Summary of Reports . . .

Sheep and Wool Day

November 3, 1961

Sponsored by:

Dairy and Animal Husbandry Department, Oregon State University, The Western Oregon Livestock Association, Oregon Purebred Sheep Breeders, and Oregon Wool Growers Association.

Tribute to . . .

HARRY A. LINDGREN

Oregon lost a great friend of agriculture with the death last January of Harry Arthur Lindgren. However, his pioneer work for the livestock industry is as much alive as though he were sitting here with us today.

As is true with any sound education, the foundation and growth of ideas and ideals are not limited by one lifetime. Harry Lindgren knew that his aspirations for our livestock industry would best endure if woven into the structure of sound organizations.

For 42 years he pursued this goal of helping to create and strengthen Oregon livestock associations devoted to self-help through education.

Harry Lindgren foresaw the present days of opportunity for Oregon stockmen to expand and fill the needs of a west coast population boom. His writings and teachings encouraged the industry to prepare for expansion.

His early experience as first superintendent of Oregon State University's branch experiment station at Astoria instilled the conviction that preparation and growth of the livestock industry should be based on fact and sound research. His 40 years (1920-1960) as Animal Husbandry Specialist for the OSU Agricultural Extension Service were dedicated to teaching, organizing, and re-teaching.

Rural meeting halls, livestock rings, and rancher's back porches were his classrooms. The whole state was his campus.

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Pasteurellosis in Sheep

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Pasteurellosis is an infection characterized by widespread capillary hemorrhage. Septicemias or blood infections can be produced by many different species of bacteria. However, hemorrhagic septicemia is a term almost universally accepted as indicating an infection with pasteurella organisms. It is a disease of world-wide economic importance.

Pasteurella infection is the most common cause of pneumonia in sheep and most often develops following some form of stress such as that arising from shipping or from a sudden severe weather change. The disease is most often seen in feeder lambs but may occur in mature sheep. Acute cases usually show multiple hemorrhages. More advanced cases develop pneumonia, pleurisy, and inflammation involving the heart and joints.

The infection occurs in other species of animals and produces a similar type of disease. It is quite host-specific in that it seldom spreads from one species of animal to another. However, disease can sometimes be introduced into another species by injection of pasteurella organisms. Pasteurellosis can cause respiratory infections in humans but is more commonly found in wound infections and abscesses.

The disease is thought to be caused by a small microorganism of the pasteurella group. This group of organisms has the property of taking on stains more deeply at the ends than in the middle, giving rise to the term bipolar. These organisms are rather easily destroyed by heat and germicides but can remain infective in manure and dead animals for some time. Two organisms in the pasteurella group are involved in hemorrhagic septicemia in sheep. *Pasteurella multocida* is more often responsible for outbreaks of the septicemic form of the disease and for pneumonia in feeder lambs recently shipped. The disease usually strikes within two weeks following shipment. *Pasteurella hemolytica* is more prevalent in suckling lambs and breeding sheep that have been through some form of stress such as being chilled or fatigued. Marsh describes an outbreak occurring when a flock had to swim an irrigation ditch to and from pasture. The infection ended when this practice was corrected.

Many scientists believe these organisms live in the upper respiratory tract and cause trouble only when body defenses have been broken down. This is substantiated by the fact that the organisms can be isolated from apparently normal animals.

One or more viruses are probably involved in this complex disease. Many outbreaks occur with typical history and symptoms, and pasteurella organisms cannot be isolated in sheep. Viral agents have been isolated from shipping fever in cattle, and there is no reason to assume that they do not occur in sheep.

In an acute outbreak, affected animals appear depressed and stand with drooping ears. They refuse to eat and soon appear gaunt. There is usually a rather thick discharge from the eyes and nose and considerable coughing may be noted. Temperatures range from 104° to 107° F., and the respiration and pulse are increased. Lameness occurs later if the joints are involved. An encephalitis sometimes occurs when the infection involves the brain. Early in an outbreak death will usually occur in one or two days. Later, most animals survive for a week or more. It is not unusual for half the flock to get sick but for only about 10% to die. The pneumonic form develops in animals that live longer. If the factor causing stress is removed, the outbreak usually subsides in a week or two.

Three forms of the disease have been observed. The acute form produces hemorrhages, the subacute a bronchopneumonia, and the chronic a pleuropneumonia. One may progress to the other.

In the early stages of an outbreak, hemorrhages occur over the heart, the heart sac, the nose, throat, and sometimes the stomach and intestine. Later the disease seems to localize in the lungs, producing a rather typical pneumonia involving their lower portions. After this stage a painful pleurisy may develop, and the lining of the lungs may adhere to the rib cage. If this happens, there is usually a thick gray pus present in the lung cavity. If the animal survives, lung abscesses may form. The liver may be spotted with very small white abscesses. The Montana Agricultural Experiment Station reports that pasteurella organisms are a very common cause of a serious form of ewe mastitis called blue-bag. It may involve one ewe or a number in a flock. The udder is almost always lost and death often results.

Many errors are made in diagnosing this disease. Poisoning from a number of plants can produce hemorrhages that are similar to those seen in pasteurellosis. A few of these plants are wild cherry, milkweed, death camas, and sneezeweed. Poisoning due to arsenic, copper, or lead also can look similar. Anthrax and enterotoxemia are sometimes confused with pasteurellosis. Anthrax can be differentiated by dark blood, swollen spleen, and cultural means used at laboratories. Enterotoxemia occurs in animals on full feed and has no relation to shipping or exposure. Laboratory methods can be used to identify this disease, also.

The final diagnosis depends on isolation and identification of the pasteurella organism from the tissues of the diseased animal.

The most important part of treatment is good nursing. Affected animals should be well bedded, protected from the elements, and fed a good quality feed. Serum is available for treatment and may be effective in the early stages. It is useless later if pneumonia has developed. Broad-spectrum antibiotics and sulfa drugs are sometimes effective.

Good nutrition, good housing, and adequate ventilation are most important in preventing pasteurellosis. If bacterins are to be used, they should be given 2 weeks prior to shipment and never while animals are in transit or during an outbreak. Breeding animals and show stock sometimes are vaccinated annually.

Anthelmintics for Controlling Sheep Parasites

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Occasionally, newspapers, agricultural journals, and other news media contain articles describing the development of a few anthelmintic (worm remedy). Usually this type of news release describes the effectiveness of a material against specific groups of parasites and also implies that it has been tested extensively by different groups of scientists within the company responsible for its development and by various outside agencies. Since there is an incessant demand for better anthelmintics, appearance of these articles frequently stimulates considerable interest and a number of requests for further information. The basic question concerns how soon the material will be available, followed by how much it will cost and how effective it is. Because of this situation, it may be interesting to review what has been accomplished regarding the development of anthelmintic parasite control in sheep, and to consider some of the factors concerning the release of new drugs.

