

# Growing with ISP

#2

Summer  
2016

Integrated Solutions for Improved Food Quality  
with Environmental and Economic Sustainability

LATE SUMMER 2016  
Integrated Soil & Plant Technologies, Inc.

[www.isptech.com](http://www.isptech.com)

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## UPCOMING EVENTS

September 26, 6:00 PM

Blackberry Meeting

Nappanee, IN

Call Brian Dinlinger for info  
937-313-3378

October 27, 2016

Cushman Creek Dealer

Meeting, White Cloud, MI

## Start thinking now about your fall check list

- Gary Shafer and Leon Hershberger

As this summer season begins to draw to a close, it's not too early to begin plans for the 2017 growing season. We've prepared a possible list of management practices for you to think about, but before we get into the list, we would like to relate a little story first. We first read this about 30 years ago, but recently saw it again on the FastCompany.com website.

"By 1918, Charles M. Schwab was one of the richest men in the world. Schwab was the president of the Bethlehem Steel Corporation, the largest shipbuilder and the second-largest steel producer in the U.S. at the time. Thomas Edison once referred to Schwab as the "master hustler." He was constantly seeking an edge over the competition.

Accounts differ as to the date, but according to historian Scott M. Cutlip, it was one day in 1918 that Schwab—in his quest to increase the efficiency of his team and discover better ways to get things done—arranged a meeting with a highly respected productivity consultant named Ivy Lee.

Lee was a successful businessman in his own right and is widely remembered as a pioneer in the field of public relations. As the story goes, Schwab brought Lee into his office and said, "Show me a way to get more things done."

"Give me 15 minutes with each of your executives," Lee replied. "How much will it cost me?" Schwab asked. "Nothing," Lee said. "Unless it works. After three months, you can send me a check for whatever you feel it's worth to you."

### THE IVY LEE METHOD

During his 15 minutes with each executive, Lee explained his simple method for achieving peak productivity:

*At the end of each day, write down the six most important things you need to accomplish tomorrow. Do not write down more than six tasks.*

*Prioritize those six items in order of their true importance.*

*When you arrive tomorrow, concentrate only on the first task. Work until the first task is finished before moving on to the second task.*

*Approach the rest of your list in the same fashion. At the end of the day, move any unfinished items to a new list of six tasks for the following day.*

*Repeat this process every working day.*

The strategy sounded simple, but Schwab and his executive team at Bethlehem Steel gave it a try. After three months, Schwab was so delighted with the progress his company had made that he called Lee into his office and wrote him a check for \$25,000. A \$25,000 check written in 1918 is the equivalent of a \$400,000 check in 2015."

So how does this relate to our own endeavors? Simple ... lists work! They help us remember  
*continued on page 3*

# Managing Early Blight and Septoria Leaf Spot

- Steve Bogash, Vegetable Crop Advisor

Early Blight and Septoria Leaf Spot are an annual occurrence in tomato fields, greenhouses, and high tunnels. ISP staff, dealer reps, and field consultants all report high levels of this disease. The high heat and low rainfall earlier this season somewhat slowed these diseases, but the return of rains coupled with lower nighttime temperatures has fired these diseases up. In addition, we are now in the typical summer weather cycle of thunderstorms followed by high humidity that enables and accelerates transmission across the field. Managing these two diseases requires careful attention and timely applications of fungicides. Fortunately, one set of practices and fungicides will manage both diseases and greatly reduce the threat of most other tomato fungal and bacterial diseases.

Both diseases overwinter on plant debris leftover from the prior season. Therefore, begin with a good rotation scheme, so that last years' decaying plant debris is not in the same field as your crop. In a high tunnel or greenhouse, completely remove as much tomato plant and roots as possible at the end of the season, then till the soil thoroughly. Apply ReStore 3G to encourage beneficial microbes and to refresh the soil. The application of a root zone applied biological such as Actinovate, RootShield Plus, or Terra Grow is recommended at planting. Starting a disease management program as soon as possible after transplanting or once the first infection is spotted is very important in slowing the spread of these diseases within a field.



