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It is easy when we are in prosperity to give advice to the afflicted.

~ Aeschylus

Maximizing the Benefits of Plant Tissue Analysis

[Steve Bogash](#), Regional Horticulture Educator

This is the 3rd in a series of articles aimed at assisting growers in producing higher quality tomatoes through better nutrient management. The first in this series was devoted to reducing the incidence of Yellow Shoulder and related ailments, and the second was titled “Maximizing Fruit Quality in Fresh Market Tomatoes.” This third article targets how to interpret and use the information from tissue analysis focusing on tomatoes. Other crops such as cantaloupes, peppers, pumpkins, and sweet corn to name but a few, can also be successfully tissue tested.

The key to good results is in taking a good sample and getting that sample to a testing lab while still in good condition. Knowing the correct parts of a plant, how much plant and the right time to collect plant tissue are important to this process.

For example, useful tomato tissue testing requires 10-15 entire leaves, including the petiole taken from the most recently fully expanded leaves. These are usually the 4th or 5th leaf down from the growing tip. These leaves are now at their full size and have changed to a mature coloration. Older leaves than these store excess nutrients and can indicate plenty of some nutrients, while younger leaves are still taking up nutrients, so may indicate a deficiency that does not exist. Collect leaves only from plants that appear average in your planting. Stunted plants or extra large plants will be poor indicators of the overall nutrient needs of a planting. Each sample should be all the same cultivar as mixed varieties will degrade the usefulness of the results as well. If necessary send in multiple samples.

Tomatoes go through 3 relatively different stages of growth during their lives. First the plant increases rapidly in size leading up to flowering. Sampling the plants at the first flowers will give you a snapshot of their early fruiting needs and go a long way to providing nutrient information

needs to prevent yellow shoulders, blossom end rot and other related, non-pathogen caused diseases. 2-3 weeks later as the fruit is sizing up rapidly is another window to tissue test. The quickly growing fruits are using quite a lot of calcium, magnesium and potassium along with other nutrients. This test will help you to assess your fertilizer program and answer the question: Are you keeping up with your plants needs? Unless you are only planning a single harvest, testing again at the beginning of the harvest will enable you to again assess your fertilizer program for continued fruiting(s).

The tissue sampling program described above is very simple and easy to apply to determinate tomato varieties, indeterminate types are somewhat more complicated in later stages, but can be successfully sampled as well. Other crops go through similar stages. Be sure to indicate the stage of the plants that you are testing on your sample submittal form. If in doubt, talk to your laboratory prior to collecting samples, most labs are very helpful in making suggestions so they get the best samples and you get the best information.

Here are definitions of the most common and confused terms on tissue analysis results:

Deficiency: There is not enough of the nutrient present to meet even the most minimal requirements of the plants. In tomatoes, deficiencies are commonly found in Ca, Mg and K. Shortages of these nutrients cause many of the common packing house losses as tomatoes are downgraded due to cracking, blossom end rot, and yellow shoulders. Depending on the specific nutrient and the degree of deficiency, you may be able to make up the difference with foliar applications, injected fertilizers, or a combination of injected and foliar applied nutrients.

Sufficiency: This is probably the greatest area of confusion for growers in determining how much fertilizer to apply as sufficiency is often expressed as a percentage. At the low end of the scale (less than 50% sufficiency), there may enough nutrient present to carry a small crop or light fruit load, but not enough to prevent all nutrient related maladies or grow a profitable crop. As the percentage moves closer to 100% sufficiency, the likelihood of a great crop that moves easily through packing increases.

Toxicity: Once a nutrient is above 100% sufficiency, some other nutrient is probably lacking as all nutrients are carried in plants in a balance. Toxicities can be expressed as phytotoxicity (leaf scorch or burn), or more often as deficiencies as other nutrients are no longer as available. In extreme cases, nutrient toxicities can kill plants.

Once you have your tissue test in hand, the next step is in determining what to apply and when. That will be the final article in this series. For copies of the first 2 articles in this series, see back issues of the Vegetable & Small Fruit Gazette or contact the author at smb13@psu.edu or 717-263-9226.

Diamondback Moth

Steve Bogash, Regional Horticulture Educator

The Diamondback moth, (hereafter known as DBM) is the single most destructive pest of cabbage, other brassicas and leafy greens worldwide. This pest was introduced to North America in the 1900's and is now widely distributed. Do to its' very short reproductive cycle, ability to have numerous generations in the same field in the same year and, unusual genetics, DBM has developed resistance to numerous pesticides over the years.

