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Calling interference

When chemical mixes don't do their job, sometimes poor water quality is to blame

Something is clearly wrong. The herbicide didn't kill the weeds. The insecticide was about as effective as spraying water on a cockroach.

You know it's not a problem with the rate. You've double-checked and triple-checked that possibility. It's not a problem with coverage, either. It must be a problem with the chemistry.

That's a distinct possibility. But perhaps it's a problem with the chemistry of the water, not the chemistry of the product. This doesn't stop people from blaming the product first.

"They don't call me when it does work," said Todd Burkdoll, a market development specialist for BASF. "They call me when it doesn't work. I have to go out there and play Columbo. I always operate under the premise that there's a Paul Harvey version of the story. Once we find out the rest of the story, we can figure out what has gone wrong. There's so many variables when you're working with biological organics."

Poor quality water can affect the pH of the soil, tying up major or minor elements. That in turn can cause

chlorosis and stunting of plant growth.

"Poor water quality can cause all sorts of problems with various products," said Dr. Kathie Kalmowitz, market development specialist for BASF Turf & Ornamental. "It alters the way things are supposed to work."

Poor water quality also can render chemicals ineffective by interfering with the chemistry.

"Manufacturers have put their products through rigorous compatibility tests prior to launching into the marketplace,"

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Kalmowitz said. "However, products cannot be expected to perform normally under extreme scenarios of poor water quality."

Often, pH is the proverbial "fly in the ointment." The level of pH is one of the most tested and documented parameters in pesticide performance. By reading label directions, and knowing the pH level of the tank water, one can quickly realize if there is a water quality problem.

Every chemical has a "half-life" which represents the length of time under laboratory conditions when 50 percent of the molecules have been degraded. The half-life for many crop

protection chemicals changes as solution pH changes. If the chemical is sensitive to pH extremes, that half-life can be significantly reduced.

There are often other problems associated with extremes in pH.

For nurseries, issues with pH are quite common, especially in the desert Southwest, where the use of reclaimed water is more prevalent.

In the Pacific Northwest, water quality issues are not as prevalent. Water tends to be more pure, whether it comes from municipal sources, private wells or storage basins on the grower's property.

"My experience in the Northwest is that the water quality is pretty good," said Burkdoll. "You get a lot of rainfall into the aquifers."

Even so, it's not unheard of for basin or well water to suffer from quality issues that interfere with chemicals.

"You never want to rule it out," Burkdoll said.

"The level of pH is one of the most tested and documented parameters in pesticide performance."

"High or low pH can impact the tank mix in several ways," Kalmowitz said. "For example, high pH can cause the chemical to fall out of solution so that you aren't delivering the intended rate. In other words, the product does not stay mixed well."


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The water can become too basic or too acidic, or it may contain high levels of sodium or other minerals that bond with chemicals before they have the chance to reach their intended target. "Or a buildup of organic matter in the water can deter efficacy like the mineral ions would," Burkdoll said.

Varying levels of acidity and alkalinity can have a profound effect on a product's performance. Fortunately, it is one of the easiest parameters to adjust in the tank mix solution.

Simply adding a buffering agent to bring the pH back into the proper balance can mitigate the problem.

"We routinely use buffering agents such as phosphoric acid to bring the pH down to about 6.0 or the high 5's," said Jack Graham, production manager of Dramm and Echler Nursery in Encinitas, Calif. "It works very well, and we have developed a comfort level about what we need to use to get it down to that level.

"We don't have to test our water constantly. The pH we start with might change a little bit, but not much."

Adding a buffer before or after the product is added to the tank mix can potentially have an impact on the overall solution.

