RUTGERS
New Jersey Agricultural Experiment Station
PLANT DIAGNOSTIC LABORATORY

Plant Diagnostic Laboratory

2022 Fiscal Year Report

(July 1, 2021 to June 30, 2022)

Mr. Richard J. Buckley
Director
Plant Diagnostic Laboratory

Ms. Sabrina Tirpak
Principal Laboratory Technician
Plant Diagnostic Laboratory

2022 Fiscal Year
Rutgers Plant Diagnostic Laboratory
Annual Report

Prepared by:
Mr. Richard J. Buckley
Ms. Sabrina Tirpak

CONTENTS **PAGE**

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 the 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 the Plant Diagnostic Laboratory during the 2022 fiscal year.

History

The Rutgers Plant Diagnostic Laboratory and Nematode Detection Service (PDL) was established 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 61,536 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.

Other Support

The PDL regularly employs Rutgers undergraduate students 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/SEBS. We owe a great deal of our success to the expertise of faculty in the departments of Plant Biology, 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.

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). Samples are submitted via United States Postal Service or by private delivery services directly to the laboratory. Many 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 sent by email to the client.

Fiscal Year 2022 Report

Operations

During the 2022 fiscal year (July 1, 2021 to June 30, 2022), the PDL examined 1,822 specimens submitted for diagnosis, identification (insects, weeds, or fungi), or nematode assay (Table 1), representing a 2% decrease (or 43 samples) from FY21. Samples (Figure 2) submitted for diagnosis (+71) and nematode analysis (+34) both increased in FY22. There was a decrease in insect identifications (-148) mostly from Cooperative Agricultural Pest Survey (CAPS) and NJ State Forestry Services trap catches (-133). 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 1,500 to 2,000 samples represent peak laboratory capacity, so at 1,822 sample submissions, the PDL was operating at the capacity of the laboratory to function efficiently.

The specimens submitted to the PDL by sample type are presented in Figure 2. Most samples, 61% (1,114), were plant samples submitted for diagnosis, 18% (325) of the samples were insect, mold, or plant identifications and 21% (383) of the samples were for nematode analysis.

Figure 1.

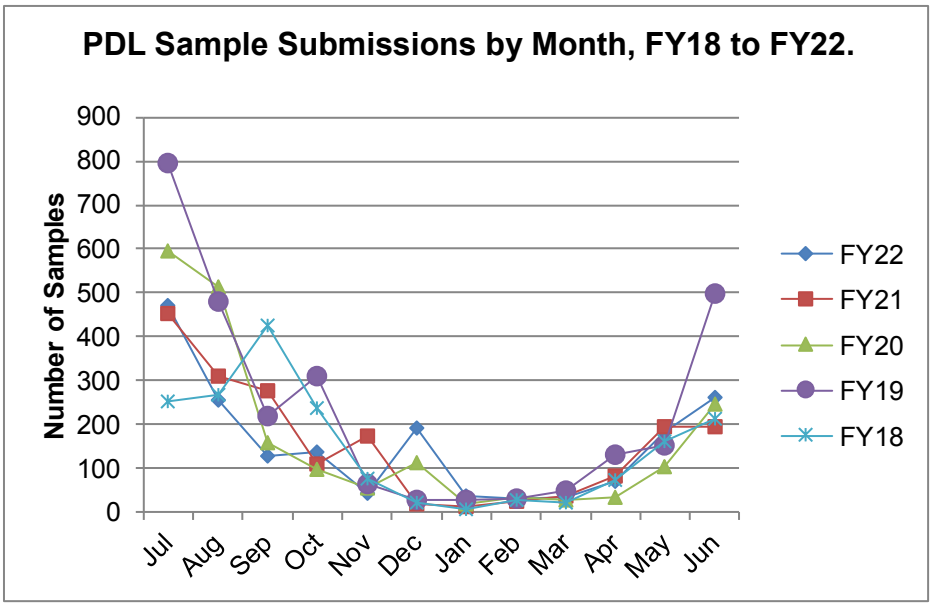
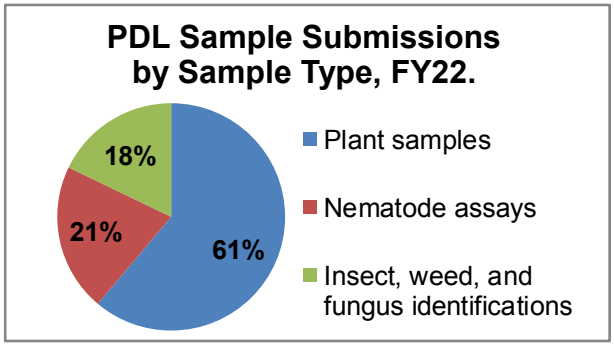


Table 1. PDL sample submissions by month, FY18 to FY22.

Month	FY18	FY19	FY20	FY21	FY22
July	252	795	596	451	471
August	266	481	513	308	254
September	424	219	156	276	126
October	236	309	96	107	136
November	74	62	52	171	41
December	20	27	112	16	190
January	6	25	18	11	34
February	25	29	32	22	29
March	21	46	27	36	33
April	71	131	33	82	68
May	161	152	103	193	180
June	212	497	246	192	260
Total	1768	2773	1984	1865	1822

Figure 2.



In Figure 3, samples submitted to the laboratory are presented by origin. In FY22, 85% of the plant submissions were from commercial clientele, 10% were from residential clientele, and 5% 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 FY22, 93% of samples submitted for plant or insect identification were from commercial clients, 7% were residential in origin, and 0% (0 samples) were from research (Figure 3). Household or nuisance pests are the primary issues of concern for residential clients.

Of the nematode assays submitted, 94% of the samples were from commercial clients, with 6% (24 samples) from research, and 0% (0 samples) from residential clientele. We expect that the number of nematode samples submitted from residential clients 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 (86%) 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 advertise 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 FY22 were submitted to the laboratory through the Rutgers Fruit IPM program from blueberry growers. Golf turf represents most of the nematode samples from turfgrass clientele. 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.

Figure 3.

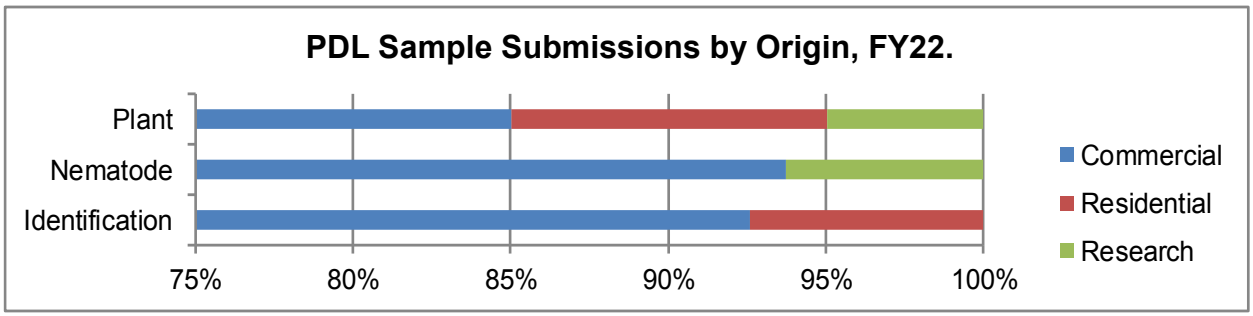


Figure 4.

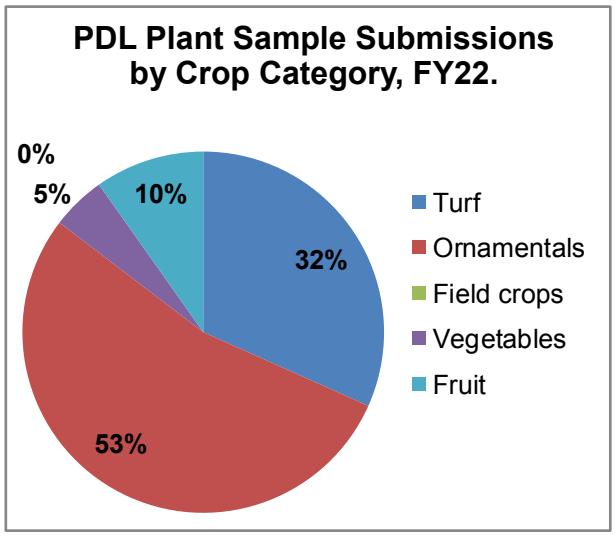
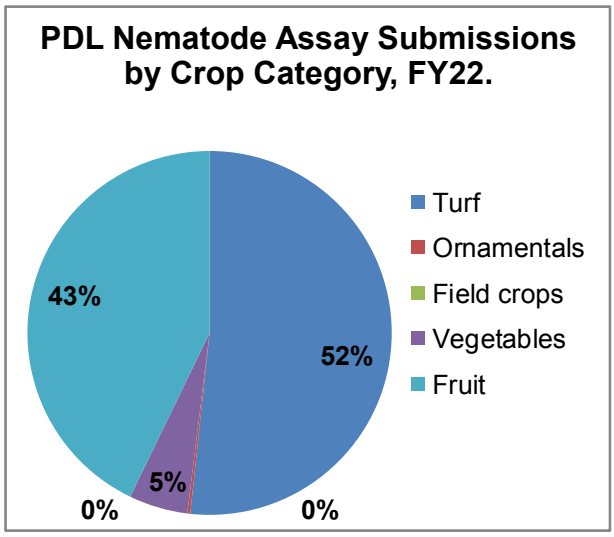


Figure 5.

