Wood chip mulch:
Landscape boon or bane?

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Landscape mulches are increasingly recognized as pivotal components of environmentally sustainable gardens and green spaces. Select the right mulch and you reap the benefits of healthier soils and plants. Choose the wrong mulch and the only plants that thrive are the weeds.

Before selecting a landscape mulch material, it's important to reflect on the purpose of the landscape in question. For instance, production agriculture generally requires short term, intensive management of a crop, while the philosophy behind landscape horticulture is the long term, sustainable management of a system. Therefore, those mulches that work best for crop production (including vegetable gardens) are often not the best choices for woody ornamental landscapes, and vice versa.

Direct benefits

The potential, *direct* benefits of any landscape mulch material can be grouped into four general categories:

Soil benefits
- improve structure
- enhance gas transfer
- enhance water infiltration and retention
- prevent erosion and compaction
- moderate temperature

Plant benefits
- provide nutrients

System benefits
- suppress pathogens and pests
- enhance beneficial organisms
- increase biodiversity
- neutralize pollutants

Human benefits
- economic
- aesthetic
- ease of application

An exhaustive review of the science behind landscape mulches is beyond the scope of this column (though I have just completed such a review for upcoming publication in a scientific journal). Instead, I'm going to address the documented benefits and drawbacks behind the use of arborist wood chips as a landscape mulch.

Perfect choice

In areas where trees are a dominant feature of the landscape, arborist wood chips represent one of the best mulch choices for trees and shrubs. A 1990 study evaluated the landscape mulch potential of 15 organic materials, including grass clippings, leaves, composts, yard wastes, bark, and wood chips. Wood chips were one of the best performers in terms of moisture retention, temperature moderation, weed control, and sustainability. In many urban areas, arborist wood chips are available for free, representing one of the most economically practical choices.

Unlike the uniform nature of sawdust and bark mulches, wood chips include bark, wood, and often leaves. The chemical and physical diversity of these materials resists the tendency towards compaction seen in sawdust and bark. Additionally, the materials vary in their size and decomposition rate, creating a more diverse environment that is subsequently colonized by a diverse soil biota. A biologically diverse soil biota is more resistant to environmental disturbance and will in turn support a diverse and healthy plant population.

Wood chips are considered to be slow decomposers, as their tissues are rich in lignin, suberin, tannins, and

Interested in field trial research?

Is your local Master Gardener program interested in conducting field trials on gardening products? Occasionally, companies will contact Dr. Chalker-Scott with requests for product testing. Interested groups will receive basic training in designing and conducting experimental field trials; local programs will need to provide all materials and field space. If interested, please email Dr. Chalker-Scott at lindacs@wsu.edu..

MORE INFORMATION

Dr. Chalker-Scott's extensive reference information is located at the following Web site:

www.puyallup.wsu.edu/~Linda%20Chalker-Scott/Wood%20chip%20references.html

other decomposition-resistant, natural compounds. Thus, wood chips supply nutrients slowly to the system; at the same time they absorb significant amounts of water that is slowly released to the soil. It is not surprising that wood chips have been cited as superior mulches for *enhanced plant productivity*. Wood chips have been especially effective in helping establish trees and native plants in urban and disturbed environments.

Arborist wood chips provide incredible weed control in ornamental landscapes. The mechanism(s) by which wood chips prevent weed growth are not fully understood, but probably include light reduction (preventing germination of some seeds and reducing photosynthetic ability of buried leaves), allelopathy (inhibiting seed germination), and reduced nitrogen levels at the soil-mulch interface (reducing seedling survival).

While there are imported wood mulches available for purchase at nurseries and home improvement centers, they are not as cost-effective as locally produced wood chips, which are often free. In a society where using locally produced materials is increasingly popular as a measure of sustainability, arborist wood chips are a natural choice. Finally, the reuse of plant materials as mulches keeps them out of the landfill—a benefit with both economic and environmental attributes.

Drawbacks of wood chips—mulch ado about nothing

There are a number of concerns surrounding the use of arborist wood chips as a landscape mulch. I have constructed a quick summary here. Relevant references can be found on the Web site listed in "More Information." Overall, the commonly expressed concerns about woody mulches are not borne out in research trials.

Concern: Woody mulches will acidify soils.

Evidence: None. In field situations it is difficult to significantly alter soil pH without addition of chemicals. Transient changes in pH may be found in the decomposing mulch layer itself, but these have little effect on underlying soils.

Concern: Woody mulches, such as cedar, leach allelopathic chemicals that kill other plants.

Evidence: Many plant materials contain allelopathic chemicals, which can prevent seeds from germinating or kill young seedlings. Most compounds have no effect upon established plants. Only a few woody materials have been found to contain allelopathic chemicals (e.g. *Juglans nigra*, black walnut). Cedars (*Thuja* spp.) have not been found to have this ability.

Concern: Mulches made from chipping diseased trees can infect healthy trees.

