UMass Extension
Vegetable Notes
For Vegetable Farmers in Massachusetts since 1975

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In this issue:

Crop conditions

Crops that went in late because of the cool, wet early summer are getting some extra time to size up with the hot, dry early fall, and summer crops like tomatoes and peppers are still pushing along. Driving around Western MA, we're seeing windrows and full bins of butternut, as well as trucks full of potatoes. See article in this issue for some ideas for achieving optimum potato storage conditions. One grower remarked this week that he was surprised to have to drag out his irrigation again so close to October. The second half of September has been pretty dry around the state—except in Southeastern MA and the islands where tropical storm Jose brought anywhere from 1 to 5 inches of rain over 3 days. Some growers are having trouble getting cover crops seeded because it is too dry for seeds to germinate (and crops are still in the field). Thanks to all who came out for the meeting at Atlas Farm on produce wash station design. While we talked about the fact that there is a huge diversity of farm scales and infrastructure needs, and food safety guidance will largely depend on a farm's own risk assessment, there are still some general concepts to consider when planning improvements. 1) Think about product flow and try to always move from dirty to clean without crossing your tracks, reducing chances of cross-contamination. 2) Use separate containers for harvesting and packing; different colors for each is even better. 3) Invest in reusable plastic containers (RPCs) for packing and shipping. It's a big expense, but an improvement over wood or cardboard, and Massachusetts has grant funds available to help with the cost of this and other improvements. 4) Use smooth and cleanable surfaces, and reduce use of wood and other porous materials. See this fact sheet from UVM Extension for options: go.uvm.edu/smoothnclean. 5) Look for equipment that is easy to take apart, clean and sanitize. There is not much currently available on the market—brush washers are a particular challenge—but designs are getting better. Growers need to reach out to manufacturers and suppliers to let them know that there is a demand for equipment that is designed with good sanitation and food safety in mind. Here's a bonus from the meeting: how to wrap a pallet like a pro, featuring Troy at Atlas Farm. **Click the photo at right!**

A farmer inspects a potato washer at Tuesday's produce wash area twilight meeting at Atlas Farm. Photo, K. Campbell-Nelson

Click photo for video link!

Pest alerts

Brassicas:

White Mold, black rot, and Alternaria leaf spot are fairly widespread now in untreated cabbage and other brassicas across the region. **Caterpillars** continue to

White rot on cabbage. Note the fuzzy white mycelia and black sclerotia--the resting spores of the pathogen. Photo, S. Scheufele

feed on these crops as well, with overlapping generations of **imported cabbageworms**, **loopers**, **diamondback moths**, and also **cross-striped cabbageworms**. **Flea beetles** are also still active in some fields—while their feeding might not pose a threat to established plants this time of year, they can move fungal spores and bacterial cells from plant to plant so they are still worth controlling for that reason, and to reduce the size of the overwintering population. Consult the New England vegetable Management Guide for pesticide recommendations.

Celery:

Celery Anthracnose has been widely reported this season and was diagnosed in Worcester Co. this week on 'Tango.' The fungus is known to overwinter in the soil, in association with plant debris, or in infected weeds in several plant families. *C. acutatum* has a broad host range infecting pepper, tomato, bean, spinach, strawberry, apple, peach, and blueberry, however, it is unclear if this strain infects all these crops including celery. A 3 to 4 year crop rotation with non-host plants should be followed. See article this issue for more details.

Cucurbits:

Black Rot was observed in bins of harvested pumpkins in Franklin Co., MA. Be sure to watch plants for disease symptoms during the season so you know what to look for on fruit, and to cull infected fruits during harvest to avoid diseases spreading in storage. Black Rot (*Didymella bryoniae*) is characterized by a distinctive black decay of the fruits of all cucurbits. In temperate regions, the disease occurs mainly on winter squash, pumpkin, and greenhouse cucumber. Symptoms vary on foliage of different cucurbits. On pumpkin and winter squash, symptoms on the leaves begin as a marginal necrosis followed by larger, wedged shaped necrotic areas, often with a yellow halo. Stem cankers develop in the cortical tissue and a brown, gummy exudate is produced. Small fruiting bodies (pycnidia or perithecia), may appear as black specks in diseased tissue. Stems may be girdled on seedlings and the plant dies, or on older plants stem cankers lead to wilt and decline. Small, water-soaked spots develop on fruit, enlarge, and exude gummy material and contain many black, fruiting bodies.