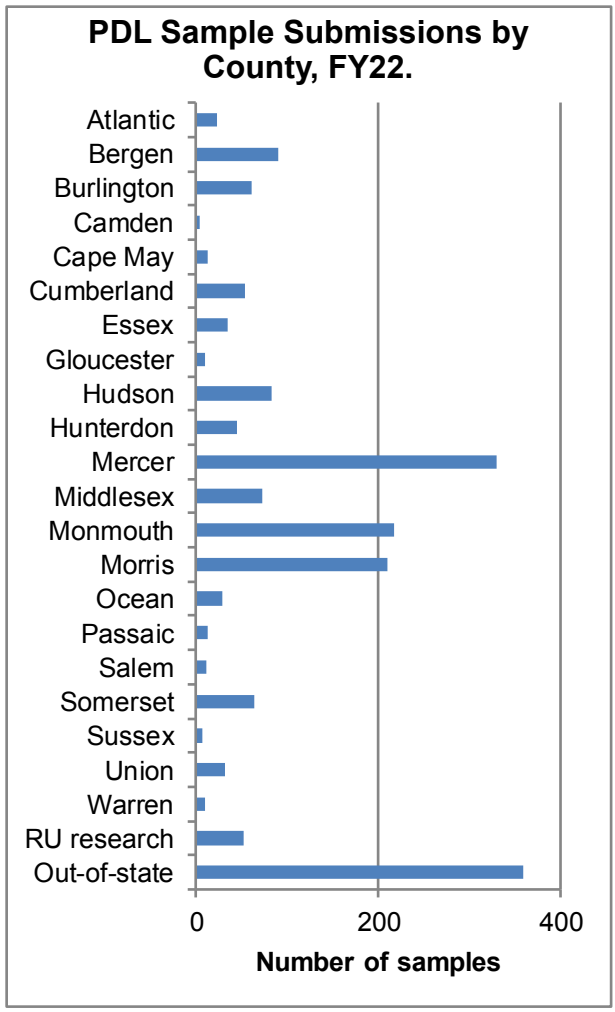


Samples were submitted to the PDL from all counties in New Jersey (Figure 6). The majority of samples, however, were submitted from counties in close proximity to the laboratory. The probable explanation for this is that many citizens in central New Jersey contact Rutgers University directly for assistance 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 20% of the samples submitted for diagnosis to the laboratory were from out-of-state. The percent of out-of-state samples remained the same from the previous FY21. Of particular note, 46% of all turf samples were from out-of-state. Golf turf samples were submitted to the laboratory from 18 states in FY22. Turf samples were received from states as far away as Arizona, California, Colorado, Connecticut, Delaware, Idaho, Kentucky, Massachusetts, Maryland, Nevada, New York, Ohio, Pennsylvania, Texas, Utah, Virginia, and Wyoming. New York and Pennsylvania provided the largest number of out-of-state samples.

Many golf turf professionals at other universities refer their clients to Rutgers for second opinions or when they are on leave. Dr. John Inguagiato at the University of Connecticut and Dr.

Figure 6.



Paul Vincelli at the University of Kentucky, both Rutgers graduates, refer clients to 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 2,700 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, 34% 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 23% of the laboratory diagnoses. Insect pest damage was diagnosed on 4% of the submissions. Identifications comprised 18% of the total number of samples submitted; of these, 17% (305) were arthropods, 0% (7) fungi, and 1% (13) were plants. Nematode detection accounted for the other 21% 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 nuisance 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 decreased in FY22 because the number of trap catch samples from the

Table 2. PDL sample submissions by county, FY18 to FY22.

In-state	FY18	FY19	FY20	FY21	FY22
Atlantic	39	73	61	24	23
Bergen	65	88	67	70	90
Burlington	51	68	75	77	61
Camden	10	32	11	10	4
Cape May	9	13	7	5	12
Cumberland	71	86	33	54	54
Essex	17	17	24	16	34
Gloucester	23	62	12	22	10
Hudson	19	9	32	33	83
Hunterdon	32	60	22	20	45
Mercer	358	875	585	449	330
Middlesex	82	62	51	42	73
Monmouth	249	263	164	200	218
Morris	159	197	234	216	210
Ocean	53	50	39	33	28
Passaic	23	27	20	24	13
Salem	51	85	32	2	11
Somerset	15	115	91	56	64
Sussex	98	16	14	8	6
Union	2	53	25	27	32
Warren	25	14	17	8	9
RU research	11	83	60	91	52
In-state total	1462	2348	1676	1487	1462
Out-of-state	306	425	308	378	360
Total	1768	2773	1984	1865	1822

Figure 7.

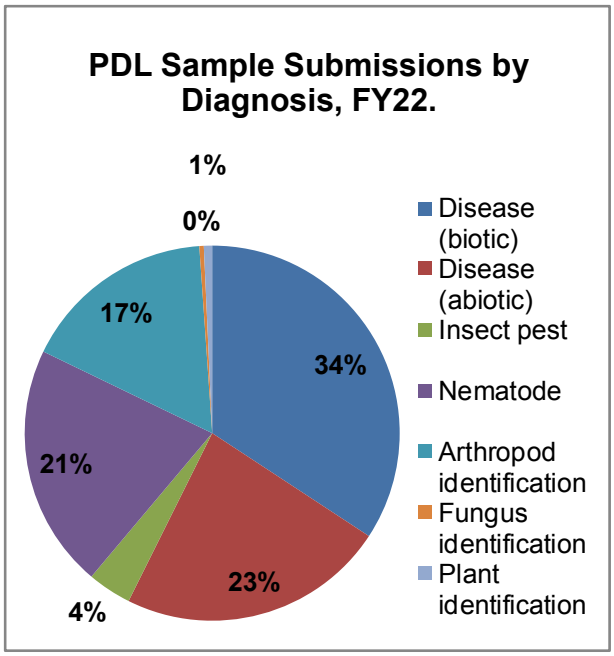
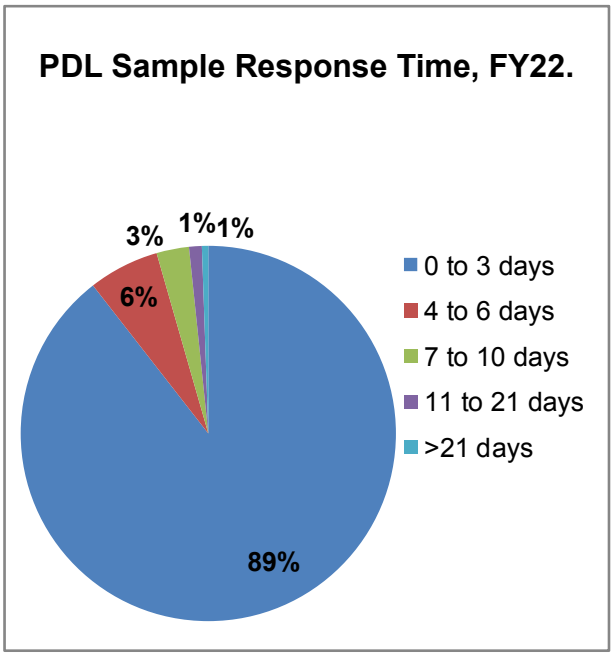


Figure 8.



state's CAPS and NJ State Forestry Services programs decreased (-133).

Fungal identification is also a popular service for the laboratory. Samples from mold-infested houses remained steady in FY22. 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 FY22, a laboratory response was prepared in less than three days for most (89%) of the samples submitted (Figure 8), and 95% of our clients received a response in less than a week. A number of the samples (30) 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.

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 RCE, SEBS/NJAES, 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 FY22. These courses included: The Golf Turf Management School: Three Week Preparatory 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 29th year for this one-day program. Mr. Buckley also coordi-

nated and taught the Advanced Topics in Professional Grounds Maintenance: Turf Disease Short Course. This was the 24th time he planned and coordinated that short course.

Mr. Buckley was an invited speaker in several RCE programs. Lectures were given in support of the Essex, Hunterdon, Monmouth, Morris, Ocean, and Passaic Counties. He also participated in the Certified Gardener Training Program in Gloucester County.

Mr. Buckley participated as a guest speaker in one undergraduate course at Rutgers: Weeds, Diseases, and Insects of Plants (11:776:391).

Mr. Buckley was also an invited speaker for: TurfNet RADIO—Turfgrass Hotline NE; Sentinel Plant Network Training Program: Northeast and Southeast Regions; Rutgers Turfgrass Research Field Day; SnyRG Fall Meeting; SiteOne University; Harrell's Northeast Turf Symposium; New Jersey Green Expo—Turf and Landscape Conference; International Society of Arboriculture of PA/DE/NJ Pest Bull Session; North Jersey Ornamental Horticulture Conference—Landscape Day; NJ Chapter of the American Society of Landscape Architects Annual Meeting; New Jersey Nursery and Landscape Association—Total Pro Expo and Conference; New Jersey Vegetable Growers Association—NJ Agricultural Convention and Trade Show; Nassau Suffolk Landscape Grounds Association—Winter Seminar; New Jersey Landscape Contractors Association—Annual Tradeshow and Conference; New Jersey Chapter of the International Society of Arboriculture—Garden State Tree Conference; Penn State Professional Pest Managers School; Long Island Golf Course Superintendents Association—Winter Education Webinar; New York State Turf and Landscape Association; Morris Arboretum School of Arboriculture; and Licensed Tree Expert Prep Course.

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 OCPE program in which she participated was the Pest Management in Land-scape Turf Short Course.

Ms. Tirpak also presented programs in support of the Essex, Monmouth, Morris, and Ocean, County Master Gardener Programs.

Ms. Tirpak participated as a guest speaker in one undergraduate course at Rutgers: Weeds, Diseases, and Insects of Plants (11:776:391).

Ms. Tirpak was also an invited speaker for: Somerset County Library System Webinar Series; Jersey-Friendly Yards Webinar Series; New Jersey Green Expo—Turf and Landscape Conference;

Extension Publications

Mr. Buckley is a contributor 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. Mr. Buckley and Ms. Tirpak wrote brief posts on the disease and insect pests problems submitted to the laboratory. The Plant Diagnostic Laboratory's PPA blog posts can be found at plant-pest-advisory.rutgers.edu/category/plant-diagnostic-lab.

- 12/22/21 - *Beech Leaf Disease in New Jersey*
- 05/12/22 - *Spring (and Summer) Leaf Spot Diseases in Lawns and Sports Turf.*
- 05/17/22 - *Leaf Spot and Melting Out……of Pachysandra?*

Two of these posts were are also published as articles in green industry newsletters:

Buckley RJ, Tirpak S. (2022, January 31). Beech Leaf Disease in New Jersey. *The New Jersey Landscape Contractor, Winter 2021-2022,* pages 58-59, https://issuu.com/njlca/docs/njlcamag-jan22e

Buckley RJ. (2022, June 08) Spring (and Summer) Leaf Spot Diseases in Lawns and Sports Turf. *New Jersey Turfgrass Association Clippings, Vol. 109 (Issue 2 2022),* pages 21-22, https://issuu.com/cecepeabody/docs/clippings_issue22022_060822

In collaborations with other Rutgers research and extension faculty and staff, Mr. Buckley made a first report for powdery mildew in industrial hemp in New Jersey (Appendix 4):

Rajmohan N, Price D, Buckley R, Komar SJ, Bamka WJ, Petit EA, Cabrera RI, Gianfagna T, Simon JE, Wyenandt CA. First report of Powdery Mildew Caused by *Golovinomyces ambrosiae* on Industrial Hemp in New Jersey. *Plant Disease*. 2022 Feb 7. doi: 10.1094/PDIS-12-21-2657-PDN. Epub ahead of print. PMID: 35130039.

