Learn the basics of wool preparation and processing

Historically, proceeds from lamb represent most of the revenue generated by sheep enterprises in the western United States. In contrast, income from wool represents only 5 to 13% of the total revenue.

With approximately 90% of U.S. sheep operations in the 1- to 100-head category, maximizing wool revenue through economies of scale may not always be feasible. For those with smaller flocks, it's often more realistic to explore opportunities for value-added marketing.

Understanding wool quality characteristics, stages of wool processing, and what to expect in terms of finished material are important considerations when adding value to your wool.

Wool characteristics

The first steps in raw wool processing are scouring (washing), carding, and combing. In both first-stage processing and yarn production, fiber diameter and length are the most important wool characteristics. Fiber diameter affects the wool's prickliness or softness and determines the amount of yarn used per square inch of fabric.

The color of the clean fiber and its strength are less important characteristics, but can affect dyeing ability and quality, potentially causing waste.

Clean wool yield

Whether wool is traded commercially as a commodity or sold as an individual fleece, clean wool yield is the most important quality determinant. Raw, or "greasy," wool freshly shorn off the sheep can be 40 to 60% dirt, dust, plant material, and wool wax (lanolin). After scouring the wool in the first stage of processing, only 40 to 60% of the original wool weight typically remains. This clean wool is commonly referred to as clean wool yield.

To improve clean yield, especially when marketing individual fleeces, a manager may choose to put a coat over the sheep fleece in the months leading up to shearing.

In a process known as "skirting," dirtier parts of the fleece are discarded. Typically, this means getting rid of soiled or stained areas near the rear end of the sheep or areas between the shoulders, which are often heavily contaminated with vegetable matter (hay, seed, and chaff). Skirting can greatly improve the wool's cleanliness before processing takes place.

Fiber diameter and length

Fiber diameter refers to the average diameter of each individual fiber and is measured in microns (µm), or 1/25,400 of an inch. Specialized laboratory instruments must be used to quantify microns, but fiber can be broadly categorized into fine (≤ 24.5), medium (24.6 to 32.5), and coarse (>32.5). Finer wool is typically softer and has higher market value.

Staple length is the measurement of the length of a lock—a fiber bundle approximately the width of a finger—from base to tip. Generally wool with a staple length of less than 3 inches can pose challenges for both commercial and small-scale wool processing.

A fleece with heavy vegetable matter (VM) contamination in between the shoulders, also referred to as the "crow's nest." Removing this portion of the fleece can greatly reduce VM contamination and improve quality. Photo by Whit Stewart.

Fiber strength is evaluated by firmly pulling on either side of the lock. Wools that are short (less than 3 inches in staple length) or "tender" (lacking in staple strength) can greatly reduce the quality and quantity of the yarn and finished product.

Wool fiber characteristics are largely driven by animal genetics. However, producers can maximize returns by providing proper nutrition to their flock, getting 12 months worth of wool growth, and sorting sheared wool into similar fiber quality lots.

Processing and associated losses

Wool-processing methods vary based on the type of wool (length and fiber diameter) and desired endpoint uses. The three main wool-processing methods are worsted, semi-worsted, and woolen (see Wool Processing Flow Chart). In smaller regional mills, depending on the equipment available, these processing methods may overlap, whereas large commercial mills may show a greater degree of specialization.

Communication with the wool mill in advance to determine their capabilities and specifications for the raw wool you produce, and what you can expect as a finished roving or yarn, is critical. Relatedly, understanding the losses expected in each stage of processing is important in order to estimate the end quantity of yarn or finished product.

Weight losses throughout the scouring, carding, combing, spinning, and dyeing processes can vary with the quality of wool, particularly fiber diameter (fine, medium, coarse), and equipment at the wool mill, but can be estimated at around 55 to 66% loss.

