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Mulch and Tree Health

Introduction

Mulching has several benefits to soil quality and tree health, but incorrect application of mulch can cause tree health issues. After reading this fact sheet you will know how mulch affects soil properties and tree health, and how to correctly apply mulch to trees.

Benefits of Mulch to Soil and Tree Health

Mulch is a layer of either organic or inorganic material that is spread on top of the soil. In forests, leaf litter and plant debris act as natural mulch (Figure 1) that protects the soil from erosion, regulates soil moisture and temperature, and forms an inherent part of the nutrient and carbon cycling (Sayer 2006).

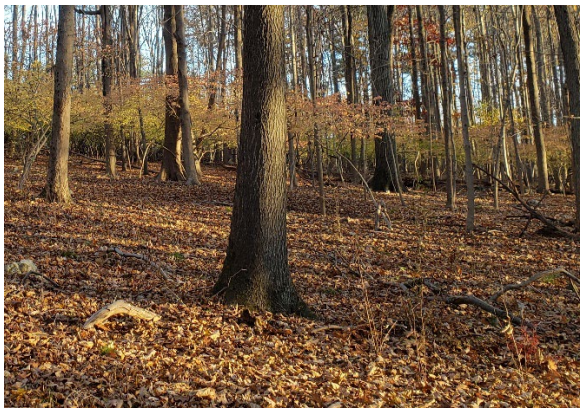

Figure 1. In forests the leaf litter, plant debris, and forest floor vegetation act as natural mulch.

In urban and landscape settings, mulching is a cost-effective way to mimic the function that leaf litter plays in forests. Mulch has a key role in protecting soil structure and preventing soil compaction, which is a prominent issue for urban trees. Compacted soils have less pore space which reduces soil oxygen levels, water infiltration, and drainage, leading to slower tree growth.

Adding 2-3 inches of woodchip mulch has been shown to reduce soil bulk density (compaction), stimulate soil microbial activity, and improve root growth (Percival et al. 2023). Mulched soils have 25% higher water holding capacity, which reduces the need for irrigation (Fite et al. 2011). Mulched trees perform well compared to trees treated with costly soil amendments (Scharenbroch et al. 2022, Fite et al. 2011), and in compacted soils, mulched trees produce three times more biomass compared to trees without mulch (Scharenbroch and Watson 2014). Mulch also smothers weeds and grass, which eliminates the need to bring in lawncare equipment near the tree, thereby reducing the risk of wounding the tree.

Types of Mulch and Their Benefits

Organic mulches include woodchips, conifer needles (pine straw), straw, grass clippings, shredded leaves, and groundcover vegetation. The gradual decomposition of

organic mulches by soil microbes releases nutrients into the soil and increases the amount of soil organic matter (SOM), which is one of the most important soil properties affecting tree health. The humic acids released from SOM regulate soil pH which affects nutrient availability. SOM provides food for earthworms and soil arthropods which aerate the soil and promote root growth.

Inorganic mulches can be gravel, rocks, plastic sheeting, and landscape fabric. Compared to organic mulches, inorganic mulches may be more durable, require less maintenance and be visually more appealing. However, they do not add carbon or nutrients to the soil and may sometimes block air and water movement (Fite et al. 2011).

How to Mulch Properly

Mulch should be applied as a uniform layer, starting near the base of the tree and optimally extending to or beyond the edge of the canopy (Figure 2). The thickness of the mulch can be 2-4 inches in dry soils and 1-2 inches in wet soils, but 2 inches is a good guideline. The larger the tree is, the larger the area that should be mulched. The mulch layer should not touch the tree trunk and root flare should remain visible. Organic mulch that covers most of the area under the canopy smothers weeds, promotes infiltration of water into the soil, modulates soil temperature, and maintains good soil structure and soil biological activity. The mulch layer should be maintained annually to ensure proper thickness and coverage of root zone as the tree grows. When correctly applied, mulch is especially beneficial for young trees that are vulnerable to drought and mechanical damage but mulch also offers benefits for mature trees (Figure 3).

Figure 2. Correct application of mulch to a young tree. Mulch does not touch the trunk, root flare is visible (arrow), mulch extends close to canopy edge, and weeds and grass are smothered.

Figure 3. Correct application of mulch to a mature tree. Root flare is visible (arrow), tree roots are covered by mulch, and weeds are smothered.

Things to Avoid When Mulching

Mulch should never be piled at the base of the trunk ("volcano mulching") (Figure 4). Mulch piled at the base of the tree creates a humid and warm microenvironment that is beneficial for microbes and insects. When the trunk and the root flare are buried in mulch, the bark becomes moist and soft which makes it more suitable as a substrate to fungi and bacteria. This can cause rot which exposes the underlying living tissues phloem, cambium, and sapwood to dehydration, pathogen infections, and feeding by insects.

Figure 4. Incorrect application of mulch. Piling mulch at the base of the tree ("volcano mulching") exposes the bark to rot.

Application of excess mulch should also be avoided. Too thick a layer of mulch starts to prevent infiltration of water into the soil and reduces the amount of oxygen in the soil. Especially if the tree is already planted below soil grade, the roots do not get enough oxygen and water. This stimulates lateral root branching from the main roots, and these branches grow towards the soil surface (Figure 5). These roots are vulnerable to freezing and dehydration and can become girdling roots that can slow down growth or kill the tree (Boggs 2020).

Figure 5. Incorrect application of mulch. Too thick a layer of mulch causes superficial rooting, formation of girdling roots, and exposes the bark to rot. The dashed line shows the top of the mulch layer which was 6 inches thick.

How to Maintain Mulch

Before applying more mulch, check the depth of the mulch layer. The layer should be 1-4 inches thick depending on the type of mulch and soil drainage. If too much mulch has been applied, use a rake or a cultivator to spread the mulch towards the canopy edge. If mulch has been piled at tree base, pull mulch away to expose the trunk so that the mulch does not touch the bark. Root flare should be visible. Appearance of weathered mulch can be refreshed by raking. If any weeds are present, remove them manually and avoid any damage to the tree.

For Further Reading:

Boggs, J. 2020. Treemergency: Mulch Volcanos are Erupting in Landscapes! Buckeye Yard & Garden Online. https://bygl.osu.edu/node/1494.

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Sayer, E. J. 2006. Using Experimental Manipulation to Assess the Roles of Leaf Litter in the Functioning of Forest Ecosystems. Biological Reviews 81:1–31. Doi: 10.1017/S1464793105006846.

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Scharenbroch, B. C., Fite, K., and Catania, M. 2022. An Arboriculture Treatment of Biochar, Fertilization, and Tillage Improves Soil Organic Matter and Tree Growth in a Suburban Street Tree Landscape in Bolingbrook, Illinois, USA. Arboriculture & Urban Forestry (AUF) 48:203–214. https://doi.org/10.48044/jauf.2022.015

Sambeek, J. V. 2016. Mulching (If Done Right) Benefits Trees and Shrubs! Green Horizons (Newsletter) 20:2.