



Annual Report 2009

TABLE OF CONTENTS

| | |
|--|-----------|
| TABLES AND FIGURES | 2 |
| ACKNOWLEDGMENTS | 3 |
| MISSION | 4 |
| HOMELAND SECURITY AND THE NATIONAL PLANT DIAGNOSTIC NETWORK | 4 |
| P&PDL AND THE INDIANA DEPARTMENT OF NATURAL RESOURCES | 5 |
| STAFF | 5 |
| BOTANY AND PLANT PATHOLOGY | 5 |
| ENTOMOLOGY | 5 |
| HORTICULTURE & LANDSCAPE ARCHITECTURE | 5 |
| AGRONOMY | 5 |
| FORESTRY & NATURAL RESOURCES | 5 |
| ADVISORY STEERING COMMITTEE | 7 |
| LABORATORY OPERATIONS | 7 |
| DIAGNOSIS PROCESS | 7 |
| SAMPLE PROCESSING (TURN-AROUND) TIME | 8 |
| SAMPLE BREAKDOWN | 9 |
| DIAGNOSES AND SAMPLES | 10 |
| MONTHLY ACTIVITY | 10 |
| LONG-TERM TRENDS | 11 |
| COMMODITIES DIAGNOSED | 11 |
| TYPE OF DIAGNOSIS | 13 |
| DIAGNOSES PER DIAGNOSTICIAN | 13 |
| DIAGNOSES PER DEPARTMENT | 14 |
| SAMPLE ORIGIN | 15 |
| CLIENTELE GROUPS | 15 |
| OUT OF STATE SUBMISSIONS | 16 |
| AN INFORMATION SOURCE | 17 |
| WEBPAGE | 17 |
| EXTENSION ACTIVITIES | 17 |

TABLES AND FIGURES

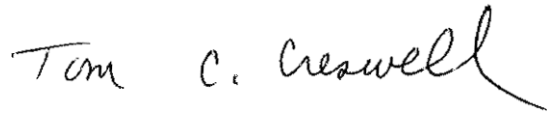
| | |
|---|----|
| TABLE 1. DEPARTMENTAL FACULTY AND STAFF THAT ASSISTED WITH DIAGNOSES IN 2009 | 6 |
| FIGURE 1. TURN AROUND TIME FOR ALL ROUTINE SAMPLES RECEIVED IN 2009 | 8 |
| TABLE 2. BREAKDOWN OF TOTAL SAMPLES FOR 2009..... | 9 |
| FIGURE 2. NUMBER OF SAMPLES RECEIVED PER MONTH IN 2009 | 10 |
| FIGURE 3. LONG-TERM TRENDS IN CLINIC ACTIVITY (1997-2009)..... | 11 |
| FIGURE 4. SAMPLES SORTED BY COMMODITY GROUP IN 2009 | 11 |
| TABLE 3. ROUTINE (NON-SURVEY) SAMPLES SORTED BY COMMODITY GROUP IN 2009 | 12 |
| FIGURE 5. PROPORTION OF PRIMARY DIAGNOSES IN 2009 | 13 |
| FIGURE 6. PERCENTAGE OF DIAGNOSES MADE BY EACH P&PDL DIAGNOSTICIAN IN 2009..... | 13 |
| FIGURE 7. PROPORTION OF TOTAL DIAGNOSES MADE BY FACULTY AND STAFF IN PARTICIPATING DEPARTMENTS IN 2009 | 14 |
| TABLE 4. AFFILIATION OF PERSONS SUBMITTING SAMPLES TO THE P&PDL IN 2009..... | 15 |
| FIGURE 8. DISTRIBUTION OF SAMPLES RECEIVED FROM OUTSIDE INDIANA BY THE P&PDL IN 2009..... | 16 |

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 online Adobe Connect training sessions for ANR educators with the intent of improving their diagnostic capabilities for plant diseases and pests in Indiana. The training in 2009 included sessions on home fungicide use and a review of major plant problems submitted to the clinic during the year.

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. Soybean rust was reported in Posey County in Indiana in 2009. The soybean field where rust was found was at R7 and rust was detected at very low levels.

