

Using Organic / Biodegradable Mulching

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The term mulch simply means ‘a covering layer put on the surface of the ground’, principally to control weeds and reduce evaporation. This layer may be of wood chip, manure, straw and other materials in a general compost, that will rot into the soil (Organic Mulches). Alternatively non-degradable mulches like plastic film or even gravel may be used, but these do not have all the benefits listed below.

Mulching has several effects on the soil and the plants growing in it. It can be used to:

- Suppress weed growth.
- Retain moisture in the soil by reducing surface evaporation.
- Insulate soil from extremes of temperature.
- Improve soil structure by adding organic matter (organic mulches only).
- Increase nutrient content of the soil (organic mulches only).
- Encourage the growth of beneficial fungi such as mycorrhiza (organic mulches only).

There are many materials that can be called organic or biodegradable mulches: compost, woodchip, forest bark, well-rotted manure, hay, straw, peat, leaves and leafmould are among the most familiar. All will steadily break down into the soil, improving its structure and nutrient content, and as a result the mulch layer will need topping up each year (usually in the spring).

The rate of decomposition will depend on the woody content of the mulch (i.e. the proportion of lignin). Wood decomposes more quickly than bark. For example, conifer bark stripped from mature pine, cypress or other softwood trees contains a high proportion of lignin, wax and protected cellulose that resist decay. Wood from these same species (especially from young trees), in contrast, rots quickly. The heart wood and bark of some trees such as Oaks, Pines and Sweet Chestnut can also take longer to breakdown due to the chemicals produced by the tree (phenols, resins, and turpentine) which slow the process of decay.

CONTROLLING WEED GROWTH

If you intend to use a mulch primarily to control the growth and spread of weeds around your garden, you will have to use a mulch layer that is thick enough to stop light reaching the weeds underneath. So if you are using an organic mulch such as straw or woodchip, you will need to cover the surface with a layer at least 10cm (4”) deep. A deep layer of organic mulch prevents young shoots from reaching the surface, the roots eventually run out of stored energy and the weed dies. If you have a very bad weed problem it might be more effective to use an artificial sheet mulch made of plastic or cardboard which can be used to smother the surface completely. However, some thick plastic sheets will also stop the exchange of oxygen between the air and the soil surface, creating anaerobic conditions.

To suppress and reduce the spread of weeds, the mulch must be in place before they start to grow. The best time to lay mulch is in the spring, and by late autumn of the same year all the annuals and

many of the perennial weeds will be dead, particularly those with shallow roots like couch grass and creeping buttercup. It may, however, take more than one year to clear those with very deep roots like bindweed, although they become progressively weaker, and those with corms (like bulbous buttercup) or bulbils (like oxalis) can be very persistent.

A thick enough layer of mulch will stop weed seeds from germinating, and those that do appear can be removed from the loose surface with relative ease. To be effective an organic mulch must be thick enough to block light from developing weeds and suppress the growth of germinating seeds so they can't reach the surface. However, application of a deep mulch can smother desirable herbaceous plants and could encourage decay in some woody stems. This can be avoided by hollowing out the area around existing shrubs and limiting the depth of mulch around stems to 10cm (4") or less.

IMPROVED SOIL MOISTURE

All mulches will help prevent the evaporation of moisture from the soil, and thereby reducing the need for watering. A layer of organic mulch on the surface also reduces run off during watering, acting like a sponge by soaking up additional water and allowing excess to percolate through. As the organic matter within the mulch is combined into the top soil it enables surplus water to be stored in the humus layer rather than just draining straight through away from surface rooting plants and trees. However, deep mulches should be avoided on waterlogged soils, as they slow down evaporation of water from the soil surface and can allow it to increase to damaging levels.

IMPROVED SOIL TEMPERATURE REGULATION

A thick layer of organic mulch on the surface of a soil acts as an insulator just as loft insulation traps heat in the winter and keeps the house cool in the summer. Applying fresh mulch around newly planted trees and shrubs in autumn can increase soil temperature and improve young root development over winter. A thick layer of mulch applied in autumn can also protect the crowns of tender plants and improve the root growth of fruit bushes. However, very deep layers of fresh wood chips (20cm / 10" or more) are liable to compost *in situ*, and this can result in a considerable temperature which may cause injury to tender plant tissues.

IMPROVED SOIL STRUCTURE

The increased soil surface moisture level and more constant temperatures encouraged by organic mulches dramatically improve the environment for soil life. The mulch protects the surface soil crust from erosion by heavy rain and reduces the harmful effects of compaction. This allows the development of a good crumb structure as the soil mixes with the decaying organic matter within the lower layers of mulch. The decay fungi and bacteria release nitrogen (N) as they break down the mulch and earthworms are encouraged to this active decomposition layer. The worms help incorporate the organic matter into the soil and as they burrow through the soil they also create channels allowing water to drain away and improve soil aeration. A good layer of mulch on the surface of a thick clay soil will soon help break up the heavy structure and allow better root penetration and improve drainage. The additional organic matter added to a dry sandy soil will help retain water near the surface and reduce the loss of valuable nutrients through leaching.

