



Annual Report 2008

Purdue University Cooperative Extension Service

PURDUE
UNIVERSITY

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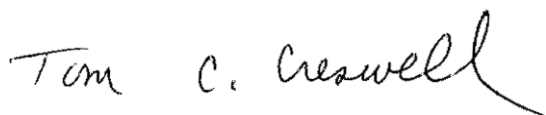
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ACKNOWLEDGMENTS

Purdue's Plant and Pest Diagnostic Lab (P&PDL) is recognized as a source of unbiased, quality, diagnostic information. This recognition is a result of the hard work and dedication of P&PDL diagnosticians and volunteer faculty and staff.

We are indebted to our computer support specialist for his database expertise, to our departmental extension Administrative Professional for her webmaster and database assistance and to our P&PDL secretary whose patience and friendly phone etiquette provides a welcome introduction to our clientele.

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



Tom C. Creswell
Director, P&PDL



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 (P&PDL) 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 P&PDL 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 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.

HOMELAND SECURITY AND THE NATIONAL PLANT DIAGNOSTIC NETWORK

As a result of the 9-11-01 terrorist attacks on the World Trade Centers and the Pentagon, Congress created a new U.S. Department of Homeland Security. With heightened awareness and concern for potential acts of bioterrorism directed at U.S. food and agricultural systems, the Department of Homeland Security provided funds for USDA/CSREES to develop the [National Plant Diagnostic Network \(NPDN\)](#). Land grant university plant diagnostic laboratories comprise the backbone of the system. The nation is divided into [five regions](#), with a regional center designated for each region. The P&PDL, as part of the [North Central Plant Diagnostic Network \(NCPDN\)](#) 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.

The P&PDL conducts IP video training sessions for ANR educators with the intent of improving their surveillance capabilities for invasive plant diseases and pests in Indiana. The training in 2008 included how to submit secure samples.

The P&PDL, as part of another NPDN initiative, was involved with the reporting of Soybean Rust (SBR) sentinel plot surveillance data to the National Plant Diagnostic Network data repository. No SBR was confirmed in Indiana in 2008.

Goss's Bacterial Wilt, a disease caused by *Clavibacter michiganensis subsp. nebraskensis*, a regulated plant pathogen on seed corn, was confirmed in August for the first time in Indiana in field and popcorn collected by a crop consultant from several fields in Pulaski county. A first report on this find of Goss's Bacterial Wilt in Indiana may be viewed at: <http://www.pddl.purdue.edu/PPDL/hot08/8-14.html>.

P&PDL 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 P&PDL provided disease diagnosis on: corn and soybean samples for the IDNR Phytosanitary Certification Program, as well as disease diagnosis of foliar pathogens on corn for entry into the National Agricultural Plant Information System (NAPIS) database, and diagnosis of 57 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 P&PDL on a part-time basis as a portion of their total commitment to their respective departments. Staffing responsibilities in the P&PDL and the department to which they belong, are listed below.

Botany and Plant Pathology

Director	Tom Creswell
Secretary and Receptionist	Janet Whaley
Webmaster and Extension Administrative Professional	Amy Deitrich
Disease diagnosis and control	Tom Creswell, Gail Ruhl
Weed identification, control, and diagnosis of herbicide injury on field crops	Glenn Nice
Computer support	Robert Mitchell

Entomology

Invertebrate and other pest identification and control	Timothy Gibb, Clifford Sadof
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Horticulture & Landscape Architecture

Identification of horticultural plants and plant problems	B. Rosie Lerner
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Agronomy

Fertility, soil and environmentally related problems of corn	Robert Nielsen
Turfgrass management	Zac Reicher, Glenn Hardebeck