Service

The PDL staff provided tours of the Ralph Geiger Turfgrass Education Center and the Plant Diagnostic Laboratory to numerous groups in FY22.

Mr. Buckley is a member of the newly formed Nursery Working Group initiated by Dr. Timothy Waller, County Agent from RCE of Cumberland County.

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. They are also members of the Forest, Landscape, and Agriculture Pest Roundtable (FLAPR) organized by the Rutgers Urban Forestry Program of NJAES. Universities, natural resource protection organizations, and industry groups are also partners of both groups.

Marketing

Laboratory services are advertised at grower meetings or other green industry events. Table-top and banner display units are used to advertise Soil Testing Laboratory and Plant Diagnostic Laboratory services. Staff from both the Soil Testing Laboratory and Plant Diagnostic Laboratory regularly attends and staffs a booth to explain laboratory services and sell soil test kits.

Over the years, this marketing initiative has brought the display to the following programs: The Great Tomato Tasting; New Jersey Green Expo Turf and Landscape Conference; Frelinghuysen Arboretum's Community Garden Conference; Rutgers Home Gardeners School; Rutgers Gardens Summerfest; New Jersey Nursery and Landscape Association NJ Plants Show - Professional Landscape and Nursery Tradeshow; and the Rutgers Turf Field Days.

Income

The PDL is expected to recover all costs and be self-supporting. Laboratory clientele are charged a nominal fee for diagnostic and testing services as well as for educational activities. Grant activity and cost-sharing arrangements also provide some degree of funding. In the spring of 2019, PDL staff convened a focus group of laboratory stakeholders to discuss the laboratory fee schedule. The group consisted of golf course superintendents, lawn and landscape professionals, academic advisors, and chemical industry representatives. The group review fees from similar labs from other states and agreed that prices were too low. The fee schedule was adjusted accordingly and the new fees were implemented immediately to zero complaints. This was the first fee increase since 2006. We agreed to reconvene the group every three years to review the changes and adjust according to market needs.

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. Internal transfer of funds was used to pay for the plant samples diagnosed for research programs at Rutgers University.

In FY22, $347,497.11 was generated from all PDL activities and covered 104% of all costs. A complete breakout of all revenues and expenses is included in Appendix 2 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 6 "no charge" samples in FY22. 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 FY23 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 FY23. 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 FY23 to cover increasing costs.

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 distribu-

tion 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 principal 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 FY22 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 provide the means to create modern educational resources for use in local and regional training programs. Grant monies received for FY23 will be used to continue to upgrade laboratory capability to handle pathogens of consequence and other biohazards; 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. With Ms. Rovin's retirement from Rutgers at the end of FY22, the tomato seed sale program will be discontinued in FY23 as of January 1, 2023. 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. The 'Rutgers 250' tomato seed variety was released for the 2016 growing season, coinciding with the 250th anniversary of Rutgers University, and a "Rediscover Jersey Strawberries" t-shirt was added for 2017. The 'Pumpkin' habanero pepper seeds were offered for sale to the public in 2018. A bicolor grape tomato variety, 'Scarlet Sunrise', was added to the seed sales in 2020. Through FY22, the PDL has processed 18,534 orders for 52,459 packets of seeds. The t-shirts are extremely popular also with over 1,877 sold. Orders continue to come into the laboratory almost daily.

Client Survey

Beginning in January of 2021 a client satisfaction survey was included with each emailed sample report. Survey data and comments are currently being collected to assist laboratory staff in evaluating the impact of our work. Survey responses collected during FY22 (93 responses) are included in Appendix 5 of this report. We anticipate reporting additional results in this publication for FY23 as the data set increases in size.

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	$50
Out-of-state	$100

FINE AND SPORTS TURF

In-state	
Disease/insect diagnosis	$100
Disease/insect diagnosis & nematode assay*	$150
Out-of-state	
Disease/insect diagnosis	$120
Disease/insect diagnosis & nematode assay*	$200

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

NEMATODE ASSAY

In-state (except fine turf)	$50
In-state fine turf	$75
Out-of-state	$100

FUNGUS AND MOLD IDENTIFICATION

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

INSECT IDENTIFICATION

In-state	$50
Out-of-state	$100

PLANT AND WEED IDENTIFICATION

In-state	$50
Out-of-state	$100

SPECIAL TESTS AND SERVICES*

Endophyte screening

Fungicide resistance testing

Pesticide residue and contaminant testing

Site consultation

Speaker request

Virus testing

***Please call ahead to discuss available tests, fees, and specifics.**

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

Appendix 2. Plant Diagnostic Laboratory Budget

Table A2.1. Expenses, PDL-FY22.

Salaries and benefits (full and part time staff)	$306,647.26
Supplies and services	
Diagnostic and testing supplies	
Printing and marketing	
References	
Equipment maintenance	
Office supplies	
Credit card fees	$21,690.28
Communications	
Telephone/fax	
Postage	$2,198.98
Travel	
Paid talks and professional meetings	$4,452.19
Total operating costs	$334,988.71

Table A2.2. Income, PDL-FY22.

Sample fees	$94,979.85
Lecture fees	
OCPE and other honorarium	$42,858.96
Grants and contracts	
NPDN	$25,000.00
IPM	$38,542.12
Other	
Salaries (NJAES/SEBS)	$146,116.18
Total actual income	$347,497.11

Table A2.3. Estimated expenses, PDL-FY23.

Salary and benefit costs	$310,000.00
Supplies and services	$10,000.00
Communications, marketing and travel	$5,000.00
Total potential cost FY23	$325,000.00

Table A2.4. Estimated income, PDL-FY23.

Plant Health Samples	
2000 @ $55 average fee per sample	$110,000.00
Lecture fees	
OCPE and other honoraria	$25,000.00
Cost recovery	
Grant and contracts	$60,000.00
Salaries (NJAES/SEBS)	$150,000.00
Total potential income FY23	$345,000.00

Appendix 3.
Table A3.1. Complete listing of lectures presented by Richard J. Buckley, PDL Director, FY22.

Date	Title	Audience	Location	Par-ticipants[1]
07/12/21	Introduction to the NPDN (0.5hr)	Sentinel Plant Network Training Program: Northeast	online	L
07/12/21	How to Submit a Plant Sample to a Diagnostic Lab (0.5hr)	Sentinel Plant Network Training Program: Northeast	online	L
07/14/21	The Art of the Diagnosis (1hr)	Sentinel Plant Network Training Program: Northeast	online	L
07/20/21	RUPDL Golf Turf Update (0.5hr)	Turfnet Radio - Turfgrass Hotline Northeast	online	I,L,T
08/16/21	Introduction to the NPDN (0.5hr)	Sentinel Plant Network Training Program: Southeast	online	L
08/16/21	How to Submit a Plant Sample to a Diagnostic Lab (0.5hr)	Sentinel Plant Network Training Program: Southeast	online	L
08/18/21	The Art of the Diagnosis (1hr)	Sentinel Plant Network Training Program: Southeast	online	L
08/28/21	How to Submit a Plant Sample to a Diagnostic Lab (0.5hr)	Rutgers Turfgrass Research Field Day	Cook Campus	I,L,T
09/27/21	Basic Diagnostics in the Nursery	SynRG Fall Meeting	Bridgeton, NJ	H
10/04/21	#1. Principles of Pest Management: Introduction to Integrated Pest Management (1.5hr)	Professional Golf Turf Management School	online	T
10/04/21	#1. Turf Diseases. Turf Diseases: Principles of Plant Pathology (2hr)	Professional Golf Turf Management School	online	T
10/05/21	#1. Diseases and Insect Pests of Ornamentals: Abiotic Stress in Trees (2hr)	Professional Golf Turf Management School	online	T
10/05/21	#1: Insects in Fine Turf: Introduction to Entomology; Insect Structure and Function (1.5hr)	Professional Golf Turf Management School	online	T
10/11/21	#2. Principles of Pest Management: IPM Basics: Considerations for Setting up a Program (1.5hr)	Professional Golf Turf Management School	online	T
10/11/21	#2. Turf Diseases: Introduction to Mycology and Fungal Structures (2hr)	Professional Golf Turf Management School	online	T
10/12/21	#2. Diseases and Insect Pests of Ornamentals: Scouting Tips for Landscapes; Pesticide Review (2hr)	Professional Golf Turf Management School	online	T
10/12/21	#2. Insects in Fine Turf: Insect Classification; Orders (1.5hr)	Professional Golf Turf Management School	online	T
10/18/21	#3. Principles of Pest Management: Principles of Insect Pest and Disease Control (1.5hr)	Professional Golf Turf Management School	online	T
10/18/21	#3. Turf Diseases: The Red Thread Syndrome; Snow Molds (2hr)	Professional Golf Turf Management School	online	T

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

Date	Title	Audience	Location	Par-ticipants[1]
10/19/21	#3. Diseases and Insect Pests of Ornamentals: New Plant Pathogens: Bacteria, Phytoplasma, Virus, Parasitic Plants (2hr)	Professional Golf Turf Management School	online	T
10/19/21	#3. Insects in Fine Turf: Insect Growth and Development; Insect Behavior (1.5hr)	Professional Golf Turf Management School	online	T
10/20/21	Diagnostic Tips for the Problem Lawn (1hr)	Emergency Pesticide Recertification Short Course	online	I,L,T
10/21/21	Basic Turf Diseases (3hr)	Emergency Pesticide Recertification Short Course	online	I,L,T
10/25/21	#4. Principles of Pest Management: Cultural Control (1.5hr)	Professional Golf Turf Management School	online	T
10/25/21	#4. Turf Diseases: Diseases Caused by Algae and Other Related Organisms; Slime Molds (2hr)	Professional Golf Turf Management School	online	T
10/26/21	Basic Plant Pathology and the Art of the Diagnosis (2.5hr)	Master Gardener Training Program	Hunterdon County	H
10/26/21	#4. Diseases and Insect Pests of Ornamentals: Leaf Spots, Anthracnose, and Stem Diseases (2hr)	Professional Golf Turf Management School	online	T
10/26/21	#4. Insects in Fine Turf: IPM Basics: A Review of Scouting Techniques and Insecticides (1.5hr)	Professional Golf Turf Management School	online	T
10/27/21	Advanced Turf Disease Workshop (3hr)	Advanced Turf Disease Short Course	online	I,L,T
10/28/21	Advanced Turf Disease Workshop (3hr)	Advanced Turf Disease Short Course	online	I,L,T
11/01/21	#5. Principles of Pest Management: Fungicide Selection and Use (1.5hr)	Professional Golf Turf Management School	online	T
11/01/21	#5. Turf Diseases: Diseases Caused by Species of the Fungus Rhizoctonia; Fairy Ring (2hr)	Professional Golf Turf Management School	online	T
11/02/21	#5. Diseases and Insect Pests of Ornamentals: Root Rots and Vascular Wilt Diseases (2hr)	Professional Golf Turf Management School	online	T
11/02/21	#5. Insects in Fine Turf: Nematodes (1.5hr)	Professional Golf Turf Management School	online	T
11/05/21	Basic Plant Pathology and the Art of the Diagnosis (2.5hr)	Master Gardener Training Program - North Jersey	online	H
11/08/21	#6. Principles of Pest Management: Fungicide Selection and Use (1.5hr)	Professional Golf Turf Management School	online	T
11/08/21	#6. Turf Diseases: Root-infecting Patch Diseases (2hr)	Professional Golf Turf Management School	online	T
11/09/21	#6. Diseases and Insect Pests of Ornamentals: Rusts, Mildews, and Molds; Mites (2hr)	Professional Golf Turf Management School	online	T
11/09/21	#6. Insects in Fine Turf: Coleoptera--Scarabs: The White Grub Complex (1.5hr)	Professional Golf Turf Management School	online	T
11/15/21	#7. Principles of Pest Management: Insecticide Selection and Use (1.5hr)	Professional Golf Turf Management School	online	T

