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Rutgers Soil Testing and Plant Diagnostic Services

2004 Annual Report

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THE STATE UNIVERSITY OF NEW JERSEY
RUTGERS
COOK COLLEGE

2004
Rutgers Soil Testing and Plant Diagnostic Services Annual Report

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Introduction

Soil testing and plant diagnostic services are provided by Rutgers Cooperative Research and Extension (RCRE), the outreach component of the New Jersey Agricultural Experiment Station (NJAES) and Cook College. Located on the Cook College campus, these laboratories provide New Jersey citizens with diagnoses of plant problems and chemical and mechanical analyses of soil. 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 2004 calendar 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 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 academic unit supporting soil testing, 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 Department 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 58,000 soil samples for nutrient analysis and continues to serve an integral role in soil nutrient management for the public and for RCRE programs. The laboratory currently is housed in the Operator Training Center on the Cook College Campus and is scheduled to move into the former HIP building on US Route 1 in New Brunswick when renovations to this new administration facility are completed in 2005.

The Rutgers Plant Diagnostic Laboratory and Nematode Detection Service

The Rutgers Plant Diagnostic Laboratory (PDL) was established in 1991 by the dedicated efforts of RCRE faculty members Dr. Ann B. Gould and Dr. Bruce B. Clarke, Specialists in Plant Pathology, Dr. Zane Helsel, former Director of Extension and current Chair of the Department of Agricultural Extension Specialists, and Dr. Karen Giroux, past Assistant Director of NJAES. The laboratory was housed on the main campus of Cook College until 2000 when it was relocated to the Ralph Geiger Turfgrass Education Building 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 began accepting samples on June 26, 1991 and has since examined more than 24,000 samples submitted for plant problem diagnosis, nematode analysis, or identification. The laboratory has become an integral part of RCRE and Cook College/NJAES programs by providing diagnostic and educational services and by assisting with research.

The RCRE Resource Center

In 1998, the Cook College Resource Center was formed, and the administrative functions of both the PDL and the STL were assigned to this unit. In 1999, Mr. Mike Green was appointed director of the Resource Center and since has guided the administrative functions of the program. In late 2004, Mr. Green and a committee of RCRE faculty began to facilitate the merger of the PDL and the STL into a single, as yet undefined, administrative unit. This body will be charged as a total cost recovery, user fee based service that is projected to be self supporting.

Staff and Cooperators

PDL

Mr. Richard Buckley is the manager of the PDL. He was promoted to this position from program associate in October of 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 PDL. Mr. Buckley will oversee

the administrative functions of the combined plant diagnostic and soil testing laboratories.

Ms. Sabrina Tirpak is the Principal Laboratory Technician for the PDL. 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 was hired as a part-time assistant in 1998 and was hired full-time upon the completion of her degree. She has also attended Clemson 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 assists in all other aspects of laboratory operations.

STL

Dr. Stephanie Murphy is the coordinator of the STL. She has served the University in this capacity since 1996 after several years as a post doctoral research technician and instructor within the Department of Environmental Sciences. Dr. Murphy has a Ph.D. in soil science from Michigan State University, a M.S. in soil management and conservation from Purdue University, and a B.S. in agronomy from Ohio State. Her interests include soil conservation, soil fertility, and the interaction of soil aggregation to plant root extracts. Dr. Murphy is responsible for the day-to-day operations of the STL, and under her direction, soil test reports have been computerized and streamlined for easier interpretation, and soil test policies have been improved to better serve clientele.

Mr. Steve Griglak, Senior Laboratory Technician, has worked in the STL since 1995. Mr. Griglak received his B.S in Environmental Science from Rutgers University in May 1998. Although his primary duty is the performance of various soil tests offered by the laboratory, he is also responsible for the maintenance and repair of laboratory equipment and testing devices.

Mr. Nick Tomasino began work in the STL in 1999 as an undergraduate assistant. He graduated from Cook College with a B.S. in Microbial Biotechnology in 2002, and was hired as a full-time technician the same year. Mr. Tomasino is responsible for the performance of various soil tests and other routine duties.

After her retirement from a successful career as a county agricultural agent in RCRE, Ms. Clare Liptak has spent countless hours in a part-time role for the STL. Ms. Liptak primarily serves to promote laboratory as well as other Resource Center services at conferences and trade shows.

Cook College Resource Center and Other Support

Ms. Terriann Di Lalo has been a part-time administrative assistant for the STL since 2002 and has recently begun to assist the PDL with its administrative functions.

