



2017 Summary Report

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Introduction

In 2017 the value of Indiana's crops (including nursery and greenhouse) exceeded 7 billion dollars (1). The Plant and Pest Diagnostic Laboratory (PPDL) is dedicated to helping protect that value by providing rapid and reliable diagnostic services for plant disease and pest problems affecting the state's crops and the green industry.

We also serve as a source of unbiased information regarding pest management strategies, provide diagnostics training and participate in the National Plant Diagnostic Network (NPDN), a consortium of Land Grant University Diagnostic Laboratories established to protect our nation's plant biosecurity infrastructure.

Extension Specialist Collaboration

As an interdisciplinary laboratory The PPDL benefits greatly from the diagnostic expertise provided by specialists in other departments (Fig. 2 and Table 1). As in past years, faculty and staff from the Departments of Botany & Plant Pathology, Agronomy, Entomology, Horticulture & Landscape Architecture, and Forestry & Natural Resources very generously provided assistance with problems involving their specialties. The PPDL team provides an ongoing point of connection between county-based Extension educators, the public and Extension specialists on campus; facilitating knowledge exchange and information about trends in lab samples to promote more informed recommendations for disease and pest management.

The PPDL team also collaborates on applied research projects and has supported research in the departments of Entomology, Horticulture and Landscape Architecture, and Forestry by providing individualized training in diagnostics and pathogen manipulation to students whose projects involve plant diseases.

Regulatory/State Collaboration

The PPDL serves as the State laboratory charged with assuring accuracy in disease diagnosis for phytosanitary certification for exports; administered by the Indiana

Dept. of Natural Resources (IDNR). The PPDL also provides insect identification and disease diagnosis for nursery inspection samples submitted by IDNR nursery inspectors. We also collaborate with the IDNR to carry out official state surveys (see below). In addition, the PPDL serves as the lab of record for the Indiana Crop Improvement Association (ICIA) and we provide hands-on disease identification training to field inspectors annually.

Sample Overview

The Purdue University Plant and Pest Diagnostic Lab provided 4384 diagnoses on 2701 samples submitted in 2017 (Tables 2 and 3), with 14% of our samples originating from outside Indiana (Fig. 1). Green industry professionals submitted 45% of all non-regulatory samples last year, similar to 2016 (Table 4). Figure 5 shows our month sample distribution of regulatory and non-regulatory samples for 2017.

Ornamental plants are consistently the largest category of non-regulatory samples (48% in 2017, up from 45% in 2016) highlighting the reliance of Indiana's Green Industry on the expertise provided by the PPDL (Fig. 7). A more detailed list of sample types is given in Table 5. While diseases comprised 58% of our diagnoses last year, arthropod problems and damage due to non-living (abiotic) factors such as herbicide injury and weather extremes continue to be a significant segment of the problems diagnosed (Fig. 3 and Table 2).

We continue to work toward providing reports as rapidly as possible (15% the same day, 55% within 3 days), see Figure 6. Samples requiring in-depth laboratory analysis naturally take longer to complete and preliminary reports are provided to update clients on sample progress.

