Annual Report
2004

Purdue University Cooperative Extension Service

PURDUE
UNIVERSITY

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TABLES AND FIGURES

ACKNOWLEDGMENTS

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

We are also indebted to our computer support specialist who keeps us 'on-line,' to our departmental extension secretary for her webmaster 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, especially during this time of heightened agro-biosecurity concerns.

Gail E. Ruhl and Karen K. Rane
P&PDL Co-Directors

"…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 (est. 1979) in the Department of Botany & Plant Pathology 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) and the University's research faculty and staff and to the Director of the Entomology and Plant Pathology Division of the Indiana Department of Natural Resources (IDNR) and associated 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 will be on the look-out for unusual or new diseases to submit to the diagnostic laboratories. This will greatly reduce the time between introduction of plant pests and diseases and their detection.

As part of this national initiative in 2004, the P&PDL conducted a four-hour IP video training session for ANR educators with the intent of improving their surveillance capabilities for invasive plant diseases and pests in Indiana. Participants were registered with the NPDN as First Detector Educators. The training included information on the NPDN, Soybean Rust, Ramorum blight, Emerald Ash Borer, giant hogweed and several other invasives.

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. In 2004, P&PDL and IDNR staff worked together during an outbreak of *Ralstonia solanacearum* Race 3 Biovar 2 (RsR3B2) in New York geranium cuttings from Guatemala.

The P&PDL also provided disease diagnosis on corn and soybean samples for the IDNR Phytosanitary Certification Program, as well as confirmation of *Peronospora tabacina* on tobacco samples as a part of the 2004 Tobacco Blue Mold Field Survey, disease diagnosis of foliar pathogens on corn for entry into the National Agricultural Plant Information System

(NAPIS) database, and testing of nursery samples for the presence of *Phytophthora ramorum* as part of the National 2004 SOD survey.

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	
Co-Directors	Gail Ruhl, Karen Rane
Secretary and Receptionist	Janet Whaley
Webmaster and Extension Assistance	Amy Deitrich
Disease diagnosis and control	Gail Ruhl, Karen Rane
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, Glenn Hardebeck
Forestry & Natural Resources	
Tree identification	Rita McKenzie

The P&PDL is fortunate to have the support and assistance of numerous faculty and staff in the School of Agriculture. During 2004, more than 25 additional faculty and staff members assisted with sample diagnoses **(Table 1)**. The P&PDL also employs a student hourly worker throughout the year to help with logging in samples, sample distribution, filing and other general laboratory duties.

Table 1. Departmental faculty and staff that assisted with diagnoses of samples submitted to the *Plant and Pest Diagnostic Laboratory* during 2004.[1]

Faculty/Staff	Number of Diagnoses	Faculty/Staff	Number of Diagnoses
Agronomy	**118 (5%)**	**Entomology**	**226 (9%)**
Brouder	6	G. Bennett	1
E. Christmas	19	L. Bledsoe	2
G. Hardebeck[2]	30	R. Foster	2
K. Johnson	14	**T. Gibb**	137
R. Nielsen	30	J. Obermeyer	5
Z. Reicher	19	**C. Sadof**	78
		R. Williams	1
Botany & Plant Pathology	**1980 (79%)**	**Horticulture & Landscape Architecture**	**165 (7%)**
R. Green	2	B. Bordelon	9
D. Huber	4	M. Dana	63
R. Latin	49	P.A. Hammer	34
C. Lembi	6	**R. Lerner**	19
D. Lubelski	1	B. Moser	3
G. Nice	86	S. Weller	37
P. Pecknold	11		
K. Rane	966	**Other**	**8 (*)**
G. Ruhl	818[3]	Bigelow	1
G. Shaner	24	Braun	1
I. Thompson	13	Chaney	1
		Palm	4
		Unknown	1
		Total Diagnoses	**2497**

[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 2004 P&PDL diagnosticians.
[3] 871 additional sample diagnoses were provided for *P. ramorum* nursery survey samples (See page 7)
* Less than 1%

ADVISORY COMMITTEES

The inter-departmental nature of the P&PDL demands frequent and free-flowing exchange of information among the participating departments. This communication takes place on at least three different levels.

The 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 periodically to the Operations Committee. The Committee is chaired by the Co-Directors of the P&PDL and is composed of diagnosticians, and the secretary.

The Operations Committee

The Operations Committee provides a forum for discussion of operational matters and facilitates communication among diagnosticians and other specialists. The Committee meets as needed and reports periodically to the Management and Policy Committee. The Committee is chaired by the Co-Directors of the P&PDL and is composed of the Steering Committee, one Extension specialist from each participating department and the Department Head charged with administrative overview of the laboratory. Departmental Extension Specialists are appointed on a three-year rotating basis.

The Management and Policy Committee

The Management and Policy Committee provides administrative overview for the P&PDL. The Committee is composed of the Heads of the participating Departments and administrators from the Cooperative Extension Service and the Agricultural Experiment Station. The Committee is chaired by the Director of the Cooperative Extension Service. The Committee meets as needed.

2004 COMMITTEE STRUCTURE

The Steering Committee: Gail Ruhl (Co-Chair, Co-Director of P&PDL; plant disease diagnosis and control), Karen Rane (Co-Chair, Co-Director of P&PDL; plant disease diagnosis and control), Glenn Nice (Weed identification and control, and diagnosis of herbicide injury on field crops), Tim Gibb and Cliff Sadof (Arthropod identification and control), B. Rosie Lerner (Identification of horticultural plants), Bob Nielsen (Fertility and soil-related problems of corn), Zac Reicher and Glenn Hardebeck (Turfgrass management), Rita McKenzie (Forestry), Bob Mitchell (Database programming, web page management and computer support), Janet Whaley (Receptionist and accounts), Amy Deitrich (Webmaster and Extension secretary)

The Operations Committee: Gail Ruhl and Karen Rane (Chairs, Co-Directors of P&PDL), Steering Committee members, Ray Martyn [Department Head (administrative overview)], Keith Johnson (Agronomy), Greg Shaner (Botany and Plant Pathology), Rick Foster (Entomology), Rita McKenzie (Forestry and Natural Resources), Allen Hammer (Horticulture and Landscape Architecture)

The Management and Policy Committee: Dave Petritz (Chair, Director of CES), Tom Jordan (Assistant Director of CES & Agriculture and Natural Resources), Marshal Martin (Associate Director of Agriculture Research Programs), Craig Beyrouty (Head, Department of Agronomy), Ray Martyn (Head, Department of Botany and Plant Pathology), Steve Yaninek (Head,

Department of Entomology), Ed Ashworth (Head, Department of Horticulture), Dennis LeMaster (Head, Department of Forestry and Natural Resources), and Gail Ruhl and Karen Rane (Chairs, Co-Directors of P&PDL)

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.ppdl.org).

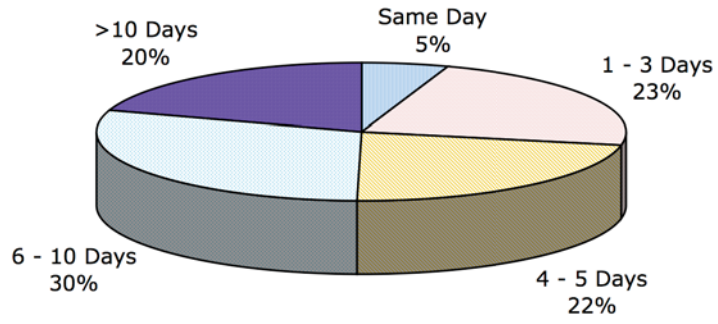
Diagnosis Process

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).

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 5% of the samples received during 2004 and 28% of the samples were completed in three days or less. A total of 50% of the samples received during 2004 were diagnosed within five working days and 80% of all samples received were answered within 10 working days. An extended turn-around time of greater than 10 days (20% of samples) was documented for those samples requiring more extensive culture work and laboratory testing **(Figure 1)**.

Figure 1. Turn-around time for all samples received in 2004*



* Turn-around time is the number of working days between receipt of samples and date of final reply completion.