Forestry & Natural Resources

Tree identification	Rita McKenzie
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The P&PDL is fortunate to have the support and assistance of numerous faculty and staff in the College of Agriculture. During 2008, 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 2008.¹			
Faculty/Staff	Number of Diagnoses	Faculty/Staff	Number of Diagnoses
Agronomy	70 (2%)	Entomology	291 (10%)
J. Camberato	12	L. Bledsoe	10
G. Hardebeck²	34	J. Faghihi	6
K. Johnson	7	R. Foster	2
R. Nielsen	15	T. Gibb	142
Z. Reicher	1	C. Hill	1
		J. Loven	1
Botany & Plant Pathology	1893 (65%)	J. Obermeyer	11
		C. Sadof	118
T. S. Abney	3	Wang	1
J. Beckerman	14		
G. Buechley	86	Horticulture & Landscape Architecture	138 (5%)
T. Creswell	527		
T. Jordan	14	B. Bordelon	6
R. Latin	30	Cassens	1
C. Lembi	8	M. Dana	47
G. Nice	72	P. Hirst	1
G. Ruhl	1110 ⁴	R. Lerner	24
G. Shaner	5	R. Lopez	17
I. Thompson	3	M. Mickelbart	10
K. Wise	21	S. Weller	32
Student Workers	515 (18%)	Other	20 (> 1%)
T. McCarthy	207 ³	E. Christmas, Ret. Fac. AGRY	4
B. Neild	308 ³	Lockhart, Univ. of MN	1
		D. Malvick, Univ. of MN	2
		J. McKemy, USDA-APHIS-PPQ	1
		L. Nees, OISC	12
Total Diagnoses			2927

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 2008 P&PDL diagnosticians.

³ Diagnoses were for Asian soybean rust sentinel plots only.

⁴ 414 additional sample diagnoses were provided for *P. ramorum* nursery survey samples

ADVISORY STEERING COMMITTEE

The inter-departmental nature of the P&PDL demands frequent and free-flowing exchange of information among P&PDL staff in participating departments. This communication takes place in an advisory capacity designated as the P&PDL Steering Committee. The Steering Committee provides a forum to discuss matters that relate to the daily operation of the P&PDL. 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 P&PDL and is composed of diagnosticians, pertinent Extension Specialists and the Extension Administrative Professional.

LABORATORY OPERATIONS

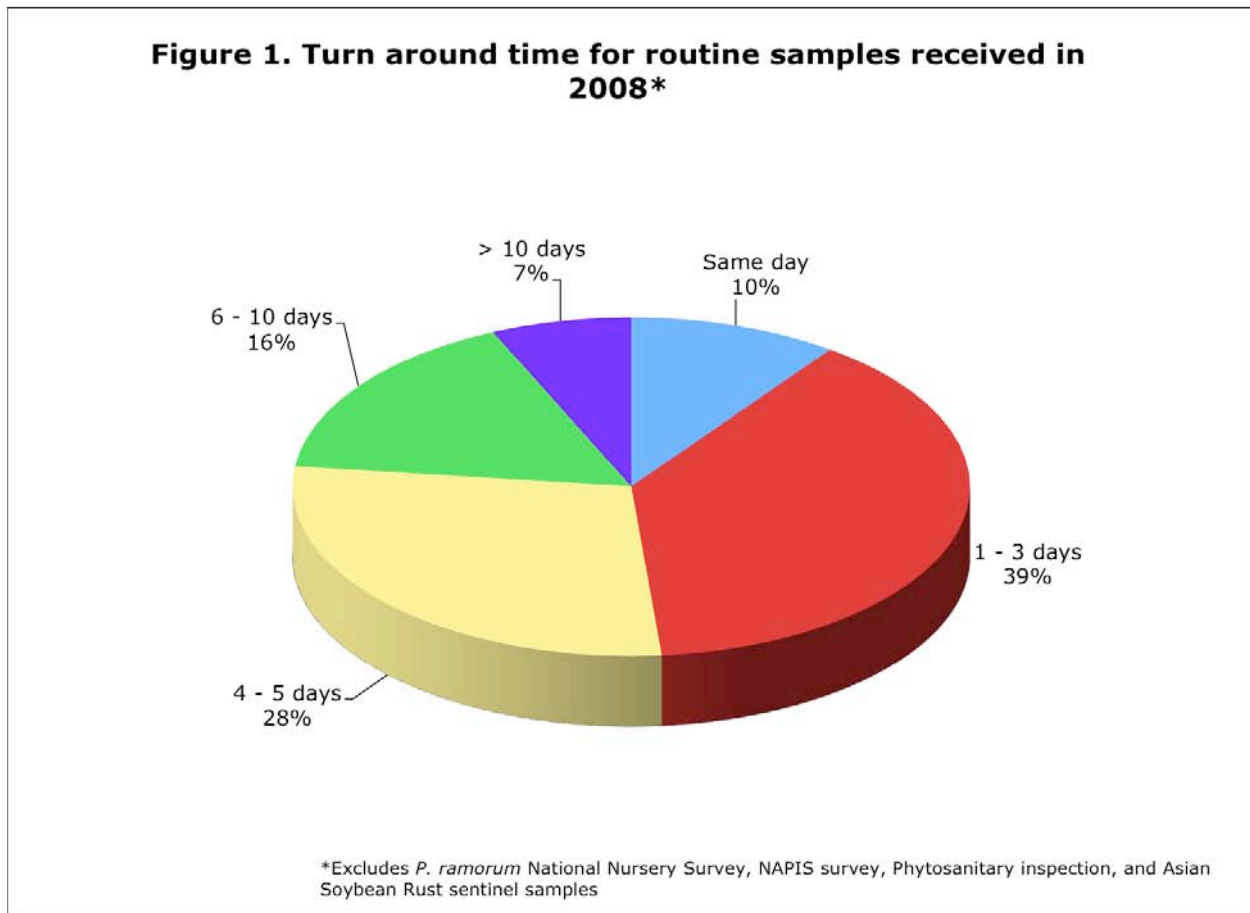
County offices of the Cooperative Extension Service (CES) are provided with a supply of sample submission forms, alcohol vials and mailing boxes to facilitate the submission of plant specimens and insects to the P&PDL. Submission forms are available online and may be downloaded from the P&PDL web page.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