Late Blight of tomato, caused by the fungus-like organism *Phytophthora infestans*, was a widespread problem in 2009 and caused major yield loss in homeowner and fresh market

tomatoes. The P&PDL reacted to the unusual outbreak by using National Plant Diagnostic Network (NPDN) funds to cover the cost of diagnosis of samples with suspected late blight. Late blight samples were diagnosed as they arrived with most reports sent out the same day. Along with Dan Egel, the P&PDL staff posted updates to our website and worked with media outlets to disseminate pertinent information to tomato growers about the threat posed by this disease. View our “What’s Hot” web feature on late blight at: <http://www.ppd.purdue.edu/PPDL/hot09/8-6.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 43 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 |
|--|------------------------------|

Horticulture & Landscape Architecture

| | |
|---|-----------------|
| Identification of horticultural plants and plant problems | B. Rosie Lerner |
|---|-----------------|

Agronomy

| | |
|--|----------------|
| Fertility, soil and environmentally related problems of corn | Robert Nielsen |
| Turfgrass management | Zac Reicher |

Forestry & Natural Resources

| | |
|-------------------------|--------------|
| General Forestry issues | Lenny Farlee |
|-------------------------|--------------|

The P&PDL is fortunate to have the support and assistance of numerous faculty and staff in the College of Agriculture. During 2009, 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 2009.¹

| Faculty/Staff | Number of Diagnoses | Faculty/Staff | Number of Diagnoses |
|-------------------------------------|---------------------|--|---------------------|
| Agronomy | 102 (3%) | Entomology | 348 (11%) |
| J. Camberato | 42 | L. Bledsoe | 1 |
| S. Casteel | 2 | J. Faghihi | 31 |
| G. Hardebeck² | 2 | T. Gibb | 142 |
| K. Johnson | 6 | C. Krupke | 2 |
| R. Nielsen | 17 | J. Obermeyer | 7 |
| Z. Reicher | 33 | D. Richmond | 1 |
| | | C. Sadof | 164 |
| Botany & Plant Pathology | 2346 (75%) | Horticulture & Landscape Architecture | 112 (4%) |
| T. S. Abney | 1 | B. Bordelon | 2 |
| J. Beckerman | 5 | M. Dana | 33 |
| T. Creswell | 847 | R. Lerner | 18 |
| D. Egel | 2 | R. Lopez | 10 |
| D. Huber | 1 | E. Maynard | 7 |
| T. Jordan | 12 | M. Mickelbart | 8 |
| R. Latin | 42 | S. Weller | 34 |
| C. Lembi | 7 | | |
| D. Lubelski | 2 | | |
| G. Nice | 162 | Other | 11 (>1%) |
| G. Ruhl | 1253 ⁴ | D. Akers, Extension Educator | 1 |
| I. Thompson | 3 | P. Bachi, Univ. of Kentucky | 1 |
| K. Wise | 9 | J. Byrne, Michigan State Univ. | 3 |
| | | E. Christmas, Ret. Fac. AGRY | 1 |
| Student Workers | 228 (7%) | R. Goforth, FNR | 1 |
| A. Leonberger | 33 | D. Lindner, USDA Forest Products Lab, Wisconsin | 2 |
| T. McCarthy | 195 ³ | D. Mollov, Univ. of Minnesota | 1 |
| | | D. Robinson, USDA-APHIS PPQ | 1 |
| | | | |
| Total Diagnoses | | | 3147 |

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 2009 P&PDL diagnosticians.

³ Diagnoses were for Asian soybean rust sentinel plots only.

