

RUTGERS

New Jersey Agricultural
Experiment Station

**Rutgers Soil Testing
and
Plant Diagnostic Services**

2014 Fiscal Year Report
(July 1, 2013 to June 30, 2014)

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2014 Fiscal Year

Rutgers Soil Testing and Plant Diagnostic Services

Annual Report

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Introduction

Rutgers Soil Testing and Plant Diagnostic Services are provided by Rutgers Cooperative Extension (RCE), the outreach component of the New Jersey Agricultural Experiment Station (NJAES) and School of Environmental and Biological Sciences (SEBS). Located on the Cook Campus, these laboratories provide New Jersey citizens with chemical and mechanical analyses of soil and diagnoses of plant problems. Their mission is to provide such services in an accurate and timely manner to meet the increasing agricultural and environmental needs of the State. These goals are achieved in cooperation with extension and research faculty and staff at NJAES. This report summarizes the activities of these laboratories during the 2014 fiscal year.

History

The Rutgers Soil Testing Laboratory

Soil testing at Rutgers has a history as long as the NJAES has been in existence. As early as the 1860s, George H. Cook was involved in the chemical analysis of soils and fertilizers. E.B. Voorhees followed Cook as director of the Experiment Station and became famous for applying chemistry to soil fertility issues. By 1940 when the Department of Soils was formed, soil testing for the public had begun in earnest as thousands of samples were analyzed for elemental deficiencies, acidity levels, and organic matter content. After the Departments of Soils merged with Farm Crops to form the Department of Soils and Crops in 1963, Dr. Dennis Markus became director of the public soil testing laboratory in the new department. When Dr. Markus retired in 1984, Dr. Harry Motto guided laboratory operations until his own retirement in 1996. Under the subsequent leadership of Dr. Stephanie Murphy, the Rutgers Soil Testing Laboratory (STL) has processed over 131,800 soil samples for chemical and physical analysis and continues to play an integral role in soil nutrient management, engineering, and environmental assessments for the public and for RCE and SEBS/NJAES programs. Since January 2006, the STL has been located in Rutgers' Administrative Services Building II on US Route 1 in New Brunswick, NJ: administratively, the STL is part of the Plant Biology and Pathology Department.

The Rutgers Plant Diagnostic Laboratory and Nematode Detection Service

The Rutgers Plant Diagnostic Laboratory and Nematode Detection Service (PDL) was estab-

lished in 1991 by the dedicated efforts of RCE faculty members Dr. Ann B. Gould and Dr. Bruce B. Clarke, Specialists in Plant Pathology, Dr. Zane Helsel, former Director of Rutgers Cooperative Extension, and Dr. Karen Giroux, past Assistant Director of NJAES. The laboratory was housed in the former USDA post-harvest research laboratory and then Martin Hall on the Cook College campus until 2000 when it was relocated to the Ralph Geiger Turfgrass Education Center at Horticultural Research Farm II in North Brunswick, NJ. The Geiger Center was made possible through the vision and financial backing of Mr. Ralph Geiger and a large group of University and turf industry cooperators.

The PDL accepted its first samples on June 26, 1991, and has since examined more than 44,500 samples submitted for plant problem diagnosis, nematode analysis, or identification. The laboratory has become an integral part of RCE and SEBS/NJAES programs by providing diagnostic and educational services in support of the teaching, research, and outreach efforts of SEBS/NJAES.

Staff and Cooperators

PDL

Mr. Richard Buckley is the director of the Plant Diagnostic Laboratory. He was hired as a program associate in 1991 and has been in his current position since 1994. Mr. Buckley received his M.S. in Turfgrass Pathology from Rutgers University in 1991. He has a B.S. in Entomology and Plant Pathology from the University of Delaware. He also received special training in nematode detection and identification from Clemson University. Mr. Buckley has work experience in diagnostics, soil testing, and field research, and is currently responsible for sample diagnosis, soil analysis for nematodes, and the day-to-day operation of the PDL. He also participates in research, teaching, and outreach activities.

Ms. Sabrina Tirpak, Principal Laboratory Technician, has worked for the PDL since 1998. She received her B.S. in Plant Science, with an emphasis in horticulture and turf industries as well as a minor in entomology, from Rutgers University in May 2000. She also attended Clemson University for special training in nematode detection and identification. Ms. Tirpak has primary responsibility for insect and weed identification, rapid screening of disease samples using enzyme-based test kits, and assisting in all other aspects of laboratory operations. She also participates in research, teaching, and outreach activities.

STL

Dr. Stephanie Murphy is the director of the STL. She has served the University in this capacity since 1996 after several years as a post-doctoral research associate and instructor within the Department of Environmental Sciences. Dr. Murphy has a Ph.D. in Soil Science from Michigan State University, an M.S. in Soil Management and Conservation from Purdue University, and a B.S. in Agronomy from Ohio State University. She is a member of the American Society of Agronomy, the Soil Science Society of America, the Soil & Water Conservation Society, and the New Jersey Association of Professional Soil Scientists. Dr. Murphy is responsible for the day-to-day operations of the STL and participates in research, teaching, and outreach activities.

Mr. Steve Griglak, Principal Laboratory Technician, has worked in the STL since 1995. He received his B.S. in Environmental Science from Rutgers University in May 1998. Mr. Griglak's primary duties include the extraction and analysis of soil nutrients and the coordination and performance of the various special tests offered by the laboratory. He is also responsible for the maintenance and repair of laboratory equipment and testing devices.

Ms. Terriann DiLalo has been a part-time administrative assistant for the STL since 2002. She is responsible for data entry, report generation, invoice processing, record keeping, and supply procurement.

Ms. Phyllis Berger was hired as a laboratory technician in 2011. Ms. Berger is a native of New Jersey and earned a B.S. in Geology from Richard Stockton University and an M.S. in soil science from the University of Arizona. She processes soil samples, performs soil tests, provides customer service, and works closely with student assistants.

Other Support

Both the STL and the PDL employ several Rutgers undergraduate students each year to assist in sample preparation, data entry, and clean-up. As the students help with many of the basic day-to-day tasks, they also gain invaluable laboratory experience that will contribute to career success after graduation.

The laboratories also benefit from the assistance of faculty in several departments, Centers, and Institutes at Rutgers University/School of Environmental and Biological Sciences (SEBS). We owe a great deal of our success to the expertise of

faculty in the departments of Plant Biology and Pathology, Entomology, Ecology, Evolution and Natural Resources, and Agricultural and Resource Management Agents. We would also like to thank the staff of the Rutgers Office of Continuing Professional Education for their support and assistance with our educational programming, and we also acknowledge members of the SEBS/NJAES Office of Communications for their support and assistance.

Laboratory Policies

The PDL receives samples from a varied clientele. Sample submission forms, sampling instructions, and fee schedules are available on the NJAES website (www.njaes.rutgers.edu/services). Sample submission forms are also available in local County Agricultural offices and by FAX directly from the PDL. Samples are submitted either by mail to a post office box in Milltown or by private delivery service directly to the laboratory. Many PDL clients walk samples directly into the laboratory.

Samples are processed on a "first come, first served" basis. Detailed records are kept on all samples. A written response including the sample diagnosis, management and control recommendations, and other pertinent information is mailed and/or sent by email or FAX to the client.

Like the PDL, the STL receives samples from a varied clientele, and fee schedules, sampling instructions, and submission forms are available on the NJAES website www.njaes.rutgers.edu/services. Soil samples can be submitted in soil test kits available for purchase from RCE County Offices, which include a submission form, sampling instructions, and a mailing bag to contain the soil sample and paperwork. Standard soil fertility testing (defined as pH, P, K, Mg, Ca, Cu, Mn, Zn, Fe, and B) is included with the purchase of the kit. Additional special tests not included in the standard assay can be requested on the submission form at additional cost. Samples may be submitted without the soil test kits as long as appropriate identifying information and pre-payment is included. Results for any tests not pre-paid will be withheld until payment has been received.

Soil samples are generally processed according to order of entry into the laboratory. Sample analysis can be prioritized, however, by paying a special express processing fee. Upon the completion of the tests, a report is generated and deliv-

ered by email or postal mail. General recommendations for limestone and fertilizer are provided on standard test reports for most New Jersey plantings. The client must supply appropriate planting information to receive fertility guidelines. The appropriate county RCE office receives a copy of soil test reports for farmer, homeowner, and landscaping clients for better service to the client and more outreach opportunities for RCE.

Fiscal Year 2014 Report

Operations

PDL

During the 2014 fiscal year (July 1, 2013 to June 30, 2014), the PDL examined 1852 specimens submitted for diagnosis, identification

Figure 1.

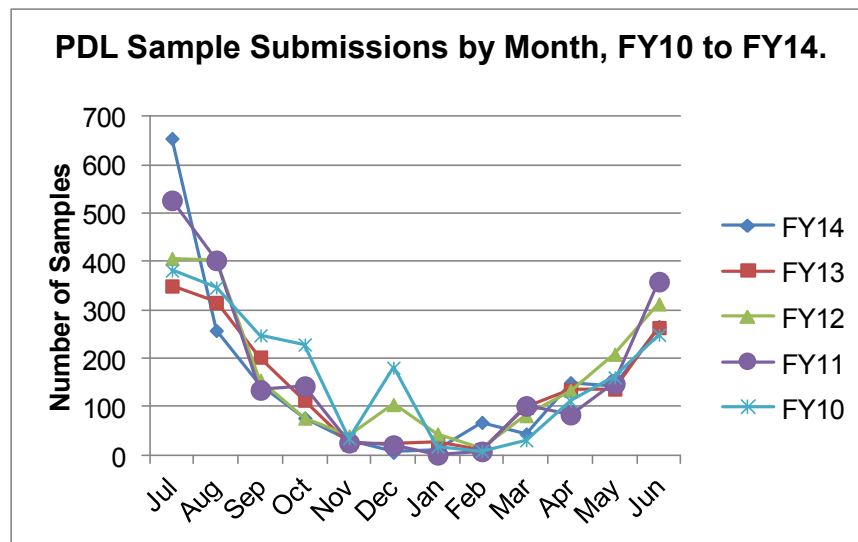
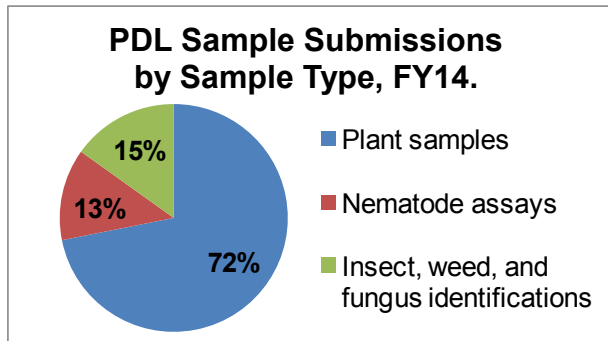


Table 1. PDL sample submissions by month, FY10 to FY14.

Month	FY10	FY11	FY12	FY13	FY14
July	382	527	407	350	655
August	347	403	403	316	258
September	248	135	155	203	145
October	229	143	77	114	77
November	35	26	40	23	30
December	181	21	105	23	6
January	18	1	44	27	10
February	9	8	14	12	68
March	31	102	82	99	44
April	112	84	134	135	150
May	161	148	209	137	143
June	249	359	313	264	266
Total	2002	1957	1983	1703	1852

Figure 2.



(insects, weeds, or fungus), or nematode assay (Table 1), representing a 9% increase (or 149 samples) from FY13. Samples (Figure 2) submitted for diagnosis (+114) increased while nematode analysis (-80) decreased slightly in FY14. There was an increase in insect identifications (+115) from Cooperative Agricultural Pest Survey (CAPS) trap catches. In general, sample submissions remained steady for most of the year, peaking in the summer and declining during the winter. It is our view that 2000 to 2500 samples represent peak laboratory capacity, so despite the slow-down in our core sample submissions, the PDL was operating near the capacity of the laboratory to function efficiently.

The specimens submitted to the PDL by sample type are presented in Figure 2. Most samples, 72% (1331), were plant samples submitted for diagnosis, 13% (241) of the samples were for nematode analysis, and 15% (280) of the samples were insect, mold, or plant identifications.

In Figure 3, samples submitted to the laboratory are presented by origin. In FY14, 87% of the plant submissions were from commercial clientele, 4% were from residential clientele, and 7% were submitted from research faculty at Rutgers University. Commercial plant managers benefit more financially from our services, thus they submit the

majority of samples to the laboratory. This distribution is consistent with other years.

In FY14, 80% of samples submitted for plant or insect identification were from commercial clients, and 19% were residential in origin (Table 2). Household or nuisance pests are the primary issues of concern for residential clients. Of the nematode assays submitted, 100% of the samples were from commercial clients, and 0% (1 sample) were from research. We expect that the number of nematode samples submitted from residential clients (0) will remain low or nonexistent, since much of this clientele is not familiar with nematode pests.

In general, samples from research programs represent a relatively small percentage of the total number of plant and soil samples received. However, research samples are an extremely important component of our submissions. Research samples allow the diagnosticians to cooperate with University faculty on problems of great importance to the State of New Jersey.

