Hello Northeast Ohio Counties!

Most of our corn crop is in growth stages V9-VT. During these stages number of potential kernel rows are determined. This is different from the number of potential kernels fertilized. If these types of conditions last well into R1 we will definitely see a loss in ear length.

On a more positive note, it looks like there is a chance of rain today.

Stay hydrated in this heat! Please call us if you need anything.
July Brings on the Heat
By: Aaron Wilson
Source: https://agcrops.osu.edu/newsletter/corn-newsletter/2020-21/july-brings-heat

Hot and dry conditions have certainly set in across the Buckeye State. Temperatures this past week have averaged 2-8°F above average, with most locations stringing together at least five consecutive days above 90°F and more to come. Based on the forecast, Columbus will likely reach 11 days this Friday, the longest stretch of 90-degree weather since July 21-31, 1999!

Along with hot temperatures there has been a lack of widespread rainfall, generally less than 0.25” statewide over the last seven days, with only brief heavy downpours for a few lucky folks across Ohio. Not only are we falling short on typical rainfall (~1” per week), but hot daytime temperatures have led to intense evaporation rates (0.25-0.30” per day). This has caused rapidly drying soils and decreasing stream flows. Abnormally dry conditions (not official drought) are now being reported (as of Thursday July 2) for about 17 percent of Ohio (Figure 1), with an expansion of these conditions anticipated this week. Please see this week’s article on Drought and Fungicide. If you are seeing drought impacts in your area, consider submitting a report to the Drought Impact Reporter. For more information on recent climate conditions and impacts, check out the latest Hydro-Climate Assessment from the State Climate Office of Ohio.

No major weather systems are expected over the next few days across Ohio, but scattered storms with locally heavy rain are possible. Highs will generally top out in the 90s and lows in the upper 60s to low 70s. By Friday, a weak cold front will try to sweep through the state which will likely bring a better chance of widespread showers and storms and slightly cooler temperatures this weekend with highs in the 80s. Overall, we are expecting 0.25-0.75” (locally heavier) of rain over the next 7 days (Figure 2).
Figure 2: Forecast precipitation for the next 7 days. Valid from 8 pm Monday July 6, 2020 through 8 pm Monday July 13, 2020. Figure from the Weather Prediction Center. The latest NOAA/NWS/Climate Prediction Center outlook for the 8-14 day period (July 14-20) shows elevated probabilities of above average temperatures and below average precipitation (Figure 3). Normal highs during the period should be in the mid-80s, normal lows in the mid-60s, with 0.85-1.05" of rainfall per week. The 16-Day Rainfall Outlook from NOAA/NWS/Ohio River Forecast Center supports below average precipitation across Ohio as well, especially in northwest Ohio where conditions are already quite dry. The forecast suggests deteriorating pasture conditions, added crop stress, and a lack moisture ahead of pollination and double-crop plantings.

Figure 3: Climate Prediction Center 8-14 Day Outlook valid for July 14-20, 2020 for left) temperatures and right) precipitation. Colors represent the probability of below, normal, or above normal conditions.
Mid-Season Weed Management in Soybeans – Hot, Dry Edition
By: Mark Loux

A few weed-related observations while we try to stay cool and hope for a day of rain or at least popup thunderstorms.

- One of the frequent questions during extended dry weather is – do I wait for rain before applying POST herbicides, or just go ahead and apply before the weeds get any larger and tougher to control. Our experience has been that it’s best to go ahead and apply when weeds are still small, even if it’s dry, and herbicides will usually do what they are supposed to. Letting them get larger without any sure forecast for rain can make for a tough situation that requires higher rates or a more injurious mix. On the other hand, waiting to apply can be fine if there is a good chance of rain within the next few days. It’s not always an easy decision.

- The deadline for applying dicamba to Xtend soybeans was June 30. Tavium can still be applied where the soybeans were planted less than 45 days ago and have not exceeded V4, an alternative to dicamba will have to be used. We should point out that very hot days and warm nights are not appropriate conditions for applying dicamba anyway.

- The replacement for dicamba on Xtend soybeans is usually going to be glyphosate or a mix of glyphosate with either fomesafen (Flexstar, etc), Cobra/Phoenix, or Ultra Blazer. Will they cause soybean injury? Yes. Will the injury be worse under hot conditions? Probably. Do you want weed control? We assume yes. Using a less aggressive adjuvant approach can reduce the injury. Example – applying fomesafen with MSO + AMS will be less injurious than COC + UAN. Be sure to use adjuvants appropriate for the weed species and size though.

