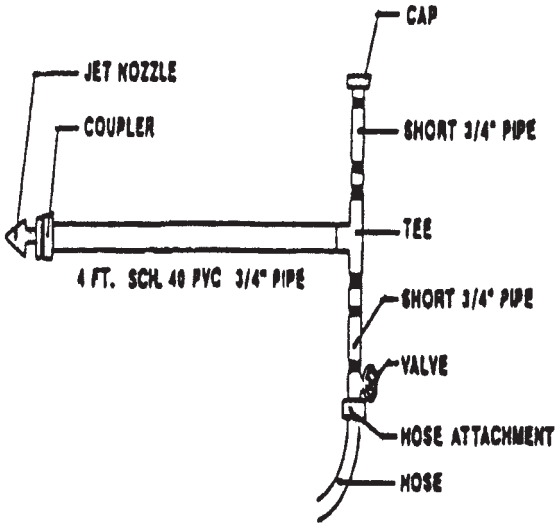
Commercial core aerators are available, or the gardener may construct one. Use a two- to four-inch diameter auger, post hole digger or water jet to drill the holes. A water jet can be made with a length of pipe (galvanized steel or PVC) three to five feet long. One end is flattened or fitted with a high-pressure nozzle. The other end of the pipe is fitted with a tee, a couple of short sections to use as handles, a gate valve to control the flow of water and a garden hose adapter as shown in Figure 2.



Water coming through the garden hose into the pipe is under pressure which will hydraulically drill a hole in the ground. The objective is to break through any impermeable soil conditions with the auger or water jet and allow water to drain away and air (oxygen) to enter the soil, improving the soil environment for growing roots.

Drill two- to four-inch-diameter holes, three or four feet deep around the plant. The number of holes drilled depends upon the size of the plant. Make slanting holes at two- to three or four feet deep around the plant. The number of holes drilled depends upon the size of the plant. Make slanting holes at two- to three-foot intervals beginning three feet from the trunk and continuing out and beyond the drip line of the plant. For shrubs, begin one foot from the trunk and extend out to its furthest roots. Fill these small holes with a mixture of approximately 35 percent organic matter and 65 to 70 percent by volume of on-site soil. Coarse organic mulch allows air and water to enter the soil, adding nutrients as it decomposes. Very coarse washed sand or small pea gravel keeps the holes open as well, but does not supply nutrients to the plants.

Vertical mulching established trees and shrubs can be done once a year, if necessary. Although this can be done at any time of the year, spring or fall is preferred while the weather is more pleasant and the plant's roots are actively growing. The smaller auger or water jet holes are less damaging to the roots and the equipment is easier to handle.

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Vertical Mulch for Healthier Trees and Shrubs

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Why do trees and shrubs fail? Some turn yellow and die immediately after planting and others die slowly. Poor planting technique and waterlogged soils from improper irrigation and/or insufficient root zone drainage are often the cause. Plants that are suffering from adverse soil conditions may display the following symptoms:

- Delayed spring growth producing weak, thin, often short new branches with yellow-green leaves.
- Abnormally small, yellow foliage that wilts easily and recovers slowly. Wilt is a natural protective mechanism of leaves that lack water. Stomates (pores) of the leaves close to prevent dehydration. The leaves lack water because roots standing in water lack oxygen required for their proper function and necessary for the uptake of water.

ROOT GROWTH

Roots continuously regenerate as soil conditions change. Root growth is most rapid during the spring and fall when soil temperatures are mild. Productive plant growth only occurs in the presence of a favorable water/air balance and a soil free of toxins or barriers. That's why up to 90 percent of the roots are normally within the upper foot of soil. This is the most favorable root environment in landscape soils. Subsoils are often compacted and waterlogged. Some plant varieties may have roots that grow outward from the trunk as

much as three to five times their height when conditions are favorable.