Turfgrass and ornamentals represent the largest agricultural commodities in New Jersey. In support of New Jersey as an urban agriculture state, it follows that the vast majority of samples (88%) were either turfgrass or ornamental plants (Figure 4). The wide variety of turf and ornamental species grown under diverse environmental conditions in our state results in a large number of problems not readily identifiable by growers or county faculty with these crops. Furthermore, extension faculty and staff who deal primarily with turfgrass and ornamental plants as commodities, as well as plant managers in the turf and ornamentals industries, readily adopted the user fee-based delivery of service. Alternatively, commercial growers of traditional agricultural crops have been slow to adopt a fee-for-service system. Certain RCE faculty members in New Jersey's southern counties continue to provide free diagnostic services and do not adver-

Figure 3.

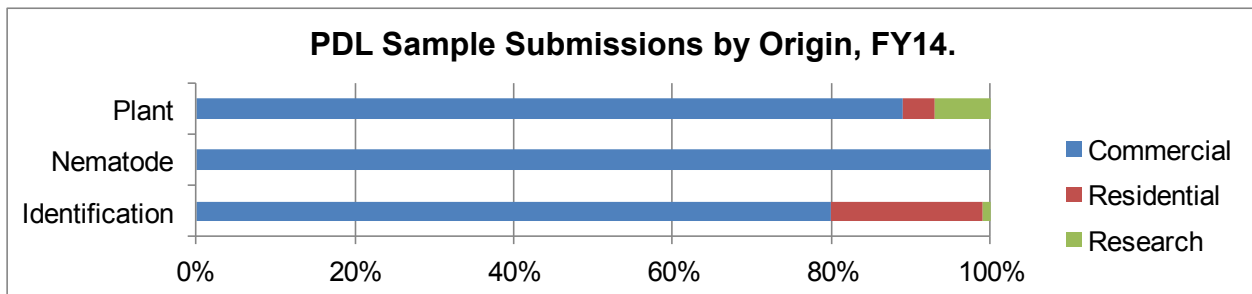


Figure 4.

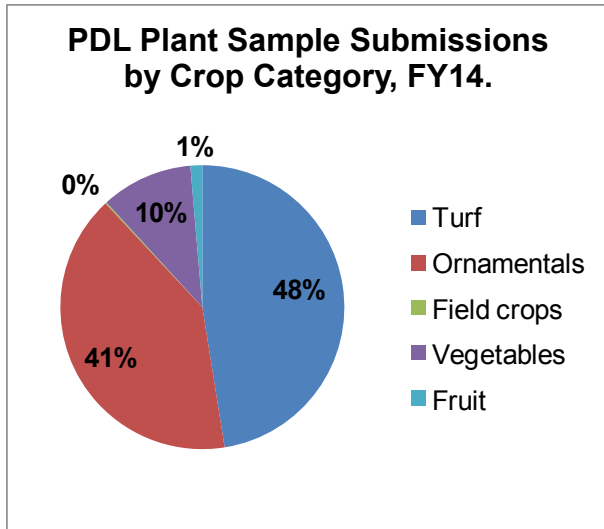
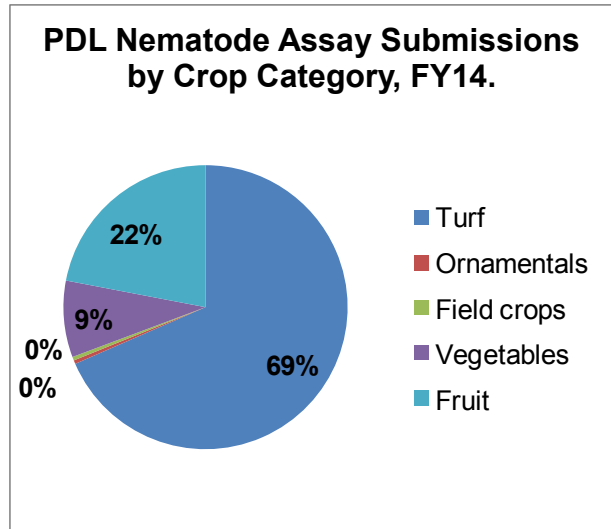


Figure 5.

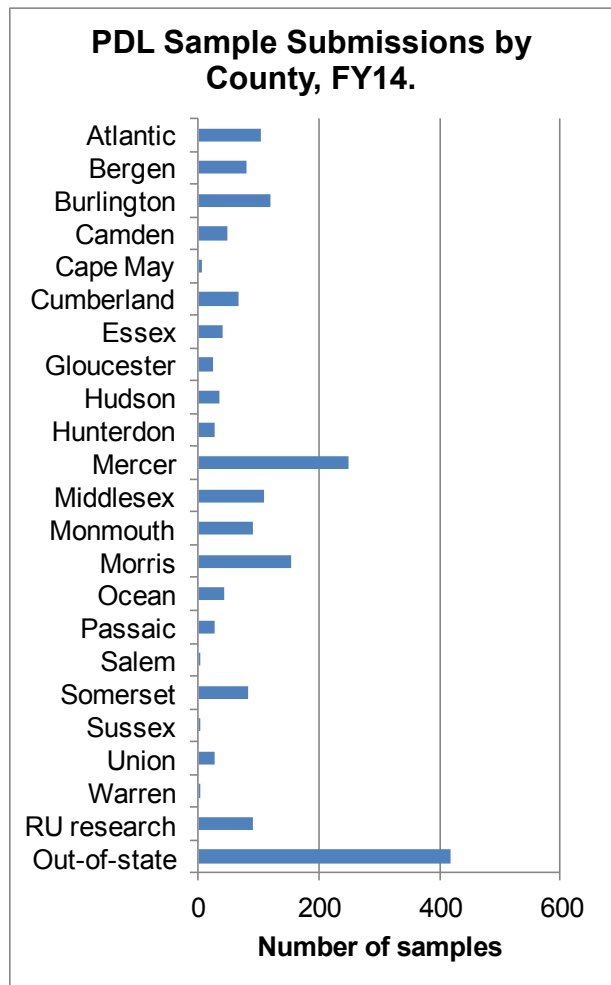


tise laboratory services to these growers. Inroads are being made with these commodity groups through the Vegetable and Fruit IPM groups, and it is our hope that sample submissions from traditional agricultural crops will increase in future years.

Traditionally, most of the soil samples submitted to the laboratory for nematode analysis were from golf turf managers; however, nematode samples from growers establishing vineyards were also very common. A large portion of the nematode samples in FY14 were submitted to the laboratory through the Fruit IPM program from blueberry growers. Another group of submissions originated with APHIS-PPQ and NJ Department of Agriculture Nursery Inspection Service for soybean cyst nematode detection. Samples free of these cysts receive phytosanitary certificates for nursery stock export to Canada. Golf turf represents most of the nematode samples from turfgrass clientele. Although the numbers are significant, interest in nematode detection on golf turf has waned as control options have been removed from the market. Problems in golf turf, particularly with nematodes, are more severe during seasons with considerable heat and drought stress, and it is those years that carry the highest submission totals.

Samples were submitted to the PDL from all counties in New Jersey (Figure 6). The majority of samples, however, were submitted from counties in close proximity to the laboratory. The probable explanation for this is that many citizens in central

Figure 6.



New Jersey contact Rutgers University directly for assistance with plant-related problems and are referred to the laboratory by the campus information service and through various academic departments. Samples were also abundant from counties with dense populations that have disease problems associated with turf and ornamentals in residential landscapes or on golf courses. In addition, county profiles are also influenced by the presence or absence of staff in those offices. To some degree, the profile also identifies county faculty and programs that promote and utilize PDL services.

Approximately 23% of the samples submitted for diagnosis to the laboratory were from out-of-state. The percent of out-of-state samples is 1% lower than in FY1, but the total number of out-of-state samples actually increased by. Of particular note, nearly 50% of all turf samples were from out-of-state. Golf turf samples were submitted to the

laboratory from 18 states in FY14. Turf samples were received from states as far away as California, Idaho, Kentucky, and Florida. New York, Pennsylvania, Connecticut, and Delaware provide the largest number of out-of-state samples. Because of his national reputation and his strong support for the laboratory, Dr. Bruce Clarke has helped the Rutgers laboratory develop into one of the premier golf turf diagnostic facilities in the country. Many golf course superintendents contact Dr. Clarke for help, who always forwards them to the laboratory for diagnostic services. Because there are very few laboratories in the country that diagnose turfgrass diseases, these superintendents have continued to submit samples to the PDL. Many golf turf professionals at other universities often refer their clients to Rutgers for second opinions or when they are on leave. Dr. John Inguagiato at the University of Connecticut and Dr. Paul Vincelli at the University of Kentucky, both Rutgers graduates, refer clients to

Table 2. PDL sample submissions by county, FY10 to FY14.

In-state	FY10	FY11	FY12	FY13	FY14
Atlantic	147	90	121	92	103
Bergen	73	113	143	112	81
Burlington	57	61	118	85	119
Camden	20	41	29	47	48
Cape May	24	11	23	10	5
Cumberland	59	53	81	142	68
Essex	53	13	23	27	41
Gloucester	27	40	33	8	25
Hudson	10	22	5	9	35
Hunterdon	27	42	17	27	27
Mercer	323	169	94	105	250
Middlesex	109	191	127	109	109
Monmouth	74	117	107	89	90
Morris	247	160	176	157	154
Ocean	40	36	60	60	42
Passaic	32	18	21	25	26
Salem	58	11	10	18	3
Somerset	81	61	114	62	84
Sussex	14	21	10	12	3
Union	38	34	34	36	28
Warren	22	12	10	13	2
RU research	22	85	90	55	90
In-state total	1557	1401	1446	1300	1433
Out-of-state	445	556	537	403	419
Total	2002	1957	1983	1703	1852

Figure 7.

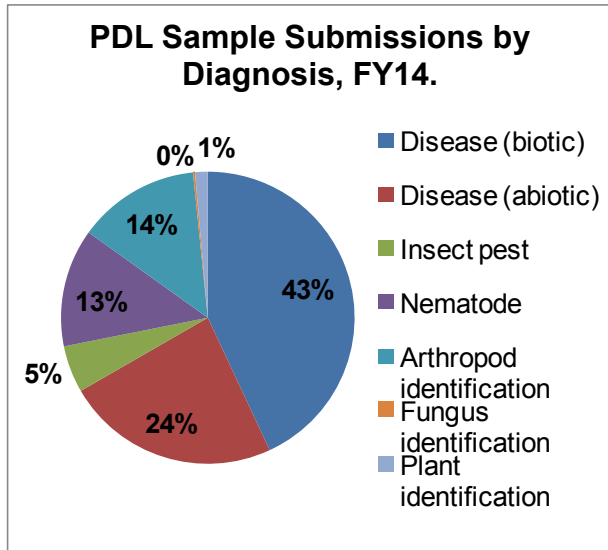
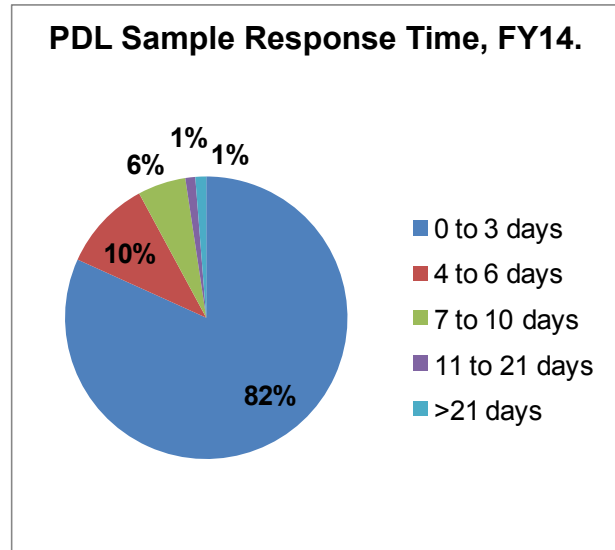


Figure 8.



the PDL. Dr. Frank Rossi of Cornell University is also a great supporter of our program. He advocates and advertises laboratory services in his ShortCutt newsletter, which reaches more than 2700 turf managers in New York State. Lastly, Mr. Buckley's association with the Professional Golf Turf Management School allows for contact with as many as 90 potential new clients each year. Many of the students turn into regular patrons of the laboratory services. The charge for out-of-state samples is substantially higher to help defray the cost of in-state samples.

Of the samples submitted to the PDL for diagnosis or identification, 43% were associated with biotic disease-causing agents (Figure 7). Abiotic disease-causing factors (e.g., environmental extremes, nutrient deficiencies, poor cultural practices, poor soil conditions, etc.) accounted for another 24% of the laboratory diagnoses. Insect pest damage was diagnosed on 5% of the submissions. Identifications comprised 14% of the total number of samples submitted; of these, 13% were arthropods, 0% fungi, and 1% were plants. Nematode detection accounted for the other 13% of submissions. The overall breakdown in sample submissions is typical of that reported by other diagnostic laboratories and reflects the normal seasonal totals for submissions to the Rutgers laboratory.

Insect samples account for most of the organisms identified by the laboratory. Many residential clients submit samples of stored product or nu-

sance pests that are found within the household. The number of these samples has declined as the Department of Entomology has added an urban entomologist who offers the service free-of-charge. Arthropod identifications also increased in FY14 because the number of trap catch samples from the state's CAPS program increased.

Fungal identification is also a popular service for the laboratory. Samples from mold-infested houses decreased in FY14. The submissions of samples for mold identification rise with media attention to the perceived health issues associated with mold-infested homes and the incidence of local flooding.