⁴ 400 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

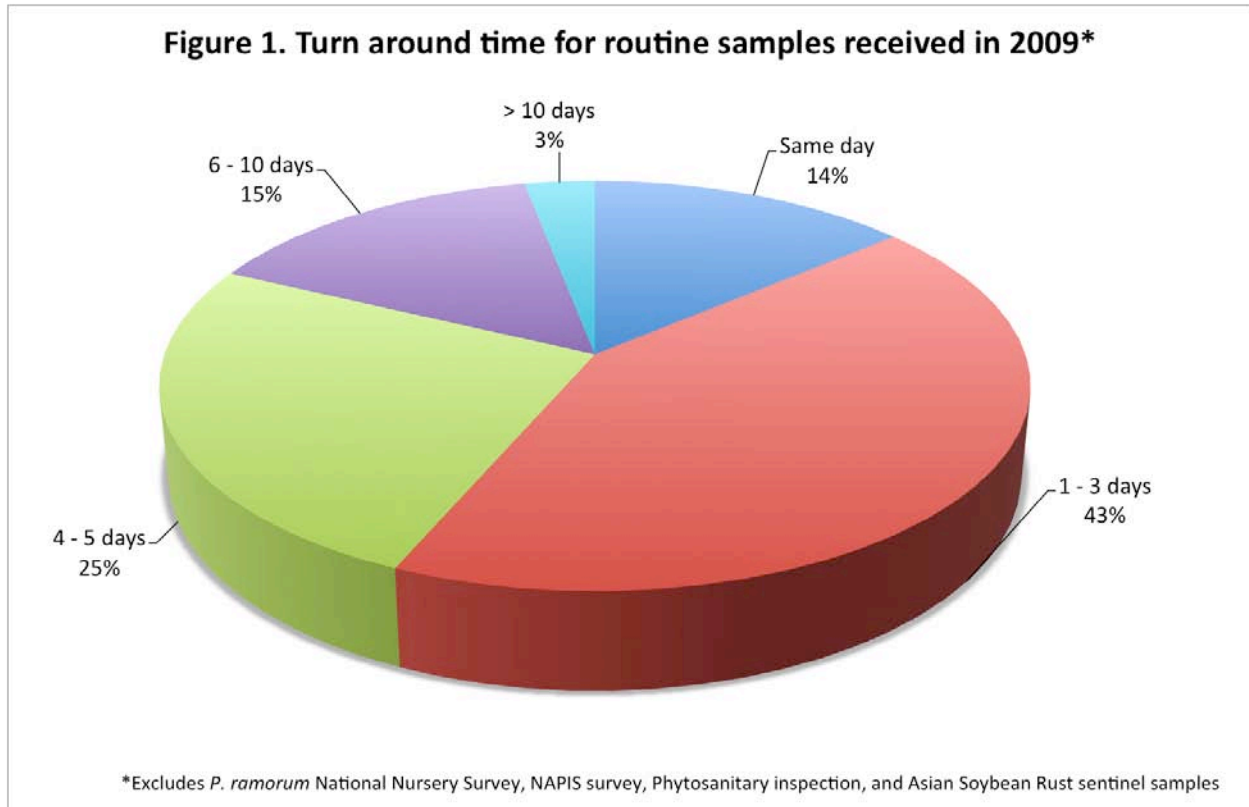
County offices of the Cooperative Extension Service (CES) are provided with a supply of sample submission forms, alcohol vials and mailing boxes to facilitate the submission of plant specimens and insects to the P&PDL. Submission forms are available online and may be downloaded from the P&PDL web page. 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 14% of the samples received during 2009 and 57% of the samples were completed in three days or less. A total of 82% of the samples received during 2009 were diagnosed within five working days and 97% of all samples received were answered within 10 working days. An extended turn-around time of greater than 10 days (3% 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

