

PURDUE
UNIVERSITY

Extension



PLANT AND PEST
DIAGNOSTIC
LABORATORY

Tom Creswell, PhD,
Lab Director

John Bonkowski, DPM,
Plant Disease Diagnostician

Todd Abrahamson,
Lab Assistant

2020

Plant & Pest Diagnostic Lab Annual Summary Report





2020 Summary Report

Tom Creswell, PhD,
Lab Director

John Bonkowski, DPM,
Plant Disease Diagnostician

Todd Abrahamson,
Lab Assistant

Introduction

The Plant and Pest Diagnostic Laboratory (PPDL) is dedicated to helping protect Indiana’s agriculture and the green industry by providing rapid and reliable diagnostic services for plant disease and pest problems. We also provide appropriate pest management strategies and diagnostics training. We are a participating lab in the National Plant Diagnostic Network (NPDN), a consortium of Land Grant University diagnostic laboratories established to help protect our nation’s plant biosecurity infrastructure.

Regulatory/State Collaboration

The PPDL serves as the state laboratory charged with assuring accuracy in disease diagnosis for phytosanitary certification for exports, administered by the Indiana Dept. of Natural Resources (IDNR). The PPDL supports the work of the IDNR by providing insect identification and disease diagnosis for nursery inspection samples and official state survey samples (see below under diagnostic highlights and surveys). The PPDL serves as the lab of record for the Indiana Crop Improvement Association (ICIA) and provides hands-on disease identification phytosanitary training to field inspectors annually. We also partner with the Office of the Indiana State Chemist to evaluate potential damage from herbicides, disease and insects on samples collected as part of official investigations of pesticide misapplication cases.

Extension and Teaching Activities

The PPDL staff typically participates in multiple in-person training events throughout the state each year. After presenting face-to-face workshops for professional landscapers, nursery growers, Master Gardeners and arborists in January and February we pivoted to online webinars, recorded presentations, and Zoom calls for the rest of the year for trainings due to COVID-19 restrictions.

In Indiana, ICIA field inspectors assist the IDNR by providing the IDNR with field inspections of crops being grown for export so that they may issue appropriate Phytosanitary export certificates. The PPDL provides phytosanitary corn and soybean disease diagnostics workshops to train Indiana Crop Improvement Association (ICIA) field inspectors annually to promote high standards of plant inspection work.

In 2020 our educational efforts included participation in Indiana Green Expo, Professional Landscape School, Turf and Landscape Field Day, Indiana Arborists Association meeting, Indiana Professional Lawn and Landscape Association, Category 1A Pesticide Training, Master Gardener events and classroom training with most of these being delivered via recorded video or live webinars.



Extension Specialist Collaboration

The PPDL benefits greatly from the diagnostic expertise provided by specialists in other departments (Table 1). As in past years, faculty and staff from the Departments of Botany & Plant Pathology, Agronomy, Entomology, Horticulture & Landscape Architecture, and Forestry & Natural Resources very generously assisted with providing problem diagnoses involving their specialties. The PPDL team provides an ongoing point of connection between county-based Extension educators, the public and Extension specialists on campus; facilitating knowledge exchange and information about trends in lab samples to promote more informed recommendations for disease and pest management.

Diagnostic Highlights and Surveys

Rosie Lerner and Bruce Bordelon, both in the department of Horticulture and Landscape Architecture, retired at the end of 2020. They have assisted the PPDL with countless samples over the years and we will miss both their expertise and friendship.

COVID-19 Impacts:

Along with the rest of the world our operations were impacted by the pandemic. As Purdue formulated a plan to keep operating our lab was classified as an essential service and remained open throughout the year. We installed plexiglass and plastic barriers between workstation, used staggered works schedules, adjusted how we received samples, wore masks and practiced strict social distancing; but we never closed. That allowed us to continue to provide diagnostic services and recommendations to our stakeholders without interruption. Travel restrictions and other limitations caused many of our clients to use our online submission tools for uploading photos of plant problems and insects (<https://ag.purdue.edu/btny/ppdl/Pages/digitalimages.aspx>).

In prior years samples submitted as photos averaged 235 per year but that nearly doubled to 462 samples in 2020. The need to de-densify our operation, coupled with a hiring freeze, led us to forego hiring a summer student as we have in past years so we all contributed more to routine lab tasks. Because we lost a technician position just before the start of the pandemic, we reduced the number of time-consuming molecular tests performed while continuing to provide essential diagnoses and sound management recommendations. The total number of samples received in 2020 dropped about 11% from the previous 5-year average.