In FY14, a laboratory response was prepared in less than three days for most (82%) of the samples submitted (Figure 8), and 92% of our clients received a response in less than a week. A number of the samples (44) took longer than 10 days to diagnose. In these cases, special consultation (i.e. culturing or other lab tests) was required for an accurate diagnosis, and the clients were advised of progress throughout the period. Since nematode samples deteriorate rapidly in storage, virtually all of the nematode processing was finished in less than three days. The rapid response time is attributed largely to the expertise of our competent staff. Adequately trained staff is essential to the continued growth and efficient operation of the laboratory.

Figure 9.

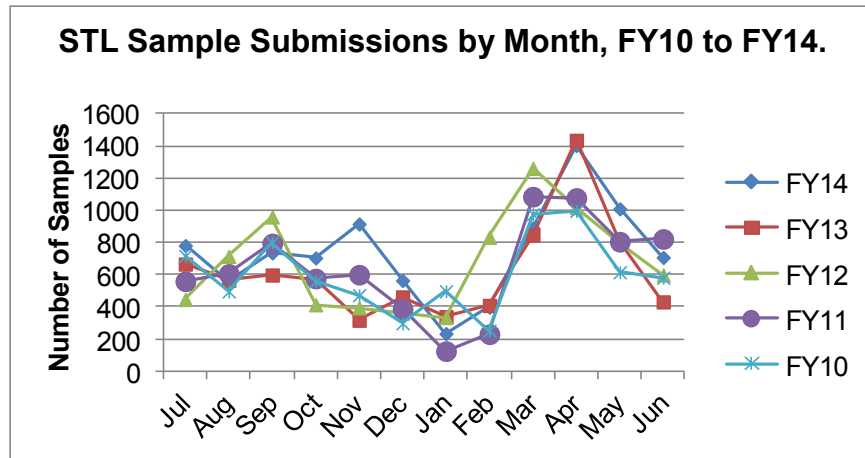


Table 3. STL sample submissions by month, FY10 to FY14.

Month	FY10	FY11	FY12	FY13	FY14
July	717	559	446	666	781
August	496	605	714	565	559
September	800	794	959	598	735
October	559	576	413	570	704
November	473	600	394	317	915
December	298	386	360	462	564
January	497	125	334	339	234
February	253	230	833	409	398
March	976	1085	1261	847	890
April	996	1077	1017	1435	1403
May	615	805	796	803	1009
June	581	822	598	431	707
Total	7261	7664	8125	7442	8899

STL

The STL processed 8899 samples of soil, compost, and irrigation water in FY14 (Table 3). The total number of samples received increased (20%) compared to FY13 (7442 samples). Of the total soil samples submitted to the STL for analysis in FY14, 64% were for the standard soil analysis (only) and 36% included requests for additional special tests (Figure 10). The number of special tests indicates the additional work load, which is not simply related to sample numbers. Sample response time is influenced by many factors, including the total number of submissions and the number of special tests requested each month.

As usual (Figure 9, Table 3), sample submissions were greatest in spring, peaking in April, in preparation for the growing season. The typical secondary surge of samples usually associated with early fall lawn fertilization did not occur but monthly sample numbers stayed fairly constant. The month most suggestive of a secondary peak was November. Turf fertilization is prohibited after December 1 for the general public and after December 15 for certified turfgrass professionals.

In FY14, soil samples from residential clientele represented 29% of the total number of soil samples (Figure 11). Commercial growers, including

Figure 10.

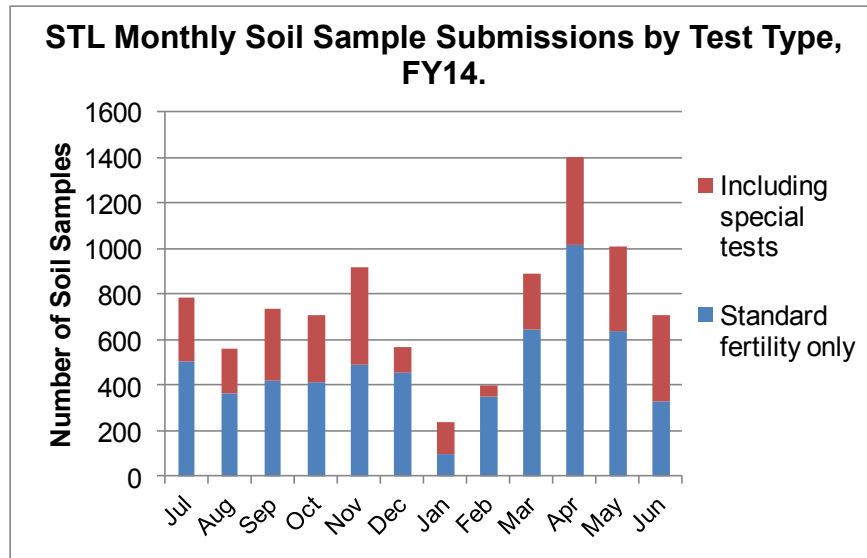
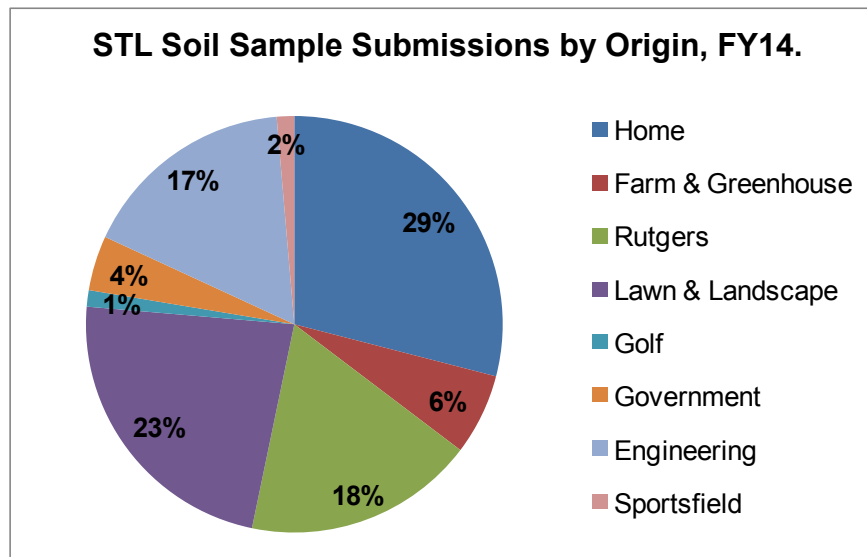


Figure 11.

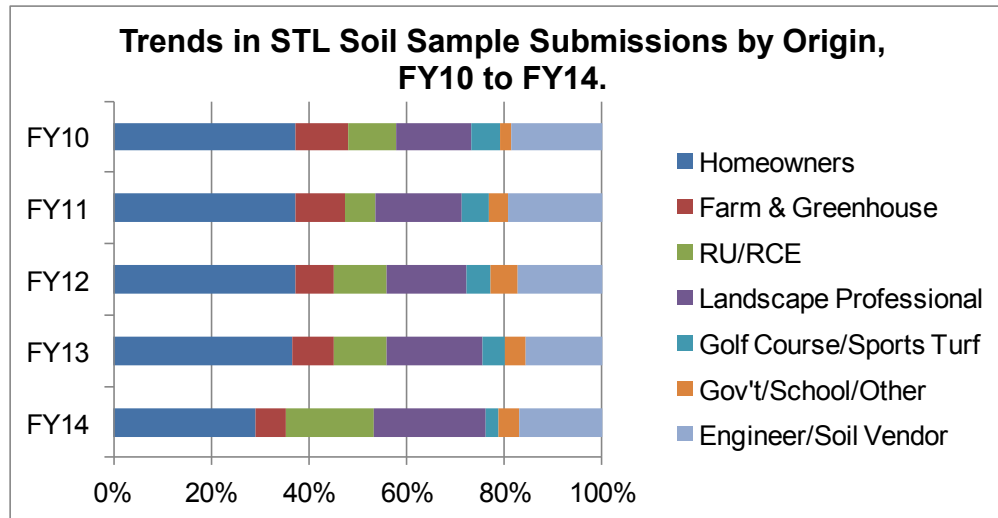


the producers of fruit and vegetables crops, submitted 6% of samples; samples from landscape professionals represented 23%; golf course samples represented 1%; and athletic field samples represented 2% of the total. Samples from engineering firms comprised 17% of the workload, 18% of the samples were from research or Cooperative Extension programs at Rutgers, and 4% were from government agencies, school districts and non-profits. Soil samples from residential clientele remain the majority of laboratory submissions. Samples from landscape professionals and environmental/engineering companies are important due to large

numbers of samples submitted and more frequent need for special tests. Special test requests provide clear financial benefit to the lab, helping to maintain necessary income. However, turnaround time is affected when laboratory staff workload is heavily laden with more labor-intensive special tests, with more time required to complete analyses and distribute soil test reports.

Looking back five years, annual numbers of samples submitted by various clientele groups show no clear or consistent trends as percentages of the total sample load (Figure 12). Percentage of

Figure 12.



samples from landscape professionals seem to be increasing modestly over that time period. The interest in school and community gardens may also be reflected in the appropriate category.

Samples were submitted to the STL from all counties in New Jersey (Figure 13, Table 4). Many samples were submitted from counties in close proximity to the laboratory (Middlesex, Monmouth); however, because most samples for soil testing are delivered by mail (facilitated by soil testing kits sold by the county offices of RCE), public access to the laboratory is less of a factor for sample submissions than those destined for the PDL. County profiles, therefore, often reflect RCE county faculty with robust home horticulture programs that actively utilize and promote STL services or those with outreach events (Master Gardener events, fairs, field days) that provide opportunities to promote soil testing. To some degree, population centers also help describe the influx of samples. Landscapers (etc.) who work across several counties have the effect of inflating the sample numbers for their “home” county. Similarly, engineering or environmental firms submit samples from a central office that may not conform to the location where the soil was sampled, but in these cases a county affiliation is not usually identified. Such soil samples are usually submitted for “topsoil” quality control/assurance with required specifications, and recommendations are only occasionally requested. Notice that three New York county Cooperative Extension offices (Ulster, Westchester, and Sullivan Counties) have adopted Rutgers STL since Cornell University closed its public service laboratory.

Figure 13.

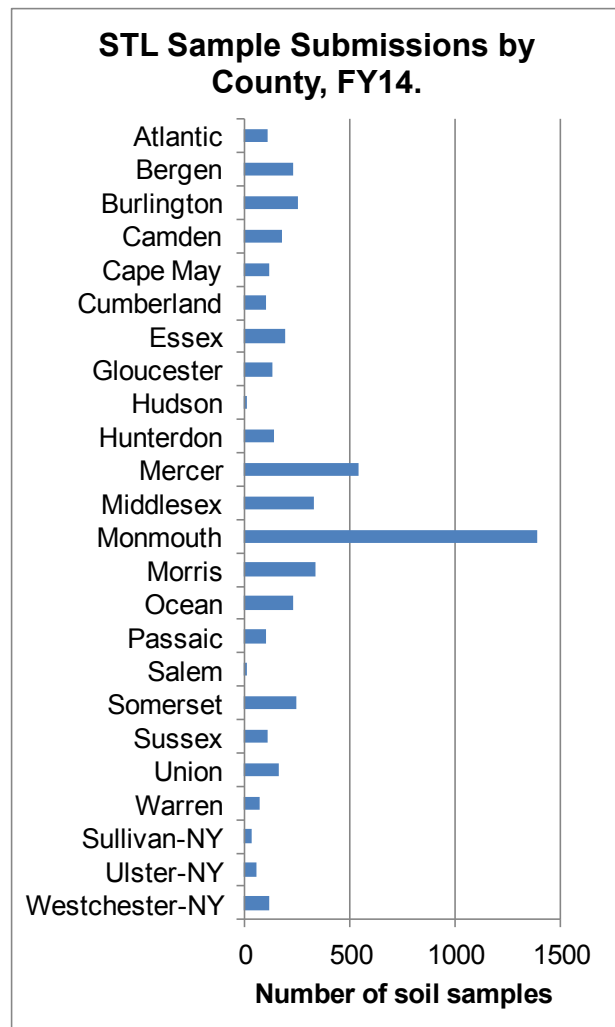


Table 4. STL soil sample submissions by county, FY10 to FY14.

In-state	FY10	FY11	FY12	FY13	FY14
Atlantic	129	154	159	138	111
Bergen	257	403	370	299	229
Burlington	392	290	409	252	251
Camden	218	213	207	151	180
Cape May	68	124	158	143	114
Cumberland	107	124	151	138	102
Essex	246	208	151	166	194
Gloucester	122	120	213	125	135
Hudson	27	41	25	26	11
Hunterdon	234	173	169	151	137
Mercer	531	562	669	506	546
Middlesex	439	484	394	328	330
Monmouth	538	522	532	886	1396
Morris	378	353	427	316	337
Ocean	338	273	215	260	235
Passaic	137	82	112	101	106
Salem	6	4	17	4	15
Somerset	664	325	305	284	250
Sussex	145	145	131	126	108
Union	268	224	217	199	163
Warren	64	70	108	61	72
New York State	35	132	237	278	209
Reference	134	111	128	31	193
Unspecified	1784	2527	2731	2473	3475
Total	7261	7664	8125	7442	8899

Figure 14. Percentages of soil samples within macronutrient classes.