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 Cook College Departments. These include the Departments of Plant Biology and Pathology; Entomology; and Ecology, Evolution, and Natural Resources. We owe a great deal of our success to the expertise of many of the faculty in these departments. We would also like to thank the staff of the Office of Professional Continuing Education for their support and assistance with our educational programming, and cannot forget the other members of the Rutgers Resource Center for their support and assistance.

Laboratory Policies

The PDL receives samples (plant samples for problem diagnosis, soil samples for nematode assays, and insects, weeds, and molds for identification) from a varied clientele. Sample submission forms, sampling instructions, and fee schedules are available on the RCRE website[1] Sample submission forms are available in local County Agricultural offices and by FAX directly from the PDL. Most samples are submitted by mail to a post office box in Milltown, or by private delivery service directly to the laboratory. Residential clientele are encouraged to use the postal service or a commercial delivery service to submit samples, which must be accompanied by the appropriate form and payment. Professional clientele may deliver samples directly to the laboratory as a “walk in” and be billed for the service.

Samples are considered in consecutive order on a “first come, first serve” 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 FAX to the client. Copies are forwarded to appropriate county faculty for their records. Commercial growers are often contacted by telephone or FAX to help them avoid delay in pest treatments.

Like the PDL, the STL receives samples from a varied clientele, and fee schedules as well as sampling and submission instructions are also available on the RCRE website. Soil samples are submitted in soil test kits, available for purchase from local RCRE County Extension Offices, that include a submission form, sampling instructions, and a mailing bag to contain the soil sample. Standard soil fertility testing ("level 1" testing defined as pH, P, K, Mg, Ca, Cu, Mn, Zn, 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 but must be paid for in advance. Samples may be submitted without the soil test kits as long as appropriate identifying information and pre-payment is included.

Although soil samples are processed in consecutive order according to entry into the laboratory system, analysis can be prioritized by paying a special express processing fee. Upon the completion of the tests, general lime and fertilizer recommendations are provided for most New Jersey plantings. The client must supply appropriate planting information to receive fertility guidelines. Responses are sent by mail to the client and to the appropriate county agricultural office.

Operations

PDL

During 2004, the PDL examined 3,139 specimens submitted for diagnosis, identification (insects, weeds, or fungus), or nematode assay (Table 1), representing a 35% increase (or 820 samples) from 2003. Part of this increase is attributed to samples submitted by State and Federal regulatory agencies conducting disease surveys. Sample submissions remained steady for most of the year, peaking in the summer and declining during the winter. It is our view that 2,000 to 2,500 samples represent peak laboratory capacity, so at this level total laboratory output was well above normal expectations.

The type of specimens submitted to the PDL by sample type is presented in Table 2. As mentioned above, the total number of plant samples is high compared to 2003 in part because of samples submitted during Federal and State surveys.

In 2004, 62% of the plant submissions were from commercial growers, 7% were from residential clientele, and 31% were submitted by research faculty at Rutgers University (Table 3). This distribution is consistent with other years. Commercial plant managers benefit most from our services and are willing to pay the fees, thus they submit the most samples to the laboratory.

Table 1. PDL sample submissions by month, 2000 to 2004.

Month	2000	2001	2002	2003	2004
January	41	17	47	26	31
February	37	46	55	33	24
March	118	85	70	56	76
April	122	137	230	75	582
May	193	226	183	179	374
June	282	317	261	276	430
July	298	459	415	442	355
August	362	421	369	347	260
September	207	921	300	417	353
October	246	876	245	211	520
November	169	172	196	233	80
December	109	169	99	15	54
Total	2184	3846	2470	2310	3139

Table 2. PDL sample submissions by sample type, 2004.

Sample Type	Number of samples	%
Plant samples	2730	87
Nematode assay	214	7
Insect, weed, and fungus identification	195	6
Total	3139	100

Although the number of plant samples increased this year, the total number of nematode assays (214) and insect, plant, or fungus identifications (195) was similar to that of 2003. Forty percent of samples requesting an identification were from commercial clients, 1% were submitted by research faculty, and 59% were residential in origin. Most of these samples were household or nuisance pests, which are largely issues of concern for residential clients. Of the nematode assays submitted, 96% were requested by commercial clients. We expect that the number of nematode samples submitted from residential clients (8, or 3%) will remain low 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. Although the number of research samples received this year represented a 100% increase from 2003, the percentage of research samples to total number submitted was similar. Research samples are an extremely important component of our case load. Research samples allow the diagnosticians to cooperate with University faculty on problems often of great importance to the State of New Jersey.

Turfgrass and ornamentals may 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 (92%) were either turfgrass or ornamental plants (Table 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, as well as plant managers in the turf and ornamentals industry, readily adopted the user fee-based delivery of service.

