



Right Tree: Right Place— Alkaline Soils

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Landscape
Management

Many landscape tree problems are the result of poor plant selection and failure to match trees to specific site. In this “Right Tree: Right Place” series of articles, we are considering some of the key site factors that can limit tree survival, health and growth. We will consider why the condition is a problem and discuss tree selections that are best suited for that site factor. In this installment of the series we turn our attention to alkaline soil pH, a common soil condition in Michigan and the Midwest.

What is soil pH?

Before we discuss alkaline soils and why they are a problem, it’s helpful to go back and review a little high school chemistry. pH is defined as the logarithm of the reciprocal of the hydrogen ion concentration of a solution. Chances are you probably forgot that little tidbit over the years, but it’s actually pretty important and we’ll get back to why in a minute. From a more practical standpoint we usually define pH as the relative acidity or alkalinity of a solution. pH is expressed on a scale of 0 to 14, with 7 indicating a neutral pH. Common examples of acid solutions are coffee (pH=5) and grapefruit juice (pH=3); common examples of alkaline solutions are seawater (pH=8) and oven cleaner (pH=13).

In soils, pH is important because it influences the availability of elemental plant nutrients. The availability of some soil nutrients, such as iron and manganese, declines as pH increases.

For other elements, like phosphorus and magnesium, nutrient availability decreases as pH decreases. These off-setting effect result in a ‘sweet spot’ for most plants of a soil pH just on the acidic side of neutral between pH 6 and 7. Of course, there are a lot of exceptions and some plants, such as azaleas and blueberries, are adapted to acid soils and require pH levels of 6 or lower. One important factor to remember when dealing with pH sensitive plants is that small changes in pH can make a big impact on plant performance. Recall the definition of pH included a logarithm. This means a pH of 6 is ten times as acidic as a pH of 7; and a pH of 5 is one

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Trees that are tolerant or intolerant of alkaline (pH 7.5-8.2) soils

Alkaline tolerant	Alkaline intolerant
Miyabei maple	Red maple
Red horsechestnut	Pin oak
Katsura tree	River birch
Redbud	Sweetgum
Yellowwood	Pear
Hardy rubber tree	Dogwood
Hophornbeam	Firs
Chinkapin oak	Spruces
Lindens	Pines
Elms	Hemlock

NOTE: List is not all-inclusive, but is intended to provide examples of common trees in each category.

hundred times as acidic as a pH of 7. For plants that are especially sensitive to pH, such as red maples, an increase in pH from 6.0 to 6.5 can be enough to induce nutrient problems.

What happens when soil pH is too high?

While a soil pH around 6.5 is often considered 'ideal' for plants, many trees can grow well at soil pH values above 7. As pH levels increase above 7.5, however, most trees will eventually experience nutrient deficiencies, often iron or manganese. Unlike problems associated with flooding or poor soil drainage, which can often lead to rapid tree failures, elevated soil pH may result in chronic long-term issues characterized by chlorosis, low vigor, poor growth, and stem dieback. In some situations it may be possible to reduce soil pH by applying elemental sulfur or fertilizing with ammonium sulfate. This effect is temporary, however, and re-application will be needed every few years to keep the pH from rising back to the baseline level. A better approach in the long term is to include soil pH as part of an initial pre-plant site assessment. If a soil test indicates a pH between 7.5 and 8.2 consider some of these trees in the site design.

Miyabei maple (*Acer miyabei*) is a relatively fast-growing tree with deep, dark green



'State Street' Miyabei maple is a medium-sized tree with excellent form and dark green leaves.

foliage. This is a medium, oval-rounded tree that typically grows to 25-40' tall. It is native to a few scattered locations near streams and rivers in Japan and considered endangered in the wild. This

species was first grown in the U. S. at the Morton Arboretum in Lisle, Illinois. 'Morton' was selected in 1988 from a parent tree that was planted at the Morton Arboretum in 1929.



Red horsechestnuts make a statement every year with their panicle of flowers. Photo: Marian Matei, Wikimedia commons

Red horsechestnut (*Aesculus carnea*)

Horsechestnuts offer a change of pace in many respects. Each spring they produce a showy panicle of flowers. In



Palmately compound leaves are a distinctive characteristic of horsechestnuts.

addition, the leaves of horsechestnut are palmately compound, which distinguishes them from almost any other tree except for closely-related buckeyes. Horsechestnut are medium-sized trees at maturity. Leaf scorch in summer is usually the common issue experienced with horsechestnut trees.



Katsura tree is ideal as a specimen tree.

Katsura tree (*Cercidiphyllum japonicum*)

is a striking medium-sized tree (40') with an upright pyramidal crown. The genus name *Cercidiphyllum* refers to the tree's round leaf shape. The leaves provide light orange color in the fall. Although Katsuras are relatively tolerant of alkaline soil conditions they are not particularly drought hardy and may drop some leaves during drought periods.