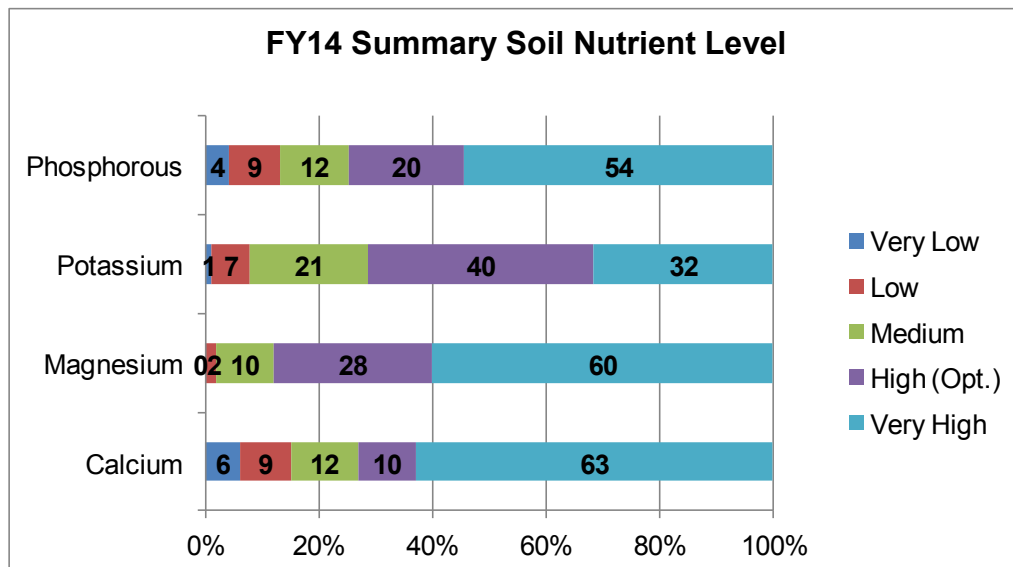
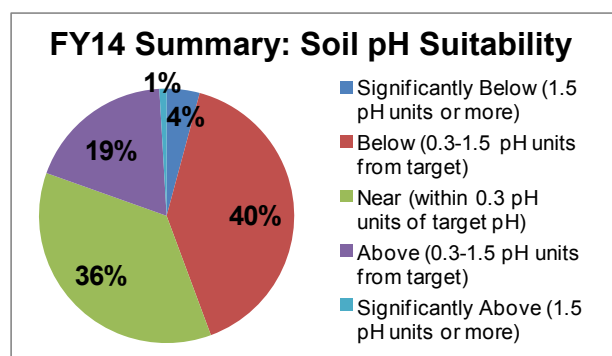


Figure 15. Soil pH of samples submitted in FY14.



For efficiency in accumulating laboratory data and generating reports for clients, an internet-based laboratory database was developed and custom-ized for Rutgers STL by Robert Muldowney of the NJAES IT staff; he has spent countless hours re-vising and upgrading the system as well as re-ponding to emergency help questions or issues. The database is designed to handle the multitude of various sample types in terms of test data and complex reporting requirements, including data summaries such as provided here for FY14. The database also serves to deliver soil test reports to clients by email.

“Standard” fertility analysis of soils includes soil pH and levels of nine nutrients. Samples must be dried, ground, and sieved (2mm) before further processing. The nutrients are extracted by a chemical solution called “Mehlich-3” and analyzed in the extractant solution by inductively coupled plasma, atomic emission spectrophotometry (ICP-AES).

Macronutrient data of soil samples received for fertility testing from July 2013 through June 2014 are summarized in Figure 14. Colored sections of bars indicate the proportion of samples that fell into the five categories of soil test levels, very high (on the left) to very low (on the right). High or very high levels of phosphorus (P) were measured in 74% of the samples tested, and potassium (K) levels were high or very high in 72% of the samples tested.

These data suggest the historical overuse of fertilizers containing P and K on soils that do not need them. This may be the result of fertilizer manufacturers promoting routine applications of their products without benefit of soil tests. Turfgrass products vary in levels of %N-%P₂O₅-%K₂O (fertilizer grade) in their four- or five-step programs according to season, and manufacturers do

not have a wide variety of products that address variations in soil test levels. Over time, this has led to the high percentage of samples with excess P and K levels. Recent recognition of negative impacts of excess P on water quality has led to increased environmental regulations, including New Jersey’s turf fertilization law; fertilizer manufacturers have had to re-formulate products to provide zero- (or low-) P contents, and now more no/low-P fertilizers are becoming commercially available. At the same time, it has become more difficult to find appropriate fertilizer ratios for soil areas deficient in P. Turfgrass “starter” fertilizer is the exception to the zero-phosphate legislation, but only one fertilizer grade is typically available per manufacturer, and grades differ between manufacturers. The limited availability in the retail fertilizer market of single nutrient materials, often recommended as a supplement to mixed, “complete” fertilizers (containing N, P, and K), is likely to exacerbate over-fertilization. That is, fertilizers with inappropriate analysis may be applied because the supplemental single-nutrient fertilizers cannot be found.

Calcium (Ca) and magnesium (Mg) are at high or very high levels in even greater percentages of the soil samples received in FY14, 73% and 88% respectively. The samples that these categories represent are often at or above the target soil pH because of limestone (CaCO₃ with various percentages of MgCO₃) applications. And yet there are samples that are deficient in one or both of those elements even when pH is optimum; gypsum (CaSO₄) or MgSO₄ are recommended amendments in those cases. Otherwise when soil pH is below optimum, limestone is recommended to address both soil pH and Ca or Mg deficiency.

While large percentages of samples received by the STL have high (optimum) or very high macronutrient levels, it would be unwise to conclude without benefit of soil test that fertilization is unnecessary for all NJ soils. Soil samples received represent a small percentage of actual land area, and the samples should not be assumed to accurately represent all areas (that is, these numbers do not represent random, unbiased sampling). Furthermore, for those soils that are deficient in any nutrient, proper fertilization would make a substantial improvement in production, quality, or health of the plant/crop.

Soil pH is another characteristic that is crucial to a soil’s fertility. Soil pH that is too high or too low can cause nutrients to be unavailable (insoluble or otherwise “tied-up”) even when present in sufficient

amounts. The target pH is determined by the plant/crop being grown. While most plants “prefer” soil pH in the range 6.1 to 6.8, there are certain plants that are adapted to more acidic soil, the “acid-loving” plants. Other plants have greater requirement for calcium and consequently perform better at slightly higher soil pH. Soil test recommendations are customized to account for these differences. Furthermore, overly acidic soils can increase solubility/availability of soluble aluminum, an element harmful to plant roots. Adjusting the soil pH benefits the plant by minimizing this stress as well.

Soil pH data of samples submitted to the STL in FY14 are in summarized Figure 15. The categories are based on the deviation from the target pH for the specified crop or planting. This demonstrates the need to optimize soil pH, either to apply limestone to raise pH or to acidify the soil. Therefore, it is clear that 36% of samples of those analyzed for pH during FY14 were “near” the target (within 0.3 pH units). Forty percent of samples were “somewhat” (0.3 - 1.5 pH units) below the optimum pH range, and appropriate limestone recommendations (various rates depending on deviation from the target and buffering capacity of the soil) were provided except in cases where acid-producing soil is suspected (pH<4.0). Four percent of samples were significantly below (>1.5 units) the optimum pH range. On the alkaline side of the scale, 19% pH samples were 0.3 to 1.5 units higher than the optimum range. If pH is above optimum by less than 0.5, the advice is to do nothing and allow the natural soil processes which occur in New Jersey’s humid, temperate climate to acidify the soil over a season. Otherwise when pH is significantly higher than the target, acidification is recommended, with elemental sulfur being the preferred soil amendment. In extreme cases, such as the 1% of samples that were more than 1.5 units above the optimum range, it is advised that the cause of alkalinity be determined before recommendations are provided.

Another interesting analysis comes from lead (Pb) screening of soil to assess contamination from historical use of leaded paint, leaded gasoline, lead arsenate pesticides, etc. Of 164 soil samples analyzed and compared to US-EPA standards, 37% had background levels of Pb, 4% were elevated; 30% were considered contaminated, and 28% exceeded the Residential Cleanup Criteria. These assessments are estimates based on correlation between EPA methods and a screening method developed in part by Rutgers researchers.

Teaching and Outreach

In addition to providing diagnostic services and soil analysis, the staff of the PDL and STL provides significant educational and outreach services to SEBS/NJAES, RCE, and other agencies (Appendix 3). Many of these activities generated additional income for the laboratories.

Richard Buckley

Mr. Buckley is an instructor in the Rutgers Professional Golf Turf Management School. He taught four courses (Diseases of Turf; Diseases and Insect Pests of Ornamental Plants; Insect Pests in Fine Turf; and Principles of Pest Management on the Golf Course) in both the spring and fall sessions. This twice a year, 10-week teaching commitment consists of a total of 140 hours of contact time per year. The teaching efforts by the PDL staff in the Professional Golf Turf Management School generate significant income for the laboratory. This income and client development source also helps support the PDL.

Mr. Buckley participated in several other OCPE short courses in FY14. These courses included: the Golf Turf Management School: Three Week Preparatory Course; Landscape Integrated Pest Management: An Intelligent Approach; Athletic Field Construction and Maintenance Short Course; and the Emergency Pesticide Credit Recertification Short Course.

Mr. Buckley served as the course coordinator and lecturer for the Pest Management in Landscape Turf Short Course. This was the 22nd year for this one-day program. Mr. Buckley also coordinated and taught the Advanced Topics in Professional Grounds Maintenance: Turf Disease Short Course. This was the 15th time he planned and coordinated that short course.

Mr. Buckley participated as a guest speaker in two undergraduate and/or graduate courses: General Plant Pathology Laboratory 11:776:311 at Rutgers University, and the Ornamental Horticultural Course at Mercer County College. He team-taught the Rutgers three-credit undergraduate course: Diseases and Insect Pests of Ornamental Plants 11:776:391 with Dr. Ann Gould. This was the third semester that this course has been presented.

Mr. Buckley was an invited speaker in several RCE programs. The following programs were included: North Jersey Ornamental Horticulture Conference – Tree Day, and the Forest Stewardship

Program. Lectures in support of the Atlantic, Camden, Gloucester, Hunterdon, Essex, Middlesex, Monmouth, Morris, Ocean, Passaic, and Union County Master Gardener Programs were also given.

Mr. Buckley was also an invited speaker for: the Pocono Golf Course Superintendents Association Summer Meeting; New York State Arborists' Annual Conference; Westchester County Golf Course Training Session; New Jersey Shade Tree Federation Annual Conference; West Virginia Golf Course Superintendents Association Turf Conference and Show; Morris Arboretum Continuing Education Program; New Jersey Green Expo Turf and Landscape Conference; New Jersey Nursery and Landscape Association NJ Plants Show - Professional Landscape and Nursery Tradeshow; Tree Tech Annual Training Meeting; New Jersey Christmas Tree Growers' Association: Annual Winter Meeting; New York State Turf Association: Southeastern Regional Conference and Adirondack Regional Conference; Shemin Landscape Supply Company Turf Days in Baltimore, MD and New York, NY; Reed and Perrine Turf and Ornamentals Seminar; SavALawn University; John Deere University programs in Saratoga, Batavia, and Verona, NY; and the Cooperative Agricultural Pest Survey and Eastern Plant Board Meeting; New Jersey Certified Tree Expert Training Program.

Sabrina Tirpak

Ms. Sabrina Tirpak is responsible for teaching Turf Diseases and Turf Insects laboratory practicums in the Rutgers Professional Golf Turf Management School. She has approximately 60 hours of contact time per year in the turf school. Another OCE program in which she participated was Landscape Integrated Pest Management: An Intelligent Approach.

Ms. Tirpak was an invited speaker for several RCE programs including: North Jersey Ornamental Horticulture Conference – Turf Day and Landscape Day; Central Jersey Turf and Ornamentals Institute; and the Rutgers Veterans Environmental Technology and Solutions Programs. She also presented programs in support of the Camden, Essex, Monmouth and Ocean County Master Gardener Programs.

Ms. Tirpak was also an invited speaker for the Pest Management Course at County College of Morris; New Jersey Green Expo Turf and Landscape Conference; New Jersey Chapter of the International Society of Arboriculture 2014 Garden

State Tree Conference; Shrewsbury Community Garden Annual Meeting; Brooklyn Landscape Gardeners' Association Annual Seminar; and the New Jersey Certified Tree Expert Training Program.

Ms. Tirpak spent considerable time and effort in FY14 conducting review sessions for Rutgers Turf Club members participating in the Golf Course Superintendents Association of America Collegiate Turf Bowl. The Turf Bowl is held at the GCSAA annual meeting. Ms. Tirpak accompanied the teams to the competition in Orlando, FL where the Rutgers team placed 7th out of 68 teams.

Stephanie Murphy

Dr. Stephanie Murphy participated in the Rutgers Office of Continuing Professional Education's Turfgrass Establishment short course, Septic Inspections in New Jersey short course, and the Professional Golf Turf Management School.

Dr. Murphy presented lectures in support of the RCE Environmental Stewardship Training in Passaic, Somerset, and Warren counties. She presented a lecture about soil science in support of the Essex County Master Gardener Program. Dr. Murphy also served at Rutgers Gardens' "Ask the Experts" table during its Open House and was an invited presenter at the 4H Science of Soil Youth Summit.

Dr. Murphy was a guest lecturer in the undergraduate course Turfgrass Management (11:776:304), and she hosted students from Fundamentals of Agroecology (11:776:230), Soil Fertility (11:776:440), and Landscape Management and Maintenance (11:550:238) for tours of the STL along with detailed explanations of soil testing theory and practices.

