Wisconsin Horticulture Update Summary, August 01, 2014

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WI WEATHER REVIEW

Cool summer temperatures and scattered afternoon and evening showers prevailed during the final week of July. A nearly stationary area of upper level low pressure dominated Wisconsin's weather, which was characterized by partly sunny skies, scattered showers, and a few isolated late-day thunderstorms. High temperatures were mainly in the 70s to lower 80s, some 5-10 degrees below normal for late July. Lows ranged from mid-40s to low 50s in the north with mid-50s to lower 60s in most other areas. Needed rainfall across the state improved declining topsoil moisture reserves and eased stress on pollinating corn and pod-setting soybeans. Rain has been insufficient for much of Wisconsin in July. Madison has received only 1.08 inches as of July 30, which is 2.85 inches below average. Condition ratings for the state's crops remain 72-85% in the good to excellent range, despite this month's predominantly cool and dry weather pattern. (Wisconsin Pest Bulletin, Vol. 59, No. 13, July 31, 2014)

Growing Degree Days (GDD)

Growing degree days is an accumulation of maximum and minimum temperatures as directly related to insect and plant development. As of July 30, in Wisconsin, the GDDmod 50 ranged from 915 to 1672: Appleton-1324; Bayfield-915; Beloit-1672; Big Flats-1441; Cumberland-1266; Crandon-1071; Crivitz-1167; Eau Claire-1458; Fond Du Lac-1335;Green Bay-1229; Hancock-1441; Hartford-1327; Juneau-1424; LaCrosse-1625; Lone Rock-1635; Madison-1553; Medford-1176; Milwaukee-1276; Port Edwards-1393; Racine-1279; Sullivan-1327; Waukesha-1327; Wausau-1217 (WI Pest Bulletin Volume 59 Number 13 July 31, 2014). To determine the Degree Days of any city in Wisconsin, use the Degree Day calculator at

http://agwx.soils.wisc.edu/uwex_agwx/thermal_models/many_degree_days_for_date

The following phenological information gives a perspective on how GDD accumulation relates to some plant and insect development (http://bygl.osu.edu/ and http://www.entomology.umn.edu/cues/Web/049DegreeDays.pdf): squash vine borer adult emergence, 900; panicled goldenraintree, first bloom, 924; June bride little leaf linden, first bloom, 953; azalea bark scale, egg hatch, 957; Japanese beetle, adult emergence, 970; rosebay rhododendron, first bloom, 1,010; June bride littleleaf linden, full bloom, 1,115; bottlebrush buckeye, first bloom, 1,158; Ural falsespirea, first bloom, 1,170; panicled goldenraintree, first bloom, 1251; Rose-of-Sharon first bloom, 1347; pine needle scale egg hatch-2nd generation, 1349; euonymus scale-2nd egg hatch,1923; magnolia scale-egg hatch, 1934; banded ash clearwing borer-adult emergence, 2195.

INTRODUCTION

Today's WHU host was Douglas County agriculture/horticulture educator Jane Anklam. The specialist was PDDC director Brian Hudelson. The special guest this week was Johanna Oosterwyk in the UW-Madison Department of Horticulture, manager of the D.C. Smith Greenhouse. Other discussion participants were representatives of the following counties: Douglas (Jane); Kenosha (MGVs); Milwaukee (Sharon); Pierce (Diana); St. Croix (Heidi); Waukesha (Ann); Winnebago (Kimberly); Portage (Walt).

HORTS' SHORTS

This week, Jane delighted participants by asking for area reports based on nearby watersheds. County agents reported a mixed bag of issues.

Southeast watersheds of upper and lower Rock River, the Fox River, the Root and the Pike:

Milwaukee County: We have had no rain for a couple of weeks so it is dry. Goldenrod is starting to flower; milkweed beetle, 0.5 inch long squash vine borer larvae and larger populations than previous years of pollinators and Monarch butterflies are here, but Japanese beetle populations are still low. We are happy that maple tar spot is not prevalent, considering the last couple of years were bad for this fungus.