- Applying POST herbicides early or late in the day may have some potential to reduce injury. Keep in mind however that the activity of most POST herbicides on weeds is reduced during overnight hours. In previous OSU research where we applied herbicides at 3-hour intervals from 6 am to 9 pm, activity was substantially reduced from 9 pm through 6 am. So activity was decreasing after 6 pm and
ramping back up after 6 am. Our studies included fomesafen, glyphosate, Firstrate, 2,4-D, and glufosinate. Of these herbicides, 2,4-D was the only one not affected by time of day. Giant ragweed was the only broadleaf weed in the 2,4-D study, which occurred in wheat stubble.

- Applying a mix or premix that contains a site 15 herbicide – acetochlor, metolachlor, pyroxasulfone, dimethenamid – often increases the risk and severity of soybean injury. It’s late enough in the season that we would question the value of including residual herbicides. Weed emergence is tapering off, and the dry forecast will prevent these herbicides from being active anyway.

- While it has not been much of an issue in Ohio, fomesafen can carryover and injury corn. This is most likely to occur for late-season applications followed by dry conditions that reduce the rate of degradation. We are at this point now, so consider a switch from fomesafen to another group 14 herbicide. There is no risk of carryover to corn for Cobra/Phoenix or Ultra Blazer.

- POST cutoff restrictions for a few soybean herbicides (DBH = days before harvest; from Table 18 of Weed Control Guide): clethodim – 60 DBH; Cobra/Phoenix – 45 DBH; Enlist Duo/One – no later than R2; fomesafen – 45 DBH; Fusion – prior to bloom; glyphosate – through R2; glufosinate – up to R1 and 70 DBH; Ultra Blazer – 45 DBH.

- We have had discussions with growers about doublecrop soybeans – whether to use a residual herbicide approach or just use POST herbicides. Herbicides that cause much injury and slow down growth should be avoided in double crop soybeans since time from planting to harvest is short. So the argument for a residual herbicide approach is probably best made in nonGMO or RR soybeans, where use of a site 14 herbicide might be required to control glyphosate-resistant weeds. Planting a LL, LLGT27, or Enlist soybean would allow use of effective POST herbicides without risk of injury. The argument against a residual herbicide approach is the possible lack of rainfall to get them working soon enough, their lack of activity on some glyphosate-resistant weeds, and possible increased carryover risk from applying this late. There are cost considerations also when making this comparison.

- The dry weather forecast has some growers abandoning plans for double crop soybeans. This is just a reminder to implement some type of weed control measures in wheat and barley stubble, with the goal of preventing weed seed and increases in the soil seedbank. Marestail, foxtail, and ragweeds are common weeds in stubble, and waterhemp could be an issue. In previous OSU research on control of marestail with herbicides in stubble, which can be difficult, applying before the end of July resulted in the most effective suppression of seed. Mowing or tillage can also be used to control weeds. Where mowing and herbicides will be combined, herbicides should be used first.
Wheat stubble does provide the opportunity to work on Canada thistle, curly dock and dandelion, among other perennials. Most effective control of these weeds will occur where they are left undisturbed from late summer into October or early November, which allows them to reach a size when herbicides are most effective. In other words – don’t mow or treat them so late in summer that they don’t have enough time to regrow prior to a fall herbicide treatment.

**Corn Growth in Hot and Dry Conditions**

By: Alexander Lindsey and Peter Thomison  
Source: [https://agcrops.osu.edu/newsletter/corn-newsletter/2020-21/corn-growth-hot-and-dry-conditions](https://agcrops.osu.edu/newsletter/corn-newsletter/2020-21/corn-growth-hot-and-dry-conditions)

In recent days we have been experiencing 90 degree F days with limited precipitation, and so we are starting to see some leaf rolling in corn. Some of this may be related to reductions in soil moisture, but may be related to restricted root systems as well. Depending on the stage of corn at the time of these conditions, different effects on yield may be expected. Corn ear development occurs throughout the growing season, and extreme temperature or moisture stress at different growth stages will decrease different aspects of grain yield. Below is a quick summary of the yield component most affected by environmental stress at different growth stages:

- **V5-7**: Number of kernel rows. Corn plants are determining the number of kernel rows as early as V5 in some corn hybrids. By V7, the number of kernel rows in the primary ear has been determined for most hybrids.
- **V9-VT**: Number of potential kernels per row (row length). Each potential kernel comes from one floret on the ear (female flower), and as conditions are more favorable for development the plant will initiate more florets. The number of potential kernels on the ear can be set through late vegetative stages (through V16).
- **VT/R1**: Number of potential kernels that are fertilized. High temperatures and moisture stress can cause pollen release to occur before silk emergence resulting in poor pollination, and can decrease pollen grain viability. Ear elongation is occurring during R1, and if stress occurs total ear length could be decreased. Yield losses have been estimated up to 13% per day of stress.
• R2-R3: Kernel number to be filled. Stress at the blister (R2) and milk (R3) stage can cause fertilized kernels to be aborted due to poor carbohydrate availability. Carbohydrate production will decrease as temperature and moisture stress increase because photosynthesis is reduced. The limited production of sugars will cause the plant to abort kernels, typically those that were the last to be pollinated (at the tip).

• R4-R5: Kernel size. At the dough (R4) and dent (R5) stages, carbohydrate accumulation within the kernels will be reduced due to environmental stress. At the start of R5, only 45% of the dry matter in each kernel has been accumulated, leaving half of the starch to be added during R5. However, the kernel contains 90% of its dry matter halfway through the R5 growth stage (milkline halfway down the kernel).

Given corn growth is maximized at 86 degrees F, temperatures exceeding this can result in reduced growth rates. Leaf area may decrease under stress conditions leading to less area available to photosynthesize, and internodes may not lengthen as much leading to shorter plants. Moisture stress can also be observed as leaf rolling. Rolled leaves help to shade the leaves by reducing the area in direct interception of light and to thicken the boundary layer (leading to less evaporation and slower water movement out of the leaves). However, leaf rolling can be seen even if soil moisture is evident under high temperatures and lower relative humidity levels. Be sure to watch the video on this topic here.

Higher temperatures (especially at night) can lead to more respiration, which could reduce yield by metabolizing sugars (rather than moving them to the kernels). Hot days also mean faster GDD accumulation during the season and can shorten the number of days the crop has to photosynthesize and create sugars. For example, let's say a hybrid needed 1350 GDDs to reach maturity after flowering. With a daytime temperature of 86 F and night temperature of 68 degrees F, it would take 50 calendar days to accumulate 1350 GDDs. Conversely, with a day temperature of 86 F and a night temperature of 63 F, it would take 56 calendar days to reach that same GDD accumulation.

In parts of the state there may be soil moisture present but root systems are being affected by soil compaction restricting growth. Another issue that has been observed is rootless or floppy corn. Seed planted in loose dry soil that becomes compacted after planting may be prone to this as well. If leaf rolling is showing up...
in your fields, consider digging some plants to assess the root systems and levels of soil moisture within the field.

Figure 1 – Corn showing leaf rolling symptomology.

Figure 2 – Rootless corn showing nodal roots developing outside soil environment.

References


**Western Bean Cutworm Numbers Remain Low Across Ohio**


We are now in the second week of monitoring for Western bean cutworm (WBC) in Ohio. Similar to last week, WBC adult numbers remain low in all monitoring counties. Trap counts for the week of June 29 – July 5 resulted in a total of 56 WBC adults (0.67 average moths per trap) (Figure 1). Overall, 26 counties monitored 84 traps across Ohio. No counties reported capturing more than 1 moth / day over the 7-day monitoring period; therefore, all counties currently remain below the recommended levels that indicate scouting for egg masses should begin.
Sustainable cover-crop farming practice faces one big limitation: Land to produce seeds

By International Center for Tropical Agriculture


As farmers around the globe look to grow food more sustainably—with less water, fertilizer, pesticides and other environmental impactors—the use of cover crops is becoming more popular. These crops, which are often grasses or legumes, or many other types of plants, are generally grown between the

Northeast Ohio Agriculture

OHIO STATE UNIVERSITY EXTENSION
Ashtabula, Portage and Trumbull Counties
harvest and planting season of the land’s main cash crop, to reduce erosion, build soil fertility and control weeds, among other benefits. Their use has jumped in recent years. From 2012 to 2017, U.S. cover crops increased to 6.2 million hectares, an increase of 50%.