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

Date	Title	Audience	Location	Par-ticipants[1]
11/15/21	#7. Turf Diseases: Anthracnose; “Helminthosporium” Leaf Spots (2hr)	Professional Golf Turf Management School	online	T
11/16/21	#7. Diseases and Insect Pests of Ornamentals: Suckers: Scale, Bugs, Hoppers, and Plant Lice (2hr)	Professional Golf Turf Management School	online	T
11/16/21	#7. Insects in Fine Turf: Coleoptera--Weevils: Annual Bluegrass Weevil; Billbugs (1.5hr)	Professional Golf Turf Management School	online	T
11/22/21	#8. Principles of Pest Management: The Least Toxic Alternative (1.5hr)	Professional Golf Turf Management School	online	T
11/22/21	#8. Turf Diseases: Dollar Spot; Gray Leaf Spot (2hr)	Professional Golf Turf Management School	online	T
11/23/21	#8. Diseases and Insect Pests of Ornamentals: Borers: Round-headed and Flat-headed Borers; Gall Makers and Miners (2hr)	Professional Golf Turf Management School	online	T
11/23/21	#8. Insects in Fine Turf: Lepidoptera: Armyworms, Cutworms, and Sod Webworms (1.5hr)	Professional Golf Turf Management School	online	T
11/29/21	#9. Principles of Pest Management: Commercial Biocontrol and Biocontrol Concepts (1.5hr)	Professional Golf Turf Management School	online	T
11/29/21	#9. Turf Diseases: Rust, Smut, Mildews and Other Minor Leaf Blighting Diseases (2hr)	Professional Golf Turf Management School	online	T
11/30/21	Diagnostic Tips for the Problem Lawn (1hr)	SiteOne University: National	online	C,I,H,G L,N,T
11/30/21	Cultural Control of Turf Diseases (1hr)	SiteOne University: National	online	C,I,H,G L,N,T
12/01/21	30 Years of the Rutgers Plant Diagnostic Lab: 2021 in Perspective (1hr)	Harrell's Northeast Turf Symposium	online	I,L,T
12/01/21	#9. Diseases and Insect Pests of Ornamentals: Borers: Weevils, Bark Beetles, and Clear-winged Moths (2hr)	Professional Golf Turf Management School	online	T
12/01/21	#9. Insects in Fine Turf: Hemiptera: Chinch Bugs; Ground Pearls (1.5hr)	Professional Golf Turf Management School	online	T
12/01/21	#10. Principles of Pest Management: Scouting Your Golf Course (1.5hr)	Professional Golf Turf Management School	online	T
12/06/21	#10. Turf Diseases: Abiotic Stress in Turfgrass (2hr)	Professional Golf Turf Management School	online	T
12/07/21	30 Years of the Rutgers Plant Diagnostic Lab: 2021 in Perspective (0.5hr)	New Jersey Green Expo - Turf and Landscape Conference	Atlantic City, NJ	I,L,T
12/07/21	Boxwood Blight Update (0.5hr)	New Jersey Green Expo - Turf and Landscape Conference	Atlantic City, NJ	I,L,T

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

Date	Title	Audience	Location	Par-ticipants[1]
12/07/21	Disease and Insects of Beech (0.5hr)	New Jersey Green Expo - Turf and Landscape Conference	Atlantic City, NJ	I,L,T
12/07/21	#10. Insects in Fine Turf: Regional Concerns: Mole Crickets and Crane Flies (1.5hr)	Professional Golf Turf Management School	online	T
12/07/21	#10. Diseases and Insect Pests of Ornamentals: Leaf Feeders: Lepids, Sawfly, and Weevils (2hr)	Professional Golf Turf Management School	online	T
12/08/21	Diagnostic Tips for the Problem Lawn (1hr)	New Jersey Green Expo - Turf and Landscape Conference	Atlantic City, NJ	I,L,T
12/09/21	Not Your Average Disease: Atypical Plant Pathogens in the Landscape (1.5hr)	New Jersey Green Expo - Turf and Landscape Conference	Atlantic City, NJ	I,L,T
12/09/21	Basic Turf Disease: Pick Your Best Defense (2hr)	New Jersey Green Expo - Turf and Landscape Conference	Atlantic City, NJ	I,L,T
12/16/21	Pest Bull Session: Diseases of Shade Trees (2hr)	ISA of PA-DE-NJ	Philadelphia, PA	A
01/10/22	#1. Principles of Pest Management: Introduction to Integrated Pest Management (1.5hr)	Professional Golf Turf Management School	online	T
01/10/22	#1. Diseases and Insect Pests of Ornamentals: Abiotic Stress in Trees (2hr)	Professional Golf Turf Management School	online	T
01/11/22	#1. Turf Diseases. Turf Diseases: Principles of Plant Pathology (2hr)	Professional Golf Turf Management School	online	T
01/11/22	#1: Insects in Fine Turf: Introduction to Entomology; Insect Structure and Function (1.5hr)	Professional Golf Turf Management School	online	T
01/12/22	Pest Update (1hr)	North Jersey Ornamental Horticulture Conference: Landscape Day	Morristown, NJ	L,T
01/17/22	#2. Principles of Pest Management: IPM Basics: Considerations for Setting up a Program (1.5hr)	Professional Golf Turf Management School	online	T
01/17/22	#2. Diseases and Insect Pests of Ornamentals: Scouting Tips for Landscapes; Pesticide Review (2hr)	Professional Golf Turf Management School	online	T
01/18/22	31 Years of the Plant Diagnostic Lab at Rutgers: Trends in Turf Disease Diagnosis (1hr)	SiteOne University: Carolinas	online	I,L,T
01/18/22	Root Infecting Patch Diseases (1hr) ONLINE	SiteOne University: Carolinas	online	I,L,T
01/19/22	The Complete Turf Disease for Golf Courses (2hr)	Professional Golf Turf Management School: Three Week Course	online	T
01/19/22	31 Years of the Plant Diagnostic Lab at Rutgers: Trends in Turf Disease Diagnosis (1hr)	SiteOne University: West	online	I,L,T
01/19/22	Diagnostic Tips for the Problem Lawn (1hr) ONLINE	SiteOne University: West	online	I,L,T
01/20/22	The Complete Turf Disease for Golf Courses (2hr)	Professional Golf Turf Management School: Three Week Course	online	T

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

Date	Title	Audience	Location	Par-ticipants[1]
01/24/22	#3. Principles of Pest Management: Principles of Insect Pest and Disease Control (1.5hr)	Professional Golf Turf Management School	online	T
01/24/22	#3. Diseases and Insect Pests of Ornamentals: New Plant Pathogens: Bacteria, Phytoplasma, Virus, Parasitic Plants (2hr)	Professional Golf Turf Management School	online	T
01/25/22	#3. Turf Diseases: The Red Thread Syndrome; Snow Molds (2hr)	Professional Golf Turf Management School	online	T
01/25/22	#3. Insects in Fine Turf: Insect Growth and Development; Insect Behavior (1.5hr)	Professional Golf Turf Management School	online	T
01/25/22	Diagnostic Tips for the Problem Lawn (1hr)	SiteOne University: Mid-Atlantic	online	I,L,T
01/26/22	The Complete Turf Disease for Golf Courses (1.5hr)	Professional Golf Turf Management School: Three Week Course	online	T
01/30/22	Plants I Love To Hate (1hr)	NJASLA Annual Meeting	Atlantic City, NJ	A,L
01/31/22	#4. Principles of Pest Management: Cultural Control (1.5hr)	Professional Golf Turf Management School	online	T
01/31/22	#4. Diseases and Insect Pests of Ornamentals: Leaf Spots, Anthracnose, and Stem Diseases (2hr)	Professional Golf Turf Management School	online	T
02/01/22	#4. Turf Diseases: Diseases Caused by Algae and Other Related Organisms; Slime Molds (2hr)	Professional Golf Turf Management School	online	T
02/01/22	#4. Insects in Fine Turf: IPM Basics: A Review of Scouting Techniques and Insecticides (1.5hr)	Professional Golf Turf Management School	online	T
02/02/22	Diagnostic Tips for the Landscape and Nursery (1hr)	New Jersey Nursery and Landscape Association: Total Pro Expo and Conference	Edison, NJ	A,I,L N,T
02/03/22	Basic Lawn Care (3hr)	Master Gardener Training Program	Ocean County	H
02/07/22	#5. Principles of Pest Management: Fungicide Selection and Use (1.5hr)	Professional Golf Turf Management School	online	T
02/07/22	#5. Diseases and Insect Pests of Ornamentals: Root Rots and Vascular Wilt Diseases (2hr)	Professional Golf Turf Management School	online	T
02/08/22	#5. Turf Diseases: Diseases Caused by Species of the Fungus Rhizoctonia; Fairy Ring (2hr)	Professional Golf Turf Management School	online	T
02/08/22	#5. Insects in Fine Turf: Nematodes (1.5hr)	Professional Golf Turf Management School	online	T
02/08/22	Diagnostic Tips for the Landscape and Nursery (0.5hr)	NJ Vegetable Growers Association: NJ Agricultural Convention and Trade Show	Atlantic City, NJ	F
02/09/22	Diagnostic Tips for the Problem Lawn (1hr)	SiteOne University	online	I,L,T
02/09/22	Root Infecting Patch Diseases (1hr)	SiteOne University	online	I,L,T
02/14/22	#6. Principles of Pest Management: Fungicide Selection and Use (1.5hr)	Professional Golf Turf Management School	online	T