Table 3. PDL sample submission by origin, 2004.

	Plant		Nematode		Identification	
Origin	number	%	number	%	number	%
Commercial	1696	62	205	96	78	40
Residential	182	7	1	1	115	59
Research	852	31	8	3	2	1
Total	2730	100	214	100	195	100

Table 4. PDL sample submissions by crop category, 2004.

	Plant samples		Nematode samples	
Crop	Number	%	Number	%
Turf	574	21	112	52
Ornamentals	1949	71	4	2
Field crops	16	1	33	16
Vegetable	166	6	3	1
Fruit	25	1	62	29
Total	2730	100	214	100

Alternatively, commercial growers of traditional agricultural crops have been slow to adopt a fee-for-service system. Certain RCRE faculty continue to provide free diagnostic services and fail to advertise diagnostic laboratory services to these growers. Inroads are being made with these commodity groups through the Vegetable IPM group, and it is our hope that sample submissions from traditional agricultural crops will continue to increase in future years.

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. In the past, a great majority of the nematode samples were submitted to the laboratory through the Fruit IPM program from peach, apple, and blueberry growers; however, the trend from that program continues to reflect a lack of grower interest in the pest, so samples continue to decrease. Although golf turf represented the highest percentage of nematode samples, the overall number of samples submitted from golf turf followed the recent trend and continued the decrease that began in 2002. The decrease in these samples occurred, in large part, because of adequate rainfall during the growing season of 2004. Problems in golf turf, particularly with nematodes, are more severe during seasons with considerable heat and drought stress.

Samples were submitted to the PDL from all of counties in New Jersey (Table 5). The majority of samples, however, were submitted from counties in close proximity to the laboratory. In addition, 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. These samples are normally from counties in close proximity to New Brunswick.

Table 5. PDL samples submitted by county, 2000 to 2004.

IIn-state	2000	2001	2002	2003	2004
Atlantic	228	148	113	118	153
Bergen	103	212	136	64	197
Burlington	98	239	79	118	146
Camden	79	264	242	56	31
Cape May	47	50	26	32	69
Cumberland	54	150	31	77	139
Essex	31	58	29	57	35
Gloucester	124	152	52	49	79
Hudson	13	5	14	11	5
Hunterdon	52	128	40	35	53
Mercer	104	231	238	135	348
Middlesex	194	257	240	317	345
Monmouth	147	239	204	225	237
Morris	166	234	161	109	128
Ocean	61	176	106	93	63
Passaic	7	80	38	32	38
Salem	30	82	18	12	32
Somerset	118	195	89	138	361
Sussex	30	99	24	14	12
Union	73	130	43	66	60
Warren	41	52	47	43	34
RU research	16	200	67	112	214
In-state total	1822	3382	2037	1913	2779
Out-of-state	362	464	433	397	360
Total	2184	3846	2470	2310	3139

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 adequate staff in those offices. To some degree, the profile also identifies county faculty and programs that promote and utilize PDL services.

Approximately 12% of the samples submitted for diagnosis to the laboratory were from out-of-state. Nearly all of these samples were turf. In fact, 52% of all turf samples were from out-of-state. Golf turf samples were submitted to the laboratory from 20 states, several from states as far away as Florida, Arizona, Washington, Montana, and California. New York, Pennsylvania, and Virginia provide the largest totals. 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 send samples to Dr. Clarke, who always forwards them to the laboratory for diagnosis. 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. Furthermore, Mr. Buckley's association with the Professional Golf Turf Management School allows for contact with as many as 90 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, 51% were associated with biotic disease-causing agents (Table 6). Abiotic injury (e.g., environmental extremes, nutrient deficiencies, poor cultural practices, poor soil conditions, etc.) accounted for another 31% of the laboratory diagnosis. Insect pest damage was diagnosed on 5% of the submissions. Identifications comprised 6% of the total number of samples submitted; of these, 3% were arthropods, 2% were fungi, and 1% were weeds. Nematode detection was the other 7% 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.

Table 6. PDL samples submission by diagnosis, 2004.

Diagnosis	Number of samples	%
Disease (biotic)	1599	51
Disease (abiotic)	964	31
Insect pest	167	5
Nematode	214	7
Arthropod identification	94	3
Fungus identification	56	2
Plant identification	45	1
Total	3139	100

Insects 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. Over the last four years, the Department of Entomology has cooperated with the laboratory to forward clients with insect identification needs. Their cooperation has been invaluable in increasing the awareness of the laboratory to potential clients. Arthropod identification, however, declined slightly in 2004 from the 2003 total (111). Fungal identification is also a popular service for the laboratory. Samples from mold-infested houses decreased in 2004 from 2003 (117) as well. The submission of samples for mold identification rise with media attention to the perceived health issues associated with mold infested homes.