Adult DBM's are brown to grayish in color with a wingspan of about 3/4 of an inch. At rest, the folded wings show a series of light-colored diamond shapes along the back of the wings where they meet. This is one of the few Lepidopteron insects that overwinter as adults. The adult DBM overwinters on plant debris or in the soil. As the temperatures go above 80°F, the time from egg to adult reduces to as little as 15 days.

Damage is caused by the DBM larvae and is very similar to that caused by cabbage loopers; numerous partial to complete holes in the leaves. Young larvae are difficult to readily notice but mature larvae are pale green and about 1/3 of inch long. Under heavy infestations the larvae can feed at the growing tip causing deformed heads and encouraging soft rots.

As noted earlier, DBM have become resistant to many pesticides. Currently, the PSU Vegetable Guide has the following materials listed: Avaunt, B.t. (aizawai strain), Entrust, Orthene, Proclaim, and SpinTor. Due to the long history of DBM becoming resistant to various insecticides, the Vegetable Guide has this note in the first line under DBM controls: "Note. Several of these insecticides may no longer be effective in certain areas due to DBM resistance. Consult your local county Extension office for most effective control". From first-hand experience with local growers' infestations, once a population gets established, it is very difficult to get full control due to where the larvae feed and the multiple age populations that can exist in the same field at the same time. Good scouting and timely management are extremely important in keeping DBM under control.

Another Strawberry Insect!

[Kathy Demchak](#), Department of Horticulture

During strawberry harvest this year (2006, for those of you who didn't read this article right away), Jim Bridge - a grower in SW PA - called me. He had damage on his strawberry fruit that was exactly like you'd expect from tarnished plant bugs. The damage was especially bad on the cultivar 'Ovation'. Jim swore that he didn't have tarnished plant bugs, and I thought he might need to have his eyes checked. Then he sent me some fruit samples – which had classic “button-berries”- and a vial full of insects. Greg Hoover (thank you, Greg!) identified the insects as “long-necked seed bugs” (*Myodocha serripes*). One of their preferred foods is strawberry seeds, so the damage they cause on strawberries is very similar to that of tarnished plant bug. There are numerous (copyrighted) images of these insects on the Internet, which you can check. If I get a chance to take a photo of a long-necked seed bug, I'll include that in a later article also. By way of a description, they are dark-brown slender insects, slightly less than ½” long with a disproportionately small head that thins out into what resembles a neck. They also have thin antennae about half as long as their bodies. You probably won't find them in your strawberry patch now, but you might next spring. If you do, please let me (or your county Extension Educator) know, and also whether they seem to be causing damage – I'd like to know how often they are a problem.

Bramble Disease Management Field Day

[Elsa Sánchez](#), [Kathy Demchak](#) & [Graham Sanders](#), Department of Horticulture

Enhance your knowledge of bramble diseases and their management through an interactive field day at Penn State University's Horticulture Research Farm on August 8th. The field day starts at 10 am and lasts until 4 pm. We're meeting at the main events building at the Ag Progress Days (APD) site at Rock Springs, PA. It's about 10 miles southwest of State College on Route 45 West. Once at the Russell E. Larson Research and Education Center, turn south at gate J. Keep going south, the road dead ends at the main events building.

You'll have the opportunity to explore a raspberry field trial and learn about practical methods for identifying common field and postharvest bramble diseases through formal and informal activities. We'll even provide hand lenses that will be yours to keep. We'll discuss sustainable management options including cultural methods and organic fungicides. Representatives from Pennsylvania Certified Organic will discuss organic certification. Things to consider bringing with you: diseased bramble samples from your farm for diagnosis and a lawn chair for your comfort. Things we'll provide to each registered participant: complimentary lunch, hand lens and handouts. We designed this field day for growers who are intermediate in their knowledge of bramble production but, anyone is welcome. This is a USDA-CSREES/SARE funded event (under SARE grant LNE05-227) and is co-hosted by the Pennsylvania Association for Sustainable Agriculture (PASA). For more information or to register contact PASA at www.pasafarming.org or 814-349-9856 ext 7. There is no fee for attending but, preregistration is encouraged.

Maryland High Tunnel Tour

W. Lantz, University of Maryland

Note from Kathy Demchak: Some folks had wanted information on this tour which was mentioned during the Vegetable and Small Fruit Field Day at Rock Springs on July 19. In case some don't know where this is - Garrett Co. is right across the PA/MD border from Somerset Co. There is no registration fee.