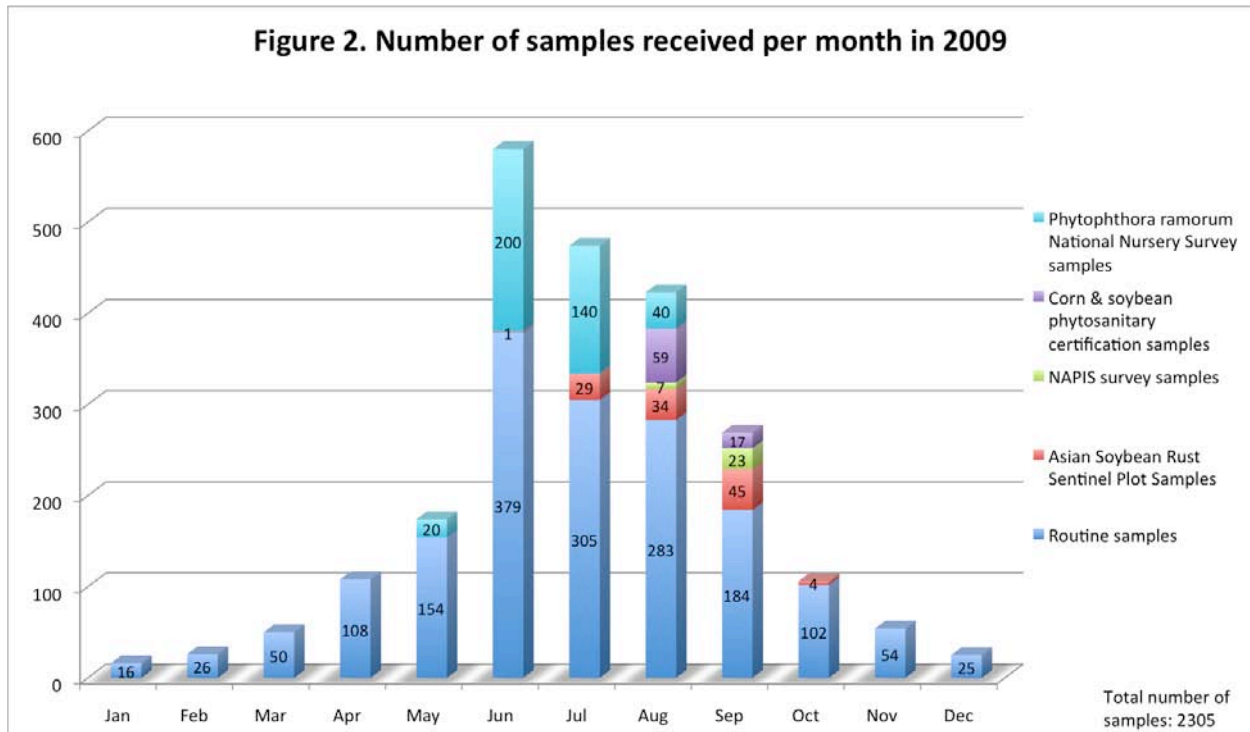
As per Table 2, approximately eight percent (131) of the total number of routine samples diagnosed by P&PDL diagnosticians in 2009 were submitted electronically, as digital samples. In addition to the 1686 routine samples diagnosed, 400 nursery samples were tested for the presence of *Phytophthora ramorum* as part of the Sudden Oak Death (Ramorum blight) National Survey. A total of 76 corn and soybean samples were submitted for disease diagnosis for phytosanitary certification (ICIA and IDNR) and 30 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 2009 | |
|--|-------------|
| Routine samples | 1686 |
| <i>Physical samples</i> | 1545 |
| <i>Digital samples</i> | 76 |
| <i>Digital samples with physical follow-up</i> | 55 |
| Regulatory/survey samples | 619 |
| <i>Asian Soybean Rust sentinel samples</i> | 113 |
| <i>P. ramorum national survey samples</i> | 400 |
| <i>Phytosanitary certification samples (IDNR/ICIA)</i> | 76 |
| <i>NAPIS corn survey</i> | 30 |
| Total number of samples | 2305 |