Black rot on pumpkin (left) amd butternut (right). Photos, S. Scheufele (L) and T. Zitter (R)

Solanaceous:

Verticillium wilt was widespread in jilo eggplant and okra this week in Worcester Co., MA and has been present on other okra and eggplant crops since August in other parts of the state. This disease is caused by two closely related soilborne fungi, *Verticillium dahliae* and *V. albo-atrum*. Isolates of these fungi vary in host range, pathogenicity, and virulence. The pathogen remains in the soil for many years. Resistant vegetable crops include: celery, asparagus, carrot, sweet potato, lettuce, alfalfa, bean, and pea. 'Classic,' 'Rosa Bianca' and 'Italian Bicolor,' eggplant are more tolerant than other varieties.

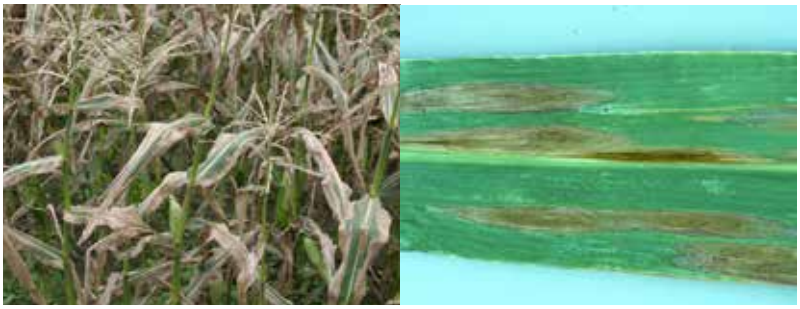
Hollow heart of potato. Photo, B. Phillips, MSU from bugwood.

Hollow Heart is reportedly widespread in the larger grades of 'Norwiss' potatoes in Hampshire Co., MA. Environmental conditions that favor development of brown center and hoolow heart are cool soil temperature (≤ 56°F for 5–8 straight days) or when available soil moisture is greater than 80%. Incidence of brown center and hollow heart also increases with periods of stress caused by high or low soil moisture, especially if heavy rains occur suddenly after a

dry spell. Large tubers are more prone to develop the disorder, so using closer spacing and making sure not to have too many skips in the row can reduce incidence of brown center and hollow heart. You can also use larger seed pieces with more eyes to get 3-4 stems per plant at emergence. Split up fertilizer application into 2-3 applications and maintain consistent soil moisture by irrigating during dry periods. There are also differences in the susceptibility of potato varieties: 'Atlantic', a widely grown potato for chip processing, is relatively susceptible to both disorders. In 'Russet Burbank', susceptibility to both brown center and hollow heart is highest soon after tuber initiation when the tubers are small.

Sweetcorn:

Northern corn leaf blight was diagnosed on the cultivars 'Allure', 'Honey Select' and 'Euphoria' from samples collected in Norfolk Co., MA and is likely widespread across MA at this time. Symptoms began with yellowing lower leaves (similar to nitrogen deficiency) in August when the corn first began to silk. Yield was significantly reduced combined with disease pressure from common rust (see below), and the problem was just now diagnosed. The disease begins as long, slender, grayish or tan leaf lesions that run parallel to the mid-vein. Lesions can eventually expand to a more oblong or "cigar" shape. They may also coalesce to form large areas of dead tissue. Dark spores may be observed in the lesions with the aid of a hand lens. Spores produced by primary lesions are carried by wind or rain splash to upper leaves. Lesions may also form on husks. Loss of photosynthetic tissue can result in decreased yield. Unlike rust, this fungus overwinters in crop residue on the soil surface. Spores are produced in late spring/early summer and are carried by wind to new plants. A one year rotation out of corn is recommended for fields with a history of NCLB. In no-till systems, a rotation of at least two years is recommended. Consider using resistant hybrids in areas with a history of NCLB. Consult your seed company representative for more information.