Extension Publications

During FY14, Mr. Buckley contributed regularly to the Plant & Pest Advisory. The print version of the newsletter was transformed for the 2013 growing season into a blog format. A special section on the blog site was designated for Plant Diagnostic Laboratory activities. To date, the PDL has more than 350 unique subscribers to the site. Each week from February to October, Mr. Buckley and Ms. Tirpak wrote brief posts on the disease and insect pests problems submitted to the laboratory. Most of the articles submitted to the PPA blog were also submitted for publication in the Cornell University ShortCUTT turfgrass newsletter. The Plant Diagnostic Laboratory's PPA blog posts can be found at

plant-pest-advisory.rutgers.edu/category/plant-diagnostic-lab.

- 07/01/13 - *The Last Word in Leaf Spots*
- 07/05/13 - *Red, White, and Brown?*
- 07/07/13 - *Singing the Blues*
- 07/11/13 - *Boxwoods: Now You See Them, Soon You Won't!*
- 07/23/13 - *Summer Time and the Livin' Ain't Easy*
- 08/05/13 - *Touch of Gray*
- 08/15/13 - *'Tis the Season*
- 08/25/13 - *Wave That Flag*
- 09/03/13 - *Rust Never Sleeps*
- 09/11/13 - *Orange is the New Black*
- 09/18/13 - *BBR--Boxwood Blight Revisited*
- 02/24/14 - *Spring Fever?*
- 03/23/14 - *Frosty Finally Melted!*
- 03/30/14 - *Frosty Finally Melted Part 2*
- 04/07/14 - *Goes to Show You Don't Ever Know*
- 04/27/14 - *Got Plans for Monday Morning?*
- 05/07/14 - *Why are There Holes in My Cheese?*
- 05/19/14 - *Fly, Boxwood Leafminers Fly!*
- 05/20/14 - *Attention Christmas Tree Growers!*
- 05/21/14 - *Golf Turf Disease of the Week: Brown Ring Patch*
- 05/21/14 - *Invasive Emerald Ash Borer Detected in NJ*
- 05/30/14 - *Golf Turf Disease of the Week: Anthracnose Basal Crown Rot*
- 06/10/14 - *They're Everywhere! They're Everywhere!*
- 06/23/14 - *Rusty, But Never Crusty*

In cooperation with USDA research efforts and several regional NPDN member labs, the PDL staff made a first report for Boxwood Blight in New Jersey (Appendix 4):

Malapi-Wight, M., J. B. Hébert, R. Buckley, M. L. Daughtrey, N. F. Gregory, K. Rane, S. Tirpak, and J. A. Crouch. 2014. First report of boxwood blight caused by *Calonectria pseudonaviculata* in Delaware, Maryland, New Jersey and New York. *Plant Disease* 98: 698.

Dr. Murphy contributed to Rutgers Cooperative Extension's response to coastal flooding regarding salt damage to plants and soil. An information sheet, Saltwater Flooding and Your Garden, that was developed by C. Costaris in Rutgers Cooperative Extension of Ocean County was reviewed and edited by Dr. Murphy and has now been submitted

for RCE Fact Sheet status. (see <http://ocean.njaes.rutgers.edu/documents/copingwtsaltwtrNov28.pdf>). Some of the same information was used for a blog post by Dr. J. Murphy (<http://turfblog.rutgers.edu/?cat=39>).

Service

The PDL staff provided tours of the Ralph Geiger Turfgrass Education Center and the Plant Diagnostic Laboratory to numerous groups in FY14. In addition, the STL staff also provided tours of their lab for several programs.

Dr. Murphy has represented the Executive Dean of Cook College/School of Environmental and Biological Sciences on the New Jersey Department of Agriculture's Soil Conservation Committee since 1998. In 2013-2014, she participated in several subcommittees, including the Soil Restoration subcommittee revising the state's Soil Erosion & Sediment Control Standards to assure well-functioning soils after disturbance, the Training subcommittee, and the Supervisor nomination subcommittee.

Mr. Buckley and Ms. Tirpak are members of the Cooperative Agricultural Pest Survey (CAPS) team. The CAPS program is a pest surveillance program managed by USDA-APHIS and state departments of agriculture. Universities, natural resource protection organizations, and industry groups are also partners.

Marketing

To help advertise laboratory services at grower meetings or other activities, two sets of table-top and banner display units are available on loan to anyone who wishes to advertise STL&PDL services. The laboratory staff is also willing to attend and staff an exhibit to explain laboratory services and sell soil test kits.

In FY14, this marketing initiative brought the display to the following programs: The 2013 Great Tomato Tasting; RCE of Middlesex County EARTH Center Open House; New Jersey Green Expo Turf and Landscape Conference; Northeast Organic Farming Association of New Jersey Winter Conference; New Jersey Vegetable Growers Association Meeting; Frelinghuysen Arboretum's Community Garden Conference; Rutgers Home Gardeners School; Rutgers Gardens Open House; New Jersey Nursery and Landscape Association NJ Plants Show - Professional Landscape and Nursery

Tradeshow; New Jersey Nursery and Landscape Association summer meeting at Rutgers Gardens; New Jersey Flower and Garden Show; New Jersey Nursery and Landscape Association Meeting; Rutgers Day (Ag Field Day); and Rutgers Turf Field Days.

To increase visibility and market the Soil Testing Lab services, a Facebook page was created in November 2011; see www.facebook.com/RutgersSoilTestingLab. Photos from the lab were posted, and a link to the website is provided there. More-or-less frequent posts include updates about work at the lab, presentations at other venues, photos related to these activities, and related news articles or opportunities. The advantage to having a presence on Facebook is that visitors can "like" or "share" the page or post, which informs their "friends" about their interest in STL's page, causing some degree of "virality". Every post is matched with a spike in "views", and a large percentage of those are from the viral nature of Facebook (compared to standard website). Very detailed statistics are available regarding the page's postings, likes, friends, and so forth. For example, a total of 309 people were reached on November 26 2013 in response to a November 22 post which originally reached 107 and achieved 12 likes. Total Facebook page "likes" increased from 153 to 199 through FY14.

Income

The PDL and STL are expected to recover all costs and be self-supporting. Laboratory clientele are charged a nominal fee for diagnostic and testing services as well as educational activities. Grant activity and cost-sharing arrangements also provide some degree of funding. PDL fees were last adjusted on July 1, 2006, and the STL increased their fees at that time and partially again on November 1, 2008. Current fee schedules are reported in Appendix 1.

A sample submission form and the appropriate payment accompanied the majority of samples received by the PDL from residential clientele. A submission form accompanied most commercial samples; however, the majority of these submissions did not include payment. In most cases, commercial growers preferred to be sent a bill. Most soil testing laboratory samples require payment at submission or when the soil test kits are purchased in each county office, but invoicing of corporations or organizations has become common. In this case, soil test results are not released until invoices are

paid. Monies collected in the county are passed to the laboratory accounts by check or internal transfer. Internal transfer of funds was used to pay for the plant and soil samples diagnosed or tested for research programs at Rutgers University.

In FY14, \$242,074.97 was generated from all PDL activities and covered 94% of all costs. In FY14, \$377,488.97 was generated from all STL activities and covered 100% of all costs. A complete breakout of all PDL and STL revenues and expenses is included in Appendix 2 of the un-abridged copies of this report.

PDL policy permits Rutgers employees, government agencies, County faculty, extension specialists, and selected government agencies to submit a small number of samples "free of charge." These samples are to be used for educational development and government service. The laboratory also receives a number of direct requests for free service from the public. In many cases, letters are sent to the "Department of Agriculture" or to some other vague address. These requests for information eventually find their way to the appropriate laboratory. The PDL processed 16 "no charge" samples in FY14. As per PDL policy, volume discounts are provided to companies submitting large numbers of samples as well as to grant-funded projects and those samples submitted from Federal and State agencies.

Future Directions

As in the past, the top priority for FY15 will be to increase revenue and reduce expenses. To accomplish this, we will continue to advertise laboratory services at trade shows, field days, fairs, and educational programs. Laboratory staff will be participating in several cost-sharing grant activities in FY15. These efforts and our continued cooperation with the Office of Continuing Professional Education are expected to generate additional funds.

Increasing advertising and awareness of laboratory services should bring increasing numbers of samples. Even with increased sample numbers, it may be necessary to increase some testing fees in FY15 to cover increasing costs.

Further development of the soil testing database continues, not only with regard to development of automated recommendations for additional crops but also in increasing laboratory efficiency. The newest soil test, soil CO₂ respiration, will continue to be publicized to increase awareness of this

biological index of “soil health” and potential N mineralization. Finally, building on attentiveness to State regulation for turf fertilizer application, efforts to recruit landscaping professionals into the STL clientele continue and will encourage sampling during non-peak periods to spread the annual workload.

National Plant Diagnostic Network

In 2003, the PDL was invited to participate in the National Plant Diagnostic Network (NPDN). The NPDN is a coordinated network of plant diagnostic laboratories from land grant universities in the US. The network provides a cohesive distribution system to quickly detect pests and pathogens that have been deliberately or unintentionally introduced into agricultural and natural ecosystems. It is designed to be a key part of our homeland security effort to protect agriculture in the nation. Advantages of joining the system include rapid evaluation and reporting of potential bioterrorist threats and other high consequence diseases or pest problems; rapid response time for diagnosis; formal coordination of diagnostic labs within the NPDN; improved links with Federal and State regulatory agencies; and improved quality and uniformity of information associated with sample submission and reporting. The USDA provides grant monies as incentive to participate. Mr. Buckley is the principle investigator in the Rutgers subcontract.

Northeast Plant Diagnostic Network

The Northeast Plant Diagnostic Network (NEPDN) is the regional part of the National Plant Diagnostic Network that focuses on regional concerns regarding plant diseases and insect pests. The regional center for the NEPDN is Cornell University. The Rutgers PDL has been identified as a cooperating institution and participates as a subcontractor to the regional center at Cornell. Grant monies provided by the USDA through the NEPDN were used in FY14 to pay salaries, participate in professional training programs and meetings, and to purchase equipment and supplies to upgrade the laboratory’s capability for accurate and timely diagnosis of plant problems. Upgrades to laboratory technologies improve communication with our local stakeholders, cooperators, and experts in the northeast regional and national networks. The capacity for improved communication facilitates the rapid dissemination of information concerning current plant disease and insect pest activity. The new equipment and upgrades in technology also pro-

vide the means to create modern educational resources for use in local and regional training programs. Grant monies received for FY15 will be used to continue to upgrade laboratory capability to handle pathogens of consequence and other bio-hazards; attend training programs for insect and disease identification; hire labor to enter data into the National Plant Disease Information System; and train Master Gardeners as first detectors.

Ramapo Tomato Sale

In the spring of 2008, the New Jersey Agriculture Experiment Station revived the hybrid tomato variety ‘Ramapo’. The staff of the PDL conducted the retail sale of the seed with Cindy Rovins. The variety ‘Moreton’ was added for the 2009 season, a “Rediscover the Jersey Tomato” t-shirt for 2010, and the variety ‘KC-146’ was introduced for 2013. Through FY14, the PDL has processed 10,376 orders for 29,218 packets of seeds. The t-shirts are extremely popular also with over 1,200 sold. Orders continue to come into the laboratory almost daily.

Appendix 1.

PLANT DIAGNOSTIC LABORATORY - FEE SCHEDULE

All fees are per sample. Please visit www.njaes.rutgers.edu/services for sampling instructions.

STANDARD SAMPLE (most samples except fine turf)

In-state	\$40
Out-of-state	\$95

FINE AND SPORTS TURF

In-state	
Disease/insect diagnosis	\$75
Disease/insect diagnosis & nematode assay*	\$120
Out-of-state	
Disease/insect diagnosis	\$95
Disease/insect diagnosis & nematode assay*	\$170

* Combination price applies only to samples from same location (ie. the same green, field, etc.)

NEMATODE ASSAY

In-state (except fine turf)	\$30
In-state fine turf	\$60
Out-of-state	\$95

FUNGUS AND MOLD IDENTIFICATION

In-state microscopic identification	\$50
Out-of-state microscopic identification	\$100

INSECT IDENTIFICATION

In-state	\$40
Out-of-state	\$95

PLANT AND WEED IDENTIFICATION

In-state	\$40
Out-of-state	\$95

SPECIAL TESTS

Fungicide resistance testing (per compound)	\$350
Call ahead to discuss specifics and multiple compound discounts.	
Virus testing	
Diagnostic screen	\$200
Individual test fee varies. Call ahead to discuss specifics.	
Endophyte screening	
In-state	\$75
Out-of-state	\$100
Pesticide residue and contaminant testing	
Call ahead to discuss available tests and fees.	

**OTHER SERVICES NEGOTIABLE.
CONTRACTS AND VOLUME DISCOUNTS ARE AVAILABLE.
ALL FEES ARE SUBJECT TO CHANGE WITHOUT NOTICE.**

Appendix 1. (continued).

SOIL TESTING LABORATORY - FEE SCHEDULE

All fees are per sample. Please visit www.njaes.rutgers.edu/services for sampling instructions.