In 2004, a laboratory response was prepared in less than three days for most (75%) of the samples submitted (Table 7), and 97% of our clients received a response in less than a week. A number of the samples took longer than 10 days to diagnose. In these cases, special consultation 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 presence of our competent staff. The addition of Ms. Tirpak in 2000 as a full-time assistant greatly enhances laboratory productivity. Adequately trained staff is essential to the continued growth and efficient operation of the laboratory.

STL

The STL processed 8,759 samples for soil chemical and physical analysis in 2004 (Table 8).

The total laboratory output increased 20% from 2003 (7,020 samples). Sample submission totals were highest in early spring in anticipation of the growing season. During the rest of the year, sample submissions remained steady, but they decreased sharply in the winter months when the ground is frozen and proper sampling becomes difficult.

Table 7. PDL sample response time, 2004.

Response Time	Number of samples	%
0 to 3 days	2349	75
4 to 6 days	689	22
7 to 10 days	55	1.75
11 to 21 days	40	1
>21 days	4	0.25
Total	3139	100

Table 8. STL sample submissions by month, 2002 to 2004.

Month	2002	2003	2004
January	475	271	423
February	745	114	248
March	899	797	1216
April	1320	1253	1156
May	725	663	784
June	580	736	1043
July	389	584	561
August	646	449	768
September	654	592	786
October	693	757	761
November	607	425	621
December	138	379	392
Total	7871	7020	8759

Of the soil samples submitted to the STL for analysis in 2004 (Table 9), 55% were for the standard soil analysis (level 1) and 45% included requests for additional special tests.

In 2004, soil samples from residential clientele represented 32% of the submission total (Table 10). Commercial growers including the producers of fruit and vegetables, as well as the managers of ornamental crops and turfgrass, represented 31% of the total. Samples from engineering firms comprised 20% of the workload, another 11% of the samples were from research programs at Rutgers, and 4% were reference samples. In the past, samples from residential clientele largely dominated laboratory submissions; however, recent growth in samples from commercial turf managers and in engineering work indicate a turn toward a professional client base.

Table 9. STL sample submissions by test type, 2004.

Test type	Number of samples	%
Standard level 1	4836	55
Special tests	3923	45
Total	8759	100

Table 10. STL sample submissions by origin, 2004.

Origin	Number of samples	%
Residential	2831	32
Engineering	1720	20
Commercial	2698	31
Research	984	11
Other	221	2
Reference	305	4
Total	8759	100

Samples were submitted to the STL from all of counties in New Jersey (Table 11). Many samples were submitted from counties in close proximity to the laboratory; however, because samples for soil testing are normally delivered in the mail, public access to the laboratory is less of a factor for sample submissions than those destined for the PDL. County profiles, therefore, reflect programs with active home horticulture programs or those with outreach events (fairs, field days) that provide opportunities to sell soil test kits. To some degree, the profile also identifies county faculty and programs that promote and utilize STL services to commercial clientele. A large number of county affiliations were unidentified on submission forms. Many of these samples were from engineering

Table 11. STL sample submissions by county, 2004

County	Samples
Atlantic	144
Bergen	509
Burlington	447
Camden	260
Cape May	129
Cumberland	250
Essex	217
Gloucester	227
Hudson	57
Hunterdon	211
Mercer	529
Middlesex	297
Monmouth	589
Morris	381
Passaic	122
Salem	59
Somerset	505
Sussex	91
Union	227
Warren	74
Reference	305
Unidentified	3086
Total	8759

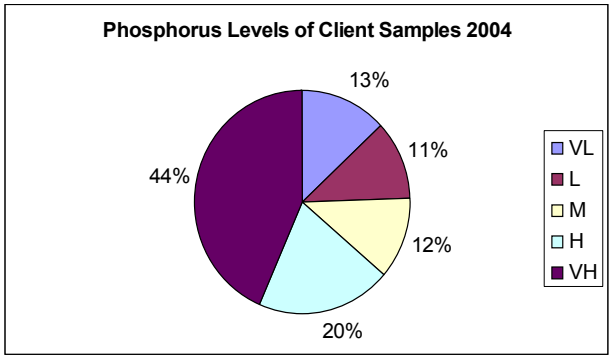

Figure 1. Phosphorus content in samples submitted in 2004.