A field infected with Northern corn leaf blight (left) and NCLB leaf lesions (right). Photos, R. Wick

Common Rust was diagnosed in the same field as NCLB above, but only on the cultivars 'Allure' and 'Honey Select'. Disease is now widespread in many parts of the state, and treatment is not recommended at this time since corn is nearing maturity and the pathogen does not overwinter here but arrives annually from the south. Symptoms of common rust are elongate to oval brown pustules on both leaf surfaces which rupture and release orange-red spores (urediniospores) that are wind-dispersed and cause infections on nearby foliage. Urediniospores may get wiped off plants leaving orange dust on hands and clothes. Pay attention now to which crops were particularly affected and select resistant cultivars in the future such as: 'Xtra Tender 277', 'Snowmass', 'Cabaret', 'Delectable', 'Silverado', 'Zenith', 'Lancelot', and 'Argent'.

Corn rust. Photo, T. Zitter

PREPARING FOR THE FALL FLIGHT OF ALLIUM LEAFMINER

Written by Ethan Grundberg, Cornell Cooperative Extension

The new invasive fly pest, allium leafminer (ALM), was found throughout much of the lower Hudson Valley this spring. Adult feeding and egg-laying damage was confirmed in Sullivan, Orange, Dutchess, Ulster, and Southern Columbia counties beginning April 20th and ending around the last week of May. Larvae that hatch from those eggs eat their way down the inside of the leaves toward the bulbs opening up physical wounds where soft rot pathogens often enter. The larvae then pupate either inside the bulb and stem or in the soil around the plants for the entire summer. Though we do not have predictive models to help us determine the likely date of emergence of the

ALM adult next to characteristic vertical "stippling" feeding and oviposition damage. Photo: E. Grundberg

fall brood, ALM adults emerged from pupae near the end of September in Pennsylvania in 2016 and were active for 4-6 weeks. We are scouting fields on farms with known ALM populations already in an effort to detect emergence as early as possible. Entomologists from Penn State University believe that fall emergence may be a week to ten days earlier than 2016, so growers with fall alliums should be prepared for ALM activity by the week of September 18th and watch for alerts from our team once we confirm the beginning of the fall flight.

Since there are typically fewer cultivated and wild alliums in the environment in the fall, growers in Pennsylvania have experienced a "concentration effect" with their fall grown alliums. The spring population is spread across a wider and larger host population, but since the fall ALM flight has fewer host plants (leeks, chives, and scallions), the damage to those crops is more severe. Most affected alliums this spring had no more than two larvae or pupae per plant when inspected. In contrast, growers with infestations in fall leeks in Ulster county in 2016 encountered well over 100 pupae per plant.

The most effective strategy for limiting damage from ALM this fall is to use row cover beginning next week on all alliums that still have lush green growth in the field (storage onions that are still field curing are not at risk) to prevent adults from landing on host crops. We are working with Dr. Brian Nault to conduct an insecticide efficacy field trial that includes both conventional and OMRI-approved products this fall, but do not currently have any pesticide efficacy data to share. There will be a free twilight meeting in Orange County on Thursday, October 19th to share preliminary findings from that study; click here https://enych.cce.cornell.edu/event.php?id=828 for more information and to register for the event.

Growers who have been spraying leeks all summer for onion thrips need to make sure that they have not already reached the maximum annual application rate of products like Agri-Mek (abamectin, IRAC Group 6), Radiant (spinetoram, IRAC Group 5), and Exirel (cyantraniliprole, IRAC Group 28) that are also labeled for leafminer management in allium crops. There is some anecdotal evidence from the spring flight that Trigard (cyromazine, IRAC Group 17) was effective at managing ALM at the labeled rate of 2.66 oz/acre in at least 10 gallons of water. Please note, however, that there is a 7-day PHI for Trigard and Agri-Mek on bulb vegetables (including leeks, chives, and green onions) whereas Exirel and Radiant have a 1-Day PHI. Organic growers unable to use row cover are encouraged to use Entrust (spinosad, IRAC Group 5) at the 2 oz/acre rate along mixed with a 1%-1.5% v/v solution of M-Pede (potassium salts of fatty acids) for better penetration of the waxy cuticle once adult feeding has begun. As always, you must follow the instructions in the label for all pesticides!

We suspect that the geographic distribution of ALM will continue to spread this fall, so growers in the Capital District [and Western MA] should be on the lookout for signs of activity in addition to farms in the Hudson Valley. We are recommending that growers thoroughly inspect allium leaves for the linear adult oviposition marks of at least 10 plants on each field edge on a weekly basis until activity is observed. If you have any questions about what you are seeing in your fall alliums, please contact one of the vegetable specialists on the ENYCHP team [or any of us at UMass Extension!] for diagnostic support.

