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## OPTIMIZING THE VALUE OF GREASE WOOL THROUGH PREPARATION AND MARKETING

A WESTERN REGIONAL RESEARCH PUBLICATION

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# OPTIMIZING THE VALUE OF GREASE WOOL THROUGH PREPARATION AND MARKETING

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A WESTERN REGIONAL RESEARCH PUBLICATION

## WESTERN REGIONAL COORDINATING COMMITTEE - 39

**Participants and Cooperators,**

California Agricultural Experiment Station

Colorado Agricultural Experiment Station

U.S. Department of Agriculture,
Agricultural Research Service,

U.S. Sheep Experiment Station, Idaho

Montana Agricultural Experiment Station

U.S. Department of Agriculture,
Agricultural Research Service,

U.S. Meat Animal Research Center, Nebraska

Nevada Agricultural Experiment Station

New Mexico Agricultural Experiment Station

Oregon Agricultural Experiment Station

Texas Agricultural Experiment Station

Utah Agricultural Experiment Station

Wyoming Agricultural Experiment Station

**Administrative Advisor**

A.C. Linton (MT)

**U.S. Department of Agriculture, Cooperative State Research Service Representatives:**

L.R. Miller and S.E. Zobrisky

**Principal Investigators and Cooperators:**

G.E. Bradford and M.Dally (CA)

S.B. LeValley (CO)

G. Snowder and H. Glimp (ID: USDA, ARS)

V.M. Thomas (MT)

J.D. Crouse (NE: USDA, ARS)

W.D. Foote (NV)

T.T. Ross (NM)

H.H. Meyer (OR; Committee Chairman)

C.J. Lupton (TX; Committee Secretary)

M.L. Riley (WY)

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# OPTIMIZING THE VALUE OF GREASE WOOL THROUGH PREPARATION AND MARKETING [1,2]

C.J. Lupton, F.A. Pfeiffer and N.E. Blakeman[3]

## Summary

Several research studies conducted in the U.S. since 1958 indicate that skirting is either economically impractical or is incapable of affecting the quality of textile structures (e.g. top) composed of wool. In contrast, other academic studies and industry records demonstrate that skirting results in higher yielding matchings containing less colored fibers and plant material than the fleeces from which the skirted wool was obtained. The quantities of skirts reported in different studies show wide variation reflecting different breeds of sheep, environmental conditions and skirting techniques employed. For fine wool skirting, tags and clippings comprise between 5 and 10% of the whole clip. For skirting to be profitable, the proportion of other skirts should not exceed 10%.

Theoretically, the value of all types of wool can be increased by careful preparation. Actually realizing higher payments for skirted wool is another matter. Over a three-year period beginning in 1985, skirted and graded Texas fine wools consistently outsold unprepared, original bag wool by 11 to 30 cents per greasy pound. This same trend was observed in other areas of the country. In some regions, it may take several years to establish the improved quality and reputation of a particular clip to the satisfaction of wool buyers. It may also be necessary for many farm flock operators (in one area) or ranchers (in another) to prepare wool in a similar manner before it is possible to present buyers with large enough quantities of skirted wools to justify payments of premium prices.

In the long-term, it is in the best interest of the U.S. wool grower to prepare his wool in a proper manner. Failure to do so will leave our domestic textile manufacturers little choice but to become more dependent upon well-prepared wools from overseas.

## Introduction

The uniformity and cleanliness of wool grown on different body areas of sheep are major influences on the degree of skirting and wool preparation. The importance of uniformity of wool characteristics in sheep and management techniques concerned with wool harvesting and preparation for sale are two of the subjects of a recent review (Jones, 1985) sponsored by the National Wool Growers Association. Recognizing the potential economic importance of the adoption of improved wool preparation techniques, Western Regional Coordinating Committee 39 resolved to prepare a manuscript addressing this subject. Three goals of this publication are to review literature pertaining to skirting of U.S. wools, evaluate appropriate research and industry generated data, and review systems for preparing and marketing wools in overseas countries.

Even though wool production and quality control are year-round activities, the manner in which wool is shorn and prepared for sale has an immediate impact upon its value and utility to the textile manufacturer.

### SKIRTING DESCRIPTION AND PROCEDURES

#### What is skirting?

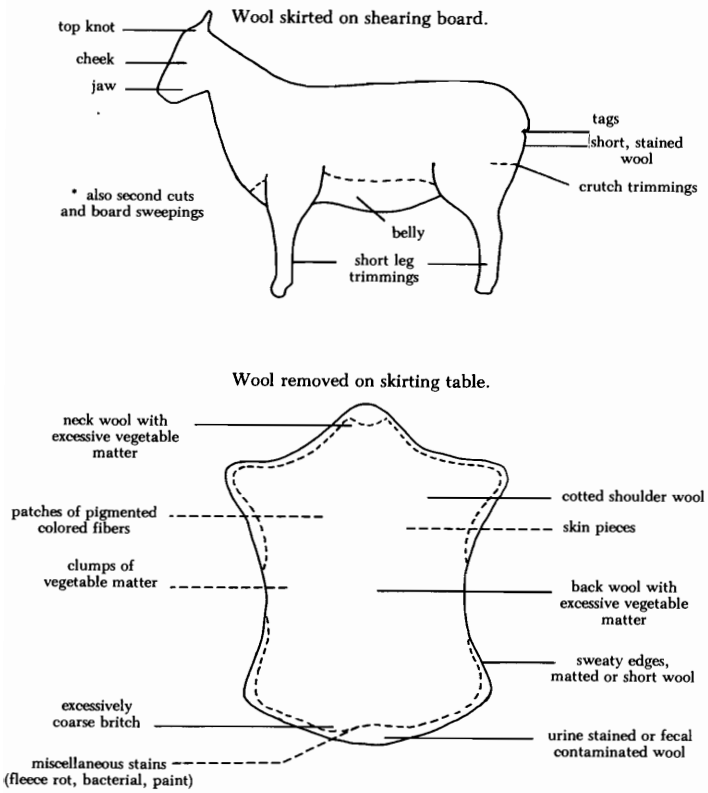
Skirting is the practice of separating all inferior fleece portions such as head, lower leg and belly wool together with urine-stained and fecal-contaminated fibers from the bulk of the fleece at shearing (see figure 1). The products of skirting are termed skirted wool and skirts. Since large variations exist among skirts from different body areas, these should be packaged separately for technical and economic reasons. Wool from the top of the head, jaw and cheeks tends to be short and sometimes heavily

[1] Under the procedure of cooperative publication, this regional report becomes, in effect, an identical publication of each of the participating experiment stations and agenices and is mailed under the indicia of each.

[2] Approved by the Director, Texas Agricultural Experiment Station, as TA 23677.

[3] Texas Agricultural Experiment Station, 7887 N. Highway 87, San Angelo, TX 76901

Figure 1. FLEECE SKIRTING




contaminated with plant material. Belly wool is usually lower yielding and may be either finer or coarser than the bulk of the fleece. It also tends to contain more vegetable and colored fiber contamination than the bulk of the fleece. Lower leg wool is short and tends to be composed predominantly of medullated hair fibers. The least valuable of the skirts, stained fibers and tags, are composed of fibers of variable length, scouring of which results in a relatively low yield of stained and colored fibers having limited utility. Since the term skirting generally implies removal of all wool that does not match the bulk of the fleece, short wool, matted pieces, paint, skin pieces, areas of the fleece heavily contaminated with plant parts and especially colored wool (stained and pigmented) all fall into the skirts category.

Related but different terms are grading, classing and sorting. Wool fleeces differ in many measurable characteristics; fineness, yield, vegetable matter type and content, length, strength and color. When fleeces are grouped according to any or all of these characteristics, the process is called grading. The term classing originated in Australia but is used to mean essentially the same as grading in some areas of the U.S. When individual fleeces are subdivided according to any or all of the above characteristics, the process is called sorting. Sorting requires more skill than grading or skirting. Wool fleeces may be graded at any one of numerous locations including the ranch, warehouse, cooperative facility, dealer's warehouse and textile mill. Sorting, on the other hand, is usually a function performed by a specialized wool dealer or the textile company itself.

Ideally, skirting of well-bred, fine-wool sheep results in a single fineness grade of wool of uniform staple length. As wool becomes progressively coarser, the economic reasons for grading diminish. Some establishments even go so far as to recommend that producers not attempt to skirt fleeces coarser than 23 microns. However, this advice appears to be negated by recent experiences in Colorado and Montana where skirting of wools coarser than 23 microns has proven to be profitable (Jones, 1988). Sorting of coarser wools is technically more difficult since numerous grades may be represented in a single fleece.

Unlike grading and sorting that require specialized knowledge and training, skirting of wools can be performed after a relatively short training period. However, skirting consistently and at a level that is likely to result in economic gain is a different matter and will be discussed further.