Waukesha (Ann): Wide variety of plants came in, lots of questions about leaf spot diseases on tomato due to cool weather. No late blight yet.

Eastern watersheds-the Wolf River, the lower Fox, and Lake Michigan shoreline:

Winnebago County: It has been quiet, but we are getting a few calls about blossom end rot and plant/weed ID. We had one question on yellowing pumpkin leaves which we are following up with Brian. It has been hit or miss on the rain.

North Central watersheds-Upper Wisconsin River:

Portage County: We are just west of eastern continental divide, close to the mighty Plover River. Late blight has been confirmed in our county. We are getting reports of leaf spots on tomato which are possibly a nutrient deficiency or Septoria leaf spot . We had a grass ID, which we finally decided was smooth brome grass with Mark's help. Farm Tech days are coming up and we are anticipating good attendance.

Northwestern watersheds-the Chippewa and lower Chippewa Rivers, Eau Claire River, Pepin River:

St. Croix County: We had calls on oak wilt and how to minimize its spread, buckthorn control, bats. Plant ID included woodland plant hog peanut and the difference between poison ivy and Virginia creeper and how to eliminate them. I had SWD in my home garden, which I am trying to minimize. We have had no rain and we really want it.

Pierce County: Some raspberry growers are proactively spraying for Spotted Wing Drosophila because of its historic presence here. There is still adequate soil moisture, although we could use some rain. We had a variety of fungal diseases with a case of Impatiens Downy Mildew confirmed. Problems with apple tree dieback are continuing. Gnats and blackflies are driving people crazy and they are desperate for control options.

North watersheds-Bayfield and Ashland:

Douglas County: We have had good rain. The temperatures have been cool, so tomatoes are still just blossoming but peppers are aborting due to the cool nights. We are used to short seasons, but we are wondering if we will get any tomatoes this year. Not many insect problems yet. We will be doing weed and pest tours in the community gardens and hope we find some. We are still seeing apple decline due to winter injury. Things look pretty.

SPECIALIST REPORT: Insect Diagnostic Lab Update

Presented by P. J. Liesch, Interim Assistant Faculty Associate, UW-Madison Department of Entomology, and Interim Manager of the UW-Extension Insect Diagnostic Lab *pliesch@wisc.edu*

There was no IDL update this week.

SPECIALIST REPORT: Plant Diagnostic Disease Clinic

Presented by Brian Hudelson, Sr. Outreach Specialist, UW-Plant Pathology, and Director of the UW-Extension Plant Disease Diagnostics Clinic (PDDC) bdh@plantpath.wisc.edu

The PDDC update for July 25 through August 1 is attached to the end of this summary.

It has been busy week in the clinic again for vascular wilts on woody plants, and we diagnosed oak wilt on red/white/and an unidentified oak. Cherry, apple, and crabapple trees are still coming in with decline and collapse due to winter injury, some with canker fungi as a secondary cause. Numerous root rot species, affecting woody and herbaceous ornamentals and vegetables, including peach, raspberry, vinca, balsam fir and beans were seen this week. Our first report this year of Impatiens Downy Mildew was confirmed. Vegetable diseases were prevalent this week. We saw more black rot on kale and collard greens. Septoria leaf spot, early blight, bacterial spot and bacterial canker, and walnut toxicity on tomato were also identified. Powdery mildew on pumpkins is common now.

Phytophthora Root Rot on Peach

We found this on root tissue from peach transplants in a commercial orchard. Many of their new trees collapsed and died.

Pythium Root Rot on Raspberry

A homeowner submitted the raspberry sample that was affected with pythium.

Aster Yellows/Black Heart on Celery

We identified the aster yellows phytoplasm on celery. The symptoms were yellowing, distorted and stunted leaves. This sample also had interior deterioration of the crown, but no pathogens were identified from culturing. We attributed the rotten interior to a disease called Black Heart, which is similar to Tomato Blossom End Rot in that it is a nutrient deficiency of calcium uptake.