DIAGNOSES AND SAMPLES

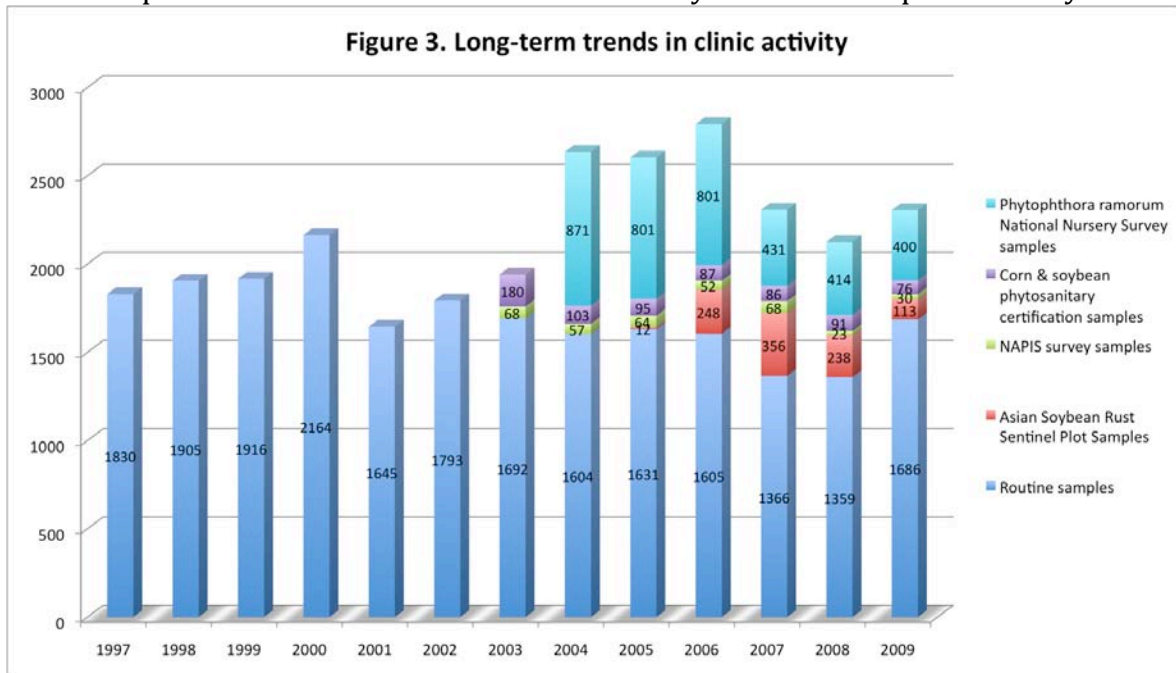
Monthly Activity

During 2009, the Laboratory diagnosed a total of 1686 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 2009 *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 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.



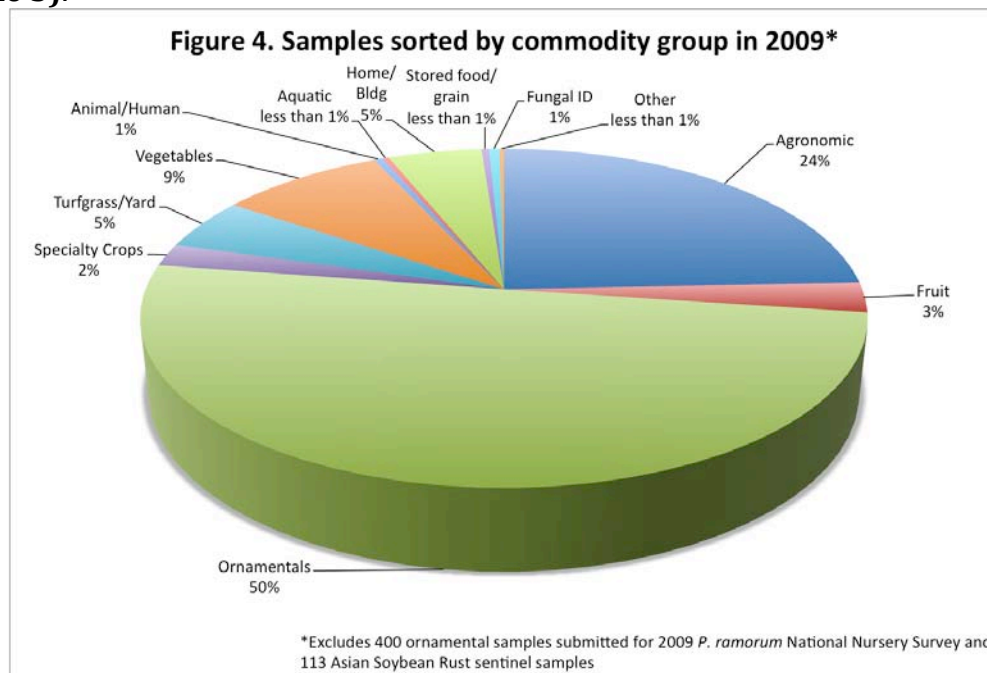
Long-Term Trends

Routine sample submissions have remained relatively stable for the past twelve years.