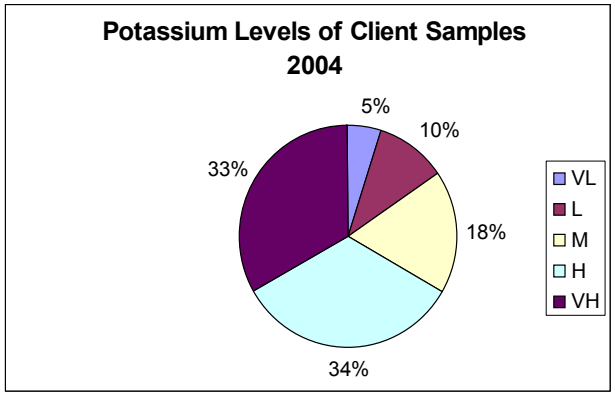

Figure 2. Potassium content in samples submitted in 2004.

firms that submit soil from a central office that does not conform to the location where the soil was sampled.

Figures 1 and 2 indicate the phosphorus and potassium content of the soil samples submitted for analysis in 2004. High levels of phosphorus were measured in 64% of the samples tested, and potassium levels were high or very high in 67% of the samples tested. These data suggest the overuse of fertilizers containing potassium and phosphorus on soils that do not need them. Commercial fertilizer manufacturers promote routine applications of their products without benefit of soil tests. Turfgrass products vary levels of $N\text{-}P_2O_5\text{-}K_2O$ in their four or five step programs according to season and without regard to soil test levels. Furthermore, most of the materials commercially available for residential use are combination products. Single nutrient materials are rare in the market. It is nearly impossible to apply adequate nitrogen on turfgrass or residential gardens without over application of phosphorus and potassium.

In Figure 3, the soil pH of soil samples submitted to the STL in 2004 is summarized. The distribution of these data is skewed, with most of the samples (41%) falling in the optimal range for most plants. Samples from slightly acidic or slightly alkaline soils were nearly evenly distributed at 27 and 22%, respectively. The tendency of humid temperate climate soils is toward acidity, so the number of

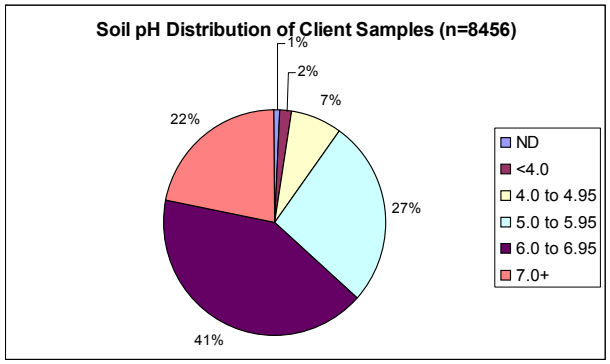

Figure 3. Soil pH of samples submitted in 2004.

samples in the optimal and alkaline groups indicates the reliance on liming materials to support soil pH for good plant growth and in some cases (22%) the overzealous use of those materials. Approximately 10% of the soils were outside of the normal range for most plants. Soils at pH 4.5 to 5.5 are optimal for certain crops (blueberry, potato) or ornamental plantings (azalea, rhododendron, fir, spruce). Those with a pH at or below 4 may be acid sulfide soils.

In 2004, the average response time for soil samples was 5.4 days. In Table 12 the average response time for standard level 1 tests is listed according to month. The number of special tests is also indicated to show the additional work load during the month. Response times varied from 2.3 days in February to 8.7 during June. Sample response time is influenced by the total number of submissions at the time and the number of special tests requested with those samples. Response time for standard tests is primarily influenced by volume. The equipment used for nutritional analyses (the DCP) can only do so many samples in a given time, so the responses slow as the number of samples increase. Special tests may be held by the laboratory until the number of samples accumulates enough to efficiently run the tests. Large numbers of special tests influence sample turn-around time because they take technician time away from the standard testing. Months with large numbers of standard tests and/or large numbers of special tests have the longest response times (note March to June).

Table 12. STL sample response times by month and test type, 2004

Month	Number of standard (level 1) tests	Response time days	Number of special tests
January	292	3.4	131
February	126	2.3	122
March	857	6.0	359
April	800	6.8	356
May	457	8.5	327
June	274	8.7	769
July	271	4.9	290
August	374	3.5	394
September	506	3.9	280
October	434	4.4	327
November	327	3.9	294
December	118	2.9	274
Total	4836	5.4	3923

Teaching

In addition to providing diagnostic services and soil analysis, the staff of the PDL and STL provide educational services to Cook College/NJAES, RCRE, and other agencies (Appendix 3). Many of these educational activities generated additional income for the laboratory.