A High Tunnel Twilight Tour will be held in Garrett County on Tuesday, September 26th, 2006. The first stop on the tour will be Dan Yoder's farm south of Oakland, Maryland. Dan and his wife Irene raise fall-bearing raspberries in a 30'X96' high tunnel. The Yoder's get exceptional yields, size and quality of fruit. The second stop is the farm of Charles and Cheryl DeBerry. The DeBerry's received a partnership grant along with the Garrett County office of Maryland Cooperative Extension from Northeast SARE to look at organic strawberry production. The DeBerry's have part of their planting inside of a high tunnel. The project also consists of spring planted 'Everest' strawberries and 'Darselect' June bearing plants which have been planted at five different planting times, three weeks apart, beginning in mid May. Both the ever bearing and June bearing plants are producing fruit for summer markets.

If you have more questions or to register for the tour please call the extension office Maryland Cooperative Extension office in Garrett Co., Maryland at 301-334-6960.

Training the Next Generation of Extension Educators in Guanajuato: Technology Applications for Production Agriculture (TAPA)

[Bill Lamont](#), Department of Horticulture

The Pennsylvania State University and the University of Guanajuato, in collaboration with the Centro de Investigacion en Quimica Aplicada, are involved in a three year project to increase the production of locally produced horticultural crops by small growers in Mexico. The project takes a three-pronged approach to this goal by providing formal training, research collaboration and an outreach program to assist the Mexicans in reaching the small farmers with the latest information on the use of plastics in the production of horticultural crops.

Prior to the fall semester 2005, two Mexican graduate students, Sandra Flores-Mejia and Efrain Calderon Reyes from the University of Guanajuato arrived at Penn State for one year. In January 2006, three more students Esteban Rico Jaramillo, Cesar de Leon Gutierrez, and Gustavo Garcia Rodriquez arrived from University of Guanajuato for one year of training. The students have been taking courses in the Department of Horticulture, Department of Agricultural and Biological Engineering, Department of Agricultural Economics, Department of Entomology, Department of Plant Pathology and Department of Agricultural Education and Extension.

In addition to their course work they are learning how to conduct applied research at The Pennsylvania State University's Center for Plasticulture and High Tunnel Research and Education Center. They have also been involved in marketing of horticultural products from the farm at the

Department of Horticulture's retail outlet "The Cellar Market". The students have their own research project titled "*Influence of Different Color Plastic Mulches on the Growth and Yield of Tomatoes and Peppers*" which provides "hands-on" training on how to design an experiment, plant it, maintain it, collect data, analyze data and write up the results from the experiment.

The students have been actively involved in all the research projects at the Horticulture Research Farm, learning about the latest plasticulture technology. Also a Mexican researcher, Dr. Luis Ibarra from the Centro de Investigacion en Quimica Aplicada, Saticillo, Mexico, spent three weeks at Penn State learning about what our faculty are doing in the field of plasticulture, and also sharing his research experiences on the use of plasticulture with the students and Penn State researchers.

The students have been actively involved in field days, workshops, on-farm visits, short courses, winter commodity meetings both in Pennsylvania and outside in New Hampshire, and Ohio. In the future, the students, assisted by faculty from Pennsylvania State University and the University of Guanajuato, will conduct outreach/demonstration programs on the farms of producers in Guanajuato, Mexico training the farmers on how to utilize plasticulture technology.

Dr. Mike Orzolek, Professor of Vegetable Crops and Dr. Elsa Sanchez, Assistant Professor of Horticulture Systems in the department will visit the University of Guanajuato in November and work with Sandra Flores-Mejia and Efrain Calderon Reyes in reaching out to the small growers with the latest plasticulture technology.

The Organic Way – Managing Diseases

[Elsa Sánchez](#), Department of Horticulture, Penn State University

I recently returned from the annual American Society for Horticultural Science conference. One of the presentations I attended was called Pest Management for Organic Seed Production by Milt McGiffen of the University of California at Riverside. The talk included the importance of site and cultivar selection, cultural practices and spray options for managing diseases. That talk led to the development of this article.

Site Selection


While site and cultivar selection and preplant soil preparation are of great importance and require careful evaluation regardless of management system, in organic production diseases are managed first with preventative strategies. Therefore the importance of site and cultivar selection and preplant soil preparation is amplified. Select fields with a low number of pests and cultivars with resistance to pests that are potential problems.

