



Extension FactSheet

Plant Pathology, 1680 Madison Avenue, Wooster, Ohio 44691

Control of Nuisance and Detrimental Molds (Fungi) in Mulches and Composts

Harry A. J. Hoitink

Department of Plant Pathology, OARDC/ The Ohio State University, Wooster, OH 44691

Mulches and composts are often used to improve soils and plant health and to control weeds. They improve drainage as they decompose even though the ability of the soil to hold moisture is increased. They lower soil temperature in the summer and insulate roots from cold in winter conditions. Eventually, they mineralize, release nutrients for plants, and leave humic substances as residues. Their beneficial side effects gradually disappear unless more mulch or compost is applied.

Generally, these organic materials inhibit undesirable microorganisms such as soilborne pathogens that cause diseases of plants. They also stimulate the activity of many types of beneficial microorganisms, including mycorrhizal fungi. Occasionally, however, microorganisms (primarily fungi) in mulches and composts can become a nuisance and even cause certain diseases of plants. Whether a mulch or a compost provides beneficial or detrimental effects is largely determined by the type of organic matter from which it was produced and the degree to which it was decomposed and treated before its application in the landscape. The temperature, pH, and moisture content of the products just before application also have an effect. The severity of nuisance fungi can be minimized if appropriate steps are taken in time.

Examples of Nuisance Fungi

The shotgun or artillery fungus (*Sphaerobolus*) may cause serious problems. While it decays the mulch, it also produces fruiting structures that resemble tiny cream or orange-brown cups that hold a spore mass resembling a tiny black egg (1/10 inch in diameter). This fungus shoots these spore masses high into the air. They stick to any surface and resemble small tar spots on leaves of plants or the siding of homes (Fig. 1). They are difficult to remove, leave stained surfaces, and may result in major damage.

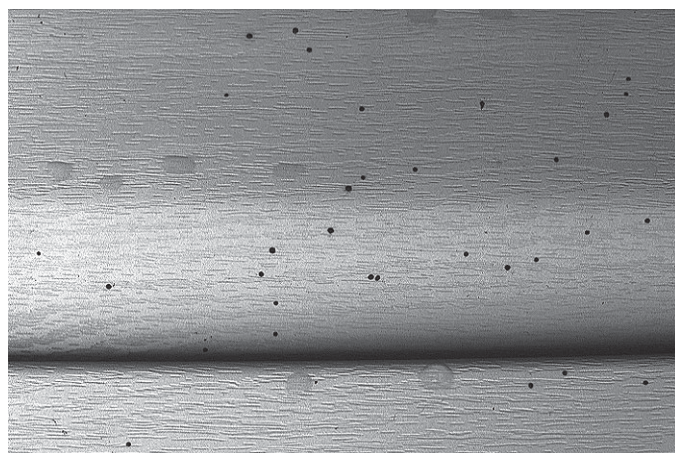


Figure 1. Artillery fungus spore masses on vinyl siding

Slime molds are another type of nuisance fungus. They first appear as bright yellow or orange slimy masses that may be several inches to a foot or more across. They produce tiny spores that eventually dry out and blow away. These molds, like many others such as stink horns (Fig. 2) and bird's nest fungi, actually should be considered microbial ornamentals in the landscape. However, some fungi in mulches and composts produce toad stools (mushrooms) (Fig. 3), and some of these are toxic to humans. It is a good idea to destroy them when small children have access to the mulched area.

Another fungal problem that is often not identified correctly occurs when mulches are applied too deep (4–6 inches) instead of the ideal depth of 1.5 to 2 inches. Deep layers of mulch, particularly if prepared from fresh woody materials, may actually undergo high temperature decomposition during the summer. The result is that the mulch dries out to less than 34% moisture and becomes a dusty mass. Fungi often colonize these dry mulches until they become a water-repelling, moldy chunk of material. Young trees mulched in this way



Figure 2. Stinkhorn (*Mutinus caninus*) on mulch. The cap of the fruiting body gives off a foul odor. (Photo courtesy of L. H. Rhodes.)

sometimes die from drought even though the homeowner irrigates the area, because water runs off the mulch since it repels water.