Table 1. Departmental faculty and staff that assisted with sample diagnoses - 2020 ^[1]

Faculty/Staff	Number of Samples	Faculty/Staff	Number of Samples
Agronomy	3	Entomology	129
Keith Johnson	1	Tim Gibb	68
Jim Camberato	1	Cliff Sadof	48
Bob Nielson	1	John Obermeyer	5
		Larry Bledsoe	4
		Other	4
Botany & Plant Pathology	3196	Horticulture & Landscape Architecture	68
John Bonkowski	1318 ^[2,3]	Rosie Lerner	28
Tom Creswell	990	Aaron Patton	19
Darcy Telenko	386	Kyle Daniel	11
Marcelo Zimmer	250	Other	10
Janna Beckerman	137		
Lei Zhang	91		
Dan Egel	8		
Ian Thompson	5		
Other	11		
Forestry & Natural Resources	6	Non-Purdue Specialist	45
Lindsey Purcell	6	Jan Byrne, MSU	45 ^[4]

- [1] Names in **BOLD** are Department Diagnostic Liaisons.
 [2] 202 diagnoses were provided for *Phytophthora ramorum* nursery survey samples.
 [3] 91 diagnoses were provided for Phytosanitary field survey samples.
 [4] 45 PCR negative diagnoses provided by MSU diagnostician certified for *P. ramorum* testing

Table 2. Affiliation of persons submitting samples to the PPDL - 2020

Affiliation	Number of samples	% of Total
Non-regulatory Samples	1727	75.90%
Commercial	1219	53.6%
Garden Center/Greenhouse/Nursery	268	11.8%
Landscaper/Groundskeeper/Lawn & Tree Care	199	8.8%
Crop Consultant	198	8.7%
Agribusiness	187	8.2%
Other	101	4.4%
Arborist	99	4.4%
Grower/Farmer	93	4.1%
Extension Educator	42	1.8%
Pest Control	29	1.3%
Golf Course	3	0.1%
Non-Commercial	508	22.3%
Homeowner	332	14.6%
Researcher/Specialist	102	4.5%
Extension Educator	74	3.3%
Regulatory Samples	547	24.1%
IDNR (SOD <i>P. ramorum</i> nursery Survey)	202	8.9%
Office of the Indiana State Chemist	173	7.6%
IDNR/ICIA (Phytosanitary certification field inspection)	91	4.0%
IDNR (Nursery inspection)	81	3.6%
Totals:	2274	100%

Ramorum Blight/Sudden Oak Death survey:

The PPDL continued our long-term partnership (2004-2020) with IDNR in the annual Cooperative Agriculture Pest Survey (CAPS) to test nursery samples for the presence of *Phytophthora ramorum*, causal agent of Ramorum Blight and Sudden Oak Death. If this pathogen became established in the state it would threaten a wide range of ornamental woody plants and forest trees, including rhododendron, azalea, viburnum and oaks. This nursery survey assists in protecting Indiana landscapes, forests and the timber industry from a potentially destructive pathogen while preventing impacts to trade that might occur if *P. ramorum* became established in our nurseries and forests.

In contrast to 2019 there were no *P. ramorum* detections in 2020. As a result, the number of samples for this survey was reduced to 202 (Table 2), to allow nursery inspectors to focus on other disease and insect problems.

Boxwood Blight survey:

The first detection of boxwood blight in a landscape setting in Indiana occurred in 2018 when a homeowner contacted the IDNR after reading about the symptoms of boxwood blight (Fig 1.) in an IDNR news release. In 2019, IDNR Inspectors collected samples from unhealthy boxwood plants near the original landscape detection and sent them to the lab. The PPDL confirmed the sample as being boxwood blight positive. This confirmed the establishment, spread, and overwintering of boxwood blight in a second Indiana landscape, but since then we have had no additional boxwood blight positive samples from landscapes. All boxwood blight survey samples from nursery inspection samples were negative in 2020.



Figure 1 Boxwood with boxwood blight symptoms, black stems (left) and defoliation (right).