Diagnosis Process

Information from the sample submission form is logged into the P&PDL computer database as well as the NPDN Plant Diagnostic Information System (PDIS), and the sample is assigned a unique number in both databases. 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 10% of the samples received during 2008 and 49% of the samples were completed in three days or less. A total of 77% of the samples received during 2008 were diagnosed within five working days and 93% of all samples received were answered within 10 working days. An extended turn-around time of greater than 10 days (7% 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

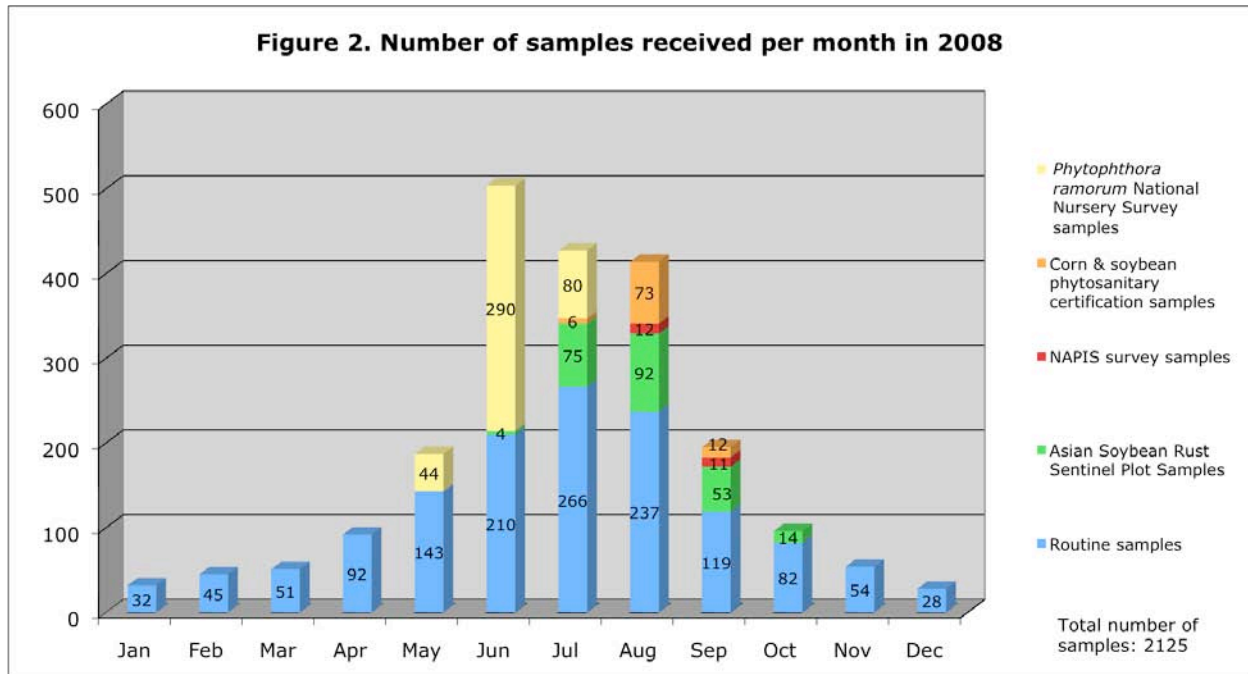
As per Table 2, approximately seven percent (92) of the total number of routine samples diagnosed by P&PDL diagnosticians in 2008 were submitted electronically, as digital samples. In addition to the 1363 routine samples diagnosed, 414 nursery samples were tested for the presence of *Phytophthora ramorum* as part of the Sudden Oak Death (Ramorum blight) National Survey. A total of 91 corn and soybean samples were submitted for disease diagnosis for phytosanitary certification (ICIA and IDNR) and 23 additional corn samples were submitted for disease diagnosis to contribute to the collection of Indiana data for the NAPIS database.