Commodities Diagnosed

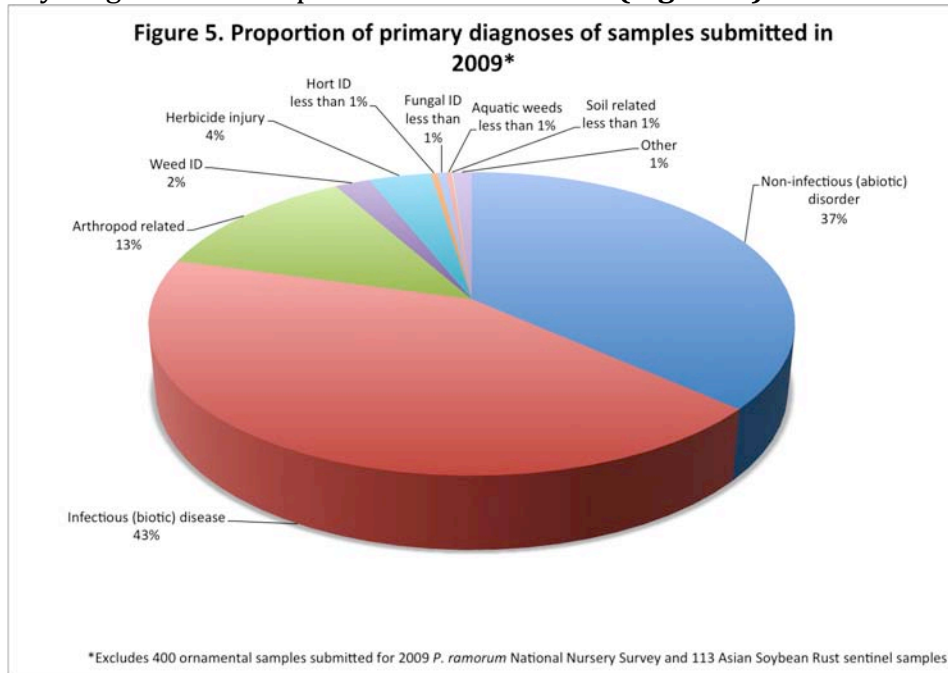
Figure 4 and **Table 3** show the number of specimens submitted in each commodity group, for 2009. The majority of samples submitted for diagnosis (50%) were from the ornamentals commodity group. In descending order, agronomic crops (24%), vegetables (9%), insects infesting homes and other buildings (5%), and turfgrass/yard (5%) comprised the other major commodities submitted for routine diagnosis. Several other minor commodity groups comprised the remaining 6% of the submitted samples (**Figure 4** and **Table 3**).



| Table 3. Samples sorted by commodity group¹ | | |
|--|----------------------------|----------------------|
| | 2009 | |
| Commodity | Number of Specimens | %² |
| Agronomic | 436 | 24 |
| Alfalfa | 8 | * |
| Barley | 3 | * |
| Corn | 268 | 15 |
| Forage/Pasture | 9 | 1 |
| Misc small grains | 2 | * |
| Soybeans | 107 | 6 |
| Weed ID | 4 | * |
| Wheat | 35 | 2 |
| Fruit | 51 | 3 |
| Small Fruit | 29 | 2 |
| Tree Fruit | 22 | 1 |
| Ornamentals | 900 | 50 |
| Flowers | 210 | 12 |
| Grnd Cvr/Vines | 20 | 1 |
| Interior Plants | 12 | 1 |
| Shrubs | 192 | 11 |
| Trees | 466 | 26 |
| Specialty Crops | 39 | 2 |
| Field | 9 | * |
| Hort | 30 | 2 |
| Turfgrass/Yard | 88 | 5 |
| Vegetables | 155 | 9 |
| Miscellaneous | 123 | 7 |
| Animal/Human | 8 | * |
| Aquatic | 6 | * |
| Home/Bldg | 88 | 5 |
| Stored Foods/Grains | 7 | * |
| Fungal ID | 10 | 1 |
| Other | 4 | * |
| Total Specimens | 1792 | 100 |
| ¹ Excludes 400 ornamental samples submitted for 2009 <i>P. ramorum</i> National Nursery Survey and 113 samples submitted for Asian soybean rust sentinel plots ² Percent of total samples submitted during the year * Less than 1% | | |

