Factsheet

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Alternative Bedding Materials for Livestock

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INTRODUCTION

Due to rising costs and/or shortages of some traditional bedding materials for livestock housing, many producers are looking for alternative materials. Some of these materials are by-products from manufacturing and processing companies that have found innovative ways to manage their waste more resourcefully (Table 1). This factsheet explains factors to consider when evaluating alternative bedding materials for livestock housing.

Table 1. Examples of alternative bedding materials

Product	Source
Paper Products	
Shredded paper/cardboard	Industries, offices, residences
Shredded drywall paper	Industries, construction
Paper sludge	Industry (paper mill wastewater)
Paper fibre	Pulping process by-product
Wood Products	
Recycled wood products	Industries, construction
Sawdust from furniture plants	Industries, construction
Separated Manure Solids	
Separated manure solids	Anaerobic digester
Separated manure solids	Solid liquid separator
Composted manure	Drum composter
Other Organic Products	
Mushroom farm compost	Mushroom farm
Peat moss	Peat mine

Selection of an alternative bedding material varies with the farm and depends on the type of housing, bedding management and type of manure handling system. Switching to an alternative bedding material can provide an economic benefit to the operation and an opportunity to improve animal health and welfare through improved bedding practices.

EVALUATING BEDDING MATERIALS

Due to limited research on alternative bedding materials, evaluating the suitability of alternative bedding materials for livestock housing is challenging. Consider a number of key factors, including the impact on animal health and the barn environment, when deciding if the alternative material meets the farm's financial and operational needs and goals.

Operational Impact

Availability — Make sure the new material will meet the long-term needs of the barn. Find a reliable supplier who can provide bedding materials year round. In areas with a small agricultural land base and high livestock densities, the demand for agriculture-based bedding materials could be high. In this situation, it may make sense to switch to alternative materials to ensure a consistent supply.

Material Handling and Storage — Labour efficiency is a critical factor in sustaining a farm operation. Switching to a new system should not result in extra labour to obtain, handle, clean and dispose of the bedding material.

It is important to assess if the alternative bedding material will require a change in the storage system as the facility set-up may vary depending on the choice of material. Switching to bale straw requires a larger storage area with plenty of air flow around the bales to prevent spoilage. Organic bedding material (e.g., shavings, sawdust and shredded paper) requires storage in a dry and clean facility. Commercially produced organic bedding material usually comes in bags and is normally suppled year round, therefore requiring a smaller storage area.

Manure Management System — Assess the effect of switching to an alternative bedding material on the manure handling and treatment system (e.g., pumps, barn cleaners and composting or anaerobic digestion systems). Switching to an alternative bedding material that calls for major changes in the manure handling system could require additional financial investment. A change in bedding material can also impact the waste management system. An operation switching from composting straw bedding waste to composting a wood-based bedding material has to consider the effect on the composting process because of the higher carbon to nitrogen (C:N) ratio. Some paper-based bedding materials can also clump together, making spreading on land or composting more difficult to handle.

Economics — Switching to an alternative material could increase the risk of uncertainty regarding supply and cost of material. A case study conducted by researchers from the University of New Hampshire showed that 26% of farmers reported switching primary bedding materials between 2003–2013, of which 82% converted from sawdust or shavings to a non-woody bedding type, citing mill closings and increased cost (Smith et al., 2017). Select alternative bedding materials that are competitively priced. Money can be saved if large on-farm storage space is reduced and material is delivered on demand, year round.

The cost advantage of switching to an alternative bedding material is unique to each operation and must be individually determined. Make sure to check the quantity of material required and the cost implication. Sometimes, inexpensive materials that require twice the amount of the current bedding may not be a good buy because the volume needed results in higher costs.

Animal Health and Comfort

Health — Animal health is a critical factor when considering alternative bedding materials. The presence of bacteriological, physical and chemical contaminants in bedding materials may pose a health risk to livestock, operators and consumers.

Comfort — Dairy cows prefer bedding materials that are soft, dry and clean, as they provide a more comfortable resting area for them. Resting areas with comfortable bedding material encourage animals to rest at least 12–14 hr a day. The material must provide non-abrasive cushioning for all points of contact (i.e., hocks, knees, hips and udders).

