Milan Ohio
ESTD GROWERS MINERAL 1955
THE FARMERS SOLUTION

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The Growers Solution

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WATER SOURCES & FOLIAR FEEDING

by Zach Smith,
Product and Training Specialist

One of the biggest obstacles to foliar feeding for some is their source of water. GMS can be sprayed on straight and was the norm during the early days of the company when lower volume sprayers were more ubiquitous than they are today. However, with larger spray volumes necessitating mixing GMS with water, as well as many people's preferences for adding water to their spray, some issues arise with how well GMS mixes with certain water sources and how well those waters are absorbed into plant foliage.

We have long known that the phosphorus (P) in GMS will combine with certain elements in hard water and precipitate out. More recent research has also shown that those elements in hard water can be left on the leaf surface if not absorbed. Having said all of this, there are many times that we have been surprised when a hard water does not react with GMS and appears to be very spray compatible. It seems that the water quality discussion is far from over. The following experiment exemplified all of this.

Matt Gooding has worked quite a bit with different water sources to learn more about what makes water, GMS, and plants tick. In this case, he wanted to see what the results would be of using different water sources, all mixed as a 10% solution with GMS (1 part GMS to 10 parts water), spraying them on a cucumber leaf, then allowing them to absorb/dry. The sources of water he used were city water from Tiffin, Ohio; well water from his farm; well water run through a water softener; and rainwater.

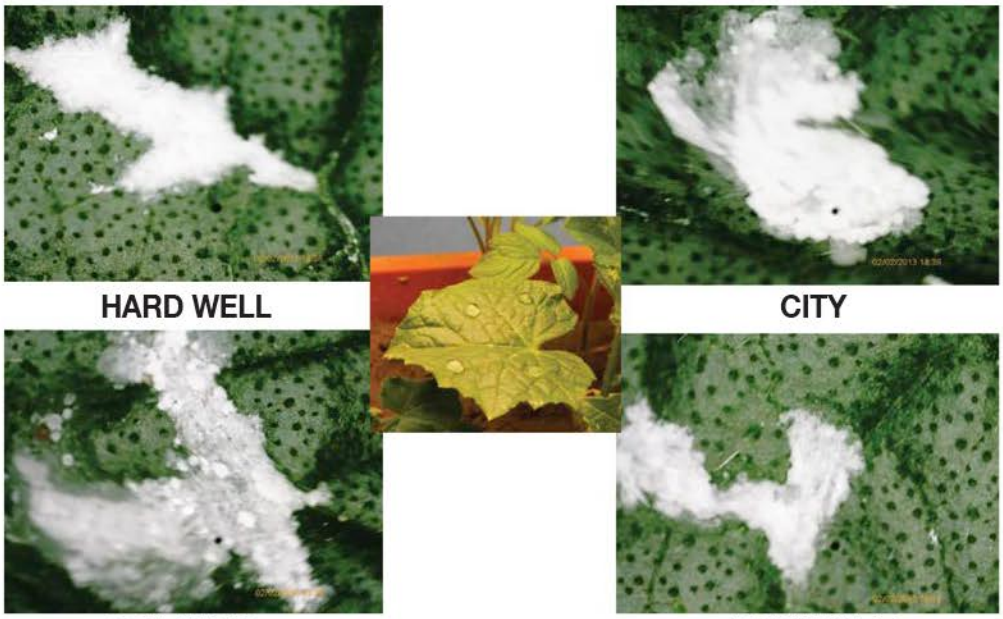
His (and our) expectation was that the well water (softened or not) would perform the worst, while rainwater would perform very well, and the city water would be somewhere in between. This is not entirely what happened. As you can see in **Photograph A**, all four sources left a residue behind on the leaf after drying for 4 hours. The amount of residue left is less in the rainwater, but the other three appear functionally equal.