LANDSCAPE

Level 1 - Fertility Test: \$20 Nutrients, pH, recommendations

Level 2 - Problem Solver (soil/plant suitability test): \$50 Nutrients, pH, soluble salt level, organic matter content, soil textural class, recommendations

Level 3 - Topsoil Evaluation: \$80 Nutrients, pH, soluble salt level, organic matter content, percentages of sand/silt/clay, soil textural class, gravel content, recommendations

FARM

Farm Fertility Test: \$20 Nutrients, pH, estimated CEC & cation saturation, recommendations from RCE agent

Pre-sidedress Nitrate Test (only): \$20 Nitrate-nitrogen soil to determine mid-season fertilizer requirement. Results within 3 working days (assuming dry sample when received), report FAXed.

Full Farm Test: \$50 Nutrients, pH, estimated CEC & cation saturation, Inorganic-nitrogen, organic matter content, recommendations from RCE agent

GOLF & SPORTS TURF

Golf/Sports Turf Fertility Test: \$20 Nutrients, pH, estimated CEC & cation saturation, recommendations

Golf/Sports Total Turf Soil Test: \$50 Nutrients, pH, estimated CEC & cation saturation, soluble salt level, organic matter content, soil textural class, recommendations

Sand-based Root Zone Test: \$50 Nutrients, pH, estimated CEC & cation saturation, recommendations, soluble salt level, organic matter content by loss-on-ignition, percentage fines, recommendations

ORGANIC MEDIA

Greenhouse (soilless) Potting Media: \$50 Nutrients, pH, electrical conductivity, available nitrogen (nitrate and ammonium) by saturated media extract

Compost/Basic: \$60 pH, electrical conductivity, nitrate-nitrogen by saturated media extract, maturity index

Compost/Technical: \$125 pH, electrical conductivity, available nitrogen (nitrate and ammonium) by saturated media extract, organic matter content, total Kjeldahl nitrogen, C:N ratio, maturity index, moisture content, coarse/inert fragment content. Report FAXed.

Compost Available Nutrients: add \$15 (add to either compost test above) Water-soluble P, K, Ca, Mg, Cu, Mn, Zn, B, Fe by saturated media extract

Compost Total Nutrients: add \$50 (add to either compost test above) Total P, K, Ca, Mg, Cu, Mn, Zn, B, Mo in ashed compost sample

Notes: "Nutrients" refers to P, K, Ca, Mg, Cu, Mn, Zn, B, Fe. Cation saturation refers to calculated % of CEC for macronutrient cations: Ca, Mg, K. The pH test includes determination of lime requirement by Adams-Evans buffer. When not preceded by "percentages of sand/silt/clay", "soil textural class" refers to texture by feel (qualitative).

Appendix 1. (continued).

TECHNICAL TESTING

Permeability Class Rating: \$100 Percentages sand/silt/clay, sieve analysis of sand, gravel content. Report FAXed.

Acid-producing Soil Test: \$40 pH before and after oxidation, level of sulfate for determination of acid sulfide/sulfate soil or sediment. Report FAXed.

Technical Topsoil Evaluation: for blended/manufactured topsoil substitute \$85 Fertility, pH, soluble salt level, organic matter content, percentages of sand/silt/clay, soil textural class, gravel content, visual assessment. Report FAXed.

Ecological Research Test: \$110 Nutrients, pH, estimated CEC & cation saturation, soluble salts, organic matter content, percentages of sand/silt/clay, soil textural class, TKN, Inorganic N. Report FAXed.

INDIVIDUAL SOIL TESTS

Soil pH and Lime Requirement Only: \$10

Soluble Salt Test: \$10

Soil Organic Matter Content: \$15

Loss-on-ignition Organic Matter: \$15 by ashing

Soil Texture/Particle Size: \$30 sand/silt/clay %

USDA Sieve Analysis of Sand: \$50 class percentages: very coarse, coarse, medium, fine, very fine; also gravel content

Custom Sieve Analysis: \$15/sieve client specified

Gravel (>2mm) Size Distribution: \$10

Inorganic Nitrogen: \$20 nitrate- and ammonium-nitrogen

Total (Kjeldahl) Nitrogen: \$20

Cation Exchange Capacity or Exchangeable Cations: \$50 Ca, Mg, K, & Na

Cation Exchange Capacity & Exchangeable Cations: \$75 percentages of Ca, Mg, K, & Na on exchange sites

Lead Screening by Mehlich 3: \$20 extractable lead (Pb) and estimated total lead; interpretation of relative risk

Soil Water Content, as received: \$10

OTHER ANALYSES

Water Analysis for Irrigation: \$20 pH; soluble salt content; soluble P, nitrate-nitrogen, & Fe

Plant Tissue Analysis: call for estimate Kjeldahl N; P, K, Ca, Mg, Cu, Mn, Zn, B, Fe, Mo

FEE ADJUSTMENTS

Express Processing: \$50 charge per sample. Turnaround time will depend on tests required and total number of samples in batch. Includes FAXing of report.

Special Reporting Requirements: \$180/hour calculated in 15 minute increments for example percent passing format for sieve analysis, calculation of coefficient of uniformity, particle size distribution graph, compliance of results to specifications, recommendations to meet specifications, critique of specifications

Appendix 2. Plant Diagnostic and Soil Testing Budgets

Table A2.1. Expenses, PDL-FY14.

Salaries and benefits (full and part time staff)	\$235,784.75
Supplies and services	
Diagnostic and testing supplies	
Printing and marketing	
References	
Equipment maintenance	
Office supplies	
Credit card fees	\$18,513.94
Communications	
Telephone/fax	
Postage	\$2,183.31
Travel	
Paid talks and professional meetings	\$2,413.97
Total operating costs	\$258,895.97

Table A2.2. Income, PDL-FY14.

Sample fees	\$97,853.50
Lecture fees	
OCPE and other honorarium	\$21,386.25
Grants and contracts	
NPDN	\$18,225.00
Other	
Salaries (NJAES/SEBS)	\$104,610.22
Total actual income	\$242,074.97

Table A2.3. Estimated expenses, PDL-FY15.

Salary and benefit costs	\$247,800.00
Supplies and services	\$19,500.00
Communications, marketing and travel	\$3,000.00
Total potential cost FY15	\$270,300.00

Table A2.4. Estimated income, PDL-FY15.

Plant Health Samples	
2000 @ \$55 average fee per sample	\$110,000.00
Lecture fees	
OCPE and other honoraria	\$22,000.00
Cost recovery	
Grant and contracts	\$20,000.00
Salaries (NJAES/SEBS)	\$110,000.00
Total potential income FY15	\$262,000.00

Appendix 2. Plant Diagnostic and Soil Testing Budgets (continued).

Table A2.5. Expenses, STL-FY14

Salaries and benefits (full and part time staff)	\$302,237.88
Supplies and services	
Lab chemicals and supplies	
Proficiency testing program	
Soil test kits	
Office supplies	
Computer maintenance	
Printing and marketing	
Credit card fees	\$26,887.20
Equipment/Maintenance	
Lab instruments repair	
Service contracts.....	\$9,850.33
Communications	
Telephone/fax	
Postage	\$2,589.04
Travel	
Paid talks and professional meetings	\$0
Payment to NJAES	
ICP purchase reimbursement	\$0
<hr/>	
Total operating costs	\$341,564.45

Table A2.6. Income, STL-FY14.

Sample fees	
STL.....	\$321,089.50
Lecture fees	
OCPE and other honoraria	\$100.00
Other	
Salaries (NJAES/SEBS)	\$56,299.47
<hr/>	
Total actual income	\$377,488.97

Table A2.7. Estimated expenses, STL-FY15.

Salary and benefit costs	\$296,000.00
Supplies and services.....	\$28,000.00
Equipment/Maintenance.....	\$12,000.00
Communications, marketing and travel	\$3,500.00
Payment to NJAES	
ICP purchase reimbursement	\$50,000.00
<hr/>	
Total potential cost FY14	\$389,500.00

Table A2.8. Estimated income, STL-FY15.

Soil Analysis	
9,300 @ \$35 average fee per sample	\$325,500.00
Lecture fees	
OCPE and other honoraria	\$100.00
Cost recovery	
Salaries (NJAES/SEBS)	\$55,000.00
<hr/>	
Total potential income FY14.....	\$380,600.00

**Appendix 3.
Table A3.1. Complete listing of lectures presented by Richard J. Buckley, PDL Director, FY14.**

Date	Title	Audience	Location	Participants ¹
08/26/13	Fungicide Selection and Use (1hr)	Pocono Golf Course Superintendents Association Summer Meeting	Moscow, PA	T
09/29/13	Tree Disease Update (1.5hr)	New York State Arborists' Annual Conference	Liverpool, NY	A,I
09/29/13	Invasive and Domestic Bark Beetles (1.5hr)	New York State Arborists' Annual Conference	Liverpool, NY	A,I
09/30/13	Bacterial Leaf scorch of Amenity Shade Trees (1.5hr)	New York State Arborists' Annual Conference	Liverpool, NY	A,I
10/03/13	Recognizing Abiotic Stress in Turf (1.5hr)	Westchester County Golf Course Training Session	Elmsford, NY	T
10/07/13	Turf Diseases: Basic Plant Pathology (2hr)	Professional Golf Turf Management School	Cook Campus	T
10/07/13	Principals of Pest Management: What is IPM? (1.5hr)	Professional Golf Turf Management School	Cook Campus	T
10/09/13	Insects in Fine Turf: Introduction to Entomology / Structure and Function (1.5hr)	Professional Golf Turf Management School	Cook Campus	T
10/09/13	Diseases and Insect Pests of Ornamentals: New Plant Pathogens; Bacteria and Viruses (2hr)	Professional Golf Turf Management School	Cook Campus	T
10/10/13	The Art and Science of Disease Diagnosis (3hr)	Master Gardeners Training Program	Passaic County	H
10/14/13	Turf Diseases: Basic Mycology (2hr)	Professional Golf Turf Management School	Cook Campus	T
10/14/13	Principals of Pest Management: IPM Basics (1.5hr)	Professional Golf Turf Management School	Cook Campus	T
10/15/13	Diseases and Insect Pests of Ornamentals: Abiotic Stress Disorders (2hr)	Professional Golf Turf Management School	Cook Campus	T
10/16/13	Diseases of Turf (1hr)	Emergency Pesticide Recertification Short Course	Cook Campus	A,T,L
10/16/13	Insects in Fine Turf: Insect Orders (1.5hr)	Professional Golf Turf Management School	Cook Campus	T
10/21/13	Turf Diseases: Red Thread / Snow Molds (2hr)	Professional Golf Turf Management School	Cook Campus	T
10/21/13	Principals of Pest Management: Scouting (1.5hr)	Professional Golf Turf Management School	Cook Campus	T
10/22/13	Basic Turf Disease: Pick Your Best Defense (1hr)	Mercer County College Ornamental Horticultural Course	Mercer County	C
10/23/13	Insects in Fine Turf: Growth and Development / Behavior (1.5hr)	Professional Golf Turf Management School	Cook Campus	T
10/23/13	Diseases and Insect Pests of Ornamentals: Leaf, Needle and Transition Diseases / Cankers (2hr)	Professional Golf Turf Management School	Cook Campus	T
10/24/13	Diseases and Insect Pests of Turf (3hr)	Emergency Pesticide Recertification Short Course	Cook Campus	A,T,L
10/24/13	Diseases and Insect Pests of Ornamentals: Root and Crown Rots / Vascular Wilts (2hr)	Professional Golf Turf Management School	Cook Campus	T
10/25/13	A Crystal Ball View of Future Pests (1hr)	NJ Shade Tree Federation Annual Conference	Cherry Hill, NJ	A,H,I,L

**Appendix 3. (Continued)
Table A3.1. (Continued)**

Date	Title	Audience	Location	Participants¹
10/28/13	Turf Diseases: Pythium Diseases / Yellow Tuft (2hr)	Professional Golf Turf Management School	Cook Campus	T
10/28/13	Principals of Pest Management: Principals of Pest Control (1.5hr)	Professional Golf Turf Management School	Cook Campus	T
10/30/13	Diseases and Insect Pests of Ornamentals: Molds, Mildews, and Rusts / Mites (2hr)	Professional Golf Turf Management School	Cook Campus	T
10/30/13	Insects in Fine Turf: Nematodes (1.5hr)	Professional Golf Turf Management School	Cook Campus	T
10/31/13	The Art and Science of Disease Diagnosis (3hr)	Master Gardeners Training Program	Middlesex County	H
11/01/13	The Art and Science of Disease Diagnosis (3hr)	Master Gardeners Training Program	Middlesex County	H
11/04/13	Principals of Pest Management: Cultural Strategies (1.5hr)	Professional Golf Turf Management School	Cook Campus	T
11/04/13	Turf Diseases: Fairy Ring / Rhizoctonia Diseases (2hr)	Professional Golf Turf Management School	Cook Campus	T
11/06/13	Recognizing Abiotic Stress in Turf (1hr)	West Virginia Golf Course Superintendents Association Turf Conference and Show	Morgantown, WV	T,I
11/06/13	Nematodes in Golf Turf (1hr)	West Virginia Golf Course Superintendents Association Turf Conference and Show	Morgantown, WV	T,I
11/11/13	Turf Diseases: Root Infecting Patch Diseases / Bentgrass Dead Spot (2hr)	Professional Golf Turf Management School	Cook Campus	T
11/11/13	Principals of Pest Management: Fungicide Selection (1.5hr)	Professional Golf Turf Management School	Cook Campus	T
11/12/13	The Art and Science of Disease Diagnosis (3hr)	Master Gardeners Training Program	Union County	H
11/13/13	Insects in Fine Turf: Billbugs and Annual Bluegrass Weevils (1.5hr)	Professional Golf Turf Management School	Cook Campus	T
11/13/13	Diseases and Insect Pests of Ornamentals: Sucking Insects (2hr)	Professional Golf Turf Management School	Cook Campus	T
11/15/13	Nematodes and Nematode Extraction (3hr)	General Plant Pathology Lab (11:770:311)	Cook Campus	C
11/18/13	Turf Diseases: Anthracnose / Dollar Spot / Copper Spot (2hr)	Professional Golf Turf Management School	Cook Campus	T
11/18/13	Principals of Pest Management: Insecticide Selection (1.5hr)	Professional Golf Turf Management School	Cook Campus	T
11/20/13	Insects in Fine Turf: Lepids in Turf (1.5hr)	Professional Golf Turf Management School	Cook Campus	T
11/20/13	Diseases and Insect Pests of Ornamentals: Borers - Lepids (2hr)	Professional Golf Turf Management School	Cook Campus	T
11/20/13	Turf Diseases: Gray Leaf Spot / Leaf Spots (2hr)	Professional Golf Turf Management School	Cook Campus	T

