



Annual Report 2012

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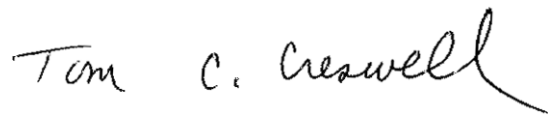
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ACKNOWLEDGMENTS

Purdue's Plant and Pest Diagnostic Lab (PPDL) works with specialists from multiple departments to provide a unique and critical resource for diagnosis of plant problems and pest identification. The hard work of the diagnosticians and volunteer faculty and staff are essential to this effort.

We are indebted to our departmental extension Administrative Professional for her webmaster and database assistance and to our PPDL secretary/receptionist whose patience and unfailingly friendly presence provides a welcome introduction to our clientele.

To the administration at Purdue University, we thank you for recognizing the vital role of the PPDL in addressing Indiana's plant and pest diagnostic needs.



Tom C. Creswell
Director, PPDL



Gail E. Ruhl
Senior Plant Disease Diagnostician

“...to enable people to improve their lives and communities through learning partnerships that put knowledge to work” (Extension mission as per the National Association of State Universities and Land Grant Colleges, 2001)

MISSION

The Plant and Pest Diagnostic Laboratory (PPDL) at Purdue University is an interdisciplinary laboratory that was established in 1990 with funding from the Crossroads initiative to integrate the existing plant disease and weed diagnostic lab in the Department of Botany & Plant Pathology (est. 1979) with the identification services provided by the Departments of Entomology, Horticulture and Landscape Architecture, Agronomy and Forestry. The mission of the PPDL is to provide accurate and rapid identification of plants, pests, and plant problems; suggest management strategies, when requested; and serve as a source of unbiased information for plant and pest related problems.

The Laboratory provides technical expertise to specialists and county Extension educators of the Purdue University Cooperative Extension Service (CES); to University research faculty and staff; to the Office of the Indiana State Chemist; to the Director of the Entomology and Plant Pathology Division of the Indiana Department of Natural Resources (IDNR) and associated nursery inspectors. The laboratory also provides routine pest and plant problem diagnoses for private businesses and citizens of Indiana.

COOPERATION WITH THE NATIONAL PLANT DIAGNOSTIC NETWORK

The National Plant Diagnostic Network (NPDN) was created in 2002 to help address concerns over potential bioterrorism attacks on U.S. food and feed crops. That mission has evolved over the years to one of strengthening diagnostic labs, improving training for diagnosticians and training “first detectors” for a broad range of problems including detecting and identifying invasive species.

The NPDN joins together plant and insect diagnostic laboratories at land grant universities across the U.S. and its territories into a system of five regions. The PPDL, as part of the North Central Plant Diagnostic Network (NCPDN) (<http://www.ncpdn.org/>) region has been working with counterparts at other land grant institutions to prepare for plant disease and pest introductions that might pose a threat to American agriculture. Part of this response includes providing training protocols for threat pathogens for the “first detectors.” First detectors typically include individuals such as county Extension educators, growers, crop consultants and regulatory field inspectors. Once trained, first detectors are on the lookout for unusual or new diseases to submit to the diagnostic laboratories. This greatly reduces the time between introduction of plant pests and diseases and their detection.

TRAINING INITIATIVES

The PPDL conducts online Adobe Connect training sessions for Agriculture & Natural Resources (ANR) educators with the intent of improving their diagnostic capabilities for plant diseases and pests in Indiana. The training in 2012 again included a review of major plant problems submitted to the clinic during the year. Master Gardener (MG) volunteers, a key resource for assisting county Extension Educators, were trained across the state in the art and science of diagnosing plant diseases, including a 4-hour hands-on workshop at the State MG Conference. Presentations to grower groups and specialized training events provided outreach to more than 2000 green industry professionals. Highlights include interactive outreach at the Indiana Green Expo, The Midwest Regional Turf Field Day and Indiana Professional Lawn and Landscape Association.

SURVEY WORK

The PPDL participated in CAPS survey efforts to check for the presence of *Phytophthora ramorum* in Indiana nurseries and retail/garden center outlets that receive perennial woody plant material from the West Coast. There were no survey confirmations of *P. ramorum* in Indiana. However, one Oregon Trace Forward sample of Rhododendron collected and submitted by an IDNR inspector from one of the CAPS sites at a garden center in St. Joseph county did test positive for *P. ramorum*. Standard operating procedure for positive Trace Forward finds includes destruction of infected and surrounding plants and disinfecting the site to prevent spread from the area. The information gathered from this survey was provided to the NPDP national data repository as well as uploaded through the CAPS data system. This data helps researchers and regulatory agencies guide research and monitoring efforts.

PPDL AND THE INDIANA DEPARTMENT OF NATURAL RESOURCES

The Plant and Pest Diagnostic Laboratory serves as the plant disease diagnostic facility for the Indiana Department of Natural Resources (IDNR). The IDNR and the Purdue Plant and Pest Diagnostic Laboratory work together during outbreaks of diseases of regulatory concern.

