Improving Lawn and Landscape Soils

Poor soil is a common cause of failure to grow vigorous, attractive lawns, trees and shrubs. Topsoils vary greatly from one location to another. Topsoil's ability to support plant growth can differ from block to block, from farm to farm and from the bottom to the top of a slope.

Conserving soils

When topsoil is eroded or is removed or buried during construction, growing plants in the remaining soil becomes more difficult. How well the soil is conserved and improved largely determines whether plants will become established and grow vigorously, or if they will even survive.

When building a new home, the desirable topsoil should be stockpiled during construction and replaced after construction is completed.

The lot grade or slope is also important in soil conservation. Whenever possible, provide good surface drainage without creating steep slopes, depressed areas or large level areas. The average lot should be raised at least 6 inches at the center or around the buildings. Soil types that tend to hold water need more slope than those that dry quickly after rains. Soil improvement should be made after grading is completed.

Improving soils

Lawn and gardens

The lawn and gardens will be in place for many years. While a garden may be fertilized later, the lawn becomes difficult and often impractical to dig up after it is established. So, it is important for the soil to be well prepared before establishing a lawn.

Dark color and crumbly texture may indicate good soil but are not a guarantee that the soil contains all the necessary nutrients. Have soil tested before preparing soil for planting so that nutrient deficiencies and pH may be corrected. After receiving the soil test results, apply the recommended amounts of fertilizers and soil amendments (lime, elemental sulfur) and work them into the top 6 inches of soil.

Organic matter is very important to successful plant growth. In general, Missouri soils have about 2.5 to 3 percent organic matter. Soils with at least 2.5 to 3 percent organic matter are preferable for growing lawns. Flowers, gardens and landscapes will do well in soils with 4 to 6 percent organic matter.

Adding organic matter to the soil improves the soil's structure, aeration, water- and nutrient-holding capacity, root penetration and workability. To add organic matter, spread 1 to 3 inches of peat, compost or well-rotted manure over the soil when other nutrients are added, and work all of this into the existing soil to a depth of about 6 inches.

Surface applications of organic matter do not provide the soil aeration, moisture regulation and deep root penetration that is possible when organic matter is mixed into the soil.

In addition to incorporation into the soil, applying organic matter as mulch is beneficial for many flowers, vegetables, trees and shrubs. Top-dressing of lawns may be done with good topsoil or topsoil–organic material combinations to smooth out irregular areas in the lawn or help decay thatch. Adding a few inches of topsoil does not generally improve the texture or performance of heavy clay and poorly drained soils unless it is done in combination with core aerification.

Trees and shrubs

Selection. Select trees and shrubs that are adaptable to existing soil conditions. Know whether a plant requires well-drained soil, is drought tolerant, or is water loving.

If the proper plants are chosen for the location, soil conditioning will improve their survival rate from transplanting and their root establishment, will hasten resumption of normal growth, and will increase their lifelong vigor.

Planting. When planting trees and shrubs, always dig generous planting holes shallow and wide. The hole should be at least twice the width of the root ball or the container in which the plant is growing and no deeper than the root ball of the tree or shrub to be planted. Soil loosened below the root ball will settle over time, creating a planting depression that will accumulate excess water. In heavy clay soils, planting trees and shrubs a few inches above the grade of the surrounding soil is preferable. In extreme cases, mound planting is preferable, as it can help with root development above existing compacted soil. See Figure 1.

