



Environmental Horticulture Notes

EHN 53

GARDEN AND LANDSCAPE PLANTINGS ON HARDPAN SOILS

Hardpan soils are noted for the problems they present—but if the nature of the soil is understood, the problems can usually be overcome.

WHAT IS HARDPAN SOIL?

Hardpan soil is a soil that is underlaid by a rock-hard layer of material close enough to the surface to limit the depth plants can extend their roots and to prevent internal drainage of the soil.

The soil above the hardpan varies in depth from a few inches to two or three feet. It may be of good texture and have good structure making it easy to work—or it may be of poor texture, dense and hard making it very difficult to work. In places where the soil above the hardpan is easy to work, only the problems caused by the hardpan need be considered. On the other hand, if the soil above the hardpan is dense and hard, this problem must also be considered in addition to those caused by the hardpan. This leaflet deals only with the problems caused by hardpan. Suggestions for easing the problems with dense, hard soils are given in Environmental Horticulture Note #54, “Managing Clay Soil in Gardens and Landscape Plantings.”

The term hardpan is often mistakenly used to describe any soil that is difficult to work or that drains poorly. Plants do not grow roots in hardpan. Hardpan is rock and neither roots nor water can penetrate it. To determine whether a material is hardpan or simply very hard soil, break a chunk off and put it in water. If it absorbs water, it is hard soil. If it will not absorb water, it is probably hardpan.

PROBLEMS CAUSED BY HARDPAN

Roots cannot grow into hardpan, so root development is limited to what soil there is above the hardpan. Plant growth may be restricted because of the limited volume of soil from which plants can obtain nutrients and water. Lack of soil depth may prevent some trees and shrubs from developing a large enough root system to hold them in place during high winds, especially when soil is very wet.

Water cannot penetrate hardpan. Consequently, the soil above it can easily become waterlogged because the excess water cannot drain to lower depths. Waterlogged soil contains very little, if any, air. Without air in the soil, the roots of most plants do not function properly and soon die in soil that is too wet.

WHAT CAN BE DONE ABOUT HARDPAN SOIL PROBLEMS?

PROVIDE SURFACE DRAINAGE

Grading the entire site to a slope of at least ½ to 1 percent, leaving no pockets to collect and hold water helps reduce waterlogging of the soil.

INCREASE SOIL DEPTH

The deeper the soil above hardpan, the less likely there are to be problems. Where the soil is very shallow it may be desirable to add soil. When adding soil it is important to blend and mix the soil that is added with the

The University of California prohibits discrimination or harassment of any person in any of its programs or activities. (Complete nondiscrimination policy statement can be found at <http://ucanr.edu/sites/anrstaff/files/107778.doc>) Inquiries regarding ANR's equal employment opportunity policies may be directed to Linda Marie Manton, Affirmative Action Contact, University of California, Davis, Agriculture and Natural Resources, One Shields Avenue, Davis, CA 95616, (530) 752-0495

Agriculture • Community Resource Development • Nutrition, Family and Consumer Sciences • Master Food Preservers • 4-H Youth Development • Horticulture • Master Gardeners
University of California, U.S. Department of Agriculture, and the County of Sacramento cooperating.

Sacramento County Board of Supervisors -- Phil Serna, 1st District; Jimmy Yee, 2nd District; Susan Peters, 3rd District; Roberta MacGlashan, 4th District; and Don Nottoli, 5th District.
Also, Brad Hudson, County Executive; Ann Edwards, Countywide Services Agency; and Yvonne Nicholson and Chuck Ingels, Cooperative Extension.

original. Failure to do so can increase, rather than decrease the problems. Before adding any soil, work the area where it is to go. Then add only two or three inches of soil and work it to blend it into the original. Then more soil can be added and worked in, two or three inches at a time until the desired depth is reached. The deeper the soil the better. The following table suggests desirable minimums...but there are successful gardens and landscapes growing on less.

<u>Type of Plants</u>	<u>Desired Minimum Soil Depth</u>
• Lawns and leafy vegetables	1 foot
• Ground covers, small shrubs, corn and tomatoes	2 feet
• Small trees and shrubs	3 feet
• Large trees and shrubs	3 to 6 feet

MAKE HOLES THROUGH HARDPAN

Hardpan varies in thickness. It varies from a few inches some places to many feet in other places. Where it is only a few inches thick and porous material is found beneath it, making holes through hardpan can help reduce waterlogging of the soil. Where underground conditions permit this practice to work, a hole each place a tree or large shrub is to be planted may be adequate. Each hole should be tested by filling with water six or eight times in succession to soak the porous material below the hardpan. Then, if water will drain out of the hole within 24 hours, chances are good it will help reduce waterlogging of the soil above the hardpan for several feet around the hole.

IRRIGATE TO PROVIDE ADEQUATE, BUT NOT EXCESSIVE WATER

Most plants do best when their roots are in soil that is moist. Proper irrigation consists of applying only enough water to re-wet the soil where the plants have removed it, but not so much that the soil just above the hardpan starts to become waterlogged. Roots soon die when the soil in which they are growing becomes waterlogged.

Use a soil tube or auger to dig down and check on moisture conditions. Should the lower soil begin to waterlog, either allow more days between irrigations, or put on less water when watering, or both. When watering, apply only enough to wet the soil that is getting dry. Avoid adding more where the soil is already too wet.

SELECTION OF PLANTS

The practices suggested in this leaflet can greatly reduce problems with plants on hardpan soil...but does not eliminate them. Despite all precautions that can be taken, there are apt to be times when the soil becomes very wet and poorly aerated...intolerable to plants that require well-drained soil. Trees noted for deep tap root systems such as oaks and pistache cannot be expected to do as well as alders, ash or sweet gum.

CHEMICALS TO DISSOLVE HARDPAN

Many chemicals and combinations of chemicals have been tried in hopes of finding something to eliminate the problems caused by hardpan. Unfortunately, none have proven effective.