Most people who raise sheep have been faced with problems of parasite control. The usual approach when such problems occur is to treat the flock with an anthelmintic suitable for the type of parasite that is present. This treatment may follow a severe outbreak of parasitism or be applied one or several times during the year as a means of preventing parasite buildup in a flock. The general categories of sheep parasites which we attempt to control with anthelmintics and the drugs used in each case are: gastrointestinal nematodes—phenothiazine, copper sulfate, tetrachlorethylene; lungworms—emetine compounds, Dictycide, iodine compounds; liver fluke—carbon tetrachloride, hexachlorethane; tapeworm—lead arsenate, other arsenical compounds, and nicotine sulfate.

Before 1946 all but two of these drugs were available. Certainly less research was being done in developing new compounds and the demand for effective anthelmintics was not as great as it is today. Also, until 1946 the Food and Drug Administration did not enforce rigid testing requirements before the release of new anthelmintics.

Phenothiazine, first used as an insecticide in 1934 and as an anthelmintic for controlling swine parasites in 1938, was found to be effective against sheep nematodes in 1939. Since 1939 over 400 reports have been published involving its use in controlling sheep parasites, and approximately 1,600 papers are available concerning phenothiazine as either an anthelmintic or insecticide. Likewise, numerous reports have been published on the effectiveness of carbon tetrachloride against liver fluke, and on copper sulfate-nicotine sulfate mixtures for removing stomach worms and tapeworms.

After World War II ended and the demand for human medicines had been met, many chemical and pharmaceutical companies enlarged their research and development activities to encompass the problem of finding new materials for controlling animal parasites. Part of this approach must have been stimulated by recognition of a need for more effective anthelmintics than those then available. Also, there was pressing need for compounds with a broad spectrum of activity, i.e., against a wide range of parasites such as the gastrointestinal nematodes. In any event, the criteria for development of new anthelmintics were that they be highly effective, safe to handle, easy to administer, and reasonable in cost. A great stimulus for new research resulted from the application of organic phosphate chemicals to parasite control. These had been developed by the Germans during the war and originally were intended for chemical warfare. A number of testing programs were initiated to evaluate practical methods for their use.

Between 1946 and 1961 over 350 publications appeared regarding the testing of drugs for control of pasasites in sheep. To illustrate how this type of research has been intensifying, 53% of these reports involve work done since 1957. From 1946 to 1957 published anthelmintic studies averaged 14 papers per year, and since 1957, the average has been 34. Furthermore, 29% of the publications have involved phenothiazine, 52% of all publications concerned attempts to control nematodes, and 19%, 15%, and 14% covered flukes, lungworms, and tapeworms respectively. At least 58 different compounds have been reported during this 16-year period. Omitted from these data are the thousands of compounds that have been screened by different drug companies in their efforts to discover effective materials with practical characteristics. It is somewhat frustrating to learn that from this total effort only two compounds of recognized significance have been added to the list of commercial anthelmintics. One of these is Dictycide for control of lungworm and the other is hexachlorethane for liver fluke, which was reported in 1946. Deleted from this list are the mixtures or new combinations of old materials, which also received a certain amount of publicity at different times.

After considering these figures, a natural question is, "What does this mean?" Why the recent increase in publication? What about the news releases mentioning promising new drugs? What are the restrictions imposed on the release of newly developed anthelmintics? Why so many publications on phenothiazine? After all this research, are any new materials about to become available?

Several new compounds reported since 1957 may be approved in the next 12 to 18 months, although any effort to forecast such events is purely speculative. Two new materials are organic phosphate compounds having an efficacy primarily against stomach and intestinal parasites. Compounds having similar chemical properties and produced by the same companies already have been approved for use against cattle grubs. Two other chemicals developed by United States drug companies show equal promise but undoubtedly will have to be extensively field-tested before they can gain approval by the Food and Drug Administration. The British, who apparently are not as strict as we are in permitting the use of new anthelmintics, have produced three new chemicals since 1957. All are effective against gastrointestinal nematodes and have been tested in this country. During the past 12 months, three new compounds have been reported effective against liver fluke. A number of new and perhaps highly effective anthelmintics for controlling parasites in sheep may be available soon. However, federal approval is involved, and this is time-consuming and expensive. Before any newly publicized anthelmintic can be licensed for general use by veterinarians or livestock producers it must pass a rigid test to prove it does not cause damage to humans. These tests are the manufacturers' responsibility.

Once a material has been approved, investigations concerning its use and mode of action may be continued. An example of this is the work that has been done with phenothiazine. In 1947 several papers were published on the value of using this drug in salt. These papers indicated that this form of continuous administration would kill larval nematodes hatching from eggs in the feces. In 1951 and 1952 studies were published on the mode of action of phenothiazine in the host and against the parasite. These data showed that some of the metabolites or byproducts of phenothiazine could be as effective as the parent compound. Also, in 1951, information was released indicating that finer particles of phenothiazine were more effective than larger ones, and that divided doses were better than single doses, thus initiating the practice of low-level administration. In 1953 further papers concerning low-level administration appeared and some publications indicated that for most effective treatment, emphasis should be placed on pasture rotation and other management factors. Seven years after the advocation of phenothiazine salt preparations and two years after the initial studies involving low-level administration, publications appeared on the development of resistance to phenothiazine by certain species of gastrointestinal nematodes. In 1959 the term "purity" became important and it was shown that 10-micron particle size purified phenothiazine was just as effective in removing parasites as non-purified material having a smaller particle size. Most recently, in 1961, a report was published that indicated "synergized" phenothiazine was also meritorious in its anthelmintic accomplishments.

Likewise, other variations involving phenothiazine have been encountered while making this review. These include mixing phenothiazine with various materials to make it more palatable or mixing it with other types of anthelmintics to "promote" a wider range of effectiveness for different species of parasites.

Another compound that has received much attention for many years is carbon tetrachloride. This chemical, commonly used for control of liver flukes in sheep, is sporadically more toxic to the host than to the parasite. At least 28 reports have been published during the past 16 years concerning the use of carbon tetrachloride. It is notable that the majority of these have discussed either the toxicity of this compound or methods of administering it so the toxic effect could be reduced.

New compounds, more effective than those already available, ultimately will be approved for general use by the Food and Drug Administration. When this happens, we may be assured that such compounds have been subjected to suitable methods of evaluation to insure the safety and health of animals being treated, individuals administering the drugs, and consumers of lamb or mutton.

News releases on newly developed anthelmintics should be considered carefully to determine whether they are expressions of things to come or things available. The use of any unfamiliar anthelmintic should be used with the advice of your veterinarian and/or your county agent.

Finally, livestock producers and all other individuals associated with the application of anthelmintics to livestock should recognize that no anthelmintic ever will be any better than the method by which it is administered. This means that anthelmintic therapy must be considered as part of and not as the whole management program for parasite control.

