



Mulching: Purpose, Benefits, and Essential Information

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Why Mulch?

“The quality of items we need to survive and enjoy life, such as food, water and air as well as the health of plants and animals is determined by soil health, especially the topsoil. Mulches help protect valuable topsoil and can improve soil health and much more.” (NRCS 2021)

The term “mulch” refers to materials spread or left on the soil surface as a protective layer (usually permeable), whether organic or inorganic, loose particles or sheets. The forest is a natural recycler; when leaves fall, they are broken down and form a natural mulch. Applying mulch mimics the natural forest process. Mulch’s primary benefits (Appleton and Kauffman 2015; Thacker 2013) include:

- **Weed prevention:** Prevents weed seed from getting the light it needs to germinate and grow.
- **Insulation:** Keeps soil warmer in winter and cooler in summer; promotes earlier spring plant growth; delays soil freezing; and reduces winter soil heaving.
- **Protection:** Protects tree trunks, plant stems, and surface roots from mechanical injury from lawn mowers and string trimmers.
- **Erosion control:** Reduces soil erosion from wind and stormwater runoff by protecting or holding soil in place.
- **Soil health:** Improves soil structure, aeration, and drainage, and also helps prevent soil compaction from foot traffic, mowers, vehicles, and heavy downpours.
- **Fertility:** Organic mulch increases soil fertility as the organic matter decomposes.
- **Moisture retention:** Helps to conserve soil moisture, reducing evaporation and the need for watering.

- **Plant health:** Promotes a healthy soil microbe population that enhances root growth, facilitates water and nutrient uptake, and reduces root rot and other soilborne diseases.
- **Appearance:** Enhances garden and landscape appearance (curb appeal).
- **Financial:** Can increase property value; reduces need for fertilizer, pesticides, and machinery; and if a living mulch is used, it can increase pollination services.

Mulch Selection

Mulches have different characteristics such as color, texture, and longevity. Other factors to consider are cost, availability, and maintenance needs. Select the mulch that best fits the site, environmental conditions, project goals, and budget.

- **Summer mulches.** Used during the spring and summer seasons for annual flowers and vegetables. Summer mulches retain moisture, reduce weed growth, and moderate soil temperatures, and are often left in place through the winter to reduce erosion.
- **Winter mulches.** Used to protect flowers, shrubs, and trees from severe winter temperatures and soil heaving. Winter mulches are applied in mid-to-late fall, when the soil has cooled but before it freezes.
- **Permanent mulches.** Used when mulch is desired for a long time in an area that will not be disturbed (such as around perennial plants, trees, and shrubs), where there are no seasonal plantings, and where mulch is used for pathways. If organic mulch is used as a permanent mulch, it may need to be replenished annually. If an inorganic mulch like stone is used, it may need to be cleaned (blowing off leaves or debris) regularly.

How to Mulch

- Wear a dust mask if there's a possibility of an asthma attack or allergic reaction to dust or fungal spores that may be in the mulch.
- Remove any weeds and debris before applying any mulch.
- Apply mulch in an even layer around newly planted vegetation or already established plants.
- For trees and shrubs, apply a 2- to 3-inch layer extending at least 2 to 6 feet out from the tree trunk or shrub stems. Never pile mulch directly against the trunk or stems.
- For smaller annual and perennial plants, apply a 1- to 2-inch layer extending 3 to 12 inches out from the plant's crown (the aboveground parts of the plant). Never apply mulch over the crown of the plant.
- If using mulch with small particles (fine texture or double-shredded), apply 1-2 inches. If using mulch composed of larger particles, apply 2-4 inches.
- Mulch can be applied at any time of the year. In spring, apply mulch before the summer annual weed seeds start germinating (usually before soil temperatures warm up to about 50 degrees). In the fall, apply mulch before the winter annual weed seeds start germinating (usually when soil temperatures are below 50 degrees, measured using a soil temperature thermometer).
- If the site has perennial weeds (like dandelions, nutsedge, bermudagrass, wild garlic or onions, or poison ivy) make sure those weeds are dug out or killed with an herbicide before mulching. Otherwise, the mulch will promote healthy weeds just like it promotes healthy desirable plants. Pictures or plant samples can be taken to a local Extension office for identification.
- As organic mulches decompose, they may need to be replenished, but do not apply or let mulch build up to a depth greater than 4 inches.
- For newly planted trees, pile mulch high in a circle, sinking in a concave manner to direct water to the young tree's root system (fig. 1). Doing so for the first two years after planting will strengthen roots and contribute to the tree's longevity.