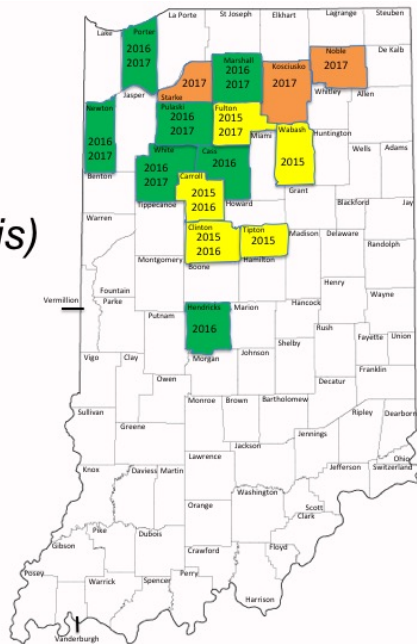
Diagnostic Highlights and Surveys

- **First detection of Bur oak blight** – a new disease on bur oaks in Indiana. The PPDL diagnosed the first case of bur oak blight (*Tubakia iowensis*) in the state from a clinic sample arriving from a northwestern county. This first find marks the eastern-most known range of this debilitating disease of bur oaks. A first report and Extension publication are planned to document the find and make the public aware of the disease.
- **First Indiana detection of Smut on Switchgrass**, caused by the fungus *Tilletia maclaganii*, in forage research plots.
- **Discovery of a previously undescribed Ilarvirus on spicebush (*Lindera benzoin*)** using NextGen sequencing in collaboration with a USDA/ARS researcher.
- **Tomato – Bacterial Spot - *Xanthomonas spp.* survey:** Completing the second and final year of a Specialty Crop Block Grant from the Indiana State Dept. of Agriculture the PPDL collaborated with Dan Egel at the Southwest Purdue Agricultural Center (SWPAC) to survey tomato fields for bacterial spot disease. This work helped characterize the predominant Indiana strains, races and pesticide tolerances of *Xanthomonas spp.* causing bacterial spot of tomato to facilitate more targeted management recommendations.

- The PPDL was the first lab in the US to diagnose **Tar Spot of Corn** (*Phyllachora maydis*) in 2015 and it has subsequently been found in four other states. The PPDL continues to track spread of this disease in Indiana through routine clinic samples and by soliciting samples from field scouts. These efforts have documented that the disease first appeared in 5 Indiana counties in 2015, was detected in 7 additional counties in 2016 and in 3 new counties in 2017.

Indiana Confirmed Corn Tar Spot (*Phyllachora maydis*)

2015 - 2017



- **Exotic Corn Pathogens Survey:** The PPDL participated for the 5th year (2013-2017) with the IDNR in an IN **Cooperative Agriculture Pest Survey (CAPS)** survey for Exotic Corn Downy Mildew Pathogens, which includes checking for *Peronosclerospora maydis* (Java Downy Mildew) *P. philippinensis* (Philippine Downy Mildew) and *Sclerophthora rayssiae* (Brown Stripe Downy Mildew) in both routine and phytosanitary corn samples. All corn foliage samples examined were free of these exotic pathogens.
- The PPDL continued collaboration with IDNR in the annual CAPS to test nursery samples for ***Phytophthora ramorum***, causal agent of Ramorum Blight and Sudden Oak Death, a potentially devastating disease of our nursery trade and timber industry. All 403 samples from the survey tested negative for *P. ramorum* (Table 4, Fig. 4).
- In collaboration with our Weed Science Specialists and their lab staff the PPDL continued offering testing to **identify weeds and weed seeds resistant to Glyphosate, PPO and ALS herbicides** using molecular methods.

Data gathered from IDNR/PPDL CAPS surveys are uploaded to the National Agricultural Pest Information System (NAPIS) database system and the NPDP national data repository. This effort in documenting reliable diagnostic information helps researchers and regulatory agencies guide future research and monitoring efforts.

Journal Publications, 2017:

Abbasi, M., Aime, M.C., Eamvijarn, A., **Creswell, T.C., Ruhl, G.E.**, Wright, S., 2017. First report of Cronartium rust disease on Chinquapin oak. Plant Disease, Feb. 2017. <http://apsjournals.apsnet.org/doi/pdfplus/10.1094/PDIS-05-16-0757-PDN>

Beckerman, J., Nisonson, H., Albright, N., **Creswell, T.**, 2017. First Report of Pythium aphanidermatum Crown and Root Rot of Industrial Hemp in the United States. Plant Disease. Feb 2017.
<http://apsjournals.apsnet.org/doi/pdfplus/10.1094/PDIS-09-16-1249-PDN>

Extension Bulletins written or revised in 2017:

Ruhl, G. and Creswell, T. 2017. Tree Diseases: White Pine Decline in Indiana. BP-34-W. <https://www.extension.purdue.edu/extmedia/BP/BP-34-W.pdf>

