GROWERTALKS

Features

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Seeing (More) Red

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This article is the third in a 12-issue series highlighting research from North Carolina State University (NCSU).

One of the most common symptoms associated with a phosphorus (P) deficiency is a red or purple coloration on the lower leaves (Figure 1). This red coloration is due to increased production of red pigments such as anthocyanins and betacyanins. These symptoms are typically undesirable when occurring on green-leafed plants; however, there are many ornamental and edible species that are valued for the red coloration of their leaves. For instance, several cultivars of alternanthera (*Alternanthera brasiliana*) and geranium (*Pelargonium x hortorum*) are grown for the rich colors they exhibit.

Figure 1. Lower leaf purple coloration can develop when P is limited. This erysimum plant was grown with low P rates and cool temperatures. Photo: Brian Whipk

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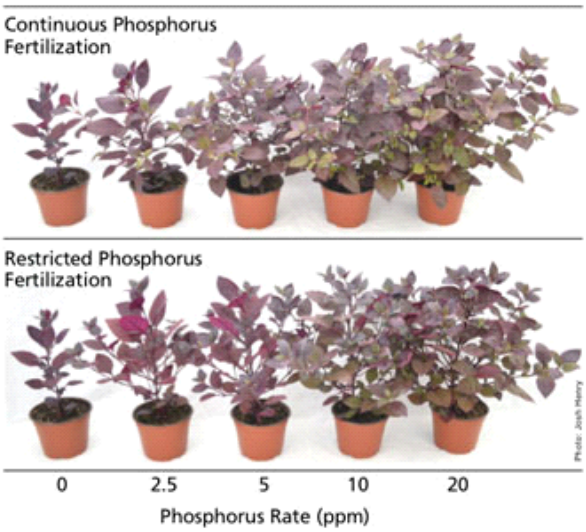
As is often said in our industry, “color sells,” so can a low P fertilization strategy be developed to grow more vibrant red-leafed plants? Our research at NC State University sought to answer this question using several P fertilization strategies.

The trials

Purple Prince Alternanthera and Bullseye Red Geraniums were grown using 0, 2.5, 5, 10 and 20 ppm P (referring to elemental P, not phosphate [P2O5]; these values are roughly 0, 6, 12, 23 and 47 ppm P2O5), holding other nutrients constant. After four weeks, half of the alternanthera plants were switched to a 0 ppm P fertilizer. Similarly, half of the geraniums were restricted to 2.5 ppm P after eight weeks. Each species was grown for an additional four weeks, and then compared based on overall growth and coloration. Foliar coloration was measured using a handheld colorimeter and the data was used to determine the hue of each plant.

In this study, plants grown with 20 ppm P were considered the standard, as this rate would be supplied by moderate to high P fertilizer formulations, such as 20-10-20 mixed at 100 ppm N or 15-5-15 Cal Mag at 200 ppm N. Both species grown in this study developed a deeper red coloration with low P fertilization, with the added benefit of limiting excessive stretch. (For more information limiting stretch with low P, check out our articles in the June and July 2017 issues of *GrowerTalks*.)



The results

Some differences were observed with these two species and the optimal fertilization strategies will be discussed for each cultivar. Plants that were later switched to 0 ppm (alternanthera) or 2.5 ppm P (geranium) will be referred to as having an "initial" P rate to differentiate from plants that had the same P rate for the entire study.

Figure 2. Alternanthera Purple Prince plants grown with P rates ranging from 0 to 20 ppm. Continuous P fertilization plants were grown with the same P rate for eight weeks, while restricted P fertilization plants were grown with the associated initial P rate for four weeks and restricted to 0 ppm P for the remaining four weeks.

Alternanthera is a betacyanin-producing species and little research had been done to determine the effects of low P nutrition on betacyanin production. This study demonstrated that limiting P significantly increased betacyanin production, leading to redder-colored plants (Figure 2). All P rates below 20 ppm resulted in redder plants but, of course, plants grown without P were excessively stunted and were not of marketable quality. Plants grown with an initial rate of 10 ppm P restricted to 0 ppm or 5 ppm initially or continuously were redder in color without any detrimental symptoms of P deficiency (Figure 3). So, for alternanthera Purple Prince, providing 5 ppm P initially or continuously, or 10 ppm P initially, provides beneficial growth control and enhances the red coloration of the foliage.

