

Hydrangea Nature's Living pH Plant

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Introduction

Hydrangea is a well-liked genus of flowering plants that are distinguished by its lush foliage and huge, eye-catching blooms. Hydrangeas are native to Asia the Americas, especially China, Japan, and Korea. They are members of the Hydrangeaceae family, which includes between 70 and 75 species. Because they may produce colorful flower clusters in a variety of colors, such as blue, pink, purple, white, and green, these attractive plants are highly valued. It's interesting to note that the pH of the soil can affect the color of some Hydrangea species, particularly Hydrangea macrophylla, which often blooms pink in alkaline soils and blue in acidic soils. It is Commonly used in gardens, landscapes, and floral arrangements, hydrangeas flourish in temperate areas. They are a favorite among gardeners because of their lengthy flowering season, which usually lasts from late spring to early October.

Characterstics of hydrangea

Hydrangea is a popular genus of flowering plants known for its large, showy blooms and lush foliage.

These ornamental plants are prized for their ability to produce vibrant flower clusters in a range of colors, including blue, pink, purple, white, and green. Interestingly, the color of some Hydrangea species – especially Hydrangea macrophylla – can vary depending on soil pH acidic soils tend to produce blue flowers, while alkaline soils result in pink blooms.

Hydrangeas thrive in temperate climates and are commonly used in gardens, landscapes, and floral arrangements. Their long blooming season, which typically spans from late spring to early autumn, makes them a favorite among gardeners. In addition to their beauty, Hydrangeas are also symbolic, often representing gratitude, grace, and abundance.

Whether grown as shrubs, climbers, or small trees, Hydrangeas are versatile and relatively easy to care for, making them a beloved choice for both amateur and experienced horticulturists.

India growing hydrangea

Hydrangeas are grown in India, primarily in regions with cooler and temperate climates, as they thrive in moist, well-drained soils and partial shade. While they are not native to India, several species – especially Hydrangea macrophylla – are widely cultivated for ornamental purposes in gardens, parks, and landscapes. Soil Prefers slightly acidic soil (pH 5.5 to 6.5); rich in organic matter. It Needs regular watering, especially during dry spells. It requires Partial shade is ideal – strong sun can damage flowers and leaves. Balanced NPK fertilizer; aluminum sulfate can be added to turn flowers blue.

Species in hydrangea

Hydrangea is a diverse genus with around 70 to 75 recognized species, but only a few are widely cultivated and well-known for ornamental or medicinal use. Here are the major species of Hydrangea:

1. Hydrangea macrophylla (Bigleaf Hydrangea)

It is Native to Japan. Large, round flower heads; known for color change (blue to pink) based on soil pH. Subtypes are mophead (large, ball-shaped blooms). Lacecap (flat heads with fertile center flowers and decorative outer florets). Some Popular Cultivars are 'Endless Summer', 'Nikko Blue'

2. Hydrangea paniculata (Panicle Hydrangea)

It is Native to eastern Asia (China, Japan, Russia). Flowers are Cone-shaped flower clusters, white flowers that often turn pink with age. More Sun-Tolerant than other species. Some Popular Cultivars are 'Limelight', 'Grandiflora' (PeeGee)

3. Hydrangea arborescens (Smooth Hydrangea)

Its Native to Eastern United States. Rounded clusters of white or greenish flowers; very hardy. Roots used in traditional herbal medicine. Some Popular Cultivars are 'Annabelle', 'Incrediball'

4. Hydrangea quercifolia (Oakleaf Hydrangea)

It is Native to Southeastern United States. Leaves look like Oak-shaped with stunning fall color; white flower spikes. It is Great for Woodland

Gardens. Some Popular Cultivars are 'Snow Queen', 'Alice'

5. *Hydrangea serrata* (Mountain Hydrangea)

It is Native to Japan and Korea. It is a smaller version of *H. macrophylla*, often used in cold climates. Its color-sensitive like *H. macrophylla*. Some popular cultivars are 'Bluebird', 'Tiara'

6. *Hydrangea petiolaris* (Climbing Hydrangea)

It is native to Korea. Woody climbing vine with white lacecap flowers. It grows on walls, fences, trees.

7. *Hydrangea involucrata*

It is native to Japan. Leaves are velvety, late summer blooms, usually blue or purple. Less common but valued in specialty gardens.

Their expression is pH-dependent: Acidic soil (low pH) leads to blue flowers due to increased availability of aluminum ions. Alkaline soil (high pH) leads to pink flowers due to reduced aluminum availability.

Major chemicals present in hydrangea

Hydrangea plants contain several notable chemical compounds, many of which contribute to their medicinal properties, pigmentation, and sometimes toxicity. Here are the major chemicals present in Hydrangea

1. Hydrangin (Hydrangeic Acid)

A cyanogenic glycoside found in various parts of the plant, especially the roots and leaves. It can release hydrogen cyanide when metabolized, which is toxic in large amounts. Historically used in traditional medicine, especially in *Hydrangea arborescens* (wild hydrangea) for kidney and bladder health.

2. Saponins

Saponins found primarily in the roots. It possesses anti-inflammatory and diuretic properties and used in traditional herbal remedies.

3. Flavonoids

Flavonoid compounds include such as quercetin and kaempferol. These are antioxidants that help protect cells from damage and contribute to the plant's medicinal potential.

4. Alkaloids: Minor alkaloids may be present in trace amounts. Some species may contain harmful alkaloids, contributing to toxicity when ingested.

5. Anthocyanins

Water-soluble pigments responsible for flower color (blue, pink, or purple). Their expression is pH-dependent: Acidic soil (low pH) leads to blue flowers due to increased availability of aluminum ions. Alkaline soil (high pH) leads to pink flowers due to reduced aluminum availability.