Heart-shaped leaves of the Katsura tree



Redbud flowers announce the arrival of spring. Photo courtesy: Indiana University-Purdue University Fort Wayne (IPFW) Grounds Dept.

Redbud (*Cercis canadensis*) is essentially a southern tree, but the northern end of its native distribution includes the lower tier counties in Michigan along the Indiana and Ohio borders. The main allure of redbud is bright pink flower display that announces the arrival of spring each year. After the flowers have faded, however, redbud is still an attractive tree with deep green heart-shaped leaves. A small tree (25'), it is well suited for areas with height restrictions or as an understory tree beneath larger trees.



Redbud works well as an understory tree. Photo courtesy: IPFW Grounds Dept.



Pea-like flowers of yellowwood. Photo courtesy: IPFW Grounds Dept.

Yellowwood (*Cladrastis kentukea*) Like redbud, yellowwood is an attractive small to medium-sized tree that produces showy flowers. Yellowwood has a scattered native range from Arkansas to Kentucky and Tennessee. It has pinnately compound leaves that turn bright yellow in fall. The common name, however, is rooted in the yellow heart wood, which is used for woodworking and from which yellow dye can be extracted.



Yellowwood fall color. Photo courtesy: IPFW Grounds Dept.



Dark green lustrous foliage of hardy rubber tree

Hardy rubber tree (*Eucommia ulmoides*) is an excellent ornamental tree with glossy green leaves and a rounded crown with upright branches. The species is native to



Hardy rubber tree has a pyramidal crown that becomes rounded with age.

China, although several sources report it is now extinct in the wild. As suggested by the common name, the tree produces a latex-like milky sap.



The fruit of hophornbeam makes it easy to see where it gets its name. Photo courtesy: IPFW Grounds Dept.

Hophornbeam (*Ostrya virginiana*) is native throughout the Eastern United States, including Michigan. It typically occurs as a small understory tree. The common name refers to the small fruits that resemble hops. *Ostrya* is also considered a valuable tree for wildlife since the fruit are preferred browse for grouse, turkeys, pheasant and other birds. Another common name for the species is ironwood in reference to the tree's extremely dense wood.



Hophornbeam fall color. Photo courtesy: IPFW Grounds Dept.



Chinkapin oak. Without the acorns it might be difficult to guess that this tree is an oak. Photo: Vojtech Zacadil Wikimedia commons.

Chinkapin oak

(*Quercus*

muelenbergii)

At first

glance, some might not

recognize this tree as a oak. The shiny

green leaves are long and narrow with

coarse marginal teeth that are reminiscent

of a chestnut. The tree is in the white oak

group and produces small oval acorns

when mature. The species is native to the

southern half of the Lower Peninsula and

much of the eastern U.S. It often occurs

naturally on limestone outcrops, which

speaks to its tolerance of alkaline soils. It

is a medium-sized tree (45').

Lindens (*Tilia spp.*) Lindens have long been popular as street trees around the world. In most cities in Europe, lindens



Lindens have long been a mainstay in European cities, in this case Copenhagen, because of their tolerance of adverse site conditions.





Redmond lindens produce a stately pyramidal form.

Elms (*Ulmus spp.*) The development of Dutch elm resistant hybrids and the selection of Dutch elm tolerant American elms have led to a resurgence in popularity of elms. Growth rates of many hybrid elms are excellent. Heights of 'Triumph', 'Accolade', and 'Commendation' elms averaged over 25' after ten years in our demonstration planting of shade tree



'Triumph' elm is a fast-grown tree with excellent form.



– usually referred to as 'limes' by Europeans – are ubiquitous. Frequently, the trees are pollarded or otherwise intensively pruned. Part of the enduring popularity of lindens in cities is their tolerance of poor conditions including high alkalinity. Lindens are good growers, forming medium to large-sized trees with a stately pyramidal form. Lindens have deep green leaves,

turning yellow in the fall. Linden flowers are fragrant and visited by bees that produce linden honey, which is considered a specialty item. Japanese beetles are the main limitation for linden in Lower Michigan and other areas where the beetles occur. Several species of lindens make outstanding landscape trees including American linden or basswood (*Tilia americana*), littleleaf linden (*Tilia cordata*) and silver linden (*Tilia tomentosa*), with numerous cultivars of each available in the nursery trade.

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cultivars at the MSU Tollgate Education Center near Novi, MI. The combination of good growth, green leaf color, and tolerance of alkaline soils and other adverse site conditions makes elm a logical choice, particularly for homeowners, landscapers and urban foresters looking to replace ash tree lost to the emerald ash borer.



The glossy green leaves of 'Accolade' elm turn yellow in the fall.

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