Other Types of Problems

Fresh mulches prepared from trees killed by plant diseases may be colonized by plant pathogens. *Verticillium dahliae*, a fungus that causes wilts and death of many shade trees and ornamental shrubs, can be carried in infested mulch and kill susceptible plants in the landscape. *Rhizoctonia solani*, another plant pathogen that causes damping-off of many types of seedling plants, is actually stimulated by fresh mulches (Fig. 4). This pathogen utilizes the cellulose in wood as a source of food.

Short-term composting of mulches in windrows under high-temperature conditions (130–160°F) kills these plant pathogens. Six weeks of composting is sufficient to kill most plant pathogens and avoid their dissemination in mulches or composts.

Mycorrhizae, which are fungi that can form beneficial associations with roots, also are affected by mulches and composts. A shallow layer of wood chips (1–2") or compost improves tree establishment because mycorrhizae are stimu-



Figure 3. Toad stool (*Lepiota americana*) on mulch under juniper. (Photo courtesy of L. H. Rhodes.)

lated by the slow release of organic sources of nitrogen and carbon in organic matter. However, a deep layer (4–6") of the same freshly chipped wood has been shown to inhibit the development of mycorrhizae during reforestation. Negative effects on mycorrhizae must be avoided in the landscape because they are very important in the maintenance of healthy plants.

Compost and mulch producers, landscapers, and homeowners can take measures to minimize fungal problems in the landscape. The type of mulch used, fresh versus composted mulch, the moisture content of the mulch before and during its utilization, the temperature and pH of the mulch before and during utilization, and the depth to which it is applied all play a role. Each factor is discussed here.

Mulch Type and Fresh versus Composted Mulch

Wood products from some trees are more resistant to decay than others and, therefore, cause fewer problems. Bark chips (nuggets) from large mature pine or other softwood trees such as cypress trees contain mostly lignin (dark material in bark), wax and protected cellulose that resist decay. On the other hand, wood wastes from these same tree species, but ground as young trees, rot quite readily because the cellulose in such bark and wood products is not yet protected from decomposition by lignin waxes or tannins.

Hardwood tree bark (oak, maple, etc.), even from large trees, contains a large concentration of cellulose that is not protected from rotting. Therefore, hardwood bark mulches, like ground wood from almost all tree species, rot readily and cause most of the nuisance mold problems in the landscape. The finer the product is ground, the more severe the problem can be! These materials are low in nitrogen content. The fine particles (less than 3/4" diameter) in such mulches cause nitrogen immobilization in soil. The microflora that decomposes the wood particles takes up the nitrogen required for growth of plants. The result is that the plant becomes starved for



Figure 4. *Rhizoctonia* crown rot of *Alyssum* in fresh mulch.

nitrogen. Some mulch producers screen all particles smaller than 3/8" out of high-wood-content or hardwood-bark mulches, which avoids most of the nitrogen immobilization problem.

The best way to avoid all these problems and bring about beneficial effects by mulching is to add nitrogen to woody and hardwood bark products followed by composting to lower the carbon to nitrogen ratio. Blending of grass clippings with wood wastes before composting is one way to achieve this. Addition of poultry manure or urea to supply 1.2 lbs. available nitrogen per cubic yard of material satisfies the nitrogen need also. Some landscapers add 10–15% by volume composted sewage sludge to hardwood bark or wood wastes, and this makes an ideal product that has performed very well in landscapes. These amended products should be composted at least six weeks. This process kills plant pathogens, eggs of insect pests, and produces a nitrified product that releases plant nutrients rather than ties up nitrogen. As mentioned above, the microorganisms that have colonized these products reduce the potential for growth of nuisance fungi and provide control of many plant diseases.

