

# Soil pH for Landscape Plants



The pH (potential hydrogen) of a soil measures relative acidity or alkalinity. The pH directly affects the availability of nutrients. If the pH is too high or too low, some nutrients become insoluble, limiting the availability of these nutrients to the plant root system.

The acidity-alkalinity scale ranges from 0 to 14. Soils are referred to as being acid, neutral, or alkaline, depending on their pH levels. A pH of 7 is neutral, while a

pH lower than 7 is acidic and a pH higher than 7 is alkaline (basic). A change of one unit in the pH scale represents a tenfold change in acidity or alkalinity. A soil with a pH of 5.0 is 10 times more acidic than a soil with a pH of 6.0 and 100 times more acidic than a soil with a pH of 7.0. For this reason, be very careful when trying to increase or decrease soil pH.

Factors that may affect the amount of amendments needed to change soil pH include characteristics of the soil, such as soil type, organic matter, and soil microorganisms. Soil pH may be changed by overfertilizing. In most cases, overfertilizing results in an acidic pH because of fertilizer salts. This can make the soil pH appear lower than it would otherwise. The leaching, or runoff of water from nearby concrete foundations, sidewalks, or streets, can result in a basic reaction or an increase in pH.

Most plants grow best within a certain range of soil pH values. Most ornamental plants grow well in a pH range of 6.0 to 7.0. But some plants, such as azaleas, gardenias, blueberries, and camellias, grow best in a soil pH level between 4.5 and 6.0. Still others, such as hibiscus, chrysanthemum, verbena, and junipers, can tolerate a relatively high pH up to 8.0. For the healthiest growth, provide your plants with their optimal soil pH range. **Table 1** lists some woody and herbaceous landscape plants and their preferred soil pH ranges.

**Table 1. Range in pH values for some common ornamental shrubs, trees, and garden flowers.**

Scientific Name	Common Name	Preferred pH
<b>Common Shrubs</b>		
<i>Abelia</i> spp.	Abelia	5.6–6.5
* <i>Abelia</i> x <i>grandiflora</i> x <i>A. shumanni</i>	Edward Goucher Abelia	5.6–6.5
<i>Berberis</i> spp.	Barberry	6.0–7.5
<i>Buddleia davidii</i>	Butterfly Bush	6.0–7.5
<i>Camellia japonica</i>	Common Camellia	4.5–5.5
<i>Camellia sasanqua</i>	Sasanqua Camellia	4.5–6.5
* <i>Camellia</i> 'Shishigashira'	Shishigashira Camellia	4.5–6.5
<i>Chaenomeles speciosa</i>	Japanese Quince or Flowering Quince	6.0–7.0
<i>Deutzia</i> spp.	Deutzia	6.0–7.5
<i>Euonymus</i> spp.	Euonymus	6.5–7.0
* <i>Evolvulus nuttallianus</i>	Blue Daze Evolvulus	5.6–6.5
<i>Gardenia</i> spp.	Gardenia	5.0–6.0
<i>Gardenia jasminoides</i>	Gardenia	5.0–6.0
<i>Hibiscus</i> spp.	Hibiscus	6.0–8.0
<i>Hydrangea macrophylla</i>	Blue Hydrangea	4.5–5.0
<i>Hydrangea macrophylla</i>	Pink Hydrangea	6.0–7.0
* <i>Hydrangea paniculata</i> 'Limelight'	Limelight Hydrangea	6.1–7.8
* <i>Hydrangea quercifolia</i> 'Snowflake'	Oakleaf Hydrangea	5.1–7.5
<i>Ilex</i> spp.	Holly	5.0–6.0
<i>Ilex vomitoria</i>	Kathy Ann Yaupon Holly	5.0–6.0
<i>Ligustrum</i> spp.	Ligustrum	6.0–7.0
* <i>Loropetalum chinensis</i> var. <i>rubrum</i>	Loropetalum or Burgundy Fringe Flower	4.5–6.5
<i>Nerium oleander</i>	Oleander	5.0–7.5
<i>Philadelphus</i> spp.	Philadelphus or English Dogwood	6.0–8.0
<i>Prunus glandulosa</i>	Flowering Almond	6.0–7.0
<i>Pyracantha</i> spp.	Pyracantha or Firethorn	6.0–7.0
<i>Rhododendron</i> spp.	Azalea	4.5–6.0
<i>Rosa</i> spp.	Hybrid Tea Rose	5.5–7.0