Fusarium Yellows/Ashy Stem Blight on Snap Beans

These poor green beans were afflicted with numerous root rot pathogens including fusarium, phytophthora, and rhizoctonia. In addition, we diagnosed fusarium yellows(Fusarium oxys and a pathogen called Macrophomina phaseolina. In soybeans the latter fungus causes Charcoal Stem Rot, but in green beans it causes Ashy Stem Blight. Brian enjoyed describing the growth in culture, particularly the speckled appearance due to the microsclerotia.

http://labs.russell.wisc.edu/pddc/files/Fact_Sheets/FC_PDF/Charcoal_Rot_of_Soybean.pdf

http://www.cals.ncsu.edu/course/pp728/Macrophomina/macrophominia_phaseolinia.HTM

Questions/Comments for Brian Hudelson

Has late blight been confirmed in Milwaukee County?
It has not been diagnosed from my lab, but maybe Amanda Gevens' lab has confirmed it. It would be worth following up with Amanda.

Is Basil Downy Mildew common throughout the state?
It is common in the Madison area and I would expect that to be true statewide, although I haven't had samples from elsewhere. If you come to Madison, we can visit Allen Centennial Gardens which has some infected basil plants. Downy mildews have done very well this year. We have seen it on basil, impatiens, and on onion.

Do you have any ideas concerning yellowing and wilting pumpkin leaves?
(This discussion preceded the actual conference.) Are the leaves in the center or at the tips? If in the center, it could be powdery mildew which can cause leaves to dry up and wilt. It may also be a fertility issue.

SPECIAL TOPIC: Supplemental Lighting

Presented by Johanna Oosterwyk of UW Dept. of Horticulture and manager of the D.C. Smith Greenhouse, the teaching greenhouse for the College of Agriculture

Johanna Oosterwyk gave a presentation about supplemental lighting as it applies to both commercial growers homeowners who want their indoor plants to perform well. Two powerpoint documents accompanied her talk and are attached to the WHU update. There is a lot of background information on the powerpoints through page 15 which she skimmed through but is worth perusing.

About Johanna Oosteryk

Johanna has degrees in both Horticulture and Life Science Communications from UW-Madison. She spent 20 years working in greenhouses, and in market gardens and nursery crops before that.

What is Light?

Light is energy and white light contains all the colors or wavelengths of light. It is important to remember this concept because of what plants do with the light. The beautiful process of photosynthesis allows plants to harvest the light energy and turn it into chemical energy in the form of storable carbohydrates.

Why is Supplemental Light Necessary?

In general, the more light plants have the more carbohydrates they can produce to use and to store. We don't usually worry about sufficient light outdoors, but indoors is another story. When plants are grown indoors or brought indoors either to a greenhouse or a home, the physical structure shades the plants and induces a light deficit. Supplemental lighting makes up the difference between what light plants get and what they need to thrive.

Photosynthetically Active Light

Not all wavelengths of light are used by plants. The powerpoint shows the spectral wavelengths where chlorophyll absorbs most efficiently. Plants absorb red and blue light better than other wavelengths or colors for photosynthesis.

How to Measure Light

In order to optimize growth, the grower must know how much light the plant is getting and more is better. The most common way to measure light is to measure illumination; that is, how bright the light is. The units for illumination are lux or footcandles. Unfortunately, light meters are calibrated to measure the wavelengths of light that humans are most sensitive to, which are the green and yellow wavelengths. It can be a bit tricky when applying light meter readings to optimize supplemental lighting for plants. Light sources typically inform you about the brightness, but plants are more interested in the energy available for photosynthesis. This is an important distinction.

It is more accurate to measure irradiance using a quantum meter, which measures light energy of Photosynthetically Active Radiation (PAR) in watts/m^2 or µmol/m^2/sec These meters are calibrated for the optimal photosynthetic wavelengths and give commercial growers more appropriate information for optimally growing plants to maximize photosynthesis and thus return on their investment.

Homeowners can get by using footcandles, but commercial growers are prudent to measure PAR to fine tune conditions.