Exotic Corn Pathogens Survey:

The PPDL participated for the 8th year (2013-2020) with the IDNR in an IN CAPS survey for Exotic Corn Pathogens. All 223 foliar corn samples received by the PPDL were diagnosed as ‘not detected’ visually/microscopically for the presence of four corn diseases with potential for high consequence outbreaks including *Peronosclerospora maydis* (Java Downy Mildew) *P. philippinensis* (Philippine Downy Mildew), *Sclerophthora rayssiae* (Brown Stripe Downy Mildew) and *Xanthomonas vasicola* pv. *vasculorum* (Corn bacterial leaf streak or leaf blight). Tar spot, caused by *Phyllachora maydis*, was added to the survey for the second year. The PPDL confirmed the presence of tar spot on 53 samples. Data gathered from IDNR/PPDL CAPS surveys are uploaded to the National Agricultural Pest Information System (NAPIS) database and the NPDN National Data Repository. This effort in documenting reliable diagnostic information helps researchers and regulatory agencies guide future research and monitoring efforts.

Corn Tar Spot Update:

Since our lab first detected this disease in the United States in 2015, Tar spot of corn, caused by *Phyllachora maydis*, has become an important disease in Indiana, primarily in the northern counties of the state.

Dr. Darcy Telenko’s applied research efforts have shown that tar spot can cause yield reductions ranging from 20-60 bu./A in individual fields. Her lab’s research efforts focus on gaining a better understanding of how quickly the disease is spreading and its distribution in Indiana. The PPDL collaborated with her lab by diagnosing tar spot on 53 samples submitted from 35 Indiana counties. (Fig 2.). Diagnostic assistance by the PPDL will contribute to a better understanding of this new disease and help provide Indiana farmers with valuable information on how to manage tar spot disease in corn.

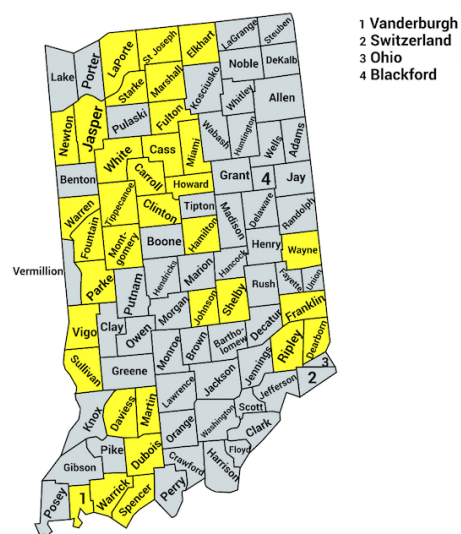


Fig. 2: PPDL Tar Spot Sample Confirmations - 2020

Southern Rust of Corn:

Every year, corn growing states are threatened with potential yield loss due to the disease southern rust, caused by the pathogen *Puccinia polysora*. The fungus cannot survive the winter in Indiana and is blown northward from the Southern US, Mexico, and South America. In severe outbreaks, growers can experience yield reductions as high as 25 bushels/acre (BP-82-W) if not managed.

Tracking the disease each year helps determine the potential need for growers to apply fungicides to protect their corn crop from this disease. Since 2019, Dr. Darcy Telenko has conducted a state-wide survey to determine the distribution of southern rust in Indiana in order to recommend appropriate management strategies. Funding provided by the Indiana Corn marketing Council paid for all southern rust samples submitted to the PPDL for diagnosis. The PPDL collaborated with her lab by diagnosing southern rust on 71 samples submitted from 63 Indiana counties (Fig 3.).