In 2004, the laboratory staff participated in a number of short courses offered by the Office of Continuing Professional Education. 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 one two-hour lecture in each class per week for a total of 40 hours of contact time. Ms. Sabrina Tirpak is responsible for teaching a laboratory practicum in the Turf School. She has improved and expanded her role in the turf school to approximately 30 hours of contact time per session. The teaching efforts by the PDL staff in the Professional Golf Turf Management School generate significant income for the laboratory. This income source is essential for the success of the laboratory as it provides virtually 100% of our revenue in the winter months.

Mr. Buckley participated in several other Office of Continuing Professional Education short courses in 2004. These courses included the Professional Grounds Maintenance short course; the Golf Turf Management School; Three Week Preparatory Course; Landscape Integrated Pest Management: An Intelligent Approach; Athletic Field Management School; the Professional Landscape and Grounds Management School, and two Emergency Pesticide Credit Recertification Short Courses. Ms. Tirpak participated in Managing Diseases in Ornamental Plants and the Professional Parks Maintenance Short Course. Dr. Murphy participated in the Home Gardeners School; Athletic Field Construction; and the Soil and Site Evaluation for Septic Systems short course.

Mr. Buckley served as the course coordinator for the Pest Management in Landscape Turf Short Course. This was the 12th 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 sixth time he coordinated that short course. Mr. Buckley was the 2004 coordinator for the Advanced Turf Management Symposium for the seventh time.

Dr. Murphy served as the organizer and coordinator of a Certified Crop Advisor seminar – Nutrient Management – for CE credit in the regional NEB-ASA-SSSA.

Mr. Buckley was an invited speaker in several Rutgers Cooperative Extension programs. The following programs were included: the Cream Ridge Nursery Growers Twilight Meeting in Burlington County; North Jersey Ornamental Horticulture Conference – Tree Day and Landscape Day; RCE Annual Conference; Rutgers Turfgrass Field Day; and the Master Gardener Helpline Training. Lectures in support of the Atlantic/Cape May, Mercer, Monmouth, Middlesex, Camden/Gloucester, Ocean, Somerset/Hunterdon, Union, and Passaic County Master Gardener Programs were also given. Ms. Tirpak presented programs in support of the Ocean County master gardeners as well as the RCRE Garden Center Training Program. Dr. Murphy presented programs in support of the Passaic County master gardeners and was an invited speaker in the Cook Sustainable Ag Workshop. She also presented in the Central Jersey Turf and Ornamentals Workshop in both Mercer and Monmouth counties.

Mr. Buckley earned income as an invited speaker for the Lawn Doctor National Convention; New Jersey Flower and Outdoor Living Show; the Brooklyn Landscape Gardeners Association Winter Meeting; New Jersey Vegetable Growers Association Meeting; Penn/Del International Society of Arborist Shade Tree Symposium; New Jersey Landscape 2004 at the Meadowlands; Nassau/Suffolk Pro Turf and Plant Conference; the Idaho Golf Course Superintendents Association Spring Meeting; New Jersey Golf Course Association Crystal Conference; South Jersey Landscape Conference; Sports Field Managers Association Turf Workshop; Fisher and Sons Turf Seminar; and the New Jersey Turf Expo. Dr. Murphy presented for the New Brunswick lead coalition.

Other educational services provided by the laboratory staff members, for whom the laboratory received no compensation, included lectures by Mr. Buckley in undergraduate and graduate courses including: Introduction to Plant Pathology, and the Plant Disease Clinic. Dr. Murphy was a guest lecturer in the undergraduate course Soils and Society. Mr. Buckley and Ms. Tirpak visited Herbert Hoover Middle School as guest speakers for several eighth grade classes. Herbert Hoover is part of Edison Township Board of Education.

Extension Publications

During 2004, the PDL staff contributed regularly to the Plant & Pest Advisory. The laboratory staff wrote a brief article on laboratory activities for each issue of the newsletter, which was bi-weekly from March to September and monthly from September to December, published by Rutgers Cooperative Extension and the New Jersey Agricultural Experiment Station. In 2004 the turfgrass portions of the articles submitted to the PPA were also submitted for publication in the Cornell University Short CUTT turfgrass newsletter.

Service

The PDL staff provided tours of the Ralph Geiger Turfgrass Education Center and the Plant Diagnostic Laboratory to numerous groups in 2004. In addition, the STL staff also provided tours for several master gardener programs and for the fall and spring undergraduate soils courses. Dr. Murphy served as the dean's representative to the State Soil Conservation Committee. Mr. Buckley is a member of the Cooperative Agricultural Pest Survey (CAPS) team.

Competitive External Grants

Dr. Murphy participated as a co-principle in two external grants; Longer Term Assessment of Putting Green Root Mixes under two Microenvironments, and Assessing the Quality of Selected Soils from the Piedmont and Coastal Plain Regions of New Jersey.