But the growth in cover cropping may soon hit a ceiling: Planting millions of acres of cover crops will require huge extensions of land to produce cover crop seed. Between 3 and 6% of the 92 million acres of cropping land currently used for corn (maize) in the U.S. may be required to produce cover crop seed for that land area.

Researchers estimated that range based on 18 cover crops currently used on corn farmlands. The study was published June 11 in Communications Biology, a Nature journal, by scientists at the University of Minnesota, University of Southern California, Saint Louis University, University of Hawaii, and the Alliance of Bioversity International and CIAT.

"Cover cropping works," said Colin Khoury, a crop researcher at the alliance, who co-authored the study. "But it's not yet commonly used, even though it's widely praised."

Despite its growing popularity, only 1.7% of U.S. cropland currently employs cover crops. Universities, nonprofits and industry are driving growth in cover crop use through research, advocacy and education.

Cover crops make soil healthier—they reduce erosion and help restore nutrients and carbon, and create the conditions where soil can better hold moisture, all of which can help mitigate climate change as well as support farmers' adaptation of their crops to hotter and drier conditions. They help control weeds and pests and can reduce the use of pesticides and chemical fertilizers, which have highly valued downstream benefits.

"Water quality improvements are seen quite rapidly when you use cover crops," said Michael Kantar, a plant breeder at the University of Hawaii.

Without investment in improving cover crops, the land needed to produce enough seed to widely scale up their use would likely cut into land used to produce cash and food crops. This is because cover crops do not generally reach a seed-producing age when planted on land between harvest and planting of food crops.

While 3 to 6% of U.S. corn farmland may not seem like much, it only takes 0. to 0.7% of that land to produce corn seed. Some of the cover crops that provide the greatest environmental benefits have the poorest seed production, meaning that as much as 12% of the U.S. corn belt would be needed to produce cover crop seed of those crops. This would be equivalent to producing 44 million metric tons less corn on those farmlands.
Invest, and look south

The authors said demand could overcome the land limitation—as long as this demand is channeled into investments in breeding programs to increase cover crop seed yield. Scientists can improve cover crops using conventional breeding techniques or biotechnological innovations, including CRISPR/Cas9 technology—essentially the same methods already used to increase seed yields in food and cash crops.

"It's not a prohibitive investment," said Kantar. "We need more dedicated breeding programs for cover crops."

Alternatively, a cover crop seed industry could expand into other temperate or even tropical growing regions, giving new income opportunities to farmers who could produce seed for an emerging, global market for more sustainable crop production.

"The economic and environmental benefits of expanded cover cropping likely surpass needed investments by a very wide margin," said Bryan Runck, the study's lead author from the University of Minnesota.

**Planting green' cover-crop strategy may help farmers deal with wet springs**

By: Penn State
Source: [https://www.sciencedaily.com/releases/2019/07/190701163835.htm](https://www.sciencedaily.com/releases/2019/07/190701163835.htm)

Allowing cover crops to grow two weeks longer in the spring and planting corn and soybean crops into them before termination is a strategy that may help no-till farmers deal with wet springs, according to Penn State researchers.

The approach -- known as planting green -- could help no-till farmers counter a range of problems they must deal with during wet springs like the ones that have occurred this year and last year. These problems include soil erosion, nutrient losses, soils holding too much moisture and causing a delay in the planting of main crops, and main-crop damage from slugs.

"With climate change bringing the Northeast more extreme precipitation events and an increase in total precipitation, no-till farmers especially need a way of dealing with wet springs," said Heather Karsten, associate professor of crop production ecology, whose research group in the College of Agricultural Sciences conducted a three-year study of planting green. "We wanted to see if farmers could get more out of their cover crops by letting them grow longer in the spring."
As cover crops continue to grow, they draw moisture from the soil, creating desired drier conditions in wet springs for planting corn and soybeans. With planting green, after those main crops are planted into the cover crops, the cover crops are typically terminated by farmers with an herbicide. The decomposing cover crop residues then preserve soil moisture for the corn and soybean crops through the growing season.

The study took place at five sites over three years -- on three cooperating Pennsylvania farms that plant no-till in Centre, Clinton and Lancaster counties; at Penn State's Russell E. Larson Agricultural Research Center in Centre County; and at the University's Southeast Agricultural Research and Extension Center in Lancaster County.

