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Hydrangea Nutrition: Lower Leaf Purpling (Phosphorus Deficiency)

Purple discoloration of the lower leaves is an indicator of limited phosphorus (P) in the plant. The availability of P can be affected by several cultural factors during hydrangea production.

Phosphorus (P) is an essential element required for plant growth, yet standard production practices for hydrangeas (*Hydrangea macrophylla*) recommend limiting P fertilization to enhance the blue sepal coloration. This situation poses a dilemma for hydrangea growers. If the P rate is too low, then lower leaf purpling can occur (Fig. 1), but if the P rate is too high, blue hydrangea cultivars will not develop the desired blue flower coloration.

To enhance the blue coloration of the sepals, aluminum sulfate is commonly applied as either a slow release granule or as a drench. Phosphorus has a naturally antagonistic relationship with aluminum, and can tie up the aluminum, thus negating its effectiveness. Therefore, a no or low P fertilization strategy is often implemented for blue hydrangea cultivars.

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Figure 1. Lower leaves of blue hydrangea plants develop a purple discoloration when phosphorus is limited by the rate used or cultural conditions.

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Growers may choose to limit P applications on both pink and blue cultivars to control excessive stem stretch. This can also lead to the onset of P deficiency symptoms of lower leaf purpling. Recent research by Josh Henry at North Carolina State University found that for many floriculture species (geraniums, angelonia, New Guinea impatiens, pot chrysanthemums, and ornamental peppers), plant growth is maximized when 5 to 13 ppm P was provided. Providing plants with 5 ppm P provided sufficient P to avoid the development of deficiency symptoms. For blue colored hydrangeas, P fertilization rates of 2.5 to 5 ppm should be provided to avoid tie up of aluminum and avoid deficiency conditions. For pink hydrangeas, slightly higher P rates of 10 to 20 ppm P can be used (Fig. 2).

Keep in mind that other factors can negatively impact P uptake by the plant. For instance, substrate temperatures below 55F (13C) typically limit P uptake by the plant. This may be an issue for hydrangea growers as plants are often grown with cooler temperatures.

At these lower temperatures, water use by the plant can be limited, thus making the plants more susceptible to overwatering. Phosphorus (and iron) uptake is a challenge for hydrangeas, like most plant species, when the substrate is excessively wet. Prolonged substrate wetness also inhibits root development, which can exacerbate these issues of nutrient uptake. On the opposite end of the spectrum, hydrangea stomates do not close, making them susceptible to drought stress. This too wet or too dry scenario can make growing hydrangeas a balancing act.

Symptoms are often visible on a larger percentage of the crop when P is limited due to low temperatures or excessive wet substrate conditions. If a P deficiency is suspected, substrate and tissue samples should be submitted to a commercial lab for confirmation.

The impact of these two cultural factors of cool temperatures and saturated substrates can be limited by

Careful water management. In practice, water management may be difficult to control due to plant-to-plant variation. Irrigation decisions must be made when most of the crop requires water. Plants that were not yet dry will remain overly saturated, causing these plants to fall further behind the rest of the crop. If possible, the plants that dry out slower may need to be grouped and irrigated at a less frequent interval.

Root rot is another factor that needs to be considered if lower leaf purpling is occurring. Problems with root rot usually occur on a few scattered individual plants. New growth is usually stunted as well. This scattered pattern will aid in your diagnosis. When leaf purpling occurs, one should always inspect the roots. Black or brown roots are a strong indicator of rot. Submit a sample to a disease diagnostic clinic to confirm your diagnosis.

Symptoms of purpling were recently observed on a crop of hydrangeas, and were believed to be caused by a P deficiency. We collected and analyzed the purple leaves from a symptomatic plant and the dark green leaves from a healthy plant to serve as a “good” comparison. The tissue analysis results confirmed that P was deficient in symptomatic leaves (Fig. 3). The good comparison plants had 0.37% P, while the leaves with purple symptoms contained 0.11% P. The recommended range for P is between 0.25 and 0.70% (Bryson and Mills, 2014). The plants exhibiting leaf purpling had less than half the P of the lower recommended limit value.