Midwest Vegetable Production Guide for Commercial Growers 2018, ID-56
<https://ag.purdue.edu/btny/midwest-vegetable-guide/Pages/default.aspx>

Midwest Fruit Pest Management Guide 2018, ID-465
<https://ag.purdue.edu/hla/Hort/Documents/ID-465.pdf>

2018 Corn & Soybean Field Guide, ID-179
<https://ag.purdue.edu/agry/dtc/Pages/CSFG.aspx>

Poster: Austin McCoy, Tom Creswell, and Gail Ruhl, 2017. First report of *Setomelanomma holmii* on blue spruce branches exhibiting needle drop in Indiana
<https://www.apsnet.org/members/divisions/nc/meetings/Documents/APS%20North%20Central%20Division%202017%20Meeting%20Program.pdf>

Educational YouTube Video on Switchgrass Diseases
K. Johnson, Ruhl, G.E. , and B. Stefanik. 2017. Diseases of switchgrass in Indiana.
https://www.youtube.com/watch?v=77ssq_uTINw

Extension and Teaching Activities

PPDL staff members participate annually in a variety of educational events and programs, including guest lectures/labs in courses in three CoA departments; trainings for green industry and crops professionals, small farms training, Master Gardener trainings, Webinars for Extension Educators, PK-12 outreach, Green Expo and the general public at the State Fair. The PPDL staff gave 30 presentations to more than 2400 attendees in 2017.

1: USDA National Agricultural Statistics Service – State Agricultural Overview:
https://www.nass.usda.gov/Quick_Stats/Ag_Overview/stateOverview.php?state=INDIANA

Fig. 1 Origin of samples received by the Plant and Pest Diagnostic Laboratory - 2017