Normally superimposed onto skirting and grading based on average diameter is classing based on staple length. For example, finewools longer than 2¾ inches belong in the staple class; 1¼ - 2¾ inch wool is called French combing while any fleeces shorter than 1¼ inches are placed in the clothing category, thus being limited to processing on the woolen system. Tender wools and those with obvious breaks would also normally fit into the clothing category, irrespective of actual length. This would be somewhat dependant upon the position of the break.

### Why is wool skirted?

The technical demands and limitations of manufacturing worsted and woolen yarns, weaving and knitting require individual items in the broad spectrum of wool textile products to be composed of specific grades or classes of wool or blends thereof. Since between and within fleece variation of diameter, color, length, strength and degree of cleanliness is often large, normal quality control requires fleeces to be graded and sorted prior to scouring.

Table 1. A comparison between Texas original bag and skirted finewools*

| | Measurements on core samples of greasy wool | | | | Measurements after combing (average of four mills) | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Wool description | CWFP† (%) | Avg. diam. (μm) | Top△ (%) | Noil+ (%) | Waste (%) | Avg. diam. (μm) | Barbe‡ (mm) | Fibers<2" (%) | Colored and black fibers/½oz. |
| Texas 70s (original bag) | 48.7 | 19.89 | 86.7 | 10.5 | 2.8 | 20.03 | 78.8 | 18.0 | 11.00 |
| Texas 70s (skirted) | 52.6 | 19.84 | 87.6 | 9.3 | 3.1 | 20.40 | 86.2 | 15.8 | 6.75 |

* Source: National Wool Growers Association

† Clean wool fiber present

△ The sliver resulting from worsted combing. Starting material for worsted drawing and spinning.

+ The short fibers separated from the longer fibers in worsted combing

‡ Weight biased mean fiber length

Traditionally, this function has been performed at the textile mills or by companies that specialize in providing specific grades of raw materials to the textile industry. An opportunity has and still does exist for ranchers to skirt and grade wool either at shearing or pay a marketing organization to do the job for them. Theoretically, when it is no longer necessary for a textile mill to perform these tasks, labor savings can be passed back to the grower in return for prepared wools. Such efforts to increase the value of raw wool have been practiced for years by individual ranchers and at some warehouses and co-ops.

Campbell (1985) conducted a study for the National Wool Growers Association to explore prospects of exporting American wools. One aspect of this project was that two very similar Texas finewools were compared from the grease state through to top making in four overseas combing mills. The major difference between the two wools was that one had been skirted and the other had not. Table 1 contains pertinent information on raw materials used and the tops produced in this study. The skirted wool yielded slightly more top having a longer average fiber length with less short fibers than the original bag (O.B.) wool. Perhaps most significantly, the top manufactured from skirted wool contained only 60% as many colored fibers as the O.B. top. At the time of writing, Spring 1988, the price differential between these two forms of wool is approximately $0.30 - 0.50/lb, greasy.

### How is wool skirted?

Various methods have been developed to add value to wool at shearing time. Such innovations include "shearer (or floor) skirting" in which the shearer makes an effort to drop the leg and belly wool onto the shearing floor in such a position that it can conveniently be picked up and placed in a designated bag while the remainder of the fleece is being sheared. "Shearer-assisted table skirting" involves the aforementioned floor skirting but in addition, the shorn fleece is placed flesh side down on a slatted table (approximate dimension 10 x 5 ft.) at which time all remaining skirts are removed prior to rolling and packaging the fleece. The whole operation takes less than one minute for a trained operator. In "table skirting," all skirting of the fleece is performed on the table. To these basic skirting techniques may be added at least two innovations. In one instance, sheep are run through the shearing shed twice. The sheep are crutched and belly, leg and sometimes wool from the head is removed on the first passage. The second time through, the balance of the fleece is shorn. In a similar operation, ewes being crutched prior to or just after lambing also have belly and leg wool removed. Subsequently, only the fleece wool is removed at shearing time. These methods were developed specifically for the purposes of minimizing contamination of fleece wool with inferior fibers including colored fibers that are associated with belly, stained and tag wools..

### Harvesting considerations that will enhance skirting.

Recognizing that wool production and quality control are a year-round activity, McFadden (1962) emphasized that wool preparation starts with the branding of freshly shorn sheep. Where branding is necessary, only recommended scourable fluids should be used. Alternatively, ear tags may be used to completely avoid the problems associated with contamination of wool with branding

fluid. Proper management of the flock during the wool growth period also has major consequences on wool quality at harvest time. Careful selection and culling techniques produce uniform flocks. Such factors as nutrition, health, careless supplemental feeding, fields and pastures heavily infested with wool-contaminating plants, crutching before lambing and spraying for external parasites all influence the ultimate quality of the wool.

A recent circular (Sachse, 1985) from New Mexico State University Cooperative Extension Service describes the shearing facilities and wool preparation techniques that are required for a successful skirting, grading or classing operation. Detailed plans of Australian-style shearing sheds and holding facilities are also available (Australian Wool Corporation, 1981-1982).

Responsibilities at shearing time fall into two main categories. The responsibilities of an owner include: being present on the shearing floor and in the wool handling areas at all times; planning a constant flow of sheep to and from the shearers; providing a firm shearing board with a sweepable surface; presenting the sheep in a clean, dry state after withholding feed and water for 12 hours prior to shearing; providing a clean, dry shearing area with adequate ventilation and light for efficient shearing and wool handling; providing adequate space for wool preparation and bagging; and, providing adequate labor to handle the sheep, wool and cleaning chores, particularly sweeping the shearing area between sheep.

The owner may also consider using the most efficient means of packaging in conjunction with improved methods of preparing wool prior to marketing. Hydraulic wool sackers and bale presses are two developments worthy of note. Increasing the density of the package also enables more representative sampling with the currently accepted coring technique.

The responsibilities of the head shearer include: providing well-trained shearers who are capable of removing fleeces in one piece with a minimum of second cuts in the wool and nicks and cuts on the sheep; providing an adequate number of shearers and equipment to complete the job in a pre-arranged time; minimizing injuries to ewes by discouraging the practice of dragging sheep by the hind leg from the catching area to the shearing floor; and, finally, encouraging his shearers to adopt a method of shearing that produces the least amount of stress and the least number of physical injuries to the sheep. This would eventually lead to the discontinuation of the shearing method prevalent in the southwestern portion of the country in which legs are routinely tied prior to shearing the bulk of the fleece. Using this technique, belly, lower leg and some stained wool from the crotch area is removed prior to tying all four legs. Subsequently, the animal is rolled and maneuvered in such a way that the remainder of the fleece is removed intact. Australian-style shearers perform the same task without tying legs. In either case, traditional, original bag wool packaging procedures would require the belly and perhaps even the head and leg wool to be placed onto the fleece prior to rolling the whole into a ball with the fiber tips inside and the shoulder wool on the outside. When packaging fleeces of uniform or single grade it has become common practice not to tie fleeces. When fleeces of variable grades are being packaged together, the rolled fleeces are normally tied with a paper string in order to facilitate grading and sorting at the textile mill. Rolled fleeces are then placed into new, clean burlap bags and packed by tramping. Such bags will contain 100 - 300 lb. of grease wool depending upon such factors as the size of the bag, wool type and the weight and vigor of the person responsible for the tramping.

In this type of operation 2 - 5% of each fleece will fall out or be removed during transfer from the shearing floor to the wool bag. This wool is composed mainly of double cuts, short leg wool and heavy tags. It is normally swept up and packaged separately as tags, sweepings or clippings. Wools packaged in the traditional original bag manner are normally graded and sorted at the textile mill or, on occasion, at the warehouse, cooperative facilities or wool dealers premises.

**Objective fleece and fiber measurements.**

Skirted and/or graded grease wool lends itself to pre-sale objective measurement to the advantage of all concerned (Lupton, 1987b). In contrast, objective measurements of wool sampled from original bags are only of limited usefulness since the values obtained quantify characteristics of whole fleeces, segments of which (skirted wool and the various types of skirts) are not usually processed together. Objective measurements could be made available to the buyer and seller at sale time. In practice, samples are sometimes measured after the sale to permit calculation of a price based upon a prearranged formula often involving clean wool yield and average diameter. Although standard U.S. methods exist for the determination of staple length and strength, objective measurements conducted on greasy wool are normally confined to parameters that can be determined from core sample, i.e. clean wool fiber present, vegetable matter present, average fiber diameter and variability of

diameter. Standard practice for core sampling of raw wool (American Society for Testing and Materials, D1060) specifies a lower limit of 25 packages for a wool lot that can meaningfully be sampled by coring and subsequently be described with objective measurements.

Findings of a preliminary study (Capener and Stockard, 1983) conducted in New Mexico suggested that it would be cost-effective for fine-wool growers that market 10,000 or more pounds of wool annually to sell their product on the basis of a certified core test. It might also be noted that this is the basis for selling most Australian wools and nearly all fine wools that enter the international market. Recent discussions of advantages of core testing and objective measuring to the various industry segments have been presented by Jones (1985), Lupton (1987b) and Johnson (1988).

