GROWERTALKS

Features

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Revising Your Phosphorus Fertilization Strategy

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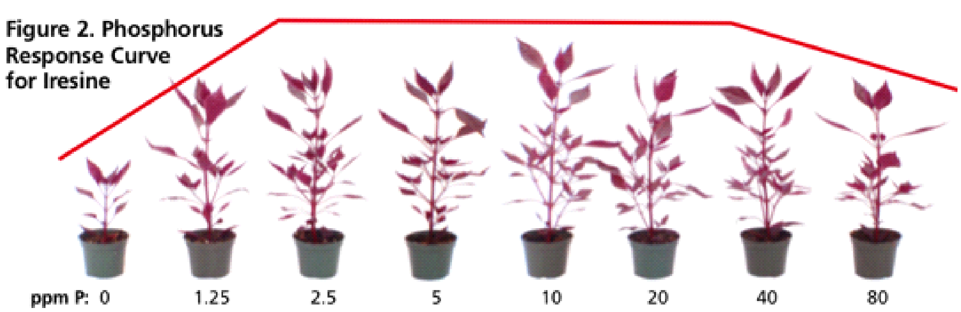
In recent years, phosphorus fertilization strategies for greenhouse crops have been changing. Fertilizer formulations that have been used for many years actually supply far more phosphorus than most crops need. In fact, only 5 to 10 ppm elemental phosphorus (not phosphate) is usually enough for healthy, compact growth in most greenhouse crops. Given this range, it's apparent that fertilizers, such as 20-20-20 and 20-10-20, supply 10 to 15 times more phosphorus than necessary even at recommended rates (Figure 1).

Figure 1. Phosphorus Content of Common Fertilizers

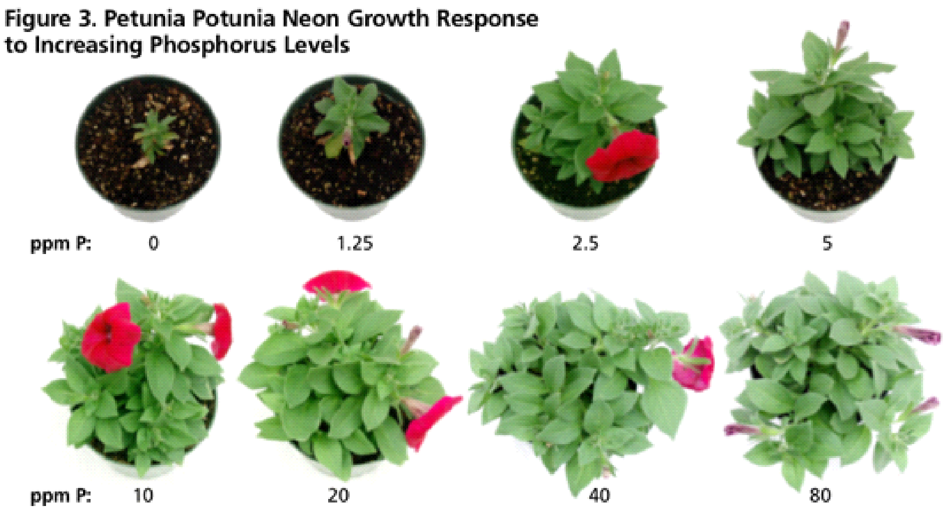
Fertilizer Formulation	Phosphorus Levels (ppm)	
	Mixed at 100 ppm N	Mixed at 200 ppm N
20-20-20	43	83
20-10-20	21.5	43
15-5-15 Cal Mag	10.75	21.5
13-2-13 Cal Mag	4.3	8.6
15-0-15	0	0

The phosphorus concentration of common fertilizers mixed at 100 or 200 ppm N. Phosphorus levels above 10 ppm normally exceed the demand by the plant.

Research is currently being conducted at North Carolina State University on phosphorus. In one experiment, we're determining the plant growth response to various levels of phosphorus fertilization. Trials have been done on alternanthera, iresine and petunia species to determine optimal phosphorus levels. These trials were conducted using rates between 0 and 80 ppm phosphorus to create a visual growth response curve (Figure 2 and Figure 3).