The PPDL provided disease diagnosis on 135 corn samples for the IDNR Phytosanitary Certification Program and diagnosis of 80 (34 of which were walnut phytosanitary samples) ornamental samples submitted by IDNR Nursery Inspectors.

STAFF

Purdue faculty and staff from the departments of Agronomy, Botany and Plant Pathology, Entomology, Forestry and Natural Resources, and Horticulture and Landscape Architecture serve as diagnosticians for the PPDL on a part-time basis as a portion of their total commitment to their respective departments. Staffing responsibilities in the PPDL and the department to which they belong, are listed below.

Botany and Plant Pathology

Director
Secretary and Receptionist
Webmaster and Extension Administrative Professional
Disease diagnosis and control
Weed identification, control, and diagnosis of herbicide injury on field crops
Computer support

Tom Creswell
Anna Meier
Amy Deitrich
Tom Creswell, Gail Ruhl
Travis Legleiter
Kyle Purple

Entomology

Invertebrate and other pest identification and control

Timothy Gibb, Clifford Sadof

Horticulture & Landscape Architecture

Identification of horticultural plants and plant problems
Diagnosis of herbicide injury on horticultural plants

B. Rosie Lerner
Mike Dana, Steve Weller,

Agronomy

Fertility, soil and environmentally related problems of corn, small grains, soybeans and forages
Turfgrass management

Robert Nielsen, Jim Camberato
Shaun Casteel, Keith Johnson
Aaron Patton

Forestry & Natural Resources

General Forestry issues

Lenny Farlee, Lindsey Purcell

The PPDL is fortunate to have the support and assistance of numerous faculty and staff in the College of Agriculture. During 2012, more than 30 additional faculty and staff members assisted with sample diagnoses (**Table 1**).

Table 1. Departmental faculty and staff that assisted with diagnoses of samples submitted to the Plant and Pest Diagnostic Laboratory during 2012.¹

Faculty/Staff	Number of Diagnoses	Faculty/Staff	Number of Diagnoses
Agronomy	133 (2%)	Entomology	466 (9%)
J. Camberato	69	L. Bledsoe	7
S. Casteel	4	B. Brown	6
K. Johnson	3	J. Faghihi	44
B. Nielsen	13	R. Foster	9
A. Patton	43	T. Gibb	184
T. Perkins	1	C. Krupke	5
		J. Obermeyer	32
Botany & Plant Pathology	4587 (85%)	C. Sadof	179
C. Aime	6	Forestry and Natural Resources	1 (*)
J. Beckerman	31	L. Purcell	1
T. Creswell	1638⁵		
D. Egel	4	Horticulture & Landscape Architecture	97 (2%)
B. Johnson	8	B. Bordelon	5
T. Jordan	35	M. Dana	16
R. Latin	2	K. Daniel	33
D. Lubelski	22	P. Hirst	2
T. Legleiter	131	R. Lerner	23
G. Ruhl	2688^{3,4}	R. Lopez	3
I. Thompson	9	L. Maynard	1
K. Wise	11	S. Saha	1
C. Woloshuk	2	S. Weller	13
		Other	95 (2%)
		J. Byrne, MI State	95
Total Diagnoses			5379

¹ The total number of diagnoses exceeds the total number of samples due to multiple problems/diagnoses per sample. More than one person may assist with a diagnosis.

² Names in bold type were designated by departments as 2012 PPDL diagnosticians.

³ 481 diagnoses were provided for *Phytophthora ramorum* nursery survey samples.

⁴ 180 diagnoses were provided for corn phytosanitary survey samples.

⁵ 306 diagnoses were provided for black walnut export certification samples.

* Less than 1%

ADVISORY STEERING COMMITTEE

The inter-departmental nature of the PPDL demands frequent and free-flowing exchange of information among PPDL staff in participating departments. This communication takes place in an advisory capacity designated as the PPDL Steering Committee. The Steering Committee provides a forum to discuss matters that relate to the daily operation of the PPDL. Input from the diagnosticians is considered essential for smooth functioning of the Lab. The Committee meets as needed and reports to the Department Head of Botany and Plant Pathology. The Committee is chaired by the Director of the PPDL and is composed of diagnosticians, pertinent Extension Specialists and the Extension Administrative Professional.

