

# Growing with ISP

Integrated Solutions for Improved Food Quality  
with Environmental and Economic Sustainability

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## UPCOMING EVENTS

December 5 - 7  
Great Lakes F&V Expo  
Grand Rapids, Michigan

January 11 & 12  
Mid Ohio Grower's Show  
Mt. Hope, Ohio

January 11 - 14  
Southeast F&V Conference  
Savannah, Georgia

Jan. 30 - Feb. 1, 2018  
Mid-Atlantic F&V Con.  
Hershey, Pennsylvania

As many of you may have noticed, we missed the Summer issue of this publication. The only excuse we have is that we probably initiated a few too many projects. Trying to deal with a fairly wide array of stress factors, working with new clientele, and participating in our normal field walks ... well ... the summer raced by. Despite the stress factors, we ended up with some really nice numbers, and several of the projects are discussed in this issue.

In review of this past season, there were several positive things that happened. First, we had the opportunity to greatly enlarge our experience with SiGuard and SiMag 58. Although we did not perform any replicated research projects, we did have quite a few comments from those of you who used the products. Probably one of the best comments was from a nursery in Iowa who used our silicon products to help with insect and disease control. Paraphrasing, he said, "It was pretty much a normal year from insects and disease. I used only SiGuard and SiMag 58 for control of these pressures, no fungicide and no insecticide. Had great control in all respects ... very happy."

I know in my tomato trials I experienced extreme pressure from both aphids and spider mites, as well as some early thrip infestation. I had one row in a late March planted greenhouse, where we compared different tomato varieties. The same project was planted the third week of May in a high tunnel. The balance of both these "houses" were Red Deuce tomatoes being grown and managed as "pesticide-free" by the grower.

Comparing my two rows to the rest of the houses, it was interesting to note the difference in insect pressure. I applied SiMag 58 every week, as I had a visible magnesium deficiency as well. Two of the weeks during the later half of the season I replaced the SiMag with SiGuard, simply because I felt I needed a little stronger application of silicon. Although I had continual pressure, especially from aphids, there was noticeably lower numbers in my two rows than the other untreated rows in the houses. Overall, I was impressed.

Several times I could see the leaf coloration improve from the magnesium in SiMag 58, and in two instances this change took place in less than a day. As stated, I had noticeably fewer aphids, and this became even more noticeable once I realized that in order to establish the silicon "protective shield" it was necessary to cover virtually all of the foliage with the spray. In other words, to really "paint" the plant.

In late September, I also used a new product that we will release this coming season. At this time we call it Insect-X-Citer, and it's comprised of a variety of essential plant oils and surfactants.

Although it was fairly late in the season, I ensured a good spray coverage and the majority of the aphids were actually killed. I never had much of a problem after that particular spray. Insect-X-Citer was also used by a number of our Hutterite growers with good success.



Early aphid population  
on tomato leaf.

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# Achieving Good Insect and Disease Control

With what I experienced this past season, we want to discuss controlling insects and disease. Outstanding control is the culmination of several management decisions. Obviously, the chemistry choice for control (pesticides and/or biocontrol materials) is of the utmost importance, but your decisions do not end there.

You should also consider how your control product works; is it a systemic that moves through most of the plant, a translaminar, which moves only a short distance inside the plant, or simply a contact. If a contact, read your label to determine the amount of time the chemistry is active, as a follow-up application will almost certainly be necessary. Regardless, in all instances, to achieve good control your spray solution must cover most or all of the plant surfaces.

This was a lesson that I learned the hard way this past season when using SIMag 58 and SiGuard as part of my foliar nutrient sprays to help control my extreme aphid pressure. Although I was pleased with the general level of control, it was also apparent that I still had rather high aphid populations. Although it seems obvious now, it took me a little while to realize that I was not really spraying the parts of the plant where the aphids were at, which of course was the underside of the leaves. Once I realized this, I lowered my spray wand and began spraying more from an upward angle rather than from the top and simply letting the spray drift downward on the plant, which is common when applying foliar nutrient. This allowed my spray to hit more of the underside of the leaves, and I did see a noticeable increase in aphid and mite control.

Also of consideration is water quality and how your pesticide will react with your water. It is usually recommended to adjust either water pH or hardness to achieve optimum chemical performance. Torch is an excellent choice for achieving optimum water quality.