Sample Breakdown

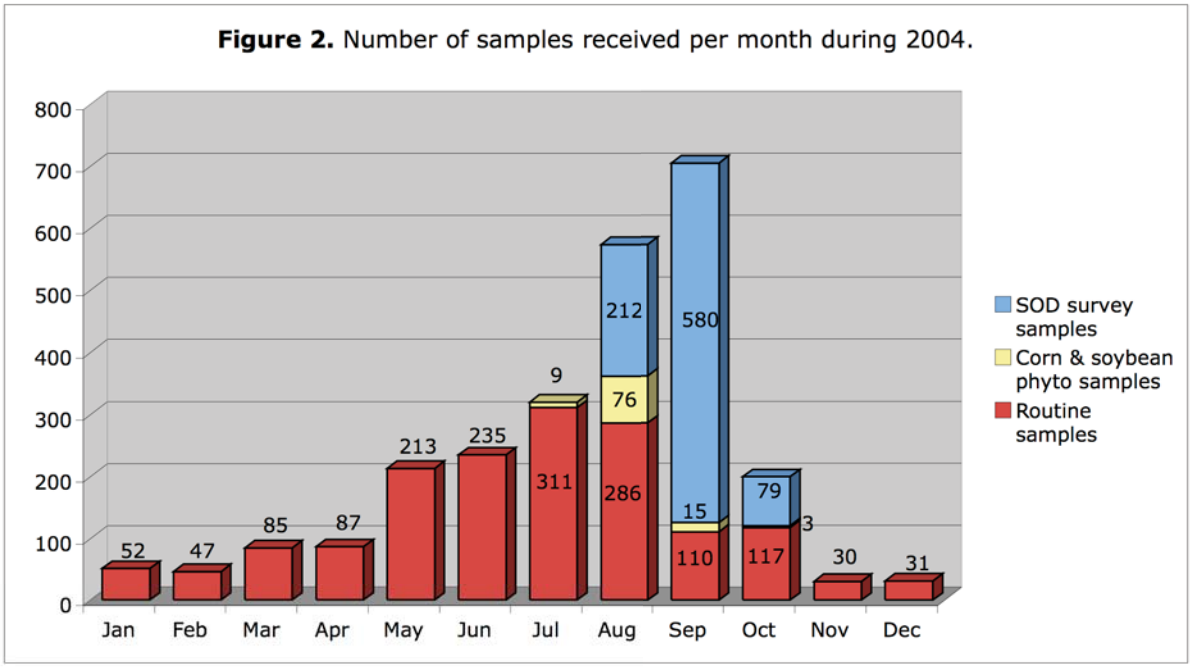
As per Table 2, approximately four percent (71) of the total number of routine samples diagnosed by P&PDL diagnosticians in 2004 were submitted electronically, as digital samples. In addition to the 1604 routine samples diagnosed, 871 nursery samples were tested for the presence of *Phytophthora ramorum* as part of the Sudden Oak Death (Ramorum blight) National Survey, and 103 corn and soybean samples were submitted for disease diagnosis for phytosanitary certification (ICIA and IDNR).

Table 2. Breakdown of total samples for 2004	
Routine samples	1604
Physical samples	*1533*
Digital samples	*55*
Digital samples with physical follow-up	*16*
SOD National Survey samples	871
Phytosanitary samples (ICIA and IDNR)	103
Total number of samples	**2578**

DIAGNOSES AND SAMPLES

Monthly Activity

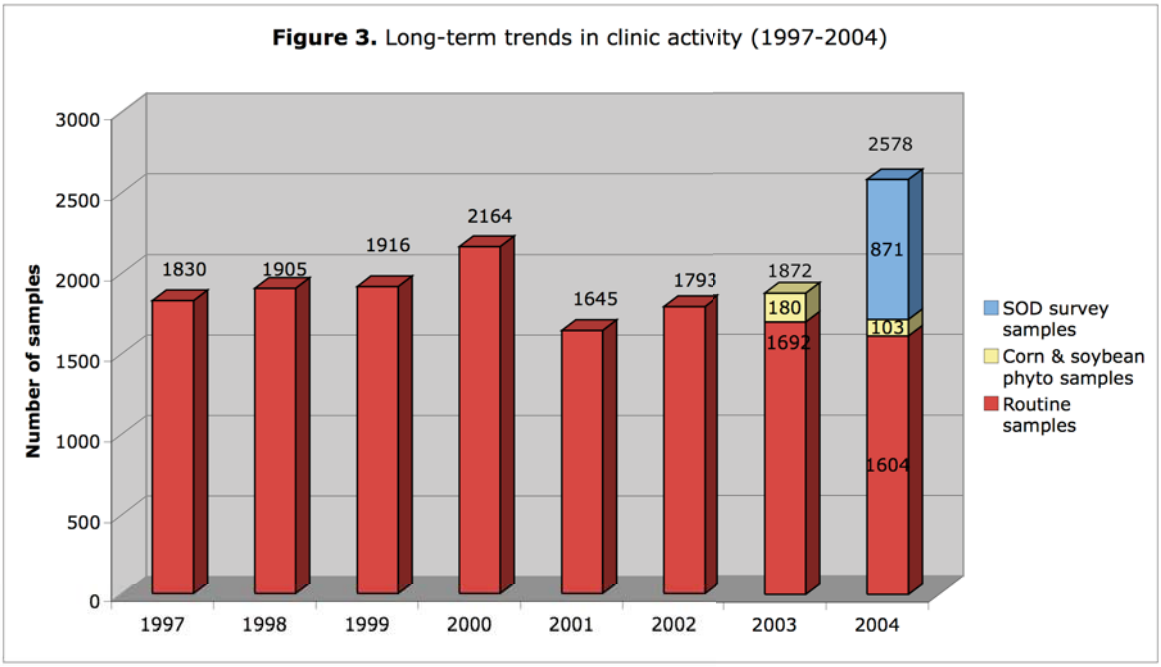
During 2004, the Laboratory diagnosed a total of 1604 routine samples. As illustrated in Figure 2, more than half of the year's routine samples were processed in the lab during the three months of June, July and August. The majority of the 2004 Sudden Oak Death (SOD) National Nursery Survey samples were submitted during August and September for diagnosis of the presence or absence of *Phytophthora ramorum*, the causal agent of SOD. During the month of August, ICIA and IDNR field inspectors submitted corn and soybean foliar samples to the P&PDL for disease diagnosis required for phytosanitary certification of seed.



Long-Term Trends

Sample submissions have remained relatively stable for the past eight years. Participation of the P&PDL in the 2004 National SOD Survey resulted in an increase in the total number of samples diagnosed **(Figure 3)**.

Figure 3. Long-term trends in clinic activity (1997-2004)



Commodities Diagnosed

Figure 4 and **Table 3** show the number of specimens submitted in each commodity group, for 2004. The majority of samples submitted for diagnosis (58%) were from the ornamental commodity group. In descending order, agronomic crops (18%), turfgrass/yard (7%) and insects infesting homes and other buildings (7%) comprised the other major commodities submitted for routine diagnosis. Several other minor commodity groups comprised the remaining 10% of the submitted samples **(Figure 4** and **Table 3)**.