<i>*Rosa x hybrida</i>	Knock Out Rose	5.5–7.0
<i>Spiraea</i> spp.	Spirea	6.0–7.0
<i>Syringa</i> spp.	Lilac	6.0–7.5
<i>Vaccinium</i> spp.	Huckleberry	5.0–5.5
<i>Viburnum</i> spp.	Viburnum	6.5–7.5
<i>Viburnum macrocephalum</i>	Chinese Snowball Viburnum	6.5–7.5
<i>Weigela</i> spp.	Weigela	6.0–7.0
<b>Common Trees</b>		
<i>*Acer x freemanii</i> ‘Jeffersred’	Autumn Blaze Red Maple	6.0–7.5
<i>Acer palmatum</i>	Japanese Maple	6.0–7.5
<i>*Acer palmatum</i> ‘Bloodgood’	Japanese Red Maple	6.0–7.5
<i>Acer rubrum</i>	Red Maple	6.0–7.5
<i>Thuja</i> spp.	Arbovitae	6.8–7.2
<i>Platyclusus orientalis</i>	Oriental arbovitae	6.8 – 7.2
<i>Betula nigra</i>	River Birch	4.5–6.0
<i>Cercis canadensis</i>	Redbud	5.5–6.5
<i>Cornus florida</i>	Dogwood	5.0–7.0
<i>X Cupressocyparis leylandii</i>	Leland Cypress	5.0–8.0
<i>Ilex</i> spp.	Holly	5.0–6.0
<i>*Lagerstroemia</i> ‘Natchez’	Natchez Crape Myrtle	5.0–6.5
<i>*Lagerstroemia</i> ‘Sioux’	Sioux Crape Myrtle	5.0–6.5
<i>*Lagerstroemia</i> ‘Tonto’	Tonto Crape Myrtle	5.0–6.5
<i>Magnolia grandiflora</i>	Southern Magnolia	5.0–6.0
<i>*Magnolia grandiflora</i> ‘Little Gem’	Little Gem Magnolia	4.5–7.5
<i>Palms</i> , various species	Palms	5.5-7.0
<i>Pinus</i> spp.	Pine	5.0–6.0
<i>Prunus</i> spp.	Peach, Cherry, Plum	6.5–7.0
<i>Malus</i> spp.	Apple, Flowering Crab Apple	5.0–6.5
<i>Pyrus</i> spp.	Pear	5.0–6.5
<i>Quercus coccinea</i>	Scarlet Oak	6.0–7.0
<i>Quercus falcata</i>	Red Oak	5.0–7.5