The next aspect to consider is the equipment that you're going to use for application. In most instances a fine mist is preferable to larger droplet sizes, but always read your pesticide label as there are some that work better if the droplet size is somewhat larger, if for no other reason than to reduce potential drift. The pressure, or force of the spray, is also important in ensuring good plant surface coverage. As I realized all too clearly, many of our insect pests such as aphids, thrips and mites are usually on the bottom of the leaves, or in other hard to reach areas. If using a contact insecticide, or silicon for plant protection, it is necessary to get these materials where the insects are actually at.

Generally speaking it's necessary to have at least 95 pounds per square inch of spray pressure, and over

100 is better. This level of spray pressure is adequate enough to actually move the plant leaves around as you're spraying, allowing coverage of all areas of the leaf, and inside the leaf canopy. Many of our plant diseases initiate in areas of the plant where air flow is poor and the humidity is somewhat higher than on the outside areas of the plant. Other diseases will often initiate at the lower levels of the plant from soil and rain splash, example being Septoria Leaf Spot, and then move upward resulting in significant leaf loss.

Airblast sprayers that cover many rows in a single pass and boom sprayers that direct pesticides downward seldom provide the level of coverage necessary for trellised tomatoes and staked peppers due to the density of leaves that need to be penetrated. Spray equipment that only applies to the top of plants such as over the row top boom sprayers can be a major factor in allowing pests to get a strong foothold. Even high pressure with lots of water to disperse the active ingredient often leaves major areas of the plant unprotected. Airblast sprayers always look like they are doing this amazing job of plant coverage and are often rated as covering fifty feet or more. While effective for vine crops and tree fruit, or if you're spraying every row, you should still realize that applications made from a spray aisle often leave substantial areas of the plant uncovered on plants in between these spray aisles.

You can check your level of coverage with water sensitive paper strips scattered throughout the plant canopy. Fill your current sprayer with plain water, install the strips throughout the canopy, make a normal application and look for the color changes. These strips are commonly available from agriculture spray equipment suppliers, and the results can be surprising: vine crop growers often discover that they need to slow down, increase pressure, or use more water; or all three. Tomato growers often discover why defoliating diseases such as Septoria Leaf Blight and Early Blight always get ahead of them.

The ideal solution for outside staked tomatoes and peppers is a drop nozzle sprayer. By spraying directly into the canopy from the side and top while using adequate water and pressure, it is much easier to get excellent coverage. The image on the opposite page shows a custom rig at the Penn State University SE Research Farm that simply sprays a single row with multiple spray nozzles. Many growers have built or purchased custom rigs for 2 or more rows. All disease protectant chemistries (fungicides, bactericides) require complete coverage for good control. In fact, all non-systemic plant protectants require 100% coverage to work well. Our silicon products have the same requirement, and I learned the lesson well. 

## Backpack Sprayer Tips; Making This Workhorse Tool Work Better

One of the hardest working tools for vegetable and small fruit growers are our backpack sprayers. Using them to their fullest will undoubtedly make for better produce through less weed pressure and greater insect, mite and disease management. Here are some tips for using these workhorses to their fullest and avoiding potential problems:

1) Have separate sprayers for herbicides. There is no problem in using the same sprayer for insecticides, miticides, fungicides, bactericides and foliar nutrients, but many herbicides are extremely hard to completely remove from sprayers. In many cases low levels measured in parts per million, or even parts per billion, of herbicide residue can do serious harm to sensitive plants like tomatoes. Mark your sprayers well with a weather and solvent resistant marker and remark them as the lettering wears over time. Make sure everyone on your team understands how important keeping these separate is to your success.

2) Consider powered sprayers. Hand pumped backpacks are inexpensive and work well when just doing a tank or two, but they get to be a real workout when the weather is hot and humid, and you've got multiple tanks to apply. Rechargeable battery powered backpacks are light and provide even application over many tanks keeping the operator fresh.

Check the specifications of the battery-powered sprayers as they vary widely. Low pressure (below 60 psi) is fine for herbicide applications, but higher pressure, thus finer droplet size, makes a huge difference in managing insects, mites and diseases. One good choice is a Dramm BP-4 sprayer that develops up to 150 psi (images show difference between a 42 psi and 150 psi



Custom sprayer at the Penn State SE Research Farm, illustrating spraying from multiple angles.

spray stream). Finer droplets at higher pressure can directly translate into better coverage on the lower surfaces of leaves which is where many problems get their start. Gasoline backpacks are great for insect and disease control, but make sure to ventilate your greenhouse or tunnel well during and after application to reduce fuel fumes.