Table 2. Breakdown of total samples for 2008	
Routine samples	1363
<i>Physical samples</i>	1271
<i>Digital samples</i>	60
<i>Digital samples with physical follow-up</i>	32
Regulatory/survey samples	762
<i>Asian Soybean Rust sentinel samples</i>	234
<i>P. ramorum national survey samples</i>	414
<i>Phytosanitary certification samples (IDNR/ICIA)</i>	91
<i>NAPIS corn survey</i>	23
Total number of samples	2,125

DIAGNOSES AND SAMPLES

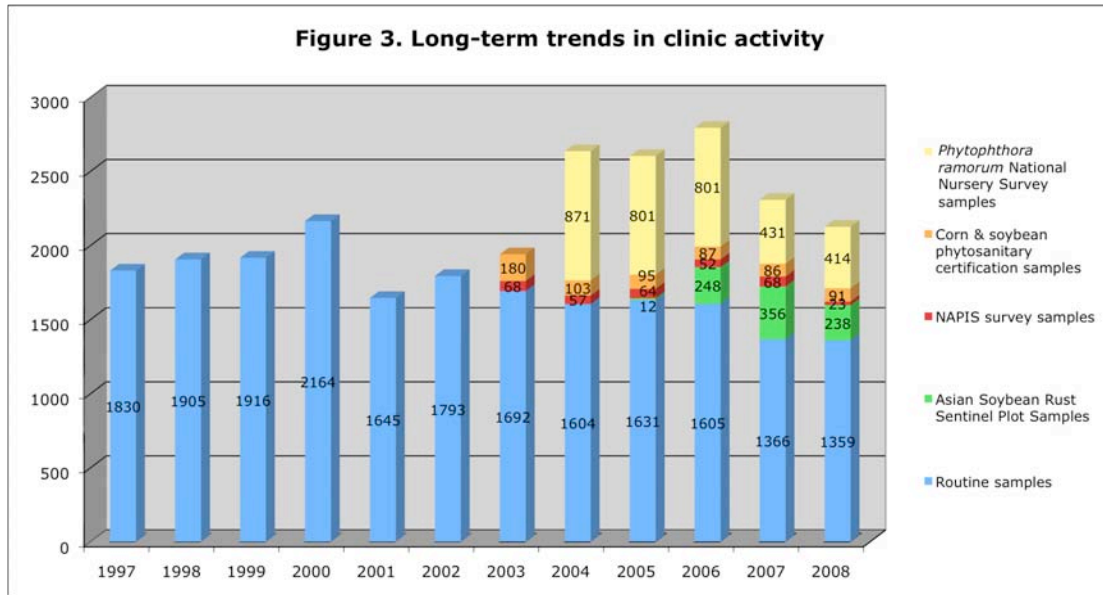
Monthly Activity

During 2008, the Laboratory diagnosed a total of 1363 routine samples. As illustrated in Figure 2, over half of the year's routine samples were processed in the lab during the three months of June, July and August. The majority of the 2008 *Phytophthora ramorum* National Nursery Survey samples were submitted during June 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 and soybean foliar samples to the P&PDL for disease diagnosis required for phytosanitary certification of seed. Corn samples were submitted in August and September for collection of NAPIS information.



