Comparative Durability of Western Juniper Shavings Used for Animal Bedding

A Final Report
Submitted To

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INTRODUCTION

Western juniper (*Juniperus occidentalis*) is found throughout the Great Basin region of the western United States. The distribution of this species is normally limited by periodic range fires, but decades of fire suppression have allowed western juniper to extend its range. Ranchers dislike this species because it displaces forage species and its roots use valuable sub-surface moisture, thereby degrading the range.

Removing juniper can be costly and time consuming, making range restoration difficult. Ranchers have long sought alternative uses for western juniper that might support harvesting. Western juniper heartwood has excellent natural durability and this species has long been used for fenceposts (Miller, 1986), but the poor stem form and the presence of extensive internal defects have generally limited the ability to produce other lumber products.

One alternative to lumber production is to flake the stems to produce shavings for animal bedding. The essential oils in western juniper heartwood may prove especially useful for controlling insect pests in bedding while reducing odor.

One problem with the use of western juniper as animal bedding arises when the soiled material is disposed in municipalities that use composting of wood debris. In these cases, the heartwood durability may slow or inhibit the composting process. This has happened with shavings from other durable heartwood species and has led to these materials being land-filled instead of recycled. This process adds costs for disposal and consumes valuable land-fill space.

Developing reliable estimates of the effects of species composition on degradation rates would help shaving users better assess the value of incorporating naturally durable wood shavings into their bedding. In this report, we describe tests of the comparative durability of 4 species of wood used as animal bedding.

Materials and Methods

Shavings of Douglas-fir (*Pseudotsuga menziesii* (Mirb.) Franco), ponderosa pine (*Pinus ponderosa* L.), western juniper, and western redcedar (*Thuja plicata* D. Donn) were provided. The shavings were used either as supplied from the producer or were used as animal bedding prior to evaluation. Samples of each material were first weighed, then oven-dried (54 C) to determine initial moisture content. In addition, the volume of the initial moisture sample was determined so that we could calculate density of the material. This was necessary because the primary measure of decomposition used in this study was mass loss. Typically, weight loss measurements are made by oven drying and weighing samples before and after fungal exposure. Oven-drying, however, might have eliminated or altered the microbial flora naturally present in the shaving. Instead, we used the weight/volume factors developed by oven-drying to partition the samples into equivalent amounts of shavings.

The shavings were partitioned into heat sealable plastic bags containing an air-permeable patch. The treatments included each species alone or with animal droppings as well as the same species diluted 1: 1 with clean ponderosa pine shavings. The latter treatment was included to determine if the presence of a non-durable wood species such as pine might encourage microbial growth and increase decomposition.

The bags were then inoculated with decay fungi. The decay fungi evaluated, *Postia placenta and Trametes versicolor***,** were inoculated into flasks containing 100 ml of malt extract and incubated at room temperature for 10 to 14 days. The resulting fungal growth was then collected on filter paper and washed with sterile water to remove the malt nutrients. The fungal mass was then washing into a flask and briefly blended to break the long mycelium into fragments and this material was poured over the shavings to introduce the test fungi.

Each shaving combination was replicated on 9 bags. The bags were incubated at 28 C for 6, 8 or 12 weeks. At each time point, 3 bags were removed, the contents were removed and weighed, then oven-dried at 54 C and weighed again. Mass loss over the 12 week exposure served as the measure of decay resistance of the various shaving combinations.

Results and Discussion

Pine and Douglas-fir shavings were extensively colonized by the test fungi and appeared to be actively degrading. Western redcedar and western juniper shavings contained little evidence of fungal colonization, even when pine sapwood was included in the mixtures.

Weight losses of Douglas-fir and ponderosa pine shavings tended to be highest in material that did not contain animal droppings (Table 1). Weight losses tended to be slightly higher in contaminated western redcedar shavings than in clean material of the same species, while there was no apparent advantage to the presence of animal waste in western juniper shavings. Animal wastes should contain higher levels of soluble nitrogen that can stimulate fungal growth. Excess nitrogen, however, can also inhibit wood degradation, depending on the fungus species. The nitrogen in the animal wastes associated with the bedding clearly did not markedly enhance the degradation rate in any species to the point where the material would compost over time.

Final weight losses also tended to reflect the natural decay resistance of the four test species, with pine losing the most weight, followed by Douglas-fir, western redcedar and western juniper (Figure 1). Weight losses tended to increase over the12 week period, although the changes were slight in some instances. Weight losses in juniper were uniformly low, regardless of the presence of animal droppings or more decay susceptible pine shavings. This progression in decay resistance is consistent with field trials of posts of these same species (Miller, 1986).

Conclusions

The results demonstrate the resistance of western juniper to microbial degradation and indicate that recycling facilities would experience difficulties in processing this material, particularly if it composed a large percentage of the throughput. While it might be possible to enhance the degradation rates through addition of other nutrients or by seeding specific fungi into the bedding, the low value of the final material would make it difficult to justify the use of these amendments. As a result, bedding with substantial amounts of juniper would not be suitable for inclusion in recycling operations that employ composting for wood debris.

Literature Cited

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Swan, L. 1997. Western juniper technical report. U.S.D.A. Forest Service. Pacific Northwest Experiment Station, Klamath Falls, OR.

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Table 1. Weight losses of ponderosa pine, Douglas-fir, western redcedar, and western juniper shavings after 6 to 12 weeks of exposure to selected decay fungi.

Wood Species	Treatment	Wood Weight Loss*		
		6 Weeks	8 Weeks	12 Weeks
Douglas-fir	Contaminated	5.7(8.2)	16.1(4.6)	16.5 (4.2)
	Clean	29.9(8.7)	37.7(10.8)	37.6 (16.0)
	Clean + Pine	6.9(2.3)	6.6(l.0)	4.9(3.6)
Ponderosa pine	Contaminated	12.1(3.4)	10.7(4.2)	5.6(2.0)
	Clean	30.1(7.2)	40.3(23.8)	57.2 (14.7)
	Clean + Pine	5.5(2.6)	4.0(1.3)	1.0(1.2)
Western juniper	Contaminated	9.9(4.5)	10.7(5.4)	8.8(9.5)
	Clean	3.3(l.7)	4.9(5.7)	8.5(2.1)
	Clean + Pine	2.6(l.2)	1.0(0.0)	0.6(2.1)
Western redcedar	Contaminated	11.2(l.8)	18.5(3.3)	14.8 (l.8)
	Clean	7.2(l.1)	7.6(l.7)	3.6(l.8)
	Clean + Pine	1.5(l.2)	3.1(3.2)	9.8 (18.1)

*Values represent means of 3 replicates per time. Figures in parentheses represent one standard deviation.

Figure 1. Weight losses of ponderosa pine, Douglas-fir, western redcedar, and western juniper shavings after 6 to 12 weeks of exposure to selected decay fungi.