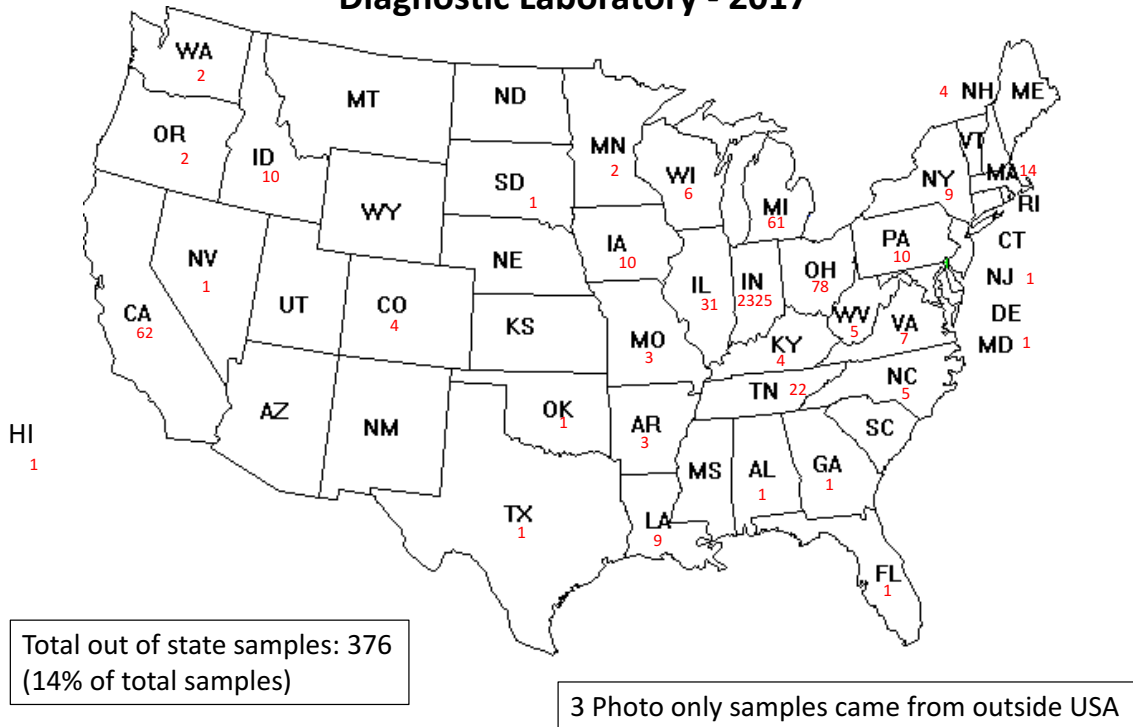


Fig. 2 - Departments Assisting with Sample Diagnosis - 2017

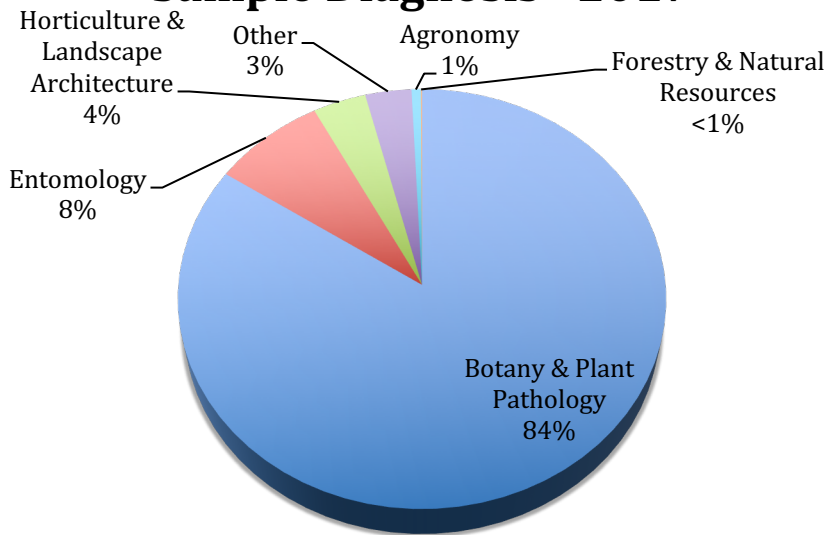


Table 1. Departmental faculty and staff that assisted with sample diagnoses – 2017 ^[1]

Faculty/Staff	Number of Samples	Faculty/Staff	Number of Samples
Agronomy	24	Entomology	293
Jim Camberato	17	Cliff Sadof	115
Keith Johnson	5	Tim Gibb	97
Bob Neilson	1	John Obermeyer	26
Shaun Casteel	1	Larry Bledsoe	24
		Rick Foster	15
Botany & Plant Pathology	3095	Jamal Faghihi	13
		Other	3
Gail Ruhl	1646 ^[2,3]		
Tom Creswell	1116		
Joe Ikley	259	Horticulture & Landscape Architecture	138
Julie Young	29	Kyle Daniel	65
Janna Beckerman	17	Rosie Lerner	36
Rick Latin	12	Aaron Patton	30
Dan Egel	6	Bruce Bordelon	3
Travis Legleiter	4	Other	4
Ian Thompson	3		
Deb Lubelski	2		
Other	1		
		Non-Purdue Specialist	120
Forestry & Natural Resources	3	Jan Byrne, MSU	105 ^[4]
		APHIS	1
Lindsey Purcell	3	Other	14

[1] Names in **BOLD** are Department Diagnostic Liaisons.

[2] 403 diagnoses were provided for *Phytophthora ramorum* nursery survey samples.

[3] 111 diagnoses were provided for Corn Phytosanitary field survey samples.