Potato Storage

Whether you're planning to store potatoes for one month or six, try to provide the best combination of conditions for maintaining optimum quality. This can be tricky; every crop is different, as are each fall's weather and harvest conditions. Whether you are storing in pallet bins, grain sacks, or bulk piles, it's important to know what conditions you are aiming for, even if you can't always achieve them in practice. Fortunately, vegetables in general and potatoes in particular are somewhat forgiving in their tolerance to less than ideal conditions. Light, temperature, humidity and ventilation all need adjustment in potato storage, and achieving the desired conditions in these areas is covered in this article.

A conveyer-feed potato storage pile. Photo, R. Hazzard

Light: Darkness is key**.** Even modest amounts of low light cause greening. If potatoes are in a multi-purpose storage where lights are

on often, or the room is not fully darkened most of the time, cover the bins or pile to keep out light, without cutting off ventilation. One solution is to use bulk bins with open bottoms, with black pallet wrap around the sides, and punched plastic row cover or burlap on top.

A thermometer to monitor air temperature in middle of potato storage pile (left) and close up of thermometer (right).
Photos, R. Hazzard

Temperature: After harvesting and curing potatoes for storage (see August 18, 2016 issue of Vegetable Notes), tubers should be cooled down to the holding temperature. Ideally, the potatoes should be cooled slowly, ½ to 1° F per day, or a maximum of 4 to 5° F per week. Harvesting outdoors at temperatures closest to storing, will reduce the amount of energy required to cool the potatoes. It's helpful to place a temperature sensor in the center and on top of the pile or bin to monitor tuber temperature, in addition to monitoring air temperature in the storage and outdoors.

Potatoes are most commonly cooled using outdoor air, but this should be managed carefully. For the best use of outdoor air, place temperature sensors inside and outside the storage, with thermostats and switches wired in series to bring air in with fans only if inside temperature is above, and outside temperature is below your desired set point. Use outdoor air that is no lower than 3 to 5° F below the tuber temperature. Through-the-pile (or through-the-bin) ventilation achieves rapid cooling, but may cause dehydration unless a humidifier is used. Air exhaust is also critical, to remove warm air.

Tubers whose temperatures fluctuate along with outdoor cool and warm spells such as we are having now, may have reduced storage life and quality. Fluctuations in temperature may also lead to condensation in the pile. If the temperatures in the top and center of the pile are above the outside air temperature, then ventilate the storage. When night temperatures are warm (in the 50's and lower 60's) and there is not enough ventilation through the pile, the temperature in the pile can get into the 70's or even 80's. Heating is generally not needed in potato storage due to the heat of respiration from the potatoes, though insulation in walls and roof is important. Significant heat can also be lost through leakage from doors and windows.

The holding temperature should be suited to your market goals and to achieve the desired balance among respiration rates, sprouting, disease development, and transformation of starch into sugars such as glucose. Respiration rates are lowest at 36 to 37°F (2 to 3°C); however at temperatures below 45°F, conversion of starch to sugar increases. Tuber rots increase greatly above 50°F. References and grower experiences don't all agree on the ideal temperatures for different uses, but the recommendations below are found in several reliable sources.

Tablestock (no sprout inhibitor): 38 to 40°F. This is the optimum temperature range for inhibiting sprouting. Some growers report that they can hold at 36°F for fresh market sales during the winter months. For diversified farms, this may allow them to store other root crops and cabbage in the same storage room as potatoes, if infrastructure is limited.

Tablestock (with sprout inhibitor): 40 to 45°F. If the humidity is kept high and sprout inhibitors are used, potatoes stored at 45°F will maintain quality similar to those stored at 40°F.

Seed potatoes: 38 to 40°F. For seed, tubers need to be kept dormant and in a sound, viable condition.

Processing: 45 to 55°F is recommended for processing potatoes, to prevent accumulation of sugars which darken the potato during cooking. Fifty to 55°F is recommended for chipping, although this varies with cultivar. High sugar levels can be lowered if the temperature is slowly elevated to 55 - 65°F for one to four weeks, a process known as reconditioning.

Managing Relative Humidity: Humidity should be maintained at 90 to 95% throughout storage life to prevent dehydration and shrinkage and reduce pressure bruising. Given high relative humidity (RH) inside and low RH and temperature outside during the winter months, adequate insulation in walls and roof is important to avoid condensation. Below are two

options for adding humidity.