<i>Quercus palustris</i>	Pin Oak	5.0–6.5
<i>Salix x sepulcralis</i>	Weeping Willow	5.0–6.0
<i>Ulmus</i> spp.	Elm	6.0–7.5
<i>Vitex</i> spp.	Vitex	6.0–7.0
* <i>Vitex agnus-castus</i>	Lilac Chastetree	3.7–6.3
<i>Common Garden Flowers</i>		
<i>Alcea rosea</i>	Hollyhock	6.0–8.0
<i>Alternanthera</i> cvs.	Alternanthera	6.5–7.0
* <i>Alternanthera dentata</i>	Purple Knight Alternanthera	6.5–7.0
<i>Hippeastrum hybridii</i>	Amaryllis hybrids	5.5–6.5
<i>Angelonia</i> cvs.	Angelonia cultivars	5.5–6.2
* <i>Angelonia angustifolia</i> 'Serena'	Serena Angelonia	5.5–6.2
<i>Antirrhinum majus</i>	Snapdragon	6.0–7.5
<i>Begonia</i> spp.	Begonia	5.5–7.5
* <i>Begonia x hybrida</i> 'Dragon Wing Red'	Dragon Wing Red Begonia	6.0–6.5
<i>Caladium bicolor</i>	Caladium	6.0–7.0
<i>Canna x generalis</i> cvs.	Canna hybrids	6.0–7.0
<i>Catharanthus roseus</i>	Madagascar Periwinkle	5.6–7.8
* <i>Catharanthus roseus</i> 'Titan'	Titan Periwinkle	5.6–7.8
<i>Celosia</i> cvs.	Cockscomb	6.0–7.5
<i>Chrysanthemum morifolium</i>	Chrysanthemum	6.0–8.0
<i>Leucanthemum maximum</i>	Shasta Daisy	6.0–8.0
* <i>Chrysocephalum apiculatum</i> 'Flambe'	Flambe	6.0–6.5
* <i>Cleome hybrid</i> 'Senorita Rosalita'	Senorita Rosalita Hybrid Cleome	5.8–6.2
<i>Cosmos</i> spp.	Cosmos	6.5–7.0
<i>Cynara</i> spp.	Globe Artichoke	6.0–7.0
<i>Dahlia</i> hybrids	Dahlia	6.5–7.0
<i>Delphinium</i> hybrids	Larkspur	6.5–7.0
<i>Dianthus barbatus</i>	Dianthus or Sweet William	6.1–7.5
<i>Dianthus caryophyllus</i>	Carnation	6.5–7.0
<i>Dianthus x hybrida</i>	Bouquet Purple Dianthus	6.1–7.5

<i>Digitalis</i> spp.	Foxglove	6.5–7.0
* <i>Euphorbia</i> hybrid 'Diamond Frost'	Diamond Frost Euphorbia	5.8–6.2
<i>Geranium</i> spp.	Geranium	6.0–8.0
<i>Gomphrena globosa</i> cvs.	Gomphrena	6.1–7.5
* <i>Gomphrena globosa</i> 'All Around Purple'	All Around Purple Gomphrena	6.1–7.5
<i>Gypsophila paniculata</i>	Baby's Breath	6.5–7.0
<i>Helleborus</i> spp.	Lenten Rose	7.0–8.0
<i>Hemerocallis</i> hybrids	Daylily	6.5–7.0
<i>Hosta</i> hybrids	Hostas	6.5–7.5
<i>Iberis</i> spp.	Candytuft	6.5–7.0
<i>Impatiens</i> hybrids	Touch-Me-Not or Balsam	6.5–7.0
<i>Iris cristata</i>	Bearded Iris	6.5–7.0
<i>Iris</i> spp.	Louisiana Iris	5.0–6.5
* <i>Lantana x camara</i> 'New Gold'	New Gold Lantana	4.5–8.5
* <i>Lantana</i> hybrid P.P.#12883	Sonset Lantana	4.5–8.5
<i>Lathyrus latifolius</i>	Sweetpea	6.5–7.0
<i>Lilium longiflorum</i>	Easter Lily	6.0–7.5
<i>Lobularia maritima</i>	Sweet Alyssum	6.5–7.0
<i>Lupinus</i> spp.	Lupine	6.5–7.0
<i>Manfreda</i> spp.	Tuberose	6.0–7.0
* <i>Melampodium paludosum</i>	Melampodium	6.1–7.5
<i>Mirabilis jalapa</i>	Four O'Clock	6.0–7.5
<i>Narcissus</i> hybrids	Daffodil or Narcissus	6.0–7.5
* <i>Ocimum basilicum</i> 'Purple Ruffles'	Purple Ruffles Basil	5.8–6.2
<i>Pachystachys</i> spp.	Pachystachys	5.5–6.5
* <i>Pachystachys lutea</i>	Yellow Shrimp Plant	5.5–6.5
<i>Papaver</i> spp.	Poppy	6.5–7.0
<i>Pentas</i> hybrids	Pentas	6.0–7.0
* <i>Penta lanceolata</i>	Butterfly Penta	6.0–7.0
* <i>Petunia x hybrida</i>	Wave Series Petunia	6.5–7.0
<i>Phlox</i> spp.	Phlox	5.0–6.0