Figure 1. Proper mulching for a newly planted tree.

Common Mistakes and Mulching Hacks

Incorrect mulching is becoming the No. 1 cause of death of trees and shrubs. When mulch is applied improperly by over-mulching or piling up mulch against the trunk of the tree, the following problems occur (Appleton and Kauffman 2015; Thacker 2013; Glen 2022):

- **Mistake: Mulch layer too thick or thin and mulch volcanoes. Hack:** Mulch should be applied no higher than the heel of a hand, generally 2-4 inches. If using finely textured or double-shredded mulch, use 1-2 inches, because these materials allow less oxygen to the root zone. Roots under deep mulch or mulch that's become impermeable will start to grow up into the upper surface for oxygen and moisture (fig. 2). With mulch volcanoes (when mulch is piled high around the base of a tree trunk), the volcano ramp structure increases runoff, reduces moisture absorption, and increases the risk of root damage during times of drought. Visually inspect the tree's root flare zone, where the base of the tree goes into the soil. This zone marks the change in the tree's cells from above-ground and below-ground cell types, and it should not be completely covered (fig.

3). If a tree trunk surrounded by mulch lacks a flare and looks like a telephone pole coming out of the ground, the mulch needs to be lowered to uncover the root flare. To correct this, mulch should be raked out to reduce the depth and spread evenly and horizontally (Thacker 2013). On the other hand, mulch applied too thinly allows light to get to the soil, allowing weed seeds to germinate.

- **Mistake: Mulch applied too close to tree trunks.** **Hack:** Keep all mulch 3-4 inches away from the trunk of the tree or shrub, allowing the root flare zone to show just above ground level. Mulch too close to the trunk keeps the bark moist, making it susceptible to insects and disease.
- **Mistake: Mulching over plants or too close to stems.** **Hack:** Apply mulch in the fall before leaves and stems die or are cut back. It can also be applied in spring after new shoots have started growing by mulching out at least 1 inch from the crown of the plants (Glen 2022). Mulching too close to the plant can smother it or cause deformed growth.
- **Mistake: Mixing soil and mulch when planting.** **Hack:** Pull back mulch from the soil surface before planting and then move it back in place after planting. Incorporating mulch that is not completely decomposed into the soil when planting creates a change in the carbon-to-nitrogen ratio in the soil, which reduces the available nitrogen needed for plant growth.
- **Mistake: Mulch not extended out to at least the plant dripline.** **Hack:** Expand the mulch bed out to the extent of branch tips (dripline) or further if possible. Established plants, particularly trees and shrubs, have less water-absorbing roots directly under their canopy and more beyond the dripline. Remember that the drip line moves out as the tree or plant grows, so the mulch bed should be expanded over time as well. Mulch offers an important layer of protection for the soil extending out from the trunk.
- **Mistake: Mulch was not properly composted to kill weed seeds and disease that may have contaminated the raw materials used to produce the mulch.** **Hack:** Make sure mulch has been composted to a high enough temperature to kill off problematic weeds and pathogens; if unsure, contact the manufacturer. Processed mulches are turned or aerated in an aerobic manner, producing enough heat to produce a clean product. But home-produced compost material to be used as mulch may not incorporate enough oxygen into the material or reach high enough temperatures. This produces

an anaerobic product with a lack of oxygen and containing rotting bacteria rather than decomposing bacteria, which produces a vinegar-like smell and slows or stops plant growth.

- **Mistake: Plastic, carpeting, or other impervious materials are used under the mulch.** **Hack:** Just use traditional mulch or landscape fabric, which is designed to be permeable. Plant roots need oxygen, so using an impervious material under mulch leads to plant decline and disease.