## WOOL PREPARATION AND MARKETING OVERSEAS

Three different systems for preparing and marketing wools in foreign countries are reviewed. The Australian system has changed considerably in the past 15 years and is geared to supplying the international worsted trade with large, uniform lines of fine wool. Marketing strategy is based predominantly upon "sale-by-sample" and public auction. A second, somewhat different system, also in a state of flux, is that used in New Zealand for the presentation and trading of relatively coarse wools. Thirdly, a system is described based entirely on subjective appraisal. This system is used for the dispersal of the relatively small and specialized British wool clip.

### Preparation and marketing of wool in Australia
(Australian Wool Corporation, 1987)

About 70,000 farms are involved in wool production in Australia. Generally, flocks range from 500 to 50,000 sheep with a typical size being 4,000. Australian sheep numbers are 156 million. More than 75% of all Australian sheep are Merinos. Purebreeds dominating the remaining 25% include Polwarth, Corriedale and Border Leicester. Three basic strains of Australian Merino are recognized. These are the Saxon (fine-wooled, 19.5$\mu$m), Peppin (medium-wooled, 21/22 $\mu$m) and the South Australian (strong-wooled, 23/24 $\mu$m) Merinos. These animals graze one-quarter of the whole continent and produced over 800 million kilograms of grease wool (including dead and fellmongered wool and wool on skins) in the 1985/86 season.

Major sectors of the Australian wool industry are the growers, brokers, buyers, testers, "dumpers" (compressors of bales prior to shipment), processors and the Australian Wool Corporation (AWC). Shearing is accomplished by 13,000 unionized shearers. Shorn wool is classed by some of the 35,000 registered woolclassers, the majority of whom are trained producers who prefer to class their own wool. The different lines are then packed into bales and delivered to the broker. Woolbrokers act as agents for the growers in the sale of their wool. There are currently 30 brokers in Australia handling the 80% of Australian wool that is sold by auction. In addition to warehousing the growers' wool, brokers obtain representative grab and core samples for display use and for testing by the Australian Wool Testing Authority (AWTA). The test information is made available to buyers prior to the time of sale. The broker is also responsible for organizing and advertising auctions, conducting the financial transactions and arranging for the physical delivery of the wool. Other optional services available to the grower include bulk classing and re-classing, blending of lots and sampling of wool not sold under the "sale-by-sample" scheme.

Recently, brokers and growers have been afforded another marketing option known as "sale-by-separation". In this system, the wool itself is retained at the warehouse to which it was originally delivered. Representative samples are sent to another location at which the wool is sold. This system permits greater flexibility in both the timing and location of sale.

Wool-buying firms purchase wool through the auction system for a variety of clients including overseas mills and Australian textile companies, and speculatively for their own accounts. Private buyers travel the country purchasing the remaining 20% of wool sold outside the auction system.

The AWTA provides accurate, impartial testing services in an attempt to "maximize net income to the Australian wool industry by encouraging the optimum application of objective measurements by woolgrowers, brokers, buyers and processors" (AWC, 1987). For the last two seasons, AWTA sampled bales representing over 99% of the Australian clip.

The wool dumping section of the industry compresses the farm bales into more compact bales, usually just prior to shipment, thereby minimizing freight costs. Approximately 95% of Austalian wool is exported, mostly in greasy form. Twenty-six firms scour and/or carbonize wool in Australia, of which five are also involved in top production.

The AWC was incorporated in 1973 having responsibilities associated with marketing and domestic promotion of the Australian clip. Funds are provided by an 8% levy on proceeds from wool sales. Of this proportion, 5% is used in the price support program, 2% for wool promotion and 1% for research. The AWC also participates in and makes recommendations for wool research conducted by Australian and international agencies. Among the fiber marketing responsibilities, AWC operates a floor and flexible reserve price scheme for wool sold at auction and by tender. In this connection, the AWC type list is used as the basis for determining the value of sale lots when operating the Reserve Price Scheme. Under the scheme, all wools appraised as a certain "type" are allocated the same value or reserve price by the AWC. The type comprises several components, each describing a characteristic of the wool, some of which are subjectively (S) assessed while others are objectively (O) measured. The present type list uses numbers from 1 to 800 to indicate specific combinations of characteristics. Yield measurements are separated from the type, e.g. Type 62 at 70%. Characteristics included in the Merino fleece category in addition to breed are style (S), fiber diameter (O), length (S or O), color (S), tensile strength (S or O), vegetable matter content (O) and vegetable matter type (S).

Traditionally, Australian woolclassers classified wool into a large number of lines based on subjective assessment of spinning quality number (strongly influenced by crimp frequency), staple length, color, condition, style and soundness. This system produced extreme fragmentation of the clip which resulted in inefficient and costly marketing. Research conducted in cooperation with textile manufacturers throughout the world showed that spinning performance cannot be accurately predicted in this manner. Important processing characteristics such as fiber diameter, yield and vegetable matter can only be accurately determined using laboratory techniques. Thus the 1970's saw the advent of objective measurement in marketing in Australia which made it feasible to combine wools of similar characteristics into much larger lines. This also led to a new classing system known as Objective Clip Preparation (OCP) and in 1986, a new "Code of Practice for Preparation of Australian Wool Clips" was released to all segments of the industry. The code recognized that clip preparation should "provide a textile fiber which processors may use with confidence" while "maximizing net returns to wool growers." This is best achieved by producing as few lines as possible from a clip while maintaining uniformity within a line and eliminating contamination of the clip with stained and pigmented fibers and all foreign material.

Skirting of Merino fleeces and separate packaging of skirts, sweepings and fleece wool were common practices in Australia at the beginning of this century. An issue still current is the extent to which skirting should be carried out. Lunney (1985) addressed this subject and observed that in the past there had been a tendency to overskirt despite the warnings of learned individuals, study groups and associations. Calculations of the trend of skirting were made by Lunney for the 31 years between 1953 and 1984 using data from the Wool Sale Statistics (Australian Wool Corporation, 1953-1984). Fleece to skirtings (including belly but excluding other types such as locks, crutchings, stains and burry clumps) ratio has changed from 2.04 to 3.00 during this time period. Thus, for the 1983-84 season, the relative amounts of fleece, skirtings (pieces), other types, and lambswool sold in Australia were 60.9, 20.3, 13.0, and 5.8% respectively. This represents a decrease in the percentage of skirts of 7% compared to 1953-54. In the same time frame, the preparation of other types has remained unchanged.

Despite this trend of decreased skirting, the actual amount of skirts removed appears very high compared to the limited U.S. commercial practice, for example, at the Sonora Wool and Mohair Company. Some of the difference can undoubtedly be explained by differences in sheep characteristics between the two locations. However, the Australian amounts are very similar to that reported by Hallford et al. (1984) in their experiment with table skirted New Mexico wools.

The Australian wool industry considers that skirting is the first prerequisite for good clip preparation. In practice, belly wool is shorn at the start of the shearing cycle and is immediately picked up from the shearing board. All urine, mud and fecal-stained wool is removed and kept separate and the clean belly wool is placed into a special belly wool line. The remainder of the freshly shorn fleece is picked up and thrown onto a table for skirting. This process involves removal of "sweaty edges", felted "neck runners", excessively yellow wool and heavy seed and vegetable contamination. In addition, "jaw pieces" and topknots are removed and placed into separate lines. Shank wool and wool from the backs and short crutch pieces are skirted and any stained wool is kept completely separate from all other lines. Care is also taken to remove all "skin pieces". It is sometimes necessary to remove hairy britch wool and wasty or tender backs. The skirted fleece is then rolled-up and presented to a classer. The classer visually appraises the charactertistics of fineness (quality number), length, strength, color and condition (yield) for each fleece and

assigns it to a particular line. In modern classing, wool from individual "mobs" is kept separate. In an effort to produce one large line comprising the bulk of the clip, three adjacent visual qualities are combined to form a single line (e.g. 70's, 64s and 60s or 60s, 58s, 56s). Typically seven lines, not including the stained wool and tags, are made for a Merino farm flock. The main line comprises the bulk of the fleeces and contains three visual qualities. A second line comprises the same qualities of wool having a substantially shorter staple length. A third line contains coarse fleeces from sheep that should subsequently be culled. All off-type fleeces (tender, cotted, colored, overgrown, from diseased sheep, containing pigmented fibers) are placed in a line for subsequent bulk classing at the brokers. Three more small lines contain the fleece trimmings, bellies and locks.

The classed fleece is placed directly into a baling device which is usually an automatic, self-pinning hydraulic type that produces an average bale weight of 169 kg (range 110-204 kg). The Code of Practice recommends 195 kg. Only AWC-approved, new woolpacks composed of high density polyethylene or jute may be used. Each bale is marked with the farm brand, woolclassers registration number, description of contents, wool store destination mark and bale number.