Quantity/Quality/Light Duration

Three properties growers need to know for supplemental lighting are:
Quantity- how much light or energy plants are getting or irradiance
Quality-which wavelengths of light plants are getting or light spectrum
Light Duration-how long are plants absorbing light

The quantity of light directly affects photosynthesis and plant growth. Each species is adapted to particular light levels. That is, some plants do better in shade and some do better in full sun. In greenhouses, an important variable is the Daily Light Integral (DLI), measured in units of mol/m^2/day. For perspective, outdoor growth is affected by Growing Degree Days which are based on temperature. In the greenhouse or home, temperature is controlled by the grower so the critical factor becomes the DLI and the goal is to optimize this factor for the crop being grown. The DLI is a cumulative measure of the amount of light exposure. The powerpoint slide shows the DLI for some crops. It is 5-10 or 7-15 for foliage or vegetable plants and natural light in the greenhouse may be sufficient even in March. It is 20-30 or 25-30 for flowers or fruit however plants may not receive this without supplemental light. By knowing the DLI of the crop you want to produce, you can provide the amount of supplemental light needed.

Two other important concepts regarding the quantity of light and the DLI are the Light Compensation Point (LCP) and the Light Saturation Point (LSP). For the former, the LCP is the lowest level of light needed to photosynthesize enough carbohydrates to equal the amount of carbohydrates expended in respiration. In other words, the point at which light is the limiting factor to growth and the plant just survives. Above this point, carbohydrates can be stored and plants can bulk up, for instance radishes can swell. Below this point, the plant is expending more calories than it is producing and must use stored carbohydrates. Since this number is based on a cumulative total, one way to lower costs for supplemental lighting is to increase the time the lights are on, rather than purchasing more fixtures. This is also a way for the homeowner to meet the light needs of houseplants.

In contrast, at the LSP, light is no longer the limiting factor for photosynthesis. In that case, carbon dioxide or water may be the limiting factor.

Plants can be acclimatized to other than the optimum light. For instance, shade plants can adapt to higher light levels or houseplants can adapt to lower light levels. They won't do great, but they will survive. In the greenhouse, you want to optimize supplemental lighting so that enough light is being provided for the plants to thrive but no energy is being wasted.

The quality of light is important as different wavelengths drive different phases of growth. Blue light helps with leaf development and height control. Without blue light, plants become tall and spindly. Red light helps induce flowering and without it plants may not flower or seed may not germinate.

Duration of light is a seasonally changing variable outside. Some plants are photoperiodic and certain developmental milestones, particularly flowering, is induced or inhibited depending on the light duration. Growers may want to take advantage of this plant characteristic depending on what they are trying to market. For instance, chrysanthemums and poinsettias are short day plants and require more than 12 hours of darkness per day to induce flowering. Lilies and petunias on the other hand are long day plants; they require less than 12 hours of darkness per day to flower.

In summary, we may want to grow plants when they naturally would not be growing or induce flowering when it wouldn't normally occur and so controlling the quality, quantity, and DLI with supplemental lighting is critical.

Lighting Options-Incandescent, Fluorescent, High Intensity Discharge, and LED

How is supplemental light provided? Incandescent, fluorescent, HID, and LED are all options and each has advantages and disadvantages.

Incandescent

This is the least expensive option but has enough disadvantages that it is not recommended. Incandescent bulbs are short-lived and inefficient, converting only 7% of the energy input into light, with the rest of the energy input producing heat. Because of this heat, the bulbs must be positioned far enough from the plants to avoid overheating them. The spectrum of light produced is mostly in the yellow/red wavelengths, so it is good for triggering or delaying flowering in photoperiodic species and is only recommended as a light source for this purpose. It specifically inhibits short day flowering. Even if you are using another type of fixture, just one incandescent fixture can promote or delay flowering in photoperiodic species. As a homeowner, if your plants are not flowering, find out if they are photoperiodic and add some incandescent lighting.

Fluorescent

Fluorescent fixtures convert approximately 20% of energy input into light and they don't produce much heat so they can be placed close to the plants. They will not cause the plants to transpire excessively. The cost is typically $20-200 for a greenhouse fixture, with each bulb $15-20. They have a good wavelength spectrum in the blue/green region for seedlings and seed germination. Homeowners can get decent seedling growth with a bank of 10 bulbs in the basement. They aren't great for greenhouses because the fixtures themselves shade the plants from natural light which is free.