A final tip: If a “fresh” look is desired each season, apply more mulch to reach the recommended 2-4 inches in depth, or lightly rake the existing mulch to achieve a finished look.



Figure 2. The landscape fabric covering this garden area has become clogged over time, not allowing water through and forcing the shrub's roots to grow upwards to the surface to gain access to oxygen and moisture.



Figure 3. This mulch is covering the tree's root flare zone and should be raked back so the mulch is not touching the tree trunk.

Types of Mulch: Pros/Cons

Organic mulches add nutrients and humus to the soil as they decompose, improving its tilth and moisture-holding capacity. In gardens, most organic mulches should be applied after plants are well established (4 to 6 inches tall). Cultivate out all weeds before spreading the mulch evenly over the bare soil between the plants. Apply organic mulches when there is reasonably good soil moisture. Infiltration of rainwater will be slowed somewhat by mulch, so it is best not to place the mulch over dry soil. Water thoroughly or wait for a good soaking rainfall before applying any mulch.

Inorganic mulches, such as plastic films, paper, and landscape fabric, are applied before planting. These materials should be spread on the ground that has been completely prepared for planting and has a high moisture level. Place the mulch over the row to be planted, then bury the edge to prevent it from blowing away. Cut slits for seeding or setting transplants. With impervious materials, a few additional slits can be made to allow water to infiltrate.

The smaller the mulch particle size and the thicker the mulch layer, the greater the possibility of weed growth in the mulch layer. Aim for 2-4 inches of settled depth (more for larger particles, less for smaller ones), replenishing as needed. Weed growth is more likely in organic than inorganic mulches. Mulches vary in size and type, including loose material and sheet. Examples include plastic sheets and loose bark.

Purpose, availability, cost, and final appearance of a mulch will be the determining factors in choosing which type to use. An evaluation of the more commonly used mulches is below, and information has been compiled into a table located on the next page of this document (Table 1). Each section describes the loose and sheet mulch options (Relf and McDaniel 2020).

Organic Mulches

When using mulch around vegetables, be sure the materials are chemical-free, especially when using grass clippings or straw. It is important to consider the type of mulch and how it will affect plants. For example, mulches like wood chips can temporarily tie up nitrogen in the soil as they decompose, potentially hindering plant growth. It's also crucial to avoid piling mulch against plant stems, as this can lead to rot and fungal issues.

Mulches made from plant material are organic mulches. Over time, organic mulches will decompose and add nutrients and organic matter to the soil. This is good

for all types of soil because it helps improve the soil's water, air, and nutrient balance. This also means that organic mulches will need to be replenished from time to time (Chalker-Scott 2015b).

Organic Loose Mulches

Bark: Bark mulches are usually shredded or chunked and made from the byproducts of pine, cedar, cypress, or other hardwood logs. They are attractive, widely available, and resist compaction. Some shredded barks, such as cypress, decompose slowly. Bark chunks (also called nuggets or decorative bark) decompose most slowly but are more prone to wash away (Chalker-Scott 2015a).

Leaves: Fallen leaves that have been shredded with a composting mower are sometimes used as mulch, although they decompose very quickly. Whole leaves can also be used, but they tend to blow around and mat together, blocking water movement into the soil. Be aware that leaves may harbor diseases, insects, and weed seeds, but composted leaves are effective as a soil amendment, alone or mixed with grass clippings. Leaves from walnut trees are toxic and should not be used as mulch (Relf and McDaniel 2020).

Straw (wheat): Straw can reduce soil erosion and act as a mulch in vegetable gardens. It is inexpensive, suppresses weeds, conserves moisture, and improves soil when it decays. On the other hand, it is attractive to rodents, decomposes quickly, and is extremely flammable. It is important to purchase "straw" rather than "hay," as straw contains less weed seed. If possible, avoid straw that has been treated with herbicides to control broadleaf weeds, as most garden plants are broad leaved and can be damaged by persistent herbicides (Aukema 2022).