Long-Term Trends

Routine sample submissions have remained relatively stable for the past twelve years. In 2008, reduction in USDA funding for soybean rust (SBR) sentinel plots contributed to a change in SBR sentinel protocols and subsequent reduction in submission of soybean samples from sentinel plots.



Commodities Diagnosed

Figure 4 and **Table 3** show the number of specimens submitted in each commodity group, for 2008. The majority of samples submitted for diagnosis (51%) were from the ornamentals commodity group. In descending order, agronomic crops (24%), vegetables (7%), insects infesting homes and other buildings (6%), and turfgrass/yard (5%) comprised the other major commodities submitted for routine diagnosis. Several other minor commodity groups comprised the remaining 7% of the submitted samples (**Figure 4** and **Table 3**).

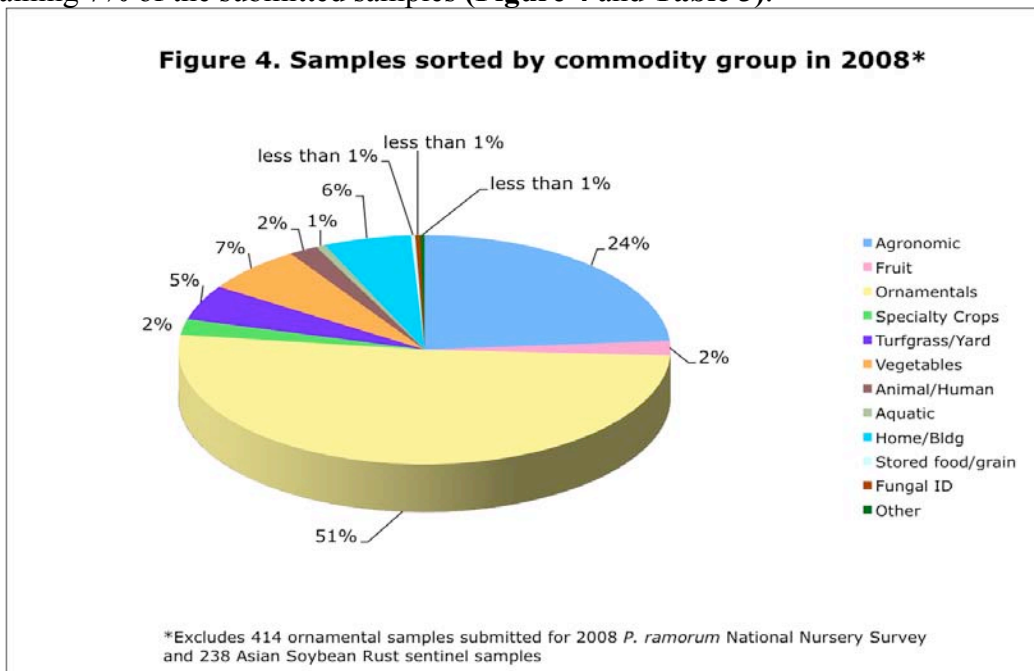
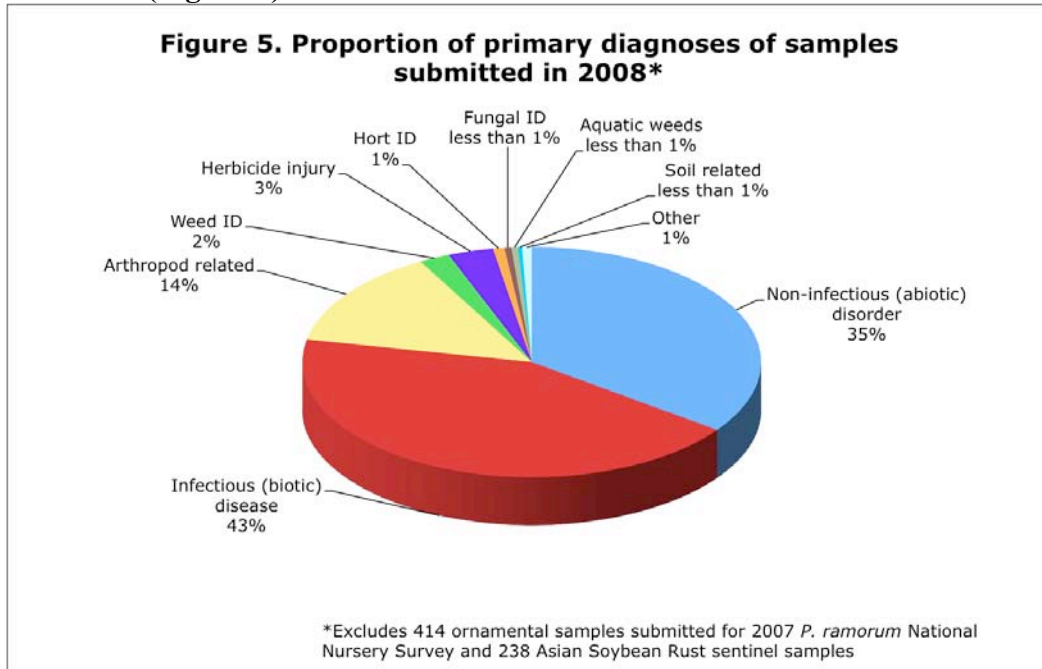