(Photo above illustrates spray pattern and volume at 150 psi. Below illustrates 42 psi. Note also how the upper part of the tomato plant in the upper right is being blown backward.)



3) Select your nozzle carefully. Adjustable cone nozzles come with many sprayers and are great multi-use applicators. However, flat tips are often superior when applying herbicides over large areas or covering lots of leaf area evenly. The dual tips that are shipped with the BP-4 (noted above) produce an impressive 'tornado' effect that does a great job covering a lot of crop quickly and evenly with good lower leaf deposition.

4) Clean your sprayer well immediately after use. This is important and a practice that often gets overlooked on a busy farm. Many materials can clog sprayer pumps and screens if left uncleaned at the end of use. Six ounces of liquid ammonia left in a tank for at least an hour will remove most deposits. (Rinse the tank well three times after use, push some clean water through the lines and

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## Greenhouse Tomato Variety Results

- Gary Shafer, ISP Research

We performed several tomato variety trials this year, in both greenhouse and tunnel conditions. The greenhouse data is shown below. Some of the challenges were described on the front page, and it was not an easy year. Diseases identified included; early blight, septoria leaf spot, botrytis (leaf mold), random sclerotinia (timber rot), random anthracnose, and late blight. Insect pests included some early thrip, the worst aphid numbers I've ever seen, spider mite, brown marmorated stink bug, tomato hornworm, corn ear worm, and grasshoppers. There was also the secondary disease issues stemming from other disease or insect damage. In total, it kind of made you not want to grow tomatoes, but even with these problems the yields were good.

The owner grows "pesticide free" produce, so we were limited as to the materials we could use to offset this pressure, but there was an early application of Pyganic applied once aphids were noticeable. This application did little to reduce the populations, or the spread throughout all the tomatoes. It had been used in the past so there was probably resistance to this chemistry. Aside from that, the primary methods of fighting aphids was introducing predator species.

All other management procedures were consistent across all varieties. Applied nutrient included dry fertilizer applied preplant, fertigation through drip lines and foliar. There were quite visible differences in the vegetative growth characteristics from one variety to another. Some were very aggressive, reaching more than ten feet of growth, while others were much more moderate in their vegetative development. Specific fertility and growth characteristics will be discussed at our winter grower meetings.

Each plot had five tomato plants, which were planted on March 23. It should be noted that the sclerotinia was isolated to one section of the greenhouse. The varieties Red Bounty, Red Morning and Red Deuce showed the highest level of infection, and all of these varieties had at least one plant die before the project terminated on October 8. The project was terminated at that point as the grower wanted to use the house for a fall planting of greens. When terminated, most all of the varieties were still growing and based upon the October weather could probably have finished some additional fruit.

Variety Name	Total Pounds Fruit Picked Per Plant	Average Fruit Weight (grams)	Disease, Pollination, Other Rejects Pounds/Plant	Seconds (< 170 gms.) Pounds/Plant	#1 Fruit (> 170 gms.) Pounds/Plant	% #1 Fruit
Mountain Glory	41.49	208.17	1.51	7.36	32.66	78.62%
Red Defender	54.01	230.23	3.07	5.43	45.51	84.26%
Dixie Red	51.36	249.17	3.45	3.02	44.89	87.40%
Volante	49.10	224.41	2.73	5.25	41.12	83.75%
Grand Marshall	54.22	204.26	6.27	5.80	42.15	77.74%
Scarlet Red	51.69	214.31	1.21	8.62	41.86	80.98%
Rocky Top	42.06	201.65	2.41	6.43	33.22	78.98%
Red Mountain	41.97	173.08	.51	12.69	28.77	68.55%
Mountain Merit	50.65	190.83	1.52	12.21	36.92	72.89%
BHN1021	53.07	180.73	1.40	15.41	36.26	68.32%
XTM2261	52.11	204.66	1.20	9.74	41.17	79.01%
Bella Rosa	44.60	212.03	.63	8.06	35.91	80.52%
XTM1134	38.49	217.18	1.09	6.66	30.74	79.86%
Resolute	41.77	187.59	.66	12.12	28.99	69.40%
Mountain Fresh+	40.22	195.74	1.35	11.03	27.84	69.22%
Red Bounty	27.94	189.17	1.17	7.40	19.37	69.33%
Mountain Majesty	36.54	202.14	.76	8.82	26.96	73.78%
Red Morning	28.78	195.41	.69	7.03	21.06	73.18%
Red Deuce	26.03	229.72	1.53	4.66	19.84	76.22%
Charger	51.63	228.48	3.95	4.57	43.11	83.50%
Skyway	46.83	226.46	3.08	3.70	40.05	85.52%
Cameo	40.27	243.55	3.23	2.10	34.94	86.76%
XTM1135	38.51	212.38	1.16	5.80	31.55	81.93%