Effects of Inbreeding on Performance Traits in Suffolks

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Four lines of purebred Suffolk sheep have been developed from the same foundation material. Each of three of the lines consists of 15 breeding ewes and 1 ram while the other line consists of 45 breeding ewes and 3 rams. All replacements were selected from the young stock produced within the line. Weight and score of the lamb at weaning and fertility of its dam provided the basis for selection. The lines have been closed since 1954. Lambs produced have varied in level of inbreeding from 0 to 45%. To give an idea of intensity of inbreeding in relation to percentage figures presented here, a lamb resulting from two generations of full brother x sister matings would be inbred 37.5%.

A thorough study has been made concerning the effects of inbreeding of the dam and of inbreeding of the lamb on birth weight, rate of gain, lambing percentage, mature size, conformation, and lamb mortality. Inbreeding of the dam or of the lamb had no effect on birth weight, rate of gain, mature size (Figure 1), or conformation as indicated by score. However, inbreeding did influence lambing percentage and mortality. The effect of inbreeding was not linearly related to these traits. That is, inbreeding above 5% caused a marked decline in twinning and the level of 6 to 15% inbreeding was as

Figure 1. Suffolk ewe J 153 produced a lamb in 1961 weighing 80 pounds and scoring 86 in conformation and 85 in condition. This ewe is representative of the Suffolks used in this research.

Table 1. Effect of three levels of inbreeding on mortality, birth type, and birth weight.

% Inbreeding	0–5%	6–15%	15% and over
Total number lambs	104	152	65
Number dead	25	34	24
Percent mortality	24	22	37
Singles	54	108	45
Twins	50	44	20
Percent twins	48	29	31

detrimental to twinning as higher levels of inbreeding (Table 1). It appears that a low level of inbreeding reduces twinning but higher levels do not prevent ewes from producing single lambs.

Mortality was not increased by inbreeding until the level of inbreeding became relatively high and then inbreeding markedly increased mortality (Table 1). Some of the more highly inbred lambs, though large at birth, were listless and showed no interest in living.

It was thought that inbreeding might result in some lines showing a marked inferiority while others would perform satisfactorily. Results show that certain traits became lower in certain lines but that no line showed general inferiority (Table 2). For example, line 2 was a very rapidly gaining line but too low in fertility, while line 3 was high in fertility but rather high in mortality and low in rate of gain.

It appears that great attention must be given to fertility and livability if closed-flock breeding is being used to produce breeding stock that will transmit with regularity when used in commercial sheep production. The best care and management are required to assist in obtaining a good lamb crop and in keeping the lambs alive. These two traits would also need careful consideration in selection of replacement animals in order to successfully maintain a closed flock.

Table 2. Performance by lines.

Line	Twins	Mortality	Birth weight	Rate of gain[1]
	%	%	*(pounds)*	*(pounds)*
All	35.51	25.86	9.26	0.54
0	30.79	26.79	9.24	0.53
1	40.74	25.45	9.09	0.55
2	28.57	19.05	10.08	0.58
3	50.00	29.00	8.86	0.54

[1] Weaning weight minus birth weight divided by age in days.

Table 3. Weaning weight and score of lambs in the four lines of Suffolks.

Line	Weaning weight (120 days)	Conformation score[1]	Condition score[2]
	pounds		
1	77	79	80
2	80	78	78
3	78	81	79
0	79	80	81

[1] 90 is excellent, 80 is superior, 70 is good.
[2] 90 is prime, 80 is choice, 70 is good.

Inbred sheep will not show as high fertility as outbreds or crossbreds and inbred lambs will be more adversely affected by undesirable environmental conditions. However, inbred stock will transmit with a greater degree of regularity than outbred stock and will sire offspring greatly superior to themselves. Therefore, inbreeding, when properly used, is a valuable tool for livestock improvement.

The performance of the inbred Suffolks in conformation and condition at weaning and in growth to weaning is satisfactory as is shown in Table 3. These figures include every lamb that survived to 120 days of age in 1960.

Rams from each of the four lines of Suffolks have been used on Columbia and Targhee ewes at the Eastern Oregon Branch Station at Union. The data on lambs produced by these matings are being analyzed at present. Averages indicate that rams from the line having the best gains have sired lambs with the best gains.

Development of a Sheep for Western Oregon

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Previous studies on the value of various breeds of sheep for fat-lamb production in western Oregon demonstrated that several breeds possess certain very superior traits but also have other mediocre traits. Thus, no breed appeared to show superiority in all traits even though certain breeds were superior to others in overall merit. It seemed desirable to combine the good traits of some of the breeds by first combining breeds and then selecting for fat-lamb producing ability in the closed flock that was established from the crossbred foundation. The Cheviot, Dorset Horn, and Columbia breeds were combined by crossing Cheviot rams (Figure 1A) with Columbia ewes (Figure 1B) and Dorset Horn rams (Figure 1C) with Columbia ewes. These crossbred sheep were then combined to provide a foundation which