<i>Phlox divaricata</i>	Wild Sweet William	6.5–7.0
<i>Plagiobothrys</i> spp.	Cornflower	6.0–7.5
<i>Plectranthus</i> hybrids	Plectranthus	5.5–5.8
* <i>Plectranthus</i> hybrid ‘Mona Lavender’	Mona Lavender Plectranthus	5.5–5.8
* <i>Rudbeckia hirta</i> ‘Indian Summer’	Indian Summer Rudbeckia	5.7–7.0
<i>Rudbeckia</i> spp.	Rudbeckia	5.7–7.0
<i>Ruellia</i> spp.	Mexican Petunia	6.5–7.0
* <i>Salvia farinacea</i> ‘Victoria’	Victoria Blue Salvia	6.0–7.0
* <i>Salvia quarantitica</i>	Costa Rica Blue Salvia	5.7–7.0
* <i>Scaevola</i> ‘New Wonder’	New Wonder Scaevola	5.5–6.5
<i>Solenostemon</i> hybrids	Coleus	6.0–7.0
<i>Solenostemon scutellarioides</i> ‘Kong’	Kong Coleus	6.0–7.0
<i>Solenostemon scutellarioides</i> ‘Mississippi Summer Sun’	Mississippi Summer Sun Coleus	6.0–7.0
<i>Tagetes</i> spp.	Marigold	6.0–7.5
<i>Tropaeolum</i> hybrids	Nasturtium	6.5–7.0
<i>Tulipa</i> hybrids	Tulip	6.0–7.0
<i>Verbena</i> spp.	Verbena	6.0–8.0
* <i>Verbena</i> x hybrid ‘Biloxi Blue’	Biloxi Blue Verbena	6.0–8.0
* <i>Verbena</i> x hybrid ‘Port Gibson Pink’	Port Gibson Pink Verbena	6.0–8.0
<i>Viola</i> spp.	Viola	6.5–7.0
<i>Viola</i> hybrids	Pansy	5.0–6.0
* <i>Viola x wittrockiana</i> x <i>V. cornuta</i>	Panola Panache	6.5–7.0
<i>Vinca</i> spp.	Periwinkle	6.5–7.0
* <i>Zinnia angustifolia</i> ( <i>Z. haageana</i> )	Narrow Leaf Zinnia	5.5–7.5
* <i>Zinnia</i> x <i>hybrida</i>	Profusion Apricot & Fire Zinnia	5.8–6.0
* Mississippi Medallion Winners: To learn more about this plant selection program, go to the Mississippi Nursery and Landscape Association website <a href="http://msnla.org/">http://msnla.org/</a> .		

## Determine pH

A soil test before planting is highly recommended. You can determine the pH of your soil by sending a soil sample to the MSU Soil Testing Lab. For instructions on how to take and submit a sample, ask your Extension office for Information Sheet 1294 or visit [www.msucare.com/pubs/infosheets/is1294.pdf](http://www.msucare.com/pubs/infosheets/is1294.pdf). Results from your MSU soil test will include recommendations of additives to adjust your soil pH and the nutrients needed for the plants you plan to grow.