In order to simulate dew, Matt misted the leaf with some rainwater and then let it sit for another 3 days. **Photograph B** (on page 4) shows the results. The city water actually performed the poorest, while the well waters were roughly equal, with a small amount of visible residue left. The rainwater results were right in line with our expectations.

You may be asking two questions: Why did the well water outperform the city water? And why do these results matter at all? As I stated above, we have been surprised many times when a hard water works well with GMS and as a foliar spray. This is because it is not only the amount of minerals dissolved in the water that affect it, but which minerals are dissolved. Ground water especially (but surface water to a lesser extent) will dissolve those minerals it comes into contact with. Depending on the parent material and structure of the ground it is in, it will have very different dissolved minerals in it than ground water from somewhere else. Elements like calcium and magnesium will bond very readily with phosphorus, but other minerals, especially anions (negatively charged elements and compounds) will not. Additionally, different elements are more or less water soluble, so when in a dried state will be more or less successfully resolubilized by the re-wetting of the leaf.

Undoubtedly, the minerals in Matt's well water are very different than those in Tiffin's city water. Municipal water treatment is usually more concerned with pathogens than mineral content, so besides some softening probably haven't removed them. It is likely that whatever elements are in Tiffin's city water are not very soluble.

"Water Sources," continued on page 4



PHOTOGRAPH A: *Dried residue from the 4 water sources mixed with GMS shown on a cucumber leaf.*

ON THE ROAD AGAIN

Hope to see you soon!

This winter, Growers Mineral, Corp. is scheduled to set up and staff booths at the following upcoming farm shows. It's a great time to stop in and review your plant food and mineral supplement program, hear about new developments at Growers, or just chat with the folks who make it all happen—your friends and neighbors.

Jan 30-Feb 1 Tues-Thurs	Mid-Atlantic Fruit & Veg. Conf. Hershey, PA
Jan 30-Feb 1 Tues-Thurs	Iowa Ag Expo/Power Show Des Moines, IA
Jan 31-Feb 2 Weds-Fri	Southern Farm Show Raleigh, NC
February 1-2 Thurs-Fri	Wisconsin Corn-Soy Expo Wisconsin Dells, WI
February 14-16 Weds-Fri	Alabama Fruit & Veg. Growers Clanton, AL
February 14-17 Weds-Sat	National Farm Machinery Show Louisville, KY
February 21-22 Weds-Thurs	Ontario Fruit & Veg. Convention Niagara Falls, ONT
February 22-24 Thurs-Sat	New York Farm Show Syracuse, NY
February 23-25 Fri-Sun	Western Farm Show Kansas City, MO
February 27-28 Tues-Weds	Central Minnesota Farm Show St. Cloud, MN
March 6-7 Weds-Thurs	Bauer Schuhl Farming School Hillpoint, WI
March 6-7 Weds-Thurs	East Central Farm Show Lindsay, ONT
March 6-8 Weds-Fri	London Farm Show London, ONT
March 14-16 Thurs-Sat	North American Farm & Power Owatonna, MN

REMEMBER: MONTHLY CONFERENCE CALL

On the second Thursday of the month at 9:00 PM Eastern for the months of September through April, we hold a conference call usually featuring a picture from the Growers Calendar along with other important agricultural events. There is no participation charge for the call. For the call, dial 1-646-558-8656 (US) or 1-438-809-7799 (CAN). The Meeting ID is 359 647 7278.

WHAT MAKES FROST A KILLER?

by Jim Halbeisen, Director of Research

Every spring, the Growers Mineral, Corp. sales team receives questions about using Growers Mineral Solutions (GMS) to lessen the effects of frost on early season vulnerable crops. This usually occurs when a Canadian cold air mass arrives unexpectedly. In the Spring of 2023, after discussing the frost issue with several sales people, an article "What Makes Frost a Killer?" appeared on *www.dtnpf.com* on April 3, 2023.