Table 3. Samples sorted by commodity group¹		
	2008	
Commodity	Number of Specimens	%²
Agronomic	354	24
Alfalfa	3	*
Barley	3	*
Clover	1	*
Corn	227	15
Forage	2	*
Pasture	5	*
Soybeans	55	4
Weed ID	7	*
Wheat	51	3
Fruit	30	2
Small Fruit	18	1
Tree Fruit	12	1
Ornamentals	755	51
Flowers	207	14
Ground Covers/Vines	22	1
Interior Plants	9	1
Shrubs	155	10
Trees	362	25
Specialty Crops	33	2
Field	10	1
Horticultural	23	1
Turfgrass/Yard	73	5
Vegetables	97	7
Miscellaneous	135	9
Animal/Human	28	2
Aquatic	9	1
Home/Bldg	85	6
Stored Foods/Grains	4	*
Fungal ID	5	*
Other	4	*
Total Specimens	1477	100
¹ Excludes 414 ornamental samples submitted for 2008 <i>P. ramorum</i> National Nursery Survey and 234 samples submitted for Asian soybean rust sentinel plots ² Percent of total samples submitted during the year * Less than 1%		

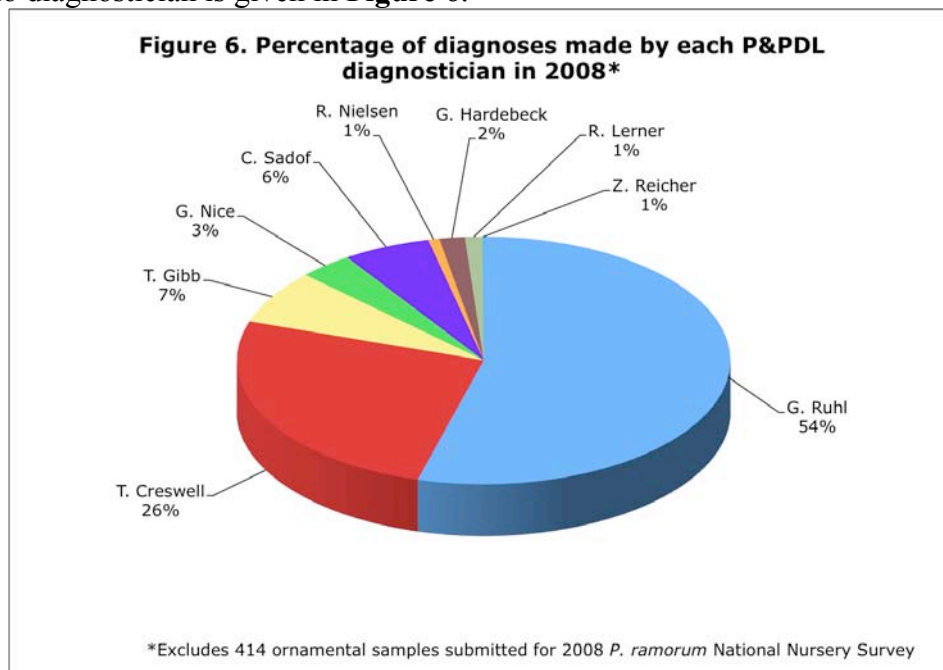
Type of Diagnosis

Many of the 2008 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 (43%), followed by noninfectious (abiotic) disorders (35%), arthropods (14%), and herbicide injury (3%). Weed ID, horticultural and fungal ID, and soil related problem diagnoses each comprised 5% or less of the primary diagnoses of samples submitted in 2008 (Figure 5).



Diagnoses per Diagnostician

