Integrated Pest Management
University of Missouri

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Missouri Produce Growers *Bulletin*

Free Water Testing for KS & MO Produce Growers

Londa Nwadike

Agricultural water can be a major conduit for pathogens that can contaminate produce, which is why the FDA Food Safety Modernization Act (FSMA) produce safety rule sets microbial quality standards for agricultural water. FDA is currently exploring ways to simplify the agricultural water standards established by the rule, and announced its intention to extend the compliance dates for agricultural water requirements (other than for sprouts) to at least the year 2022.

Knowing the quality of water used to grow fresh produce is important even before water quality compliance dates come into effect. The only action recommended right now is for growers to test their water quality. Growers should focus on understanding the quality of water they use during production of fresh produce, including for irrigation, mixing with sprays, post-harvest washing and other uses. Growers who have never tested their well water or surface water should begin testing for quantified generic E. coli, especially if the water directly contacts the fresh produce they grow. The only way to know E. coli levels in water is to test the water!

Further, if one of your produce buyers is asking you to be GAP certified to be able to sell to them, you will also need to test any pre- and post- harvest water that you use.

To help with this, Kansas State University and the University of Missouri Extension are offering up to 10 FREE microbial water tests per farmer for Kansas and Missouri produce growers until October 2019 through a generous USDA grant. These test results are acceptable for FSMA (regulatory) requirements, as well as for GAP pre-harvest water. Note that these lab results will not work for GAPs post-harvest water, so if you are interested in getting GAP certified, you would need to test your post-harvest water through a private lab (many MO growers use Midwest Labs in Omaha, NE).

Here are the details:

- Contact your local MU Extension office to ask them about getting microbial water sample collection bottles from Londa Nwadike, State Extension Food Safety Specialist. Alternatively, you can directly contact Dr. Nwadike (email nwadikel@missouri.edu, call 816 482 5860, or mail Londa Nwadike; MU Extension; 105 E 5th St, Suite 200; Kansas City, MO 64106) to request microbial water sample bottles to be sent to you. You can also request Dr. Nwadike to send a cooler for shipping the samples if needed. At that time, we will also provide you with instructions on how to take and submit the sample for testing.
- The samples need to arrive at the testing laboratory in Olathe, KS (Kansas City area) on ice/refrigerated within 24 hours of when the sample was collected. This means the samples will need to be shipped overnight on ice or can be driven to Olathe. You can ship them directly to the lab (address is on the sample instruction forms), or you can ask your local Extension office if they would be willing to ship them for you (Dr. Nwadike can pay the Extension office for the cost of shipping samples). The samples should arrive at the lab on a Monday-Wednesday so they can be analyzed.
- You will receive your testing results within one week of the samples arriving at the lab. We will only share the results of the testing with you (not with regulators or buyers).

Please contact Londa Nwadike through the contact information listed above if you have questions or would like more information on this water testing.

Also In This Issue

Biofumigation for soil-borne disease control

David Trinklein

The use of high tunnels to produce high dollar value crops such as tomato has dramatically increased in recent years. This increase in popularity partly is due to initiatives such as the USDA-NRCS EQIP program which subsidizes high tunnel purchase. Unfortunately, soil-borne diseases are becoming an increasing threat to their long-term use and profitability.

There are several unique features surrounding high tunnels/greenhouses that tend to favor to soil-borne diseases. First, the high humidity and temperatures typical of the interior of these structures are ideal for pathogen growth. Additionally, the same production area is used year-after-year for the same crop (most often tomato) which favors the build-up of disease inoculum in the soil. Finally, pesticide options for the control of soil-borne diseases of vegetables are limited.

In the past, control of soil-borne pathogens of vegetable crops was principally accomplished using soil fumigants such as methyl bromide. Due in large part to its adverse effect on the Earth's ozone layer, methyl bromide has been phased out of agricultural use. Replacement fumigants such as chloropicrin, Basamid® (dazomet), and Vapam® (metham sodium) are available. However, there are problems associated with their use.