RESTRICTED ROOT DEVELOPMENT

Waterlogged soils lack oxygen, which depletes root vitality, causes plant stress, and ultimately contributes to the death of the plant, if prolonged. Without oxygen, roots cannot absorb sufficient water and nutrients from the soil. The continuous lack of water and withdrawal of nutrients stored within the plant reduces vigor and makes the plant more susceptible to disease and insect invasion. In waterlogged soils, growth of the smaller, more tender feeder roots is handicapped most resulting in plant suffocation. Extended periods of too much water may kill the entire root system.

SOIL PROBLEMS

SOIL INTERFACES - Adding different soils and not adequately mixing them together creates impenetrable soil with interfaces. These are barriers to growing roots and water movement. A strong interface often exists between native soil and container soil if care is not taken to eliminate it at planting. With an interface, the planting hole acts as a pot in the ground preventing proper drainage and suppressing root growth. Roughen up (scarify) the edge of the hole--do not leave slick sides--and/or amend the native soil with organic matter to solve the problem.

Blow sand in southern Nevada or decomposed granite in northern Nevada are common amendments some consider as *top soil*. However, these materials can create severe soil interfacing which restricts soil-water movement, root growth, and oxygen availability to the roots if not properly incorporated into the existing soil or the backfill.

SOIL PROFILES - Soils in Nevada are poor for plant growth unless improved. Most are devoid of organic matter, alkaline (high pH), shallow and droughty. Many are underlain with slowly permeable subsoils and hardpans such as caliche. During construction activities, landscape soils are unevenly mixed and compacted. Excavated subsoils are sometimes spread over existing surface soil. Too often poor quality blow sand or decomposed granite is used as “top soil” to cover the excavated soils or even the undisturbed landscape soil.

SOIL COMPACTION - Construction vehicles and equipment typically compact soils which later interferes with water movement, creates excessive run-off, and impedes root growth. This is not unusual as many communities require building contractors to compact the soil to better support a building’s foundation. Unfortunately, the large equipment used compacts more than the soils for the foundation—often the entire landscape. Consequently, plants are subjected to poor soil-water relations. When combined with adverse climatic conditions, these factors contribute to severe plant stress and eventual death.

SALT ACCUMULATION - Water evaporating from the soil accumulates salts near the growing roots and may either impede their growth or cause them to die. Proper irrigation and periodic leaching of plant root zones will reduce the accumulation of soil salts. For leaching to be effective, good quality water low in salts must be applied in sufficient quantity to move the salts below and away from the roots. This implies that drainage is adequate as well.

NEW AND EXISTING PLANTINGS

It is best to alleviate potential soil problems before planting trees and shrubs. Follow planting recommendations available at your area Cooperative Extension office or a reliable nursery. Occasionally, water and air movement into, through, and out of soil is very slow or nonexistent. This is commonly the case in heavy clay soils and when hardpans or caliche exist. *Vertical mulching* is a gardening technique proven to be successful in correcting and improving plant-soil-water relations.

VERTICAL MULCHING

The process of drilling holes under trees and shrubs and then filling those holes with a coarse soil amendment is called *vertical mulching* (Figure 1).

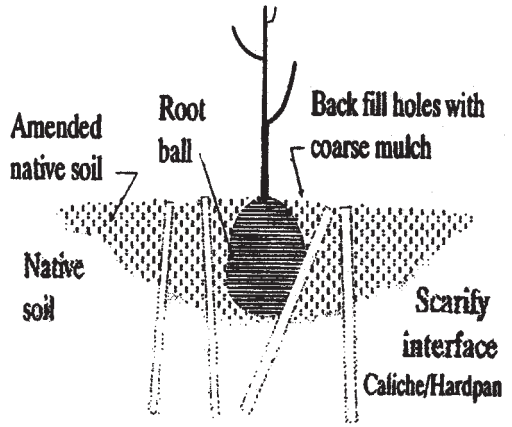

Figure 1. Vertical mulching around and under trees and shrubs.

It is a practical alternative where deep tilling is not possible (e.g. small or tight areas, on slopes, near foundations or near underground utilities). It also allows the homeowner to correct soil conditions that may be inhibiting desired plant growth without replacing the plant and/or the soil.