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

Date	Title	Audience	Location	Par-ticipants[1]
02/14/22	#6. Diseases and Insect Pests of Ornamentals: Rusts, Mildews, and Molds; Mites(2hr)	Professional Golf Turf Management School	online	T
02/15/22	#6. Turf Diseases: Root-infecting Patch Diseases (2hr)	Professional Golf Turf Management School	online	T
02/15/22	#6. Insects in Fine Turf: Coleoptera--Scarabs: The White Grub Complex (1.5hr)	Professional Golf Turf Management School	online	T
02/16/22	31 Years of the Plant Diagnostic Lab at Rutgers: Trends in Turf Disease Diagnosis (1hr)	SiteOne University	online	I,L,T
02/16/22	Diagnostic Tips for the Problem Lawn (1hr)	SiteOne University	online	I,L,T
02/18/22	Basic Turf Disease: Pick Your Best Defense (3hr)	Nassau Suffolk Landscape Grounds Association: Winter Seminar	Oyster Bay, NY	I,L,T
02/21/22	#7. Principles of Pest Management: Insecticide Selection and Use (1.5hr)	Professional Golf Turf Management School	online	T
02/21/22	#7. Turf Diseases: Anthracnose; “Helminthosporium” Leaf Spots (2hr)	Professional Golf Turf Management School	online	T
02/22/22	#7. Insects in Fine Turf: Coleoptera--Weevils: Annual Bluegrass Weevil; Billbugs (1.5hr)	Professional Golf Turf Management School	online	T
02/22/22	#7. Diseases and Insect Pests of Ornamentals: Suckers: Scale, Bugs, Hoppers, and Plant Lice (2hr)	Professional Golf Turf Management School	online	T
02/23/22	Boxwoods: Now You See Them, Soon You Won't (1hr)	New Jersey Landscape Contractors Association: Annual Tradeshow and Conference	Secaucus, NJ	I,L,T
02/28/22	#8. Principles of Pest Management: The Least Toxic Alternative (1.5hr)	Professional Golf Turf Management School	online	T
02/28/22	#8. Turf Diseases: Dollar Spot; Gray Leaf Spot (2hr)	Professional Golf Turf Management School	online	T
03/01/22	#8. Insects in Fine Turf: Lepidoptera: Armyworms, Cutworms, and Sod Webworms (1.5hr)	Professional Golf Turf Management School	online	T
03/01/22	31 Years of the Plant Diagnostic Lab at Rutgers: Trends in Turf Disease Diagnosis (1hr)	SiteOne University	online	I,L,T
03/01/22	Diagnostic Tips for the Problem Lawn (1hr)	SiteOne University	online	I,L,T
03/04/22	Trees I Love To Hate (1hr)	NJAISA: Garden State Tree Conference	Atlantic City, NJ	A
03/07/22	Our Majestic Oaks and Their Achilles' Heel (1hr)	Penn State Professional Pest Managers School	East Earl, PA	A,L
03/07/22	#9. Principles of Pest Management: Commercial Biocontrol and Biocontrol Concepts (1.5hr)	Professional Golf Turf Management School	online	T
03/07/22	#9. Turf Diseases: Rust, Smut, Mildews and Other Minor Leaf Blighting Diseases (2hr)	Professional Golf Turf Management School	online	T
03/08/22	#9. Insects in Fine Turf: Hemiptera: Chinch Bugs; Ground Pearls (1.5hr)	Professional Golf Turf Management School	online	T

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

Date	Title	Audience	Location	Par-ticipants[1]
03/08/22	#9. Diseases and Insect Pests of Ornamentals: Borers: Weevils, Bark Beetles, and Clear-winged Moths (2hr)	Professional Golf Turf Management School	online	T
03/10/22	Boxwood Pests and Diseases (1.5hr)	Weeds, Diseases, and Insects of Plants (11:776:391:01)	Cook Campus	C
03/14/22	#10. Turf Diseases: Abiotic Stress in Turfgrass (2hr)	Professional Golf Turf Management School	online	T
03/14/22	#10. Insects in Fine Turf: Regional Concerns: Mole Crickets and Crane Flies (1.5hr)	Professional Golf Turf Management School	online	T
03/15/22	#10. Principles of Pest Management: Scouting Your Golf Course (1.5hr)	Professional Golf Turf Management School	online	T
03/15/22	#10. Diseases and Insect Pests of Ornamentals: Leaf Feeders: Lepids, Sawfly, and Weevils (2hr)	Professional Golf Turf Management School	online	T
03/15/22	2021 Dead Golf Turf Year in Review: The Diagnostician's Point of View (1.25hr)	Long Island Golf Course Superintendents Association: Winter Education Webinar	online	I,L,T
03/16/22	Managing Summer Patch of Sports and Landscape Turf (1hr)	New York State Turf and Landscape Association: Webinar	online	I,L,T
03/16/22	31 Years of the Plant Diagnostic Lab at Rutgers: Trends in Turf Disease Diagnosis (1hr)	SiteOne University	online	I,L,T
03/16/22	Diagnostic Tips for the Problem Lawn (1hr)	SiteOne University	online	I,L,T
03/28/22	White Grubs	Pest Management of Landscape Turf Short Course	Cook Campus	L,T
03/28/22	Turfgrass Diseases	Pest Management of Landscape Turf Short Course	Cook Campus	L,T
03/29/22	Basic Plant Pathology and the Art of Diagnosis (3hr)	Master Gardener Training Program	Ocean County	H
03/30/22	Basic Plant Pathology and the Art of Diagnosis (3hr)	Certified Gardener Training Program	Gloucester County	H
03/31/22	Ornamental Plant Pests (3hr)	Master Gardener Training Program	Ocean County	H
04/06/22	Insect Pests of Woody Ornamentals (6hr)	Morris Arboretum School of Arboriculture	Philadelphia, PA	A,L
04/07/22	Basic Plant Pathology and the Art of Diagnosis (3hr)	Master Gardener Training Program	Monmouth County	H
04/23/22	Basic Plant Pathology (1.25hr)	Licensed Tree Expert Prep Course	Cook Campus	A,L
04/23/22	ID, Life Cycle & Control Using IPM/PHC & Fungicides (2.25hr)	Licensed Tree Expert Prep Course	Cook Campus	A,L
04/27/22	Key Insect Pests in New Jersey Landscapes (3hr)	Master Gardener Training Program	Monmouth County	H
06/15/22	Plants I Love To Hate (1hr)	Master Gardener Training Program	Morris County	H

[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=Landscapers; N=Nursery Growers; S=State Officials; T=Turfgrass Managers; X=Christmas Tree Growers

Appendix 3.

Table A3.2. Complete listing of lectures presented by Sabrina Tirpak, PDL Principal Laboratory Technician, FY22.

Date	Title	Audience	Location	Par-ticipants[1]
07/06/21	Hornets, and Wasps, and Bees, Oh My! (1hr)	Somerset County Library System Webinar Series	online	H
10/12/21	Spiders--They Can Be Your Friends! (1hr)	Jersey Friendly Yards Webinar Series	online	H
10/13/21	#1. Turf Insect Laboratory - Structure and Function; Insect Orders (3hr)	Professional Golf Turf Management School	online	T
10/14/21	#1. Turf Disease Laboratory - Basic Mycology (3hr)	Professional Golf Turf Management School	online	T
10/27/21	#2. Turf Insect Laboratory - Metamorphosis and Behavior (3hr)	Professional Golf Turf Management School	online	T
10/28/21	#2. Turf Disease Laboratory - Introduction to Microscopy (3hr)	Professional Golf Turf Management School	online	T
11/10/21	#3. Turf Insect Laboratory - Nematodes (3hr)	Professional Golf Turf Management School	online	T
11/11/21	#3. Turf Disease Laboratory - Recognizing Signs Produced by Turf Pathogens, Part 1 (3hr)	Professional Golf Turf Management School	online	T
11/15/21	Introduction to Entomology (3hr)	Master Gardener Training - Morris County	online	H
11/18/21	#4. Turf Disease Laboratory - Recognizing Signs Produced by Turf Pathogens, Part 2 (3hr)	Professional Golf Turf Management School	online	T
11/19/21	Introduction to Entomology (3hr)	Master Gardener Training - Essex County	online	H
11/24/21	#4. Turf Insect Laboratory - White Grubs (3hr)	Professional Golf Turf Management School	online	T
11/30/21	#5. Turf Insect Laboratory - Using an Insect ID Key (3hr)	Professional Golf Turf Management School	online	T
12/02/21	#5. Turf Disease Laboratory - Recognizing Signs Produced by Turf Pathogens, Part 3 (3hr)	Professional Golf Turf Management School	online	T
12/08/21	Plant Diagnostic Lab Update (0.5hr)	New Jersey Green Expo - Turf and Landscape Conference	Atlantic City, NJ	I,L,T
12/08/21	What's Buggin' Your Boxwood? (0.5hr)	New Jersey Green Expo - Turf and Landscape Conference	Atlantic City, NJ	I,L,T
12/08/21	Spotlight on Spotted Lanternfly (0.5hr)	New Jersey Green Expo - Turf and Landscape Conference	Atlantic City, NJ	I,L,T
12/14/21	#6. Turf Disease Laboratory - Lab Final: Diagnose the Problem (1.5hr)	Professional Golf Turf Management School	online	T
12/15/21	#6. Turf Insect Laboratory - Lab Final: Identifying Common Insects in Turf (1.5hr)	Professional Golf Turf Management School	online	T
01/16/22	Hornets, and Wasps, and Bees, Oh My! (1hr)	Master Gardener Training - Monmouth County	online	H
01/16/22	#3. Turf Disease Laboratory - Recognizing Signs Produced by Turf Pathogens, Part 1 (3hr)	Professional Golf Turf Management School	online	T
01/17/22	#3. Turf Insect Laboratory - Nematodes (3hr)	Professional Golf Turf Management School	online	T
01/18/22	#2. Turf Diseases: Introduction to Mycology and Fungal Structures (2hr)	Professional Golf Turf Management School	online	T