Above: Septoria Leaf Spot

Right: Early Blight



One new tool that ISP Technologies has brought to growers is silicon heavy specialty nutrients. Silicon is not considered a necessary plant nutrient like nitrogen, phosphorus, potassium, copper, iron, calcium, magnesium, etc., but is highly important in creating strong plants that resist lodging. In addition, research done at Rutgers University indicates that increasing plant available silicon directly improves the management of plant diseases such as Powdery Mildew. Silicon in the nutrient stream makes its way to plant cell walls where it makes them better able to resist germinating fungal spores' ability to penetrate into plant tissue and cause disease. Silicon has also been noted to assist plants in resisting insect damage and cope with environmental stresses such as high salts.

ISP Technologies has two products that make the application of silicon just another part of plant nutrition and pest management. SiMag58 is ideal when dealing with magnesium deficiencies which are very common in fruiting plants such as tomatoes, peppers, cantaloupes and watermelons. Its' got highly available EDTA chelated magnesium along with the maximum dose of potassium silicate. The rate for this material is 1-2 teaspoons per gallon foliarly every 7 - 10 days or 8 - 16 oz per acre per week through the drip. SiGuard is 84% available silicon so it is primarily designed to boost pest management. Apply SiGuard at 1 teaspoon per gallon foliarly. Both materials should be compatible with your current spray program and can be tank mixed with other pest management materials. Always do a jar test prior to using any new tank mix.

**Basic Early Blight / Septoria Leaf Spot program:** Either Regalia, or chlorothalonil (Bravo), or Mancozeb, plus a 'leaf spot' specific material such as: Aprovia Top (3+7), Cabrio (11), Endura (7), Flint (11), Fontelis (7), Inspire Super (3+9), Priaxor (7+11), Quadris Top (3+11), or Tanos 11+27), plus SiGuard or SiMag58. Be sure to rotate the leaf spot specific materials by FRAC code (the number after each material) to reduce the chances for fungicide resistance. Both Gavel and Zing are newer protectants that already contain mancozeb. Due to the long PHI of mancozeb (5 days), it and materials containing it are best used early in the season prior to the onset of harvest. Apply these materials every 7 days. Rotating or making an extra application of Metabolik HV-1, a biostimulant, plus a copper such as Badge or Kocide every 10-14 days will greatly boost the efficacy of any disease management program.

**Biologically-based Early Blight/ Septoria Leaf Spot program:** Begin by planning on making spray applications every 5 days. Apply Regalia with copper, then 5 days later, apply Actinovate, the 5 days later apply a biostimulant such as Metabolik HV-1 along with Cease or Companion. Begin at planting and continue all season and include SiMag58 or SiGuard with each application. Boosting this program with fertigation applied biologicals will greatly boost the efficacy of this program. Inject Regalia alternated with Terra Grow, or Actinovate, or RootShield Plus, every other week.

**Important note:** With all of the recommendations above, read the label thoroughly before making any application. Specific varieties may be sensitive to certain fungicides and any new tank mix should be both jar tested and applied to a small portion of the field prior to complete crop application.

*continued from page 1:*

what we need to do each day ... the really important activities. As humans we all have a tendency for certain “not-so-positive” habits, and when it comes to productivity, two of the worst is procrastination and being easily distracted from important tasks.

This second is especially insidious in that we can tell ourselves how busy we were all day, and perhaps we were ... but just not busy doing anything important.

So, as we come into fall there are several items to put on your checklist to get ready for this next season.

**1-Get your soil analysis:** We discussed the proper method of collecting a soil analysis in the Spring issue of this newsletter, and want to reiterate once again that collection of your soil samples and recording where you sampled is of utmost importance. This is an important tool in your fertility management program, and should not be performed in a haphazard manner. This information is also available on the ISP website.

We are often asked if a soil analysis should be taken every year, and in a high value area such as a high tunnel or greenhouse this is perhaps a good idea. In other areas such as fields for row crops, or other crops of lesser value, then every two or three years is often sufficient. An analysis is also recommended if major soil adjustments such as liming have been performed.

There are a number of good labs to perform the actual analysis, and most all will provide fertility recommendations for a small additional charge. All of the ISP Distributors will also provide fertility recommendations based upon our approach for improvement of soil productive potential. Two labs that we often use are Midwest Labs, Omaha, NE, and the A&L Labs, which have several locations across the U.S.

When choosing which lab to work with, make sure they offer a complete analysis of all of the recognized trace minerals (zinc, manganese, iron, copper and boron), as well as a Percent Base Saturation of cationic nutrients.