High Intensity Discharge (HID)

The most common fixture used in commercial greenhouse production. HID fixtures convert approximately 30% of energy input into light with output in the 400-1000 watt range, but they also give off lots of heat which can cook your plants. The fixtures cost $300-400, with approximately $25-30/bulb, but they have a long life-span. Their efficacy depends on what reflector is used; it should be shaped to direct the light downward to the bench surface and not let any light go upward. The manufacturers of these bulbs can work with the grower to develop a light plan which takes into consideration the greenhouse being used. The light plan maximizes the light output while making the light consistent to prevent shadows or bright spots. These are not typically used by a homeowner.

Light Emitting Diode (LED)

These fixtures convert 20-30% of energy input into light. Right now they are the most expensive at $700-1500 per fixture, but costs are decreasing so they are increasingly used for commercial production. The lights are also not replaceable as there is no "bulb", but they do have about an average 50,000 hour life span. Each LED is a little circuit and is soldered directly to a greenboard. A distinct advantage of LED lighting is that each LED emits a very narrow color band, only red or blue wavelengths are emitted. LED grow lights look purple due to the mix of red and blue which is a little disconcerting for greenhouse workers and sometimes a few white ones will be added for

working light. You definitely do not want to use white LEDs only as they will not provide the correct wavelengths for optimum photosynthesis. The higher efficiency claims derive from the fact there are no wasted wavelengths and all of the energy that is emitted can be used by the plant for photosynthesis. The savings come in when paying for electricity for supplemental lighting. We are seeing upgrades to germination and growth chambers for research purposes and LEDs appear to be just as effective as HID for plant growth and development.

DLI Calculator

Whatever light fixture is considered, there is a DLI calculator from the New Hampshire Extension which can give recommendations. You can input either the light fixture to find out the quantity and quality of light for that fixture or what crop you want to grow to get a recommendation of what kind of fixture to use. Using this tool helps economize supplemental lighting costs by achieving the DLI most efficiently.

Supplemental Lighting for Growth Phases

Different fixtures are more suitable for different growth plant phases. For seedling germination by either the greenhouse grower or homeowner, the quality of light should be in the red wavelengths and can be provided by fluorescent (great for homeowner), HID or LED (both good for commercial grower) fixtures. Incandescents are not recommended because they give off too much heat which can dry out the seedlings. LEDs also give off heat, but out the back of the fixture where it doesn't impact evaporation as much. HID can also give off a lot of heat.

In greenhouses where bedding plants or early stages of vegetable plants are being grown, natural light even in March or April is sufficient. In that case, why spend the money on the fixtures or electricity? Bedding plant growers rarely need supplemental lighting, except for germination. Stretching of plant stems can usually be blamed on packing the plants in too densely which prevents light from penetrating. However, vertical LED light wands have been developed that can be used within the canopy of the plants instead of overhead. This type of fixture allows light to penetrate deeper into the canopy of closely grown plants, especially greenhouse tomatoes, peppers and cucumbers.

However, if you are growing plants in greenhouses in the winter for flowers or fruits, you will probably need to pay for some supplemental lighting. It is prudent to get the lighting plan.

Lighting for Indoor Production

There is more interest in growing completely indoors, especially in the winter months, where there is no natural light source such as in an old warehouse or barn. The structure can be insulated to minimize heating costs, but you will need to provide a complete balanced spectrum of light. The light can be supplied by fluorescent (since shading natural light is not a concern), HID or LED with a mix of red and blue. We are seeing crops such as greens and herbs which are grown this way, but you want to make sure that it is a high value crop that can pay back the production costs.

Lighting for Houseplants

For growing houseplants either in the home in a dim corner or an office setting with few windows, generally we are pretty close to the light compensation point, where plants are still alive but not growing vigorously. For us, the light level is good enough to see by, but our plants are being starved. Instead of increasing the number of lights, just leave the lights on longer even up to 24 hours. Fluorescent lighting is fine; there are LEDs made for the home but they are still an expensive option at $125-175 per fixture including "bulb"; just one incandescent can be used to induce flowering just be careful of the duration.