Straw (pine): Pine needles decompose quickly, resist compaction, improve the soil when they decay, and are easy to apply. They are available at most garden centers or are free if there are already pine trees on the property. Pine needles, also called pine straw, do not change the pH of soil unless it is used as a soil amendment (Wilkins 2023).

Wood chips: Wood chips come from many kinds of trees. Wood chips resist compaction, decompose slowly, and rarely float or wash away. They are often available from local municipalities or utility companies for little or no cost. However, they may contain seeds from trees and other plants that can sprout and create weed problems. Black walnut or fresh wood chips that have not been aged (3-12 months) can be toxic to plants.

Table 1. Mulch Characteristics and Qualities

	Mulch Type	Color	Texture	Decomposition Rate	Cost	Adds Carbon to Soil (C:N)	Allows Water, Air, Nutrients to Filter Through	Floats	Heats Soil or Plants	Vegetable Gardens	Pathways
ORGANIC	Pine Straw (pine needles)	Reddish Brown	Fine	Fast	Low	Yes; causes low N	Yes	No	No	Yes	Yes
	Bark Pine, Cypress, Cedar, etc. (chunks)	Medium/Dark Brown	Fine to Coarse	Medium	Moderate	Yes	Yes	Yes	No	Yes	Yes
	Shredded Hardwood	Light/Medium Brown or Dyed	Medium	Slow	Moderate to High	Yes, if aged	Yes	No	No	Yes	Yes
	Straw (wheat)	Light Tan	Fine	Fast	Moderate	Yes	Yes	No	No, if thin layer	Yes	No
	Leaves (shredded)	Brown	Coarse	Medium	Low	Yes	Yes	No	No	Yes	Yes
	Hulls	Brown or Tan	Fine to Coarse	Slow to Medium	Moderate to High	Yes	Yes	Yes	No	No	Yes
	Lawn Clippings (pesticide-free)	Green	Fine	Fast	Low	Yes; also high N	Yes	No	No, if thin layer	Yes	No
	Sawdust	Light Tan	Fine to Medium	Medium	Low	Yes; if aged, causes low N	Yes	No	No	No	Yes
	Living Mulches/Crop Covers	Green	Fine to Medium	Medium	Low to Moderate	Yes; also high N	Yes	No	No	Yes	No
INORGANIC	Newspaper/ Cardboard (covered w/mulch)	Black and White, Brown	Solid	Slow	Low to Moderate	Yes	Yes, if soaked In water before applying	No	No	Yes	Yes
	Wood chips (grinds)	Light Tan	Coarse	Slow	Low	Yes, if aged	Yes	No	No	No	Yes
	Rock/Stone/Gravel	Various	Fine to Coarse	None	Moderate to High	No	Yes	No	Yes	No	Yes
	Geotextile (landscape fabric covered with mulch)	Generally Black	Solid	Very Slow	Moderate to High	No	Yes, until it becomes fully clogged with soil	No	Yes	No	Yes
	Plastic	Clear, Black, White, Red	Solid	Very Slow	Low	No	No	No	Yes	Yes, short-term	No

Note: Warm and humid environments cause quicker decomposition of organic mulches.

Organic Matter Not Recommended for Mulch

Hulls: Hulls from cocoa beans, rice, buckwheat, peanuts, and cottonseed can be expensive and blow or wash away easily, necessitating frequent replenishment. They can also be high in phosphorus, which can be toxic to some plants. In addition, cocoa hulls contain chemicals that can be toxic to some pets, including dogs (Cregg 2011).

Lawn clippings: Grass clippings are not recommended as mulch but can be put in the compost pile if herbicides are not used on the lawn, as the chemicals can persist. They are an excellent source of nitrogen to heat up a compost pile, especially for those gardeners without access to manure (Relf and McDaniel 2020).

Peat moss and sawdust: Both peat moss and sawdust tend to become matted and hydrophobic, blocking water penetration. Both products are a better choice as a soil amendment, not a mulch product. Be aware that as an amendment, they can alter the pH of the soil (Relf and McDaniel 2020).

