

# Fertilize, Apply Pesticides, Repeat.

**Reduce inputs by managing  
fertilizer-pest interactions**

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**T**here is a strong urge these days to market one's business as 'green' or 'sustainable'. At the same time it is increasingly necessary to save money producing and maintaining plants. Although I would caution against using environmental catch phrases to market your business unless there is something concrete to substantiate your claim, I am not a marketing expert. However, it is surprising to many that you can reduce your impact on the environment and save money at the same time. That's right, being more 'green' doesn't mean buying expensive biological control agents or losing plants to insects and disease. Modifying existing cultural practices will go a long way toward increasing sustainability and profit.

Fertilizer and pesticides have much in common. Fertilizer and pesticides are essential components of plant production and maintenance. They are also the products to which people attribute real and perceived environmental harm from our industry. Finally, both fertilizer and pesticides can reduce or exacerbate arthropod pest problems.

Fertilizer, particularly nitrogen, increases plant growth but also makes plants more nutritious for arthropods. Thus, insect and mite populations often grow and reproduce faster on plants receiving greater quantities of nitrogen. In addition, plants receiving excessive fertilizer applications can lose their innate ability to defend themselves as they shunt all their energy into vegetative growth rather than producing defensive chemicals. Thus, over-fertilization


results in poorly defended plants with rapidly developing arthropod populations. It is easy to see how more fertilizer can lead to more pesticides both of which cost money. But at least you are getting healthier, great looking plants, right? Not necessarily.

Research on spider mites has found that fertilizer can boost population growth rate by increasing egg production. Roses fertilized with 50% of the industry recommended level of nitrogen had half as many mites as those plants fertilized at 100% of recommended levels for cut flower production. Thus double the fertilizer equals double the mites. Roses grown with 50% of the fertilizer had the same total leaf area as plants in the 100% group. In addition, the number of shoots and number of flowers did not differ between the 50% and 100% treatments. So plant production was not compromised but mite production was.

Of several similar research projects conducted with thrips, a good example is the production of chrysanthemums with 50% or 100% of the recommended fertilizer rate. Again, using half the fertilizer reduced thrips populations by half. Fertilizing plants at 50% did increase production time to 88 days compared to 84 in the high fertilizer plants but plant quality (size, number of flowers) was the same except with fewer thrips.

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An interesting set of papers on whitefly found that fertilization increases whitefly oviposition preference. Thus, female whiteflies prefer to lay eggs on poinsettia and chrysanthemum plants receiving higher levels of nitrogen. This ensures the best quality host plant for their offspring which are not very mobile. Turns out this is a good choice because eggs laid on fertilized plants developed faster and produced more adults than eggs on less fertilized plants.

Finally, important research on trees found that nitrogen content increases hemlock woolly adelgid and elongate hemlock scale populations. Hemlock trees grown in the ground that received fertilizer had 7 times as many adelgids as trees that received no fertilizer even though they were infested with the same number. The mechanism behind this was that fertilization increased adelgid egg production by 223%. Survival from egg to adult increased by 250% on fertilized trees. Therefore, plants that did not receive supplemental nitrogen were better able to resist infestation and reduced population growth of those that were able to colonize. But again we will ask: "At least you had healthier faster growing trees, right?" Nope. Fertilized trees produced 33% less biomass than unfertilized ones and had inferior color. Fertilized trees had 88% of their foliage discolored by adelgid feeding compared to 12% of unfertilized trees. Thus higher adelgid density more than offset any potential benefit of fertilization on hemlock growth and appearance. In an ornamental landscape or nursery all the trees in this study would likely need to be treated with insecticide. However, the small weak population on unfertilized trees would be much easier to control and has not tarnished the plants' appearance.

These examples are intended to demonstrate the drastic changes in arthropod reproduction, feeding, and damage that are attributable to nitrogen fertilization. Clearly, growers cannot discontinue fertilizing. Fertilizing at 50% the recommended rate will likely cause changes in plant quality with some species that will reduce profit. There is a big gap between 50% and 100% that may contain an optimal level of fertilizer to maximize plant growth and minimize insect pressure. However, the first step is to be sure you are not over-fertilizing. In most cases fertilizing above the recommended rate will not increase plant growth. Plants may already be fixing carbon at a maximum rate and thus cannot produce more biomass. In addition, over fertilization increas-

es the chance that the fertilizer you paid for will simply leech out and turn your pond green.

Unfortunately, recommendations to growers and landscapers from extension and industry personnel are often discipline specific. Thus information about one aspect of plant production is conveyed without regard for other factors that may be counterproductive. In many cases it is because there is simply not enough research to understand how everything we do to plants – water, fertilize, prune, insecticides, fungicides, plant growth regulators, etc. – interact with each other. However, in this case the research is clear in that fertilizer increases arthropod reproduction, survival, and abundance in most cases. Faster pest population growth means more damage before you notice or have time to spray and more pesticide applications per year. Most years you will have enough pest problems without helping them along by needlessly increasing their survival with excess fertilizer or by killing natural enemies with excess pesticide applications. Limiting unnecessary applications means more 'green' for you and a business that is truly more sustainable.

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