There were some significant differences in yield, yet at the same time I would not necessarily rule out any of these varieties for future consideration. As an example, Red Deuce has consistently been a great performer the past several years and is probably the most popular tomato among our clientele. Yet, this year it did not perform well in the greenhouse trial, although it did quite well in the tunnel trial.

Part of your consideration should be your desired fruit size, as many of you want large tomatoes >200 grams. The leaders in fruit size, Cameo and Dixie Red both had fairly high reject numbers primarily due to catfacing. This was also a challenge with Charger.

Scarlet Red, and Red Defender started a little weak, but were without a doubt the strong finishers. Mtn. Glory and Dixie Red also finished strong. All of the varieties had rather poor yield in late August, in part due to the earlier heavy fruit set, coupled with the disease and insect pressure. They all produced beautiful fruit in late September, as well as some of the highest pounds of all the pickings.



Early fruit set, Red Bounty is the variety.

BHN1021 was continually a favorite as to flavor, yet it is designed to grow you a somewhat smaller fruit size. Yet, as with many other aspects of determining desirable varieties, all of them tasted good.

All of the varieties were presented as determinate, yet several could hardly be called that. Grand Marshall, Mountain Merit, BHN1021 and Skyway were all quite vegetative, reaching a final height estimate (up the stakes, down the stakes and into the aisle) of probably close to ten feet. Others were quite well behaved in their growth patterns, examples being Red Deuce and Bella Rosa.

So, if I were to have to judge my top five favorites, based upon this single trial, they would be BHN1021, Mountain Merit, Grand Marshall, Scarlet Red and Skyway. But it's hard to leave out Red Defender and Charger. More in the grower meetings this winter! 🌿

### Red Deuce Foliar Trial, - G. Shafer, ISP Research

Whenever possible, if the situation presents itself, we will establish some form of comparative study. When planting the tomato variety project in the high tunnel, there were three areas that allowed a comparison between foliar and non-foliar in side by side rows. There was the main planting area, and the ends of two rows. (The ends of the rows I used the grower's tomato plants, as the row was not quite completed, and I did not want to split a variety between rows.) All data presented as pounds per plant. 🌿



	Marketable Yield	% #1's
Control 1	25.94	85.89%
Foliar 1	30.43	91.99%
Control 2	11.27	79.79%
Foliar 2	22.33	85.88%
Control 3	10.13	69.12%
Foliar 3	23.34	78.58%
Control Average	15.78	78.30%
Foliar Average	25.37	85.48%



from start ...



... to finish



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# Specialty Potatoes, and the Growing Market Potential

- Gary Shafer, Research Director

Two years ago we attended the national Potato Expo in Orlando, Florida and was a little surprised by the vast numbers of potato varieties. There was a range of flesh and skin colors, white, red, gold, blue, purple; and all of the varied possibilities of shape and size. About the same time, I began noticing that many of the “upscale” chefs and restaurants were using the colored and fingerling potatoes in their recipes.

In addition to supervising annual research projects for ISP, I’m also continually looking for new market opportunities for our growers, especially those limited for growing space and needing a high income off of every acre. I’m convinced that these specialty potatoes have that potential.

This past season, we were able to put in a small project simply to learn more how several varieties grow, what yield potential might be, and how to progress further in developing a program to enhance potential yield. Varieties included Pinto Gold, a new 2017 release from the University of Maine (photo at right); French Fingerling, a red fingerling; Russian Banana, a gold fingerling; and Magic Molly, which was offered as a purple fingerling, but seemed to simply be a larger purple potato.