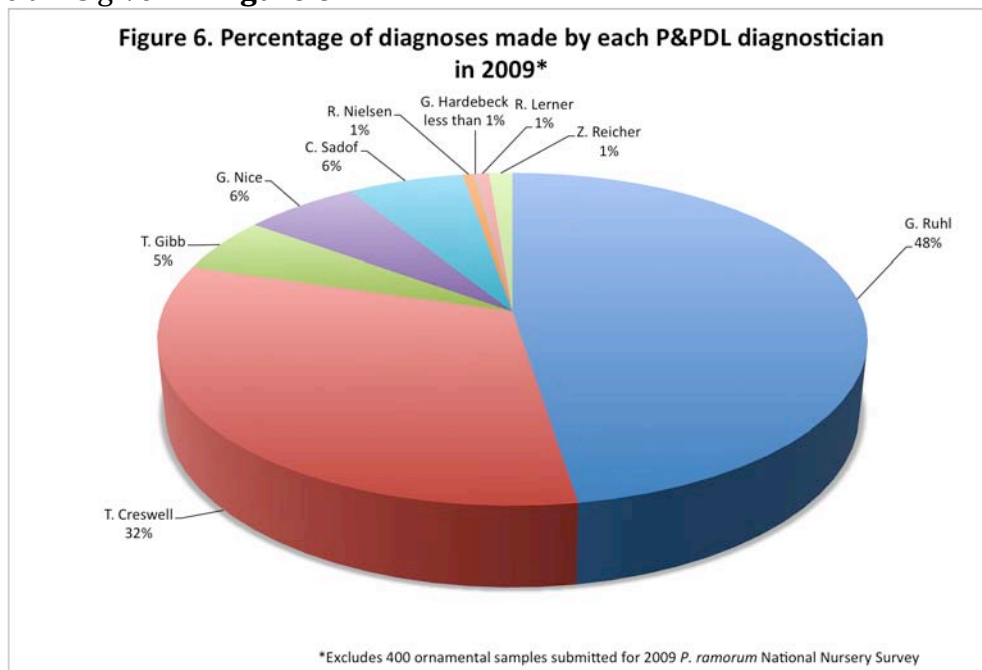
Type of Diagnosis

Many of the 2009 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 (37%), arthropods (13%), and herbicide injury (4%). Weed ID, horticultural and fungal ID, and soil related problem diagnoses each comprised 3% or less of the primary diagnoses of samples submitted in 2009 (Figure 5).



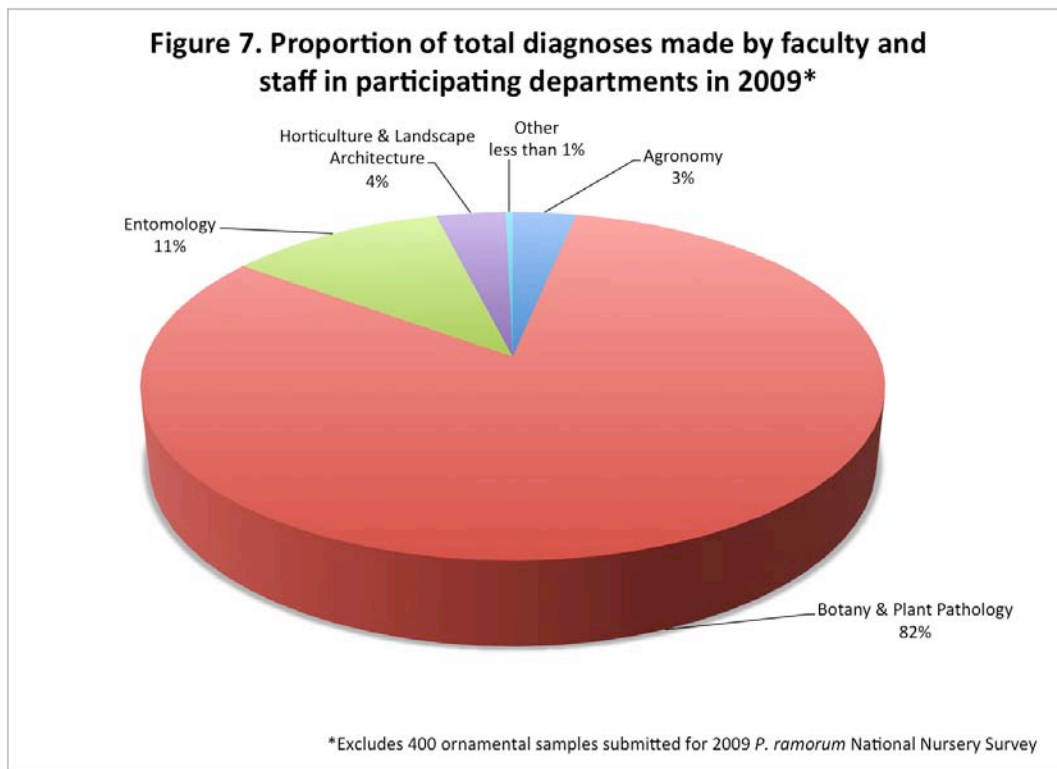
Diagnoses per Diagnostician

A comparison of the proportion of total 2009 diagnoses of samples made according to diagnostician is given in Figure 6.



Diagnoses per Department

A comparison of the proportion of total 2009 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.



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**).