A humidifier with a capacity to deliver about one gallon of water per 1,000 cubic feet per minute (CFM) is usually adequate. Centrifugal and misting humidifiers introduce water into the atmosphere in small particles. These small water particles are easily absorbed by the cool air and effectively increase RH. These systems are the most reliable and effective, however they are also the most expensive. There are several models and sizes available to fit individuals' specific needs.

Chris Callahan at UVM Extension developed a simple DIY auto-fill humidifier using a five gallon bucket, a tank de-icer for heat, and a fan. Details on this humidification system can be found at Callahan's blog.

A digital hygrometer/thermometer. Photo, R. Hazzard

Measuring Relative Humidity: Digital hygrometers are the easiest tools for measuring relative humidity. However, they can be out of calibration or give false readings, especially at higher relative humidity levels (>90%) like those needed in potato storages. Sling psychrometers are simpler mechanical hygrometers. They use two thermometers to measure dry-bulb and wet-bulb temperatures; the difference between these temperatures is used to determine the specific relative humidity of the atmosphere. Digital hygrometers should be checked against a sling psychrometer to measure their accuracy. If a digital hygrometer were off by 5%, you will know this by calibrating it against a sling psychrometer and have a better idea of the actual RH of the storage.

Ventilation: The ventilation system is the heart of the storage, controlling temperature and humidity by ventilating, recirculating and blending air. These systems range from manual to totally automatic. Convection currents cause heat to rise through the pile or bins. An exhaust fan is placed so that it removes warm air from the top of the storage. Intake fans and openings should be adjustable to control the amount of air being drawn in. It is important that air is allowed to flow around and through the potatoes, whether they are stored in bulk or in bins. For bulk storage, air should be directed from the bottom of the pile towards the top, which requires a ventilation system that is built into the floor or laid down during piling. For storage in bins, the air should be directed to flow through the bins either from bottom to top or side to side (see Belyea presentation, below, for details on how a bottom-to-top system can be designed). This allows for consistent temperatures and relative humidity throughout the storage and thus consistent tuber conditions.

Further Reading:

See Chris Callahan's blog at the UVM Extension website for further information and tools on calculating exhaust needs and fan exhaust system specifications.

For an excellent review of storage design with a lot of detail in terms that non-engineers can understand, see the presentation by Stephen Belyea, storage engineer with the Maine Dept. of Agriculture, Food and Rural Resources.

Looking to store potatoes with other crops? See the presentations from Engineering Storage Facilities for Winter Vegetable Crops and the Community Involved in Sustaining Agriculture Winter Crop Storage page.

By Ruth Hazzard and Luke Doody, UMass Extension. Resources include Dale Moyer's (Suffolk Co CES, Riverhead, NY) chapter on Potato Storage Management in Potato Production in the Northeast, edited by C Hollingsworth, D. Ferro and W. Coli 1986; USDA Handbook 66; and potato growers including Paul and Kevin Jekanowski, Jekanowski Farm, Hadley MA, and Rob Johanson, Goranson Farm, Dresden ME.

CELERY LEAF CURL


Celery leaf curl. Photo, MSU Extension

We are seeing Celery Leaf Curl caused by *Colletotrichum acutatum* in fields now and have seen it every year since it was first diagnosed in 2013. The disease was detected in Michigan and Pennsylvania in 2010 and has also been reported in CT, NJ, NY, VA, Canada and Australia. *C. acutatum* has a broad host range infecting pepper, tomato, bean, spinach, strawberry, apple, peach, blueberry, lupine, zinnia, cowpea, safflower, numerous weeds and more. It is not known if strains of

the fungus infecting different hosts can infect celery and vice versa. The pathogen is most important on strawberry, and may become more important on pepper in Massachusetts because it infects even green pepper fruit and is very aggressive unlike the more common anthracnose pathogen, *C. coccodes*. See Pepper Diseases from July 31, 2014 issue of Vegetable Notes for more on *C. acutatum* in pepper.

Petiole twisting and lesions from celery leaf curl.
Photo, MSU Extension.