Questions/Comments for Johanna Oosteryk

In my grower magazines, there is a lighting system called Chameleon Plasma, which purports to be 300 watts but it is somewhat vague. How is the Chameleon Plasma different from HID lighting?

Is it even an HID light? I am not familiar with that product but will look into it and get back to you.

How does the DLI translate into hours of light needed? Does the DLI calculator answer that?

The DLI calculator will answer that. One of the slides showed needed DLI for a variety of crops. It will ask you a bunch of questions like what light fixture you have and what time of year it is. It will calculate your ambient natural

light level based on your latitude. In Wisconsin in March, we can already achieve a DLI of about 10. That is sufficient for bedding plants which is why growers don't normally need to add light. It is not enough for tomato fruit production though. The DLI calculator will tell you how you can achieve the needed value of 25 for that crop based on the fixture you have.

For fluorescent lights, should you use a full spectrum bulb or are there specific bulbs that put out more red or blue?
You can do it either way, by using red and blue bulbs or paying extra for a bulb with special coating that will give a more complete spectrum. The plant doesn't care how the light is provided as long as the wavelengths are there.

What do you mean by red and blue bulbs?
Warm fluorescent bulbs give more light in the red/yellow spectrum and cool fluorescent bulbs give more light in the blue spectrum.

How far above the plants should the lights be positioned?
Bulbs should be 6-8 inches above seedlings because you want higher light intensity and 2-3 feet above houseplants because you want to see the plants. For LED grow lights for homes, green leaves will look black.

Is there an advantage to using grow lights?
Yes, but keep in mind that houseplants are usually chosen since they will take lower light so we are normally skirting around the light compensation point. Pothos, philodendron, and snake plants will survive with no supplemental light; all do much better if a little extra light is provided. African violets will maintain leaves, but with just a little more light they will actually flower. The owner has to decide whether investing in the grow lights and the extra cost of electricity to make their plants flourish is worth it.

ANNOUNCEMENTS

Sharon: At the State Fair in Milwaukee, our master gardeners have prepared a model of a backyard with a butterfly garden in the DNR area. Stop by and introduce yourself. Next year we will change it to a pollinator garden since it attracts more than just butterflies.

Brian: UW Day at the State Fair is Wednesday. Our booth is in the open grassy area of the midway. Last week's summary and pod cast will be up by midnight tonight.

Walt: August 12-14 is Farm Tech Days in Portage County. It's going to be a great show.

Heidi: In the Northwest, Brian will be giving his disease talk to MGVs on August 20. For any master gardener vacationers, put us on your itinerary.

The team teleconference will be next week immediately after WHU at 10:30. An agenda will be forthcoming. It will use the same lines and dial-in number.

FINAL NOTES

The next meeting is August 8. Ann Wied from Waukesha County will be hosting and the special topic will be seed saving presented by Grant Olson of the Seed Savers Exchange.

The full audio podcast of today's and archived WHU conferences can be found at http://fyi.uwex.edu/wihortupdate/

UW LINKS

Wisconsin Horticulture webpage http://hort.uwex.edu

UW Plant Disease Diagnostics webpage http://labs.russell.wisc.edu/pddc/

UW Insect Diagnostic Lab http://www.entomology.wisc.edu/diaglab/

UW Turfgrass Diagnostic Lab http://labs.russell.wisc.edu/tdl/

UW Vegetable Pathology Webpage http://www.plantpath.wisc.edu/wivegdis/

UW Vegetable Entomology Webpage http://www.entomology.wisc.edu/vegento/people/groves.html#

UW-Extension Weed Science https://fyi.uwex.edu/weedsci/

UW-Extension Learning Store http://learningstore.uwex.edu

UW Garden Facts http://labs.russell.wisc.edu/pddc/fact-sheet-listing/

WHU "OFF THE AIR"

During this past week specialists have commented on these issues off the air:

VEGETABLE CROP UPDATE

Vegetable Crop Update Newsletter #16 is available at http://www.plantpath.wisc.edu/wivegdis/

Topics covered in the issue #16 include:

Late blight updates
Blitecast and P-Days for late blight and early blight management
Cucurbit downy mildew update
Onion downy mildew confirmed in the state
Plant Disease Diagnostic Clinic updates

PDDC UPDATE

UW-Extension/Madison Plant Disease Diagnostic Clinic (PDDC) Update
Brian Hudelson, Ann Joy, Joyce Wu, Tom Hinsenkamp, and Catherine Wendt, Plant Disease Diagnostics Clinic

The PDDC receives samples of many plant and soil samples from around the state. The following diseases/disorders have been identified at the PDDC from July 26, 2014 through August 1, 2014.

PLANT/SAMPLE TYPE	DISEASE/DISORDER	PATHOGEN	COUNTY
BROAD-LEAVED WOODY ORNAMENTALS			
Burning Bush	Phomopsis Canker	*Phomopsis* sp.	Dane
Cherry (Weeping)	Phomopsis Canker Winter Injury	*Phomopsis* sp. None	Dane Dane
Maple (Japanese)	Verticillium Wilt	*Verticillium* sp.	Dane
Maple (Norway)	Phomopsis Canker	*Phomopsis* sp.	Dane
Maple (Unspecified)	Verticillium Wilt	*Verticillium* sp.	Wood
Oak (Bur)	Tatters Tubakia Leaf Spot	None *Tubakia* sp.	Dane Dane
Oak (Red)	Oak Wilt Sphaeropsis Canker	*Ceratocystis fagacearum* *Sphaeropsis* sp.	Waukesha Dane
Oak (White)	Oak Wilt	*Ceratocystis fagacearum*	Marathon
Oak (Unidentified)	Oak Wilt	*Ceratocystis fagacearum*	Burnett, Dane, Jackson, Racine

FRUIT CROPS			
Peach	Root/Crown Rot	*Phytophthora* sp., *Pythium* sp.	Racine
Raspberry	Raspberry Leaf Spot	*Cylindrosporium rubi*	Winnebago
	Root/Crown Rot	*Pythium* sp., *Rhizoctonia solani, Fusarium* sp., *Cylindrocarpon* sp.	Winnebago
HERBACEOUS ORNAMENTALS			
Impatiens	Downy Mildew	*Plasmopara obducens*	Pierce
Vinca	Root Rot	*Pythium* sp., *Rhizoctonia solani, Fusarium* sp.	Brown
NEEDLED WOODY ORNAMENTALS			
Fir (Balsam)	Root/Crown Rot	*Phytophthora sp.*	Chippewa
VEGETABLES			
Celery	Aster Yellows	*Aster yellows phytoplasma*	Richland
	Blackheart	None	Richland
Collards	Black Rot	*Xanthomonas campestris*	Crawford
Horseradish	Root Rot	*Rhizoctonia solani*	Eau Claire
	Verticillium Wilt	*Verticillium* sp.	Eau Claire
Kale	Black Rot	*Xanthomonas campestris*	Crawford
Pepper	Bacterial Spot	*Xanthomonas campestris*	Walworth
Potato	Edema	None	Crawford
Pumpkin	Powdery Mildew	*Oidium* sp.	Dane
Snap Bean	Ashy Stem Blight	*Macrophomina phaseolina*	Waushara
	Fusarium Root Rot	*Fusarium* spp.	Waushara
	Fusarium Yellows	*Fusarium oxysporum*	Waushara
	Pythium Root Rot	*Pythium* spp	Waushara
	Rhizoctonia Root Rot	*Rhizoctonia solani*	Waushara
Tomato	Bacterial Canker	*Clavibacter michiganensis* subsp. *michiganensis*	Dane
	Bacterial Spot	*Xanthomonas* sp.	Dane
	Septoria Leaf Spot	*Septoria lycopersici*	Dane, Waukesha
	Walnut Toxicity	None	Dane, Waukesha

For additional information on plant diseases and their control, visit the PDDC website at pddc.wisc.edu.