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The Growers Solution

SUMMER 2007

VOLUME 20 ISSUE 3

Glyphosate and Micronutrients

By Jim Halbeisen

"Missing Micronutrients," an article in the Spring 2007, edition of John Deere's *The Furrow,* is based on research by Don Huber, professor of botany and plant pathology at Purdue University and Barney Gordon, agronomist at Kansas State University. These researchers claim "using glyphosate is complicating the uptake of some minor nutrients."

The Kansas and Indiana studies found glyphosate resistant soybeans to be vulnerable to manganese deficiencies while non resistant varieties are not. Yield studies showed manganese additions to glyphosate resistant soybeans helped to erase "yield lag" (or "yield drag" as some call it).

The researchers offer several theories to explain the yield lag in glyphosate resistant soybeans:

1. One explanation is that glyphosate was originally developed as a chelating agent, meaning its molecule wraps around the molecules of other elements making them unavailable. Glyphosate applications on soybeans, for example, "tie-up" manganese causing "yellow flash" symptoms.

2. Another is reduced soil biological life is related to manganese deficiency. Following plant application, glyphosate moves from the leaves to the roots, where it is then secreted into the root zone. In the root zone, glyphosate reduces soil organism populations needed to make manganese available to the plant. (Remember, many botany text books say soil microbes are "plants" which means they could be susceptible to glyphosate.)

3. The researchers believe the gene inserted into soybean seed to give it glyphosate resistance also influences its root environment by changing the composition of an exuded substance from the plant's roots that helps it solubilize and utilize soil manganese. Thus, by changing the root exudate, the amount of manganese available to the soybean plant is reduced.

For years the chemical companies have said glyphosate applications have no residual effect to the soil. However, Huber's and Gordon's research seems to cast different light on that claim. But even though there might not be residual herbicide effects on crops planted after glyphosate applications, there still could be changes in the soil's life and environment.

Also, for years Growers Chemical Corporation has said foliar feeding the minerals and nutrients found in GMS can have significant positive influences on soil microbes by way of the energy (sugar) gained by plants receiving GMS sprays. Don M. Huber's research at Purdue University substantiates our position.

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Perennial Peanut Hay Problems Solved in North Florida

By Ed Bulcher and Jim Halbeisen

In October of 2005 Charles "Pete" Collins of Live Oak, in North Central Florida, went to the Sunbelt Ag Expo at Moultrie, Georgia, on a mission. His perennial peanut hay production had been having big problems, so he was looking for new ideas on fertilizing it. He planned to talk with all the fertility companies at the show figuring he might be ready to "think out of the box," even to the extent of finding an alternative to conventional fertilizer.

Pete's 2005 production of perennial peanut hay was only about thirty-five 50 pound bales per acre, whereas, eight years

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Both Ed and Pete are impressed with the root improvement of Pete's perennial peanut hay following high calcium lime additions.

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Glyphosate and Micronutrients

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To overcome manganese deficiencies, Huber and Gordon believe soil applications of manganese are best. When weeds are small (under 2 inches), they think any kind of manganese spray will work, but, as weeds grow larger, they suggest using a chelated form of manganese in the glyphosate spray. (Growers would qualify here.)

Referring back into *The Growers Solutions* archives, in the Summer 1999 edition (volume 12 issue 3, see first shaded area) we discussed the use of glyphosate in conjunction with Growers Mineral Solutions (GMS). Although Growers Chemical Corporation does not recommend mixing any chemicals with GMS, we knew farmers were doing it, so we wanted to add words of caution.

From recent farm experiences, we now have more to add.

1. If using GMS with glyphosate, it is important the spray volume be adequate to cover the small weeds hidden under the plant canopy.

2. When highly diluting GMS with hard water, the water must be correctly acidified to

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From the *Growers Solution*, Summer of 1999

Growers Notes On Roundup®

By Jim Halbeisen

This spring we have been receiving many calls on mixing Growers Nutritional Solutions 10-20-10 with Roundup® Ultra for Roundup Ready® soybeans. Because this will be the third year some customers will be mixing GNS 10-20-10 with the popular post emergence herbicide we can pass on information learned from our experience.

The rate of GNS 10-20-10 to be used on soybeans depends to a great extent on their vegetative growth when the application is to happen. If the soybeans are less than 10 inches tall the best economic approach would be to use 1 gallon per acre of GNS 10-20-10; whereas, if soybeans are over 12 inches in height a 2 gallons per acre application is recommended.