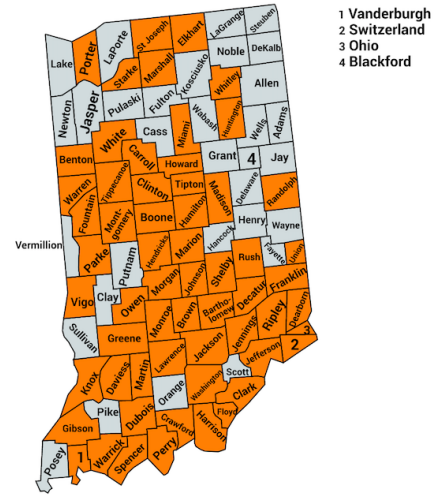


Fig. 3: PPDL Southern Rust Sample Confirmations - 2020

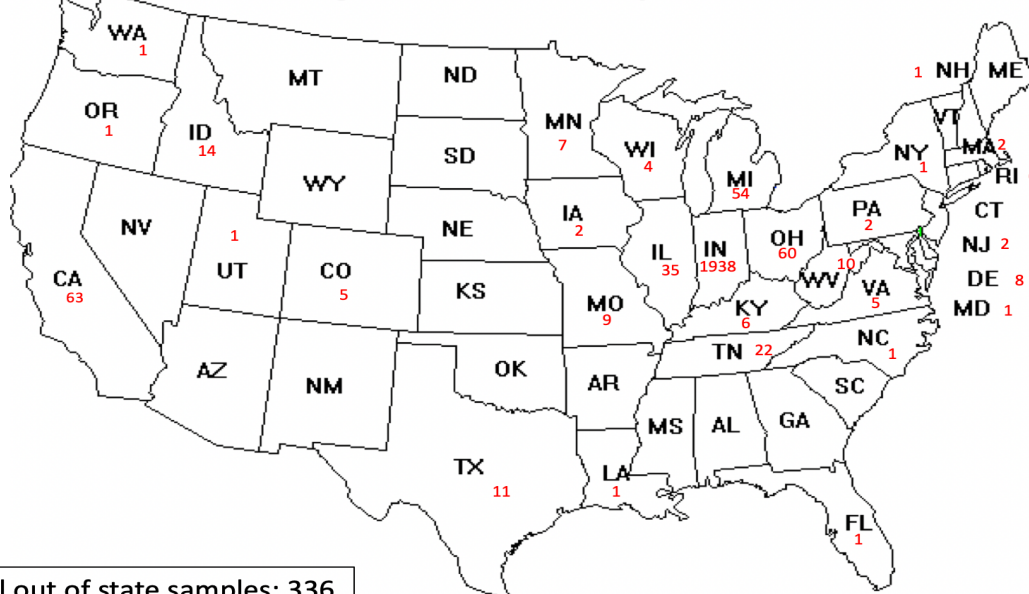
Soybean Cyst Nematode(SCN) Testing:

We welcomed a new nematologist, Dr. Lei Zhang, to Purdue in late 2020. Dr. Zhang will be conducting research on soybean cyst nematode (SCN) and other plant parasitic nematodes (<https://ag.purdue.edu/btny/Pages/Profile.aspx?strAlias=leizhang&intDirDeptID=10>). The PPDL helped him obtain 105 soil samples from known SCN fields by hosting a free sample program for SCN analysis, funded by the Telenko lab. The no-cost analysis of one sample per grower will be extended through spring 2021 but samples must be sent directly to SCN Diagnostics at the University of Missouri. See the Field Crops Pathology website for more details: <https://extension.purdue.edu/fieldcroppathology/>

Sample Overview

Over the last 20 years the PPDL has provided diagnosis or identifications on a total of 46,398 samples, of which 12,595 were regulatory samples. In 2020 we diagnosed 3777 problems on a total of 2274 samples submitted (Tables 2 & Fig. 6), with 336 of our samples originating from outside Indiana (Fig. 4).

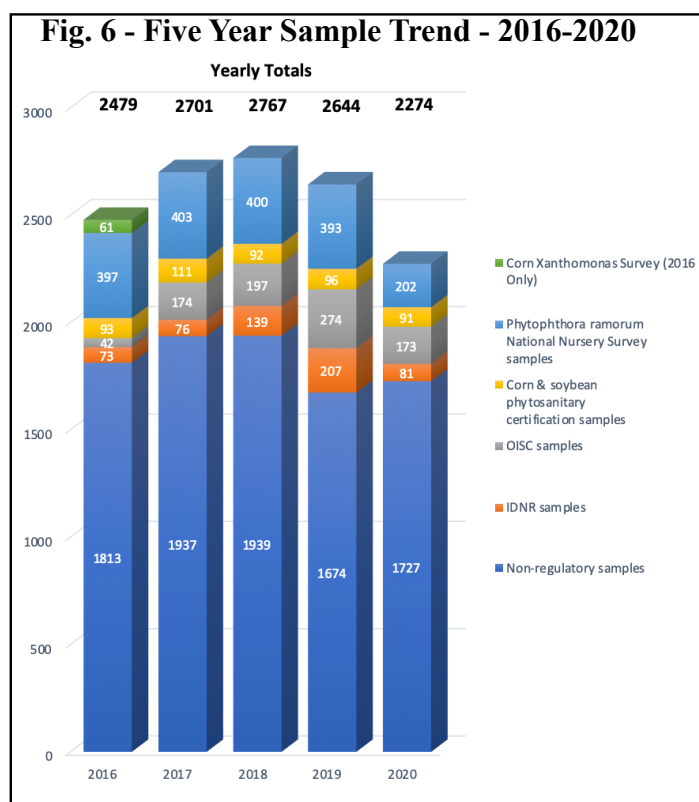
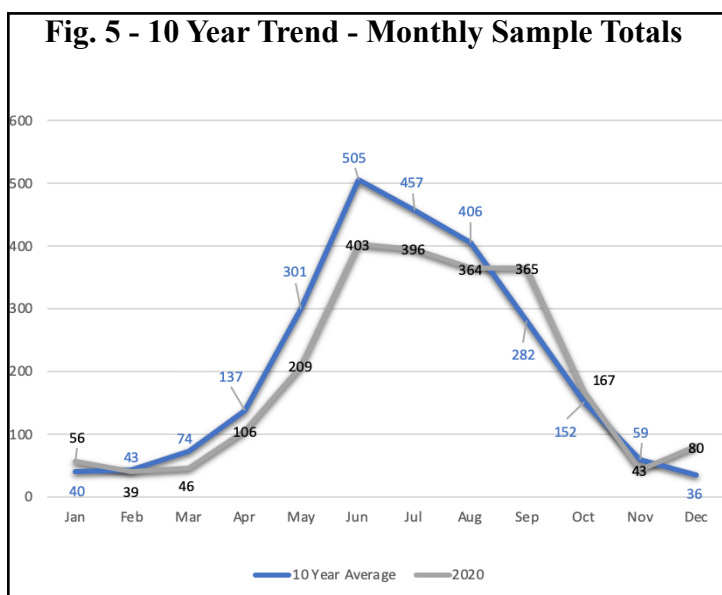
Fig. 4 Origin of samples received by the Plant and Pest Diagnostic Laboratory – 2020