**2 - Soil Amendments:** Once you receive your recommendations, the fall is the best time to apply major soil amendments such as lime or gypsum, as well as animal manures, compost, or other materials such as green sand. If applying manures, it is important to have it analyzed as well, in order to determine the nutrient value of what you’re applying. If utilizing “green” plow-downs, it is also beneficial to apply a small amount of nitrogen to aid with decomposition. This nitrogen is usually not lost, and will release during the spring.

**3 - ReStore 3G:** ReStore 3G is recommended at a rate of three gallons per acre (8.82 ounces per 1,000 square feet.

ReStore 3G is particularly beneficial in “covered” growing environments where we grow high value crops, and will often grow the same crop (tomatoes) year after year. It has also shown strong benefits with row crops in fields or soils that indicate soil biology issues. See the accompanying article on 3G in this newsletter for more information, but it’s a strong choice for refreshing your soil.

**4 - Deep Tillage:** Perhaps the only situation worse than too little water when growing crops is too much water. Oxygen is essential in maintaining beneficial soil microbial activity. In areas of a field where soils are either shallow due to underlying compaction, or even in lower areas of a field where water tends to collect, excess water will quickly create an anaerobic situation (lacking oxygen), which tends to bring on an array of pathogenic organisms resulting in root diseases and perhaps even plant death.

In addition, the reduction in beneficial microbial activity has a strongly negative effect on nutrient availability, as microbes are paramount in how nutrients become available for plant uptake. Proper drainage is also important in allowing a soil to “flush” excessive nutrients and fertilizer salts below the root zone.

We have often stated that in years of excess or deficient moisture, one should carefully study their crops. Make notes where the crop shows stress. Take a penetrometer, or even a metal rod and push it into the ground. The depth to which you can insert the rod is about the same depth that plant roots will be able to penetrate.

Compaction is a major factor in inhibiting crop yield, and fall is an excellent time to incorporate deep tillage if necessary. One might even need to consider drainage tile in fields where the topography indicates water collection.

**5 - Plant a Cover Crop:** The data supporting the benefits of having a cover crop is very strong, and it has long been our opinion that it’s very positive to have something growing in your fields if weather permits. This encourages soil life as it provides a food source for soil microbes, thus increasing potential nutrient availability for future crops. It also aids with adding organic matter in your soil, which will certainly aid in building soil productive potential.

There are many choices for cover crops, although late fall planting limits your options somewhat. Cereal rye or oats can be planted late, and still achieve a respectable stand, and although perhaps not the best choice it is much better than nothing.

With all of these suggestions, your goal is to improve your soil’s productive potential. Crop yield is a combination of a wide variety of factors, some of which we can’t control. Others we can impact in a positive manner, and in all instances it makes sense to continue building your soil. It pays off in many ways.



# Making Some Sense on the “Final” Rule on Food Safety

Steve Bogash, Vegetable Crop Advisor / Researcher

The produce safety rule(s) on food safety are now finalized. These rules are part of the much larger Food Safety Modernization Act (FSMA). They affect everyone who grows, ships, processes, packages, and sells food and food products. While many smaller growers are exempt from compliance with these rules, that does not remove these same growers from following proper practices to reduce the chance of food-borne illnesses. Much of this article is summarized from the FDA Food Safety article: Key Requirements: Final Rule on Produce Safety. Every produce grower should read this 7 page article.

## Water Quality

The water quality standards are based heavily on an active water testing program and the presence of generic E. coli bacteria. No detectable (zero level by water testing at an accredited laboratory) is allowed in agricultural water used for: hand washing, cleaning food contact surfaces, water that contacts food, water to make ice, and water used to irrigate sprouts. If any E. coli is detected in sources used for any of these purposes, then proper treatment or a change of water source is immediately required.

For water that is used for irrigation and pesticide spray applications, the levels have been set at two interrelated levels; the GM (geometric mean) and STV (statistical threshold value). Think of the GM as the average E. coli level in a given water source. That level is 126 colony forming units (CFU) in a 100 ml water sample. The STV level was created due to the high variability in water sources during the growing season in response to weather events and shifts in water levels in aquifers. That level is 410 CFU. These levels were set to provide growers, consultants and regulators measurable values to use in managing water sources.

If your water source test above the levels described in the paragraph above, then there are 3 methods to reduce E. coli levels in order to safely sell your produce: Water treatment, washing produce with water that meets the current standard, and allowing time for dangerous microbes to die off after the last application of water that exceeds current levels.