A study on Nova Scotia dairy farms using compost bedding showed that cows spent over 1.5 hr more in kiln-dried shavings than in wood-wallboard bedding material, suggesting that resting time varies, depending on how comfortable the bedding material is (LeBlanc et al., 2013) (Figure 1).

Environmental Impact

Crop Production — Ensure the alternative bedding material is biodegradable and suitable for crop production. The rate of breakdown and the products of decomposition are important considerations. As they decompose, some materials, depending on their composition, can tie up important nutrients (e.g., nitrogen) for a period of time, making it unavailable to the crop. The release of nutrients following decomposition may not coincide with crop demand.

Land Application — Almost all bedding material is land-applied as a nutrient source for plants. It is important to choose bedding materials that will have a minimum adverse impact on the environment. Large pieces of plastic that survive manure handling, storage and spreading are unsightly and environmentally irresponsible. Glass and metal shards spread on land are also a concern. The effects of chemical contaminants such as polychlorinated biphenyls (PCBs) and heavy metals in bedding materials are harder to assess and are of greater concern.

Figure 1. Dairy cattle reclining on a bedding mixture of wallboard paper and sawdust.

CHARACTERISTICS OF ALTERNATIVE BEDDING MATERIALS

It is important to check these properties of alternative bedding material before it is accepted at the farm.

Absorbency

The Absorbency Factor (AF) of a bedding material is its capacity to hold moisture from manure and urine. AF indicates the weight of water held per unit weight of the material. Table 2 lists the average absorption capacities for some traditional and alternative bedding materials. These factors are intended to be a rough guide, as absorbency of materials depends on different variables (e.g., source of material, initial moisture content and degree of grinding).

If there is no information on the absorbency of an alternative bedding material, estimate absorbency using the following method:

1. Place 1 kg (2–3 lb) of the bedding material in a bag made of porous but non-absorbent material (e.g., onion bag or one leg of a pair of panty-hose) and weigh it.
2. Using a 20-L (5 gal) pail filled with water, place the bag in the pail and leave it completely immersed for 24 hr. Be sure to use enough water so that some free water is left in the container at the end of 24 hr.
3. Take the bag out of the water and hang to drain but only until it has stopped dripping, not so long that the sample has started to dry out.
4. Reweigh the bag of bedding and calculate the absorbency factor using the following formula: Absorbency Factor = (weight after soaking – original weight) ÷ original weight.

If the bedding material and bag weighed 1 kg before soaking and 3.5 kg after, the absorbency factor is: (3.5 – 1) ÷ 1 = 2.5, which means the material has the capacity to hold 2.5 times its weight in water.

Many commercially available paper- and wood-based bedding materials will be highly absorbent if kiln dried prior to delivery. Alternative bedding materials should be carefully evaluated for their absorbency and the amount of bedding required to maintain animal dryness and comfort. Other properties such as compressibility, abrasiveness, roughness and surface wetness of the bedding material also have an impact on animal comfort and ultimately on their health and productivity.

Table 2. Absorbency of traditional and alternative bedding materials (initial moisture content <10%)

Material	Type or Form	Absorbency Factor
Wheat straw	baled	2.1
	chopped	2.1
Barley straw	baled	2.0
	chopped	2.0
Oat straw	baled	2.5
	chopped	2.4
Hay	baled	3.0
	chopped	3.0
Sawdust	hardwood	1.5
	softwood (pine)	2.5
Shavings	hardwood	1.5
	softwood (pine)	2.0
Corn stover	shredded	2.5
Corn	ground cobs	1.5
Sand	—	0.3
Peat moss	pit	10.0
Shredded paper	recycling facility	2.8
Shredded lumber	demolition waste	1.15

Adapted from: Dairy Housing and Equipment Handbook, MWPS; *Absorbency of Alternative Livestock Bedding Source*, Iowa State University, 2007.