Total out of state samples: 336
(14.8% of total samples)

Table 3. Diagnoses Sorted by Category - 2020		
Category	Number of Diagnoses	% of Total
Pathogens	2195	58%
Fungi	1913	51%
Viruses	174	5%
Bacteria	108	3%
Abiotics	863	23%
Cultural/Environmental	464	12%
Chemical/Herbicide Injury	302	8%
Nutritional	40	1%
Other	57	2%
Arthropods	445	8%
Insects	270	7%
Nematodes	103	3%
Mites	63	2%
Other	9	< 1%
Plants/Weeds	89	2%
Other	185	5%
Totals:	3777	100%

A ten-year trend analysis showed that sample numbers typically peak in June with sample numbers staying high in July and August. By comparison samples in 2020 plateaued at 102 samples fewer in June than is typical but remained about the same through September with more samples than average in the last quarter of the year. (Fig. 5). The five year sample trend is shown in Figure 6.



Ornamental plants are consistently the largest category of non-regulatory samples (50%) highlighting the reliance of Indiana’s green industry on the expertise provided by the PPDL (Fig. 7). A more detailed list of sample types is given in Table 4.

While diseases comprised 58% of our diagnoses last year, arthropod problems and damage due to non-living (abiotic) factors such as herbicide injury and weather extremes continue to be a significant segment of the problems diagnosed (Fig. 8).

Despite the pandemic restrictions we were able to process 51% of all samples in 3 days or less. Samples requiring in-depth laboratory analysis naturally take longer to complete and thus preliminary reports are provided to update clients on sample progress.

Table 4. Non-regulatory Samples by Category - 2020		
Category	# of Samples	% of Total
Agronomic	446	26%
Soybean	214	12%
Corn	164	9%
Hemp	45	3%
Forage	13	1%
Other	6	<1%
Small Grains	4	<1%
Fruit	80	5%
Fruit	56	3%
Small Fruit	24	1%
Ornamentals	870	50%
Woody ornamental - Deciduous	451	26%
Woody ornamental - Evergreen	216	13%
Annuals	104	6%
Perennials	95	6%
Other	4	<1%
Turf	35	2%
Vegetables/Herbs	128	7%
Tomato	51	3%
Other	35	2%
Lettuce	32	2%
Herbs	8	<1%
Cucumber	2	<1%
Miscellaneous	168	10%
Insect ID	83	5%
Plant/Weed ID	57	3%
Other (Multiple Host, Aquatics)	23	1%
Mushroom/Mold	5	<1%
Total Samples:	1727	100%