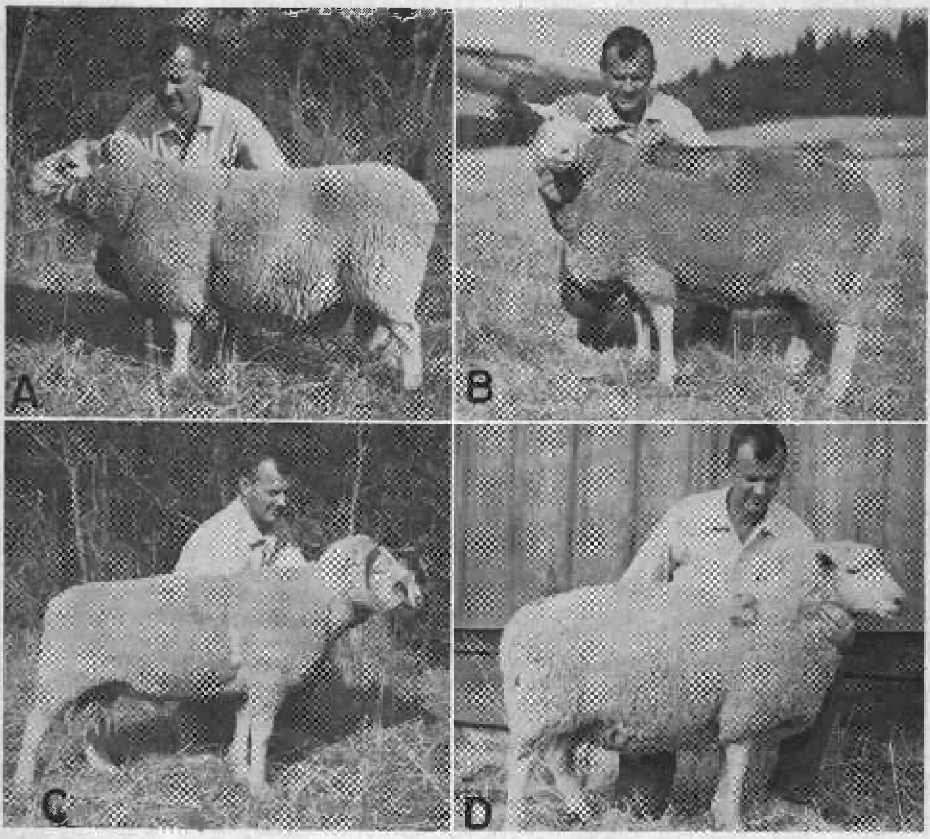

Figure 1. (A) Cheviot ram, (B) Columbia ewe, and (C) Dorset ram—typical of those used in producing a foundation for the sheep being developed. (D) Ewe No. I 128 produced one lamb in 1960 weighing 79 pounds at 120 days and scoring 83 in conformation and 81 in condition. In 1961 her lamb weighed 98 pounds and scored 94 in conformation and 94 in condition. This ewe is representative of the animal being developed in the OSU research program.

has been bred and selected as a closed flock. The Dorset breed was used to bring in high fertility and good milking ability. The Cheviot was used to introduce open face, good mutton type, and extreme ruggedness. Columbias were used because a flock of older, good producing ewes that produced a heavy clip of good quality wool was available.

This combination should make it possible to develop an open, white-faced sheep that produces large, meaty lambs carrying sufficient finish to make good carcasses. Selection is based primarily on weight at 120 days of age and scores for condition and conformation.

Considerable variation exists in the flock under development. This variation is both expected and desirable from a genetic standpoint. It is desirable because variability is necessary for effective selection. In development of a breed, variation is necessary to give the kind of combinations required.

Undesirable combinations also will occur but this is of little consequence because they can be culled. The desirable combinations are essential for building the kind of flock required. It is the policy to use several rams (6 to 8 each year) in the development of this sheep so that fixing of traits quickly will not result. When traits become fixed selection becomes ineffective. Also, several rams of the Cheviot and Dorset breeds were used in the original matings to give a wide genetic base.

Production in this sheep is good (Figure 1D). The 112 lambs produced in 1961 averaged 82 pounds at 120 days of age and scored 88 in conformation[1] and 88 in condition[2]. No creep feeding was practiced. The ewes were fed hay and some grain during the lambing season.

[1] 90—excellent ,80—superior, 70—good.
[2] 90—prime, 80—choice, 70—good.

Responses Obtained from Selecting for Traits of Economic Importance

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Results reported here are from only one of several sheep breeding research projects in progress at Oregon State University and its branch experiment stations.

Performance tests

Each year approximately 50% of the Hampshire lambs weaned at the Central Station are utilized in performance testing. Also, Columbia and Targhee ram lambs are performance tested at the Eastern Oregon Branch Experiment Station at Union. Immediately after weaning, the Hampshire lambs are placed on full feed for periods of 55 and 34 days for rams and ewes, respectively. Daily gain and feed efficiency records are obtained during this performance period. These records are utilized in an index for selecting four ram lambs to be progeny tested with Columbia and Targhee ewes at the Eastern Oregon Station. For the past two years the most efficient gaining Hampshire ram lamb also has sired crossbred offspring which were more efficient when placed on performance test. In 1959-60 the top ram lamb was 7% more efficient than the other three selected rams and his respective offspring were 5% more efficient than offspring from the other three selected rams. In 1960-61 similar results were obtained and are reported in Table 1.

Results in Table 1 illustrate that ram C-61 was 6% more efficient in feed utilization than the other three rams, and his selected crossbred ewe lambs were 5% more efficient. Although these differences are not high, it should be pointed out that the four ram lambs progeny tested were first selected on the basis of high performance, and little variation existed among them for this trait. The conformation and size of the four ram lambs can be

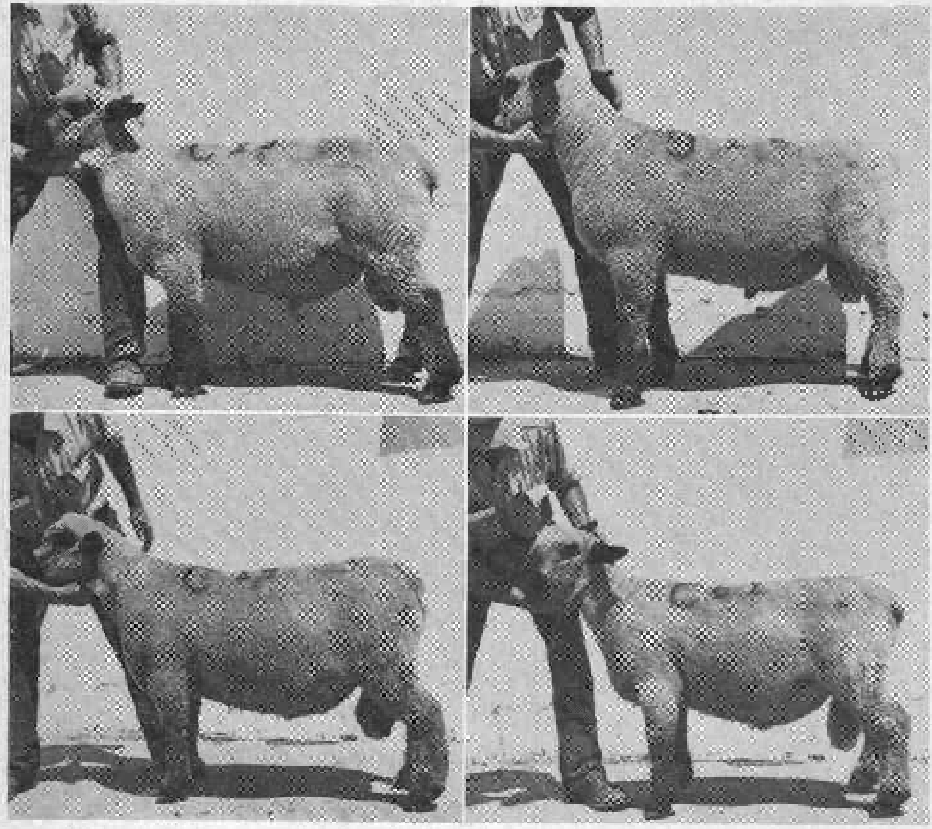

Figure 1. Conformation and size of four ram lambs can be noted above. Top photos: C-13 (left), C-15; bottom photos: C-17 (left), C-61.

seen from their pictures taken the day they came off the performance test July 21, 1960 (Figure 1).

This year, among four sire groups, differences in feed efficiency of 36 and 20% were obtained for purebred Hampshire ewe and ram lambs respectively.