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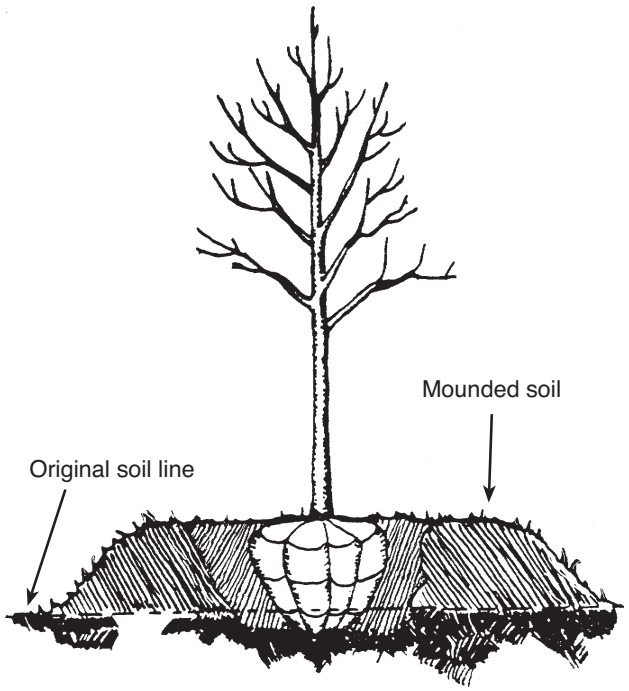

Figure 1. Mound planting.

Although surface drainage is easy to observe, internal drainage of soil is often not known. Internal drainage can be checked quite easily. Dig planting holes in advance, and fill them with water. If all the water drains out in the first 18 to 24 hours, drainage is satisfactory. If the water stagnates for two days or longer, indicating poorly drained soil, select water-tolerant plants, or plant in a raised bed or mound. Placing gravel at the bottom of the planting hole will not improve the internal drainage.

Amending the soil used to backfill planting holes provides questionable benefits. If any soil amendment is done in the planting hole, provide for a gradual transition of soil types (textures). If the backfill soil is drastically different from the existing soil, roots will not readily penetrate the soil around the planting hole. Significant textural differences in soil can also affect soil water movement. If the container growing mix is high in peat and the surrounding soil is clay, water will tend to move out of the root ball. Excessively wet root zones may result when the tree's or shrub's root ball is high in clay content and the backfill soil contains a high level of organic matter. See Figure 2.

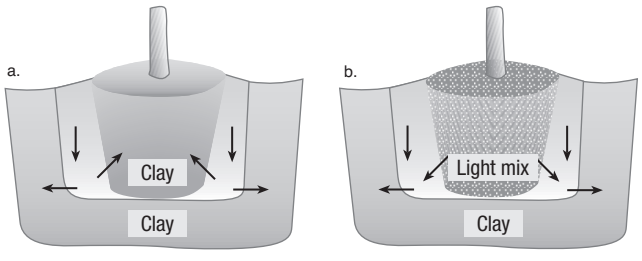

Figure 2. How transplanting into clay soil affects water movement (see arrows): (a) When the root ball is also composed of clay soil, water tends to move into the clay and saturate the root ball. (b) When the root ball is composed of a light mix, such as peat, water tends to move away from the root ball.

A small amount of organic matter added to the backfill soil is generally beneficial. Incorporate most of the organic matter into the top 6 to 12 inches of soil in a large area around the planting hole. Improving the soil surrounding the planting hole provides a good base for new root growth in areas where most new roots will develop.

Special soil situations

Raised beds

Where soil or drainage is a problem that cannot be corrected easily or economically, raised beds can add several inches of good soil in a well-drained area.

Beds can be constructed of brick edging, masonry or rot-resistant timbers and filled with soil previously combined with organic matter and nutrients. Low mounds of soil without edging can add several inches of desirable soil. See Figure 3. For more information on raised beds, consult MU Extension publication G6985, *Raised-Bed Gardening*.

Soil for containers

Planters, patio wells, tubs and pots have their own soil needs. All containers should have drain holes. Excellent drainage is essential. Good drainage means that watering must be done frequently. Use a well-drained, lightweight potting mix designed for growing plants in containers. In very large containers or raised beds, mixing topsoil with a mineral material such as calcined clay or expanded shale can help maintain good drainage for many years.

Soil amendment materials

Many kinds of materials are available for soil improvement. Thorough blending of these amendments with the soil is very important. Plant roots may not cross a boundary between distinctly different types or textures of soils or soil amendment materials. Avoid heavy top-dressing, poor mixing or other practices that cause distinct layering.