Dry Matter Content (DM)

Different types of bedding materials have different dry matter (DM) levels. Cows tend to avoid wet bedding, and this can decrease their lying time. A study conducted by Reich, et al., shows that cows spent 1.1 hr less per day lying on a wet sawdust bedding (DM 34.7%) compared to dry sawdust bedding (DM 89.8%). Studies also show that bedding with higher levels of moisture content have increased levels of microbial activity, leading to harmful levels of environmental pathogens. David Wolfgang, Pennsylvania Extension Veterinarian, and Dan McFarland, Pennsylvania Extension Engineer, recommend bedding materials with at least 60% DM for dairy barns. Most bedding materials made from by-products from process industries, such as pulp and paper and paper recycling facilities, contain high levels of moisture in their raw state. These materials are often kiln-dried to reduce the moisture content to less than 10%.

Particle Size

Material particle size influences the bacteria population in livestock bedding. Fine-sized materials provide more surface area for bacteria to grow compared to materials with larger particles (Figure 2). According to Dr. J.S. Hogan, Agriculture Research and Development Center, Ohio State University, the bacteria count of these common bedding materials generally ranks as follows:

- chopped straw > long straw
- sawdust > shavings
- chopped newspaper > shredded paper

Avoid materials that are too fine, as they tend to stick to the skin and teat ends, exposing them to higher concentrations of bacteria.

Clean Material

Bedding material should be clean and free of foreign objects. Sharp objects (e.g., glass, nails and metal shards) in bedding material can cause physical injury both externally and internally. Plastic, if ingested, can cause digestive obstruction or, in some cases, death. Plastics are also a concern when the manure/bedding mixtures are to be land-applied.

Figure 2. Beef cattle standing on a mixture of corn stover and recycled wood pallets bedding.

Bacterial Contaminants

Bedding with low bacteria counts can improve milk quality and reduce the level of mastitis in a cow herd. Many organic bedding materials have relatively few mastitis pathogens prior to use, but the count increases within 24 hr. Counts above 1 million colony-forming units (CFU)/mL increase the incidence of mastitis. The goal is to maintain the bacterial count below this level in any dairy bedding. Fresh and clean bedding will normally have bacteria counts lower than 5,000 CFU/mL of bedding (Reneau, 2001). Good bedding management practices (i.e., changing soiled bedding material daily and all the material regularly) also play a critical role in controlling bacterial growth in bedding.

Chemical Contaminants

Bedding material must be free of chemical contaminants. Due to limited research studies, the risks associated with chemical contaminants in alternative bedding materials are not well known.

Depending upon the chemical, livestock could suffer external and/or internal injuries. Chemicals in the bedding could contaminate the meat, eggs and milk produced. They may also be harmful to crop production or the environment, once the bedding material has been land-applied. For example, land application of materials with a high or low pH in large quantities can affect soil pH, potentially reducing productivity. Lead, asbestos, volatile organic chemicals and wood preservatives are contaminants to avoid.

Testing for the presence of arsenic, boron, cadmium, chromium, cobalt, copper, lead, mercury, molybdenum, nickel, selenium and zinc is recommended for materials that are applied to agricultural land. Include analysis for organic chemicals that may affect animal health and/or crop production, including volatile organics, pesticides, wood preservatives, etc.

Dairy producers should thoroughly investigate the risks associated with a new material prior to deciding if it is suitable:

- Ensure the material is environmentally safe and contains no contaminants that are unacceptable to animal health and land application.
- Contact a veterinarian for livestock health-related concerns.
- Ask for information on how the bedding material was produced, handled, stored and transported.
- Consult experts who know the manufacturing process and can help assess risk to livestock, manure treatment systems (e.g., composting and digesters) and crops, if land-applied.
- Contact nutrient management consultants who can interpret the test results of the material and assess its impact on the environment.
- Compare the concentration of trace elements present in the material to allowable concentrations for non-agricultural source materials that can be applied to agricultural land in Ontario, which are described in Schedule 5 of Ontario Regulation 267/03.

SUMMARY

It is up to producers to find the most suitable bedding material for their operation. Ask suppliers to analyze the material for different health and environmental properties and provide proof of quality prior to accepting the material. The person receiving the material is potentially liable for any contamination associated with the storage and use of the material. Switching to alternative bedding material may provide an economic and environmental alternative to the operation. It also offers an opportunity to improve animal health and welfare through improved bedding practices.

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