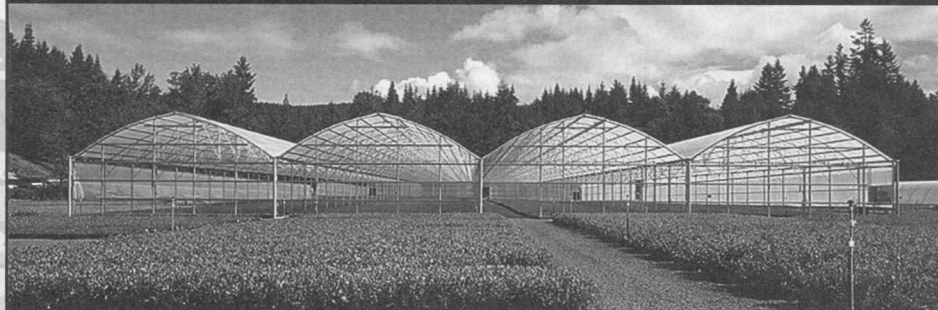
"We add the buffer to the water before we add the product," Graham said. "Some products are already buffered from the manufacturer, so if you play around with buffering the entire tank mix, you don't really know what you're doing. We prefer to start with water that is corrected for pH and go from there."

Other factors such as mineral content of water are not as obvious but can still have major ramifications on the efficacy of the tank mix. Sometimes those problems are a little more difficult to recognize as well as reconcile.

"I think there are two areas where these types of problems can become major issues," Kalmowitz said. "Those are situations where applicators are using reclaimed water where

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“Not only should the water be tested, it should be tested periodically.”

the mineral makeup of the water is unknown and secondly, in situations where the sodium content of the water is excessively high.”

Both situations could be present concurrently. As water becomes an increasingly scarce and sought-after resource, reclamation is becoming more and more common among nurseries, golf courses and agricultural enterprises.

“The first step is to test your water so that you know what you’re dealing with,” Kalmowitz said. “It seems like

common sense, but a lot of people just don’t bother to do it. Not only should the water be tested, it should be tested periodically because water quality is ever-changing. What you’re dealing with today might be different than what you have to deal with next month.”

Mineral antagonism occurs when there are naturally occurring dissolved ions in water that chemically bond to and effectively neutralize certain chemistries. It’s notably a problem with certain herbicides, such as glyphosate. However, other plant protection materials are also prone to mineral antagonism, and the phenomenon can severely restrict activity on the intended target where weeds, pests and disease are otherwise easily controlled.

Hard water is the culprit in most mineral antagonism problems primarily

because of the high concentration of calcium. However, other elements such as magnesium and iron can also bond electrostatically to certain chemistries, rendering them largely ineffective.

Again, correcting mineral antagonism is a relatively simple and inexpensive problem to fix by adding something to the water to tie up minerals such as calcium so it will not bond to the active ingredient in the product. Water conditioners can greatly enhance product performance in hard water solutions.

High salt levels can be particularly troublesome in some tank mixes, according to Kalmowitz. “Sodium can change the balance of chemicals,” she said. “Sodium in water can hydrolyze a pesticide, fungicide or herbicide, causing it to split into other compounds and rendering it ineffective.

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"We've seen examples of sodium almost instantaneously reducing the half-life of a chemical from days to mere minutes. It can be a very serious problem if you're dealing with water that is high in sodium."

Reclaimed water can create additional problems that need to be addressed. Copper, iron and other compounds can pose problems.

"There are numerous compounds that can attach themselves to a chemical and alter the fungicidal or insecticidal effect," Kalmowitz said. "The more serious problem is often what effect that can have on the plant, rather than the efficacy or inefficacy of the material."

"A material tank mixed with water of poor quality can undergo changes in chemical composition that may cause plant tissue burning that wouldn't have otherwise been a problem. There are any number of scenarios that can occur when you're dealing with water quality and the numerous compounds that are interacting among the water and the products you add to the tank mix."

Another issue in dealing with reclaimed water is the potential for inadvertently adding pathogens back into the production system. That can be a serious concern, depending on where the water is being recycled, how it is treated before being reapplied, and what plants are being subjected to reclaimed water.

"You certainly don't want to be introducing pathogens back into the system," Kalmowitz said. "This is especially important point for those production sites that retain their runoff and recycle within their operation. If you are unsure of how to sample water, check with your local university farm advisor for information."

Water quality is a multi-faceted issue just in itself. Start adding products to the tank and it becomes even more complex. The more you add, the more complex it gets. However, it all starts with water, and knowing the makeup of that water is the first step in achieving and maintaining pesticide efficacy. ©

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