

After all these years there are still plenty of places I could improve forage management. I'm still increasing ewe production, lamb gain efficiency, trying new forage varieties, double cropping, and improving forage on my nontillable dike pasture.