All varieties with the exception of the Russian Banana showed a significant increase in the computed cwt per acre. All data is an average of three reps except for Magic Molly with only one rep.



**Procedure:** We divided seed pieces into approximately equal numbers in order to have both “control” and “treated” plots. Treatment included on a “per acre basis”, 12 ounces MetaboliK HV-1, 64 ounces PhytoGro Xtra (applied as a soak over the row at planting), and three foliar applications of 4-18-38 at a rate of 5 pounds. (This foliar rate is less than what would usually be recommended, but we were simply using the foliar solution left over from the tomato projects). This project was next to onions, and all the plots received the same nutrient as the onions. This included dry preplant based upon soil analysis, 2 small rates of 28% N (May and June), and several July applications of 5-25-25.



**Conclusions:** Based upon the observations and yields that were achieved this season, we believe that there is certainly a positive potential of growing specialty potatoes. Even though there is probably not a market outlet for thousands of acres at this point, there is potential for many of you. At the Expo I was told that many of the fingerling potatoes could produce yields of up to 450 cwt per acre, and we came very close to that in our trials.

Recently I was at a local grocery and as I usually do, I was prowling through the produce section seeing what might be new. I found fingerling potatoes, which was somewhat unusual, and they were retailing for \$1.57 per pound. Assuming a yield of 40,000 pounds per acre (400 cwt), and a wholesale price of perhaps \$.60 per pound, this equates to potential income of \$24,000 per acre.

This is less than some of our other produce crops such as tomatoes and peppers, but there is also a significant labor difference. Tomatoes require intensive management and picking at least once per week, lasting several months during the season. The demand for specialty potatoes is growing (especially in the gourmet markets); can be easily grown; and offers a good amount of income per acre. 🌿

	Ave # Tubers/Plant	Ave Tuber Weight (gms)	Yield/Acre cwt.
French Fingerling			
Control	17.57	65.83	346.46
Treated	20.43	63.37	402.45
Russian Banana			
Control	19.24	54.36	254.33
Treated	17.58	50.67	245.98
Pinto Gold			
Control	16.71	69.50	329.30
Treated	17.89	69.37	422.30
Magic Molly			
Control	8.86	77.16	306.49
Treated	11.29	77.45	392.11

### **Backpack Sprayers, continued from page 3:**

nozzle(s), clean the nozzle screens, then fill with water and ammonia and let sit. Drain, then flush with clean water and the sprayer is ready to use or store. There are also commercial tank cleaners, and it should probably be mentioned that any of our plant foods are extremely effective at cleaning chemical residues from poly or plastic spray tanks. There have been several instances where this has been a problem with larger and older agricultural spray equipment.)

5) Keep the fill screen/strainer basket in place. It's there for a reason, and will be valuable for avoiding clogged nozzle tips.

6) Take the time to calibrate your sprayer(s). There are many ways to do this, but in general, you will be filling the sprayer with a known amount of water and seeing how far it goes, then doing the math for a full application. Everyone carries their sprayer wand differently and walks at different speeds, so it's worth the time to get this right. Here again, a powered sprayer eliminates the variable of the pressure changing during application. Certain materials such as glyphosate, foliar nutrients (ISP plant foods, silicon, biostimulants), and insecticidal soaps (Insect-X-Citer) rates are based on percentage of, or amount of material in solution. This eliminates the calibration step as the operator only needs to watch for good coverage.

7) Use the right PPE. Rubber boots, rubber gloves and goggles are a must as it is nearly impossible to do a good application without getting some material on you. Read the label(s) carefully and follow the recommendations for using the right protective equipment. When working in tight conditions such as a greenhouse or tunnel, a Tyvek suit will keep just applied surfaces from soaking skin. Thin plastic raincoats are also excellent for keeping tank solution from getting on you.

8) Winter / off-season care. As growers, we often tend to think more about repairs and maintenance to tractors and related equipment. Taking the time to go over every backpack in preparation for the next season will make for an easier spring when we begin using our sprayers again. Most manufacturers have good information for getting parts. Replacing hand grips, shoulder straps and looking for other wear areas will go a long way to reducing startup frustrations. Gasoline backpacks should either be drained, run until empty, or have fuel stabilizer added to their tanks per the manufacturers recommendations.