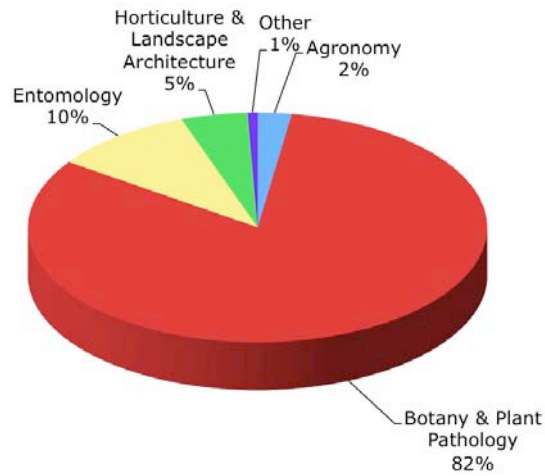
A comparison of the proportion of total 2008 diagnoses of routine (non-survey) samples made according to diagnostician is given in Figure 6.



Diagnoses per Department

A comparison of the proportion of total 2008 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 (82%) of samples.

Figure 7. Proportion of total diagnoses made by faculty and staff in participating departments in 2008*



*Excludes 414 ornamental samples submitted for 2008 *P. ramorum* National Nursery Survey

SAMPLE ORIGIN

Clientele Groups

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

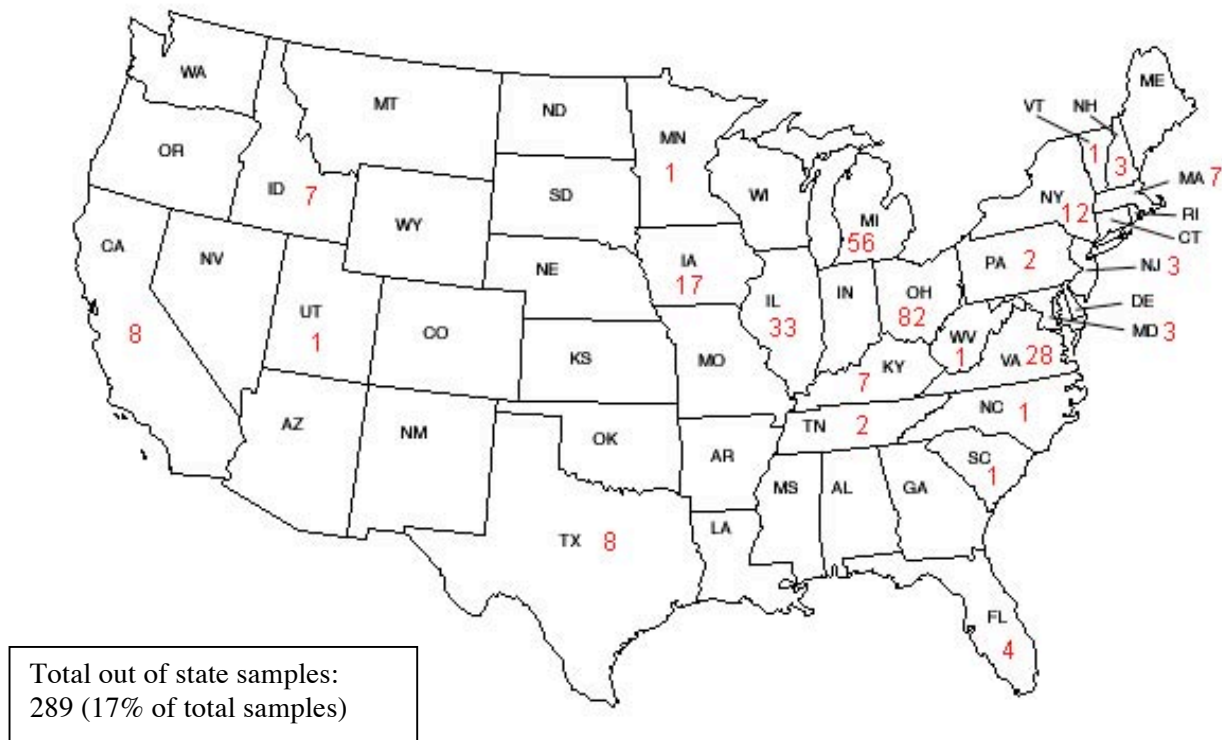
Table 4. Affiliation of persons submitting samples to the P&PDL in 2008¹		
Affiliation	Number of samples	%
Commercial	856	48
Consultant	115	7
Dealer/Industry Rep	162	9
Garden Center	25	1
Golf Course	25	1
Greenhouse	160	9
Growers – Agronomic	7	*
Growers – Fruit/Vegetables	39	2
Growers – Ornamentals/Turf	2	*
Landscaper	73	4
Lawn/Tree Care ²	123	7
Nursery	65	4
Pest Control	60	3
Non-Commercial	606	35
Extension Educator	309	18
Homeowner	115	7
Purdue – not Educator	171	10
Other	11	*
Regulatory/Survey	249	15
ICIA	119	7
IDNR	68	4
State Chemist	62	4
Totals	1711	100