Figure 4. Samples sorted by commodity group

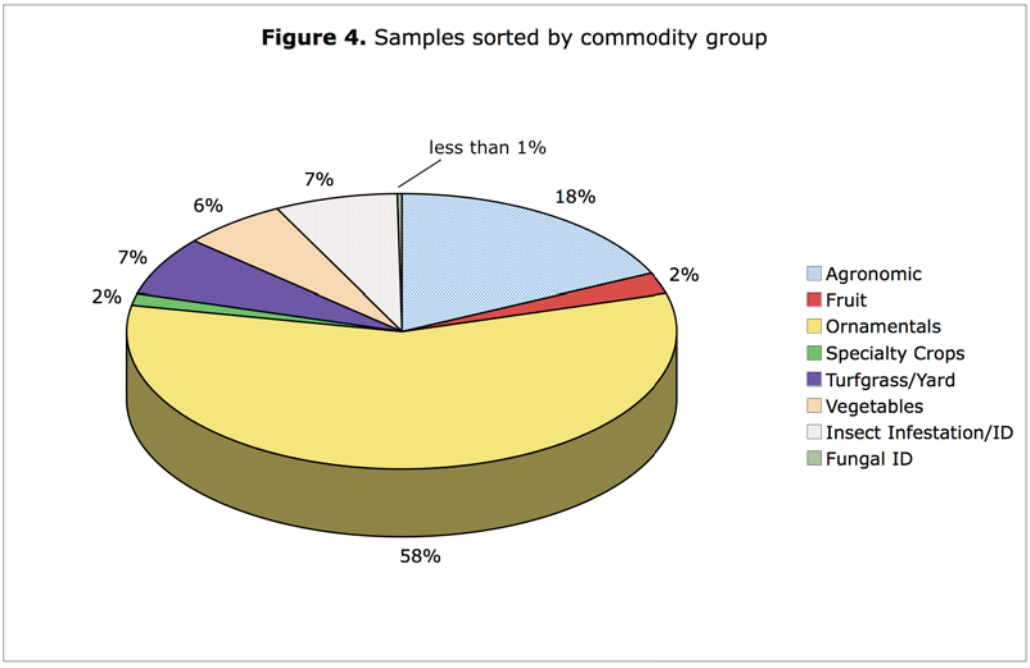


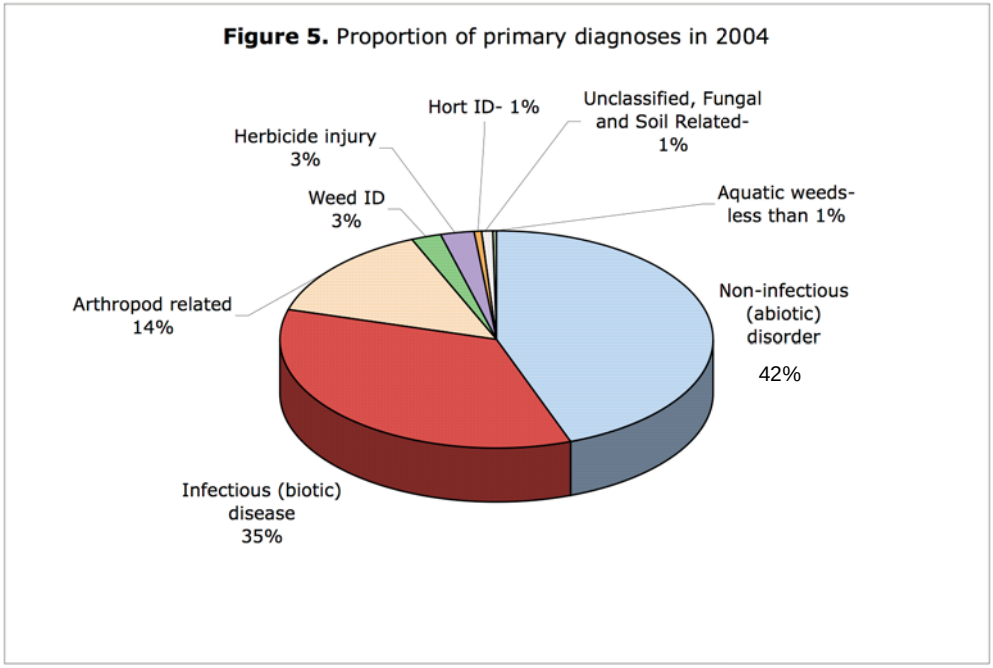
Table 3. Routine (non-survey) samples sorted by commodity group

	2004	
Commodity	**Number of Specimens**	**%[1]**
Agronomic	**290**	**18**
Alfalfa	12	1
Barley	3	*
Corn	157	10
Wheat	31	2
Soybeans	73	5
Forage	3	*
Pasture	1	*
Popcorn	1	*
Plant ID	7	*
Insect ID	1	*
Sorghum	1	*
Fruit	**38**	**2**
Small Fruit	24	1
Tree Fruit	14	1
Ornamentals	**923**	**58**
Flowers	266	17
Interior Plants	27	2
Grnd Cvrs/Vines	35	2
Shrubs	253	16
Trees	342	21
Specialty Crops	**25**	**2**
Field	11	1
Hort	14	1
Turfgrass/Yard	**109**	**7**
Vegetables	**100**	**6**
Miscellaneous	**119**	**7**
Animal/Human	13	1
Aquatic	5	*
Home/Bldg	83	5
Wood	2	*
Stored Foods/Grains	4	*
Unclassified[2]	8	*
Fungus	4	*
Total Specimens	**1604**	**100**

[1] Percent of total samples submitted during the year
[2] Unclassified – Commodity group was not provided on submission form
***** Less than 1%

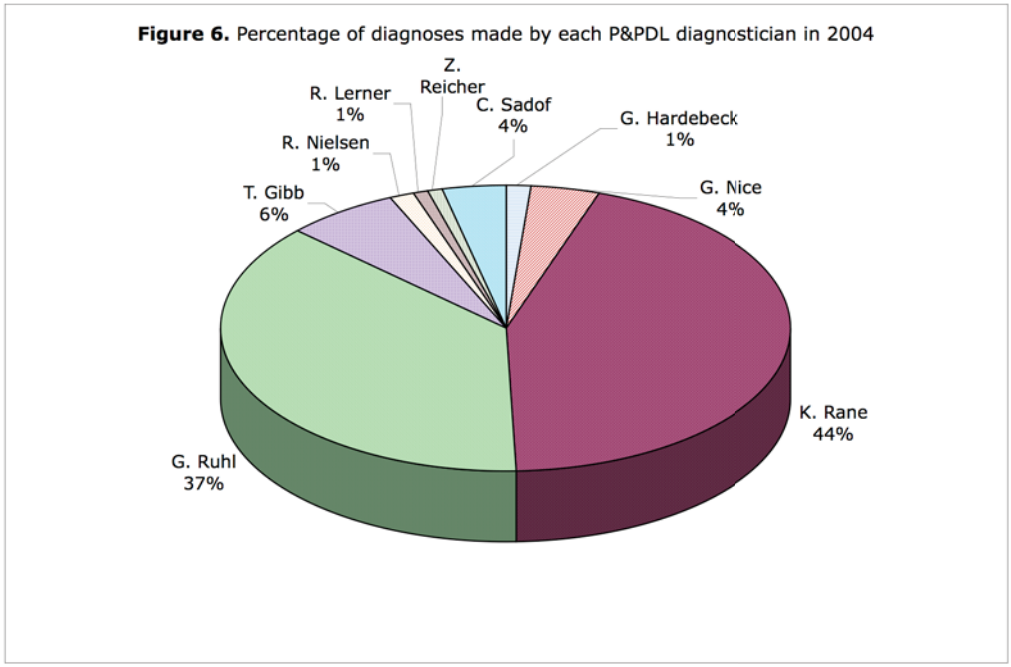
Type of Diagnosis

Many of the samples received multiple diagnoses due to more than one causal agent. The most frequently diagnosed causal agents, determined by the type of diagnosis made, were noninfectious (abiotic) disorders (42%), followed by infectious diseases (35%), arthropods (14%), weed identification (3%), and herbicide injury (3%) **(Figure 5)**.



Diagnoses per Diagnostician

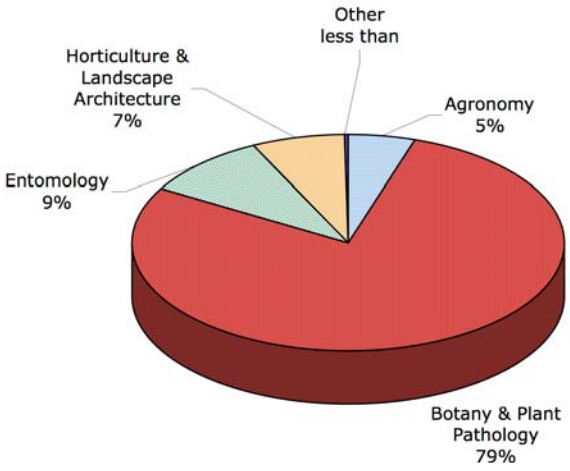
A comparison of the proportion of total diagnoses of routine (non-survey) samples made according to diagnostician is given in **Figure 6**.



Diagnoses per Department

A comparison of the proportion of total diagnoses made according to participating departments is given in **Figure 7**.

Figure 7. Proportion of total diagnoses made by faculty and staff in participating departments in 2004



Commodity Group Causal Agents

The number and proportion of samples with abiotic (noninfectious) and biotic (infectious disease, arthropod and weed) problems by commodity groups are presented in **Table 4**.