## Water Testing

This is probably going to be the heaviest burden on produce growers as the water testing protocols are fairly intense.

- For farms that are using untreated surface water, the requirement is for a survey of 20 samples collected near harvest over 2 to 4 years. These samples will be used to develop a given farms GM and STV. Then, 5 samples must be collected every year to update those calculations.

- For untreated ground water sources, they call for an initial survey of 4 samples collected in one year near harvest, then one sample per year to update those calculations.

- Untreated groundwater that is used for handwashing, on food handling surfaces, for making ice and in other places where zero E. coli is allowed must be tested 4 times in the first year, then once annually unless that annual test indicates any E. coli.

- Public water and water that is treated per these “rules treatment requirements” are not required to be tested so long as those sources meet relevant requirements.

## Raw Manure Use

Farmers must apply raw manure to fields at least 120 days before that crop is harvested for crops that are not in contact with the soil. So, crops such as greens and herbs fall under this 120 day requirement.

The second part of this rule covers crops such as: trellised tomatoes, peppers, eggplant, and sweet corn where the edible portion does not come into ground contact. Here the interval between application and harvest is 90 days.

## Stabilized Compost

Microbial standards have been set for biological soil amendments and manure that has been composted completely. Those making such stabilized amendments need to follow those guidelines. Any application of such materials must be done in such a way as to minimize the chance for contact with produce at all times.

## Sprouts

Simply put, sprouts are considered to be dangerous under this rule. There is just no other way to interpret these new regulations. Sprout seeds must be tested, water used to irrigate sprouts must be tested and the final product (sprouts) must be tested. All must be found free of dangerous microbes.

Due to the intensive testing regimen and time requirements to grow and safely sell sprouts while they are still in saleable condition, it is hard to see how to produce sprouts for sale without an on-site laboratory. It is very hard to see how small sprout producers can survive and still comply.

## Domesticated and Wild Animals

This area of the rule has been much discussed and it looks like commonsense has prevailed. If animals are used in the production of produce such as horses or mules used to spray, cultivate and pull harvest wagons, farmers are required to take all measures reasonable to prevent contamination of produce by livestock. If contamination is noticed, and farmers are required to inspect their fields, then those areas should be marked. Farmers are not required to exclude wild animals from production areas, destroy habitat, clear borders or drainage areas.

## Worker Training, Health and Hygiene

Requirements include:

- Keeping ill or infected workers from handling food or coming into contact with food contact surfaces.
- Having all food handling workers trained and in compliance with proper hand washing practices.
- Preventing farm visitors from contaminating food and food contact surfaces.
- All farm workers and their supervisors that handle food, apply pesticides, and the like must be trained in health and hygiene.

## Equipment, Tools and Buildings

Standards are now in place for equipment, tools and structures that relate to food production and handling. Greenhouse, germination chambers, packing areas, toilets, and handwashing facilities all have published specifications. Maintenance of these facilities is part of these specifications.

## Exemptions

- The current rule does not apply to processed produce, only to raw produce. Your local health department of Department of Agriculture can provide you with the rules for processed produce products.
- Commodities that are rarely consumed raw such as asparagus, black beans, kidney beans, lima beans, navy beans and similar beans, garden beets, eggplant, sweet corn, okra, potatoes, pumpkins, winter squash, sweet potatoes and peanuts are exempted as proper cooking should kill any pathogens.
- Food grains for the same reason as above.
- Produce for personal or on-farm consumption.
- Economic exemptions: 1) Farms with produce sales of less than an average of \$25,000 over the past 3 years. 2) Farms with total food sales of less than \$500,000 per year over the prior 3 years. And, 3) Farms that sell produce to be processed in such a way to reduce or eliminate any pathogens (such as squash for pumpkin pie).

Even though you may be exempt, being exempt from these regulations does not free growers from their responsibility to grow and sell only safe produce. Not only can the FDA remove an exemption due to food safety investigations and their responsibility to protect public health, but farmers are not protected from liability in the case of food-borne illnesses if they are exempt.

It is highly recommended that every farm practice good food safety throughout their operation.

- Know your water sources and test regularly for the presence of E. coli. Treat if necessary to reduce the potential for contamination from these sources.
- Everyone that handles produce in any way should receive training in proper practices, health and personal hygiene.

- When renovating or rebuilding packing, production and storage areas be sure to build them in compliance with the latest standards as it is always easier and less expensive to do these right the first time.