Synthetic chemical fumigants most often are applied as gases injected into the soil or as granules that release the active ingredient. Because of the inherent toxicity of chemical fumigants and the possibility of off-gassing from treated sites, the use of these compounds is rigidly controlled by the government. Applicators must be trained and certified to use these compounds in a legal manner. Additionally, they tend to be expensive. Thus, growers are seeking viable alternatives to replace traditional chemical fumigation as a means of managing soil-borne diseases.

Biofumigantion represents one such alternative. Biofumigation involves the use of plants, mainly from the *Brassicaceae* (or mustard) plant family, to both control soil-borne diseases and improve soil health. Many members of the mustard family contain compounds known as glucosinolates (GSLs). The latter are organic compounds that contain sulfur and are responsible for the pungency in crops such as mustard, cabbage and horse radish. They are present in the stem, leaves, roots and seeds of plants containing them.

Upon hydrolysis after plant tissue has been incorporated into the soil, the GSL contained releases chemicals known as isothiocyanates. Isothiocyanates have both fungicidal, nematicidal and weed suppressive properties. Methyl isothiocyanate, a synthetic isothiocyanate, is the compound that serves as the active ingredient for chemical soil fumigants such as metam sodium. Thus, the same toxic compound found in synthetic fumigants can be supplied by plants, but at much lower concentrations. Biofumigants, therefore, pose much less risk to the environment and carry fewer governmental regulations.

Recent studies have demonstrated that growing brown mustard (*Brassica juncea*) as a cover crop and then thoroughly incorporating it into the soil can reduce weed pressure, parasitic nematodes, and soil-borne pathogens (e.g. Pythium, Rhizoctonia, Sclerotinia. Verticillium & Phytophthora). The mode-of-action is much the same as with chemical fumigants, but on a greatly reduced scale.

The use of mustard as a biofumigant can be accomplished in two ways: 1) grow it as a cover crop and incorporate it into the soil, or 2) apply mustard meal derived from ground mustard seeds and incorporate it into the soil.

Strains of mustard selected for high GSL content are commercially available for use as biofumagants. Rupp Seeds (800-700-1199) markets the Caliente series of mustards which have been used successfully in university trials. Alternatively, Mighty Mustard® (509-487-0755), a Washington-based company, markets its own series of biofumigant mustard. It must be noted, because of their high GSL content, biofumigant mustards are **not** suitable for livestock grazing.

After a suitable seedbed is prepared, biofumigant mustards are broadcast seeded at the rate of about 10-15 lbs./acre, or .5 lbs./1,000 sq. ft. Lightly working the seeds into the soil improves germination which occurs in about five to seven day, depending upon soil temperature. The greater the plant growth, the greater the amount of GSL available for soil incorporation. Therefore, adequate water should be supplied and other best management practices followed.

The GSL concentration in mustard plant material is at its highest just before full-bloom (about 60-80% of the plants are flowering). At this time the above-ground growth must be chopped as finely as possible. GSL release increases as plant particle size decreases. If available, the use of a flail mower is recommended in order to shred the plant material thoroughly.

Immediately after shredding, the biofumigant crop should be incorporated thoroughly into the top five to eight inches of soil using an implement such as a rotary tiller, and not simply turned under with a plow. Research has demonstrated that 80% of the GSL present in the plant tissue shredded will be released within 20 minutes after mowing. Therefore, time is of the essence. Once the plant material has been incorporated, the soil should be watered and sealed with a tarp or sheet of plastic to trap the GSL and its breakdown gases in the soil.

After 14 days have passed, the tarp/plastic may be removed, since all of the plant material will have decomposed by that time. Attempting to plant the area prior to the passage of two weeks could result in significant crop injury or hinder seed germination.