Fig. 7 Non-regulatory Sample Categories - 2020

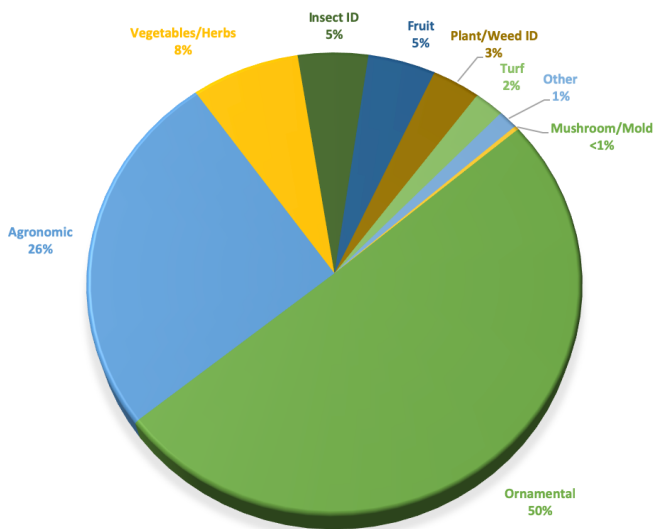
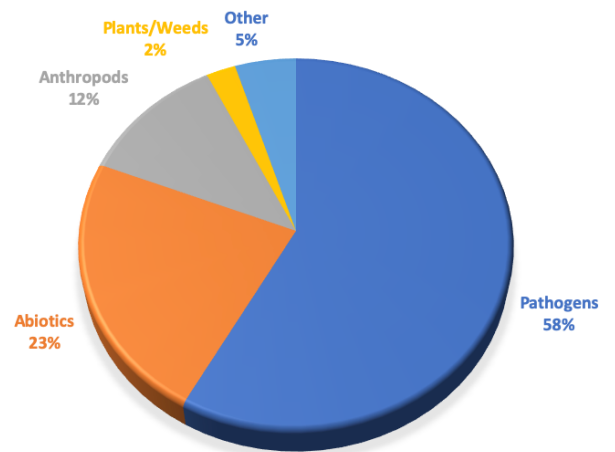


Fig. 8 Diagnoses by Problem Category - 2020



Journal Publications

First report of the NA2 clonal lineage of *Phytophthora ramorum* in Indiana. C. M. Press, V. J. Fieland, T. Creswell, J. Bonkowski, L. Miles, and N. J. Grünwald. *Plant Disease*, 2020, <https://doi.org/10.1094/PDIS-12-19-2543-PDN>

First Report of *Macrophomina phaseolina* Causing Charcoal Rot of Cucumber in Indiana. D.S. Egel, W. Guan, T. Creswell, J. Bonkowski. *Plant Disease*, 2020, <https://doi.org/10.1094/PDIS-11-19-2421-PDN>

Extension Bulletins written or revised in 2019

Midwest Vegetable Production Guide for Commercial Growers 2021, ID-56 (revised)
mwveguide.org.

Midwest Fruit Pest Management Guide 20121-2022, ID-465 (revised)
<https://ag.purdue.edu/hla/Hort/Documents/ID-465.pdf>

2020 Corn & Soybean Field Guide, ID-179 (revised)
https://edustore.purdue.edu/item.asp?Item_Number=ID-179

Phytophthora Diseases in Ornamentals, BP-215-W (new)
https://edustore.purdue.edu/item.asp?Item_Number=BP-215-W

BP-204-W; Managing Phytophthora blight of cucurbits (revised)
<https://www.extension.purdue.edu/extmedia/bp/bp-204-w.pdf>

2020 Awards

PUCESA Team Award for Purdue Landscape Report

The American Society for Horticultural Science Extension Division,
Outstanding Education Materials Award



A vertical poster with a green and white color scheme. At the top, the text "TEST, DON'T GUESS" is written in large, bold, black letters. Below this is a row of five small images: a green leaf with a brown spot, a green leaf with a black beetle, a green leaf with a white spot, a green tree, and a pink flower. Below the images, the text "WE IDENTIFY:" is written in bold, black letters. Underneath is a bulleted list: "Plant Diseases", "Insects and pests", "Plants and weeds", and "Damage caused by weather, chemicals, growing conditions". Below the list, the text "VISIT: www.ppdn.purdue.edu" and "To submit photos, download forms and more." is written. At the bottom, the NPDN logo is displayed, along with the text "The PPDL proudly partners with The National Plant Diagnostic Network" and "Purdue University, LSPS Room 116 765-494-7071". The name "Tom Creswell, Lab Director" is written at the very bottom. At the bottom of the poster, the Purdue University logo and "Extension PLANT AND PEST DIAGNOSTIC LABORATORY" are displayed.