Table 4. Types of Primary Problems Diagnosed on Selected Commodity Groups[1]

Commodity	Number of samples	Abiotic Problems		Biotic Problems							
				Disease		Arthropods		Weeds		Fungal/ Plant ID	
		Number	%[2]	Number	%	Number	%	Number	%	Number	%
Animal/ Human	13	-	-	-	-	13	(100)	-	-	-	-
Agronomic Crops	290	116	(40)	174	(60)	7	(3)	13	(5)	-	-
Aquatic	5	-	-	-	-	1	(20)	4	(80)	-	-
Flowers	266	107	(40)	135	(51)	21	(8)	-	-	1	(*)
Fruits, small	24	13	(54)	11	(46)	-	-	-	-	-	-
Fruits, tree	14	6	(43)	5	(38)	2	(14)	-	-	1	(7)
Ground covers/Vines	35	10	(29)	16	(46)	4	(11)	3	(8)	2	(6)
Home/ Building	83	-	-	-	-	83	(100)	-	-	-	-
Interior Plants	27	16	(59)	7	(26)	4	(15)	-	-	-	-
Shrubs	253	182	(72)	45	(18)	18	(7)	-	-	3	(1)
Specialty Crops	25	5	(20)	18	(72)	1	(4)	-	-	1	(4)
Stored Foods/ Grains	4	-	-	-	-	4	(100)	-	-	-	-
Trees	342	224	(65)	60	(18)	56	(16)	1	(*)	1	(*)
Turfgrass/ yard	109	45	(41)	41	(38)	5	(5)	18	(16)	-	-
Vegetables	100	42	(42)	55	(55)	2	(2)	-	-	1	(1)
Other	14	-	-	-	-	7	(50)	4	(29)	3	(21)

[1] Sample numbers do not equal the number of diagnoses because not all samples represented problems (e.g. horticultural plant and weed identification, etc.)

[2] Numbers in parentheses are the percentage of the total number of samples for that commodity group.

* Less than 1%

SAMPLE ORIGIN

Clientele Groups

Samples are submitted to the P&PDL by homeowners, farmers, dealer/industry representatives, consultants, greenhouse growers, golf course superintendents, landscapers, pest control operators, lawn and tree care specialists, garden center and nursery personnel, University employees and others **(Table 5).**

Table 5. Affiliation of persons submitting non-survey samples to the Plant and Pest Diagnostic Laboratory in 2004

Affiliation	Submitted by CES[1]		Submitted by Public		Total	Percentage[3]
	Physical Samples	Digital[2] Samples	Physical Samples	Digital Samples		
Consultant	-	-	94	1	95	6%
Dealer/Industry Rep	-	1	136	1	138	9%
Garden Center	1	-	10	1	12	1%
Golf Course	-	-	23	-	23	1%
Greenhouse	7	-	249	-	256	16%
Homeowner	136	38	123	7	304	19%
Grower-Ag	15	4	10	2	31	2%
Grower-Fruit/Veg	5	3	13	-	21	1%
Grower-Ornamental	3	-	18	-	21	1%
Landscaper	-	2	56	-	58	4%
Lawn/Tree Care	4	1	98	1	104	6%
Nursery	-	-	57	-	57	4%
Pest Control	1	-	37	-	38	2%
Other-Misc	8	5	45	3	61	4%
ICIA	-	-	77	-	77	5%
IDNR	-	-	154	-	154	10%
IDNR-Forestry	-	-	11	-	11	1%
State Chemist	-	-	40	-	40	2%
USDA	-	-	39	-	39	2%
Purdue-not Educator[4]	-	-	61	2	63	4%
Extn – no client	1	-	-	-	1	*
Total	181	54	1351	18	1604	100%
Proportion of submitted samples[5]	**235 (15%)**		**1369 (85%)**			

[1] CES = Cooperative Extension Service County Office
[2] These digitals were electronically submitted via a site on the P&PDL web page
[3] Percentage of total samples received by affiliation
[4] Purdue Grounds, Animal Disease Diagnostic Lab, White River Gardens, and Purdue Faculty, Staff and Graduate Students
[5] Proportion of samples submitted by CES vs. proportion of samples submitted by public in 2004

County Distribution
With the obvious exception of Tippecanoe (P&PDL's home county), the number of sample submissions from within the State correlated to population distribution when mapped as either samples submitted from CES Educators or as samples submitted directly by the public **(Figure 8)**.

Figure 8. Distribution of samples submitted directly from Purdue Cooperative Extension Offices and directly from the general public in 2004.

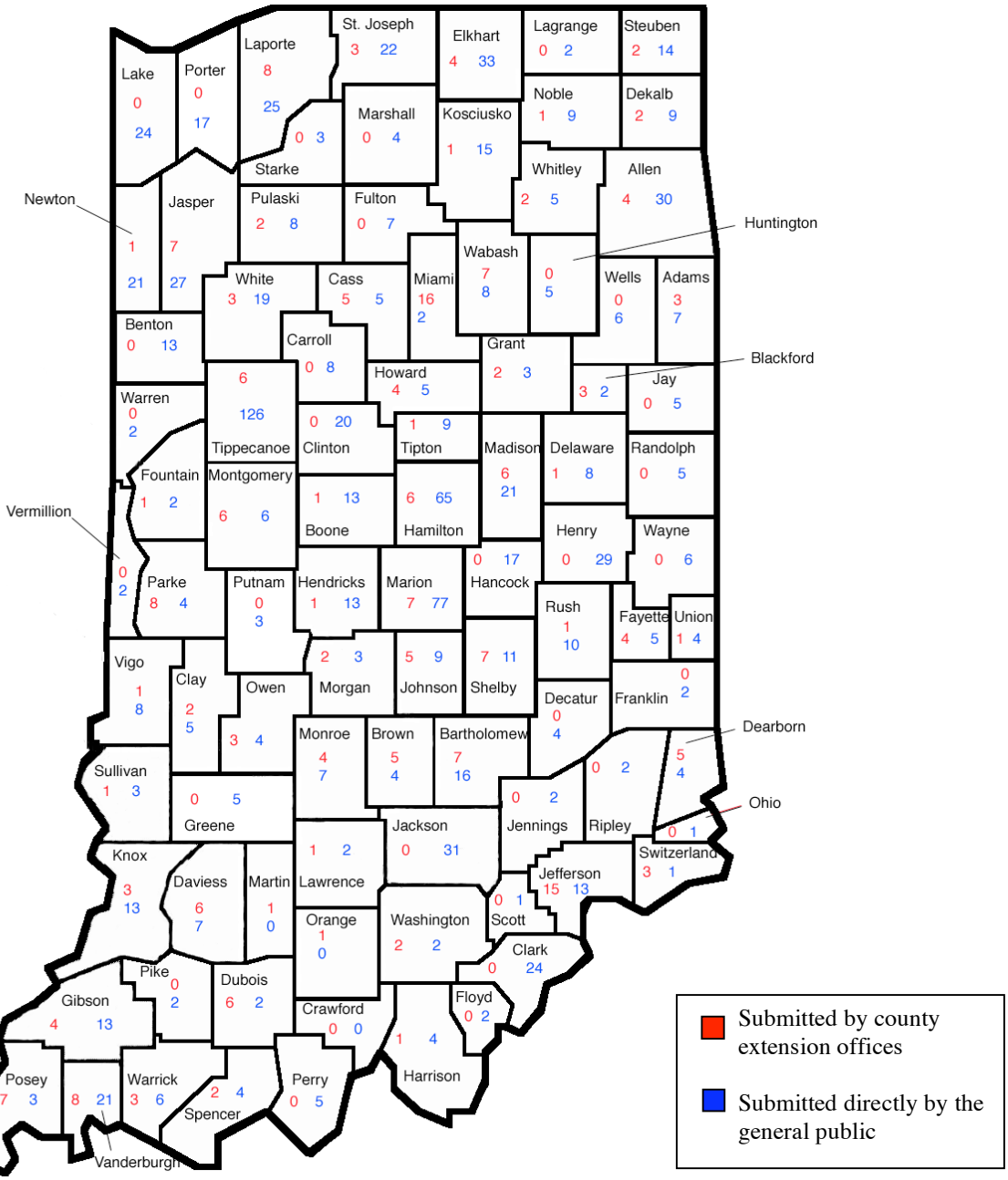


Table 6. Sample submissions by Indiana county: CES (shaded columns) vs. general public submissions