Peat. An assortment of materials generally referred to as "peat moss" is the most readily available material for soil conditioning. Peat creates favorable changes in the soil. It makes the soil more granular and more easily worked. It hastens the escape of excess water and, at the same time, absorbs and holds more water for plants. Peat allows more air to enter the soil, thus encouraging the growth of roots and microorganisms that help make plant nutrients more available. Most commercial peats are free of weed seeds and plant diseases.

Differences between sources of peats will cause variation in acidity (pH), ability to hold water and nutrient content (Table 1). Peat materials that are black and fine-textured are of little value for improving soil structure.

Although peat contains some plant nutrients, it should not be considered a fertilizer. What makes peat valuable is the long-term improvement it makes in the soil's physical characteristics.

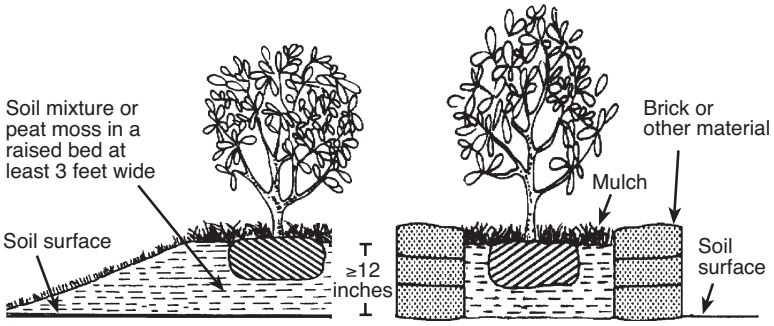

Figure 3. Examples of raised beds for clays and other soils of poor structure.

Manure. Results when using manure are variable because manure varies in nutrient value, degree of decomposition, and freedom from weed seeds and disease organisms. Manure contains more nutrients than peat, usually has lower acidity than peat, and does not last as long in the soil as peat.

In some areas, barnyard manure is readily available. Although nutrients are lost in aging, well-rotted old manure is much better for plants than fresh manure with straw residue. The greatest disadvantage of manure is the weed seeds that are often present. Manure with a high content of bedding materials may tie up nitrogen from the soil by the process called temporary nitrogen immobilization by microbes.

Composted or dried manure is more desirable because weed seeds and potential human pathogens have been killed. It is packaged for more convenient handling and often has plant nutrients added to bring it to a standard fertility level.

Fresh manure should not be used except as a light top-dressing on beds. If used in this way, it should not touch any plant stems or leaves.

Processed or rotted manure may be used in fairly large quantities as a soil amendment, mulch or top-dressing. Manure that has been rotted and exposed to weather may be used more liberally than the processed, bagged, dried manure. A layer 1 to 3 inches deep may be incorporated when preparing a flower bed or lawn seedbed, but no more than 1 to 2 inches of the processed type should be used.

Poultry manure contains greater amounts of nitrogen with less litter and thus should be used more cautiously than other manures. When preparing flower beds and lawn seedbeds, only a 1- to 2-inch layer of rotted poultry manure should be added. If processed types are used, only a ¾- to 1-inch layer should be incorporated.

Wood byproducts. Sawdust, wood shavings, shredded wood, pulverized bark and wood chips can be used to improve soils. In a raw or fresh state, wood byproducts are low in nitrogen. When wood byproducts decay, microbes use nitrogen from the surrounding soil and the plants become starved for nitrogen. Adding nitrogen fertilizer to the material when it is mixed with soil or composted (Table 2) will ensure plants receive the nitrogen they need. For best results, wood byproducts should be composted before being added as a soil amendment. Very coarse wood products should be used only for mulching.

In addition to the incorporation of nitrogen into the soil, two or three more small applications of nitrogen should be made at three- to five-week intervals during the spring and summer to relieve extended nitrogen starvation when wood byproducts are used directly as a soil amendment.

Wood ash is strongly alkaline, containing mostly lime and potassium. It is a soil conditioner only in the manner of limestone and is most useful in treating strongly acid soils.

Sewage sludge. Dried sewage sludge is often available from sewage treatment plants. Its composition and nutrients vary with the source and the disposal process. Most sludge available in bulk form is lower in nutrients than manure. It is similar to peat for improving soil texture and should be used at the same rates as peat or composted manure.