IMPROVED AVAILABILITY OF NUTRIENTS

The nutrient released as the mulch decays will depend entirely on its origin and what organic matter may be within it. Mulches with a high C:N ratio (high in carbon and low in nitrogen) such as forest bark, sawdust, hay and straw can cause nitrogen deficiencies in the soil if they are dug into the surface. This occurs because the decay organisms need nitrogen to grow and absorb more than they release. When this type of material is used as a surface mulch the process is much slower and nitrogen loss is less of a problem.

When a poorly decomposed woodchip mulch is used, additional nitrogen can be added in the form of animal manure (chicken manure is particularly good). However, the application of soil fertilisers should be done with great care, as it can damage the delicate balance of soil ecosystems by changing the soil chemical integrity and altering the pH (acidity/alkalinity). These changes can dramatically affect a plant's ability to absorb soil nutrients.

Mulch pH will vary considerably depending on the origin of the organic matter, for instance, wood Chipping's from conifers will have a relatively low pH (6 or less). However, recent research work at RHS Wisley has indicated that mulch pH does not affect the soil on which it is spread. The decomposition process appear to produce neutral pH readings of around 7.5. This does not reduce the importance of regular monitoring of soil pH as this is very important, and should be combined with a good record system. These records will help with plant selection.

ENCOURAGE GROWTH OF BENEFICIAL FUNGI (MYCORRHIZA)

The presence of fungi is essential to maintain a healthy soil environment and encourage root growth. The fruiting bodies of fungi (mushrooms) often appear on organic mulches, usually arising after rainy weather. These fungi are not harmful to the plants and not all of them are poisonous. However, it may be advisable to remove the mushroom fruiting bodies if you have small children.

Some fungi combine with fine plant root hairs to form mycorrhizal associations, (Mycorrhiza means "fungus-root") which work as an extension of the plant's root system and improve their ability to absorb soil nutrients and water. In return for this the fungi are provided with sugars for the plant, which have been produced in the leaves by photosynthesis (the process that uses the sun's energy to produce carbohydrates from water H²O and carbon dioxide CO²). The association of these fungi with both young and established trees and woody shrubs can vastly improve their growth and development. Research studies have shown that this fungus/plant partnership helps plants survive stress, absorb more water and essential elements, and increase resistance to root disease pathogens and pests.

In nature, mycorrhizae are readily available to plants. However, in residential gardens, natural levels of endomycorrhizae fungi, which live inside the plant's roots, and ectomycorrhizae fungi, which reside on the outside of roots, can be extremely low. This is especially true when soils are distressed by compaction, fertiliser imbalance and other problems associated with urban landscapes. These mycorrhizae fungi can now be purchased in a powder or liquid form that can be added to the soil at the time of planting, or injected around the rooting area of mature specimens.

The saprophytic fungi, which live on the dead organic matter in the surface mulch actively compete with parasitic fungi such as Honey Fungus (*Armillaria sp.*) and suppress their development. Some research carried out in Canada found that if stumps of recently felled trees were inoculated with

Sulphur Tuft (*Hypholoma sp.*), Honey Fungus could be excluded. Maintaining the diversity of soil organisms and encouraging natural competition all helps to sustain a healthy soil ecosystem.

SOIL NITROGEN AVAILABILITY

Nitrogen (N) is one of the elements which is essential for all living organisms, but despite forming the largest proportion of the atmosphere around the earth as N², it is not always readily available. Plants cannot absorb N from the air, so it has to be converted to a form that they can take up through their roots.

Fungi and bacteria decompose the carbon compounds within the woody plant tissues of the organic mulch, (lignin and cellulose) which are broken down into simpler carbohydrates (basic carbon (C) compounds). The fungi and bacteria use these carbohydrates as food so they can grow and reproduce. But nitrogen is also required by the decay organisms to grow, and wood Chipping's (especially from winter pruning) often have a very high C:N ratio.

If the mulch has a high C:N ratio (eg. 150:1) and does not contain enough nitrogen, the fungi will absorb it from the surrounding soil. This can cause a temporary soil nitrogen deficiency especially if the mulch is mixed into the soil and is finely textured. Fortunately this is a temporarily problem because, the decomposition process, by the fungi and bacteria, results in the release of nutrients back into the soil. The C:N ratio can be reduced by composting the mulch first and even mixing in more green leafy material like grass cuttings. After composting the C:N ratio can be reduced to around 40:1.

Wood Chipping's containing high proportions of leaves, needles or bark, are likely to be higher in Nitrogen and will have less impact on the available soil N levels. However, this high content of soft plant tissue will also decompose quicker and may increase the temperature of a fresh mulch. It is still better to leave the mulch to compost for a short period before application.

Bacteria release nitrogen in the form of nitrate, which is easily leached from the soil and therefore lost to surface roots, whereas the fungi that break down the organic mulch release nitrogen into the soil in a form of ammonia nitrate, which is less mobile. Fungi are particularly beneficial to plants and should be encouraged.

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