County	Purdue Not-Educator	Homeowner		Commercial		Regulatory and Other		Total	
Adams			3	7				7	3
Allen	3	1	2	18	2	8		30	4
Bartholomew			4	10	1	6	2	16	7
Benton				6		7		13	
Blackford		1	3	1				2	3
Boone		1		9	1	3		13	1
Brown		1	5	3				4	5
Carroll	1			7				8	
Cass			5			5		5	5
Clark				9		15		24	
Clay		2	1	3	1			5	2
Clinton		7		11		2		20	
Daviess		1	6	3		3		7	6
Dearborn	1		4	1	1	2		4	5
Decatur				3		1		4	
DeKalb				4	2	5		9	2
Delaware			1	7		1		8	1
Dubois			6			2		2	6
Elkhart			1	26	3	7		33	4
Fayette			3	5	1			5	4
Floyd		1				1		2	
Fountain			1	1		1		2	1
Franklin		2						2	
Fulton	2	2		3				7	
Gibson			4	5		8		13	4
Grant			2	2		1		3	2
Green		1				4		5	
Hamilton	3	4	6	51		7		65	6
Hancock				13		4		17	
Harrison				1		3	1	4	1
Hendricks		1	1	12				13	1
Henry		1		4		24		29	
Howard		2	3	1	1	2		5	4
Huntington				2		3		5	
Jackson	1			9		21		31	
Jasper		2	4	22	3	3		27	7
Jay				4		1		5	
Jefferson			11	1	4	12		13	15
Jennings				1		1		2	
Johnson			5	4		5		9	5
Knox	5		2	5	1	3		13	3
Kosciusko			1	12		3		15	1
LaGrange				1		1		2	
Lake	3	8		10		3		24	
LaPorte	7		7	11		7	1	25	8
Lawrence			1			2		2	1
Madison			6	13		8		21	6
Marion	3	8	1	52	6	14		77	7
Marshall				2		2		4	

Table 6 cont'd. Sample submissions by Indiana county: CES (shaded columns) vs. general public submissions

County	Purdue Not-Educator	Homeowner		Commercial		Regulatory and Other		Total	
Martin			1						1
Miami			16			2		2	16
Monroe	1		4	3		3		7	4
Montgomery			5	2	1	4		6	6
Morgan			2	2		1		3	2
Newton	5	3		11	1	2		21	1
Noble			1			9		9	1
Ohio						1		1	
Orange			1						1
Owen			2	1	1	3		4	3
Parke			5	1	2	3	1	4	8
Perry				3		2		5	
Pike		2						2	
Porter		5		7		5		17	
Posey			6	3			1	3	7
Pulaski	1		1	5	1	2		8	2
Putnam				3				3	
Randolph				5				5	
Ripley						2		2	
Rush				5	1	5		10	1
Scott						1		1	
Shelby			3	3	4	8		11	7
Spencer			1	2	1	2		4	2
St. Joseph		2	3	14		6		22	3
Starke				2		1		3	
Steuben			2	2		12		14	2
Sullivan	1		1	1		1		3	1
Switzerland			2		1	1		1	3
Tippecanoe	23	55	3	43	3	5		126	6
Tipton		1	1	5		3		9	1
Union		1		2	1	1		4	1
Vanderburgh		5	3	4	5	12		21	8
Vermillion				1		1		2	
Vigo			1	4		4		8	1
Wabash			6	3	1	5		8	7
Warren				2				2	
Warrick			2	3	1	3		6	3
Washington			2	1		1		2	2
Wayne				6				6	
Wells				1		5		6	
White		1	2	16	1	2		19	3
Whitley		2		1	2	2		5	2
Subtotals	60	123	175	542	54	331	6	1056	235
Totals	60	298		596		337		1291	

The shaded columns are submissions from Indiana CES for clients and the un-shaded columns are submissions directly from the general public to the lab

As noted on **Tables 6**, the vast majority (91%) of the commercial samples submitted by Indiana clientele were sent directly to the P&PDL by the commercial clients rather than submitted via their county extension educators (9%). The opposite trend is reflected in the homeowner submission. The majority of homeowners (59%) submitted their samples via their county extension educators, with 41% submitting them directly to the P&PDL.

The most frequent users (82%) of the P&PDL in 2004 were the general public (commercial and non-commercial) who directly submitted 1056 samples for diagnosis **(Table 6)**. County extension educators submitted only 235 samples (18%). In fact, archived P&PDL annual reports document that this has been the trend for the past eleven years. County Extension Educators have not been the most frequent P&PDL users since 1993, following the introduction of an $11.00 handling fee.

Out of State Submissions

The Laboratory is primarily intended to serve residents of Indiana, however, due to the P&PDL's national reputation, diagnostic services were also provided for 312 samples submitted from 24 other states during 2004. The lab has a USDA/APHIS/PPQ permit to receive out-of-state samples for diagnosis from the lower 48 states. No out-of-country samples are accepted. **(Table 7; Figure 9)**

Table 7. Out of State Submissions to the P&PDL in 2004.

State	Homeowner	Commercial	Total
Arizona		5	5
California		15	15
Delaware		2	2
Florida		1	1
Georgia	2		2
Idaho		12	12
Illinois	2	36	38
Iowa		7	7
Kentucky		5	5
Massachusetts		3	3
Maryland		2	2
Michigan		61	61
Missouri		2	2
Montana	1		1
North Carolina		9	9
New Hampshire		15	15
New Jersey		4	4
New Mexico		1	1
New York		22	22
Ohio	1	43	44
Pennsylvania	1		1
Utah	1	19	20
Virginia		37	37
Wisconsin		3	3
Totals	8	304	312

Figure 9. Distribution of samples received from outside Indiana by the Plant and Pest Diagnostic Laboratory in 2004.

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 Dept. of Botany and Plant Pathology and Amy Deitrich as webmaster, is 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 a "picture of the week", up-to-date information on "What's Hot" in the P&PDL and links to informational sources, as well as access to ten years of archived web page information. There is a keyword searchable database of past questions and answers, current questions and answers (many with pictures), 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 5,027 requests per day for P&PDL web pages from January 1 through December 31, 2004, an increase from 2003 of almost 3,000 'hits' per day.

Extension Activities

P&PDL staff members participate in a variety of Purdue University sponsored events and educational programs. Some of these programs in 2004 included Garden Day, Master Gardener Training, Turf and Ornamentals Workshops, Pesticide Applicator Training, and Certified Crop Advisor Training.

APPENDIX A **Master Table. Summary of All Diagnoses by Crop Category and Causal Agent Type. 2004**

Commodity Group	Number of Samples Submitted	Abiotic[1] Problems	Infectious Diseases	Herbicide Injury	Insect Injury	Insect ID	Weed & Plant ID	Soil Related	Fungal ID	Insufficient Sample Information	Total Diagnoses[2]	% Diagnoses
Agronomic	**290 (18%)**	**100**	**174**	**16**	**6**	**1**	**13**				**310**	**19**
Alfalfa	12	10			1		1				12	
Barley	3		3								3	
Corn	157	49	115	12			1				177	
Wheat	31	18	11				2				31	
Soybeans	73	23	42	4	4						73	
Forage	3		1		1		1				3	
Pasture	1						1				1	
Popcorn	1		1								1	
Plant ID	7						7				7	
Insect ID	1					1					1	
Sorghum	1		1								1	
Fruit	**38 (2%)**	**14**	**16**	**5**	**2**		**1**				**38**	**2**
Small Fruit	24	8	11	5							24	
Tree Fruit	14	6	5		2		1				14	
Miscellaneous	**119 (7%)**					**108**	**8**		**3**		**119**	**7**
Animal/Human	13					13					13	
Aquatic	5					1	4				5	
Home/Bldg	83					83					83	
Wood	2					2					2	
Stored Foods/Grains	4					4					4	
Unclassified[3]	8					5	3				8	
Fungus	4						1		3		4	
Ornamentals	**923 (58%)**	**529**	**263**	**16**	**100**	**3**	**10**	**1**	**1**		**923**	**57**
Flowers	266	107	135	2	20	1	1				266	
Interior Plants	27	16	7		4						27	
Grnd Cvrs/Vines	35	8	16	2	2	2	5				35	
Shrubs	253	182	45	5	18		3				253	
Trees	342	216	60	7	56		1	1	1		342	
Specialty Crops	**25 (2%)**	**5**	**18**		**1**		**1**				**25**	**2**
Field	11	1	10								11	
Hort	14	4	8		1		1				14	
Turfgrass/Yard	**109 (7%)**	**37**	**41**	**3**	**2**	**3**	**18**	**5**			**109**	**7**
Vegetables	**100 (6%)**	**39**	**55**	**2**	**2**		**1**			**1**	**100**	**6**
Total	**1604 (100%)**	**724**	**567**	**42**	**113**	**115**	**52**	**6**	**4**	**1**	**1624**	**100**

[1] Abiotic problems include cultural, environmental, soil and site related (not herbicide)

[2] The number of diagnoses may be greater than the number of samples submitted due to multiple problems diagnosed on one sample

[3] Unclassified - Commodity group was not provided on submission form

* Less than 1%

APPENDIX B: COMMODITY RELATED SUMMARIES

Vegetable Diseases, *Dan Egel, Region Pest Management Specialist, SWPAC, Purdue University*

The 2004 season began with a relatively cool spring. Perhaps for this reason, there were several cases of vegetable transplant damage as a result of faulty heater exhaust. In a milder spring, these greenhouses will be ventilated from outside more often.