**Appendix 3. (Continued)
Table A3.1. (Continued)**

Date	Title	Audience	Location	Participants¹
11/22/13	Identification and Control of Ornamental Plant Disorders (6hr)	Morris Arboretum Continuing Education Program	Philadelphia, PA	A,C,H,I,L
11/25/13	Principals of Pest Management: Biorational Pesticides (1.5hr)	Professional Golf Turf Management School	Cook Campus	T
11/27/13	Insects in Fine Turf: Chinch Bugs and Green Bugs (1.5hr)	Professional Golf Turf Management School	Cook Campus	T
11/27/13	Diseases and Insect Pests of Ornamentals: Borers - Beetles (2hr)	Professional Golf Turf Management School	Cook Campus	T
12/02/13	Insects in Fine Turf: Moles Crickets and Crane Flies (1.5hr)	Professional Golf Turf Management School	Cook Campus	T
12/02/13	Principals of Pest Management: Turf Diagnostic Tips (1.5hr)	Professional Golf Turf Management School	Cook Campus	T
12/02/13	Turf Diseases: Rusts, Smuts, Molds, Mildews and Minor Leaf Blights (2hr)	Professional Golf Turf Management School	Cook Campus	T
12/04/13	Diseases and Insect Pests of Ornamentals (2hr)	Professional Golf Turf Management School	Cook Campus	T
12/10/13	Bacterial Leaf Scorch and Downy Mildews in NJ Landscapes (0.5hr)	New Jersey Green Expo Turf and Landscape Conference	Atlantic City, NJ	A,I,L,T
12/10/13	Cultural Strategies to Reduce Turf Diseases on Sports Fields (0.5hr)	New Jersey Green Expo Turf and Landscape Conference	Atlantic City, NJ	A,I,L,T
12/10/13	Boxwood: Now You See Them, Soon You Won't (0.5hr)	New Jersey Green Expo Turf and Landscape Conference	Atlantic City, NJ	A,I,L,T
12/11/13	Insects that Suck: Hard and Soft Scale (0.5hr)	New Jersey Green Expo Turf and Landscape Conference	Atlantic City, NJ	A,I,L,T
12/12/13	Buckley's Bootcamp: Fungicide Selection and Use (1hr)	New Jersey Green Expo Turf and Landscape Conference	Atlantic City, NJ	A,I,L,T
12/12/13	Buckley's Boot Camp: Fairy Rings in Turfgrass (1hr)	New Jersey Green Expo Turf and Landscape Conference	Atlantic City, NJ	A,I,L,T
12/16/13	The Art and Science of Disease Diagnosis (3hr)	Master Gardeners Training Program	Morris County	H
01/06/14	Turf Diseases: Basic Plant Pathology (2hr)	Professional Golf Turf Management School	Cook Campus	T
01/06/14	Principals of Pest Management: What is IPM? (1.5hr)	Professional Golf Turf Management School	Cook Campus	T
01/07/14	A Crystal Ball View of Future Pests (1hr)	North Jersey Ornamental Horticulture Conference: Tree Day	Randolph, NJ	A,I,L,T
01/08/14	Insects in Fine Turf: Introduction to Entomology / Structure and Function (1.5hr)	Professional Golf Turf Management School	Cook Campus	T

**Appendix 3. (Continued)
Table A3.1. (Continued)**

Date	Title	Audience	Location	Participants¹
01/08/14	Diseases and Insect Pests of Ornamentals: New Plant Pathogens; Bacteria and Viruses (2hr)	Professional Golf Turf Management School	Cook Campus	T
01/10/14	The Complete Turf Disease for Golf Courses (3hr)	Professional Golf Turf Management School: Three Week Course	Cook Campus	T
01/13/14	Turf Diseases: Basic Mycology (2hr)	Professional Golf Turf Management School	Cook Campus	T
01/13/14	Principals of Pest Management: IPM Basics (1.5hr)	Professional Golf Turf Management School	Cook Campus	T
01/15/14	Diseases and Insect Pests of Ornamentals: Abiotic Stress Disorders (2hr)	Professional Golf Turf Management School	Cook Campus	T
01/15/14	Insects in Fine Turf: Insect Orders (1.5hr)	Landscape IPM Short Course	Cook Campus	T
01/16/14	The Art and Science of Disease Diagnosis (1.5hr)	Professional Golf Turf Management School: Three Week Course	Cook Campus	L,T
01/17/14	The Complete Turf Disease for Golf Courses (3hr)	Professional Golf Turf Management School	Cook Campus	T
01/20/14	Turf Diseases: Red Thread / Snow Molds (2hr)	Professional Golf Turf Management School	Cook Campus	T
01/20/14	Principals of Pest Management: Scouting (1.5hr)	Professional Golf Turf Management School	Cook Campus	T
01/22/14	Insects in Fine Turf: Growth and Development / Behavior (1.5hr)	Professional Golf Turf Management School	Cook Campus	T
01/22/14	Diseases and Insect Pests of Ornamentals: Leaf, Needle and Transition Diseases / Cankers (2hr)	Professional Golf Turf Management School	Cook Campus	T
01/22/14	Leaf Feeding Insects in Landscape Turf (1hr)	New Jersey Nursery and Landscape Association: Plants Show	Edison, NJ	A,L,N,T
01/23/14	A Crystal Ball View of Future Pests (1hr)	Tree Tech Annual Training Meeting	Essex County	A,L,T
01/25/14	IPM for Christmas Tree Growers (1hr)	New Jersey Christmas Tree Growers Association Annual Winter Meeting	Burlington County	L,I,X
01/27/14	Turf Diseases: Pythium Diseases / Yellow Tuft (2hr)	Professional Golf Turf Management School	Cook Campus	T
01/27/14	Principals of Pest Management: Principals of Pest Control (1.5hr)	Professional Golf Turf Management School	Cook Campus	T
01/28/14	Buckley's Bootcamp: Basic Turf Diseases (2hr)	New York State Turf Association: Southeastern Regional Conference	Fishkill, NY	I,T
01/28/14	Buckley's Bootcamp: Basic Turf Insect Pests (2hr)	New York State Turf Association: Southeastern Regional Conference	Fishkill, NY	I,L,T
01/29/14	Plants I Love to Hate (1hr)	New York State Turf Association: Southeastern Regional Conference	Fishkill, NY	I,T
01/29/14	Insects in Fine Turf: Nematodes (1.5hr)	Professional Golf Turf Management School	Cook Campus	T

**Appendix 3. (Continued)
Table A3.1. (Continued)**

Date	Title	Audience	Location	Par- ticipants₁
01/29/14	Diseases and Insect Pests of Ornamentals: Root and Crown Rots / Vascular Wilts (2hr)	Professional Golf Turf Management School	Cook Campus	T
01/30/14	Basic Turf Disease: Pick Your Best Defense (1hr)	Shemin Landscape Supply Company: Baltimore Turf Day	Baltimore, MD	L,T
01/30/14	Bacterial Leaf Scorch in Amenity Shade Trees (1hr)	Shemin Landscape Supply Company: Baltimore Turf Day	Baltimore, MD	L,T
02/04/14	The Art and Science of Disease Diagnosis (3hr)	Master Gardeners Training Program	Atlantic County	H
02/10/14	Principals of Pest Management: Cultural Strategies (1.5hr)	Professional Golf Turf Management School	Cook Campus	T
02/10/14	Turf Diseases: Fairy Ring / Rhizoctonia Diseases (2hr)	Professional Golf Turf Management School	Cook Campus	T
02/11/14	Insects in Fine Turf: White Grubs (1.5hr)	Professional Golf Turf Management School	Cook Campus	T
02/12/14	Insects in Fine Turf: Billbugs and Annual Bluegrass Weevils (1.5hr)	Professional Golf Turf Management School	Cook Campus	T
02/12/14	Diseases and Insect Pests of Ornamentals: Molds, Mildews, and Rusts / Mites (2hr)	Professional Golf Turf Management School	Cook Campus	T
02/17/14	Turf Diseases: Root Infecting Patch Diseases / Bentgrass Dead Spot (2hr)	Professional Golf Turf Management School	Cook Campus	T
02/17/14	Principals of Pest Management: Fungicide Selection (1.5hr)	Professional Golf Turf Management School	Cook Campus	T
02/18/14	The Art and Science of Disease Diagnosis (3hr)	Master Gardeners Training Program	Camden County	H
02/19/14	Principals of Pest Management: Insecticide Selection (1.5hr)	Professional Golf Turf Management School	Cook Campus	T
02/19/14	Insects in Fine Turf: Lepids in Turf (1.5hr)	Professional Golf Turf Management School	Cook Campus	T
02/19/14	Diseases and Insect Pests of Ornamentals: Defoliators (2hr)	Professional Golf Turf Management School	Cook Campus	T
02/20/14	Basic Turf Diseases: Pick Your Best Defense (1hr)	Athletic Field Construction Short Course	Cook Campus	T
02/20/14	Boxwood: Now You See Them, Soon You Won't (1hr)	Reed and Perrine Turf and Ornamental Seminar	Manalapan, NJ	A,L,T
02/21/14	Diseases and Insect Pests of Ornamentals: Sucking Insects (2hr)	Professional Golf Turf Management School	Cook Campus	T
02/24/14	Principals of Pest Management: Biorational Pesticides (1.5hr)	Professional Golf Turf Management School	Cook Campus	T
02/24/14	Turf Diseases: Anthracnose / Dollar Spot / Copper Spot (2hr)	Professional Golf Turf Management School	Cook Campus	T

**Appendix 3. (Continued)
Table A3.1. (Continued)**

Date	Title	Audience	Location	Participants¹
02/25/14	Identification and Control of Ornamental Plant Disorders (6hr)	Morris Arboretum Continuing Education Program	Philadelphia, PA	A,C,H,I,L
02/26/14	Insects in Fine Turf: Chinch Bugs and Green Bugs (1.5hr)	Professional Golf Turf Management School	Cook Campus	T
02/26/14	Diseases and Insect Pests of Ornamentals: Borers - Beetles (2hr)	Professional Golf Turf Management School	Cook Campus	T
02/26/14	Turf Diseases: Gray Leaf Spot / Leaf Spots (2hr)	Professional Golf Turf Management School	Cook Campus	T
03/03/14	Principals of Pest Management: Turf Diagnostic Tips (1.5hr)	Professional Golf Turf Management School	Cook Campus	T
03/03/14	Turf Diseases: Rusts, Smuts, Molds, Mildews and Minor Leaf Blights (2hr)	Professional Golf Turf Management School	Cook Campus	T
03/05/14	Recognizing Abiotic Stress in Turf (1hr)	Shemin Landscape Supply Company: New York Turf Day	New York, NY	L,T
03/05/14	Turf Encounters of the Third Kind: Diseases We Never Talk About (1hr)	Shemin Landscape Supply Company: New York Turf Day	New York, NY	L,T
03/05/14	Fungicide Selection and Use (1hr)	Shemin Landscape Supply Company: New York Turf Day	New York, NY	L,T
03/06/14	Basic Turf Disease: Pick Your Best Defense (1hr)	SavALawn University	Southbury, CT	A,L,T
03/06/14	Might be Mites! (1hr)	SavALawn University	Southbury, CT	A,L,T
03/11/14	2013 Golf Turf Year in Review (1hr)	John Deere University: Saratoga New York	Saratoga, NY	A,L,T
03/12/14	2013 Golf Turf Year in Review (1hr)	John Deere University: Turning Stone Resort	Verona, NY	A,L,T
03/13/14	2013 Golf Turf Year in Review (1hr)	John Deere University: Batavia New York	Batavia, NY	A,L,T
03/14/14	The Complete Turf Disease (6hr)	Advanced Turf Disease Short Course	Cook Campus	L,T
03/19/14	Buckley's Bootcamp: Basic Turf Diseases (2hr)	New York State Turf Association: Adirondack Regional Conference	Lake Placid, NY	I,T
03/19/14	Buckley's Bootcamp: Basic Turf Insect Pests (2hr)	New York State Turf Association: Adirondack Regional Conference	Lake Placid, NY	I,T
03/19/14	Plants I Love to Hate (1hr)	New York State Turf Association: Adirondack Regional Conference	Lake Placid, NY	I,L,T
03/19/14	Recognizing Abiotic Stress in Turf (1hr)	New York State Turf Association: Adirondack Regional Conference	Lake Placid, NY	I,L,T
03/25/14	Hands on Diagnostics Training (3hr)	Master Gardeners Training Program	Hunterdon County	H
03/26/14	The Art and Science of Disease Diagnosis (3hr)	Master Gardeners Training Program	Essex County	H

**Appendix 3. (Continued)
Table A3.1. (Continued)**

Date	Title	Audience	Location	Participants ¹
03/27/14	The Art and Science of Disease Diagnosis (3hr)	Master Gardeners Training Program	Monmouth County	H
04/01/14	The Art and Science of Disease Diagnosis (3hr)	Master Gardeners Training Program	Ocean County	H
04/03/14	Key Pests in the Landscape (3hr)	Master Gardeners Training Program	Ocean County	H
04/08/14	Working with CAPS and the NPDN (1hr)	Cooperative Agricultural Pest Survey and Eastern Plant Board Meeting	Princeton, NJ	A,L,S,T
04/12/14	Basic Plant Pathology (0.75hr)	New Jersey Certified Tree Expert Prep Course	Cook Campus	A,L,T
04/12/14	ID, Life Cycle, and Control Using IPM/PHC and Fungicides (2.25 hr)	New Jersey Certified Tree Expert Prep Course	Cook Campus	A,L,T
04/23/14	The Art and Science of Disease Diagnosis (3hr)	Master Gardeners Training Program	Gloucester County	H
06/17/14	Your Trees' Health (2.5hr)	Forest Management and Stewardship Program Series	Gloucester County	A,H,I,L

Table A3.2. Complete listing of lectures presented by Sabrina Tirpak, PDL Principal Laboratory Technician, FY14.