Mr. Buckley participated as a co-principle in three external grants; Long-term Evaluation and Improvement of Golf Turf Management Systems with Reduced Chemical Pesticide Inputs; Sudden Oak Death and Asian Longhorn Beetle Educational CD-Rom; and Regional Center Plant Diagnostic Facility.

Marketing

An advertising brochure was developed by the PDL in 1992 for general distribution at county offices,

grower meetings, and other activities. This brochure briefly describes the services of the PDL and how to access them. To date, well over 30,000 copies of this brochure have been distributed. Similar marketing media have been developed by the STL and extensively distributed. Once again, we give our special thanks to the Department of Continuing Professional Education, which placed a copy of the advertising brochure in each short course educational packet that was distributed.

To help advertise laboratory services at grower meetings or other activities, a mobile display unit was developed. The display is part of the RCRE Resource Center mobile marketing unit. This display briefly describes the services of the laboratories and how to access them, and is available on loan to anyone who wishes to advertise these services. The Resource Center has taken over the responsibility of representing the laboratory with the display unit at fairs, trade shows, and other events. This initiative brought the display to many programs including Ag Field Day, the Rutgers Gardens Open House, Turf Field Day, and the NJ Turf Expo.

In 2004, the PDL conducted a direct mail campaign to each of 1000 clients in the laboratory database. Cards reminding the clients of laboratory services and offering a discount for 2005 were mailed the third week in December.

Funding

The plant diagnostic and soil testing laboratories are expected to recover all costs and be self-supporting. For the PDL, income is generated by charging clientele for diagnostic services and educational activities. The current laboratory fee schedules are reported in Appendix 1. Over $108,736 was generated from diagnostic services and nematode assays during 2004. This total was slightly higher (9%) than the $97,307 generated in 2003. Another $26,000 in grant money was secured in December. Funds generated from educational outreach reached $19,836 in 2004.

A sample submission form and the appropriate payment accompanied the majority of samples received 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. Almost 100% of the clients billed have remitted payment. Furthermore, the laboratory continues to recover outstanding accounts from past years. Transfer of funds paid for almost all of the samples diagnosed for research programs at Rutgers University.

Laboratory policy allows 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 non-address. These requests for information eventually find their way to the laboratory. The PDL processed 144 “no charge” samples in 2004 (Table 13). These samples accounted for 5% of the samples processed. We are working to minimize the number of no charge requests, particularly for those clients outside of RCRE/Cook College/NJAES. As per laboratory policy, volume discounts are provided to grant funded projects and those samples submitted from Federal and State agencies. The “phantom income” generated from these discounts and the no-charge samples totals $33,120.

Table 13. PDL no-charge samples, 2004.

Client	Number of samples
RCRE County faculty/staff	86
RCRE specialist	17
Non-RCRE research programs	3
Non-RCRE faculty/staff	22
Government agencies	5
Direct mail/walk-ins	11
Total	144

Income generated from all laboratory activities covered 100% of the non-salary expenses incurred in 2004. When costs and revenues are considered including salary and phantom income, the PDL generated 70% of the total operational costs in 2004.

In the Soil Testing Laboratory, charging clientele for soil analysis and educational activities generates funding for the laboratory. The current laboratory fee schedule is also reported in Appendix 1. Over $170,974 was generated from soil assays during

2004. This total was higher than the funds generated in 2003. Another $53,000 in income was generated by cost sharing and educational outreach. Income generated by the STL in 2004 covered 100% of all of the laboratory costs and provided $18,366 in profit.

If response time is not a concern and there are more than ten samples, STL policy indicates research samples can receive discounted testing. These samples are often set aside during busy periods with public samples. The discount is 50% for any test that regularly costs $6 or more. In 2004, researchers received $18,525 in sample discounts.

Income generated by the PDL and the STL combined easily covered 100% of the non-salary expenses incurred in 2004. When costs and revenues are considered including salary and phantom income, the combined service units generated 100% of their total operational costs in 2004 as well. The STL profit carried much of the PDL shortfall. A complete break out of all PDL and STL revenues and expenses is included in Appendix 2.

Future Directions

As in the past, the top priority for 2005 will be to generate more income. To accomplish this, we will continue to advertise laboratory services at trade shows, field days, fairs, and educational programs to attend with the display unit. Print ads are being developed for publication in grower and professional journals. We are currently negotiating with the officials of the New Jersey Turfgrass Association for joint marketing activities. Laboratory staff will be participating in several cost sharing grant activities in 2005 and continued cooperation with the Office of Continuing Professional Education are expected to generate additional funds.