LABORATORY OPERATIONS

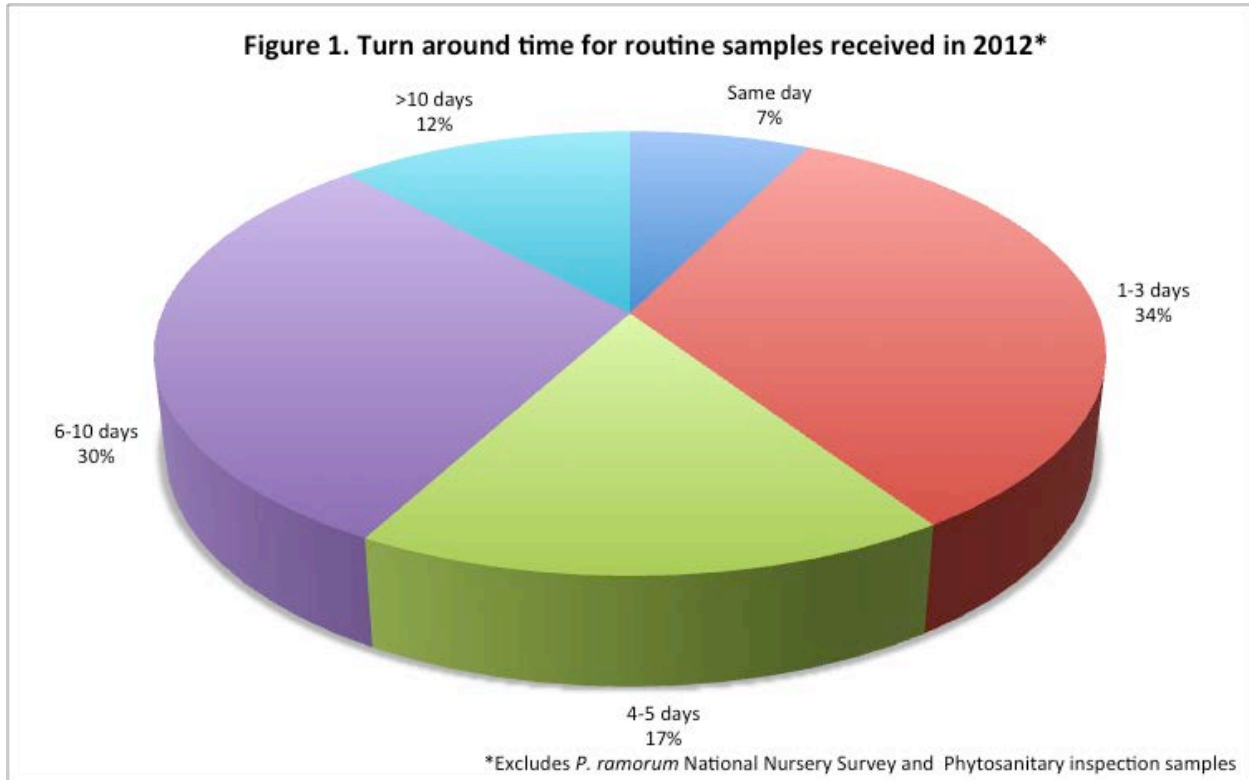
County offices of the Cooperative Extension Service (CES) are provided with a supply of sample submission forms, alcohol vials and mailing boxes to facilitate the submission of plant specimens and insects to the PPDL. Submission forms are available online and may be downloaded from the PPDL web page. Completed submission forms are to accompany all sample submissions. Digital images may be submitted, from the PPDL web page (<http://www.ppd.purdue.edu>).

Diagnosis Process

Information from the sample submission form is logged into the NPDN Plant Diagnostic Information System (PDIS) database and the sample is assigned a unique. Samples are then distributed to the appropriate diagnostician. If the diagnosis requires pathogen isolation or some other lengthy procedure (determined by the diagnostician), a preliminary reply, including a tentative diagnosis and projected final completion date, is returned to the client. When the diagnosis has been completed the identification and management recommendations (when requested) are entered into the database, printed, and the final response along with any supporting information is returned to the client and/or submitter via electronic mail and/or FAX, and US mail (as requested by the submitter on the submission form).

Sample Processing (Turn-around) time

Turn-around time is the length of time between when a sample is received and when the final diagnosis is returned. Same day service was provided for 7% of the samples received during 2012 and 41% of the samples were completed in three days or less. A total of 58% of the samples received during 2012 were diagnosed within five working days and 88% of all routine samples received were answered within 10 working days. An extended turn-around time of greater than 10 days (12% of samples) was documented for those samples requiring more extensive culture work and laboratory testing (**Figure 1**). Preliminary reports were sent for samples requiring additional time for pathogen confirmation.



Sample Breakdown

In addition to the 1650 routine samples diagnosed, 412 nursery samples were tested for the presence of *Phytophthora ramorum* as part of the Sudden Oak Death (Ramorum blight) National Survey. A total of 135 corn samples were submitted for disease diagnosis for phytosanitary certification (ICIA and IDNR), and 34 black walnut samples were tested for export certification.