The AWC is also charged with maintaining the quality of clip preparation. This is achieved through the operation of a voluntary, woolclasser registration scheme, a clip inspection service and general extension work. It is interesting to note that the AWC also has the authority to withdraw its reserve price support from any wool that has not been prepared in accordance with industry-agreed, clip preparation standards.

The test procedures required for sale-by-sample include grab and core sampling of every bale in a lot. These samples are used for display on the showfloor and for testing by AWTA. In addition, official weighing of each bale is required for AWTA, broker and grower records. Routine pre-sale measurements include wool base (with theoretical estimates of processing yields) mean fiber diameter, vegetable matter base and description of vegetable type. All of this information is placed on an IWTO Test Certificate which is issued prior to the sale. As discussed previously, the marketing options available to the Australian woolgrower are public auction, public tender and private treaty. A distinct advantage of private sales is the relatively rapid payment for the wool clip to the grower. Of course, the grower needs to be well advised on current wool prices before participating in this type of sale.

The ultimate goal of current research being conducted in Australia is to develop a system of selling combing wools based on description alone. To this end, sales with additional measurements taken from the grab sample were introduced in January 1985 when pre-sale tests for staple length, staple strength and position of break became commercially available, complementing the existing core-test measurements. The measurement of clean color is expected to be available very soon. Approximately 18% of combing wools offered for sale by auction in the 1986/87 season were tested for length and strength. Other characteristics under examination for inclusion by objective measurement include variability of fiber diameter and resistance to compression, which gives an indication of crimp and/or bulk.

**Clip preparation and marketing of wool in New Zealand**

Sixty-five million sheep populate the islands of New Zealand, outnumbering humans 20:1. Ninety percent of wool production is exported assisting the sheep industry to produce about one third of all overseas income for the country which is the largest supplier of coarse wool in the world. New Zealand is also the third largest grower behind Australia and Russia. However, its industry is considerably different than that of Australia, being geared primarily for meat and carpet wool production. Popular sheep breeds (in order of decreasing numbers) include Romney, Coopworth, Perendale, Corriedale, New Zealand Halfbred, Merino, Borderdale and Drysdale. The principal philosophy towards wool is to produce the greatest weight at least cost. The average farmer runs 1,500 ewes, often sharing pastures with cattle, deer and goats. Total annual wool production in 1986 was 796 million pounds of which about 15% was slipe wool, that removed from skins. Despite having different types of sheep industries, the new New Zealand practices towards wool preparation are not dissimilar to Australian (and South African) methods and are summarized as follows (Grace, 1986, 1987 and Grower Services Division, NZWB).

The objectives of good wool handling are "to provide both the buyer and the manufacturer with parcels of wool they can handle confidently, knowing they are uniform and meet the standards required for processing into quality yarns and textiles" and "to maximize the net returns of the woolgrowers." These objectives are best achieved by grouping wools into as few graded or classed lines as possible; removing cotts (felted wool), stains, excessive vegetable matter, and off-type fleeces; consistent preparation; and packing the contaminant-free wools in bales having legible identification.

The farmer prepares for shearing by having his sheep "dagged" (crutched or tagged) at least two weeks beforehand. At shearing, the sheep are presented in clean and dry condition to the shearer, who shears without tying legs. Rectangular and circular slatted tables are commonly used to skirt and grade the shorn wool. Interestingly, scrapers are recommended over brooms for keeping the shearing and wool areas clean. Scrapers minimize the risk of wool contamination.

Classing is nowadays restricted to fine wool clips (since classing of coarse wools is not profitable) and involves sorting the clip into a number of lines according to average diameter, length and color. It is only justified when distinct premiums are being paid. Most other wool types are graded, which in New Zealand means producing a uniform line of wool, keeping out whole fleeces which differ radically from the bulk. Non-conforming fleeces in a purebred flock which has grazed as a unit all year are few. Skirting is a prerequisite to both classing and grading but the key words in New Zealand are usually, "skirt lightly".

Typically, a fleece arrives at the table every 20-30 seconds which does not leave much time to do anything but remove the permanently discolored parts. This is the most important aspect of skirting coarser wools but in addition, a variable amount of attention is paid to separating belly wool, crutch wool, second cuts, leg wool, topknots, cotted portions, grass stain, heavy brand marks, and portions of the fleece carrying particularly heavy vegetable matter.

The Wool Board provides specific suggestions for working crossbred, second shear and lamb fleeces as well as crutchings. Throughout, the importance of minimal skirting is stressed.

Finally, the different lines are pressed into uniform bales, care being taken not to exceed the 200 kg limit. A target weight of 180 kg is recommended. Each bale is branded with a farm brand, description of contents and bale number prior to shipment to the wool broker.

"Sample selling" in New Zealand is a method of displaying wool for sale using a representative sample of wool together with a test certificate showing yield, fiber diameter, color and vegetable matter content. Grab samples are used to provide the sale sample and core samples are taken from the bales to provide representative samples for objective measurements. Wool is sold at one of eight auction centers (about 75% of total) and privately (about 25%) but standard advice from the Wool Board is to sell wool at the earliest opportunity. As in the U.S., picking the best sale remains somewhat of a gamble, but generally the best prices are received by those farmers who shear early. When wool is sold privately, the buyer's assessment of yield usually prevails. A better alternative and one becoming more prevalent is for the buyer to negotiate a clean price and have it tested prior to payment. A third alternative is to have the wool tested on the farm and receive a guidance report prior to selling. This report does not carry the status of a certificate because sampling and weighing are not controlled. However, a report can be obtained in only two days from either of the two testing organizations.

Like its Australian counterpart, the N.Z. Wool Board maintains a minimum price for each type of wool. Other responsibilities connected with quality control of the N.Z. clip include the training and certification of shearers, wool handlers and classers. So far as pre- and post-sale objective measurements are concerned, test houses are now routinely measuring yield, vegetable matter content, diameter and color. Bulk will probably be available next followed by staple length, strength and medullation. The Board considers it possible that in the future wool will be traded on measurement alone, with no display samples.

**Preparation and marketing of wool in the United Kingdom**

There are about 90,000 wool producers in the U.K. producing about 130 million pounds of grease wool a year. This quantity of wool is grown by about 20 million sheep representing 40 pure breeds, many half-breeds, hybrids and crosses. Another 15 million sheep a year are sold for meat before growing a full fleece. Most of this wool is removed from the skin after slaughter. These numbers indicate that the average clip per farm is small, about 1,400 lb and extremely varied.

Nearly all of the fleece wool is sold through the producer-operated British Wool Marketing Board (BWMB) which was established in 1950. The Board arranges for wool received from the farmer to be graded and then sells it to the trade at auction. The Board is also responsible for fleece improvement and wool preparation programs and policies and promotion of wool sales. The Board sponsors wool research and product development. Without the BWMB, the vast majority of producers selling individually could not hope to obtain full market value for their small, variable clips. The system appears to be working well since, for its type, British wool regularly commands the highest price in the world.

Each year, the government establishes a guaranteed price for British wools after consultation with the farmers' unions. The Board then estimates its marketing costs and deducts these from the overall guaranteed price. A schedule of maximum prices for all grades is then prepared and made available to producers in April, prior to shearing time. This schedule of prices reflects changes in the relative market prices of different grades from the previous year and results in the payment of an average price to all producers of a particular grade when the wool is presented in the recommended manner. The vast quantities of skin wool produced in the U.K. do not qualify for these guaranteed prices. The effect of this pricing mechanism is to eliminate short term price fluctuations to producers while passing on long term market differentials and price trends. When the proceeds of the Board's wool auctions exceed the amount paid to producers in any one year, the excess goes into a reserve account. When the situation is reversed, money is pulled out of the reserve or borrowed from the government. Special arrangements are made with the government to avoid excessive accumulations of debts or credit balances.

Like the American Wool Council of the American Sheep Producers Council, the BWMB makes the following suggestions to its growers in regards to shearing, wool preparation and presentation: "Keep sheep dry and clean for one night under cover prior to shearing. Always shear on a hard, clean surface in a dry, clean, well-lit shed. Avoid straw, grass or other vegetable contamination. Remove all "claggs", "daggings" and "soily bellies" from the fleece wool and package separately. Keep "hog wool" (the first clip of wool from sheep not shorn as lambs) separate from ewe and wether wool. Shear carefully and avoid double cuts. After shearing, roll the fleeces and pack them into "sheets" (supplied by the BWMB - approved wool merchant) having the identity of the grower and his address on the inside and outside of the package. Use only the string supplied by the merchant. Avoid sisal, jute and polypropylene twines as these are potential sources of wool contamination. Do not mix hill wool with lowland wool. Store the wool in a clean dry building until it is shipped to the merchants warehouse." Producers are specifically requested not to stain or tint their wool when dipping or spraying sheep and to make sure only fully-scourable branding fluids are used - sparingly! Finally, to encourage the production of higher quality wool, the Board offers a free ram fleece assessment service.