6. Coumarins and Tannins

It is present in small amounts and contributes to the plant's astringent properties and may play a role in its defense mechanisms. A remarkable and unusual botanical occurrence is the color shift of hydrangea blossoms, especially in the species *Hydrangea macrophylla*, also referred to as bigleaf hydrangea.

How colour change occurs in hydrangea

The color change in hydrangea flowers, particularly in the species *Hydrangea macrophylla* (also known as bigleaf hydrangea), is a fascinating and unique botanical phenomenon. This color change is primarily influenced by soil pH and the availability of aluminum ions (Al^{3+}) in the soil.

Mechanism of Color Changes in Hydrangea.

1. Soil pH and Aluminum Availability

In acidic soil (pH below 6.0), aluminum ions are more soluble and available to the plant. The plant absorbs aluminum, which binds with anthocyanin pigments in the flower. This forms a blue complex, resulting in blue or purple flowers. In neutral to alkaline soil (pH above 6.0), aluminum becomes less available or locked in the soil. The anthocyanin pigments are not bound to aluminum. This leads to the production of pink or red flowers.

Chemical Basis

The key pigment is delphinidin 3-glucoside, a type of anthocyanin. In acidic soils with aluminum, delphinidin forms a stable blue complex with aluminum ions.

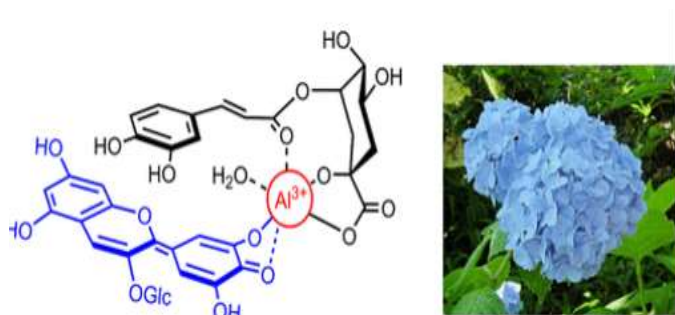
In alkaline soils

The aluminum complex doesn't form, and the pigment appears pink or reddish. Influencing color in gardens can intentionally change the flower color by modifying soil conditions:

To blooms blue

Increase the availability of aluminum and make the soil more acidic (pH 5.0–5.5). Measure the pH of the soil. Send a sample to a nearby lab or use a

soil pH test kit. For blue blooms, the pH should be lower than 5.5. Put Aluminum in the Soil Use aluminum sulphate, which is sold in garden centers: For every gallon of water, mix 1 spoonful. Throughout the growing season, apply around the base every two to four weeks. As an alternative, grow hydrangeas on soil that is rich in aluminum, which is naturally present in acidic soils. Make the Soil Acidic To gradually lower pH, apply sulfur (elemental sulfur) or peat moss. Additionally, you can add coffee grinds, pine needles, or acidic fertilizers like urea or ammonium sulfate. If at all feasible, use rainwater in your water. Because tap water contains minerals, it can elevate pH. Have patience. A season or even a few weeks may pass before the hue changes completely.



Source: Kin-ichi-oyama[2015]

To Blooms Pink

Increase the soil's alkalinity (pH to 6.5–7.0) and prevent the absorption of aluminum. Measure the pH of the soil. Use a test kit to determine the pH of your soil right now. Raise Soil pH Add garden lime (dolomitic lime or calcitic lime): Apply 2–4 tablespoons per plant in early spring or fall. Mix into the top 6–8 inches of soil. Re-test soil pH every few week. steer clear of aluminum Avoid using acidic fertilizers or aluminum sulfate. Make use of fertilizer high in phosphorus, which binds aluminum and decreases its availability. Employ Alkaline Mulch Substances Use ground eggshells or wood ash as mulch (in small amounts).

Role of aluminium ions

The pH of the soil and the amount of aluminum ions (Al³⁺) present in the soil have the biggest effects on this color shift. The pH of the soil and the availability of aluminum Aluminum ions are more soluble and accessible to plants in acidic soil (pH less than 6.0). Aluminum is absorbed by the plant and combines with the flower's anthocyanin pigments.

Blue or purple flowers are the product of this blue complex. Alkaline to Neutral Soil (pH more than 6.0): Aluminum is either locked in the soil or becomes less accessible. Aluminum is not bonded to the anthocyanin pigments. As a result, pink or red flowers are produced.



Source: Chenery, E. M. (1946)

Chemical Foundation

The primary pigment is an anthocyanin called delphinidin 3-glucoside. In aluminum-containing acidic soils: Delphinidin and aluminum ions combine to generate a stable blue complex. In soils that are alkaline, The pigment appears pink or reddish, and the aluminum complex does not develop.

By altering soil conditions

To turn flowers blue: Reduce the pH of the soil to make it more acidic. Add materials to the soil, such as sulfur or aluminum sulfate.

To turn flowers pink: Make the soil more alkaline by raising its pH. Reduce the uptake of aluminum by adding lime (calcium carbonate).

While some species of hydrangea have been used in traditional medicine, parts of the plant (especially leaves and buds) can be toxic if ingested due to cyanogenic compounds. Proper preparation is essential in medicinal use.

Conclusion

Hydrangeas are extraordinary plants that not only beautify gardens with their colorful flowers but also function as natural indicators of soil chemistry. Their capacity to alter flower color depending on soil pH and the presence of aluminum highlights the complex connection between plant biology and environmental influences. By altering the pH level and aluminum concentration in the soil, it is possible to

grow hydrangeas that exhibit a range of colors, from pinks and reds in more alkaline environments to blues and purples in acidic ones.

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