For example, if you delivered 100 pounds of raw wool to the mill for processing, you would anticipate 34 to 45 pounds of usable yarn after all stages of processing. Typically, 30 to 40% of the raw wool's weight is lost during scouring, 8 to 12% during carding, and 8 to 17% during combing.

Adding value

Opportunities for direct marketing of wool fiber continue to grow across the U.S., but capitalizing on this growing segment requires following best practices before your product arrives at the mill. Understanding wool quality characteristics such as fleece cleanliness, staple length and strength, and fiber diameter will help ensure that your wool can be processed into high-quality yarn and other end products.

Before you launch a marketing campaign, make sure to estimate the amount of saleable product you'll bring home from the mill. Wool processing comes with additional costs and time, but with careful estimation and attention to quality, value-added wool products can be profitable, even on a small scale.

Want to know more about wool? Contact **Whit Stewart**, UW Extension sheep specialist, at whit.stewart@uwyo.edu or (307) 766-5374 and he'll be happy to help.

Value-added products and processing costs
Approximate amounts of yarn (lbs.) needed to make finished goods at a regional-sized mill[1]

Item	Approx. lbs. of yarn
Saddle blanket or rug	3.0 pounds
Table runner	0.75 pounds
Scarves	0.60 pounds
Sweaters	1.40 pounds
Beanie	0.20 pounds
Mittens/gloves	0.27 pounds

[1]Based on estimates from Mountain Meadow Wool Mill in Buffalo, Wyoming.

Raw wool processing cost estimates from regional wool mills in the U.S.[1]

Processing estimates[2]	
Raw wool to clean wool	**$2.00 - $5.00 per pound**
Raw wool to batting (sheets of carded wool to be used for felting)	**$12.00 per pound**
Raw wool to roving (thick, continuous cords of wool for hand-spinning)	**$10.00 - $18.00 per pound[3]**
Raw wool to yarn	**$20.00 - $32.00 per pound** (Depending on type of yarn made)

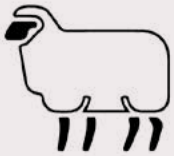
[1]Processing estimates were obtained from 4 regional processors in the U.S. in 2021.

[2]Processing estimates are priced on a finished pound.

[3]Roving to yarn cost will vary based on a broad range of yarn specifications.

WOOL PROCESSING

stages and industry segments



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Sheep Producers

An experienced shearing crew harvests the wool and ensures each animal is cared for and treated properly. Once the fleece (6–12 lbs.) comes off the sheep, dirty portions are removed, and it is packaged in a 450-lb. bale for shipping.

Wool Warehouse/Broker

Wool from farmers and ranchers is delivered to warehouses where it is weighed, quality is determined, and it is marketed to buyers.

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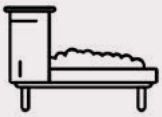

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First-stage Processing

Worsted, semi-worsted, & woolen processes include washing (scouring) the raw wool to remove impurities. Depending on end-point use, wool fibers are further aligned through carding and combing processes to produce a thick roving.

Spinning & Dyeing

Wool can be dyed at the roving, yarn, or fabric stages. Spinning twists roving, extending the fibers and giving strength to yarn for weaving or knitting. Spinning machines can create various yarns for a variety of end-point uses.

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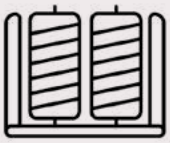

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Weaving & Knitting

Weaving produces cloth by interlacing two sets of yarn at right angles to each other—this repeated process forms woven fabrics. Interlocking loops of yarn produce knitted fabrics.

Wholesaler/Retailer

Wool can be utilized in various products, from next-to-skin base layers to heavy outerwear, home insulation, garden pellets, bandages, or even composite materials.

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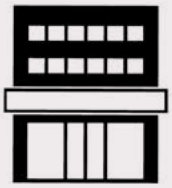

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Consumer

Consumers choose wool for numerous qualities, including moisture wicking, thermal comfort, flame resistance, durability, and breathability.

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