Remember that drift control is very important when spraying Roundup® Ultra. If using the fine mist tips (smaller drops) Growers Nutritional Solutions normally recommends, be sure to spray in very low wind speeds and use enough water to give adequate coverage to the plants and weeds. When using the drift control tips (larger drops) designed for spraying in light breezes, use an amount of water that gives good coverage, but keep it to the minimum.

Also, it is important to remember that absorption by the plant of an organic molecule, (Roundup® Ultra), occurs much easier than an inorganic molecule, (GNS 10-20-10). Therefore you will get absorption of Roundup® Ultra in the heat of the day; but to get the inorganic elements in GNS 10-20-10 absorbed, you still must follow the Growers regular recommendation and spray in the evening, early morning, or on a foggy overcast day.

Some operators who normally spray straight Growers 10-20-10 (no dilution) have had trouble mixing Roundup® Ultra because of the very high load of nutrients in Growers, and have found it necessary to add an equal amount of water in the mix. Also, if you are using hard water when spraying GNS 10-20-10 continue to soften it as in the past before placing the GNS 10-20-10, ammonium sulfate, and Roundup® Ultra in the spray tank.

According to Monsanto's latest recommendation guide, when using a clear liquid N-P-K foliar fertilizer (Growers) with Roundup® Ultra it is best to use a clean ammonium sulfate as part of the spray mixture. Their mixing order is: #3, #4 and #5. We are adding #1 and #2.

1. add water
2. add water softening agent (if necessary)
3. add ammonium sulfate
4. add GNS 10-20-10
5. add Roundup® Ultra

Finally, Monsanto suggests that trace minerals could hinder the success of their herbicide on perennial weed control or even annual weed control, but Growers Nutritional Solutions customers have not found this to be the case in field usage of these products. Actually, we do not recommend mixing any pesticide with Growers Nutritional Solutions 10-20-10. (See "Growers Recommendations For Using" book.) However, over the years many people have done so, and successfully, to cut costs, but at their own risk. ■

From the *Growers Solution*, Summer of 2000

Water Hardness

By Jim Halbeisen
Growers Research Director

As we start another season of foliar feeding, it is important to remind you about water quality and its effect on Growers Nutritional Solutions 10-20-10 (GNS 10-20-10). The number one factor to be concerned with is the calcium and magnesium hardness of the water. This is very important because the calcium in hard water forms a very strong chemical bond with the phosphorus (P) present in Growers, and its resulting white precipitate (the junk in your screens and nozzles) will not dissolve to any extent in water. This precipitate doesn't occur very often, but when it does, two problems arise.

The first is pretty obvious: physical plugging of screens, orifices, and nozzles that can infuriate a farmer to the point where he will probably not want to work with GNS 10-20-10 ever again. Some try to overcome plugging by using larger openings which should allow the precipitate to flow better. This may overcome the plugging, but it still doesn't solve the second, and probably more important, problem.

The second problem is that the calcium in the hard water ties up some of the P in GNS 10-20-10 so that it is not properly used by the plant. Calcium phosphate (the insoluble white precipitate) is not absorbed into plants unless its chemical bond is broken up by a relatively strong acid which would never occur on the surface of a plant leaf and rarely in the soil profile. (This is the reason why it doesn't make sense to use calcium phosphate as a mineral source for an animal where the mineral is not placed into direct contact with the acid of a true stomach.)

To prevent the interaction of the P in GNS 10-20-10 and the calcium in hard water, the calcium must be "tied up" similar to the way ammonium sulfate is used in hard water for the Roundup® products. Ammonium sulfate, however, will not work with GNS 10-20-10 as it does with Roundup®. To neutralize the calcium in hard water for Growers use, we suggest using vinegar, citric acid, or sulfuric acid (battery acid). Some farmers have had success with Shaklee's Basic H® product at 1/4 cup per 55 gallons of water. Also, there are other products used in the vegetable industry for softening hard water that can be used in most cases with GNS 10-20-10.

Do not assume pH indicates the hardness of water. A true hardness test should be used. There are hardness test kits available, or take a water sample to a treatment specialist (such as Culligan). Hardness is expressed as grains of hardness or ppm (parts per million) of hardness. The conversion formula is: Grains of Hardness x 17.4 = ppm of Hardness.

To the right are types and amounts of softening products to be added to the hard water that will be used to dilute GNS 10-20-10.

Make sure the water softening products and the water are put in the spray tank and agitated before adding the GNS 10-20-10.