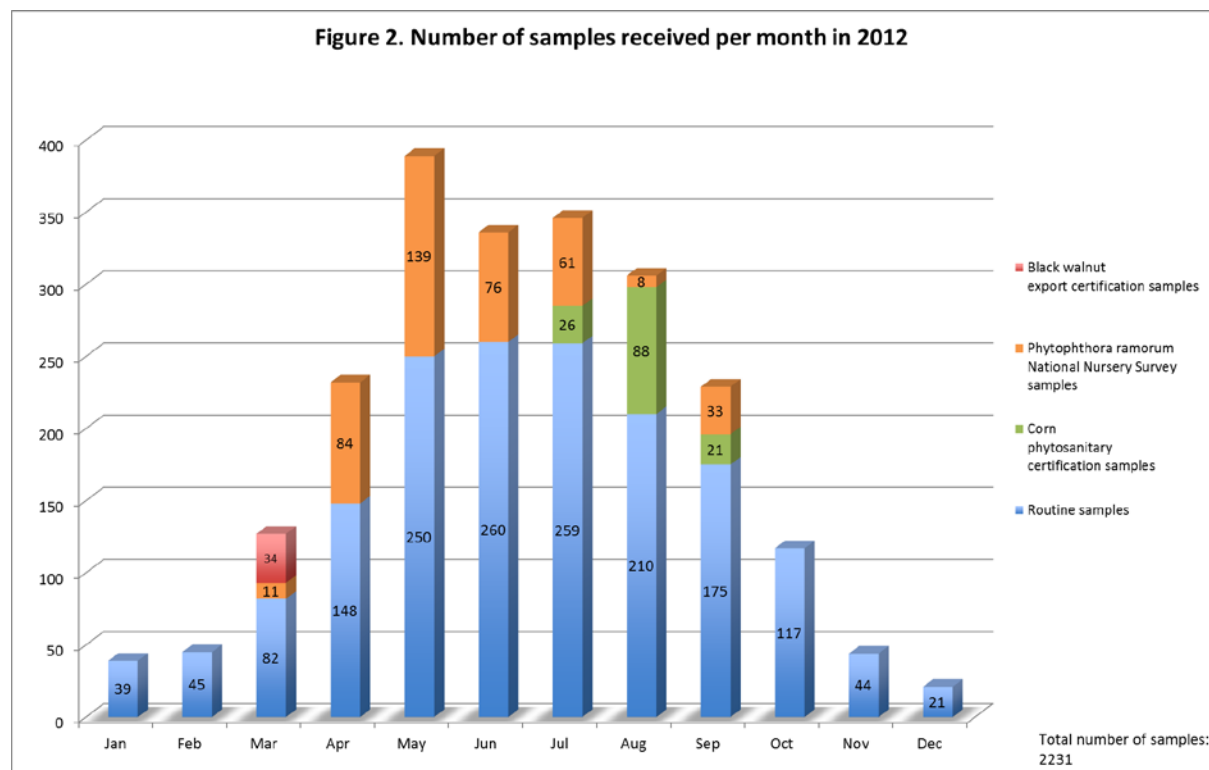
Table 2. Breakdown of total samples for 2012

Routine samples	1650
Regulatory/survey samples	547
<i>P. ramorum</i> national survey samples	412
Phytosanitary certification samples (IDNR/ICIA)	135
Black walnut export certification samples	34
Total number of samples	2231

DIAGNOSES AND SAMPLES

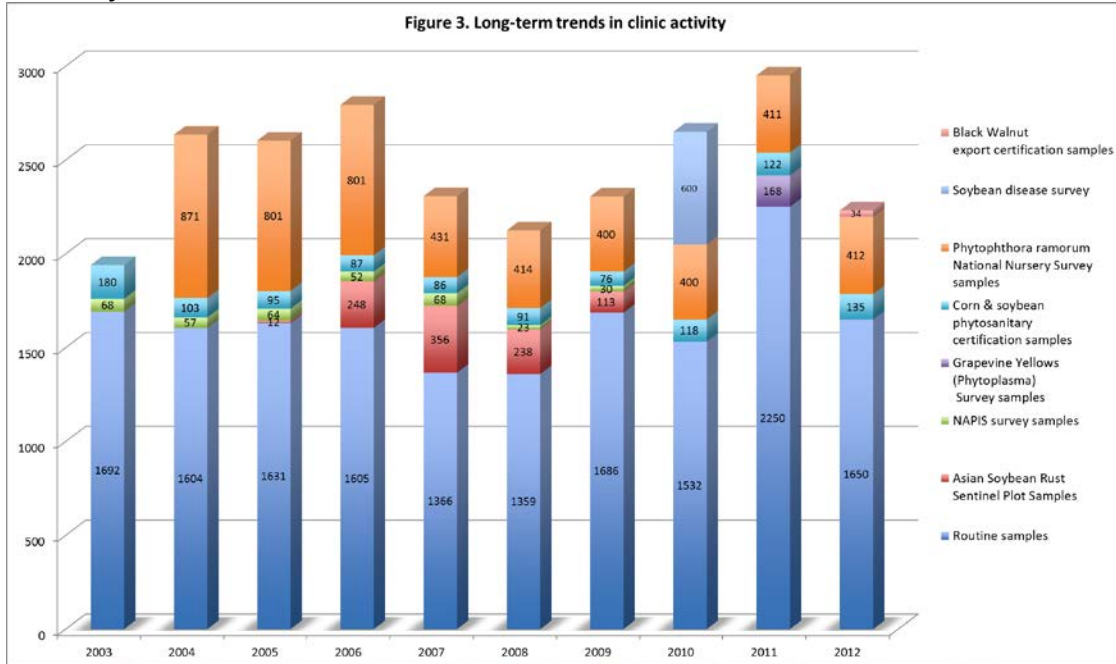
Monthly Activity

During 2012, the Laboratory diagnosed a total of 1650 routine samples. As illustrated in Figure 2, almost half of the year's routine samples were processed in the lab during the three months of May, June, and July. All 34 of the black walnut export certification samples were submitted in March. The majority of the 2012 *Phytophthora ramorum* National Nursery Survey samples were submitted during May for diagnosis of the presence or absence of *P. ramorum*, the causal agent of Ramorum blight. During the months of July, August, and September, ICIA and IDNR field inspectors submitted corn foliar samples to the PPDL for disease diagnosis required for phytosanitary certification of seed.