[4] 105 PCR negative diagnoses provided by MSU diagnostician certified for *P. ramorum* testing

Fig 3. Diagnoses by Category - 2017

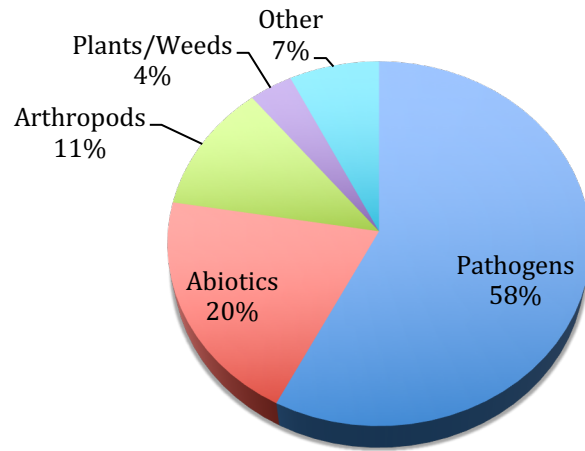


Table 2. Diagnoses Sorted by Category - 2017

Category	Number of Diagnoses	% of Total
Pathogens	2523	58%
Fungi	2130	49%
Viruses	267	6%
Bacteria	126	3%
Abiotics	878	20%
Cultural/Environmental	431	10%
Chemical/Herbicide Injury	364	8%
Nutritional	78	2%
Other	5	<1%
Arthropods	507	11%
Insects	311	7%
Mites	142	3%
Nematodes	48	1%
Other	6	<1%
Plants/Weeds	156	4%
Other	320	7%
Totals:	4384	100%

Table 3. Regulatory vs. Non-Regulatory Samples - 2017

Sample Type	Number of Samples	% of Total
Non-regulatory samples	1937	72%
Regulatory/survey samples	764	28%
Total number of samples	2701	100%

Table 4. Affiliation of persons submitting samples to the PPDL - 2017

Affiliation	Number of samples	% of Total
Commercial	1227	45.4%
Garden Center/Greenhouse/Nursery	358	13.3%
Crop Consultant	243	9.0%
Landscaper/Groundskeeper/Lawn & Tree Care	179	6.6%
Agribusiness	160	5.9%
Grower/Farmer	101	3.7%
Extension Educator	56	2.1%
Arborist	49	1.8%
Pest Control	34	1.3%
Golf Course	24	0.9%
Other	23	0.9%
Non-Commercial	710	26.3%
Homeowner	253	9.4%
Researcher/Specialist	233	8.6%
Extension Educator	224	8.3%
Regulatory/Survey	764	28.3%
IDNR (SOD <i>P.ramorum</i> nursery Survey)	403	14.9%
Office of the Indiana State Chemist	174	6.4%
IDNR/ICIA (Phytosanitary certification field inspection)	111	4.1%
IDNR (Nursery inspection)	76	2.8%
Totals:	2701	100%