- Regularly attend food safety trainings to stay current. There is ongoing research into manure and manure handling that will impact future regulations.

## Summary

These new rules are complex, but compliance is not an insurmountable hurdle. Learning about them and implementing them into your regular production practices will not only make you a safer grower, but will also help to avoid food safety related legal entanglements.



Bejo Seed 2016 Open House and Field Trials, 2016, Geneva, NY. We enjoyed a wonderful day looking at new varieties, and visitation.



# Managing Downy Mildew & Powdery Mildew

Steve Bogash, Vegetable Crop Advisor / Researcher

Downy Mildew on cantaloupes and winter squash (butter-nuts and acorn) has been confirmed throughout much of the Northern United States. In addition, we are now in the typical summer weather cycle of thunderstorms followed by high humidity that encourages Powdery Mildew on cucurbits and eventually field and tunnel peppers and tomatoes. Managing these two very different diseases requires careful attention and timely applications of fungicides.

One new tool that ISP Technologies has brought to growers are silicon heavy specialty nutrients. Silicon is not considered a necessary plant nutrient like nitrogen, phosphorus, potassium, copper, iron, calcium, magnesium..., but is highly important in creating strong plants that resist lodging. In addition, research done at Rutgers University indicates that increasing plant available silicon directly improves the management of plant diseases such as Powdery Mildew. Silicon in the nutrient stream makes its way to plant cell walls where it makes them better able to resist germinating fungal spores' ability to penetrate into plant tissue and cause disease. Si has also been noted to assist plants in resisting insect damage and cope with environmental stresses such as high salts.

ISP Technologies has two products that make the application of silicon just another part of plant nutrition and pest management. SiMag58 is ideal when dealing with magnesium deficiencies which are very common in fruiting plants such as tomatoes, peppers, cantaloupes and watermelons. Its' got highly available EDTA chelated magnesium along with the maximum dose of potassium silicate. The rate for this material is 1-2 teaspoons per gallon foliarly every 7-10 days or 8-16 oz per acre per week through the drip. SiGuard is 84% available silicon so it is primarily designed to boost pest management. Apply SiGuard at 1 tsp. per gallon foliarly.

Both materials should be compatible with your current spray program and can be tank mixed with other pest management materials. Always do a jar test prior to using any new tank mix.

## Basic Downy Mildew (DM) management program:

Either Regalia, or chlorothalonil (Bravo), or Mancozeb, plus a DM specific material such as: Ranman, Previcur Flex, Zampro, Tanos, Curzate, Zing (already has chlorothalonil), Forum, Gavel, Presidio or Ariston, plus SiGuard or SiMag58.

## Basic Powdery Mildew (PM) management program:

Either Regalia, or chlorothalonil, plus a PM specific material such as: Quintec, Torino, Proline, Procure, Rally, tebuconazole, Inspire Super, or Aprovia Top, plus SiGuard or SiMag58.

Important note: With all of the recommendations above, read the label thoroughly before making any application. Specific varieties may be sensitive to certain fungicides and any new tank mix should be both jar tested and applied to a small portion of the field prior to complete crop application.

# ReStore 3G - For Your Soil

Gary Shafer, Research and Field Service

ReStore 3G offers an array of benefits, all of which work to perform exactly what the product name implies ... to aid in restoring, or improving, soil vitality. It contains high levels of both humic and fulvic acids, bio-ferments, carbohydrates, penetrants, and fungal extracts including an assortment of dormant CFU's (colony forming units) of beneficial fungal species. It is recommended to be applied at a rate of 3 gallons per acre, and is particularly effective for preparing your soil for winter.

We included this application as part of the "Fall Check-List". Once the product is activated by coming into contact with soil, it begins to perform several key functions including not only the addition of beneficial fungal species, but also providing an immediate food source for these organisms as well. Most of our crop production soils tend to be more bacterial than fungal. While this is somewhat desirable and natural, increasing the ratio of fungi to bacteria will produce many benefits.

Fungi are microscopic cells that usually grow as long threads or strands called hyphae, which push their way between soil particles, roots, and rocks. Hyphae are usually only several thousandths of an inch (a few micrometers) in diameter. A single hyphae can span in length from a few cells to many yards. A few fungi, such as yeast, are single cells.

Hyphae sometimes group into masses called mycelium or thick, cord-like "rhizomorphs" that look like roots. Fungal fruiting structures (mushrooms) are made of hyphal strands, spores, and some special structures like gills on which spores form. A single individual fungus can include many fruiting bodies scattered across an area as large as a baseball diamond.