## Changing the pH

Rather than changing the pH of the soil to meet the requirements of a plant, select plants suited to the natural pH of the soil. Use the information in Table 1 to help you select plants to suit your soil's natural pH. If you need to change the soil pH, you have several options. **Please remember, for the most accurate results, it is best to follow the recommendations on a soil test when trying to change the pH of the soil (refer to Extension Information Sheet 1294).**

Most soils in Mississippi are acidic. With cultivation, fertilization, and acidic soil amendments, sooner or later most gardeners will need to add ground lime material to the soil to raise the pH. Therefore, lowering the soil pH is not a common practice. A few exceptions would be soils that (1) had runoff from cement constructed houses, driveways, sidewalks, or other constructions, (2) had been overlimed, or (3) had a calcareous parent material. The latter soils are typical of naturally alkaline soils found in parts of the Black Belt Prairie region of northeast Mississippi.

## Lowering the pH

**Elemental sulfur** is effective but slow acting. It is best to add elemental sulfur several months before planting to give it time to work. If you add it to established plants, be sure to water it in immediately to avoid burning of shallow roots. Once the correct pH is established, the sulfur remains effective for years.

**Iron sulfate** will also decrease soil pH and is faster acting than elemental sulfur. But you need a lot more iron sulfate than elemental sulfur to achieve the same pH change. Follow label instructions carefully because too much iron sulfate can burn shallow plant roots.

You can also use **ammonium sulfate** to decrease soil pH, and it is less likely to burn shallow plant roots. If you want to produce blue blossoms on your mophead hydrangeas, you can use aluminum sulfate to lower the pH while adding aluminum. Aluminum together with a low pH produces the blue color. Except for blue hydrangea, aluminum sulfate is not recommended as a soil acidifying amendment because of the potential for aluminum toxicity to plant roots.

## Increasing the pH

If you need to increase the soil pH, you may use lime in the form of calcium carbonate or dolomite (calcium and magnesium carbonate). Most homeowners prefer the pelletized form of lime over agricultural limestone because it is easier to apply with spreaders. It is non-dusty and can be evenly distributed without being affected by wind.

Apply lime before planting so you can thoroughly incorporate it and have time—several months—to increase the soil pH. Hydrated lime is not recommended because it can burn plants easily. Applying too much lime can reduce nutrient availability, especially of micronutrients like iron, manganese, and zinc.

**Table 2. Application rates for some amendments that change soil pH.**

Amendment	Application per 100 square feet		Reaction speed	Effect on pH
	Dry	Liquid		
Ammonium sulfate	0.5 to 1.0 pounds	1 ounce in 2 to 3 gallons water	Rapid	Decrease
Aluminum sulfate	(not recommended)	1 ounce in 5 gallons water	Rapid	Decrease
Limestone	5-20 pounds		Slow	Increase
Dolomite	5-20 pounds		Slow	Increase
Sulfur, elemental	1-2 pounds		Slow	Decrease
Iron sulfate (20% Fe)	8-12 ounces	1 ounce in 1 gallon water	Slow	Decrease

## Summary

Test your soil pH before planting. Select plants suited to the natural pH range or determine the optimum pH range for your plants following the information in Tables 1 and 2. Follow your soil test recommendations closely. Contact your Extension office or the MSU Soil Testing Laboratory if you need help interpreting the soil test results.

## Resources

Some general information was summarized from these websites:

University of Florida Extension <http://hort.ufl.edu/gt/soilph/soilph.html> and <http://hort.ufl.edu/gt/soilph/soilph.html>

University of Illinois Extension <http://web.extensio.uiuc.edu/champaign/homeowners/080818.html> and <http://web.extension.uiuc.edu/champaign/homeowners/080626.html>

Cornell University Cooperative Extension <http://counties.cce.cornell.edu/suffolk/HortFactSheets/factsheets/Liming%20Acid%20Soils.pdf>

Other MSU Extension resources:

P2311 *Soil pH and Tree Species Suitability in Mississippi* <http://msucares.com/pubs/publications/p2311.pdf>

IS1294 *Soil Testing for the Homeowner* <http://msucares.com/pubs/infosheets/is1294.pdf>

P666 *Selecting Landscape Plants* <http://msucares.com/pubs/publications/p0666.pdf>

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