Fig 4. - Five Year Sample Trend 2013-2017

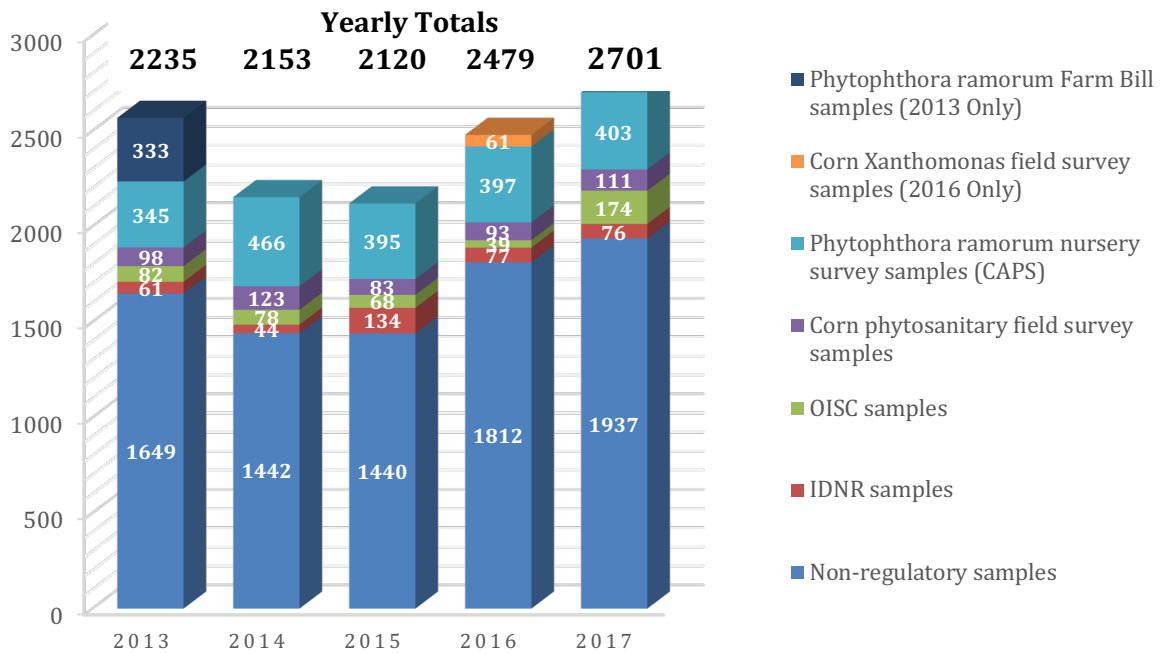


Fig. 5 - Monthly Totals - 2017

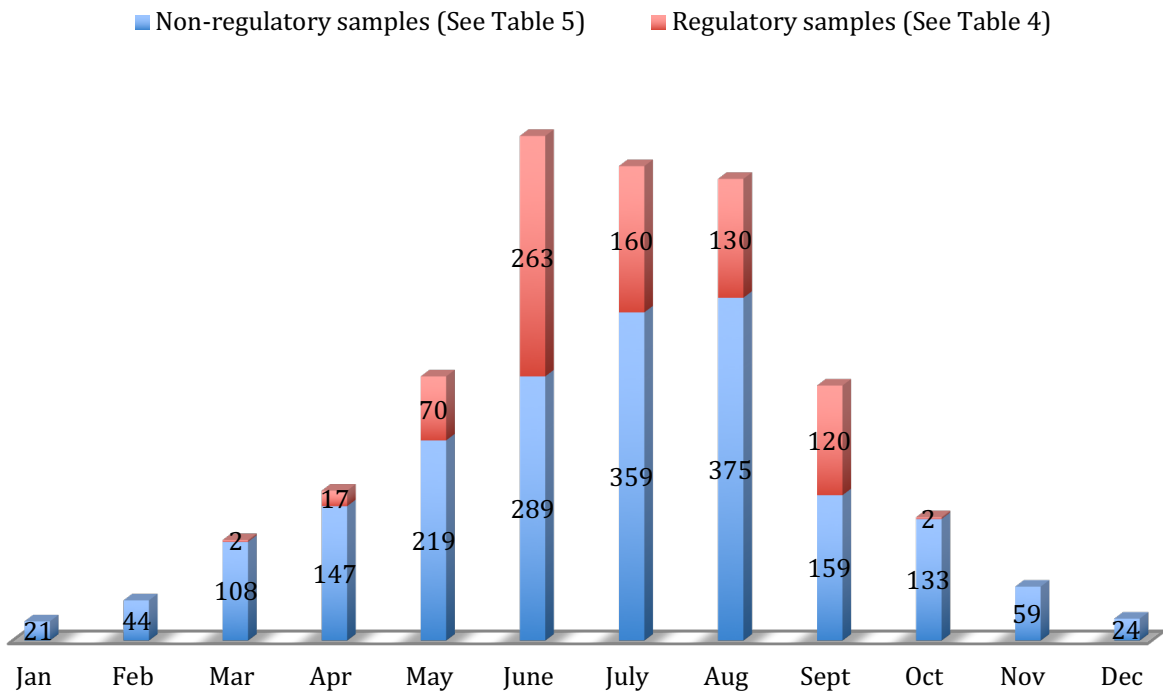
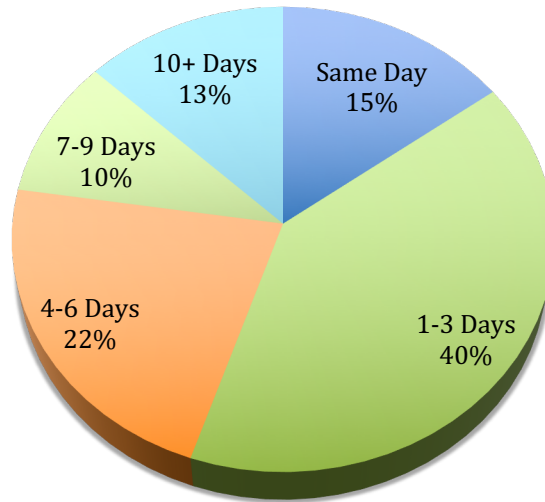


