

Wool Gaining Favor Outside of Apparel Industry

Traditionally, wool has been used in making worsted and woolen fabric for apparel and carpet, but wool's resiliency, absorbency, and flexibility have made it a popular input into other industries as well.

Wool fibers are mechanically processed to form yarns, threads, fabrics, and nonwovens, with various end uses. Apparel, upholstery, blankets, carpeting and carpet pads, windings for baseballs, felts for piano hammers, and fabric for billiard and gaming tables are just a few of the many products that are made out of wool. New uses for wool include mulches, needle-punch pads, and booms, socks, and mitts to soak up oil and other materials from spills and leaks (table 11).

Wool Goes Through Several Processing Steps

The first step in wool processing takes place on the ranch

Table 11--Nonapparel uses for wool

Category	Uses
Pressed felts	Hats Banners Piano hammers Board erasers Insoles
Carpets	Rugs Tufted carpets Carpet underlay
Blankets and bedding materials	Home Emergency/hospital
Furnishings	Upholstery (fabric covering and filling in homes, cars, and airplanes) Wall coverings Office dividers Soundproofing barriers Gaming table covers
Mattress filling	Filling component Futons
Quilt fillings	Comforters Mattresses Pillows Quilted jacket lining Cushions
Industrial and other uses	Oil or hazardous-material clean-up pads Structural insulation Baseball winding Ballet-shoe toe padding Padding (saddles, bicycle seats, sports equipment, etc.) Cleaning aids or tools Car insulation Fluid filters (oil, etc.) Glove padding Mulch pads (erosion control)

Source: National Lamb and Wool Grower, May 1996.

where the sheep are shorn or clipped. The wool is sorted by length and fineness for its intended use in either the worsted or woolen system. Worsted and woolen are the two major classifications for wool yarns and fabrics. The primary difference between the two systems is the quality of the wool fiber they require and, thus, the value of the wool. The worsted system uses wool fibers that are of fine diameter and more than 3 inches in length. The fibers are combed and drawn during processing to make the individual fibers lie parallel and to eliminate shorter fibers, called noils. Worsted yarn is used to produce higher quality wool products, such as suits, dresses, gabardines, and crepes. The woolen system uses shorter wool fibers to make fluffy yarns for sweaters, coats, and carpets. Beside raw wool (wools that have not been previously processed), the woolen system uses noils from the worsted system.

Properties of wool that affect its value include fineness, fiber length, strength, color, the number of intermingled black fibers, and the presence of vegetable and foreign matter mixed in it. Fleece wool, which comes from the main body of the sheep, is normally separated from the belly and the skirtings. Fleece wool is evaluated for its quality and usually sold to processors in the worsted system. Belly wool is of good fineness but is shorter, relatively weak, discolored, and likely to carry vegetable matter. Belly wool is best suited for the woolen system. Finally, the skirtings provide the coarsest wool, which is often stained and is likely to carry kempy hairs (stiff, unshippable fibers that will not take a dye). Skirtings are best used by the woolen system or in nonwoven applications.

After the fleece is clipped from the sheep and sorted, the wool is scoured or washed to remove grease and foreign matter, which can account for 30 to 70 percent of raw (unscoured) fleece weight. Wool is then passed through a system of wire rollers that straighten the fibers and remove any remaining vegetable matter. This process, called carding, produces a waste material that can be blended back into the spinning process with other wool to produce special-effect yarns or it can be sold for use in other markets.

Wool is a natural protein fiber, similar to the protein found in human hair and fingernails. Properties of protein fibers, including low flammability, flexibility, and absorbency, make wool an excellent candidate for industrial applications. Wool is normally regarded as a safe flammable material since it burns very slowly and is self-extinguishing. Wool can also be given a flame-retardant finish with little effect on the physical or chemical properties of the fiber. Second, wool has excellent flexibility. The fibers can be bent back on themselves 20,000 times without breaking, as compared to 3,000 times for cotton and 75 times for

rayon. Finally, wool can absorb moisture in vapor form and repel moisture in liquid form (up to 30 percent of its weight) without the surface feeling wet.

Most Wool Is Used for Apparel

The 1996 U.S. supply of raw wool is estimated at 175 million pounds, clean (after scouring), 10 percent below last year (table 12). Stocks at the beginning of 1996 are estimated to have been 40 million pounds. Estimated 1996 wool production, at 30 million pounds, is 11 percent less than the previous year. U.S. raw wool imports are 85 million pounds, 4 percent below 1995.

The apparel industry accounts for the largest share of raw wool, using more than 64 percent on average during 1990-94 (figure 5). Although most wool is used in the apparel industry, some of the lower quality wool is not suitable for this use and can be put into nontextile or industrial applications. Nearly 6 percent of raw wool was used in industrial and other consumer products during 1990-94. This category includes, for example, mattress felts, felts for filtration, and shoe padding.

