Into the blue
A comparison of substrate amendments for the adjustment of hydrangea flower color

By Heather Stoven and Jim Owen

New hydrangea cultivars are being introduced on a regular basis, many of which have sepals that vary in color based upon the characteristics of the growing media. It is important to understand the color changing mechanism in order to facilitate the desired flower color for production and sales.

The availability of aluminum (Al) is what causes a change of color in the sepals from varying shades of pink to blue. However, the availability of this element is dependent upon the substrate pH. More Al is available to the plant at lower pH, resulting in blue flowers, and less Al is available at higher pH, resulting in pink flowers. The Ball Redbook, a popular grower reference manual, suggests pink flowering hydrangeas be grown in a pH of 6.5 and blue at 5.5.

Drenches or substrate amendments of aluminum sulfate (AlSO₄) are commonly used in the industry to provide aluminum and to lower pH, producing...
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blue flowers. However, it is not always easy to achieve the clear blue color that is desirable even with aluminum sulfate applications and a sufficiently low pH. Also, if the pH gets too low, plant growth and quality can be insufficient.

Testing with pozzolan clay

In order to address the issue of blue hydrangea flowers, a study using pozzolan clay (diatomaceous calcined clay containing 10 percent Al by weight) was established at the North Willamette Research and Extension Center in Aurora, Ore.

Due to the amorphous structure and high Al content of the clay, it was hypothesized that hydrangea flowers could be produced with a truer blue color and at a higher pH than can be done with typical grower practices. Previous studies have been done with zeolite (Opena and Williams, 2003) and kaolinite (Handreck, 1997) clays to produce blue flowers; however, it was only possible at low pH levels.

*Hydrangea macrophylla* Endless Summer® was potted into three Douglas-fir-bark-based substrates with different amendments in #2 containers on June 1, 2007. Nine substrate treatments were used in the experiment, and each was replicated 10 times.

The substrates were as follows: 9:1 (by volume) DFB to pozzolan clay (Western Pozzolan Corp., Doyle, Calif.), 7:3 (by volume) DFB to sphagnum peat moss, and 3:2 (by volume) coarse DFB to fine DFB. Three rates of AlSO₄ were added to the three substrates: a high rate of 12.5 pounds per cubic yard; a medium rate of 6.3 pounds per cubic yard; and a control treatment (no AlSO₄). A requisite amount of dolomite lime was added to each of the treatments to equalize pH across treatments. Dolomitic lime was incorporated at a rate of 1.2, 0.90, and 0.60 pounds per cubic yard for the high, medium, and control AlSO₄ treatments, respectively. Micromax micronutrient package was applied.

Scientists at Oregon State University found that these conditions of amended soil and aluminum sulfate resulted in different hydrangea bloom colors as shown.

![Figure 1. Effect of substrate and aluminum sulfate (AlSO₄) on color rating of hydrangea Endless Summer® flowers](image-url)
Scientists found they could improve hydrangea flower color by adding calcined clay to the growing medium.

Figure 2. Effect of substrate and aluminum sulfate (AlSO₄) on customer appeal rating of hydrangea Endless Summer® flowers

As AlSO₄ rates increased, the flower color was rated as more blue. The same effect was also seen when the AlSO₄ rate was 0, the addition of clay produced blue flowers which were rated higher than the flowers from the peat and none substrates. When the flowers were ranked for customer appeal, blue flowers were preferred (Fig. 2).

As AlSO₄ rates increased, the flower color was rated as more blue and consequently appeal ratings also increased. The clay amendment treatments had the highest color and appeal ratings, with the clay with high AlSO₄ combination rated highest overall.

The pH varied slightly between 6.63 and 7.02 for the different substrate treatments, and was significant. However, we hypothesize the differences in soilless substrate solution pH were due to discrepancies in the dolomite and aluminum sulfate rates.
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Since the variability of substrate pH was not great, it likely did not affect flower color or growth. The mean height (22.6 inches), mean width (35.7 inches) and mean growth index (90.8 cm.) was not significantly different between treatments, meaning that the substrate amendments and aluminum sulfate rate did not affect plant growth.

Conclusions

The incorporation of pozzolan clay, in addition to AlSO₄ in the substrate, assists in changing of hydrangea sepal color to a blue color even at high pH levels without negatively affecting growth. This will give more leeway in the production of blue hydrangeas, allowing for the desired flower color without the complications of maintaining a low pH.

If reoccurring issues with aluminum availability and flower color occur, the evaluation of growing practices other than pH management may be warranted. Although we found that conventional substrate components (i.e. bark, peat) do not appear to affect aluminum availability, there are other areas of production that can.

Fertilizer programs can interfere with aluminum availability; an example of this would be the possibility of a chemical interaction between injected AlSO₄ and liquid feed. An easy solution to this problem would be to incorporate the granular form of AlSO₄, controlled release fertilizer or both.

Aluminum availability is directly responsible for the production of blue hydrangea flowers. Results demonstrated that pozzolan clay is one method that can be used to produce enhanced blue sepal color in container-produced hydrangeas. Nursery growers who observe poor growth from low substrate pH or have difficulty achieving blue hydrangea sepal color could successfully use an amorphous aluminosilicate clay (approximately 10 percent aluminum) to amend their substrate, thus alleviating these issues.

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Additional Reading:


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