This article discussed in some detail how frost injures fresh growing plant tissue. Also, the author lists the various parameters that are necessary to create damage to the plant tissue, a section of this article we believe is most helpful in understanding how GMS may influence healthy plant tissue in a way that helps lessen the amount of frost damage. The following are direct quotes from this article:

Here a few notable ways that plants can survive temperatures below freezing.

1. We deal with ice on roadways and sidewalks by spreading salt on the ice. Plants can do something a little similar. By accumulating more dissolvable solids like proteins sugars, and other minerals, they can create their own slurry that lowers the freezing point of water by sometimes several degrees.

2. Plants can create "anti-freeze" proteins and push them to the cell walls or excrete them to limit the ability of ice crystals to attach to the leaf or stem surfaces.

3. Some plants can create proteins called "dehydrins" that bind to water molecules and make it more difficult for water to form crystalline structures that result from freezing.

4. They can alter their lipid composition in their fluids to make it more viscous, again making it more difficult for water to form crystalline structures that result from freezing.

5. They can generate a little bit of heat. Though it is not like animals, plants also consume some of the sugars they eat to perform specific functions for growth and development. That consumption generates heat, just like it does for us. When you work hard, you get hot. Plants can do a little of that as well.

The Growers Mineral, Corp. sales team that has the most experience with this use of GMS usually have producers apply 1 to 3 gallons per acre of GMS ahead of the frost event in an attempt to ensure absorption of the product before the frost event. All GMS sales team members have picked up their own "little bag of tricks" that they learned from their customers over their years of experience. So anyone interested in using GMS for a frost event, please contact your local GMS sales representative or Growers Mineral, Corp. in Milan, Ohio. ■

FOLIAR FERTILIZER FOLLY OR FOLIAR NUTRITION FOR IMPROVED YIELDS

by Jim Halbeisen, Director of Research

As farmers examined the various agricultural publications in the Spring of 2023, they would have seen both of the titles that are used as the title of this article. It is very interesting to search the sources of the two articles that are alluded to in this article's title.

In recent years, as farmers are becoming quite familiar with foliar applied pesticides (herbicide, insecticides, and fungicides), it seems to draw to a logical conclusion that foliar applied nutrients may be useful for an agricultural producer. However, the article "Foliar Fertilizer Folly" on May 19, 2023 appearing on *www.dtnpf.com* stated that a study of small-plot trials across a 16 state university area showed foliar applied elements did not consistently increase soybean yield or grain composition. These university researchers concluded that use of foliar applied nutrition is something farmers really need to think twice about before using.

As a contradiction to this article, the article "Foliar Nutrition for Improved Yields" appeared on June 1, 2023 on *www.farmprogress.com*. This article was published by the seed company Beck's Hybrids. The Beck's article does state that foliar feeding has been a topic of debate over the years. The debate time for foliar feeding was emphasized in the university article, but the Beck's article moved in another direction by saying that the use of foliar applied nutrients have some advantages over soil applied elements. These advantages occur because many factors within the soil affect nutrient availability and that nutrient availability to plants is not just related to the presence or absence of a nutrient within the soil, but whether the nutrient is in a form that can be assimilated by plants.

So, the Beck's article states that when considering a foliar feeding plan, one of the most important considerations is what time during the day a foliar product should be applied. Since an inorganic element (nutrient) is being applied to an organic (plant tissue) material, the leaf surface should be covered with dew and respired water so as to act as a carrier to allow the elements to enter the plant. Also, when the atmosphere is cooler, plants retain water longer with slow evaporation rates. Also, in the morning and evening, plant stomata tend to be open which helps increase element uptake. Thus, Beck's Seed is suggesting foliar feeding can work if certain environmental conditions are part of the program. The environmental