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

Date	Title	Audience	Location	Par-ticipants[1]
01/18/22	#2. Insects in Fine Turf: Insect Classification; Orders (1.5hr)	Professional Golf Turf Management School	online	T
01/19/22	#1. Turf Disease Laboratory - Basic Mycology (3hr)	Professional Golf Turf Management School	online	T
01/20/22	#1. Turf Insect Laboratory - Structure and Function; Insect Orders (3hr)	Professional Golf Turf Management School	online	T
01/23/22	#4. Turf Disease Laboratory - Recognizing Signs Produced by Turf Pathogens, Part 2 (3hr)	Professional Golf Turf Management School	online	T
01/26/22	Household Insect Pests (3hr)	Master Gardener Training - Essex County	online	H
02/02/22	#2. Turf Disease Laboratory - Introduction to Microscopy (3hr)	Professional Golf Turf Management School	online	T
02/03/22	#2. Turf Insect Laboratory - Metamorphosis and Behavior (3hr)	Professional Golf Turf Management School	online	T
03/01/22	#8. Diseases and Insect Pests of Ornamentals: Borers: Round-headed and Flat-headed Borers; Gall Makers and Miners (2hr)	Professional Golf Turf Management School	online	T
03/03/22	#4. Turf Insect Laboratory - White Grubs (3hr)	Professional Golf Turf Management School	online	T
03/07/22	Rhododendron Diseases and Insect Pests (1.5)	Weeds, Diseases, and Insects of Plants (11:776:391:01)	Cook Campus	C
03/09/22	#5. Turf Disease Laboratory - Recognizing Signs Produced by Turf Pathogens, Part 3 (3hr)	Professional Golf Turf Management School	online	T
03/10/22	#5. Turf Insect Laboratory - Using an Insect ID Key (3hr)	Professional Golf Turf Management School	online	T
03/16/22	#6. Turf Disease Laboratory - Lab Final: Diagnose the Problem (1.5hr)	Professional Golf Turf Management School	online	T
03/17/22	#6. Turf Insect Laboratory - Lab Final: Identifying Common Insects in Turf (1.5hr)	Professional Golf Turf Management School	online	T
03/28/22	Leaf Feeding Insects in Landscape Turf (1hr)	Pest Management of Landscape Turf Short Course	Cook Campus	L,T
04/05/22	Household Insect Pests (3hr)	Master Gardener Training	Ocean County	H
04/12/22	Introduction to Entomology (3hr)	Master Gardener Training	Monmouth County	H
05/19/22	Household Insect Pests (3hr)	Master Gardener Training	Monmouth County	H

[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=Landscapers; N=Nursery Growers; S=State Officials; T=Turfgrass Managers; X=Christmas Tree Growers

Appendix 4. Disease Note.

Disease Note

Diseases Caused by Fungi and Fungus-Like Organisms

First Report of Powdery Mildew Caused by *Golovinomyces ambrosiae* on Industrial Hemp in New Jersey

Nimmi Rajmohan,[1] Dana C. Price,[2] Richard J. Buckley,[1] Stephen J. Komar,[3] William J. Bamka,[3] Eric A. Petit,[1] Raul I. Cabrera,[1,4] Thomas J. Gianfagna,[1] James E. Simon,[1] and Christian A. Wyenandt[1,4,†]

[1] Department of Plant Biology, Rutgers University, New Brunswick, NJ 08901
[2] Department of Entomology, Rutgers University, New Brunswick, NJ 08901
[3] Department of Agricultural and Natural Resources, Rutgers University, New Brunswick, NJ 08901
[4] Rutgers Agricultural Research and Extension Center (RAREC), Bridgeton, NJ 08302

Funding: Funds were provided by the New Jersey Agricultural Experiment Station, Rutgers Cooperative Extension and multi-state HATCH project (NJ12550). Plant Dis. 106:2534, 2022; published online as https://doi.org/10.1094/PDIS-12-21-2657-PDN. Accepted for publication 4 February 2022.

In December 2019, New Jersey became one of the first states to have its industrial hemp (*Cannabis sativa* L.) plan approved by the U.S. Department of Agriculture (USDA) following enactment of the 2018 Farm Bill that authorized the production of hemp. Following this approval, hemp was legally grown for the first time in 2020. During the growing seasons of 2020 and 2021, powdery mildew-like symptoms were observed during the summer months (Jun to Aug) in greenhouse hemp research and fall months (Aug to Oct) in field production plots on Rutgers Agricultural Experiment Station farms in southern and northern New Jersey. Symptoms were observed on leaves and stems of hemp cultivars 'CB Genius', 'Cherry Wine', and 'Bay Mist'. Symptoms initially appeared as small white patches of mycelia and conidia on the adaxial surface of leaves that gradually spread to entire leaves and stems. Leaf discoloration (e.g., chlorosis) and premature leaf drop were observed. More severe symptoms and damage were observed in the greenhouse than outdoor cultivation. A voucher specimen was deposited in the U.S. National Fungus Collections, USDA-ARS, Beltsville, MD (accession number 929187). Morphological examination of the white colonies from the cultivar Baymist was carried out using light microscopy and further characterized by sequencing. This isolate was labeled PMH2. Hyphae were septate, conidiophores were hyaline, unbranched, 130 to 240 µm in length, and produced one to four conidia in chains. Conidia were hyaline, ellipsoid to ovoid in shape, and 20 to 36 × 10 to 18 µm (n = 30). Oil-like drops were present within conidia, although no distinct fibrosin bodies were observed. Chasmothecia were not observed. Morphological observations were consistent with those of *Golovinomyces* spp. as described by Braun and Cook (2012). Morphological observations (conidiophore and conidial measurements) were also similar to the description of *G. ambrosiae* on hemp in Wiseman et al. (2021). Sequencing of the internal transcribed spacer (ITS), large ribosomal subunit (28S), intergenic spacer (IGS), beta-tubulin (TUB2), and chitin synthase 1 (CHS1) regions was carried out with the primer sets ITS5/ITS4, LSU1/LSU2, IGS-12a/NS1R, TubF1/TubR1, and gCS1a1/gCS1b, respectively, as shown by Qiu et al. (2020). Maximum-likelihood phylogenetic analysis confirmed the grouping of the PMH2 isolate within the *G. ambrosiae* accessions. Each individual gene alignment was treated as a separate partition. Sequences were not concatenated for maximum-likelihood phylogenetic analysis. Sequence data were deposited in GenBank under the accessions OK626453 (ITS), OK626454 (28S), OL456201 (IGS), OL415512 (TUB2), and OL415513 (CHS1). To fulfill Koch's postulates, two mature, potted plants of *C. sativa* cv. 'Alpha Explorer' were inoculated by gently pressing symptomatic hemp leaves onto their leaf surface. They were incubated in an indoor grow room at 23°C and relative humidity of 50%. Non-inoculated healthy plants of Alpha Explorer served as a control. Inoculated plants developed powdery mildew symptoms within 10 to 12 days, while all control plants were asymptomatic. The powdery mildew on inoculated plants was found to be morphologically similar to the original. *G. ambrosiae* has been reported on *C. sativa* in Oregon (Wiseman et al. 2021) and *G. ambrosiae* (as *G. spadiceus*) has been reported on *Cannabis* in Kentucky (Szarka et al. 2019), Ohio (Farinas and Hand 2020), and New York (Weldon et al. 2020). This is the first known report of *Golovinomyces ambrosiae* causing powdery mildew on hemp in New Jersey. With the December 15, 2021, opening of cultivation licensing and retailing of recreational marijuana, the acreage of hemp production in New Jersey is expected to significantly increase, particularly for greenhouse production. It is important to document the species to develop management strategies to control this disease.

References:

Braun, U., and Cook, R. T. A. 2012. Taxonomic Manual of the Erysiphales (Powdery Mildews). CBS Biodiversity Series No. 11. CBS, Utrecht, the Netherlands.
Farinas, C., and Hand, F. P. 2020. Plant Dis. 104:2727.
Nguyen, L. T., et al. 2015. Mol. Biol. Evol. 32:268.
Qiu, P. L., et al. 2020. BMC Microbiol. 20:51.
Szarka, D., et al. 2019. Plant Dis. 102:1773.
Weldon, W. A., et al. 2020. Plant Health Prog. 21:47.
Wiseman, M. S., et al. 2021. Plant Dis. 105:2733.

The author(s) declare no conflict of interest.

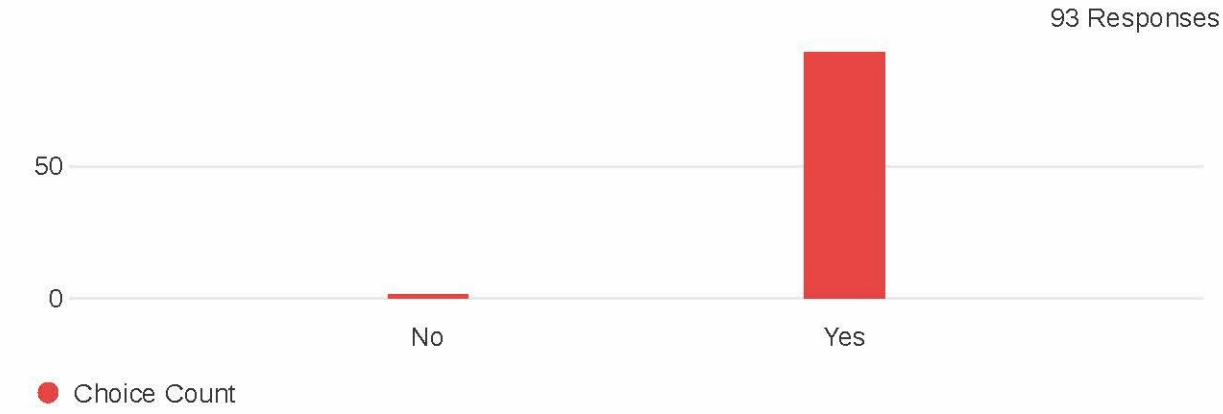
e-Xtra

Keywords: *Cannabis sativa*, *Golovinomyces ambrosiae*, hemp, powdery mildew

†Indicates the corresponding author.
C. A. Wyenandt; wyenandt@rutgers.edu

Appendix 5. Plant Diagnostic Laboratory Client Survey, FY22.

