Chemical and environmental treatment of whole tree juniper chips to lower fecal coliform counts.

Mike Gamroth

Department of Animal Sciences

Oregon State University

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Introduction

Mastitis is the leading cause of milk loss and the most costly disease to treat on the farm. Bedding materials can be nutrient sources for organisms that cause environmental mastitis and allow for transmission from one cow to another through contact with the bedding.

As dairy herds control contagious mastitis pathogens, such as *Streptococcus agalactiae* and *Staphylococcus aureus*, environmental pathogens become the most significant source of intramammary infections (Eberhart, 1972, 1977). Coliform bacteria are always present in dairy confinement facilities and can cause serious mastitis. Clean housing and milking hygiene practices have been shown to help control new infections (Carroll, 1980; Eberhart, 1972; Natzke 1976; Smith, 1985; Hogan 2003).

Organic bedding material can be a source of environmental mastitis pathogens. Some studies have related counts of environmental bacteria on bedding materials with numbers found on teat skin and in quarter milk samples (Fairchild, 1982; Hogan 1990; Janzen, 1982). While some studies and farm experiences show little correlation of bedding cleanliness and rate of clinical mastitis (Fairchild, 1982; Natzke, 1976), limiting bacterial growth on bedding would reduce the challenge of environmental bacteria to the udder. Sawdust and wood products generally contain more coliform bacteria, where straw bedding contain high numbers of environmental streptococci and green hardwood sawdust containing bark material is associated with a higher incidents of *Klebsiella* mastitis. Byproducts of wood processing are an important source of organic bedding on

dairy farms. However, economic and environmental pressure on the wood industry could reduce supplies of suitable wood sawdust and shavings. Alternative bedding materials and techniques to extend the service life of beddings would be helpful in freestall confinement facilities.

Some studies have reported the suitability of alternative bedding materials and the effectiveness of organic bedding treatments to retard organism growth (Hogan, 1989, 1990; Janzen,1982,Zehner, 1986).

Two samples of fresh chipped whole tree juniper were cultured by the OSU College of Veterinary Medicine Diagnostic Lab in late 2003. Both showed high counts of fecal coliform bacteria, including *E. coli* and *Klebsiella* species. Such counts would indicate the material is unacceptable as a dairy cattle bedding. The objective of this study was to evaluate alternative chemical and environmental treatments to limit the fecal coliform contamination of whole-tree green chipped juniper and dry chipped juniper.

Materials and Methods

Four chemical/environmental treatments with the potential to reduce bacteria counts were tested on two types of chipped juniper. Whole juniper trees with needles (GREEN) and without needles (DRY) were chipped through a Vermeer BC1230A self-powered mobile chipper to about 2.5 to 4.0 cm (1 to 1-1/2 inch) in size. Chips were collected in plastic garbage bags and immediately hauled 415 km (250 mi) to the OSU dairy in Corvallis on Sunday, April 21, 2004.

Whole tree (GREEN) chips

Whole tree without needles (DRY) chips

That night approximately 1 kg (2.2 lb) portions of the chips were poured into 40 cm x 60 cm (16" x 24") aluminum pans prior to treatment. Samples of the untreated GREEN and DRY chips were sealed in plastic bags and refrigerated overnight. These samples were delivered the next morning to the OSU Veterinary Diagnostic Lab for dilution and plating on MacConkey agar plates. All fecal coliform counts were cultured on the same medium and colony forming units (CFU) were counted after 48 hours incubation at 37ºC (98.6º F). The only exception was when bacterial colonies overgrew the culture dish before 48 hours.

Treatments to control bacteria were: 50 ppm iodophor solution sprayed over the surface of the panned chips (GERMICIDE), calcium hydroxide powder or hydrated lime at 120 ml (4 oz) /cubic foot of chips mixed into panned chips (LIME), open air drying of chips in the dairy barn (AIR DRY), and composting chips held in 19 liter (5 gal) buckets and turned every 5 days (COMPOSTED).

Chips treated with lime and germicide were sampled after 14 hours and placed in plastic bags for immediate delivery to the lab. Air dry and composted were sampled at 7 days and 15 days and delivered to the lab.

Finally, two 19 liter (5 gal) buckets of bedding were poured onto the cow feed alley the first night, the second morning, and on day 5 to imitate bedding kicked into the alley and flushed into the manure system.

Table 1. Fecal coliforms in fresh and treated chipped juniper – March, April 2004.

	Fresh	Lime	Germicide	Air dry	Air dry	Composted	Composted
		12 h	12 h	1 week	2 weeks	1 week	2 weeks
GREEN	2,000	-	600	1,500	7,500	TNTC	5,000
DRY	TNTC	100	TNTC	TNTC	100,000	TNTC	10,000
TNTC >100,000							

As with previous samples of chipped green juniper, bacteria counts of fresh samples were very high as shown in Table 1. Two previous samples of the green juniper had coliform counts too numerous to count (TNTC). The green whole tree fresh sample was lower for this trial at 2,000 CFU/g. The dry chipped material was TNTC on first analysis.

Air drying and composting had little effect on bacteria counts. Levels of fecal coliform never reached acceptable levels. Chips were too large making the volume too porous to heat adequately when composting. However, the chips could pack tightly enough

during air drying to conserve moisture which supports bacterial growth. The chips are simply the wrong size for either of these practices.

The sprayed-on germicide had no effect on bacteria counts in the DRY chips and reduced the count to 600 CFU/g in the GREEN chips.

Hydrated lime dusted on the chips reduced bacteria counts after 14 hours of contact time. GREEN chips showed no growth of bacteria and DRY chips were 100 CFU/g. This was the only treatment that helped reduce bacteria counts to levels near acceptability. From previous work, we know that lime-treated bedding become re-contaminated and grows bacteria while in cow freestalls (Gamroth, 1992). For this reason, it is likely that only the GREEN chips showing no growth would be acceptable as bedding.

Some dairy producers use hydrated lime to help dry and sanitize conventional bedding in freestalls. This means there would be no additional treatment costs for using the GREEN juniper chips with lime. Cost of this treatment on conventional or juniper would be about $.10/stall/week.

Chip size

Some equipment plugging occurred with chips. A large piece was found caught in the intake of the chopper/agitator pump in the reception pit. Temporary plugging occurred in other sections of the transfer piping between the reception pit and the mechanical liquid-

solid separator. A more uniform 2.5 cm (1 in) chip with no pieces larger than 5 cm (2 in) will be required in any system where manure is pumped. This will likely require post-chipping screening or the current material would need to be used only in solid manure handling systems or for mud control much like “hog fuel” from the lumber industries.

Whole-tree without needles chips showing the large chucks of juniper unacceptable to liquid manure handling systems.

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