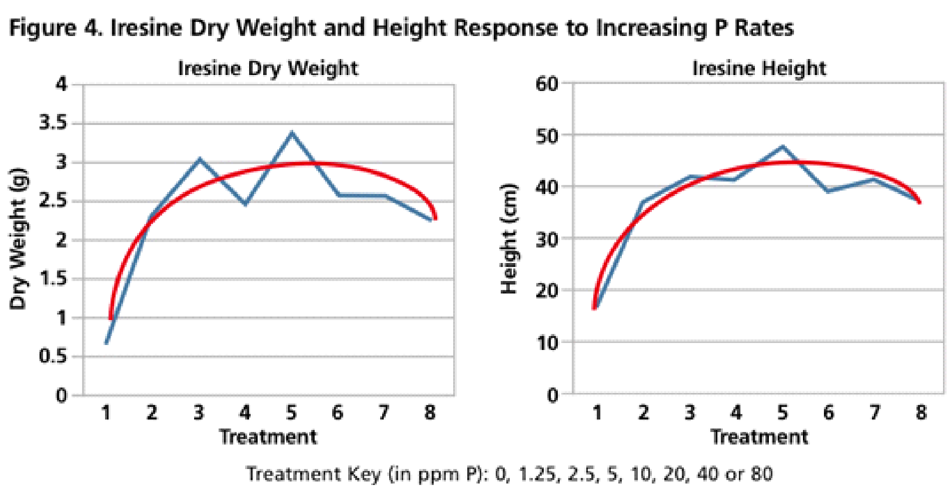


The response of iresine to increasing concentrations of phosphorus from 0 to 80 ppm P, while N is held constant at 150 ppm (Henry, unpublished data).



The response of petunia to increasing concentrations of phosphorus from 0 to 80 ppm P, while N is held constant at 150 ppm (Henry, unpublished data).

When no phosphorus is supplied to the plant, it will have stunted growth and remain quite compact. As small increments of phosphorus are added to the fertilizer solution, growth rapidly increases up to about 5 to 10 ppm depending on the species. After this point, growth begins to plateau and remains fairly constant as more phosphorus is added. This plateau continues as the P concentration increases, but growth will eventually begin to decrease due to toxic levels of phosphorus building up in the plant tissue. This decrease in growth affects both height and dry weight, and can begin to occur at rates above 40 to 80 ppm phosphorus (Figure 4).



Growth response curves of iresine dry weight and plant height as phosphorus fertilization concentrations increase from 0 to 80 ppm (Henry, unpublished data).

Additional research has been conducted by Dr. Paul Nelson at NCSU over the past several decades. In his research, it's been found that reduced or even 0 ppm phosphorus regiments can be very beneficial for plug production by limiting stretch. Of course, no phosphorus can only be used for short-term crops such as plugs, as deficiency symptoms can quickly develop when plants don't have adequate phosphorus. In 2014, there were two major cases where losses occurred with garden mum crops when phosphorus was limited (see e-GRO 3-62: http://www.e-gro.org/pdf/362.pdf).

Deficiency symptoms related to phosphorus often include the typical reddening or purpling of the lower foliage. Olive green spots can occur as another deficiency symptom as well, especially during warmer growing conditions. These spots often develop within a chlorotic area in the center of the leaf.

It's important to note that phosphorus deficiency can occur even when sufficient rates are supplied in the fertilizer. Certain growing conditions can greatly affect the plants' ability to take up phosphorus and can result in deficiency symptoms. Issues with root health, including root rot, are one set of conditions that can lead to phosphorus deficiency. Cold and wet conditions, as well as drought stress, can also lead to a deficiency situation. In all of these cases, plants lack the ability to take up adequate phosphorus and can therefore exhibit the red or purple discoloration often associated with phosphorus deficiency.

Reddening of the lower leaves can, however, occur for a number of unrelated reasons. These "mimics" can be due to low substrate pH, low EC or even sulfur deficiency. Due to the variety of potential causes, conducting pour-through tests or even tissue analysis are important first steps to take to determine the issue.

Symptoms of toxicity are less likely to occur, but it's still good to recognize them if high levels of phosphorus are being supplied to the crop. Toxicity symptoms manifest themselves as iron deficiency or interveinal chlorosis of the upper foliage. When phosphorus reaches toxic levels, it has an antagonistic effect on iron uptake by the plant. This is most common in crops native to Australia such as scaevola, as they're highly sensitive to elevated phosphorus levels. Deficiency and toxicity alike can usually be avoided by providing the optimal range of 5 to 10 ppm phosphorus.

Low phosphorus fertilization regiments can be highly beneficial for producing healthy ornamental crops in the greenhouse setting. The optimal range of phosphorus is about 5 to 10 ppm for most annual plants. Slightly higher P levels of 10 to 20 ppm P are needed for heavy-feeding crops, such as poinsettias, petunias and garden mums. These rates can be achieved using 13-2-13 Cal Mag as a constant feed mixed at 100 or 200 ppm nitrogen. Using 15-5-15 Cal Mag as a constant feed at 100 ppm nitrogen will also supply sufficient levels. A third option could involve alternating between 15-5-15 at 200 ppm nitrogen and 15-0-15 to achieve the same effect.

Reducing phosphorus fertilization rates can have a number of benefits for growers, such as reducing fertilizer costs. Phosphorus runoff has also been an issue affecting water quality and causing algae blooms such as those in Lake Erie. Reduction of runoff has definite benefits for the environment. Additionally, using a low-phosphorus fertilization strategy can produce more compact plants. When plants are more compact, growers can benefit from a potential reduction in spacing during production, as well as fitting more shelves per shipping rack. Lastly, compact plants are generally more desirable from the consumer standpoint.

There are numerous reasons to revise your phosphorus fertilization strategy, so, hopefully, this information will help in doing so. **GT**

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