Reproductive performance of crossbred and purebred ewe lambs

Four crossbred offspring (Hampshire x Columbia) were selected from each progeny tested ram lamb and bred as lambs to further determine their performance. It is possible to compare their performance with that made by purebred Hampshire ewe lambs. The increase in reproductive efficiency of the crossbred dam over the purebred dam is shown in Table 2.

Results from this first year of breeding ewe lambs clearly indicate the superiority of the crossbred dams over the purebred dams in all traits of economic importance. This significant increase in production can be illustrated further by assuming the number of ewe lambs as 100 and determining the economic return from both groups.

Table 1. Performance record of selected ram lambs and their respective crossbred offspring.

	Ram number			
	C-13	C-15	C-17	C-61
Ram lambs (1960)				
Gain on performance test (lbs.[1])	62	62	66	65
Feed efficiency (lbs.[2])	6.16	6.16	5.93	5.70
Four crossbred ewe lambs from each ram (1961)				
Gain on performance test (lbs.[3])	25.3	23.0	25.5	25.0
Feed efficiency (lbs.[4])	7.12	7.00	7.11	6.71

[1] 55-day period immediately after weaning.
[2] Pounds of feed consumed to produce one pound of gain.
[3] Mean of 4 lambs, 34-day period immediately after weaning.
[4] Mean of 4 lambs.

Table 2. Average value of performance traits from purebred and crossbred ewe lambs.[1]

	Purebred	Crossbred	Advantage of Crossbred
Number	18	16	
Body weight 8–31–60 (lbs.)	132	130	None
Body weight 10–21–60 (lbs.)	139	140	None
Average lambing date	3–1–61	2–13–61	1 estrus period
Ewes lambing[2] (percent)	50	94	+44
Lambing percentage [3]	111	153	+42
Death loss first 48 hours (percent)	30	17	+13
Pounds lamb weaned per ewe[4]	56	82	26

[1] Bred as lambs.
[2] Based on ewes exposed to ram.
[3] Based on ewes lambing.
[4] Lamb weight adjusted to 120 days of age.

Assuming lambs are selling at 15 cents per pound the 100 crossbred dams would return approximately $200 more than a similar number of the purebred dams. It should be pointed out that the results are only for one year and that such differences may not be experienced with all crossbred ewe lambs. These crossbred ewe lambs were all sired by Hampshire rams that had been selected because of their high individual performance. Both groups of ewe lambs were on an excellent plane of nutrition at all times. The extra care given both groups during the pasture period made it possible to save some lambs that presumably would have been lost.

Carcass traits

Besides increasing efficiency of his unit the producer is becoming more aware of marketing a product that will satisfy the housewife and make her a steady buyer of lamb. Interest among Oregon producers in carcass values can be attested by the number of carcass contests sponsored by our sheepmen in cooperation with their county extension agents. More basic information is needed on the inheritance of carcass traits, cut-out-values, and consumer preferences before it will be possible to produce the kind of lamb that will be the most acceptable to all concerned.

During the past four years results on carcass-cut-out values have been obtained on weanling and fed lambs. More data have been obtained on weanling lambs and the results have been extremely valuable in obtaining basic information for various carcass traits. Besides carcass data from wether offspring of the four progeny tested Hampshire ram lambs, and the Columbia and Targhee lambs, three other

Table 3. Average value of carcass traits by breed of ram

	Breed of sheep					
Ram breed	Hampshire	Columbia	Targhee	Southdown	North Country Cheviot	Dorset Horn
Number of rams	4	2	2	1	1	1
Dam breed	Columbia or Targhee	Columbia	Targhee	Crossbred ewe lamb[1]	Crossbred ewe lamb[1]	Romney
Number of carcasses	20	6	6	5	9	6
Slaughter age (days)	148	157	151	118	118	124
Carcass grade[2]	3.6	2.7	2.8	4.0	3.4	4.2
Carcass length (cm.)	60.7	63.1	62.9	51.2	55.6	58.2
Carcass weight (lbs.)	43.1	40.4	41.6	29.9	33.1	38.8
Trimmed loin (lbs.)	4.6	4.5	4.5	3.5	4.2	4.4
Meat in legs[3] (lbs.)	10.6	10.2	10.4	7.2	8.4	9.6
Meat in legs[4] (percent)	24.6	25.2	25.0	25.9	24.8	24.7
Fat thickness at 11th rib (mm.)	4.4	2.8	4.4	5.0	3.6	4.8
Loin-eye area[5] (sq. in.)	1.74	1.54	1.53	1.61	1.73	1.70
Loin-eye area adjusted to 120 days of age (sq. in.)	1.45	1.18	1.21	1.64	1.76	1.62

[1] Crossbred ewe lambs were Hampshire rams on Columbia ewes.
[2] Scores from 5 (prime) to 1 (cull).
[3] Legs were boned out.
[4] Based on carcass weight.
[5] Includes only *longissimus dorsi* muscle at 11th rib.

breeds of rams were included in 1961. The 1961 results from these six breeds are shown in Table 3.

Results in Table 3 are not comparable between breeds because data have not been adjusted for known environmental effects. Hampshire, Columbia, and Targhee lambs were raised at the Eastern Oregon station, and the other three groups were raised at the Central Station. At a comparable age the Southdown sired lambs possessed a higher carcass grade, thicker fat covering, and slightly smaller loin-eye area than did those from the North Country Cheviot. As expected, the Southdown-cross carcasses were shorter in length. Although the Southdown-cross lambs had the smallest weight of boned leg meat they had the highest percentage of meat when based on carcass weight. Lambs sired by the North Country Cheviot or Southdown ram constitute a three-breed cross and these lambs had the largest adjusted loin-eye area.

Several trends have been consistent over the past four years. Purebred Targhee lambs have averaged higher in carcass grade and greater in thickness of fat at the 11th rib, and generally have had a smaller loin-eye area than purebred Columbia lambs raised under a similar environment. Crossbred lambs from Hampshire sires have scored higher in carcass grade and carcass conformation, have been shorter in carcass length, and have had a larger loin eye than purebred Columbia or Targhee lambs. Adjusting the loin-eye area to 120 days of age, the difference between lambs from Hampshire, Columbia, and Targhee sires is even more apparent. There was a 25% difference between the average size of the loin eye from lambs of the four Hampshire rams. This certainly indicates that sufficient variation exists in this trait that it could be improved by a selection program. Heavier lambs at 120 days of age probably will have a larger loin eye.

Various phenotypic correlations have been calculated for live animal and carcass measurements. However, only a few will be listed. Loin-eye area has a correlation coefficient of .14, .23, and .34 with conformation score of the lamb, thickness of fat at 11th rib, and USDA carcass grade, respectively. The correlation was .94 between width of carcass hind legs and boned-out meat in legs. Some of these values are high enough that they may be of importance in selecting a lamb with more lean meat.