Long-Term Trends

Although there was a decrease in submission of routine samples due to the extended drought in 2012, overall, routine sample submissions have remained relatively stable for the past ten years.



Commodities Diagnosed

Figure 4 and **Table 3** show the number of specimens submitted in each commodity group, for 2012. The majority of samples submitted for diagnosis (52%) were from the ornamentals commodity group. In descending order, agronomic crops (18%), insect identification (11%), and turfgrass (7%) comprised the other major commodities submitted for routine diagnosis. Several other minor commodity groups comprised the remaining 12% of the submitted samples (**Figure 4** and **Table 3**).

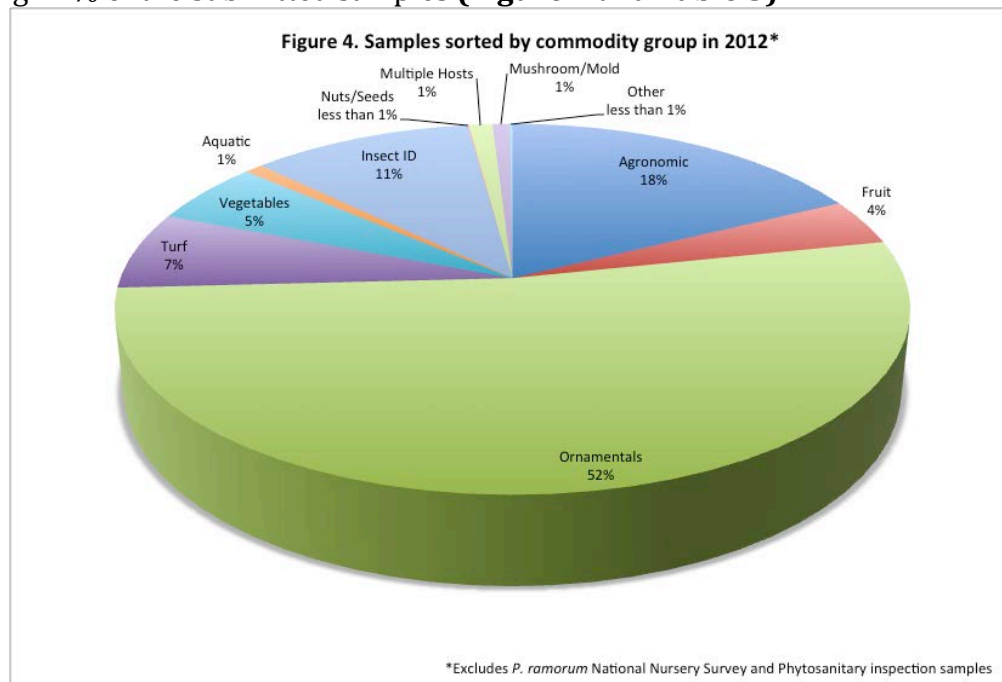


Table 3. Samples sorted by sample category¹		
	2012	
Category	Number of Specimens	%²
Agronomic	297	18
Field crops	263	16
Forage	4	*
Small grains	30	2
All Fruit	68	4
Fruit	38	2
Small Fruit	30	2
Ornamentals	884	52
Annual	91	5
Biennial	1	*
Citrus	1	*
Deciduous	334	20
Evergreen	279	17
Forested Area	3	*
Ground Covers/Vines	7	*
Perennial	168	10
Turf	114	7
Vegetables	92	5
Miscellaneous	229	14
Aquatic	15	1
Insect ID	178	11
Nuts/Seeds	1	*
Multiple Hosts	19	1
Mushroom/Mold	14	1
Other	2	*
Total Specimens	1684	100