Organic Sheet Mulch

Newspaper and cardboard: Three to four layers of newspaper or one layer of cardboard (without tape, glue, waxy coating, color printing, or labels) can be used alone or with an organic mulch to effectively keep down weeds, especially in the vegetable garden. The material should be soaked in water before applying to prevent it from becoming hydrophobic. To keep it from blowing away, weigh or pin it down or cover it with a 1- to 2-inch layer of organic mulch. Newspaper and cardboard are easily available, inexpensive, decompose quickly, and can be tilled into the garden soil at the end of the growing season. Be mindful not to use cardboard with glue, waxy coating, color printing, labels, or other materials with chemicals that can be toxic or prevent gas exchange in the soil (Chalker-Scott 2015a).

Inorganic Mulches

Inorganic mulches include stone, geotextiles (landscape fabric), and plastics. These mulches can be expensive, but they stay in place and last a long time, even permanently. Inorganic mulches do not add organic matter to the soil.

Inorganic Loose Mulch

Rock: Crushed rock, gravel-type rock, and volcanic rock are available in a wide variety of textures, colors, and materials and are generally used in flower beds, rock gardens, driveways, and walkways. Rock mulches can move down into the soil over time, making future digging difficult. Consider putting a landscape fabric under the rock to reduce the movement of rocks into the soil. Once rock becomes mixed with the soil, it is nearly impossible to get out. Light-colored rocks can reflect heat onto plants, scorching sensitive plants. Rocks also tend to move out of beds and can become a tripping hazard or can be thrown by lawn mowers, potentially causing injury or damage. Dark-colored rocks can cause high soil temperatures, which can damage plant roots. Many gravel-type rock mulches are made from limestone and should not be used around rhododendrons, azaleas, laurels, and other acid-loving plants. Leaves, twigs, and other debris fall, wash, or blow into rock mulches. The debris is difficult to remove, can make the rock look less attractive, and can cause a weed problem.

Inorganic Sheet Mulches

Geotextiles: These are fabric mulches made from synthetic materials like polypropylene, polyester, polyethylene, and polyamides. These mulches are often called landscape fabrics or weed barriers. They allow air, water, and fertilizer to go through into the soil, but also prevent weed seed in the soil from germinating and growing. For the best results, place the fabric on weed-free soil. It can be covered with a thin layer of organic or inorganic mulch to improve the appearance, keep it in place, and reduce damage to the fabric from sunlight. Over time, the fabric can clog with sediment or debris, and weeds can grow. It is important to remove weeds as soon as they are noticed. Otherwise, the roots can grow through the fabric and become very difficult to remove.

Plastic sheeting: Plastic works well for keeping weeds down and retaining soil moisture. Although it prevents water and air from leaving the soil, it also prevents it from entering the soil, making it unsuitable for landscape plantings. Plastic is best reserved for vegetable gardens where irrigation systems can be placed under the plastic and bare spaces left between rows to allow water entry into the soil. Plastics are inexpensive and readily available but become brittle and break up with age, and should therefore be covered by loose mulch. Plastic in the environment is becoming a rising concern, so care should be taken not to let it break down as part of the soil (Appleton and Kauffman 2015; Relf and Close 2009; Relf and McDaniel 2020).

Plastic sheeting comes in both clear and opaque, differently colored materials. Each type has its own use:

- Clear plastic is used to warm the soil in the spring to prepare areas for planting.
- Black plastic is used to shade out weed seed for periods before planting, or as part of row covers.
- White plastic absorbs less heat and is used as a temporary row cover.
- Red plastic reflects certain wavelengths of light back up to the more shaded lower leaves of plants, which enhances plant growth.

Cover Crops, Living Mulches, Green Mulches, or Manures

A cover crop or living mulch is a temporary planting of a fast-growing crop, usually sown in the fall and tilled under in the spring, which protects the soil from wind and water erosion and adds organic matter. When these crops are incorporated into the soil, they are called green manure/mulch. These crops are left in place for six months to a year. Legumes are especially efficient because they “fix” nitrogen from the air into the soil (Relf and McDaniel 2020).

Additional Resources

How to Hire an Arborist

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