¹ Excludes 414 ornamental samples submitted for 2008 *P. ramorum* National Nursery Survey
² Includes lawn/tree care companies and museum/park grounds departments
* Less than 1%

Out of State Submissions

The Laboratory was established to serve residents of Indiana, however, due to the P&PDL's national reputation, diagnostic services were also provided for 289 samples (17% of total routine samples) submitted from 24 other states during 2008*.

Figure 8. Distribution of samples received from outside Indiana by the Plant and Pest Diagnostic Laboratory in 2008.



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

AN INFORMATION SOURCE

The P&PDL 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.

Webpage

The Virtual Plant and Pest Diagnostic Laboratory, the P&PDL World Wide Web Home Page, (URL: <http://www.ppd.purdue.edu>) was put "on-line" in June of 1995. The web server, now maintained by Bob Mitchell, IT manager for the Department of Botany and Plant Pathology and Amy Deitrich as webmaster, serves as an invaluable educational tool accessible not only to the citizens of Indiana, but people throughout the United States and the world. The P&PDL web site provides information and links on species invasive to Indiana, up to date soybean rust information, a "Picture of the Week," information on "What's Hot" in the P&PDL, and many featured links. There is a keyword searchable database, a digital library and a link for submitting digital samples to the P&PDL. Web server statistics for the Plant and Pest Diagnostic Laboratory reported an average of 15,894 requests per day for P&PDL web pages from January 1 through December 31, 2008.

Extension Activities

P&PDL staff members participate in a variety of Purdue University sponsored events and first detector educational programs. Some of these programs in 2008 included:

- Master Gardener Training
- Turf and Ornamentals Workshops
- Arborist training
- ANR educator hands-on training
- IDNR Nursery Inspectors: Training for *P. ramorum* Survey
- IDNR and Indiana Crop Improvement Association (ICIA) inspectors: Training for Phytosanitary Field Inspection of corn and soybeans.

Plant Disease Diagnostic Discoveries

Goss's Bacterial Wilt, a disease caused by *Clavibacter michiganensis subsp. nebraskensis*, a regulated plant pathogen on seed corn, was confirmed in August for the first time in Indiana in field and popcorn samples submitted from Pulaski county. A first report on this find of Goss's Bacterial Wilt in Indiana may be viewed at: <http://www.ppd.purdue.edu/PPDL/hot08/8-14.html>.