Alternatively, mustard meal such as Pescadero Gold™ (831-763-3950) can be used to incorporate GSL into the soil instead of growing mustard plants. While this practice is more expensive, it will result in a higher amount of GSL being released into the soil resulting in superior disease control and weed supression. Using this method, 1 lb. of mustard meal per 45 sq.ft. of soil is applied and thoroughly incorporated into the soil. As above, water the soil and seal with a tarp or layer of plastic, in the case of mustard meal, for at least three weeks.

Depending on mustard strain and supplier, biofumigant mustards seeds for a 30 x 100 ft. high tunnel would cost less than $10. Mustard meal (Pescadero Gold) would cost about $130, if purchased in 50 lb. bags.

In summary, biofumigation tends to suppress rather than totally eliminate soil-borne pathogens as do chemical fumigants. Therefore, it must be used as part of an integrated disease management program. The elimination of diseased tissue, crop rotation and (when available) the use of resistant varieties should be considered as reduce crop loss from soil-borne diseases.

New Horticulture Specialist Hired in the West Central Region James Quinn

Ramón Arancibia is a new West Central Region Horticulture Specialist housed in Butler, Missouri, serving primarily Bates, Benton, Cass, Cedar, Camden, Cooper, Dallas, Henry, Hickory, Laclede, Johnson, Moniteau, Morgan, Pettis, Polk, St Clair and Vernon counties, but with additional coverage as needed. As the regional specialist, he will provide collaborative leadership and subject-matter expertise through educational opportunities to enable businesses, farms, families and communities to strengthen the economy and enhance the quality of life in Missouri.

Ramón has more than 30 years of experience in research and production of horticultural crops at six universities and as a grower back in Chile, where he is from. He graduated as an Agricultural Engineer with a major in fruit trees and berries at the University of Chile before coming to the U.S. as a visiting scientist to work on postharvest physiology/pathology at the University of California-Davis. He then went to Louisiana State University to obtain the M.S. and Ph.D. degrees while working as a Research Associate in vegetable crops. After graduation, he became a Research Specialist at the University of the Virgin Islands to lead their horticulture research program. He went back to the South to conduct sweetpotato research and outreach at Mississippi State University before becoming a faculty member at the Dept. of Horticulture, Virginia Tech. Some accomplishments include three book sections, 22 refereed articles, and 13 extension publications. In addition, Ramón contributed to the Mid-Atlantic Commercial Vegetable Production Recommendations and the Southeastern U.S. Vegetable Crops Handbook. He has given over 200 presentation at farmer's production meetings, field days, workshops, and professional conferences.

In addition to facilitating and coordinating research and extension activities to address concerns of specialty crop farmers, Ramón has worked with a broad range of farmers of various cultural and ethnic backgrounds. He is enthusiastic on his move to Missouri and the opportunities MU Extension offers. His areas of expertise include sustainable/organic production systems, plasticulture/protected production systems, irrigation management and plant diseases.

Novelty Melon Trial Funded by Missouri Department of Agriculture James Quinn

Missouri is known for growing quality cantaloupes and watermelons. Watermelons have undergone revolutionary changes the last 30 years including seedless varieties and smaller 'personal' sizes. For cantaloupes, few substantive changes have occurred until the recent release of the hybrid 'Sugar Cube', a personal sized, very sweet hybrid now popular with some growers and consumers. Are growers and 'foodie' consumers ready for a look at other novelty melons? Missouri Department of Agriculture decided it was worth a look and funded this modest project for $8,000.

An underappreciated fact about melons is there are 10 categories; only cantaloupes are widely grown. Other categories include Ananas, Butterscotch, Canary, Crenshaw, French Charentais, Galia, Honeydew, and Piel De Sapo. Since 2015, new releases in most categories have been grown and taste tested in a Columbia, MO garden. During this time, four melons were identified for semi-commercial evaluation; needed is information on yield, quality and storage. These novelty melons are Brilliant (Canary), Honey Orange (crispy flesh Honeydew), Lambkin (Piel De Sapo), and Lily (small & early Crenshaw). Each has an appearance and taste profile distinctly different from cantaloupe.