Taste panel scores

It is important to know whether or not eating qualities are significantly influenced by sire or breed of lamb. The 1961 results on 64 roasts from 15 sires indicated no significant difference for any of the eating quality scores. Organoleptic tests were conducted on a 7-rib roast and only the *longissimus dorsi* muscle was used for tasting. Over the past four years similar results have indicated no significant differences for these taste panel scores. This seems to indicate that for weanling lambs of these ages the *longissimus dorsi* muscle is uniformally juicy, tender, and lacking in any strong aroma or flavor. If roasts from the legs were used for taste scoring the results could be different because of the exercise that leg muscles receive. Results in Table 4 were obtained from a trained taste panel committee of six people. For aroma and flavor of lean and fat a low score is more desirable than a high score. A high value is more desirable for the other four scores.

Table 4. Average value of organoleptic scores by breed of ram.[1]

	Breed of sheep					
Ram breed	Hampshire	Columbia	Targhee	Southdown	North Country Cheviot	Dorset Horn
Number of rams	4	2	2	1	1	1
Dam breed	Columbia or Targhee	Columbia	Targhee	Crossbred ewe lamb	Crossbred ewe lamb	Romney
Number of carcasses	20	6	6	5	9	6
Aroma	4.63	4.49	4.52	5.0	4.7	4.9
Texture	4.97	4.46	4.62	5.3	5.0	4.9
Flavor lean	4.54	4.41	3.99	4.5	4.7	4.6
Flavor fat	4.42	4.55	4.66	4.6	4.8	4.6
Juiciness	4.89	4.56	4.61	5.0	4.8	4.8
Tenderness	5.25	4.89	5.21	5.4	5.3	5.2
Overall score	5.05	4.63	4.27	5.3	4.9	4.9

[1] A scale of 1 - 7 is used for scoring.

Although the difference was not significant, the younger lambs from the Southdown sire were finer in texture, more juicy, more tender, and were more desirable overall than any lambs of the other breeds.

Crossbreeding research for 1961-62

Continued research is planned on differences in reproduction efficiency and lamb production between crossbred and purebred ewe lambs and crossbred yearling ewes. This year Columbia and Targhee ewe lambs were included in this research at the Eastern Oregon and Central stations. Research will continue on carcass evaluation and taste panel scores for various purebreds, two-breed, and three-breed crosses.

Problems Encountered in Lamb Slaughter

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The sheep industry in the Willamette Valley has come a long way in the past 15 years. Lambs now being produced are much better than when I first came to Portland 16 years ago. At that time most of the lambs were a byproduct of the farmers here in the Valley. Conformation was poor and not too much importance was placed on finish or quality. In our opinion, tremendous strides have been made by people in producing a better kind of lamb.

Percentage of yield in the carcass is of great importance to the packer. From a yield standpoint, a lamb that is properly finished, with good conformation, and with a pelt or skin that is not too thick or heavy, is the most desirable. Dressed carcass weight desired by most of his customers ranges between 40 and 55 pounds, with a slightly better demand for the 45 to 53 pound carcass.

A moderately fat lamb, without too large a kidney and not a heavy, "barky" type, is most desirable. This is not much of a problem during the months when genuine spring lambs are coming to market, but becomes so as we get into the feedlot season of December, January, and February. This is when we encounter heavy, overfat lambs. It is unfortunate that these lambs cannot be marketed when they reach a weight of approximately 100 pounds and before they become overfat. I believe they would bring a better net realization to the grower or feeder than if held until they weigh 110 to 130 pounds, and are too fat and undesirable to the retail dealer and his customers.

As a general rule, heavy, overfat lambs have to be sufficiently discounted to the retailer (enough for him to create an outlet at a price desirable enough for the retail trade) so his customers will buy cuts from this type animal. The discounted price is reflected in the price growers and feeders get for their lambs.

A lamb that will yield 45% is not worth as much money as one that will yield 50%. Therefore, "filling" by the grower or feeder is not recommended because a high dressing percentage is desirable. It might be worthwhile for the packer to pay a cent or two per pound more to some growers than to others because of the difference in the yields of their lambs.

Byproducts play a very important part in lamb prices. If the packer can get a good price for the pelt, from the "fancy" meats (such as liver, heart, and tongue), and from the green casing, he can pay a higher price to the grower or feeder.

You are well aware of the present price of wool compared to past prices. I remember one time we were getting $14 for a wool pelt. At that time we were paying 27 to 28 cents a pound live for lambs and selling the carcass for 32 cents. But today's price of wool pelts is far, far below this. In fact, some of the pelts (such as a sheared pelt, called a No. 3) are not worth saving. The price for green casings is not good. Natural sheep casings for sausage have been replaced by synthetic casings; "fancy" meats (such as lamb liver, hearts, and tongue) do not draw a premium price and, at times, are difficult to dispose of.

Eastern markets have quite a bearing on prices in Portland and in this area. The only time we can move lambs out of the western area is when a surplus exists that lowers the price of live lambs to the point where they can be slaughtered and shipped into eastern markets. Also, the demand for lamb in eastern markets must be strong and the price sufficiently high to cover freight costs involved and still return the lower price lambs cost in the west. If it were not for this eastern market, we probably would see live lambs priced so cheap during the surplus run that no one would want to grow lambs for market.

During the fall months lambs have a New York warehouse-delivered price approximately the same as the Portland price. Thus it is unprofitable at this time of the year to ship lambs from this area. Not enough demand exists on the west coast to take care of supplies.

I have been asked to give my opinion of losses incurred through federal meat inspection. The only losses incurred by federal meat inspection are certainly justified—animals that are diseased to a point where they should not be used for food, and parts of animals (livers, hearts, and tongues) that are infected with some form of disease or parasite. I am sure you all agree you would not want to eat any of the meat from the kind of animals indicated. In our opinion, federal meat inspection should be mandatory at every slaughterhouse and packing house in the United States.

I would also like to touch briefly on what kind of a lamb we will need to meet customer requirements in the future—possibly 10 years or so from now. This is something about which we can only guess but I can tell you what I personally think. Future customer demands will, in all probability, be for a lamb the same weight we are now producing, with a minimum of fat, but young and tender. At the retail level this lamb will need to be as boneless as possible and trimmed so there is no waste visible to the housewife as she does her shopping.

I think the packer will have to make a change in the way lambs are dressed. It has been many, many years since there has been any change in the way lambs are slaughtered and carcasses hung on the rail for sale. It is possible that lambs will be streamlined in carcass form on the kill floor. We have done some experimenting locally by dressing a lamb on the kill floor in a slightly different way than the general method. We have removed the front and rear shin bones, removed the tail, taken out the kidney and the skirt meat, put a galvanized skewer up the spinal column to keep the neck straight.