Compared to the 2003 season, there was a more rainfall spread out over the summer. More rain resulted in an increase in foliar diseases. These included early blight and Septoria of tomato, gummy stem blight of watermelon and Alternaria leaf blight of muskmelon. Another factor in the occurrence of these diseases was the length of the rotation and the history of the disease in that location. Increased rainfall was also correlated with an increase in certain soil borne diseases. Examples would be mature watermelon vine decline and Phytophthora diseases.

Other diseases are not as closely related to weather. A few cases of bacterial fruit blotch of watermelon occurred in southwest Indiana. This disease can be seed transmitted. Downy mildew of pumpkins was quite widespread across Indiana. Some growers reported severe yields losses due to downy mildew. This disease requires the introduction of the proper spore type from the Gulf States as well as relatively cool, dewy nights.

Tree Fruit Diseases, *Paul Pecknold, Professor, Botany & Plant Pathology, Purdue University*

Wet and moderately cool conditions throughout the spring and summer months resulted in a high amount of cedar apple rust infection and continued pressure from apple scab throughout the year. The wet weather also resulted in an increase of Phytopthora crown rot on both apples and stone fruit; the degree of infection will become more apparent during the coming growing season. Fire blight was very sporadic throughout the state in both severity and occurrence; contributing factors appeared to be the frequency of rainfall during bloom and the number of holdover cankers from the previous year(s). Blister spot of Crispin, another bacterial disease, was again more widespread and severe than normal due to frequent rainfall. A midsummer reversal in weather, from wet to dry conditions that extended well into the Fall harvest period resulted in light to moderate levels of sooty blotch and flyspeck and secondary pinpoint apple scab. Brown rot on peaches, plums, and cherries was more apparent this year than normal. Extended periods of wet weather during the bloom and fruit ripening periods provided excellent infection and post-infection conditions for brown rot. The most severe brown rot problems developed where growers failed to provide adequate fungicide protection during and shortly after shuck split. In general, the past growing season experienced moderate disease pressure resulting in an 'average' disease year for tree fruit diseases.

Agronomic Crop Diseases, *Greg Shaner, Professor, Botany & Plant Pathology, Purdue University*

Fusarium head blight of wheat was widespread in Indiana. The week before wheat flowered was dry, but wet weather commenced about the time flowering began, early enough for symptom development and production of deoxynivalenol in grain.

Some widely grown corn hybrids proved to be susceptible to northern corn leaf blight, and the disease caused premature defoliation wherever these hybrids were grown. Gray leaf spot developed late and was not severe.

Turf, *Zac Reicher, Extension Turfgrass Specialist and Glenn Hardebeck, Turfgrass Research Agronomist, Department of Agronomy, Purdue University*

An unusually wet and cool summer made for ideal growing conditions for turf throughout

the state as well as ideal conditions for dollar spot, which ravaged lawns, athletic fields, and golf courses. The mild summer conditions also allowed both *Poa trivialis* and *Poa annua* to survive well into the summer without their annual thinning. However, drought besieged the state from early August to early October causing substantial thinning of lawns and other non irrigated turf areas. More importantly, it exacerbated turf damage from annual white grubs leading to widespread damage. Severe grub damage was unexpected since a wet summer tends to distribute egg laying over all turf areas rather than concentrating it in irrigated areas, as would occur during typical drier summers. Renovation of severely damaged areas as well as normal September fertilization practices were either delayed or ineffective due to the lack of rainfall. Additionally, broadleaf weed herbicide applications made typically in September were also delayed or ineffective because of dry conditions. Thankfully, rains returned in October and these combined with extended growing conditions well into November and December left turf areas in average to above average condition across IN going into the winter.

Weed Science, *Tom Bauman, Professor, Botany & Plant Pathology; Bill Johnson, Assistant Professor, Botany & Plant Pathology; and Glenn Nice, Weed Diagnostician, Botany & Plant Pathology, Purdue University*

We received a number of corn and soybean herbicide injury reports during 2004. In some cases, the cause of the injury was related to stressful weather conditions which reduced the plant's ability to metabolize or degrade the herbicide.

Herbicide Injury Issues

Growth Regulator:

Several cases of soybean growth regulator injury were sent into the P&PDL in 2004. This is a common situation in Indiana and the surrounding states or for that matter anywhere where corn and soybean are grown in close proximity. Soybean leaf puckering, cupping, and strapping are a common symptom when exposed to low doses of a growth regulator such as 2,4-D, Banvel, Clarity, Crossbow, Distinct, etc. In many cases if the injury occurs early in the season there is no yield response. However, if the growing season leads to delayed corn applications and injury occurs later in the soybean development yield effects may be seen. For more information on growth regulator injury on soybean, see the following publication (http://ipcm.wisc.edu/pubs/pdf/dicamba2004.pdf).

Lightning + Distinct:

Early August samples of corn were sent to the P&PDL. The corn in the samples were severely damaged and malformed (Figures 1 and 2). This was also seen once in 2003. In all the cases, from the information given, the only thing that was the same between the samples were that Lighting + Distinct were tank mixed POST. Whether this was the result of this tank mix was not determined. A Lightning + Distinct tank mix is a labeled tank mix and has been used by several producers at no detriment to the corn crop. However, use of adjuvants, such as crop oil concentrate or methylated seed oil is not recommended due to crop injury. Also weather conditions can have an effect on ALS herbicides such as Lightning. If this injury is herbicide related several things could be interacting to induce this level of injury including environmental conditions at time of application, the use of an adjuvant, and excessive rates.

Figures 1 and 2. Malformed corn leaves.

Weed Issues

Water-Cress:

In 2004, several samples of yellow water cress (*Roippa spp*.) were received for identification. Speciation was not determined due to contradictions in the literature concerning this group of plants. Samples were all found in areas that were wet in the spring, but had dried out. For the most part, water cress like a moist habitat and I believe that in 2004 the increased concern about this plant is due to flooding that Indiana experienced early in the season, allowing water cress to become established in producers' fields.

Giant Hogweed:

A new invasive plant by the name of giant hogweed (*Heracleum mantegazzianum*) was identified in Indiana but an employee of JFNew (a Natural Resource Consulting agency, www.jfnew.com). Giant hogweed is a problem invasive in Australia, Europe, and Canada. In the US it has been found in Maine, Michigan, New York, Pennsylvania, and Washington. It is a large plant in stature resembling a large cow parsnip (*Heracleum maximum*). For more information about giant hogweed see the following article "The Infamous Giant Hogweed" (http://www.btny.purdue.edu/weedscience/2004/articles/gianthogweed04.pdf)

Greenbrier:

Several homeowners that have woods on their property submitted vines (with and without spines) that were identified to belong to the Smilax genus. Although unusual to many, plants from this genus are fairly common in Indiana's wooded areas and are known as "Jacob's Ladder" and "Bristly Sarsaparilla".

Figure 3. Smilax leaf, stem and berries.

Horseweed/marestail:

Horseweed (aka marestail) is weed common to Indiana and much of the Midwest. It can emerge in the fall or spring and is listed as one of the more difficult weeds to control and increasingly problematic according to Indiana farmers surveyed between 1996 and 2000. A characteristic of horseweed is that it is well adapted to no-till systems typifying the response of winter annuals to the elimination of preplant tillage and subsequently infesting summer annual crops. Horseweed generally emerges in the fall (August – October), overwinters as a rosette, and produces seed the following spring or summer. However, some researchers reported that horseweed could emerge well into the spring and that spring emergence should be considered in no-till management systems.