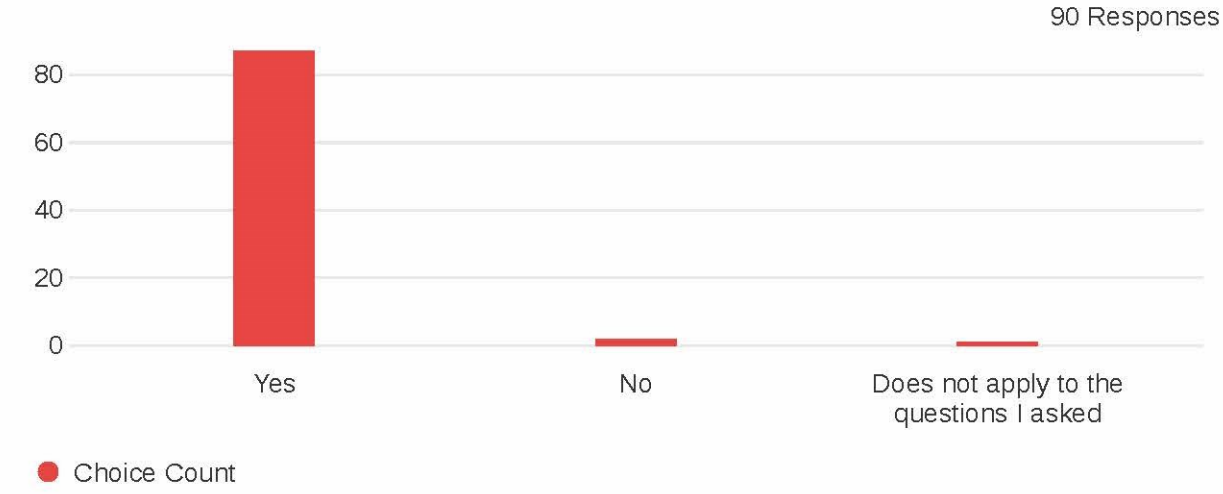
Q1 - Did you receive the diagnostic report(s) in a timely manner?



Q2 - Please describe the issue with the timeliness of your diagnostic report(s).

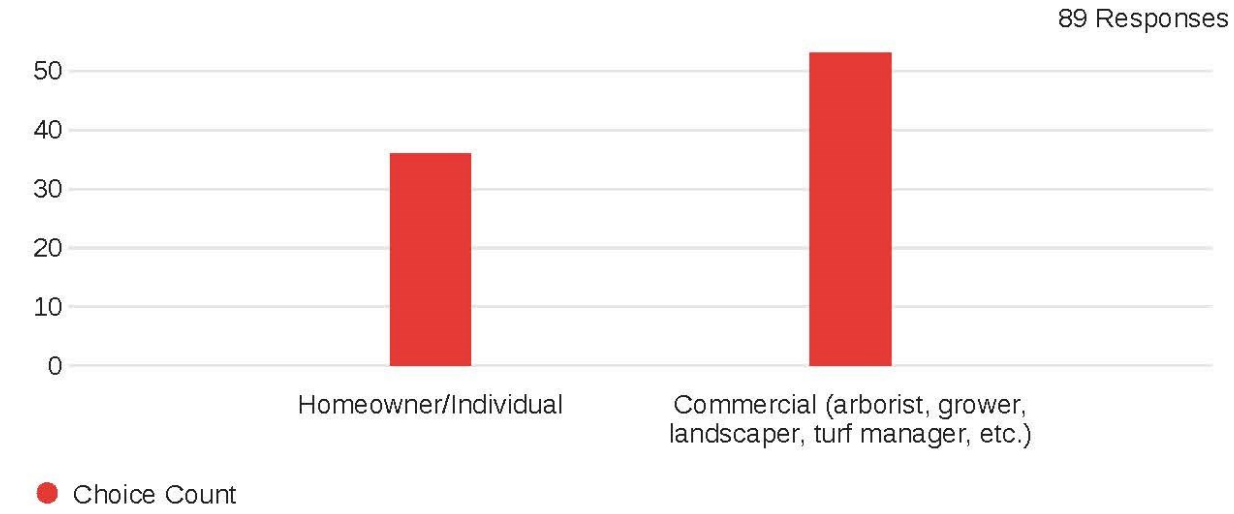
No data found - your filters may be too exclusive!

Q3 - Did the information provided help you to solve your problem?

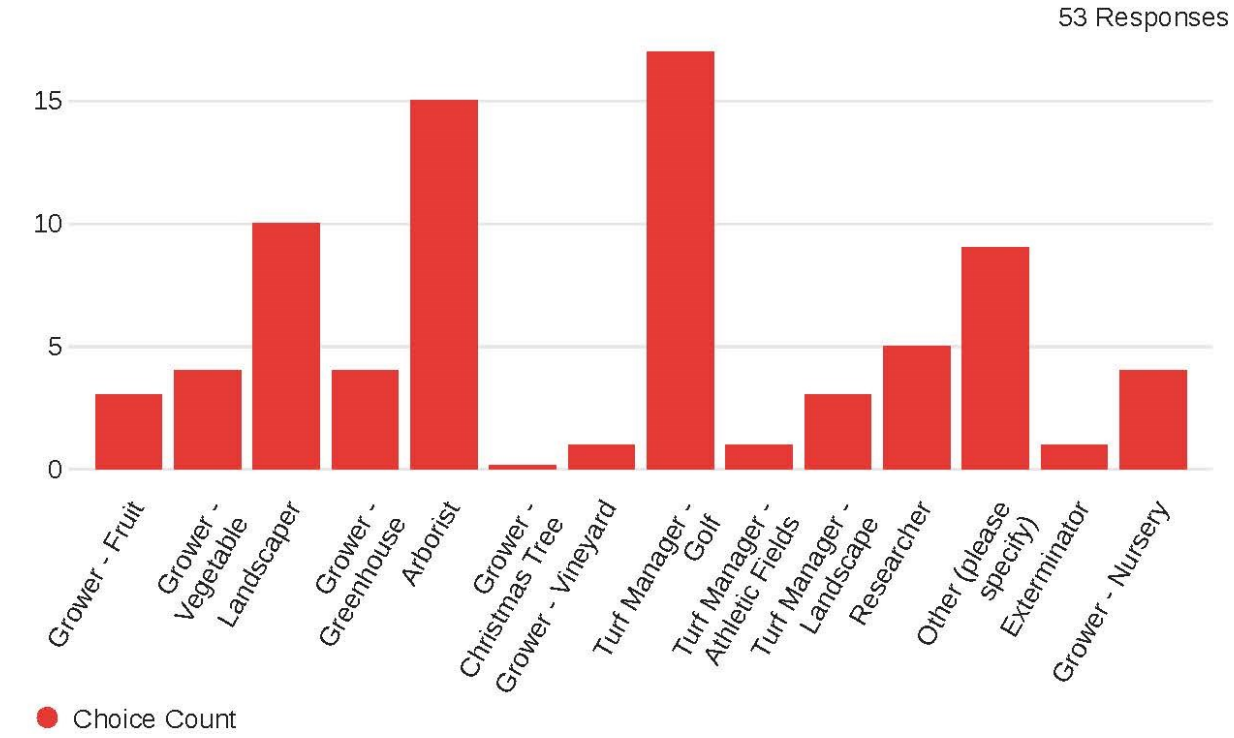


Appendix 5. (Continued)

Q4 - As a client of the Rutgers Plant Diagnostic Laboratory, how is your role best described?



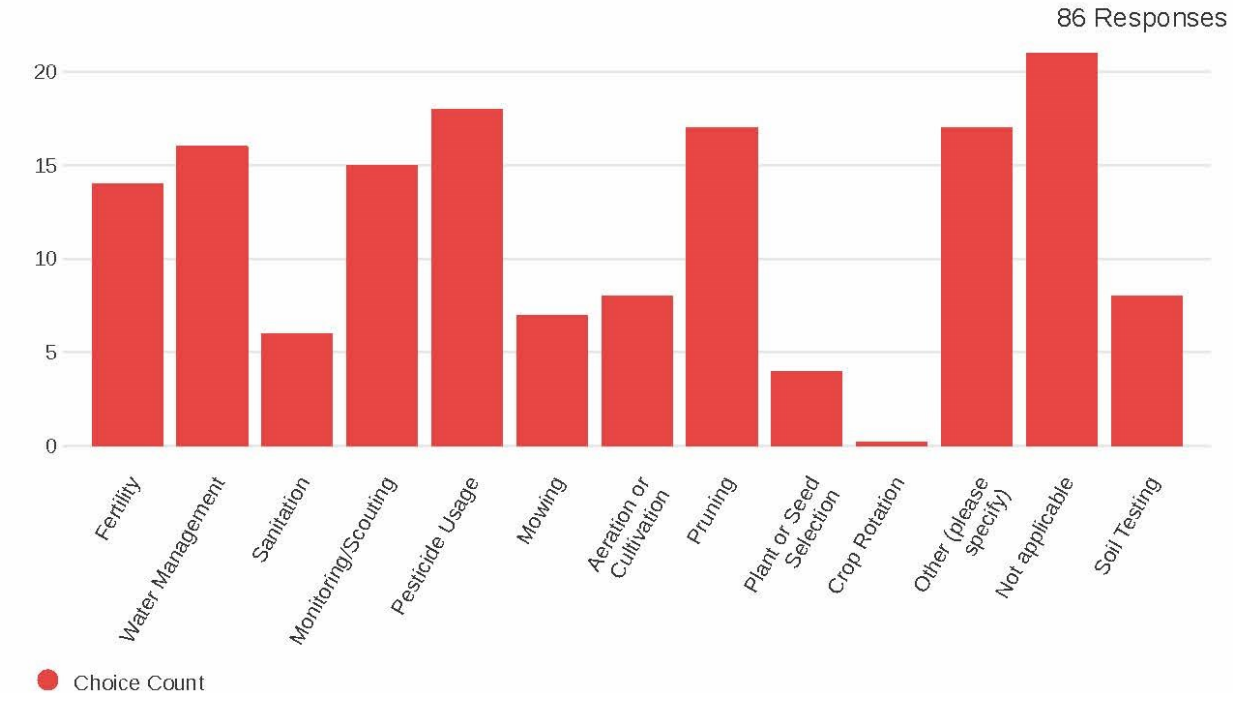
Q4.1 - Please check all that apply to describe yourself: - Selected Choice



Appendix 5. (Continued)

Q5 - Did the information provided help you to use Integrated Pest Management (IPM) strategies (cultural practices and use of least toxic pesticides as a last resort) to manage your pest or disease problem(s)?