Wool grade specifications for British Wools are described in a booklet published by the BWMB (1987). Eight major categories of wool are subdivided into individual grades each of which is described in terms of seven characteristics. These are degree of fineness, length of staple, handle of wool, degree of luster, color, strength and "other factors." The major categories for English, Welsh and Scottish wools are Down Wools (4 grades) Fine Wools (18 grades) Medium Wools (27 grades) Masham Cross and Leicester (20 grades) Lustre Wools (9 grades) Cheviot, Radnor and Welsh (32 grades) Swaledale, Blackface and Herdwick (32 grades) and Lamb Wools (26 grades). In addition, 34 grades are used to distinguish the wools produced in Northern Ireland.

Interestingly, degree of fineness is described in terms of "quality numbers", 28's being the thickest, coarsest fibers and 100's, the very thinnest, finest fibers. Most British wools fall within the range 28's - 58's. In contrast to the U.S. system, British quality numbers "are not based on any particular unit of measurement; they are standards handed down from generation to generation of woolmen and can be learned only by practical experience and handling of wool."

Thus the grading of Britains's wide range of wools is not based on scientific measurement but on the individual, subjective assessment of each fleece by trained personnel. Consequently, fleeces from a single flock may be classified into six or more different grades. By strict maintenance of these grades, the BWMB is able to offer the U.K. clip for sale in large, graded lots, thus securing the best net return from the market for its producer members.

**Implications for the U.S. Industry**

From the viewpoint of domestic production, it is probable that the relatively small, variable U.S. clip could not be sold most efficiently using any one of these systems. Nevertheless, valuable insights can be obtained by studying these different methods with a view to subsequently adopting only those portions that can be shown to produce greater efficiency and profitability in the context of the U.S. wool industry.

Using currently recommended standard sampling procedures, many individual U.S. clips are theoretically too small (less than 25 bags) to be cored. This, however, is no longer a valid reason not to use objective measurements when marketing wool. A reasonable option for properly skirted and graded wool is to combine small clips of similar qualities for objective evaluation and subsequent sale. The actual sale of skirted and graded clips can be efficiently accomplished through existing marketing chan-

nels; pools, cooperatives and warehouses. Although some consolidation is expected for future years, a single national wool marketing system for the U.S. is not envisaged. In contrast, a single national policy concerning wool preparation and marketing would have many positive repercussions and is strongly recommended.

## WOOL PREPARATION EXPERIENCES IN THE U.S.

Much as been written and discussed concerning the merits of ranch and farm skirting of wool. Many undocumented and poorly documented trials have resulted in varying degrees of economic success or failure. Research in this field within the U.S. has been fairly sparse during the past 20 years. McFadden (1962) presented skirting information pre-dating 1962 (e.g., 1912 - 1960).

McFadden (1958) reported that Australian skirted wools had been introduced and accepted on the world market, and indicated that market researchers thought similar skirting of American wools would likewise enhance value to the manufacturer. These statements contradicted the conclusion of an earlier skirting study (Anon., 1952) reported by a technical committee (representing the Agricultural Experiment Stations of nine western states) which found that skirting was not profitable. McFadden thought that the 1952 report was actually inconclusive mainly because of resistance to change by certain segments of the industry. He subsequently proceeded to conduct his own experiment (McFadden, 1958). Fleeces from three groups of improved New Mexico fine wool sheep (24 animals/group) in each of two years were either not skirted, shearer skirted or table skirted. Wool from each group was evaluated prior to scouring and conversion into top. The manufactured tops were fully evaluated in terms of mean fiber diameter, average fiber length, proportion of noils, ratio of top to clean and greasy wool and actual value as determined by the regulations of the Wool Associates of the New York Cotton Exchange (top) and the Boston Wool Market (noils). Ultimately, McFadden concluded that shearer skirting was economically impractical. He further concluded that to justify table skirting, a producer must receive a premium of at least 7 percent for the skirted wool and a discount of not more than 11.3 percent for the skirts.

It is noteworthy that McFadden's shearer skirts constituted 15.4% of the fleece whereas the table skirts composed 20.4% of the whole. It is possible that in 1957, the textile industry did not emphasize colored and black fiber content in top as much as today since the author did not report these parameters. Whatever the case, this authoritative report undoubtedly convinced many producers that skirting was not profitable unless the aforementioned premiums and discounts could be assured prior to shearing.

Pexton et al. (1969) studied the influence of two levels of skirting upon the characteristics of the tops produced from skirted and unskirted medium grade (23 - 24 $\mu$m) wool. The control in this three year study was fleeces in which only tags and stained wool (3.1%) were removed. Optimum skirting removed 8.9% and maximum skirting 16.4% of the total clip. All wool was scoured with all main lots being French combed and processed into top. The authors concluded that optimum and maximum skirting of this type of wool showed no beneficial effect on scoured yield, top-and-noil yield, neps (small aggregations of entangled fibers), black fiber content and vegetable matter. Optimum skirting increased scoured fiber length but this advantage was lost by the time fibers were converted into top. The fiber diameter of top was significantly decreased by both levels of skirting.

Close inspection of the yield data for skirted wool and skirts reveal several inconsistencies. For example, the mean scoured length of maximum skirted wool was less than that of either the control or the optimum skirted. Also, mean fiber lengths in top for the three types of wool were uniformly short suggesting the possibility of a mechanical limitation in processing. This is reflected in the Boston appraisals of top samples that revealed 32 of the 45 lots processed were too short in fiber length for grade. Since even the control wool used in this study contained only 2.3 colored fibers/14.2 g, the wools were obviously relatively low in black fiber content. However, commercial white tops containing more than 10 black fibers per 100g can suffer a reduction in value of 4 to 15% (Fleet, 1985).

The authors' contention that maximum and optimum skirting had no beneficial effects on wool processing of clips which were uniform initially is seriously undermined by the aforementioned observations. Nevertheless, it is nowadays generally conceded that skirting is potentially more beneficial when applied to fine wools as compared to wools coarser than 23 microns.

Capener and Stockard (1983) gave an account of a study for which one objective was to identify changes in the marketing of New Mexico wools that would narrow the price difference between comparable New Mexico and Australian wools. The authors observed that between 1971 and 1980 the average annual reported price of U.S. territory wools had averaged 28 cents a pound (grease

basis) less than similar quality Australian wool. In contrast, territory wools in the previous decade averaged 6.3 cents per pound more than comparable Australian wool. Findings of this preliminary study suggested that it would be cost effective for wool growers that market 10,000 or more pounds of wool annually to sell their wool on the basis of a certified core test. It was also recommended that emphasis be placed on marketing wool that is free of black fibers, plastic and other foreign material. Presumably, this situation could be approached by skirting.

In another study, data were collected from three range flock operations in southeastern New Mexico in 1983 (Early, 1984). The flocks were composed of uniform, fine-wool sheep. Seven thousand eight hundred fleeces weighing 71, 120 lb were shearer skirted and the grease wool was baled at the ranches. Skirts (belly, face, leg and stained wool) averaged 12% of the total fleece weight, ranging from 9.5 to 17.5% among ranches. The wool was sold on the basis of core tests, and the author calculated that the three ranchers who skirted, baled and core tested their wool, received about 10 cents a grease pound more than the average received by other producers in the area for wool of a similar quality. The author stopped short of recommending skirting, carefully pointing out that it was not possible to determine the relative contributions to the higher price of the four variables being tested, i.e., skirting, core testing, selling on the basis of a core test and baling.

In recent years, concern has been expressed (Jones, 1985) about coarse britches in sheep and the part this trait should play in selection for breeding. Willingham et al. (1984) undertook a skirting study to determine the contribution of the britch area to overall fiber diameter and fleece weight in two flocks (207 animals) of uniformly fine Rambouillet ewes in west Texas. Britch wool was removed at shearing from a random sample of sheep from each flock. Wool weights were determined for the entire fleeces and the removed britches. Britch wool composed 5.7% of the whole. Average fiber diameter values were also determined for each group in grease, scoured and top forms. Britch wool was consistently coarser than the rest of the fleece; however, removal of the britch wool did not significantly increase the fineness of the remainder. Both flocks were fine enough (20.2 and 19.4 $\mu$m) that skirting of britches was not a paying proposition. This conclusion could well be reversed in the case of flocks that are not quite as fine (e.g. 22.2 $\mu$m.) for which removal of 5.7% britch wool could cause the balance of the wool to be elevated by one fineness grade.

In a skirting study conducted with 134 fine-wool ewes that had been maintained under drylot conditions, Hallford et al. (1984) reported that table skirts comprised 30.7% of the total fleece compared with 19.6% for shearer skirts. Wool that had been skirted on the table was higher yielding than either shearer skirted or non-skirted wool (54.5, 48.0, 50.7%, respectively). However, no significant differences were noted in either average diameter, variability of diameter or vegetable matter content among matchings from the two skirted groups and intact control fleeces. The authors concluded that from a technical standpoint, skirting fleeces of this type does not appear to be advantageous. Additional work is required to determine if this conclusion also applies to fine-wool sheep maintained under range conditions. One quality characteristic not reported in this study was colored fiber content. Results of this measurement could have reversed the conclusion. A major concern arising from this particular study was the difference between the relatively large quantities of skirts removed in the two techniques. The authors recognized that removing this much wool was not an economical proposition with existing market conditions. In private communication, Sachse (1987) indicated that table and shearer skirting trials had been conducted on 20 New Mexico range ewes in 1987. Even though the intention was to be as conservative as possible, shearer and table skirts again made up high proportions that Sachse considered economically unacceptable (18.9 and 22.5%, respectively).