Horseweed having an 8 to 13-fold resistance compared to a susceptible population was discovered in 2000 in Delaware in continuous no-till soybean production. Since this first report, glyphosate-resistant (GR) horseweed has also been discovered in Tennessee, Kentucky, Maryland, New Jersey, Ohio, Indiana, and Arkansas in similar cropping situations. Biotypes resistant to glyphosate and cloransulam are suspected in southern Indiana and northern Ohio, respectively. In 2004, glyphosate resistant horseweed/marestail samples were found in 19 Indiana counties (Figure 4.)

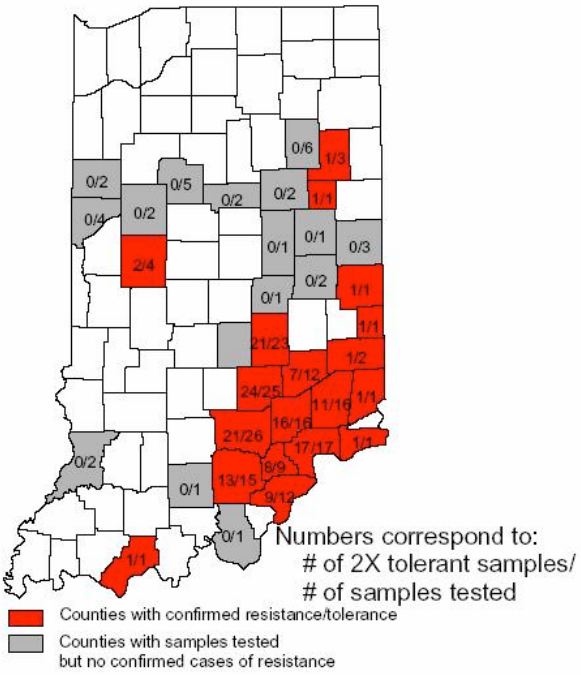


Figure 3. Indiana counties sampled that had glyphosate resistant horsewee/marestial. Source: http://www.btny.purdue.edu/weedScience/2004/articles/updatemarestail04.pdf

Ornamental Plant Disease Problems, *Paul Pecknold, Professor, Botany & Plant Pathology, Purdue University*

Shade tree anthracnose was light to moderate this past growing season. Maple anthracnose was almost nonexistent, while ash, oak and sycamore anthracnose were light to moderate. The degree of disease severity and occurrence varied throughout the state depending

on the amount and duration of early spring rainfall and the stage of plant growth. As usual, apple scab was very evident during the spring period, but did not reach the epidemic levels that it has in past years. Other prominent leaf diseases included *Guignardia* leaf blotch of horse chestnut and buckeye; powdery mildew of lilac and susceptible shade trees, and cedar apple rust. Of interest was the lack of blister leaf of oak, juniper tip blight, and cedar quince rust, three diseases that have been fairly prominent in previous years. Sphaeropsis tip blight continues to devastate pine plantings throughout the state; especially Austrian and Scotch pines. Also of concern was the apparent increase in oak wilt reported from northwest Indiana. Overall, the past growing season experienced moderate disease pressure resulting in an 'average' year for landscape tree and shrub diseases.

Household Insects, Honeybees, Insects on Fruits and Vegetables, *Tim Gibb, Insect Diagnostician, Entomology, Purdue University*

Indiana experienced a comparatively mild winter in 2004. Accumulated growing degree days were higher than normal in late winter and early spring. Unusually wet weather conditions developed in early to mid Spring of 2004 and persisted across most of the state. Precipitation continued throughout most of the growing season (spring and summer) and then turned off in early September for 4 – 5 weeks, causing soils to finally dry out.

The insect news of the year in 2004 was the mass emergence of the 17 year periodical cicada in several areas across the central and southern parts of the state. Some reports described thousands of cicadas emerging from the ground all at once. While in most situations, this was merely a phenomenon, some complaints of damage were registered. Calls received ranged from complaints of damage to trees and shrubs because of the oviposition slits of the female, to the unbearable noise of the cicadas calling to even a few complaints of smell as the insects began dying enmass. Three species of cicada were involved in this mass emergence. Extension and media alerts issued in late winter and early spring helped to minimize the potential damage of this insect in small trees, nurseries and fruits. Advanced warnings allowed control strategies (including modifying chemical treatments, altering planting recommendations, and applying netting material to susceptible trees) to be in place that prevented most severe cicada damage to commercial trees.

In general, Indiana experienced excellent weather for beekeeping in 2004. There was sufficient rain throughout the season (until September), but there was also plenty of sunny weather for bees to forage on flowers. Most beekeepers removed surplus honey in August, but the bees were able to produce more honey for overwintering. A lack of rain from September to early October caused the fall flowers (primarily goldenrod and aster) to quit producing nectar slightly earlier than normal. As a result, some Indiana hives were light on honey stores in the fall due to the September drought-like conditions but the situation is not as bad as it was during 2003.

Lower than normal tick and biting fly complaints were received during the spring and summer of 2004. Mosquito complaints were common early in the season, due primarily to the nuisance mosquito (*Aedes vexans*) and the heavier rain periods. Some concerns about West Nile virus were expressed, but not as many as during 2003. Overall, human biting ticks and insects remained relatively quiet during 2004, except for the early season nuisance mosquito complaints.

More psocids occurred in stored grains and also in processed foods in 2004 than normal. Hairy fungus beetles in stored foods were also higher, both probably due to the humid conditions of early 2004. Higher than usual foreign grain beetle activity was found both in stored grains and also in new homes. New home construction during the wet spring conditions in early 2004

resulted in more damp/wet wood becoming enclosed in wall voids and attics. Molds developing in these conditions were highly conducive for foreign grain beetle infestations.

Generally, fruit and vegetable damaging insects were slightly lower in 2004 than normal. Apple pests, including codling moth and spotted tentiform leafminer, were conspicuously absent throughout much of the state. Corn borer damage to sweet corn and other crops was reduced. Lower than normal 1st generation flights were low, which afforded little opportunity for 2nd generation corn borers to develop in numbers high enough to cause usual sweet corn injury. Corn earworm (tomato fruitworm) populations were low throughout the state in the early 2004 season, however intense tropical storm activity in the southern states accounted for a higher influx of earworms in the state during the late summer and resulted in some late season damage.

Bean leaf beetle damage on soybeans was isolated and localized. Soybean leaf aphid populations were much lower in 2004 than the previous year. Lack of synchrony between the development of the aphid and the plant, as well as the absence of south winds during the migratory phase of the aphid resulted in minimal new movement in 2004 as compared with 2003. Asian lady beetle populations in soybean fields were less during 2004 probably due, in large part, to the decreased abundance of soybean aphids. Lack of aphids also mitigated the nuisance problems with syrphid flies that Indiana residents experienced in 2003.

The majority of Indiana's corn crop was planted and harvested earlier than usual in 2004. Corn earworm, normally a late season pest, did not develop during 2004. The corn rootworm beetle variant pushed its way southward during 2004 and, as a result, for the first time poses moderate risk to 1st yr corn in central and south Indiana counties in 2005. European corn borer numbers have been falling over last 3 yrs, possibly due to wet springs. Estimates based on stalk splitting in late 2004 indicate that populations of European corn borer are the lowest recorded in many years. A lower population of corn borers going into the 2004/05 winter further suggest lower threat again in 2005 (although the ultimate 2005 population may be more dependent upon spring and early summer growing conditions than on the size of the population going into winter). True armyworm was found in an isolated area on early field corn, indicating a probability of a single early heavy flight event from the southern states. However, armyworm infestations were not nearly as severe nor as widespread as was the case 3 yrs ago.

In alfalfa, the alfalfa weevil population and damage was moderate to light (similar to last year). Potato leafhopper populations were high last year and started out heavy in 2004 but cool rains and possibly fungal infections hampered the buildup of this pest. Populations continued to decline as the year progressed.

In ornamentals plants, most aphids and scales numbers were low. Webworms such as tent caterpillar, fall webworm and mimosa webworm were higher than normal. Bagworms continued to create problems in spruce and other evergreen plantings. Generally, spider mite activity was higher than usual with spruce spider mites leading the way.