In this project, these four novelty melons, and 'Sugar Cube' (as a control), will be grown in a replicated yield and quality trial. Melon farmers in SE & SW Missouri will also grow and evaluate them. Taste testing will occur at five or more venues. Field worthiness and consumer interest will be documented. Results will be given in January 2020 at the Great Plains Growers Conference, during the annual melon meeting in Southeast Missouri and in extension publications and newsletters.

Additional farmers interested in trialing these melons are welcome! They will be provided seeds at no cost. We ask that all four are grown as well as Sugar Cube. A minimum of 50 plants each is desired. Contact me if you are interested.

What's New in the 2019 Midwest Veggie Guide?

James Quinn

The Midwest Vegetable Production Guide for Commercial Growers is revised annually. There are no major revisions to the 2019 edition; in 2017 there were several, as Michigan State University joined with the seven other Midwestern States. Below are some changes and comments regarding the 2019 edition.

Revisions:

- There were three new tables created last year, one each on fungicides, insecticides and herbicides, which presented selected information, such as the trade name, active ingredient, signal word (caution, danger or warning), the rotational code, usage in greenhouse, and if an organic product. This year's tables use the trade name for sorting the information, making it easier for most to find the desired information.
- A new searchable, mobile-friendly version of this guide is expected sometime in December.

Pest management discussions (in the crop specific sections):

- Cucurbits and cucumber beetles: threshold numbers for this pest are now included, with additional comments on their management. Cantaloupe, cucumber and watermelon thresholds are 1 beetle/plant and for squash and pumpkin is 5 beetles/plant.
- Thrips have been added to fruiting vegetables, reflecting their challenge for tomatoes, both greenhouse and field. I initiated this action, due to comments/complaints from Missouri growers the past several years. An entomologist from Kansas supported this request. There are 21 insecticides listed and many have comments that may be helpful. Two examples, Warrior II comment is 'not for use against Western Flower thrips' and Agri-Mek SC is noted as 1 day PHI for 'commercially-grown greenhouse tomatoes'. (There is a discussion of insecticide rotation options for thrips in the onion pest control section)
- Tomato spotted Wilt Virus/Impatiens Necrotic Spot Virus has a management discussion, which focuses on thrips pest control. With greenhouses, being careful to control thrips on ornamentals (e.g. impatiens) when growing anywhere near tomatoes is noted.

New products:

- Satellite Hydrocap (pendimethalin) is now labeled for Cole Crops and Onions as a preemergent. While this is the same active ingredient as Prowl (3.3 EC and H2O), Prowl is not labeled at this time. If interested in Satellite Hydrocap, consider looking for it early. It was not listed in this guide in 2018.
- Exirel is a new insecticide class available for use on Onions to control thrips. Minecto is an insecticide mix also with this active ingredient (Cyantraniliprole), now labeled for thrips control on onion.

Product alert:

- Lorsban is listed in the guide as an insecticide for several vegetable crops (e.g. Asparagus, Cole crops, Legumes and Sweet Corn), but there is ongoing discussion about it revoking it. The online version of the production guide will be revised if changes are necessary, but the print copy has been run.

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Central Missouri - Drip Irrigation Workshop

Morgan County Seeds, Friday February 22nd 2019 9:00 a.m. – 3:30 p.m.

You are invited to attend a **FREE** workshop covering many aspects of Drip Irrigation Systems for small and medium sized fruit and vegetable production operations. The workshop will be hosted in the meeting room at Morgan County Seeds, 18761 Kelsay Rd, Barnett, MO. The workshop will be conducted by MU Extension with support from the Missouri Department of Agriculture Specialty Crops Program. Lunch provided too! Pre-registration is requested in order to help with estimates for handouts and food needs.

To register:

Contact Joni Ross Harper, Central Missouri Drip Irrigation Workshop, Morgan County Extension Center, 100 East Newton, Courthouse 4th floor, Versailles, MO 65084, (573) 378-5358 or rossjo@missouri.edu.

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