Fungi perform important services related to water dynamics, nutrient cycling, and disease suppression. Along with bacteria, fungi are important as decomposers in the soil food web. They convert hard-to-digest organic material into forms that other organisms can use. Fungal hyphae physically bind soil particles together, creating stable aggregates that help increase water infiltration and soil water holding capacity.

According to numerous sources discussing soil biology, soil fungi is classified into three primary groups: **Decomposers:** saprophytic fungi – convert dead organic material into fungal biomass, carbon dioxide (CO<sub>2</sub>), and small molecules, such as organic acids. These fungi generally use complex substrates, such as the cellulose and lignin, in wood, and are essential in decomposing the carbon ring structures in some pollutants. A few fungi are called "sugar fungi" because they use the same

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# Fall Fertilization for June-bearing Strawberries

- Gary Shafer & Steve Bogash

There are two important goals for optimum strawberry production, the first is setting a high fruit load potential, and the second is harvesting the maximum amount of the potential fruit set ... maintaining both fruit size and flavor. June bearing strawberries set next year's fruiting potential in the late summer and early fall. In addition, since early vigor during spring regrowth is essential for fulfilling the fruit potential and growing high quality berries, we must have a plant that goes into winter dormancy with high levels of nutrient and energy. (Everbearing and day neutral berries continually set fruit and are fertilized differently.)

In replicated trials this past season we've seen that strawberries respond very strongly to MetaboliK HV-1. We recommend 16 ounces per acre be applied either pre-plant or post planting. This can be applied in a variety of ways, although through the drip is probably the easiest. If you have second year berries, we apply 16 ounces per acre in both spring and fall.

Plasticulture production of strawberries is becoming more common, using plugs perhaps more so than bare root. Somewhat depending upon your location, planting may range from late July to mid-August. This offers a six to eight week window where the plants have to vegetate, increase crown numbers and initiate fruit ... all within this rather short time frame prior to dormancy. Plant available nutrient supplied through fertigation increases your chances of success tremendously. Most of the comments concerning application of ISP plant foods is somewhat specific for plasticulture production, and is given on a "per acre" basis.

Concerning dry fertilizer applications, general information indicates a recommendation of 1/2 pound of a balanced 10-10-10 be applied per 100 square feet either preplant or following renovation. This equates to about 200 lbs per acre of fertilizer material, or the equivalent of 20 lbs. of actual nitrogen, phosphorus and potassium. Although okay from a general fertility standpoint, we don't totally agree that this is all that's necessary. We believe that there should be higher levels of nitrogen to build an aggressive frame, and more timely application of mineral nutrient to initiate and finish fruit. It is our belief that N should be applied following either renovation of your existing bed, or shortly after planting a new bed.

Nitrogen is of utmost importance in developing the vegetative frame, in both number and size of leaves, in order to capture a maximum amount of light. Or put another way, to maximize the potential of energy (sunlight) capture. In building the frame we are also increasing the number of crowns, where fruit is actually initiated. Discussing nitrogen, it takes from 40 to 60 units of nitrogen to grow the proper frame, and from our experience the variety Chandler will respond to even more, particularly at the northern edge of their growing zone. Approximately 20 units per acre of the major nutrients was supplied from the 10-10-10, which leaves us deficient at least 20 units of N, and probably more. Phosphorus, and certainly potassium, will also be deficient as initiating and/or setting fruit is primarily a mineral and energy function. Adequate P and K is important ... secondary and trace minerals as well.

From about mid-August to mid-October nitrogen should be fertigated at 3.5 - 6 pounds per week depending on your harvest goals and planting quality. A combination of ISP 28-16-7 and 10-20-20 (or 9-14-24) with micros is the ideal nutrient formula to provide not only nitrogen, but all other necessary nutrients as well, and this program is geared to reach our goal of 60 units of nitrogen.



Assume one acre using a split application of 28-16-7 and 10-20-20 to provide .75 of N per acre per day. Splitting the .75 pounds/per day nitrogen target between the two products would equal .375 pounds of nitrogen to come from each. Performing the math -  $.375/.28 = 1.34$  pounds of 28-16-7 per day; and  $.375/.10 = 3.75$  pounds of 10-20-20 per day. Again this is based upon a "per acre" basis. For smaller plantings simply multiply the 1.34 pounds of 28-16-7 and 3.75 pounds of 10-20-20 by the fraction of an acre of your planting. Fertigation does not need to be done daily, and best results are obtained by splitting nutrient applications between two to three applications per week.