Bassett et al. (1972) noted that efforts had been made over a long period of time to encourage wool preparation practices that would provide more uniform sale lots which could compete directly with imported wools. Specifically, the efforts of the Sonora Wool and Mohair Company were outlined for the spring of 1971 when the warehouse marketed 700,000 lb. of wool from which the bellies had been separated on the shearing floor. Belly wool constituted 7.5% of the total wool shorn and was shown to be shorter, slightly coarser and weaker than either the staple or French combing wools. The belly wool also contained more colored fibers and vegetable matter. The researchers noted that removal of belly wool on the shearing floor was accomplished with no increase in labor costs and concluded that the difference in colored fiber content and other quality characteristics should warrant a premium for the skirted wools. No economic data were presented at that time.

Bassett (1985) expanded his earlier report on fine wools that had been shearer skirted in the Sonora area. Data were added from 1972 and an Australian Type 62 (21 $\mu$m, U.S. 64/70s) wool was purchased for comparison with

domestically grown and shearer skirted staple, French combing, clothing wools, skirts and comparable non-skirted fleeces. Objective measurements were made on representative samples of the grease wool and top. The data indicated no significant differences in average diameter between any of the lines. Staple length differences simply reflected the method used to class the wools in the shearing shed. Clean yields were as expected with the skirts yielding less clean wool (44.9%) than the skirted lines (49.6 - 54.0%) including the Australian wool (70.3%). From measurements made on wool top, there was clear evidence of the improvement that had been made in decreasing colored fiber content by removing belly wool from fleeces. The reported number of colored fibers per ½ oz of top was 49.0 for skirts, 48.7 for non-skirted fleeces, and 6.1 for skirted, French-combing fleeces.

Bassett also discussed economic considerations for the practice of removing belly wool at the shearing floor. His first point was that higher prices must be paid for skirted wools in order to justify the practice and he observed that buyers in Texas had consistently paid higher prices for skirted Texas wools *when presented in volume.* The second factor was the amount of skirt removed. In the 1971 Sonora study, quantities of belly wool separated ranged from 3.9 to 12.8% except for one clip with heavy burclover contamination from which 17.3% was removed. The average proportion of belly wool removed from 700,000 lb of wool was 7.5%. Bassett concluded that removal of amounts in excess of 9.0% may make the practice economically questionable. Of course, a third key factor in the economic consideration is the price that will be paid for belly wool.

**Recent skirting trials at the Texas Agricultural Experiment Station, San Angelo** (Lupton, 1987a)

A flock of Rambouillet (41) and crossbred (198) ewes was identified for a skirting study in May, 1987. The animals had been maintained on rangeland located northwest of San Angelo, Texas, for the previous 12 months (with the exception of one group, the ¼ Booroola Merino x ¾ Rambouillet that spent only the last 4 months with the main flock). Approximately one third of these sheep had been tagged immediately after lambing in January and February. At shearing, belly wool from each animal was shearer-skirted and weighed. Subsequently, the balance of the fleece was table-skirted, removing tags, stained wool and other inferior portions. The table skirts and skirted fleeces were also weighed. Results are presented in table 2. Total skirts removed ranged from a low of 8.1% for the ½ Finn x ½ Rambouillet sheep to 15.7% in the case of the ½ Booroola Merino x ½ Rambouillet group. Prior tagging of some of these animals undoubtedly caused the reported values to be slightly lower than they would otherwise have been.

Skirted fleeces and belly wool from each group were bagged separately. Subsequently, yield and fiber diameter

**Table 2. Skirting information for 7 groups of sheep of different breeding***

| Breed I.D. | Number of animals | Average wt. whole fleece (lb) | Average wt. belly wool (lb) | Average wt. tags and non-belly skirts (lb) | Average proportion of skirts (%) |
|---|---|---|---|---|---|
| ¼ Booroola Merino x ¼ Coopworth x ½ Rambouillet | 37 | 9.96[a] | .76[a] | .57[a] | 13.3 |
| ½ Dorset x ½Rambouillet | 23 | 7.27[b] | .46[bc] | .27[bc] | 10.0 |
| ½ Finn x ½ Rambouillet | 53 | 7.55[b] | .33[c] | .28[c] | 8.1 |
| Rambouillet | 41 | 10.31[a] | .62[ab] | .63[a] | 12.1 |
| ½ Finn x ¼ Booroola Merino x ¼ Coopworth | 14 | 7.98[b] | .57[ab] | .51[ab] | 13.5 |
| ½ Booroola Merino x ½ Rambouillet | 26 | 10.42[a] | .83[a] | .81[a] | 15.7 |
| ¼ Booroola Merino x ¾ Rambouillet | 45 | 10.11[a] | .77[a] | .67[a] | 14.2 |

* Column means not sharing common superscripts differ ($P < 0.05$).

Source: Willingham, T., M. Shelton and C.J. Lupton, 1988.
The influence of introducing the Booroola Merino genotype into Rambouillet flocks on reproduction and fleece traits in comparison with other selected breed crosses.
SID Research Journal: 4(2), 1-5.

Table 3. Yield information for skirted and belly wools[+]

| Breed I.D. | Number of Animals | Fleece CWFP[*] (%) | Belly CWFP (%) | Fleece VMP[Δ] (%) | Belly VMP (%) |
|---|---|---|---|---|---|
| ¼ Booroola Merino x ¼ Coopworth x ½ Rambouillet | 37 | 56.3[cd] | 43.5[b] | .9 | 2.3 |
| ½ Dorset x ½ Rambouillet | 23 | 53.4[de] | 41.1[cd] | 1.4 | 2.8 |
| ½ Finn x ½ Rambouillet | 53 | 54.6[d] | 39.0[d] | 1.2 | 3.5 |
| Rambouillet | 41 | 50.0[e] | 37.0[e] | .6 | 2.7 |
| ½ Finn x ¼ Booroola Merino x ¼ Coopworth | 14 | 66.5[a] | 46.6[a] | 1.2 | 4.0 |
| ½ Booroola Merino x ½ Rambouillet | 26 | 59.7[bc] | 42.2[bc] | 1.0 | 2.1 |
| ¼ Booroola Merino x ¾ Rambouillet | 45 | 61.1[b] | 46.8[a] | .8 | 2.1 |
| Combined tags and non-belly skirts | (239) | 31.9 | | 2.9 | |

[+] Column means sharing common superscripts do not differ (P> 0.05).

[*] Clean wool fiber present

[Δ] Vegetable matter present

Table 4. Fineness values for skirted and belly wools[*]

| Breed I.D. | Number of Animals | Average fiber diameter of skirted wool (μm) | Average fiber diameter of belly wool (μm) |
|---|---|---|---|
| ¼ Booroola Merino x ¼ Coopworth x ½ Rambouillet | 37 | 24.2[b] | 24.1[b] |
| ½ Dorset x ½ Rambouillet | 23 | 25.7[b] | 26.2[a] |
| ½ Finn x ½ Rambouillet | 53 | 22.8[c] | 22.7[c] |
| Rambouillet | 41 | 22.3[c] | 20.8[d] |
| ½ Finn x ¼ Booroola Merino x ¼ Coopworth | 14 | 28.0[a] | 26.8[a] |
| ½ Booroola Merino x ½ Rambouillet | 26 | 22.6[c] | 21.9[c] |
| ¼ Booroola Merino x ¾ Rambouillet | 45 | 22.6[c] | 21.9[c] |

[*] Column means sharing common superscripts do not differ (P> 0.05)

values were determined for representative core sample. Table 3 provides clear evidence that belly wool is lower yielding and more contaminated with vegetable matter than the average of the fleeces from which it was separated. Table 4 indicates that belly wool is generally finer than the balance of the fleece for this particular group of Rambouillet and crossbred ewes, the only notable exception being the ½ Dorset x ½ Rambouillet group.

This experiment confirmed some of the technical advantages of skirting; however, the actual dollar values of the skirted wools and skirts in the 1987 wool market were not determined. A concurrent series of experiments was designed to partially answer some of the economic questions for fine wools.