"Fertilizer Folly," continued on page 4

CADMIUM A NEW WORRY FOR VEGETABLE & FRUIT GROWERS

by Jim Halbeisen, Director of Research

According to Gordon Johnson, Vegetable and Fruit Specialist from the University of Delaware, the U.S. Food and Drug Administration (FDA) has recently been targeting heavy metals in foods as a health concern. In the article "Heavy Metals a New Worry for Vegetable, Fruit Growers" from the *Delmarva Farmer* on March 14, 2023, Johnson says in the document "Closer to Zero," FDA's Toxic Elements Working Group is prioritizing 3 areas concerning heavy metals:

1. Identify prevalence
2. Identify vulnerable populations such as infants, children, elderly, or compromised individuals
3. Determine ways to reduce exposure

The heavy metal elements listed in "Closer to Zero" are arsenic (As), lead (Pb), cadmium (Cd), and mercury (Hg). The heavy metal Cd has been on Growers Mineral, Corp.'s radar screen since meeting Dr. Tom Swarczek in the 1990's. In the early 2000's, government reports were indicating that Cd was being found in unexpectedly high levels in human tissue. In the past, government officials always believed Cd entered human tissue through smoking, but with smoking decreasing, those same government agencies must now put the blame on food.

According to Johnson, the classic entry of Cd into the food chain is through fertilizer. It is well known that the original P sources for fertilizer (rock) have significant volumes of Cd in their composition. So this article concludes the best way to lower Cd in the food chain is to lower the amount of P fertilizer used and to use a P fertilizer that is formulated from P sources with lower Cd volumes. These two recommendations are exactly the approach followed when using GMS. Growers Mineral, Corp. has always used a smaller volume of fertilizer and has used higher grade P sources containing lower Cd concentrations since 1955, while using vigorous metal testing procedures since the 1990's.

An interesting side note to Johnson's article is the statement that, to reduce Cd levels in plant tissue, a farmer should "Reduce chloride additions to soils. Some fertilizers such as potassium chloride (0-0-60) increase Cd availability."

So now the question is whether Cd regulation is in the near future for fruit and vegetable production for food. The answer to this question may be foreshadowed in another article from *www.npr.org* on December 30, 2022. This article title is "Hershey's Faces a Lawsuit Over Heavy Metals in Its Dark Chocolate Bars." A quote from this article is very interesting: "The lawsuit is seeking $5 million from Hershey's calling its advertising and marketing campaign for the dark chocolate bars 'false, deceptive, and misleading.' The plaintiffs' lawyers argue that had Hershey's disclosed on its labeling that those dark chocolate bars contained lead and cadmium, Lazazzaro would not have purchased them."

It has come to our attention that the cannabis industry is already testing products for heavy metals such as arsenic (As), lead (Pb), and cadmium (Cd). Could the big box stores start testing fresh food products or even food grains for heavy metals such as Cd? Probably the medical and pharmaceutical industries will or have investigated that answer. ■

MORE THIRD PARTY VERIFICATION

A nice follow-up on the "Third Party Verification: the Growers Program" article came to us from the *AgTalk* web site when Jrhgrain Farms of Hickory, NC posted:

"I'm working on a project with a university and private company. Spreading 6-8 tons of lime to the acre...How do you charge for that?"

We hope Mr. Hedrick is using lime with a calcium to magnesium ratio of 8 to 1.

THIRD PARTY VERIFICATION: THE GROWERS PROGRAM

by Jim Halbeisen, Director of Research

Since 1955, we have suggested to farmers that profitable crop production does not require as much fertilizer volume to be applied as is advised by the agricultural establishment. So it was with great interest we read about the dry land winner of a national corn contest.

Russell Hedrick of Hickory, North Carolina was recognized at the North Carolina Commodities Conference for a dry land corn yield in 2022 of 459.1 bushels per acre. A North Carolina State University Extension corn specialist said that yield is the highest dry land corn yield ever achieved and it broke the previous record of 442.14 bushels set by Francis Childs of Manchester, Iowa in 2002. When examining the fertility data from Mr. Hedrick, one starts to question the regular recommendations supplied by the agricultural establishment. Mr. Hedrick planted 45,900 seeds of corn per acre in 30 inch rows while applying 310 pounds of nitrogen (N), 140 pounds of phosphorus (P_2O_5), and 40 pounds of potassium (K_2O). He also applied trace elements of sugar, fulvic acid, and humic acid.