Compost. Compost is very beneficial for soil improvement. It offers many of the same features as manure and may be used at the same rates. It can be used in potting soil, in the preparation of flower beds and gardens, and as a mulch for trees and shrubs. Chopped straw, leaves, grass clippings, weeds and other plant refuse may be composted.

To start the compost heap, place a 6- to 8-inch layer of plant materials in a well-ventilated bin. Moisten these materials, but do not soak them. Use a mix of dried and fresh plant refuse to achieve a good carbon-to-nitrogen ratio. If green (high nitrogen) plant materials are unavailable, use manure or commercial fertilizer as a nitrogen source. Sprinkle 1 cup of a garden fertilizer such as 10-5-4 or 12-12-12 for each 25 square feet. The layer should then be covered with ½ to 1 inch of soil.

Use several layers to complete the heap. Keep the heap moist but not soaking wet. Make the top of the heap flat or slightly depressed in the center so that rainfall can soak in. During warm weather, the pile should be turned about

Table 1. Major characteristics of peat.

Type	pH	Water-holding capacity	Nitrogen content
Sphagnum moss peat	3.0–4.0	high	0.6–1.4
Hypnum moss peat	5.0–7.0	high	2.0–3.5
Reed-sedge peat	4.0–7.5	medium	2.0–3.5
Decomposed peat (very fine and black)	5.0–7.5	low	2.0–3.5

Table 2. Nitrogen addition to wood byproducts.

		Fertilizer per volume of material		
Nitrogen source		Bushel	Cubic yard	1,000 sq ft, 1 inch deep
Ammonium sulfate	21%	1 cup	10.0 lb	36 lb
Ammonium nitrate	33%	¾ cup	7.5 lb	27 lb
Urea	45%	½ cup	5.0 lb	18 lb

once a month. During winter months, turning will not be necessary. The materials will decompose thoroughly in 4 to 12 months, depending on the frequency with which the compost heap is turned.

For more details on composting structures and methods, refer to MU Extension publication G6956, *Making and Using Compost*.

Cover crops

Grow cover crops in your garden in the fall after harvesting. Cover crops like cereal rye, annual rye and hairy vetch do well in Missouri conditions. Cover crops help improve soil structure, reduce soil erosion and increase water movement through the soil (infiltration). Leguminous cover crops such as hairy vetch perform better when inoculated with rhizobium bacteria, which fix a significant amount of atmospheric nitrogen into a form plants can use. Planting and plowing in a combination of leguminous and nonleguminous — such as cereal rye, annual rye, buckwheat — cover crops will improve the soil by building up soil organic matter and structure, and providing nitrogen to the soil.

Sand

The grades of sand used in construction are most readily available. This sand has little water-holding capacity and no nutrient value. Seventy-five percent or more by volume must be mixed into heavy clay soils before there is any improvement in aeration, internal drainage or texture. Adding lesser amounts of sand can compound aeration and drainage problems. Sand mixed with clay can set up into a bricklike mixture. Peat or compost should be used instead to improve heavy clay soils.

Sand applied as a top-dressing often seems to disappear into the soil but actually remains as a surface layer. So, sand should not be used alone as a top-dressing.

Limestone

Agricultural limestone is commonly used to supply calcium and to regulate soil acidity but is overlooked for its ability to improve the texture of heavy soils. If soils contain enough limestone, do not add more because the balance of soil nutrients can be upset by the use of too much lime. For best results, use lime only as recommended based on results of a soil test.

Other agricultural byproducts

Peanut shells, tobacco stems, rice hulls, corncobs and other fibrous agricultural byproducts are sometimes available for soil additives or mulching. Most of these materials when crushed to a fine texture with nitrogen added (Table 2) will be good soil conditioners. In their coarse state, these materials are suitable for mulching.

Meat meal, tankage, fish meal and cottonseed meal have little soil-conditioning ability. However, because they contain from 6 to 10 percent nitrogen, they are useful for side-dressing many ornamental plants.

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