Rambouillet ewe flocks maintained at 3 locations were selected for this series of experiments. In two flocks, the animals were divided into two groups containing equal numbers. Wool from one group was skirted using a shearer-assisted, table skirt. Wool from the other half of the flock was packaged in original bag form. In the third flock, wool from one third of the animals was skirted by shearing the tags, belly and leg wool one day before shearing the balance of the fleece; another third of the wool was skirted using the shearer-assisted, table method and the balance was packaged in original bag form. Core

Table 5. San Angelo flock (257 mixed age, commercial Rambouillet ewes, untagged)

| Wool I.D. | Fiber diameter (μm) | CWFP* (%) | VMP△ (%) | Grease weight (lb) | Fraction of total (%) | Price ($/lb,greasy) |
|---|---|---|---|---|---|---|
| Skirted staple | 20.9 | 53.7 | 2.3 | 1017 | 81.0 | 1.608 |
| Belly wool | 20.5 | 35.6 | 4.4 | 104 | 8.3 | 0.500 |
| Tags | 20.8 | 34.6 | 3.6 | 134 | 10.7 | 0.500 |
| | | | | 1255 | | |
| Original bag | 20.6 | 51.4 | 1.9 | 1348 | 100.0 | 1.360 |

**Calculation:**

Average price of skirts and skirted wool = $1.40/lb.

Average weight grease wool produced/sheep = 10.13 lb.

Increased return from skirting = $1.40-$1.36/lb.

= $0.04/lb.

= $0.40/sheep

* Clean wool fiber present

△ Vegetable matter present

samples were taken from each lot of wool and analyzed for diameter, yield and vegetable matter. Subsequently, portions of the skirted and original bag wools were sold through 3 different warehouses, thus allowing simple economic comparisons. The results obtained are summarized in tables 5, 6 and 7.

Sheep in the San Angelo and Brady flocks (tables 5 and 6) had not been crutched (tagged) prior to lambing. Consequently, relatively large quantities (10.7 and 13.0%) of tag wool were removed from these fleeces on the skirting table. Belly wool removed by the shearers ranged from 8.3 to 13.1% resulting in total skirts of 19.0 and 26.1%. Although wool from the two flocks was very similar, prices received were somewhat different. In particular, one warehouse did not distinguish between tags and belly wool, resulting in a relatively low price ($0.50/lb) for the latter. Nevertheless, skirting these two flocks resulted in a pre-incentive increased return from skirting as compared to original bag marketing of $0.40 and $0.92/sheep. This does not include the cost of extra labor required to table-skirt the wool. Warehouses in Texas charge producers about $60/day for one professional grader. Assuming such a person can keep up with 8 shearers each shearing 100 head per day and that each sheep yielded 10 lb. grease wool, the cost of using a grader would be 0.75 cents per pound or approximately 7.5 cents per sheep.

Table 7 shows the results of skirting wool from sheep that had been previously tagged. The sheep in Group I were completely shearer-skirted the day before shearing proper. A proportion of staple wool was probably included in the skirts bag since the proportion of skirts was 22.6%. Perhaps if the researcher had communicated better to the shearer, less good wool would have been sheared the first day. Despite this heavy skirt, increased returns attributable to skirting were $1.70/sheep. Shearer assisted table-skirting of Group II resulted in an 11% total skirt which when compared to original bag marketing produced a pre-incentive advantage of $2.56/sheep. Obviously, only true skirts should be removed since financial advantages are quickly eroded when skirting is excessive, i.e. greater than 15%.

Valid criticisms of "academic" skirting studies are that the results are based on relatively small quantities of wool often sold in a single marketing year. To correct this shortcoming, the skirting exercises described last will continue for at least 3 more years. With respect to increasing the quantities of wool being studied, it will become necessary to cooperate with commercial producers. At this time, totally valid comparisons between skirted and unskirted wools are difficult to find in the commercial sector. Nevertheless, the following data appear to be informative.

Table 6. Brady flock (227 3 year old Rambouillet ewes, untagged)

| Wool I.D. | Fiber diameter (μm) | CWFP* (%) | VMP△ (%) | Grease weight (lb) | Fraction of total (%) | Price ($/lb,greasy) |
|---|---|---|---|---|---|---|
| Skirted staple | 20.9 | 55.8 | 1.5 | 907 | 73.9 | 1.665 |
| Belly wool | 20.5 | 36.9 | 3.8 | 161 | 13.1 | 0.890 |
| Tags | 21.4 | 36.4 | 4.1 | 159 | 13.0 | 0.475 |
| | | | | 1227 | | |
| Original bag | 20.7 | 51.7 | 2.6 | 1198 | 100.0 | 1.325 |

**Calculation:**

Average price of skirts and skirted wool = $1.41/lb.

Average weight grease wool produced/sheep = 10.86 lb.

Increased return from skirting = $1.41-$1.325/lb.

= $0.085/lb.

= $0.92/sheep

* Clean wool fiber present

△ Vegetable matter present

## Commercial experience

In 1986, a flock of Rambouillet ewes in western South Dakota was divided into two groups. Unskirted wool from one group was marketed in original bag form. Wool from the second group was table-skirted by professional classers. Results of this trial are summarized in table 8. Objective measurements were conducted at a commercial wool testing lab. The overall skirt was 10.6%. Gross returns for the skirted wool (skirted staple, bellies and skirts) were $1.2635/lb or $1.2219/lb after the classers had been paid. Skirting this particular flock resulted in an extra 4 cents/lb being paid for the skirted wool. It is interesting to note that the classers used in this part of the country normally keep up with 3 shearers, each shearing 100 sheep per day. Assuming 8 lb fleece weights, the cost of classing is approximately $0.04/lb greasy wool. This is considerably more expensive than the "Texas grader".

The data presented in tables 9 and 10 serve to further validate the technical reasons for skirting. Specifically, these tables highlight the relatively high yields and low vegetable contents of the skirted wools versus the bellies and skirts. Furthermore, these data illustrate the average quantities of skirts removed by professional classers. Some of these data appeared in the appendix of a previously referenced publication sponsored by the National Wool Growers Association (Jones, 1985). Unfortunately, original bag controls were not available for direct comparison with these skirted wools. The wool described in table 9 was table-skirted by professional classers who removed a very consistent 14.0, 15.4 and 14.9% of skirts over a three year period. In contrast, the wool from Montana (table 10) was shearer-skirted with the shearers separating 6.3, 6.2 and 5.7% skirts over a three year period. It was unclear whether or not these sheep had been crutched prior to shearing. Normal management practices in this area would not include crutching. It is noteworthy that in these two particular flocks, belly wool was consistently coarser than the skirted matchings. This is contrary to observations on some Texas wools made earlier in this report.

The Sonora Wool and Mohair Company in Texas has established a reputation for marketing skirted (predominantly table) and graded fine wools. Table 11 summarizes the results of wool sales over the past 10 years. The data clearly show a substantial price differential between the graded and original bag wools averaging $0.168/lb during this 10 year period. Throughout this time, the cost of skirting and grading fleeces was estimated to range from 1 - 1.5 cents/lb. It is interesting to note the consistency of the proportions of skirts (6.96 - 8.37%). Quantities of tags and clippings (unstained wool removed at tagging or crutching time) were more variable (5.16 - 9.73%).

**Table 7. Barnhart flock**
**(124 mixed-age, registered Rambouillet ewes, tagged)**

| Wool I.D. | Grease weight (lb) | Fraction of total (%) | Price ($/lb,greasy) |
|---|---|---|---|
| I. (39 sheep) | | | |
| Skirted staple (shearer) | 293.0 | 77.4 | 2.070 |
| Skirts | 85.6 | 22.6 | 0.620 |
| II. (41 sheep) | | | |
| Skirted staple (table) | 366.0 | 89.0 | 1.970 |
| Skirts | 45.4 | 11.0 | 0.620 |
| III. (44 sheep) | | | |
| Original bag | 414.0 | 100.0 | 1.565 |

**Calculations:**

**Group I**

Average price of skirts and skirted wool = $1.74/lb.
Average weight grease wool produced/sheep = 9.71 lb.

Increased return from skirting = $1.74-$1.565/lb.
= $0.175/lb.
= $1.70/sheep

**Group II**

Average price of skirts and skirted wool = $1.82/lb.
Average weight grease wool produced/sheep = 9.71 lb.

Increased return from skirting = $1.82-$1.565/lb.
= $0.255/lb.
= $2.56/sheep

From a theoretical point of view, the comparison between skirted and original bag wools in this table may not be strictly valid. It is possible that a difference existed between the original quality of the fleeces that were skirted versus those that were packaged as original bag wool. For example, the skirted wools may be slightly superior to the original bag wools. Unfortunately, there is no way to correct for this situation in the tabulation. Despite these shortcomings, the information presented in table 11 strongly supports the contention that skirting and grading increase the value of fine wools in the marketplace.