With this information, it appears Mr. Hedrick grew his corn crop with 0.68 pounds of N per bushel, 0.30 pounds of P_2O_5 per bushel, and 0.09 pounds of K_2O per bushel. These are fertility rates that are significantly lower than what the agricultural establishment says is required to grow a profitable crop. Mr. Hedrick's discussion about this issue of fertility needs was very interesting.

These are several quotes from Mr. Hedrick:

"It's not about nutrient amounts—it's about placement and balance. We use half the fertilizer of what many other guys use..."

"Stop relying on a 0" to 4" or 0" to 6" soil sample. There is so much more going on in the ground deeper than 6"."

"We precision apply in bands. We rely on our ground and the living organisms within to balance our budget."

"As farmers improve the biological function in soil by using regenerative practices, nutrient cycling is also improved. It's sometimes hard for a farmer to trust the biological function in soil, because it is opposite of what we've been taught."

"I want to tell farmers that even if you can cut back in the right way a little on fertilizer, the profitability side goes up. If profit and improved ROI don't come with those yields, then we're spinning our wheels." ■

MORE FERTILIZER EFFICIENCY

by Jim Halbeisen, Director of Research

In the Late Fall, 2022 edition of The Growers Solution, we discussed a webinar presented by Novozymes Bio Ag in which they presented availability data about Phosphorus (P) in soil. The knowledge about poor P availability in soil is commonplace in the agricultural establishment literature. Therefore, an article published by Penn State Cooperative Extension on the website www.farmprogress.com on March 14, 2022 about improving fertilizer efficiency was not surprising.

As with other articles in the recent agricultural literature, this article focused on improving fertilizer P availability. And, as with the other articles, Penn State Cooperation Extension stated, "For P fertilizers, the application should be banded rather than broadcasted to reduce fixation by soil minerals, and be placed several inches deep into the soil so that crop roots can access the nutrients... granular or liquid starter fertilizer units on a planter is a perfect strategy to increase P efficiency."

So recent agricultural literature, whether it be private industry or public institutions, is advocating placing P fertilizer in a band as close to the plant as possible. Therefore, the concepts of the original Growers Mineral, Corp. founders is being advocated by the agricultural establishment for price (economics) and conservation (environment). ■