Date	Title	Audience	Location	Participants ¹
10/15/13	Turf Disease Laboratory - Basic Mycology (3hr)	Professional Golf Turf Management School	Cook Campus	T
10/17/13	Turf Insect Laboratory - Insect Orders (3hr)	Professional Golf Turf Management School	Cook Campus	T
10/29/13	Turf Disease Laboratory - Introduction to Microscopy (3hr)	Professional Golf Turf Management School	Cook Campus	T
10/31/13	Turf Insect Laboratory - White Grubs (3hr)	Professional Golf Turf Management School	Cook Campus	T
11/01/13	review session for GCSAA collegiate Turf Bowl competition (1.5hr)	GCSAA Turf Bowl Review Session	Cook Campus	C
11/06/13	Diseases and Insect Pests of Ornamentals: Defoliators (2hr)	Professional Golf Turf Management School	Cook Campus	T
11/06/13	Insects in Fine Turf: White Grubs (1.5hr)	Professional Golf Turf Management School	Cook Campus	T
11/12/13	Turf Disease Laboratory - Turfgrass Pathogens (3hr)	Professional Golf Turf Management School	Cook Campus	T
11/13/13	review session for GCSAA collegiate Turf Bowl competition (1.5hr)	GCSAA Turf Bowl Review Session	Cook Campus	C
11/15/13	Turf Insect Laboratory - Turfgrass Insect Pests (3hr)	Professional Golf Turf Management School	Cook Campus	T
11/20/13	Preparing for a Career in Plant Science (1hr)	Pest Management Course at County College of Morris	Randolph, NJ	C

**Appendix 3. (Continued)
Table A3.2. (Continued)**

Date	Title	Audience	Location	Participants¹
11/21/13	Turf Insect Laboratory - Turfgrass Insect Pests (3hr)	Professional Golf Turf Management School	Cook Campus	T
11/26/13	Turf Disease Laboratory - Turfgrass Pathogens (3hr)	Professional Golf Turf Management School	Cook Campus	T
12/06/13	Turf Disease Laboratory - Turf Pathogens Review and Final (1.5hr)	Professional Golf Turf Management School	Cook Campus	T
12/09/13	Turf Insect Laboratory - Turfgrass Insect Pests Review and Final (1.5hr)	Professional Golf Turf Management School	Cook Campus	T
12/12/13	Buckley's Boot Camp: Wood Boring Insects in NJ (2hr)	New Jersey Turfgrass Association Expo	Atlantic City, NJ	A,I,L,T
01/06/14	Understanding White Grubs (1hr)	North Jersey Ornamental Horticulture Conference: Turf Day	Randolph, NJ	A,L,T
01/08/14	Key Pests to Watch for in 2014 (1hr)	North Jersey Ornamental Horticulture Conference: Landscape Day	Randolph, NJ	A,L,T
01/13/14	Common Insect Pests in Vegetable Gardens (1hr)	Shrewsbury Community Garden Annual Meeting	Shrewsbury, NJ	H
01/14/14	Turf Disease Laboratory - Basic Mycology (3hr)	Professional Golf Turf Management School	Cook Campus	T
01/15/14	Key Insect Pests of Ornamentals (1.75hr)	Landscape IPM Short Course	Cook Campus	L,T
01/16/14	Turf Insect Laboratory - Insect Orders (3hr)	Professional Golf Turf Management School	Cook Campus	T
01/20/14	review session for GCSAA collegiate Turf Bowl competition (1.5hr)	GCSAA Turf Bowl Review Session	Cook Campus	C
01/28/14	Turf Disease Laboratory - Introduction to Microscopy (3hr)	Professional Golf Turf Management School	Cook Campus	T
01/30/14	Turf Insect Laboratory - Turfgrass Insect Pests (3hr)	Professional Golf Turf Management School	Cook Campus	T
02/12/14	Turf Disease Laboratory - Turfgrass Pathogens (3hr)	Professional Golf Turf Management School	Cook Campus	T
02/19/14	Household Insect Pests (3hr)	Master Gardeners Training Program	Essex County	H
02/26/14	Basic Entomology (3hr)	Master Gardeners Training Program	Gloucester County	H
02/27/14	Turf Insect Laboratory - White Grubs (3hr)	Professional Golf Turf Management School	Cook Campus	T
03/04/14	Turf Disease Laboratory - Turfgrass Pathogens (3hr)	Professional Golf Turf Management School	Cook Campus	T
03/05/14	Diseases and Insect Pests of Ornamentals: Borers - Beetles (2hr)	Professional Golf Turf Management School	Cook Campus	T
03/05/14	Insects in Fine Turf: Moles Crickets and Crane Flies (1.5hr)	Professional Golf Turf Management School	Cook Campus	T
03/06/14	IPM Strategies for Bark Beetles (0.75hr)	Central Jersey Turf and Ornamentals Institute	Manalapan, NJ	A,L,T
03/10/14	Disease and Insect Pests of Annuals and Herbaceous Perennials (2hr)	Brooklyn Landscape Gardeners' Association Annual Seminar	Brooklyn, NY	L,T
03/11/14	Household Insect Pests (3hr)	Master Gardeners Training Program	Camden County	H

**Appendix 3. (Continued)
Table A3.2. (Continued)**

Date	Title	Audience	Location	Participants ₁
03/13/14	Turf Disease Laboratory - Turf Pathogens Review and Final (1.5hr)	Professional Golf Turf Management School	Cook Campus	T
03/14/14	Bark Beetles (1hr)	NJAISA 2014 Garden State Tree Conference	Atlantic City, NJ	A,L
03/17/14	Turf Insect Laboratory - Turfgrass Insect Pests Review and Final (1.5hr)	Professional Golf Turf Management School	Cook Campus	T
03/19/14	Common Insect Pests in Vegetable Gardens (1hr)	Master Gardeners Training Program	Monmouth County	H
03/25/14	Plant Diagnostic Laboratory tour (2.5hr)	Delaware Valley College Plant Pathology Lab	Cook Campus	C
04/01/14	Household Insect Pests (3hr)	Master Gardeners Training Program	Monmouth County	H
04/08/14	Household Insect Pests (3hr)	Master Gardeners Training Program	Ocean County	H
05/03/14	Common Insects: Life Cycles and Control Using IPM/PHC and Pesticides (1hr)	Certified Tree Expert Prep Course	East Windsor, NJ	A,L,T

Table A3.3. Complete listing of lectures presented by Dr. Stephanie Murphy, STL Director, FY14.

Date	Title	Audience	Location	Participants ₁
09/25/13	Soil Science for Master Gardeners (3hr)	Master Gardeners Training Program	Essex County	H
10/15/13	Rutgers Soil Testing Laboratory Tour (2hr)	Fundamentals of Agroecology (11:776:230)	Cook Campus	C
10/15/13	Rutgers Soil Testing Laboratory Tour (2hr)	Soil Fertility (11:776:440)	Cook Campus	C
10/18/13	Soil Texture (1hr)	Professional Golf Turf Management School	Cook Campus	T
11/20/13	Rutgers Soil Testing Laboratory Tour (2hr)	Landscape Management and Maintenance (11:550:238)	Cook Campus	C
12/20/13	Manufactured Topsoils (1hr)	Turf Establishment Short Course	Cook Campus	L
01/14/14	Soils and the Environment (3hr)	Environmental Steward Training	Passaic County	H
01/23/14	Soils and the Environment (3hr)	Environmental Steward Training	Somerset County	H
01/28/14	Soils and the Environment (3hr)	Environmental Steward Training	Warren County	H
01/15/14	Soil Testing - What Do the Results Tell You? (3hr)	Science of Soil - Youth Summit	Cook Campus	C
01/31/14	Soil Texture (0.5hr)	Professional Golf Turf Management School	Cook Campus	T
05/01/14	Soil Texture (1.5hr)	Turfgrass Management (11:776:304)	Cook Campus	C
06/25/14	Biology of Septic Treatment in Soil (1.5)	Septic Inspections in New Jersey Short Course	Cook Campus	Hf,E

₁ Audience Addressed: A=Arborists; C=College (Academic); Co=Construction; E=Engineers; F=Farmers; G=Greenhouse; H=Residential Clientele; Hf=Health Officers; I=Industry; L=Landscape; N=Nursery Growers; S=State Officials; T=Turfgrass Managers; X=Christmas Tree Growers

First Report of Boxwood Blight Caused by *Calonectria pseudonaviculata* in Delaware, Maryland, New Jersey, and New York

APS apsjournals.apsnet.org/doi/abs/10.1094/PDIS-10-13-1102-PDN



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Disease Notes

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- **e-Xtra**

Boxwood (*Buxus* spp.) are commercially important evergreen ornamental plants with an annual market value of over \$103 million in the United States. The recent U.S. incursion of boxwood blight disease caused by the fungus *Calonectria pseudonaviculata* (syn. *Cylindrocladium pseudonaviculatum*, *Cy. buxicola*) threatens the health and productivity of boxwood in both landscape plantings and nurseries. The first confirmed U.S. reports of the disease were made from Connecticut and North Carolina in November 2011 (2,4), followed by diagnoses in 10 additional states during 2012 and 2013. By August 2013, symptoms consistent with boxwood blight had been observed from *B. sempervirens* in Delaware,

Appendix 4. Disease Note (Continued)

Maryland, New Jersey, and southeastern New York. Affected plants showed rapid onset of disease symptoms: dark brown to black spots or diffuse dark areas on leaves, followed by defoliation. Narrow, elongate black cankers also formed on current season shoots. Symptomatic stems and leaves were placed in petri dishes with moistened filter paper at 22°C for 3 days under continuous light. Conidiophores were excised, then placed on potato dextrose agar amended with streptomycin and neomycin (0.3 g/l). Resultant colonies showed dark brown pigmentation at the colony center surrounded by tan to reddish brown rings with white mycelia at the advancing edge. Conidia ($n = 30$ per isolate) were hyaline, cylindrical, rounded at both ends, with a single septum (45 to 76×4 to $6 \mu\text{m}$; avg. $63 \times 5 \mu\text{m}$). Conidiophores ($n = 20$ per isolate) comprised a stipe, a hyaline septate stipe extension (length 119 to $192 \mu\text{m}$; avg. $150 \mu\text{m}$) and a terminal ellipsoidal vesicle (diameter 4 to $10 \mu\text{m}$; avg. $7 \mu\text{m}$). Based on morphological characteristics, the causal agent was identified as *C. pseudonaviculata* (1,4). Voucher specimens were deposited in the U.S. National Fungus Collections (BPI 892698 to 701). To verify morphological diagnosis, genomic DNA was extracted from fungal biomass grown in liquid cultures of yeast extract peptone dextrose media. A portion of the β -tubulin gene (*TUB2*) was PCR amplified and sequenced bi-directionally using primers Bta/Bt2b (3). BLASTn searches of NCBI GenBank databases using the *TUB2* sequences (Accession Nos. KF785808 to 11) demonstrated 96 to 100% sequence identity with other *C. pseudonaviculata* isolates. To confirm pathogenicity, 5-month-old *B. sempervirens* and *B. microphylla* seedlings were spray-inoculated with a spore suspension of 1×10^4 conidia/ml. One isolate from each state was independently tested with four replicates each. Non-inoculated water-sprayed plants served as negative controls. Plants were maintained in growth chambers at 22°C under constant light. Blight symptoms developed 4 to 5 days post inoculation. *C. pseudonaviculata* was re-isolated from inoculated plants; no symptoms or signs were observed from control plants. To our knowledge, this is the first report of *C. pseudonaviculata* in the states of Delaware, Maryland, New Jersey, and New York. This report demonstrates that *C. pseudonaviculata* is now widespread across the United States eastern seaboard, and represents a substantial threat to boxwood plants in North American landscapes and nurseries.

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