The American Wool and Mohair Association (AWMA) operates 6 warehouses located in Sonora, Mertzon, Ozona, Eden, Del Rio and Goldthwaite, Texas. For the past three years, this association has sold skirted and graded fine wools on the basis of core tests. In comparison to the Sonora Wool and Mohair Company, the Association markets a much higher proportion of original bag wools, the quality of which closely approaches the original quality of the skirted wools. Thus, comparing prices received for graded versus original bag wools sold through the Association would appear to have more validity than the previous comparison (table 11). A three year summary of wool sales of the AWMA is presented in table 12. The data indicate that grading and skirting wools have benefited producers to the extent of 11.3, 13.9 and 29.9 cents/lb, greasy over the past three years. Again, the average cost of grading would have been between 1 - 1.5 cents/lb during this period.

**Table 8. Wool skirting in western South Dakota**

| Wool I.D. | Grease weight (lb) | CWFP* (%) | VMP$^{\Delta}$ (%) | Average diameter ($\mu$m) | Sale disposition | Price ($/lb,greasy) |
|---|---|---|---|---|---|---|
| Skirted staple | 15,997 | 63.2 | 0.8 | 20.90 | Export | 1.3272 |
| Bellies | | 49.0 | 1.5 | 21.27 | Domestic | 0.8208 |
| | 1889 | | | | | |
| Other skirts | | 43.3 | 3.1 | 21.18 | Domestic | 0.6278 |
| Original bag | 14820 | 60.7 | 1.9 | 21.53 | Domestic | 1.1839 |

* Clean wool fiber present

$^{\Delta}$ Vegetable matter present

Table 9. Wool skirting in the Belle Fourche, South Dakota area

| Year | Wool description | Weight (lb) | Fraction of total (%) | Average diameter (μm) | CWFP + (%) | VMP Δ (%) |
|---|---|---|---|---|---|---|
| 1984 | Ewe | 24,800 | 62.5 | 21.95 | 59.2 | 0.4 |
| | Yearling ewe | 9,310 | 23.5 | 19.57 | 56.4 | 2.1 |
| | Bellies | 2,215 | 5.6 | 22.21 | 50.2 | 1.2 |
| | Skirts | 3,348 | 8.4 | 21.44 | 49.0 | 1.4 |
| 1985 | Ewe | 18,500 | 61.4 | 21.59 | 56.4 | 1.1 |
| | Yearling ewe | 7,010 | 23.2 | 19.88 | 56.7 | 1.2 |
| | Bellies | 2,145 | 7.1 | 22.91 | 49.4 | 2.3 |
| | Skirts | 2,495 | 8.3 | 22.16 | 44.3 | 2.2 |
| 1986 | Ewe | 31,082 | 73.7 | 21.54 | 58.5 | 0.9 |
| | Yearling ewe | 4,786 | 11.4 | 21.33 | 59.4 | 1.2 |
| | Bellies | 1,567* | 3.7* | 21.81 | 48.4 | 3.2 |
| | Skirts | 4,731 | 11.2 | 21.53 | 47.8 | 1.7 |

* Part of bellies was mixed with skirts

+ Clean wool fiber present

Δ Vegetable matter present

Table 10. Wool skirting in southwestern Montana

| Year | Wool description | Weight (lb) | Fraction of total (%) | Average diameter (μm) | CWFP* (%) | VMP Δ (%) |
|---|---|---|---|---|---|---|
| 1984 | Ewe | 36,378 | 76.1 | 21.86 | 52.3 | 0.7 |
| | Yearling ewe | 8,403 | 17.6 | 20.30 | 57.3 | 0.9 |
| | Bellies | 2,995 | 6.3 | 22.40 | 47.8 | 1.3 |
| 1985 | Ewe | 35,285 | 76.6 | 21.11 | 53.6 | 0.8 |
| | Yearling ewe | 7,912 | 17.2 | 19.06 | 56.9 | 1.2 |
| | Bellies | 2,858 | 6.2 | 22.91 | 49.4 | 2.3 |
| 1986 | Ewe | 33,937 | 73.9 | 20.67 | 52.3 | 0.4 |
| | Yearling ewe | 9,380 | 20.4 | 19.50 | 55.6 | 0.5 |
| | Bellies | 2,636 | 5.7 | 21.27 | 48.4 | 1.6 |

* Clean wool fiber present

Δ Vegetable matter present

Table 11. Ten year summary of wool sales of the Sonora Wool and Mohair Company

| | 1977 | 1978 | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 10 year means |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Average price of skirted wools ($/lb)[Δ] | 1.030 | 1.004 | 1.195 | 1.345 | 1.510 | 1.265 | 1.207 | 1.257 | 1.225 | 1.125 | 1.216 |
| Total weight of skirts and skirted wools (lb) | 660,063 | 558,358 | 643,583 | 606,242 | 576,899 | 577,353 | 591,219 | 613,505 | 481,520 | 487,034 | 579,578 |
| Average price of O.B. wools ($/lb) | 0.920 | 0.900 | 1.100 | 1.150 | 1.410 | 1.153 | 1.037 | 1.050 | 0.888 | 0.872 | 1.048 |
| Total weight of O.B. wools (lb) | 231,006 | 158,114 | 151,812 | 50,477 | 149,990 | 108,090 | 90,432 | 87,089 | 33,264 | 48,624 | 110,890 |
| Pre-incentive price differential ($/lb) | 0.110 | 0.104 | 0.095 | 0.195 | 0.100 | 0.112 | 0.170 | 0.207 | 0.337 | 0.253 | 0.168 |
| Proportion of skirts (%)[*] | 7.83 | 8.16 | 7.40 | 7.47 | 8.37 | 6.96 | 7.76 | 7.03 | 7.18 | 7.67 | 7.58 |
| Proportion of tags and clippings (%)[**] | 8.03 | 5.16 | 9.07 | 8.16 | 8.92 | 8.44 | 8.89 | 6.32 | 9.73 | 7.69 | 8.04 |

[Δ] This price includes staple, French combing, clothing and skirts

[*] From skirted wool only

[**] From skirted and O.B. wools

Table 12. Three year summary of wool sales of the American Wool and Mohair Association, Texas

| Year | Graded/skirted wool (lb)[Δ +] | Average price ($/lb) | Ungraded O.B. wool[+] (lb) | Average price ($/lb) | Pre-incentive price differential ($/lb) | Incentive payment rate (%) | Price differential including incentive pymt ($/lb) |
|---|---|---|---|---|---|---|---|
| 1985 | 1,548,391 | 1.132 | 998,298 | 1.019 | 0.113 | 160.7 | 0.295 |
| 1986 | 1,625,174 | 1.076 | 1,150,948 | 0.937 | 0.139 | 166.5 | 0.370 |
| 1987 | 1,711,507 | 1.731 | 1,093,025 | 1.432 | 0.299 | 118.0[*] | 0.652 |

[Δ] Includes staple, French combing, clothing and skirts wool.

[*] Based on 1987 support rate ($1.81) and current estimated national average price ($0.83).

[+] Tags and clippings not included.

## Conclusions

Research experience with wool skirting in the U.S. has been quite varied. Numerous data sets illustrate that yield, vegetable content, length and colored fiber characteristics of raw wool are improved by skirting individual fleeces. A limited amount of information suggests that these improvements remain measurably significant after the wool is processed into top. Other studies suggest that skirting does not result in improved top characteristics, particularly when applied to uniform fleeces having low colored fiber contents.

Commercial experience with skirting, usually combined with grading or classing, further serves to validate the technical reasons for skirting. However, truly valid comparisons between original bag and skirted wools are very difficult to identify in the commercial sector. All commercial data reviewed support the practice of skirting both from the technical and financial points of view. It is likely that detracting information would not be publicized to the same extent.

Overall, the data suggest that skirting (particularly shearer assisted, table skirting) can profitably be applied to fine-wool fleeces when prices are at relatively high levels. The financial incentive to skirt is lowered as wool prices decrease or as skirting costs increase. Since price and fiber diameter are inversely related, it follows that the financial incentive for skirting is lower for medium and coarse wools then for fine wools. However, very little information is available concerning the skirting of medium and coarse wools.

The most critical aspect of skirting wool is the amount actually removed as skirts. Assuming that 5 - 10% of the fleece is removed as tags and clippings at tagging time, then only 10% or less of the remaining fleece should be consistently relegated to skirts in order to assure financial success of the practice. Because of industry emphasis on white and pastel textiles, it is probably most important to skirt all colored and stained fibers and wool contaminated with excessive vegetable and other foreign materials. This can be achieved almost entirely by removing belly wool and crutchings from the bulk of the fleece. Skirting of other areas in the fleece should be minimal.

In the final analysis, the majority of producers are expected to respond more to the dictates of the textile industry than to the results of academic studies or isolated commercial experience. In contrast to the current situation in which premium prices are being paid for skirted and graded wool, it appears that major segments of the textile industry may make skirting a pre-condition of sale in the future. Such action will be guaranteed to revolutionize the way wool is prepared for sale in this country.

In conclusion, removal of significantly inferior portions of the fleece prior to packaging freshly shorn wool is expected to yield adequate compensation exceeding the cost of skirting and offsetting the relatively low prices paid for the skirts. At this time, skirting is a value-adding exercise that can easily be applied to wool preparation on any ranch or farm.

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