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SPRING
2024

CHANGE SERVICE REQUESTED

CASH IN ADVANCE DISCOUNTS

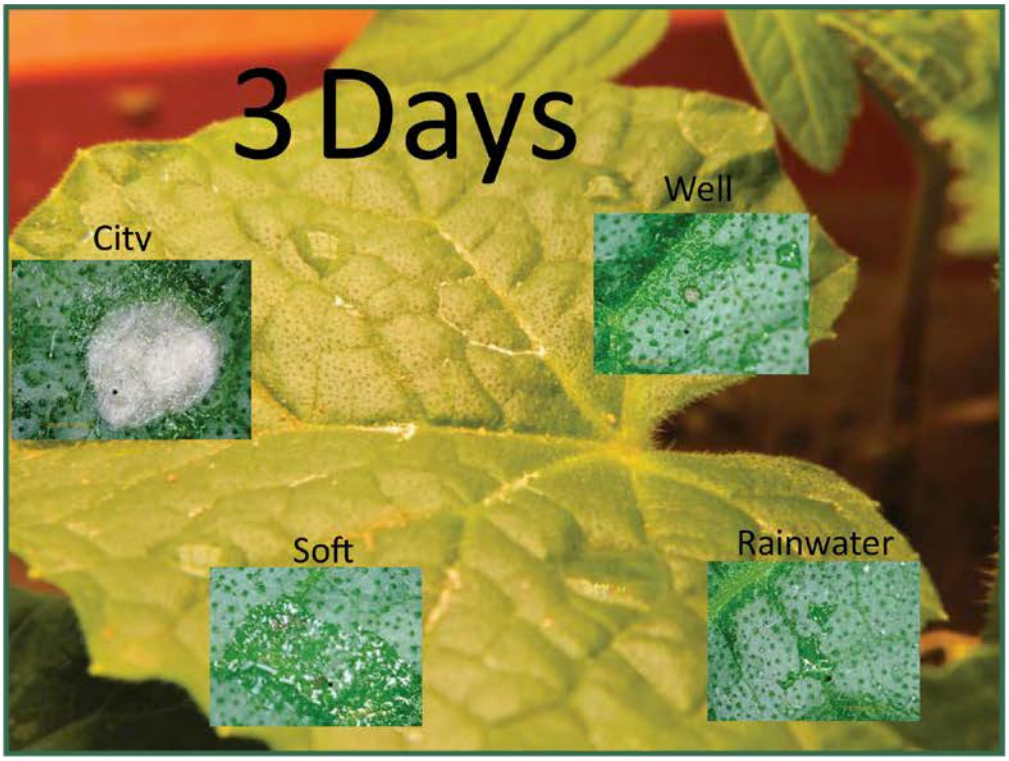
January 10-January 30, 2024 6%

January 31-February 29, 2024 4%

"Water Sources," continued from page 1

It is important to note there that softening salt softeners work by replacing positively charged cations in the water with sodium, so they do remove calcium and magnesium, which reduces scaling problems but often actually increases the amount of hardness in the water by adding a lot of sodium. It would appear that whatever elements are in Matt's well water are more soluble than the city water, but sodium is also quite soluble. This would explain their mostly equal results.

To answer my second posed question, I believe these results are important because they 1) give us greater insight into how water responds to and affects foliar spraying, and 2) emphasized the importance of testing a water source before using it in a foliar mix. It is not just a matter of mixing well with GMS, but also one of what effect it will have on the leaf surface. A leaf covered in minerals will lose photosynthetic capacity until they are washed off or resolubilized, something that we have seen is not always easy to do. We believe that having the correct water source greatly increases the efficiency and efficacy of whatever you are spraying, be it a fertilizer or chemical. ■



PHOTOGRAPH B: *The results after misting the dried leaf surface to simulate dew and then letting sit for 3 days.*

"Fertilizer Folly," continued from page 2

conditions were never discussed in the technical version *(Agronomy Journal)* of the university research.

So, it now appears that the agricultural literature gives the farmer opposing views from private enterprise and the university system.

At the time these articles appeared on the internet, a third article appeared on *www.researchandmarkets.com/reports/* discussing the foliar spray market. The target for this article are money investors.

"The foliar spray market is projected to grow from USD 7.3 billion in 2023 to USD 9.6 billion by 2028 growing at a CAGR of 5.5% during the forecast period. Foliar sprays are gaining popularity in agriculture due to their ability to provide crops with necessary nutrients, resulting in improved growth, yield, and quality. This is particularly important for high-value crops like fruits vegetables, and ornamental plants. Foliar sprays also reduce the need for excessive use of fertilizers and chemicals, making them an environmentally friendly approach to agriculture. As sustainable agricultural practices gain more attention, the demand for foliar sprays is increasing, as they can be formulated to be environmentally friendly and promote sustainable agriculture. Additionally, the adoption of precision agriculture technologies, like sensors and drones, is driving the demand for foliar spray. Moreover, the demand for foliar sprays is driven by the need for improved crop yield and quality, the adoption of precision agriculture technologies, and the growing awareness of sustainable agriculture practices."

A quote from the university article did say, "Now we can't say that they're not going to work for anybody anywhere..." ■