The Role of Sheep and Sheep Products in Waste Management

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Summary
Our appreciation of the potential role and value of sheep and their products in the handling of waste materials is still in its infancy. A limited number of novel applications are currently in use. However, with the increased interest in biological solutions to environmental problems, additional roles for sheep products will undoubtedly emerge.

Introduction
For the purposes of this paper, the term “waste” is interpreted as any material which constitutes an environmental disposal problem. Economic constraints and environmental concerns have stimulated a search for creative alternatives to current disposal practices such as burning and disposition in landfills. Sheep have been shown to be able to make contributions to waste management both as consumers and producers. The sheep’s digestive tract allows it to process many products which would otherwise be considered wastes, and turn those materials into high quality food and/or fiber. The adage, “One man’s trash is another man’s treasure,” is equally apropos for sheep. Likewise, sheep can be a source of products that can assist in management of other wastes.

Discussion
Some wastes, although of low economic value themselves, do have nutritive value and can be fed to sheep. Examples include: 1) crop residues and processing by-products, 2) animal by-products (chicken manure), 3) suburban horticultural residues (grass clippings), and 4) urban residues (edible food garbage). The utilization of crop residues and processing by-products is an accepted practice and has been well documented in the literature (Sempeho, 1987; Abdelhamid and El-Ayoty, 1988; Gasa et al., 1989; Serrano, 1989; Smith, 1989; Guessous et al., 1991; Snyman, 1991). Utilization of animal by-products has also been evaluated in a number of studies and is used to limited extent (Barth and Gelaya, 1980; Hall and Keys, 1980; Ben-Ghedalia et al., 1982; Radick, 1989; Belyea et al., 1990; Channa and MacIntosh, 1990; Cooke and Fonteno, 1990; Flachowsky and Henning, 1990; Iniguez-Covarrubias et al., 1990; Ayangbile and Tallam, 1992). Utilization of suburban horticultural residues and urban residues have received much less attention because of unawareness of the potential benefits and/or concerns about potential risks.

Some problems associated with utilization of the products listed above are the high water content, with the resultant costs of transportation and concerns about possible presence of chemical residues. Although a wide variety of chemicals are approved for use on plants and may be present in crop residues and processed by-products, very few of these compounds are approved for consumption by animals. Similarly, animal by-products may contain residues of chemicals incorporated into feeds and may act as a vehicle to concentrate trace elements. In addition, there is concern about the possible presence of potential biological pathogens. Horticultural residues may contain residues of chemicals that are approved for use neither on food plants nor in animals. Depending on source and content, urban residues could contain potential biological pathogens which sheep may or may not be able to detoxify.

The feeding of selected waste materials to sheep has the potential for reducing the burden placed on landfills while converting the waste materials into added value products such as meat, milk, fiber and manure.

Other waste products have no, or even a negative, nutritive value and so cannot practically be fed to sheep. However, a variety of sheep products can be used to manage some of these wastes.

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Wool as a Sorbent for Oil Spills

Environment Canada has been experimenting with a number of organic and synthetic sorbents for diesel, crude and Bunker C oils (Environment Canada, 1991). Of the seven organic sorbents tested, wool exhibited the highest oil retention capacity and the maximum reusability. Results from private testing laboratories in the U.S. have shown wool to be very effective in sorption of No. 2 diesel, light crude and heavy crude oils. Wool was capable of sorbing 12 to 44 times its own weight, depending on pad thickness and type of oil. The sorptive capacities of other commercial sorbents tested were either below this range or near the lower end. In addition, wool is all natural and biodegrades within weeks to a few months, depending on climatic conditions. As a sorbent, it can be reused as many as eight times and the oil squeezed from the saturated wool can be further utilized. Wool has a high tensile durability and is flame retardant. All these characteristics combine to make wool an excellent choice for oil spill containment and clean up (Millsaps Sorbent & Environmental Laboratory, 1993).

Wool as a Mulching Agent

Wool mats for gardening use have recently become commercially available. The \( \frac{3}{8} \) inch-thick mats allow water to percolate through but retard soil moisture evaporation, retain soil warmth and control weeds. The mats biodegrade over a two- to five-year period and release nitrogen, potassium, sulfur and other trace minerals. The product provides an additional outlet for low-grade, pigmented woods and is also an environmentally friendly alternative to herbicides and plastic sheeting (Sheep sheets, 1993).

Sheep Manure in Bioremediation

The Minnesota Department of Transportation has conducted pilot studies using sheep manure to treat petroleum contaminated soils (Kamnikar, 1992). After mixing and monitoring soils for 11 weeks, the composting process successfully reduced the concentration of contaminants to a non-regulatory level. The manure was shown to provide a source of microorganisms that can break down petroleum hydrocarbons and an additional energy source for the microorganisms. An added benefit of the composting process was the production of an end product with high organic value, suitable for use as top soil, mulch or fill material. Costs per yard of treated soil averaged $13.00 versus $10.00 to $15.00 for spreading contaminated soil on land for long-term aeration or $40.00 to $60.00 for incineration of the soil. At Carswell Air Force Base in Fort Worth, Texas, officials are testing a mixture of sheep manure and wood chips exposed to sunlight to speed up the process of neutralizing petroleum-soaked soil.

Sheep Rumen Fluid in Biodegradation

Certain microorganisms can use coal as a substrate to produce water-soluble coal compounds. These compounds can in turn be converted by the microorganisms in sheep rumen fluid into alcohols and organic acids for industrial and liquid fuel uses (Department of Energy, 1991). Organisms isolated from the sheep rumen have been found to biodegrade pyrrolizidine alkaloid toxins found in tansy ragwort plants. This discovery explains the relative resistance of sheep to tansy ragwort poisoning versus the high susceptibility of cattle (which lack the organisms). From this work, a probiotic product is being developed to protect cattle from the effects of the weed. Cattle and horse losses due to tansy ragwort are estimated at $20 million annually in Oregon, northern California and Washington (Craig et al., 1986, 1992; Wachenheim et al., 1992a, 1992b). These organisms are evidently able to split open the aromatic ring of the pyrrolizidine alkaloids. A wide variety of environmental pollutants contain aromatic nitrated compounds which the organisms can attack. Current work is focusing on the degradation of munitions containing trinitrotoluene (TNT) and of other priority pollutants (Craig, 1993).

Conclusions

It is encouraging to see both commercial and research interest in exploring innovative uses of sheep and sheep products in the management of wastes. This is just another example of the sheep's diversity and the role they can play in ecosystem management.

Literature Cited


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2 “Ewe Mulch,” Sheep Shoppe, P.O. Box 134, Fort Stockton, TX 79735.