Around homes, the number of social and solitary wasp complaints was slightly higher in 2004, despite early rains. Spiders around homes and other buildings were common in 2004 but not nearly as common as was the case during 2003. Box-elder bug complaints were higher than normal (similar to 2003). Elm leaf beetles and home invading weevils (black vine and strawberry root weevil) were nearly non-existent during 2004.

Number of termite and ant calls from homeowners was lower than usual this year. Wet organic matter in yards and gardens near residences allowed high numbers of millipedes, sowbugs and pillbugs, to develop, especially during the spring and early summer time. Like last year, homeowners in 2004 often complained of these nuisance pests covering sidewalks, patio and garage floors and even entering into basements through window cracks and utility ports.

Insects in lawns and golf courses were less problematic in 2004 than usual. Japanese beetles emerged earlier than normal in 2004 and some high, localized populations existed. However, due to the wet growing conditions of the spring and summer, concentrations of the beetles doing damage to either plants, trees or laying eggs in turfgrass was not evident. Spotty Japanese beetle damage was reported in berries, fruits and grains during 2004, however, lack of damage may be due to the number of plants that were abundant during early 2004 and competed for the beetle feeding.

Billbugs in turfgrasses continue to increase in number and damage as of late, even though their damage often goes misdiagnosed. Moles and earthworm complaints continued to increase throughout the state during 2004. There appears to be a direct link between mole numbers and earthworm activity. Both are increasing in number of complaints. Incidence of cluster fly activity is likewise increasing.

Due to publicity by the media and warnings by extension specialists the pending threat of emerald ash borers invading Indiana, more green beetles were submitted for identification during 2004 than previously. These included beetles such as carabids (fiery hunters), tiger beetles and green June beetles.

Pest activity that is new and unusual includes corn leaf blotch miner in isolated areas. South Central Indiana may be experiencing higher wireworm problems possibly due to the changing farming practices of that area. Use of silage from winter wheat and a second crop of corn (both cut green) leaves the soil full of decomposing grass roots throughout the entire growing season. This practice provides abundant food for wireworm larvae. Over the northern and central regions of the state, earwigs continue to become a more common nuisance problem. Reports of true bed bug infestations have been more common during the past few years in Indiana. This mirrors the increase in bed bug activity nationwide and confirms the reported resurgence of true bed bug infestations especially in the hotel and bed and breakfast industry. Until recently, bat bugs predominated the number of Cimicid related calls. Bagworms are expected to continue to increase in numbers. Complaints of moles, earthworms and cluster flies are expected to continue to increase due to the wholesale change in chemical applications in lawns and other turfgrasses.

Ornamentals – Insect Problems, *Cliff Sadof, Professor, Entomology, Purdue University*

The rainy cool summer brought much pleasant weather, and dampened the spirits of our most hearty insect pests. Japanese beetle populations, like last year were very much diminished in most of the state. Hot weather associated with adult flight simply failed to occur. Wet weather this year assured a healthy grub population for this fall.

This year saw our first public concerns about gypsy moth activity in the northeastern part of the states. It ran the whole gamut, from a failed court injunction to stop BT applications, to the public wanting their neighborhoods treated for gypsy moth. Fortunately the gypsy moth population took a nose dive with annual trap catch reduced to about 12,000 moths, or about half of what we had last year.

Outbreaks of half wing geometers and linden looper were found in south central Indiana in Jackson, Washington, Floyd, Perry, Harrison, Crawford and Clark counties this spring. Further to the east toward Madison, an outbreak of forest tent caterpillar defoliated ridge tops along the Ohio River. More red elms (*Ulmus rubrum*) continue to enter an age class that is more susceptible to outbreaks of Dutch elm disease. Heavy rains over the 4th of July weekend dumped over 10" of rain along the Wabash Valley causing a 50-year flood event in North Central Indiana. Another 10" of rain fell on Labor Day weekend in Indianapolis causing more record flood events.

August also brought about another outbreak year of fall webworms. The outbreak seems to have spread from the north to as far south as Evansville. Bagworms and mimosa webworms were abundant as well. Despite the cold wet weather, there were numerous outbreaks of spider mites on maples and oaks. Some curiosities- for the second year in a row, a flea weevil (apple flea weevil) *Rhynchaenus pallicornis* (Say) was seen to defoliate local elms. With one generation a year, this early season leaf miner and late season adult defoliator seems to have replaced Elm leaf beetle as our local principle defoliator of elms. Beech blight aphid, *Grylloprociphilus imbricator*, has caused numerous phone calls this fall, but does not appear to be causing much damage. Asian ambrosia beetles continue to be reported in few nurseries in southern Indiana. They have not yet emerged as a landscape pest.

Small Fruits, *Bruce Bordelon, Associate Professor, Horticulture and Landscape Architecture, Purdue University*

The winter of 2003-2004 was fairly normal. The winter was colder than we have experienced in recent years, but not much below normal. The coldest temperatures of the season occurred January 31 - February 1 and the coldest area was a band from Terre Haut through Columbus to Richmond. Temperatures reached the high teens below zero and a few –20s were reported. Just as in 2003, the coldest report was from Crawfordsville at –27, and the warmest was from Tell City at 7˚F. The cold temperatures caused some cold damage on grapes, brambles, and peaches, especially across the band mentioned above.

Scattered frosts occurred in late April and early May, which caused some damage in certain areas. Grapes and apples were hardest hit.

Overall, temperatures were relatively warm during the April and May. April was one of the driest and windiest months on record.

Rainfall was plentiful May through July and fairly well distributed in most areas. Parts of Indiana had very heavy rainfall in mid-June, causing extensive flooding, but not adversely affecting fruit crops. (Some vegetables and row crops were flooded out.) Very dry conditions have occurred from August until mid-October. In general, crops matured about a week earlier than normal.

Small Fruit and Grapes:

The winter temperatures caused damage to grapes and brambles this year. The frosts in May had mixed results. Some sites were severely damaged, especially on early budding varieties. Other plantings escaped significant injury.

Grapes

Because of the excellent growing season in 2003, grape yield potential was very high and most varieties set a very large crop despite some winter injury. Growers had to thin aggressively to avoid overcropping.

Grape phylloxera (foliar form) was widespread in 2003, but back to lowl levels in 2004. Similarly, Japanese beetle numbers seemed to be down in 2004 though they continue to be a problem in vineyards in many parts of the state. The Multi-colored Asian Lady Beetle (MALB) was a significant problem in 2003, but a complete no-show this year. This is similar to the pattern we've seen in the past, with a heavy infestation year followed by a year with few, if any, beetles. No one is complaining, but I think we are all bracing for a huge onslaught next year.

This was the year of the emergence of the Brood X 17 year cicadas. Millions of these insects emerged in some areas, especially central Indiana. We suffered some damage on young grape vines in our research plots near Butlerville, and saw fairly extensive damage in some commercial plantings, but overall, the effect on grapes was not too severe.

Disease problems were not widespread, but there were some reports of heavy powdery mildew incidence. Heavy rains during August caused significant loss of fruit quality in some areas where fruit ripening coincided with the heavy rains. This was especially true in southern and central areas. Later ripening varieties, and northern and central areas had fewer problems as there was very little rain in September, and very mild conditions, perfect fruit ripening weather.

Blueberries

Overall the crop was at or below average but better than 2003 when winter injury was severe. The Jersey variety, which had a lot of winter kill two seasons ago look like they will be back to normal next season. The berry size was average above average and the quality overall was good. The season was 7 to 10 days early. Japanese beetles were less of a problem than in past years.

Brambles

Blackberries and raspberries both suffered from the winter injury in northern areas. Good yields were obtained only where freeze damage was not severe. Japanese beetles continue to be the worst insect problem, though tarnished plant bug has been noted on fall-bearing types. Asian Lady Beetles also have been noted on overripe fruit.

Strawberries

The strawberry crop was good across the state this year. Timely rainfall kept plants in good condition. Fruit size and quality were excellent in most areas. Black root rot complex continues to be a major limiting factor to longevity in matted row plantings.

Tree Fruit:

Overall, this wasn't much of a insect year due to the cool temperatures. Periodical cicada was the big story for tree fruit growers. Most applied Danitol and it worked great. Colding moth damage was spotty this year.

Disease problems were more prevalent. Frequent rains in May and June lead to heavy incidence of apple scab.