Our reasoning for this type of dressing was: first, the neck curves upward when a lamb is dressed, but by straightening it the retailer can get desirable, even, square neck cuts; then, by removing the front and rear shanks, tails, kidneys, and kidney fat, we will be doing only what the retailer does today after the carcass reaches his market. Instead of having the retailer throw waste material in the bone barrel and ship it back to the processing plant to be rendered and processed, the packer keeps it at his plant. This is possibly a little farfetched, but it sounds reasonable.

Lamb and the Trend Toward Greater Meatiness

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Conformation

A great deal has been said regarding lamb, relative to its smooth, blocky conformation. We should discard the word "blocky" and substitute smooth, long-bodied conformation. By smooth we mean a medium of fat cover, a straight rib carriage (not ballooned out), and a carcass covered with a minimum of fat. By conformation we mean thick muscled, with the minimum of fat covering necessary to create marbling for tenderness, juiciness, and high quality.

Excess fat

In lamb, as in beef, pork, or veal, you are faced with the problem of growing what the consumer will buy. Also, a product needs to be processed profitably. You are also faced with the problem of small volume due to the lack of demand that has been created by thin-muscled lamb with an excess of fat.

Processing of lamb

To a processor of lamb, a carcass from 50 to 60 pounds is the most desirable if it has sufficient fat for marbling. The carcass should show a large loin eye, long rib rack, short loin, thick meaty shoulder, and a well-muscled leg. All of these indicate desirable conformation. With a minimum of outside fat to be removed there will be less kidney knob fat for the rendering plant. Such a meat type carcass will yield a higher percentage return from the more desirable cuts. The breast and flank generally are of no more value than are handling costs in wrapping and freezing. Often they are moved at a "dump" price. More emphasis on muscling of these cuts should be given. Often a well-muscled cut represents the difference between profit or loss in a processing operation. With more lean meat in these cuts, the possibility for their sale is unlimited. For example: (1) barbecued or charcoal broiled flank and breast would give pork spareribs a run for their money; (2) these cuts when boned and sold as chopped lamb cutlets, without excess fat, can be sold on a par with veal cutlets in self-service counters or on restaurant menus; (3) they may be boned and sold as boneless lamb stew.

Potential market

The potential market for processed frozen lamb cuts seems unlimited. Lamb is tender, tasty meat that freezes well. It is a commodity that lends itself to the processed meat industry which emphasizes speed and cost control. It is up to you, the grower, to provide the main ingredient—quality control. The time and money involved in producing and marketing a desirable lamb are considerably less than for beef. Also a more meaty carcass could be sold in volume for use in home freezers. The cost of a lamb carcass will fit the family budget of more people than the extra expense for half of a beef or pork carcass. More lamb can be placed on the table with a dollar spent for lamb than can be provided by this amount in the purchase of pork.

Future trend

The bulk of beef sales in the last 10 years has moved toward emphasis on primal cuts, and this will occur in lamb. Today the super markets are buying more primal cuts than carcasses. The breakdown into primal cuts of 32 lambs (including utility, good, and choice grades) when compared with 22 beef of good and choice grade yielded 95.8% primal cuts for six cuts of lamb against 88.04% for primal cuts of beef. Although not conclusive, it seems that by producing a longer bodied, meatier lamb, lamb can be put in a favorable position with beef and pork from a processing standpoint.

Yes, the lamb has lost its place on the American menu because of too small a bite of meat in the chop in proportion to the fat around it.

It is up to you to produce a meatier lamb.

Lamb Carcass Contests

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The primary objective of a carcass contest is to provide information and education to all people interested in the meat industry—producers, packers, marketing agencies, restaurant operators, retailers, educators, and consumers.

The ideal carcass contest demonstrates the most desirable carcass for everyone in the industry, and shows examples of deviations from the ideal. The contest also should show the relationship of desirable characteristics in the carcass to those in the live animal.

First of all, the ideal carcass selected must be the type in demand by those selling lamb products to consumers. Without further belaboring the "red meat-fat" problem, this carcass must have a high yield of salable meat of a desirable quality. Studies with pork and beef carcasses, which indicate that 70-75% of the variation in yield of salable cuts can be accounted for by variation in fat content of the carcass, have shown us the way in selecting high yielding lamb cracasses. This same concept has been investigated with lamb carcasses and confirmed by Hoke *et al* (1). Their investigations pertaining to lamb carcasses of Prime, Choice, and Good grades are summarized in Tables 1 and 2. Their data show that observations most accurately measuring waste fat account for most of the variation in yield of retail cuts, while conformation accounts for a very small, generally insignificant portion of the variation in retail cuts. Zinn (2) has confirmed these results (% retail fat trim correlated with % retail trim cuts gave a coefficient of $r = -.78$) and has further demonstrated that loin-eye area accounts for very little (loin-eye area correlated with % retail trim cuts, $r = -.07$) of the variation in yieldability.

It must be conceded at this point that we currently follow USDA grading in which conformation plays a major role in final grade, and also that a large loin-eye is a very desirable trait to consumers—in those retail cuts in which the loin-eye is exposed.

Characteristics indicative of desirable quality, to the best of our knowledge, are: (youth, as indicated by color and porosity of the bones, shape of the ribs, and color of the lean; marbling, as indicated by fat streaking, feathering, and firmness of flank as seen in the cut carcass; and texture and firmness of the lean meat.

Once criteria for judging have been determined, as discussed above, the method of application must be decided on. In a carcass contest, one point of interest to many segments of the meat industry is knowledge concerning methods of selecting desirable carcasses. Therefore, selection should be done in as expeditious a manner as possible so that it not only facilitates the operation of a large contest but also is applicable to the commercial selection of large quantities of meat. Based on the preceding considerations and in part following recommendations

Table 1. Simple correlations within grade-weight groups between yield of retail trim cuts from the leg, loin, rib, and shoulder and various objective and subjective carcass measures.

	Prime 35–45	Prime 55–65	Choice 35–45	Choice 55–65	Good 35–45	Good 55–65
Conformation ..	.271	.282	.096	.183	.515[1]	.358
Finish grade	–.432[1]	–.766[1]	–.615[1]	–.731[2]	–.333	–.811[2]
Fat thickness over ribeye	–.483[2]	–.853[2]	–.785[2]	–.688[1]	–.574[2]	–.872[2]

[1] Significant at $P < 0.05$. [2] Significant at $P < 0.01$.

Table 2. Simple correlations within grades between various subjective and objective measurements and yield of retail trim cuts from the leg, loin, rib, and shoulder.