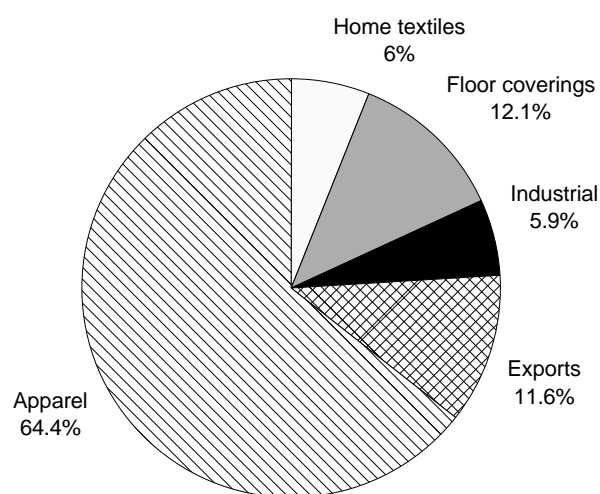
In addition to low-value wool, wool waste from the wor-

sted and woollen industries is also available for industrial uses. Each step of the manufacturing process (carding, combing, spinning, weaving, and fabric cutting) produces wool fiber wastes that can either be blended back into the wool processing system or used directly to form non-wovens. Ron Aljoe of National Nonwovens estimates there are 30 million pounds of low-value wool and wool waste available each year that are suitable for industrial uses.

Demand for New Wool Products Is Growing

Consumers' perception of the benefits of using natural products has stimulated interest in industrial uses of wool. Although many industrial wool products, such as felts for piano hammers, cleaning tools, and stuffing for gloves and saddles, have existed for years, markets for some higher value wool products are still being developed. The perceived lack of a constant supply for industrial applications can explain some manufacturers' hesitancy in using wool as a major input. They are concerned with finding a consistent and inexpensive source of lower grades of wool and wool wastes. To this end, manufacturers are looking for ways to retrieve the wool they need before it goes through all of the processes required for apparel use. Retrieving the wool before these processes would make it less expensive.

Figure 5
U.S. Consumption of Wool by End Use, 1990-94



Source: Fiber Organon, September 1995.

Despite the supply concerns, many firms are capitalizing on the unique properties of wool. For example, Hobbs Bonded Fibers of Waco, Texas, is selling Wool-Zorb products, a range of oil spill clean-up products made from wool. These wool products can absorb more oil than polypropylene, can float on top of the water, and are reusable because the oil can be squeezed out of the sorbent up to eight times. And unlike polypropylene, which is not biodegradable, wool can biodegrade under favorable, controlled conditions, eliminating the costs for hazardous waste storage. Wool absorbents can also be used in other industries where chemical spills and leaks occur, such as garages, refineries, and machine and printing shops. Hobbs Bonded Fibers processes 100,000 to 150,000 pounds of wool per year in its oil spill products and needle-punch pads for use as mattress tops and nonwoven blankets.

Another example of lower quality wool use is wool mulch. The Applesed Wool Corporation of Plymouth, Ohio, sells a mulching and weed suppression wool mat. According to the company, "Ewemulch" is aesthetically more pleasing than black plastic and is easy to lay. It will allow water to pass through to the soil while acting as a barrier to reduce

Table 12--U.S. wool supply and use, 1990-96

Year	Beginning	Pro-duction	Imports	Unac-counted	Total supply	Mill use	Exports	Total use	Ending stocks
	stocks January 1								
Million clean pounds									
1990	89.2	46.8	71.7	7.1	214.8	132.7	2.7	135.4	79.4
1991	79.4	46.7	86.5	7.1	219.7	151.5	3.9	155.4	64.3
1992	64.3	44.1	89.3	4.5	202.2	150.8	3.4	154.2	48.0
1993	48.0	41.2	100.3	7.0	196.5	156.8	2.5	159.3	37.2
1994	37.2	36.5	91.7	42.5	207.9	153.3	2.9	156.2	51.7
1995	51.7	33.6	88.8	20.0	194.1	148.2	6.0	154.2	39.9
1996 1/	39.9	30.0	85.0	20.0	174.9	140.0	3.0	143.0	31.9

1/ Forecast.

Sources: Bureau of Census and USDA.

soil desiccation during dry periods and as an insulator under moist conditions. After 1 year, wool is degraded sufficiently to be incorporated into the soil and becomes a supplier of nutrients. Ewemulch mats are also available preseeded with wildflower or other plant seeds for a variety of applications, such as creating a butterfly or wildlife habitat. Applesed also sells hanging basket liners and carpet pads made from wool. The company estimates its yearly use of wool to be 80,000 to 100,000 pounds, including imported wool waste.

Lanolin Supply Down, Prices Stable

Raw wool contains 10 to 25 percent grease, or lanolin, which is recovered during the scouring process. Lanolin consists of a highly complex mixture of esters, alcohols, and fatty acids and is used in adhesive tape, printing inks, motor oils, and auto lubrication. It can also be refined for use in cosmetics and pharmaceuticals. Virtually all cosmetics and beauty aids, such as lipsticks, mascara, lotions, shampoos, and hair conditioners, contain lanolin.

U.S. regulations require lanolin to be free of contaminants, such as pesticides, if it is used in cosmetics or pharmaceuticals. Cosmetic-grade lanolin cannot contain foreign contaminants exceeding 40 parts per million (ppm), and not more than 10 ppm of any one contaminant. Lanolin for medical applications has a total contaminant limit of 3 ppm. These regulations were originally opposed by the lanolin and cosmetics industries, but now are seen as a potential selling point for safety to consumers.

The supply of lanolin depends on the amount of wool scoured. And with wool processing down at the moment, supplies of woolgrease have fallen. Industry sources estimate the U.S. market for lanolin to be about 5 million pounds per year, with approximately 70 percent satisfied by domestic production. The demand for lanolin has been steady for several years because lanolin is considered by many analysts to be a mature industry, with limited growth prospects. Many suppliers are concerned that the public's perception of lanolin as an animal-derived product has adversely affected its potential for future market growth. [Jacqueline Salsgiver, ERS, (202) 501-7107, jsalsgiv@econ.ag.gov]