Stop feeding by mid-October, or about a month prior to covering, to allow the plants time to slow continuing growth and go dormant before winter. About a month before average dormancy date, apply 8 to 10 pounds of 4-18-38. This will put the berries "to bed for the winter", helping to ensure strong roots and crowns which will aid in reducing "heaving" of the crown and/or winter kill. This will also build strong crowns and roots, and a plant that will take off come spring.

simple substrates as do many bacteria. Like bacteria, fungi are important for immobilizing, or retaining, nutrients in the soil. In addition, many of the secondary metabolites of fungi are organic acids, so they help increase the accumulation of humic-acid rich organic matter that is resistant to degradation and may stay in the soil for hundreds of years.

**Mutualists:** develop mutually beneficial relationships with plants. Mycorrhizal fungi are the best known, and grow inside plant roots. Arbuscular mycorrhiza (VAM) are the most common, especially in agricultural plant associations. These fungi have arbuscles, growths formed inside the plant root that have many small projections into root cells, as well as their hyphae outside the root. This growth pattern increases the plant's contact with the soil, improving access to water and nutrients, particularly phosphorus, while their mass of hyphae protects roots from pests and pathogens.

**Pathogens:** (including the well known *Verticillium*, *Phytophthora*, *Rhizoctonia* & *Pythium* fungi) penetrate the plant and decompose the living tissue, leading to weakened or dead plants. Where disease symptoms are seen, the pathogenic fungi is usually the dominant organism in the soil. Soils with high biodiversity can suppress soil-borne fungal diseases.

In addition, both the fungi and bacteria will aggressively decompose any crop, or hydrocarbon, residues from the previous season. This aids in reducing potential sites for over-wintering by both disease and insect species. Of course, it also aids in any nutrient content being recycled into the nutrient pool for future crop growth.

Although designed more for high value crops such as produce, ReStore 3G is also used by a number of row crop farms. Reports have included much improved tillage ("ground works better"), better water/rainfall penetration, more rapid degradation of corn residue, and a significant reduction of "free" sodium and/or fertilizer salts.

## Comparison of Onion Varieties Candy and Delgado

- Gary Shafer, Field Research

Anyone who has attended our winter meetings the last several years is aware that I am not a big fan of the onion Candy. The variety has several positive qualities including large size and a good flavor, and is excellent for the fresh market. But as with many of the sweet Spanish type onions it is not bred to be stored for any length of time.

Although somewhat tolerant to pink root, Candy is quite susceptible to many other diseases that affect onions. Cornell performed disease susceptibility research in 2010 comparing five popular onion varieties, and Candy was the most susceptible of the five varieties. We've also performed several onion projects in recent years with similar results. Candy was always among the highest yielding at harvest, but was often in the middle of the varieties after even several weeks of storage. Even though many growers have made significant reductions in disease loss when using the ISP Onion Program on Candy, it still exhibits some of the poorest tolerance to pressure

This season we established a small onion plot at the Horse Progress Produce Exhibit, comparing Candy to Delgado, a variety bred by Bejo Seed. Although the variety Expression, also developed by Bejo, is the variety they report compares closest to Candy, we have seen that Delgado is as good, if not a little better choice in the Michigan/Indiana area.

Transplants were provided by Soil Friends, Kalamazoo, MI. The Candy transplants were started three weeks prior to Delgado, although all of the transplants were planted in the beds on the same day. The Candy transplants were larger at the time of planting.



Onion variety trials, Bejo Open House, Geneva, New York, 2016

All of the onions were harvested the third week of August, with Candy being more mature at harvest. Results are:

|                                 | Candy  | Delgado |
|---------------------------------|--------|---------|
| Average Bulb Weight (grams)     | 697.08 | 601.70  |
| Average Bulb Diameter (inches)  | 4.98"  | 4.55"   |
| Total Marketable Weight (grams) | 36,329 | 36,866  |
| Weight Disease Loss (grams)     | 8,981  | 1,041   |
| Percent Disease Loss            | 19.28% | 2.75%   |

Most of the disease issues were slippery skin, botrytis (neck rot), and one onion in the Candy with basal plate rot.