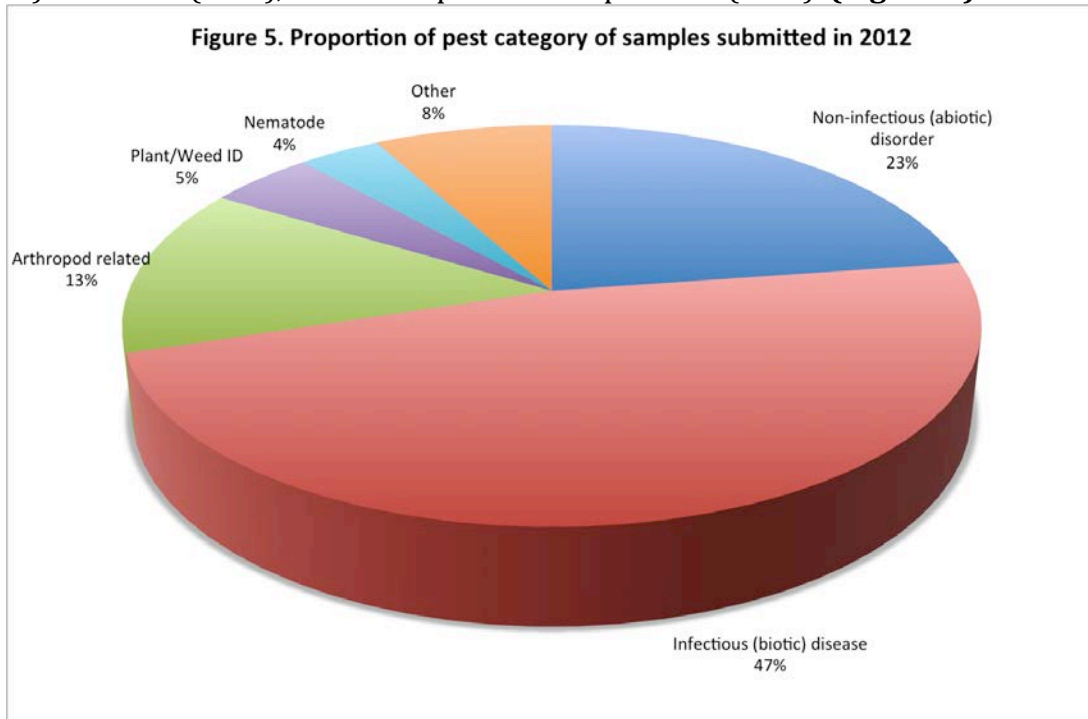
¹ Excludes 412 ornamental samples submitted for 2012 *P. ramorum* National Nursery Survey and 135 samples submitted for corn Phytosanitary Testing.

² Percent of total samples submitted during the year

* Less than 1%

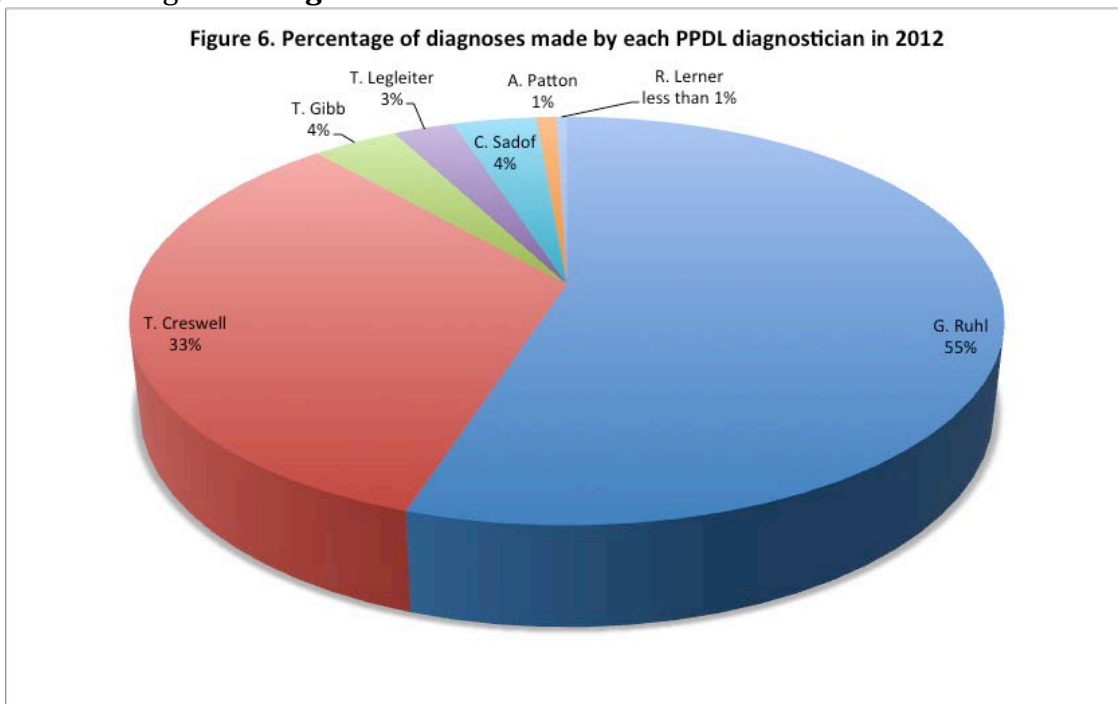
Type of Diagnosis

Many of the 2012 samples received multiple diagnoses due to the presence of more than one causal agent. The most frequently diagnosed group of causal agents, determined by the type of diagnoses made, were infectious diseases (47%), followed by noninfectious (abiotic) disorders (23%), and arthropod-related problem (13%). (Figure 5).