Cultivar Selection

Selecting cultivars with disease resistance or tolerance is a good strategy for minimizing the risk of a disease outbreak. As an example, a study is currently being conducted at Southern Illinois

University to examine the performance of several cultivars of bell peppers in soil infested with *Phytophthora capsici* which causes phytophthora blight. The study used conventional production methods including black plastic mulch, raised beds and drip irrigation. ‘Paladin’, a resistant cultivar, showed the lowest incidence of blight and the highest yields. ‘Alliance’, ‘Aristotle’ and ‘Revolution’, tolerant cultivars, had lower incidences of blight and higher yields than the remaining cultivars (‘Commandant’, ‘King Arthur’, ‘Legionnaire’, ‘Knight X3R’ and ‘California Wonder’).

We are also currently updating the Culture and Cultivars for the Gardener, Bedding Plant Grower,

Garden Center and Direct Marketer to include this symbol  for vegetable cultivars recommended for direct market and sustainable agriculture enterprises based on high yield potential, pest resistance and quality. These cultivars have not been evaluated for organic production. However, you may consider trialing these on a limited basis and directly comparing them to your standard cultivars. The series can be found through the College of Agriculture Sciences publications website at <http://pubs.cas.psu.edu/>.

Cultural Practices

Cultural practices include proper moisture and nutrient management, sanitation, rouging, vector management, manipulating planting dates and crop rotations. One strategy is to study the disease cycle for weaknesses in disease development. As an example, weaknesses of the organisms that cause damping-off are that they are favored by cool and moist conditions. When planting transplants, damping-off can be culturally managed by planting when conditions are warm and not excessively wet which also favors rapid germination.

Allowable and Restricted Pesticides

Pesticides, which are in compliance with the National Organic Program (NOP) rule, can also be used in managing diseases. The Organic Materials Review Institute OMRI is currently the largest organization in the US that determines whether materials are in compliance with the (NOP) rule. Manufacturers submit products to OMRI which are reviewed and placed in a Generic Materials List and Brand Name Products List. Lists can be obtained directly from OMRI (www.omri.org) or through your certifying agency.

The fact that a material is OMRI listed does not mean that it can always be used. Materials and products in the lists are given a status of allowed (A), prohibited (P) or restricted (R). Allowed materials have been determined to be compliant with the NOP rule while prohibited materials are not. Restricted means that certain requirements must be met before these products are used. In many cases, in order to use restricted products you must have a documented reason for using them, such as to correct certain nutrient deficiencies. In other cases, a material can be used as long as certain conditions are met. For example, fixed copper can be used for disease management as long as it is “used in a manner that minimizes accumulation in the soil and shall not be used as herbicides” (page 16, Generic Materials List). In all cases, it is best to get approval from your certifying agency before using any product.

Upcoming Meetings

If you have a meeting you would like to announce, please send the meeting title, date, location and contact information to esanchez@psu.edu.

Local

August 8, 2006. Bramble Disease Management Field Day, Horticulture Farm, Rock Springs, PA. For more information contact the Pennsylvania Association for Sustainable Agriculture (PASA) at 814-349-9856 or at www.pasafarming.org.

August 26, 2006. Workshop for Training Master Gardener's on High Tunnel Technology, the Penn State High Tunnel Research and Education Facility, Horticulture Farm, Rock Springs, PA. For more information contact Bill Lamont, wlamont@psu.edu or Becky Grube becky.grube@unh.edu, or George W. Hamilton george.hamilton@unh.edu.

September 7, 2006. Twilight Vegetable Pest Walk in Northampton County, starting at 4:30 pm. Pesticide update credits will be offered. Contact Emelie Swackhamer, Lehigh and Northampton County Cooperative Extension for more information at 610-391-9840 or 610-746-1970.

September 28, 2006. Twilight Pumpkin Variety Meeting at Delaware Valley College, Doylestown. For more information contact Scott Guiser at 215-345-3283.

Regional

October 26 & 27, 2006. Greenhouse Design & Operation, Cook College Office of Continuing Professional Education, New Brunswick, NJ. For more information contact Karen Tizzano at ktizzano@rci.rutgers.edu.

National

International

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The newsletter is also posted within three days on the Department of Horticulture Vegetable program website at: <http://hortweb.cas.psu.edu/extension/veg crops/newsletterlist.html>.

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