Evidence: Most studies indicate that diseased mulch cannot transmit pathogens to the roots of healthy trees. Under no circumstances should wood mulch be used as backfill. Not only is this a poor installation practice, but a potential mechanism for disease transfer as well. Fungal communities found in wood chip mulches are generally decomposers, not pathogens. Under healthy soil conditions, beneficial and harmless fungi can out-compete pathogens for space on plant roots. Furthermore, healthy plants are not susceptible to opportunistic pathogens such as *Armillaria* and *Phytophthora,* which are often ubiquitous but inactive in well-managed soils.

Concern: Wood chips could be a fire hazard, particularly when they are used on landscapes around structures.

Evidence: Coarse textured organic mulches, like wood chips, are the least flammable of the organic mulches. Fine textured mulches are more likely to combust, and rubber mulch is the most hazardous of all tested landscape mulches.

Jim Black

A bargain for gardeners

Arborist wood chips are available locally in many communities. Most sources are free or inexpensive for wood chips made from recycled pallets and other discarded wood products. That this mulch is both cheap and scientifically proven to be superior makes it an ideal Master Gardener-recommended product.

At left, Yakima County recyling and compost education program coordinator Mikal Heintz is shown with her wood chip operation located at the county landfill. Former head of the Yakima Area Arboretum, Mikal works with the community to promote composting and wood chip mulches.

Concern: Wood chip mulches will tie up nitrogen and cause deficiencies in plants.

Evidence: Actually, many studies have demonstrated that woody mulch materials increase nutrient levels in soils and/or associated plant foliage. My hypothesis is that a zone of nitrogen deficiency exists at the mulch/soil interface, inhibiting weed seed germination while having no influence upon established plant roots below the soil surface. For this reason, it is inadvisable to use high C:N mulches in annual beds or vegetable gardens where the plants of interest do not have deep, extensive root systems.

Concern: Woody mulches will attract termites, carpenter ants, and other pests.
Evidence: Many wood-based mulches are not attractive to pest insects but are actually insect repellent. For instance, cedar (*Thuja*) species produce thujone, which repels clothes moths, cockroaches, termites, carpet beetles, Argentine ants, and odorous house ants. In general, termites prefer higher nutrient woody materials, such as cardboard, rather than wood chips.

Application

Let wood chips age before using them if there are concerns about disease. Personally, I have never done this; I happen to love the smell of fresh wood chips and enjoy spreading them out over the landscape. Additionally, some of the nutrient value (particularly nitrogen if the chips contain leaves or needles) will be lost in the composting process. Using fresh chips ensures that some of the foliar nitrogen will feed the landscape rather than the compost pile.

Before installing wood chips, create a thin underlying layer of a more nutrient-rich mulch (like compost) if there are concerns about nutrient deficiencies. This "mulch sandwich" approach is a logical one that mimics what you would see in the mulch layer of a forest ecosystem. It's not required, though, and over time a wood chip mulch will develop this same structure as the lower layers break down.

Begin mulch application before annual weeds are established. Mulch is most effective in suppressing weeds when weeds are not yet present on site. Therefore, bare soil should be mulched as soon as practical, especially in the spring and fall when weed seed germination is at its peak. If this is not possible, the most effective, non-chemical way to remove weeds prior to mulching is to mow them as close to the ground as possible, followed immediately by mulching.

Prune or mow perennial weeds at the root crown in early spring when root resources are lowest (generally just as leaf growth begins). Extensive pulling of perennial weeds from unprotected soil is not recommended, as this disturbance will increase erosion, especially in sandy soils or in sloped areas. It is better to keep unprotected soil undisturbed. However, you can pull resprouting perennial weeds covered in mulch; the mulch layer prevents erosion and facilitates pulling.

Remove all noxious weed materials from site to prevent rerooting or seeding. Self explanatory!

Install chips to the desired depth. A successful wood chip mulch must be deep enough to suppress weeds and promote healthy soils and plants: research has demonstrated that weed control is directly linked to mulch depth, as is enhanced plant performance. A review of the research on coarse organic mulches and weed control reveals that shallow mulch layers will promote weed growth and/or require additional weed control measures. I recommend 4-6 inches for ornamental sites and 8-12 inches for restoration sites and/or perennial weed problems.

Keep mulch away from trunks of trees and shrubs. Piling mulch against the trunks of shrubs and trees creates a dark, moist, low oxygen environment to which above-ground tissues are not adapted. Fungal diseases require a moist environment to grow and reproduce; piling mulch on the trunk provides exactly the right conditions for fungi to enter the plant. Likewise, opportunistic borers are more likely to invade a plant whose bark is wet due to excessive mulching. Rather than creating mulch volcanoes, instead taper the mulch down to nearly nothing as you approach the trunk. This donut-shaped application will protect the soil environment as well as the above-ground plant tissues.

Arborist wood mulch, when used with contrasting landscape textures, such as the gravel, rock, and grass shown at right, produces a low-maintenance but beautiful garden setting.

Replace mulch as needed to maintain desired depth; replacement rate will depend on decomposition rate. Once mulch is applied, little management needs to be done other than reapplication to maintain minimum depth. High traffic areas are most likely to need replacement.