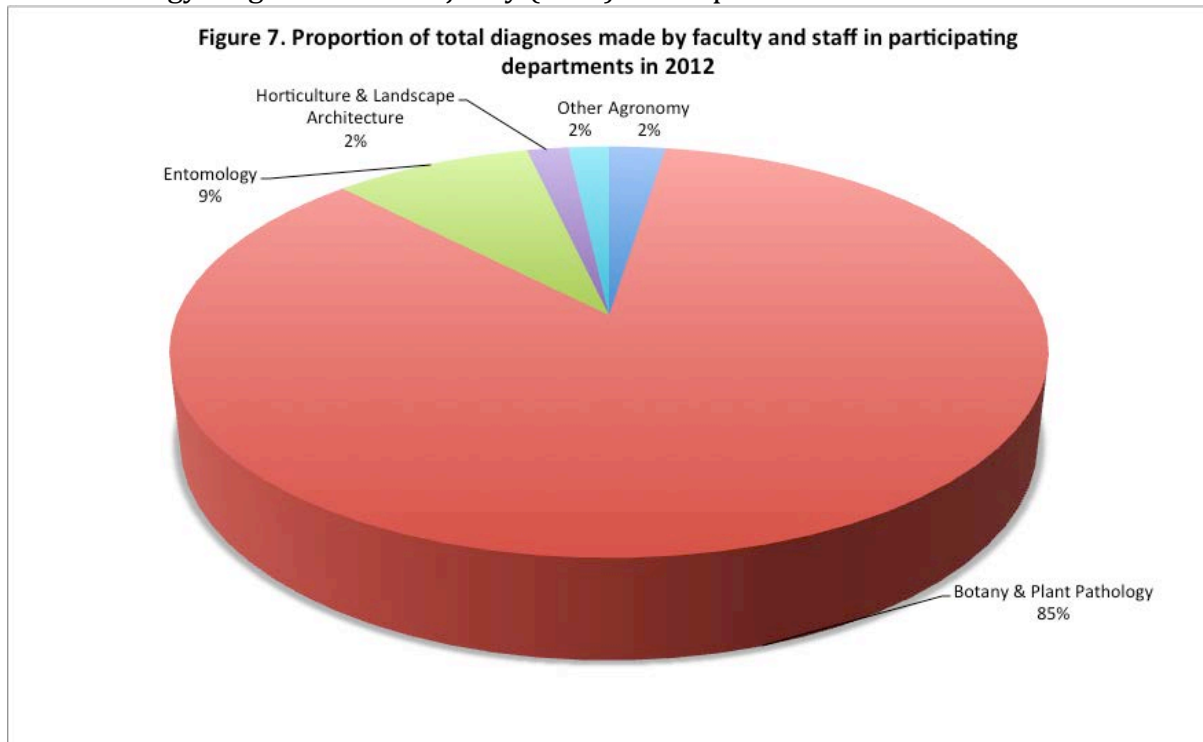
Diagnoses per Diagnostician

A comparison of the proportion of total 2012 diagnoses of samples made according to diagnostician is given in Figure 6.



Diagnoses per Department

A comparison of the proportion of total 2012 diagnoses made according to participating departments is shown in **Figure 7**. The faculty and staff in the Department of Botany & Plant Pathology diagnosed the majority (85%) of samples.



SAMPLE ORIGIN

Clientele Groups

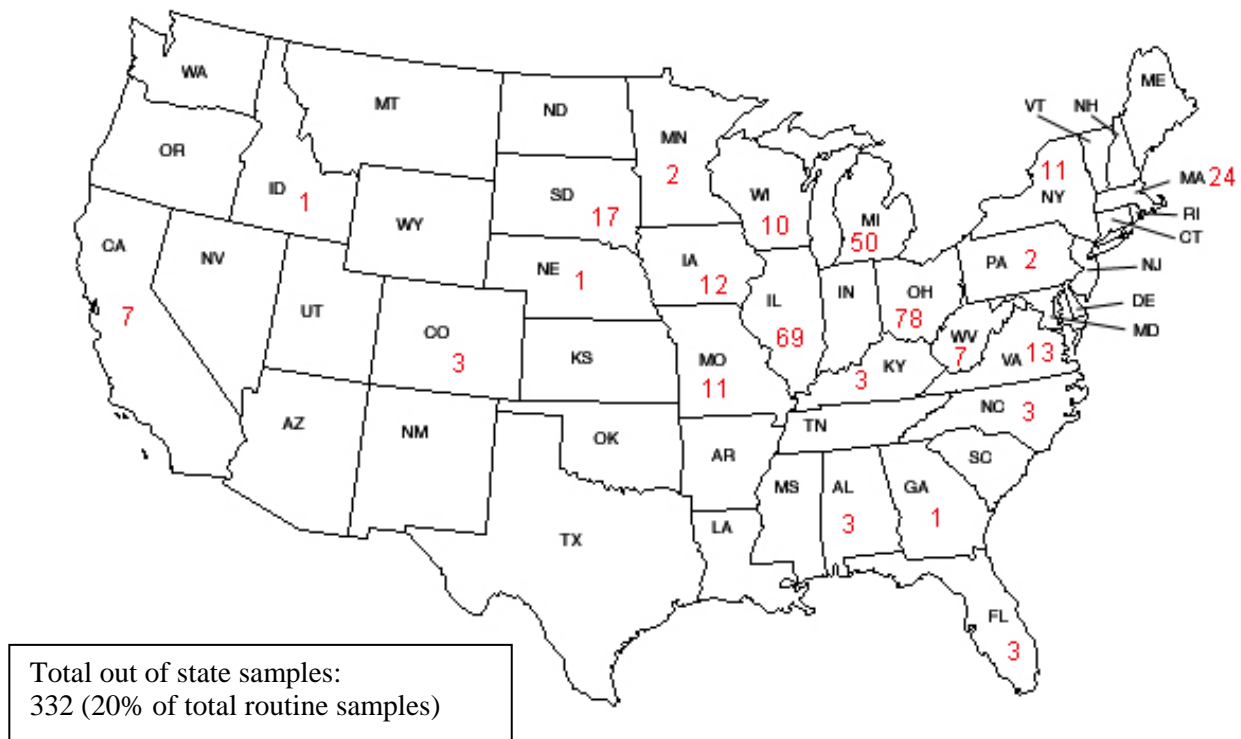
Samples are submitted to the PPDL by commercial and non-commercial clientele as well as by IDNR/USDA/APHIS personnel for regulatory and survey work (**Table 4**).