Symptoms on celery include curled leaves, occasional discoloration of leaf margins, twisted petioles, and lesions on petioles. Leaves remain green but often appear fan-like and curl downward. Leaf curl is often the most prominent symptom observed and can resemble injury from growth regulator type (i.e. 2,4-D) herbicides. Infected plants are stunted with small, malformed, cupped leaves which become brittle and crack. The fungus advances into the stalks which become twisted with reddish to light brown lesions developing on the outside and inside of the stalks or inside the crown. Advanced symptoms of collapsed and rotting centers may easily be confused with Black heart, a physiological condition of celery related to poor calcium assimilation and fluctuating water levels. Celery may become infected at any stage of growth in both the greenhouse and field, and plants become disfigured and unmarketable.

Life Cycle: *C. acutatum* is known to overwinter in the soil, in association with plant debris, or in infected weeds in several plant families. The fungus can remain for long periods in dead plant material on the surface or buried in the soil. It can penetrate through all plant parts, but the crown is often preferred due to the relatively humid conditions there. Conidia (spores) are easily spread in splashing water from overhead irrigation and wind driven rain leading to rapidly developing infections.. The pathogen grows best at warm temperatures (> 77°F), but can be active from 59°-86° F. Leaf wetness duration of greater than 12 hours results in the most severe disease although infection can occur with shorter leaf wetness periods.

Management: *C. acutatum* can be carried from the greenhouse into the field and symptoms may be latent at first, causing outbreaks later on. Start with clean flats and growth medium. Scout plants twice a week for symptoms; remove and destroy affected plants. In the greenhouse, provide good ventilation with horizontal fans, heating and venting, especially when warm days are followed by cool nights. Use irrigation practices that promote rapid drying and make sure water does not pool anywhere in the greenhouse. In the field, removal of crop debris after harvest and plowing under crop residue will limit pathogen carryover from year to year. A 3-4 year crop rotation with non-host plants should be followed. Avoid working the fields when the plants are wet, work in fields with a history of the disease last, and power wash equipment between fields. Celery seed continues to be screened for this pathogen at Penn State, however it has not been found to be seed borne yet. A similar pathogen of celery, *C. nymphaeae,* causing celery stunt anthracnose has been detected in seed by researchers in Japan, and seed treatment at 122°F for 30 minutes has been recommended.

Several research trials have shown that the strobilurin fungicides are most effective (i.e. Quadris or Flint). Resistance to these fungicides develops fairly quickly so they should be rotated with other fungicide classes such as propiconazole (Tilt) and should be mixed with a protectant fungicide (e.g. chlorothalonil, mancozeb, or copper). See the New England Vegetable Management Guide for more information.

-Bess Dicklow, UMass Plant Disease Diagnostic Lab, Emeritus

Events

Massachusetts No-Till Conference 2017: Dairy and Vegetables

When: Monday, October 30, 2017 - 9:00am to 3:00pm

Where: Carter and Stevens Farm, 500 West Street, Barre, MA 01005

Topics will include:

- Why No-till Works! (*Kate Parsons, NRCS Resource Conservationist*)
- Nutrient Management in No-till systems (*Tom Morris, UConn Plant Science Professor*)

- Cover Crop Selection and Termination (*Dave Wilson, PennState Extension Agronomist)*
- Pest and Disease Management for No-Till (*Katie Campbell-Nelson, UMass Extension Vegetable Program*)
- Adapting Your Planter for No-Till (*John Hoffman, Johnny's Ag Service, Ellington,CT*)
- Equipment tradeshow
- Dairy and Vegetable Farmer panels

One Pesticide credit will be available for this program, and Crop Advisor credits will be available.

Registration: $16.00 (*lunch included*)

Click Here To Register: http://events.eventzilla.net/e/notill-farming-conference-2138904873

Questions? Contact Lisa Trotto at 508-829-4477 x7038, or Lisa.trotto@ma.usda.gov

New England Vegetable and Fruit Conference

When: Tuesday, December 12 to Thursday, December 14, 2017

Where: Radisson Hotel, 700 Elm St, Manchester, NH 03101

The New England Vegetable & Fruit Conference and Trade Show will include more than 25 educational sessions over 3 days, covering major vegetable, berry and tree fruit crops as well as various special topics. A Farmer to Farmer meeting after each morning and afternoon session will bring speakers and farmers together for informal, in-depth discussion on certain issues.

There is also an extensive Trade Show with over 120 exhibitors. We hope that you will enjoy your time here, and meet with fellow growers, advisors, researchers, and industry representatives. We want you to leave with new ideas and new information that will have a positive impact on your farm.

Registration information coming soon!

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