Temperature, Moisture Content, and pH

Landscapers often apply quality mulch products from high temperature piles (140–160°F) directly into the landscape. The temperature of the mulch is high because of heat produced by growth of microorganisms, known as thermophiles, in storage piles during the composting process. These microorganisms die soon after the mulch cools to 50–80°F after it has been placed around homes. Because they require high temperatures to survive, they cannot grow and compete with soil microorganisms at the low temperature of mulches in the landscape. The sudden temperature drop that often occurs after mulch is applied creates what is known as a “biological vacuum.” It also can occur during bagging of products at producers of mulches and particularly during dry seasons. Mesophiles (low temperature soil microorganisms) rapidly colonize such

mulches. If the mulch is dry, or dries out to a moisture content below 34% during the first day after it is applied (mulches are dusty below this moisture content), fungi become the primary colonizers. This sets the stage for problems later, and the problem becomes most severe in mulches that are applied too deep in the landscape.

After prolonged heavy rains, the dry material colonized by fungi eventually becomes wet. Dry products stored in bags may also become moist when water produced as a result of microbial activity accumulates along the inner surface in bags. Bacteria then rapidly colonize the fungal white mass to induce the formation of fruiting structures by the fungi. The nuisance toad stools and other fruiting structures appear a few days later.

Mold problems occur also when dry products are bagged or applied to dry soils. Dry composts removed from high-temperature piles occasionally cause mushroom problems in bags and also in soils at nurseries. These moldy products inhibit plant growth in field soils as well as in potting mixes. They also cause wettability problems if dry conditions persist in the soil for a few weeks to give fungi a chance to become the dominant colonizers. Plants do not grow well in such moldy soils.

These problems can be reduced by soaking the high-temperature products with water as they are applied in the landscape or bagged. The high-moisture organic matter then becomes rapidly colonized by bacteria during the first few days. These bacteria compete with fungi to reduce the potential for the development of major mold problems. This strategy has been successfully applied over the past decade to hardwood as well as softwood composts and mulches. It has controlled nuisance problems caused by many fungi in various parts of the United States and abroad.

The pH or acidity of the mulch is another important factor. Sour mulches that give off acrid odors may range in pH from as low as 2.5 up to 4.8. Highly acidic mulches are toxic to most plants and promote the growth of fungi. Bacteria that inhibit fungal growth cannot colonize mulches when the pH is lower than 5.2. The low pH and fungal problems are avoided if the raw material is nitrified and composted as described earlier.

In summary, water applied at the right time during composting, storage, and mulching can solve most of the fungal nuisance problems. It is best to maintain a water content higher than 40% on a total weight basis. Again this allows bacteria as well as fungi to colonize the organic matter, and it sets up competition for nuisance molds. The moisture content of most organic products actually can be raised above 50% and not present excessive weight problems during transport.

What to Do Once the Problems Occur

Sometimes very little can be done to control nuisance fungi other than to spade the mulch into the surface soil layer followed by soaking with water. Another option is to remove the

mulch, place it in a heap after thorough wetting to allow for self-heating to occur (110–140°F). This will kill nuisance fungi. If fresh dry mulch is placed on top of mulch colonized by nuisance fungi, the problems may occur again the following year or even earlier.

The best control strategy for homeowners and landscapers is to purchase composted products low in wood content. Fresh, finely ground woody products should be avoided for many

reasons unless composted first. Coarse fresh woody products are much less likely to cause problems unless applied too deep. It is important to soak all mulches immediately after they have been applied. Generally, mulches should not be applied to a depth greater than two inches. Mulches and composts applied in this manner provide many types of beneficial effects rather than nuisance problems, or worse, plant diseases. Sour mulches should be avoided altogether.

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Keith L. Smith, Associate Vice President for Ag. Adm. and Director, OSU Extension
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