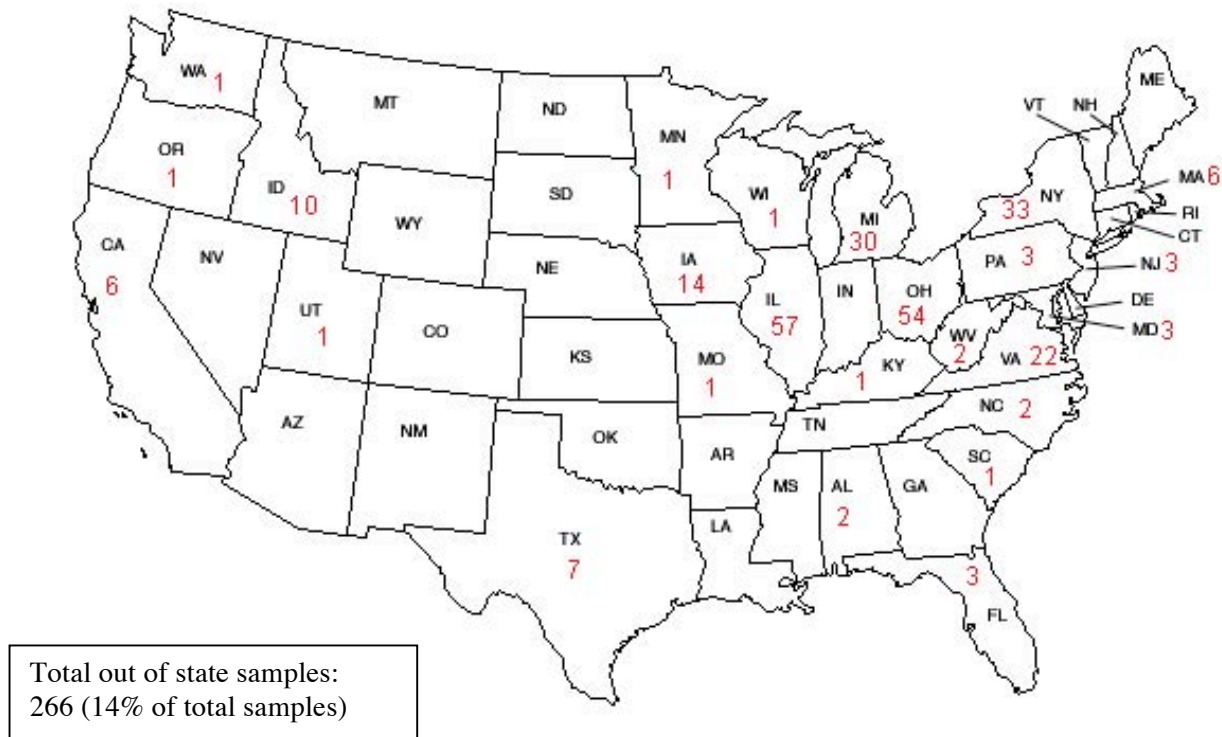
| Affiliation | Number of samples | % |
|----------------------------|--------------------------|------------|
| Commercial | 980 | 51 |
| Consultant | 101 | 5 |
| Dealer/Industry Rep | 253 | 13 |
| Garden Center | 25 | 1 |
| Golf Course | 27 | 1 |
| Greenhouse | 166 | 9 |
| Growers - Agronomic | 12 | 1 |
| Growers - Fruit/Vegetables | 24 | 1 |
| Growers - Ornamentals/Turf | 6 | * |
| Landscaper | 58 | 3 |
| Lawn/Tree Care | 231 | 12 |
| Nursery | 55 | 3 |
| Pest Control | 22 | 1 |
| | | |
| Non-Commercial | 649 | 34 |
| Extension Educator | 256 | 13 |
| Homeowner | 150 | 8 |
| Purdue - not Educator | 200 | 11 |
| Other | 43 | 2 |
| | | |
| Regulatory/Survey | 276 | 15 |
| ICIA | 113 | 6 |
| IDNR | 106 | 6 |
| State Chemist | 57 | 3 |
| | | |
| Totals | 1905 | 100 |

¹ Excludes 400 ornamental samples submitted for 2009 *P. ramorum* National Nursery Survey
* 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 266 samples (14% of total routine samples) submitted from 25 other states during 2009*.

Figure 8. Distribution of samples received from outside Indiana by the Plant and Pest Diagnostic Laboratory in 2009.



* 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.ppdl.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 17,110 requests per day for P&PDL web pages from January 1 through December 31, 2009 from a total of 156 countries worldwide.

As social media popularity continues to grow, the P&PDL strives to stay on top of the trend and make communication easier for our clientele. We now have a presence on Facebook and Twitter and our number of followers continue to grow.

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 2009 included:

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