Q6 - Did you implement or alter any management practice(s) based on recommendations in the diagnostic report(s)? Please select all that apply: - Selected Choice



Appendix 5. (Continued)

Q6_11_TEXT - Other (please specify) - Text

17 Responses

Other (please specify) - Text
will recommend to plot holder as well as other community gardeners across the state who receive our bi weekly reports
I just received the report. But I do plan to implement watering recommendations and probably pruning
Not yet
Vacuum every day
Actions suggested are to start in March
The report recommendations will help my arborist to treat the problem.
Removal
adjusted irrigation frequency
Not yet
Because of demand ideal water management is not always optimal
I passed this on to my lawn care pro.... Let's see!
Arbor Kelp (2x/annually); Arbor Balance (1x every 3 yrs.)
Probable removal
Recommendation was to hire a professional service to assist with the conditions of the tree as diagnosed. I will follow up with this recommendation immediately.
seeding
Heped me make recommendations to the Golf Course Superintendent
Moved mulch away from house

Appendix 5. (Continued)

Q7C - If you implemented any of the practice(s) recommended, please select all of...

24 Responses

Field	1-10%	11-25%	26-50%	51-75%	76-100%
A reduction in potential plant loss	4	2	0	4	6
Increased yield	1	0	1	2	0
Reduced the amount of unnecessary inputs (pesticides, fertilizer, etc.)	2	1	3	2	6
Limited the spread of disease or insect pest	3	1	2	4	7
Reduced the impact on aesthetics	3	2	2	3	9
Increased profit	0	1	1	3	2
Increased quality of crop/plant	1	0	2	7	7

Q7H - If you implemented any of the practice(s) recommended, please select all of...

8 Responses

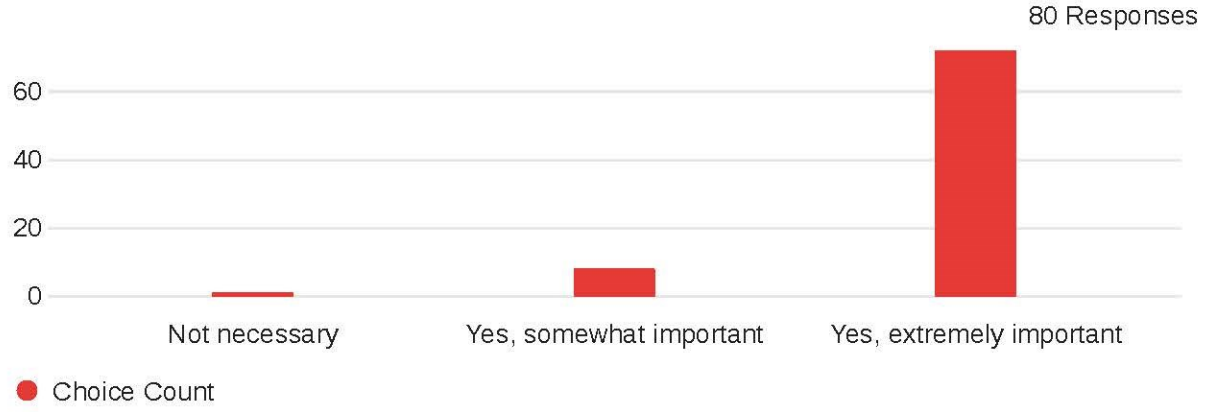
Field	1-10%	11-25%	26-50%	51-75%	76-100%
A reduction in plant death	0	1	1	0	2
Reduced the amount of unnecessary inputs (pesticides, fertilizer, etc.)	0	0	1	0	0
Limited the spread of disease or insect pest	0	0	1	1	2
Reduced the impact on aesthetics	0	1	0	1	1
Increased quality of crop/plant	0	1	1	2	2
Increased yield	0	0	0	0	1

Appendix 5. (Continued)

Q8 - Were you able to reduce the use of pesticides as a result of the information provided in the diagnostic report(s)?

Q8.1 - What would be an estimate of the cost savings from reducing the use of pesticides as a result of the information provided?

Q9 - Does the Rutgers Plant Diagnostic Laboratory provide a beneficial service for you?



Appendix 5. (Continued)

Q10 - If you would like to share any additional comments about the service you received from the Rutgers Plant Diagnostic Laboratory, please enter them below.

44 Responses

If you would like to share any additional comments about the service you received from the Rutgers Plant Diagnostic Laboratory, please enter them below.

thank you so much for your timely reply and for diagnosing the problem. We really appreciate you!
Cynthia Triolo
RCE of Morris County

It is always a pleasure dealing with such knowledgeable professionals. This is a very valuable service and reasonably priced.

Very timely response as always . Diagnostics a valuable tool in decision making in client's plant health care program. Conclusion of abiotic factors negatively impacting plant, and absence of insects or disease prevents unnecessary applications of pesticide/ fungacide/fertilizer. Staff provides an excellent report as usual.

Excellent !!

Richard Buckley was professional and informative, answered the phone in a timely manner

Thanks for your timely service/analysis!

Thanks so much for your clearly written report on my azalea sample. Your instincts about the problems being due to stresses on the plant make a lot of sense to me. Thanks as well for the rapid turn-around. Much appreciated!

I appreciate the thoughtful analysis and detailed recommendations. Lots of useful information. This tree has considerable sentimental value to my family - the cultivar was discovered by my great-great-uncle 200 years ago in Switzerland. Thank you!

Excellent Team of Professionals at the lab. Very important for New Jersey Farm community and businesses

Appendix 5. (Continued)
Q10. (Continued)

I would like to thank the Diagnostic Laboratory for the information on my Palm plant. While I am sad to learn that it is a Fusilium infection, I am glad that I now know what has been causing the trouble and I will work to try to prolong its life.

The report was prompt and thorough and even though I am just an individual homeowner, not a farmer or a company, I feel my request was treated equally.

Thank you.

I like the thoroughness of the diagnostics, and that it is broken down into layman's terms for the customer. Using the lab is a great way to double check what you believe is going on with your turf.

When I'm being challenged by a fine turf health issue the Rutgers Plant Diagnostic Laboratory has always provided the scientific answers, and remedies in an expeditious fasion. Thank you, Rich, Sabrina and your team for your professionalism.

The survey asked for results. There hasn't been enough time to see the results on the plants, but to make cultural practices with a direction to proceed

This service is essential for quick diagnosis of issues. Thank you for the quick results.

Rutgers Diagnostic Lab services are an important resource to the tree care industry in New Jersey

Quick results, easy to deal with, essential for diagnosing crop problems. Phone calls are answered quickly as well which is a big deal. Huge thanks to the staff!

Thank you for the analysis
.

I did not answer the questions regarding how the change of practices effected our outputs because we have not yet had time to see any changes! Thank you for your help!

I need to send more samples. I need to find what kind of mite or whatever is crawling on me and biting me

The Associate that answered the door was most helpful and personable. The service was superior and quick.

There needs to be proper signs on the property directing people seeking the Plant Diagnostic Lab.

I was glad I took the time to hand deliver the samples seeing the Gardens expanded my knowledge and further interest in Rutgers's assets.

I need you guys

Appendix 5. (Continued)
Q10. (Continued)

Deadheads and plants perfect together

Sabrina at RPDL provided prompt responses to our inquiry and concerns. While we have not yet implemented the recommendations we will provide our arborist with the report and ask that the recommendations be followed. I will inform you of the results. Thank you again for this valuable service. Frank Barszcz

Thank you for your help!

Rich and Sabrina provide a vital service. With bls and beech leaf disease I don't know what I would without them. I really miss their presentations.

all people involved were friendly and helpful. THANK YOU

Thank you for your help

Grass Roots is very helpful bringing the samples to the Rutgers lab. Got results and options for solutions quickly. Sometimes I need help knowing amount of damage/threshold and sometimes i use the results as justification for budget purposes. Buckley is the best.

The survey came directly after the soil results so many of the questions cannot be answered in terms of application of the results.... I passed the results onto my lawn care team for them to evaluate and implement as they see fit. Some of your feedback overlaps what we have been doing. some is different. The process and availability of the service were great. The results will take a season or two. More than happy to report back then if applicable for your needs.

It was suggested that I have another arborist service to evaluate my Pin Oak. I wanted to have this report available to share. I suspect this service may offer a more robust effort for the Pin Oak to live its best remaining years. While I am not 100% certain it does have bacterial leaf scorch, it is in decline. I will have the grass beneath it removed and have leaf litter/compost blend applied (excluding base area) and continue to supplement with drip line during periods of extreme heat and no rain. I wish it were easier to have samples submitted or a followup built in to the process. There seems to be conflicting information among resources and it is discouraging.

Results were timely with current science being the response to my diagnostic request.

You provide a very valuable service to the arborist and forestry professions.

The Rutgers Plant Diagnostic Laboratory is a tremendous asset to the industry. I would pay double the price to have my specimens analyzed. Staffed with friendly an knowledgeable people, it is easy and pleasurable dealing with them.

Timely turnaround and a great diagnosis on a typically southern disease.

Appendix 5. (Continued)
Q10. (Continued)

I was very impressed by the rapid turn around and the helpful response provided. Because additional professional, on-site help was recommended, I have not yet been able to secure that assistance but I would be happy to follow-up again with a survey response after the recommended strategy has been completed and the results of such strategy is noted.

Excellent work. Thank you so very much for your services.

thanks for the help

Incredibly hard working lab! Nothing but praise for what they do for the industry!

PDL is a great resource for NJ and for that matter the countries golf courses

I greatly appreciate the speedy response and highly informative narrative provided, regarding the health of my trees. The test results confirmed what I had suspected as the cause of their condition (environmental), and set my mind at great ease that there was no human tampering (chemical poisoning) present, or any diseases or pests. This is the second time I have utilized Rutgers PDL, and it has been a valuable resource as my 200 Leyland Cypress progress in their stages of growth. Thank you!

Results were shockingly fast, thank you!

Would not have known where to go to identify the insect pest.

Thank you! please let us know (Trust for Governors Island) if there are any more cases of massaria in the tri state area.

great service

Great professional service

I use RPDL primarily for an impartial entity and for more intensive diagnostics. The team is a valued service that I use during the year. I find the information informative and helpful. Thanks Todd.

RUTGERS
New Jersey Agricultural
Experiment Station
PLANT DIAGNOSTIC LABORATORY

Plant Diagnostic Laboratory
New Jersey Agricultural Experiment Station
Rutgers, The State University of New Jersey
Ralph Geiger Turfgrass Education Center
20 Indyk-Engel Way
New Brunswick, NJ 08901

Cooperating Agencies: Rutgers, The State University of New Jersey, U.S. Department of Agriculture, and Boards of County Commissioners. Rutgers Cooperative Extension, a unit of the Rutgers New Jersey Agricultural Experiment Station, is an equal opportunity program provider and employer.