Fig. 6 - Reporting Turn-Around Time - 2017



*Molecular Identification and culturing extends sample completion time for complex samples.

Fig. 7 - Non-regulatory Sample Categories - 2017

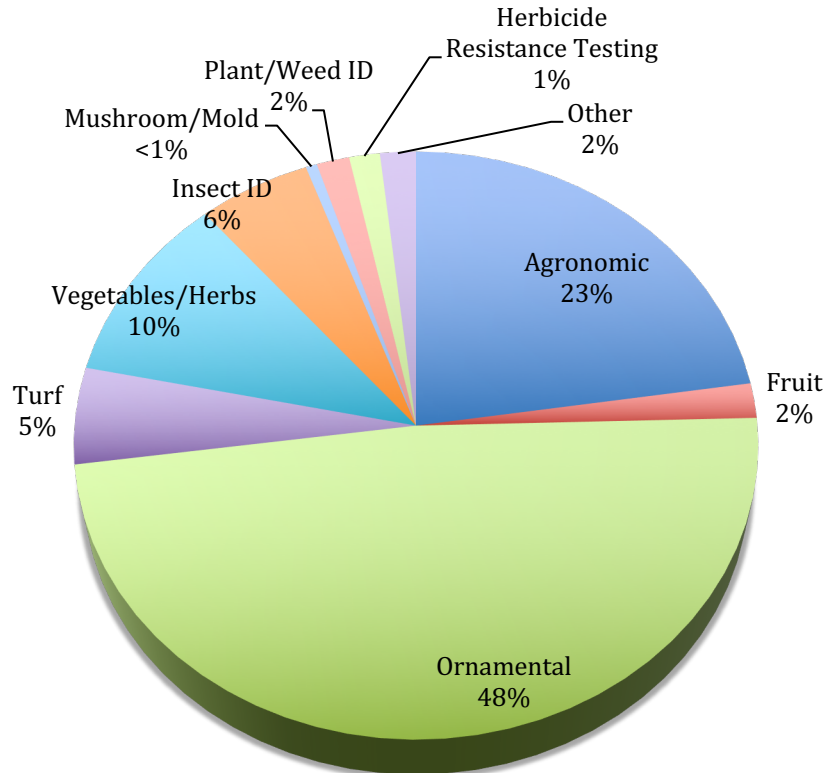


Table 5. Non-regulatory Samples by Category - 2017		
Category	Number of Samples	% of Total
Agronomic	439	23%
Corn	209	11%
Soybean	137	7%
Switchgrass	41	2%
Wheat	25	1%
Other	27	1%
Fruit	37	2%
Fruit	20	1%
Small Fruit	17	1%
Ornamentals	936	48%
Woody ornamental -Deciduous	390	20%
Woody ornamental - Evergreen	271	14%
Perennials	152	8%
Annuals	123	6%
Turf	103	5%
Vegetables/Herbs	204	11%
Tomato	97	5%
Herbs	27	1%
Pumpkin	15	1%
Pepper	11	1%
Lettuce	10	1%
Other	44	2%
Miscellaneous	218	11%
Insect ID	110	6%
Plant/Weed ID	32	2%
Herbicide Resistance Testing	30	2%
(Waterhemp, Palmer Amaranth, Giant Ragweed)		
Other (Multiple Host, Aquatics)	33	2%
Mushroom/Mold	13	1%
Total Samples:	1937	100%