Geraniums are an anthocyanin-producing species and numerous cultivars are grown for the deep red foliar band or zone on the upper surface of the leaf. The Bullseye Red Geraniums grown in this study were very responsive to different P rates. Plants that were grown with 0 to 2.5 ppm P were stunted and had a significant delay in flowering. Geraniums grown without P also developed severe necrosis on the lower leaves and had noticeably smaller leaves than plants grown with P. The foliar zones were redder in plants grown with a continuous rate of 5 ppm P or less, or any plant grown with P restricted after eight weeks (Figure 4).

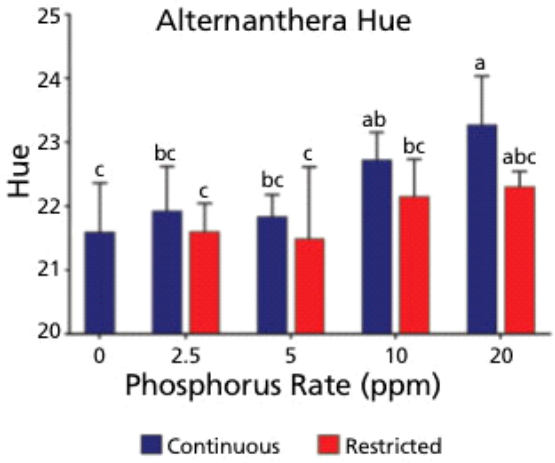


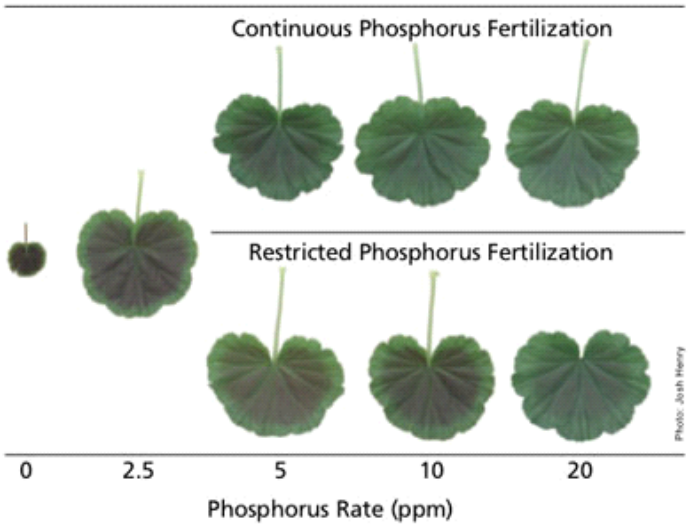
Figure 3. Alternanthera foliar leaf color represented by hue. The lower the value, the closer to "red" on a 360-degree spectrum. Bars with different letters are significantly different.

Additionally, these zones were more prominent against the green leaf margins. For Bullseye Red Geraniums, the optimal fertilization strategy used an initial rate of 5 ppm P restricted to 2.5 ppm P. This strategy resulted in redder, more compact plants without a delay in flowering.

When restricting P, be sure to monitor your crop for detrimental P deficiency symptoms including chlorosis, necrosis and excessive stunting. If these symptoms are observed, you can supply a low rate of P (5 to 10 ppm) to mitigate the damage and return your crops to a healthy and vibrant state. We recommend trialing this fertilization strategy prior to implementation on an entire crop. Low P fertilization can be a successful production method for color enhancement and growth control, but it requires a watchful eye to ensure the plants remain healthy.

Also of note was that limiting P significantly limited the number of branches on alternanthera with every drop in the P rate. This wasn't the case with geraniums, as similar numbers of branches developed with 5 to 20 ppm P. A low P fertilization strategy isn't recommended if branching is your goal (i.e. producing stock plants for cuttings). If your goal is finishing plants for consumers, you'll find that this fertilization strategy offers several benefits, such as keeping plants compact and giving red-leafed crops a deeper and more vivid color. **GT**

Figure 4. Geranium leaves exhibiting different foliar zone coloration from each P treatment.



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