Another way of avoiding GNS 10-20-10 precipitating in hard water is to mix them in a one to one ratio. But make sure it is 1:1, and the GNS 10-20-10 is put in the spray tank before the water is added.

If there are any doubts about whether the water and Growers will mix, try smaller amounts of each in the intended proportions in a bucket or other container. If the mix stays clear, it should be all right to spray, but if it clouds up (the calcium-phosphate precipitates), then softeners are needed.

If the mix is to be one to one or less (Growers to water) then there should be no problems regardless of how hard the water is, but the Growers must be added to the spray tank first before the water.

Finally, it is our experience that the softer the water, the better the chances are the Growers 10-20-10 will work properly. ■

HARDINESS Grains	HARDINESS PPM	RECOMMENDATION
0 - 5	0 - 87	No softening needed
5 - 25	87 - 435	Vinegar 1 qt. per 200 gal. of water Citric Acid 1/4 lb. per 1,000 gal. of water
25 - 50	435 - 870	Vinegar 1 qt. per 100 gal. of water Citric Acid 1/2 lb. per 1,000 gal. of water
Over 50	Over 870	Sulfuric Acid 2 cups per 400 gal. water

Perennial Peanut Hay

Continued from page 1

earlier, it had been about two hundred bales. And this decreased production and quality hadn't happened overnight. Pete had been asking the local established experts for help and was told to just add higher levels of potash fertilizer and trace elements to each acre. Their standard recommendation for limestone was one ton of dolomite lime and one ton of gypsum per acre per year. Following their recommendations, Pete's crop continued to degrade.

But while he struggled, Pete researched some on his own, and along the line he found data indicating calcium could be a key piece in his production puzzle. His soil testing helped confirm his suspicions. Soil tests from the worst hay field areas showed a lot less calcium than the better areas. So, when Pete went to the Moultrie show, he was pretty well convinced calcium could somehow be part of the solution.

Pete visited 10 or 12 fertility companies at Moultrie, but Growers Minerals got most of his attention. Their emphasis on soil calcium levels and the weight of a one gallon jug of GMS struck a note.

Ed Bulcher and Pete Collins examine high calcium lime in Northern Florida.

(Many times, GMS representatives will have a gallon jug of GMS at farm shows for prospective customers to heft. Trace elements are heavier in weight than nitrogen, phosphorus, and potassium, so when they are present, the density of a solution will be higher. One gallon of GMS solution weighs about 11.4 pounds.)

After detailed discussions with the GMS representatives, Pete was a little nervous about his "out of the box thinking." Yet, with his own calcium research, he knew they almost had to be right when he was told calcium was key to the soil repair process and GMS would complete all his fertility needs.

Pete went back to Live Oak and found a source of high calcium material (33.7% calcium and 0.87% magnesium) that was fine enough and soft enough to breakdown in a short period of time. He began applying it in the fall of 2005 in problem areas and at rates he could evaluate in the future. In 2006 on fields where Pete applied between 15 to 17 tons per acre of the calcium material, he also used about 6 gallons of GMS per acre instead of conventional dry fertilizer.

When we visited Pete in April of 2007, after about 18 months with his being on the Growers Program, we found him well pleased. In walking over his fields, we found his perennial peanut hay roots are pushing down into the soil profile 24 inches. This is significantly deeper than the 4 to 6 inch root depth he had at the beginning of the 2006 season. We also found each plant root had increased its number of nodules tremendously. Pete was particularly impressed these improvements had occurred so quickly, especially in the very dry 2006 year, which, normally, would not have been favorable for dissolving the calcium materials or maximizing the use of GMS. Pete claims all symptoms of herbicide injury, disease, and mineral and nutrient deficiency have disappeared from his perennial peanut hay.

Pete feels the Growers Program has improved production, and it comes with a very significant cost savings. He says his total cost of purchased lime and GMS for the 2006 season was less than one season's dry fertilizer he bought previously.

Pete's perennial peanut hay renovation success has aroused his neighbors' interest who, having similar problems with their fields, had also been searching for solutions. Heading into the 2007 season, Pete is excited about future possibilities. ■

On The Road Again

SUMMER 2007

This summer Growers Nutritional Solutions 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 programs, hear about new developments at Growers or just chat with the folks who make it all happen—your friends and neighbors.