Upon observing purple leaves throughout the crop, we suspected that the P fertilization rate was low. It was likely

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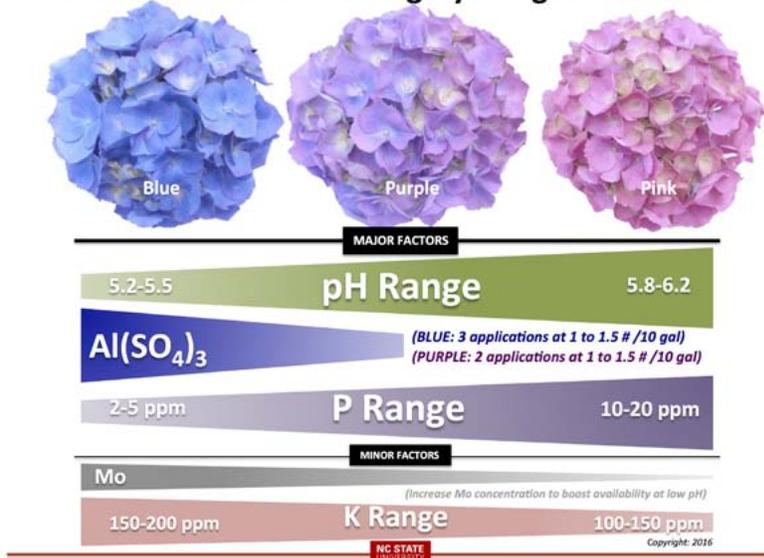
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Fertilization Factors Affecting Hydrangea Flower Color

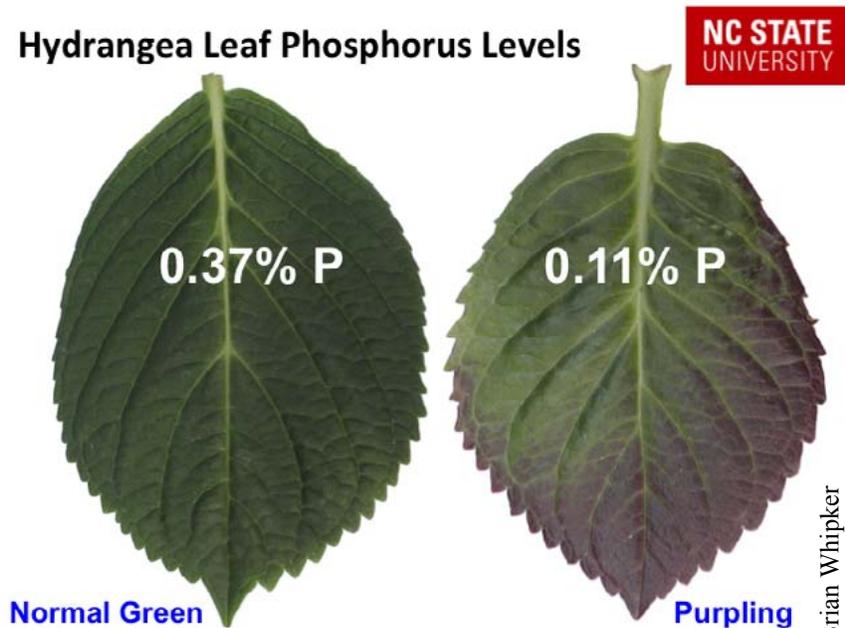


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Figure 2. Fertilization recommendations for blue and pink hydrangeas.

confounded because we experienced a week of cloudy weather, which limited the frequency of irrigation and consequently when fertilizer was applied. This resulted in prolonged saturation of the substrate, which can cause limited P uptake. This example illustrates the interaction between P rate and environmental conditions. It is impossible to decouple plant nutrition and growing conditions, thus to avoid this situation, both factors must be addressed.

Hydrangea Leaf Phosphorus Levels



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Figure 3. A comparison of tissue phosphorus (P) values from a lab analysis. Low P levels were confirmed by the test.

Literature Cited:

Bryson, G.M. and H.A. Mills (editors). 2014. Plant Analysis Handbook IV, Micro-Macro Publishing, Athens Georgia. p. 600.