At each location, researchers compared the results of planting green to the traditional practice of terminating cover crops 10 days to two weeks before planting the main crops of corn and soybeans.

Cover crops included in the study were primarily rye and triticale, as well as a mixture of triticale, Austrian winter pea, hairy vetch and radish in one location.

Findings of the research, recently published online today in *Agronomy Journal*, were mixed, according to study leader Heidi Reed, a doctoral student in agronomy when the research was conducted who is now an educator with Penn State Extension, specializing in field and forage crops.

Reed noted that planting green appeared to benefit soybean crops more than corn.

Planting green increased cover crop biomass by 94 percent in corn and by 94 to 181 percent in soybean.

However, because planting green results in more cover crop residues acting as mulch on the surface, it also cooled soils from 1.3 to 4.3 degrees Fahrenheit at planting.

At several of the sites during the study years, main-crop plant populations were reduced when planted green, possibly due to the cooler temperatures slowing crop emergence and nutrient cycling, and/or from cover crop residue interference with the planter. In corn, in a few cases, crop damage by slugs was also increased when corn was planted green.

No-till farmers struggle with slugs damaging corn and soybean seeds and seedlings because no-till doesn't disturb the soil and kill slugs or bury their eggs the way tillage does.

"No-till with cover crop residues also provides habitat for some crop pests and keeps the soil moist -- so no-till cover crop systems tend to be great slug habitat," Karsten said.

"We had hoped that letting cover crops grow longer in the spring would supply alternative forage for the slugs, as well as habitat for slug predators such as beetles --
and these factors would reduce slug damage of the main crop seedlings. But we did not see a consistent reduction in slug damage on main crops as we expected."

When researchers compared crop-yield stability between the two cover crop termination times across the multiple locations and years, corn yield was less stable and reduced by planting green in high-yielding environments; however, soybean yield was not influenced by planting green.

"We concluded that corn was more vulnerable to yield losses from conditions created by planting green than soybeans," Reed said. "Since soybean yield was stable across study locations, and not affected by cover crop termination date, we suggest that growers who want to extend cover crop benefits and avoid the risk of crop-yield reduction from planting green should consider trying it first with soybean."

**Ashtabula County Agricultural Scholarship Winners Announced**

The Ashtabula County Agricultural Scholarship Fund was founded on April 29, 1952 by a group of local leaders to help promote interest in the study of agriculture, home economics, environmental sciences, and natural resources. Since then, the committee has grown to also include community scholarships which are open to any student regardless of the college major. This scholarship program is driven by a group of Ashtabula County volunteers and supported by countless families, agribusiness firms and prior recipients. If you are interested in donating, call Andrew Holden at 440-576-9008.

This year, the committee is pleased to announce a total of $17,500 in scholarship money will be awarded to twenty outstanding young people for the 2020-2021 school year. It was a tough selection process for the committee as we were impressed with all the applications submitted for consideration. The scholarship recipients are as followed:

Allison Graves, daughter of Adam & April Graves of Jefferson, is the recipient of a $1,000 Ashtabula County Holstein Club Scholarship. Allison is a 2020 graduate of Pymatuning Valley High School and will be attending Youngstown State University next fall.

David Riley son of Ron and Wendy Riley of Williamsfield, is also a recipient of a $1,000 Ashtabula County Holstein Club Scholarship. David was a 2018 graduate from Pymatuning Valley High School and is currently attending Kent State University majoring in Biology and Pre-Veterinary Medicine.
Stuart Struna, son of Edward & Margaret Struna of Williamsfield, is also the recipient of a $1,000 Ashtabula County Holstein Club Scholarship. Stuart is a 2020 graduate of Pymatuning Valley High School and will be attending Kent State University majoring in Integrated Social Studies.

Kate Cole, daughter of Joe and Deana Cole of Dorset, is the recipient of the $1,000 Lester C. Marrison Memorial Scholarship. Kate is 2019 a graduate of Cole Academy and will be attending The Ohio State University – ATI where she is majoring in Livestock Management and Production.

Mason Mazzaro, son of Thomas & Charity Mazzaro of Williamsfield, is the recipient of the $1,000 Service-Jerome Scholarship. Mason was a 2019 graduate from Pymatuning Valley High School and is currently attending Ohio State University where he is majoring in Agribusiness and Applied Economics.