9) SUMMATION - Take care of your backpack. Use the right backpack for the job. Have dedicated backpacks for herbicides only. Clean your backpack well between uses and storage, and replace parts as needed. This is a valuable tool and should give you years of service. 🌿

## **Continuing To Grow With Blueberries**

Last year we were involved with a small blueberry trial in Michigan, and saw good results. We had the largest yield increase of all the companies in the trial, plus a noticeable increase in berry firmness. This year, additional growers successfully used CalStore to achieve firmer berries. The comments we heard were quite encouraging.

This coming season we will be even more involved with blueberries as we begin a multi-year study comparing our blueberry program to a control area. We will monitor bush development, berry set (abortion), berry size, fruit firmness, and economics. We will also monitor fruit loss from spotted wing drosophila (SWD).

There has been some research indicating that the female SWD prefers to lay her eggs in softer fruit. Increasing fruit firmness earlier in the season resulted in a reduction of fruit loss. There is no question we can provide a firmer berry.

We will also begin a multi-year project studying the growth characteristics of 24 to 26 new varieties of blueberries (many not even released yet) in order to make specific recommendations for each variety. It's important to understand growth and fruiting characteristics of any specific variety. Once better understood, one can then enhance positive traits, and make better management decisions to cover weaknesses. (This is why we perform so many variety trials with tomatoes, peppers and other crops. Aside from the breeders themselves, we probably know the strengths and weaknesses of most commonly grown varieties better than anyone in the field).

### ***Blackberries in southern Indiana ... very good results!***



- from page 1) Another very interesting observation, which we will add to the list of positive items to come from the work this season, is illustrated in these three photos from the high tunnel tomato project. Late blight showed up in early September, and the center photo shows the aisle between my variety trial (right half of the photo) and the grower's tomatoes (left side). As was mentioned, I was applying foliar nutrient and silicon at least once per week.

The variety in the forefront of the left row (my trial) is Red Deuce, as is all of the grower's tomatoes in the left row. Although we can't make a definitive statement as to why late blight affected the non-foliar tomatoes as negatively as it did, and was only showing slight damage on ours, it's obvious that there is a significant difference. Perhaps it was the silicon that was part of the foliar applications; perhaps it was simply that the foliar treated plants had more "energy" and was not as susceptible to the disease. Regardless of the reasons why, this was a contributing factor as to why the Red Deuce tomatoes in our row significantly out yielded what I refer to as the control (Red Deuce with no foliar). (This data is listed on page 5.)

It will be interesting to do further research on this, and visit with pathologists as to their thoughts. No doubt they can add some interesting insight. 🌿



(Top: Red Deuce foliar treated)

(Below: Red Deuce no foliar)



## Comparison of Delgado Onions: Foliar to No Foliar Applications

Although we did not have an onion variety trial this past season, we did have one small onion project where we took a grower's onions and applied three foliar applications. Each foliar consisted of 5 pounds/acre 4-18-38. The onions were planted with four lines per bed, with dual drip lines per bed. These foliar applications were all in one bed, and it alternated "control - foliar - control - foliar - control - foliar". Just prior to harvest the middle of each treatment was estimated and a total of six consecutive onions were pulled from both the outside and a middle line (row).

The 72 non-foliar onions had a harvest weight of 20,711.50 grams, the 72 foliar onions weighed a total of 22,110.50 gms, for a 6.75% increase in harvest weight. Harvest was delayed somewhat due to rain, and there was a small amount of slippery skin present. The control had 5.56% bulbs infected, the foliar having 2.78% infection. Taking out the diseased bulbs, the foliar treated onions had a 9.90% increase.

Average bulb weight was obviously increased as the number of bulbs being harvested was equal. What was somewhat interesting was that the onions from the middle row had a greater percentage increase than those on the outside row. The bulbs on the outside had a larger average bulb size, perhaps due to either less competition from neighboring onions, or perhaps an increase in available sunshine. A drip line was between the two lines, so any nutrient applied through drip lines should have been equal. This is somewhat of an indication that the onions from the middles benefited more from foliar applied nutrient than the onions from the outside row. This is consistent with earlier projects where foliar results increased, as a percentage, in higher stress situations.



Harvested Delgado onions, control on left, foliar at right.

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