July 17-19, 2007	Michigan Ag Expo East Lansing, MI
Aug. 7-9	Farmfest Redwood Co., MN
Aug. 7-9	Empire Farm Days Seneca Falls, NY
Aug. 14-16	Penna Ag Progress Days Rock Springs, PA
Aug. 28-30	Farm Progress Show Decatur, IL
Sept. 18-20	Ohio Farm Science Review London, OH
Sept. 18-20	Wisconsin Farm Technology Days Green County, WI

Hope To See You!

Glyphosate and Micronutrients

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avoid chemical interactions. (See *The Growers Solution*, Summer 2000, Vol. 13, Issue 3. for dealing with hard water situations.) (See second shaded area.)

3. GMS applied with the glyphosate has helped fight off yield lag, affected by the chelation elements in GMS and confirming what *The Furrow* article suggested be used.

4. Some GMS representatives have clients reduce their glyphosate rates when applying it with GMS, saying it helps keep the spray cost down, although weed species and infestation can influence this decision. Others feel a lighter glyphosate rate is less harsh to the plant environment and will help increase yield. The researchers in "Missing Micronutrients" seem to back up this idea with their discussion on soil microbes and plant exudates.

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SUMMER 2007

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Glyphosate and Micronutrients

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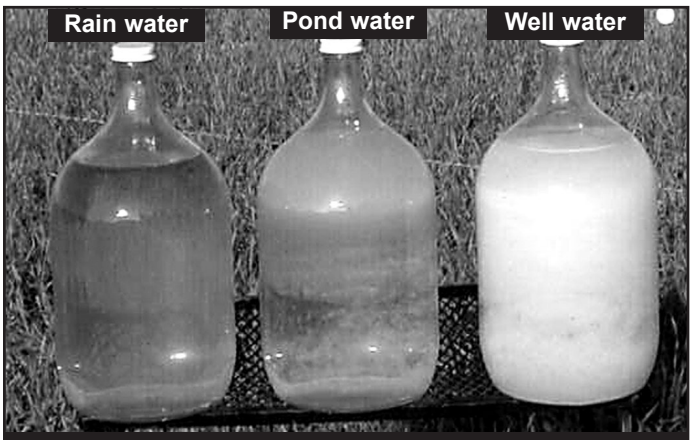
5. Some companies believe glyphosate works better when sprayed during the heat of the day, but our experience does not confirm this thought, especially when used with GMS.

Finally, Don Huber and Barney Gordon suggest manganese deficiencies not only affect soybeans, but also glyphosate resistant corn. And, they contend manganese is not the only micronutrient element affected, but that zinc or iron absorption may also be impaired. Anyone using glyphosate resistant soybean or corn plants for silage or hay can recognize and understand Huber's and Gordon's conclusions. Namely, that manganese deficiencies cause yield reductions in glyphosate soybeans, and in significantly lower manganese concentrations in above ground plant parts. This means it is possible to have lower levels of zinc and manganese in silage and hay crops which would affect the immune systems of the animals consuming them.



3 hours after adding Growers to the water

Many customers have found increased micronutrient levels in their silages and hays after foliage spraying them with GMS as recommended by their Growers representatives.

Foliar spraying GMS might well be the best way to overcome the negatives of glyphosate sprays and their resistant gene insertions.

GMS has usually been recommended to be applied straight, or undiluted, for different reasons, one is that the water used for dilution could have complicating chemistry problems. Likewise, because the water volumes recommended for glyphosate spray coverage, the diluting water quality (hardness) must be considered when GMS is to be included in the spray.

The picture on the left shows how water quality can affect the spray effectiveness of GMS. Each of the three bottles has 10 parts water mixed with 1 part GMS.

The bottle on the left has soft rain water (with dissolved solids readings of 0 - 20 µmhos, or 3 grains or less +/-) mixed with GMS, resulting in practically no nutrient precipitation and making most all the minerals in GMS available to the plants being sprayed.

The center bottle has semi-hard water (dissolved solids of 600 - 650 µmhos, or 12 - 15 grains +/-) mixed with GMS, resulting in some precipitation which indicates some of the minerals in GMS are "tied up," and will not be available to the plants being sprayed.

The right hand bottle has hard water (dissolved solids of 1500 - 1700 µmhos, or 70 - 75 grains +/-) mixed with GMS resulting in significant precipitation. This indicates a large percentage of the GMS's beneficial minerals are "tied up," or not usable, seriously reducing the nutritional benefits intended for the plants being sprayed.

The water in the center and right hand bottles should be treated, acidified, or in someway, neutralized, so that the useful minerals in the GMS do not precipitate. ■

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