Sierra Szuhay, daughter of Rhonda Szuhay of Jefferson, is the recipient of a $500 Lautanen Family 4-H Scholarship. Sierra is a 2020 a graduate of Jefferson Highschool and will be attending Thomas Moore University next fall majoring in Exercise Science.

Austin Stringfellow, son of Marc & Anita of Jefferson, is a recipient of a $1,000 Centerra Co-op Scholarship. Austin is a 2022 graduate of Pymatuning Valley High School and will be attending the University of Northwestern Ohio next fall majoring in Agriculture Mechanics.

Kenneth Crouch Jr., son of Kenn and Beth Crouch of Jefferson, is also a recipient of a $1,000 Centerra Co-op Scholarship. Kenneth is 2020 graduate of Pymatuning Valley High School and will be attending Ohio Technical College majoring in Welding and Fabrication.

Kayla Lindberg, daughter of Jeff & Cindy Lindberg of Austinburg, is a recipient of the $1,000 Allan C. Jerome Scholarship. Kayla is a 2020 graduate of Geneva High School and will be attending Penn State University in the fall majoring in Mechanical Engineering.

Jenna Swiger, daughter of Julie and Jeremy Swiger of Pierpont, is a recipient of the $1,000 Prochko Family Memorial Scholarship. Jenna was a 2019 graduate from Pymatuning Valley High School and is attending The Ohio State University, majoring in Animal Science.
Cheyenne Kase, daughter of Suzette Bryner & David Kase of Jefferson, is the recipient of the $1,000 Harold & Dick Springer Memorial Scholarship. Cheyenne is a 2019 graduate of Jefferson High School and is currently attending The Ohio State University - ATI, majoring in Animal Science / Animal Health.

Aubrey Hane, daughter of Lori and Michael Hane of Williamsfield, is the recipient of the $1,000 Christopher L. Zaebst Memorial Scholarship. Aubrey is a 2020 graduate of Pymatuning Valley Area High School and will be attending Youngstown State University, majoring in Agribusiness and Business Management.

Katherine Eldred, daughter of Myron & Rosmarie Eldred of Kingsville, is also a recipient of the $1,000 Christopher L. Zaebst Memorial Scholarship. Katherine is a 2019 graduate from Edgewood High School and is currently attending The Ohio State University, majoring in Exercise Science.

Lacy Moore, daughter of Rick and Greta Moore of Andover, is also a recipient of the $1,000 Christopher L. Zaebst Memorial Scholarship. Lacy is a 2018 graduate from Pymatuning Valley High School and is currently attending Youngstown State University majoring in English.

Shane Hogle, son of David & Cheryl Hogle of Conneaut, is the recipient of the $1,000 Sanborn Family Scholarship. Shane is a 2020 graduate of Edgewood High School and will be attending Youngstown State University majoring in Music Performance.

Mason Shreve, son of Paul & Dawn Shreve, is the recipient of a $1,000 Ashtabula County Ag Scholarship. Mason is a 2020 graduate of Grand Valley High School and will be attending Thiel College, majoring in Environmental Science.

Tiffany Ellsworth, daughter of Jeremy and Tammy Ellsworth of Williamsfield, is also a recipient of a $1,000 Ashtabula County Ag Scholarship. Tiffany is a 2019 graduate of Christian Liberty Academy and is currently attending Kent State University majoring in Applied Science-Veterinary Technology.

Emma Lamont, daughter of Brian Lamont of Conneaut, is also the recipient of a $1,000 Ashtabula County Ag Scholarship. Emma was a 2019 graduate of Conneaut High School and is attending Bowling Green State University majoring in Secondary Education: Family and Consumer Sciences.
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PESTICIDE COLLECTION DAY: ODA CLEAN SWEEP

Tuesday, August 25th, 2020 - 9:00 AM to 3:00 PM

Location: Perry Coal and Feed  4204 Main St, Perry, OH 44081

Cost: Free

Details: Pesticide Collection for all Commercial and Private Agricultural Applicators (Nurseries, Farms, Grape Growers, Christmas Tree Growers)

Not intended for homeowners

Contact information: Thomas deHaas – OSU Lake County Extension, ANR Educator dehaas.2@osu.edu or 440-853-2630

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