Table 4. Affiliation of persons submitting samples to the PPDL in 2012		
Affiliation	Number of samples	%
Commercial	1003	45
Agribusiness	124	6
Arborist	37	2
Company/Firm	29	1
Consultant	134	6
Garden Center	5	*
Golf Course	30	1
Greenhouse	149	7
Grower/Farmer	61	3
Landscaper	84	4
Lawn Care/Landscaper	155	7
Lawn/Tree Care	71	3
Medical Doctor/Hospital	6	*
Nursery	57	3
Park/School/Church Grounds Keeper	11	*
Pest Control	47	2
Veterinarian	3	*
Non-Commercial	554	25
Extension Educator	192	9
Homeowner	210	9
Other	23	1
Researcher/Specialist	129	6
Regulatory/Survey	674	30
ICIA	135	6
IDNR	80	4
Annual SOD Survey	412	18
Indiana State Chemist	47	2
Totals	2231	100
* Less than 1%		

Out of State Submissions

The Plant and Pest Diagnostic Laboratory was initially established to serve residents of Indiana, however, due to the PPDL's national reputation, diagnostic services in 2012 were also provided for 332 samples (20% of total routine samples) submitted from 22 other states*.

Figure 8. Distribution of samples received from outside Indiana by the Plant and Pest Diagnostic Laboratory in 2012.



* The PPDL has a permit issued by USDA/APHIS/PPQ to receive out-of-state samples for diagnosis from the continental 48 states. No out-of-country physical samples are accepted.

AN INFORMATION SOURCE

The PPDL staff not only provide accurate and timely diagnosis of samples, but also serve as a resource of information for plant and pest-related problems. The team cooperates with university personnel to provide accurate and up-to-date information to clientele.

Web Presence

Amy Deitrich maintains our website (<http://www.ppd.purdue.edu>) allowing us to educate stakeholders via “Picture of the Week,” and “What’s Hot” feature articles on topics of current concern. We continue to share our postings via Facebook and Twitter and look for ways to expand our reach online.

Extension Activities

PPDL staff members participate in a variety of Purdue University sponsored events and educational programs. Some of these programs in 2012 included:

- Master Gardener Training
- Turf and Ornamentals Workshops
- Southern Indiana Landscape School
- Indiana Green Expo
- Adobe connect update to county extension educators
- IDNR Nursery Inspector Training for *P. ramorum* Nursery Survey
- Indiana Crop Improvement Association (ICIA) inspector training for Phytosanitary field inspection of corn and soybeans.
- Spring Fest (A University-wide 2 day public relations event)

Continuation of 2011-2012 Imprelis® Response

By now the Imprelis® story is well known to most but we continued to receive samples of trees in 2012 with injury symptoms. Most of the trees that were identified and confirmed as damaged by Imprelis in 2011 that did not die, continued to decline in health throughout the 2012 growing season. Follow-up branch samples from Imprelis damaged trees were collected in 2012 by the OISC for residue level testing and also used in a cooperative study with the PPDL, OISC and Aaron Patton (AGRY) documenting the effects of using Imprelis damaged trees as mulch. We continued to provide assistance to stakeholders by diagnosing new samples of the problem and by updating our online publications (<http://www.ppd.purdue.edu/PPDL/pubs/briefs/ImprelisUpdate2013.pdf>).

The rapid response provided by the PPDL, in collaboration with a team of Purdue University experts in the College of Agriculture, was recognized by the University with two awards: The 2012 Purdue College of Agriculture TEAM award and the 2012 PUCESA Team award.