	Prime	Choice	Good
Conformation	.227	.097	.430[1]
Finish grade	–.581[1]	–.600[1]	–.532[1]
Fat thickness over ribeye	–.774[1]	–.756[1]	–.796[1]
Total fat trimming	–.921[1]	–.915[1]	–.886[1]
Carcass weight	–.405[1]	–.479[1]	–.448[1]
Kidney fat	–.737[1]	–.848[1]	–.826[1]

[1] Significant at $P < 0.01$.

made by J. D. Kemp (3) to the Reciprocal Meats Conference, the following procedures are recommended:

- When possible, all entries should be shown or displayed on foot and in the carcass as a means of providing educational information.
- Final placing should be based only on carcass considerations.
- The local contest committee should establish classes by breed or on an all-breed basis.
- Carcasses should fall within a 40 to 60-pound weight range. Where numbers warrant, it is advisable to have more than one weight class with a narrow weight range.
- Judging should be done by a committee of three, preferably one from industry, one from the USDA Grading Service, and one from a college or university.
- All carcasses should be code numbered after slaughter to avoid the possibility of ownership identification by the judging committee.
- Carcasses should be ribbed perpendicular to the long axis of the rib-eye

muscle so that one rib remains on the hind saddle.

• Loin eyes should be traced and measured with a planimeter. Fat thickness over the loin-eye should be taken at the center of the long axis of the eye and at each end where the curve starts. These three measures should be averaged. An additional fat measures should be made 3 inches beyond the lateral edge of the loin-eye muscle.

• Judges should make their decisions using their estimate of—

Cutability based on: thickness of fat cover; amount of kidney and pelvic fat; area of loin eye; and relative proportion of cuts.

Quality based on: marbling; color of lean and fat; age as estimated by bone structure and color of lean; and firmness of lean and fat.

• Carcasses should be grouped into five categories as follows: 1-a[1]. Highly desirable carcasses with a uniform but not excessive fat covering, thickly fleshed, and possessing excellent quality characteritics. They should be trim and not show excess kidney and pelvic fat and they should possess quality equal to or exceeding USDA Average Choice. The loin-eye area per 100 pounds carcass weight should meet or exceed the following specifications while fat covering over the rib must not exceed the following specifications:

Carcass weight	Min. loin-eye area per 100 lbs. carcass wt.	Max. fat thickness
(pounds)	*(square inches)*	*(inches)*
40–45	4.50	.35
46–50	4.40	.35
51–55	4.30	.40
56–60	4.20	.40

2-a. Carcasses with quality equal to group 1-a but with slightly less than minimum loin-eye area or slightly more than maximum fat or both or one with conformation somewhat less desirable.
3-a. High quality carcasses that are lacking in muscling and/or excessively wasty resulting in low cutability.
1-b. Carcasses with very desirable conformation and cutability but with quality below the grade Average Choice.
2-b. Carcasses lacking in both cutability and quality.

• Numerical placing of carcasses should be on an individual basis using 1-a carcasses first and then 2-a or 1-b and so on through the groups, depending on the degree to which they deviate from the most desirable.

[1] 1, 2 and 3 refer to cutability; a and b refer to quality.

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New Methods In Wool Marketing

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Core testing

Taking the guess out of wool marketing is now a possibility. It only remains for wool growers to avail themselves of the services of their own organization which is prepared and equipped to perform the various necessary technical tests which establish the real and actual value of wool. The manufacturer buys grease wool on the basis of clean content or yield. In buying grease wool in the field, clean content is the controlling factor. Clean content means the amount of clean wool that remains in a pound of grease wool, after the grease, suint, vegetable, and other foreign materials are removed.

It has been possible, for several years, to ascertain the clean yield or shrinkage of grease wool by core testing. Handlers have been using this method for some time. Cores are taken from representative bales or bags, usually one core to the bale or bag. These core samples are then sent to one of the commercial testing companies that test wool on a commission basis. There the samples are carefully scoured and the actual yield and shrinkage of the wool is obtained.

If the clean value of $\frac{1}{4}$ blood valley wool is $1 a pound, and the wool shrinks 45%, the grease value naturally is 55 cents. In other words, 45 pounds of clean wool is recovered from 100 pounds of grease wool. If the wool is exceptionally light, for example 41% shrink and 59% yield, the grease price would be 59 cents. It is of economic importance for a grower to know what his wool yields.

It is well known in the wool trade that the possibility of profits, and much of the profit in the wool buying industry in the past has been due to "over-shrinking" of the wool by buyers. For example, the buyer estimates that the wool will shrink 45%, and adds a safety margin of 1 or 2% to protect himself. If he buys it on the basis of 48%, and the wool actually yields 55% or has a 45% shrinkage, the wool grower loses 3 cents a pound. In a practical operation of core testing it does not pay to core test small lots of wool as the cost of coring runs approximately $25 a sample.

How then can the small wool producer receive the benefits of coring? This can be accomplished by assembling large accumulations of similar wools, grading them, and them combining them into sizable lots of similar quality grade and shrinkage. Experienced graders and marketers who have handled these wools for years are able to estimate shrinkage and yield on most wools within 1 or 2%. These wools are then placed in a lot with the same shrinkage range and then cored. This gives a small grower the fairest possible estimate of shrinkage and yield, and the nearest to an actual figure that he can secure by any method.

Grading by micron

The micron system is used to determine the diameter of fibers and the grade of wool. It is a recent advance in wool marketing. The old method, commonly called the American system, of classifying grades of wool was to call them fine, half-blood, ⅜th's blood, ¼ blood, low ¼ blood, and braid. This American system grew up in the early days when crossbreeding with Merino sheep resulted in the establishment of these grades. In our opinion it is a very imperfect method of grading wool, and it is seldom used now by manufacturers and marketing agencies. However, the grade names are still used, but usually accompanied by the spinning count, which originally was the English system. Theoretically the numerals used to designate grades signified the spinning capacity of the wool. For example, a fine wool with a spinning count of 70s would spin 70 hanks of yarn, weighing approximately a pound. Each hank is 560 yards in length. Braid wool with a spinning count of 36s would spin 36 hanks of yarn, and so on. This method is now being further refined by use of a machine to determine the diameter of the fiber by microns. A micron is 1/25,000th of an inch.

The following are the grades of wool and the micron measurements showing the diameter:

Fine wools	21.4 microns	64's for fine
Half blood	25.0 microns	60's for half-blood
⅜th's blood	28.0 microns	50's for ⅜th's blood
¼ blood	31.4 microns	50's for ¼ blood
Low ¼ blood	34.0 microns	46's for low ¼ blood
Common and braid	37.3 microns	40's for braid

We now have facilities available for "microning" wools to determine the grade. This method is available when disputes arise as to the actual grade of the wool. This custom service is furnished, as is the coring method, and for about the same price. Some mills have even suggested that they wish to buy not only on the core test, but also on the micron test. However, this test has not come into general use to any extent.

Practically all mills maintain testing laboratories in which they have machines for measuring the micron diameter of their wools. We use the commercial testing companies when we find it necessary to determine the micron count of a particular lot of wool.

Proposed micron specification

A specification using micron measurements for grades of grease wool was prepared by the U. S. Department of Agriculture Wool Laboratory, Denver, Colorado.

You can see that there are a number of factors which determine the value of wool. Making use of these factors in marketing wool will increase the wool grower's income.