We anticipate spending a considerable amount of time integrating soil testing operations with the PDL. The STL will undergo a move in late-summer and is conducting a process review and equipment upgrade program in anticipation of the move. Reporting, sample submission policy, pricing, and test availability are being evaluated with input of a committee of interested RCRE faculty for both the PDL and the STL. We are constantly evaluating the immediate and future needs of the State for additional services. Your suggestions are welcome.

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. The network will provide 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 association 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 provided grant monies as incentive to participate.

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 intends to participate as a subcontractor to the regional center at Cornell. Grant monies provided by the USDA through the NEPDN were used in 2004 to purchase equipment and supplies to upgrade the laboratory's capability for accurate and timely diagnosis of plant problems. Two web-enabled microscopes with digital imaging devices were purchased. The equipment upgrades will allow for improved communication with our local stakeholders and those cooperators and experts in the northeast regional and national networks. The capacity for improved communication will facilitate the rapid dissemination of information concerning current plant disease and insect pest activity. The new equipment and upgrades in technology will also provide the means to create modern educational resources for use in local and regional training programs. Grant monies received for 2005 will be used to upgrade laboratory capability to handle pathogens of consequence and other biohazards, upgrade computing systems in the PDL and STL, and to train Master Gardeners as first detectors.

Appendix 1. Fees

Table A1.1 2005 PDL Fee Schedule:

Most samples (except fine turf):
- $30 instate
- $75 out-of-state

Fine and sports turf:

Instate:
- $65 per sample
- $100 disease and nematode assay

Out-of-state:
- $95 per sample
- $150 disease and nematode assay

Nematode assay:
- $20 instate (except fine turf)
- $50 instate (fine turf)
- $75 out-of-state fine turf

Fungus and mold identification:

Instate:
- $30 microscope identification
- $60 culture identification

Out-of-state:
- $75 microscope identification
- $100 culture identification

Insect identification:
- $30 instate residential
- $40 instate commercial
- $75 out-of-state

Plant and weed identification:
- $30 instate
- $75 out-of-state

Special tests:

Fungicide resistance screening:
- $100 instate
- $150 out-of-state

V*irus screening:*
- $75 instate
- $100 out-of-state

Endophyte screening:
- $75 instate
- $100 out-of-state

Other services negotiable. Contracts and volume discounts are available.

Table A1.2 2005 STL Fee Schedule

Landscape

Level 1	Fertility Test: Nutrients, pH, recommendations	$10
Level 2	Problem Solver (soil/plant suitability test): Nutrients, pH, soluble salt level, organic matter content, soil textural class, recommendations	$25
Level 3	Topsoil Evaluation: Nutrients, pH, soluble salt level, organic matter content, percentages of sand/silt/clay, soil textural class, gravel content, recommendations	$45

Greenhouse

	Saturated (Organic) Media Extract Analysis: Nutrients, pH, electrical conductivity, inorganic nitrogen	$20

Appendix 1, continued.

Sport Turf

Level 1	Fertility Test: Nutrients, pH, estimated CEC & cation saturation, recommendations	$10
Level 2	Complete Test: Nutrients, pH, estimated CEC & cation saturation, soluble salt level, organic matter* content, soil textural class, recommendations	$25
Level 3	Sand Root Zone Test: Nutrients, pH, estimated CEC & cation saturation, recommendations, soluble salt level, organic matter* content, percentage fines	$30

*Organic matter content would be determined by Loss-on-ignition for golf course greens, as described by USGA guidelines.

Engineering

Level 1	Permeability Class Rating: Percentages sand/silt/clay, sieve analysis of sand, gravel content	$50
Level 2	Topsoil Evaluation: Fertility, pH, soluble salt level, organic matter content, percentages of sand/silt/clay, soil textural class, gravel content	$45
Level 3	Boring/Excavation Material Test: Acid-producing soil test	$10
Level 4	Ecological Research Test: Nutrients, pH, estimated CEC & cation saturation, soluble salts, organic matter content, percentages of sand/silt/clay, soil textural class, TKN, Inorganic N	$60

Individual Special Soil Tests ("ala carte")

Soil pH and Lime Requirement Only	$5
Soluble Salt Test	$5
Soil Organic Matter Content	$10
Soil Texture (sand/silt/clay %)	$20
USDA Sieve Analysis of Sand	$35
Inorganic Nitrogen	$10
Total (Kjeldahl) Nitrogen	$12
Cation Exchange Capacity	$30
CEC & Exchangeable Cations	$45
Lead Screening by Mehlich 3	$10

Other Analyses

Water Analysis for Irrigation: pH, soluble salt content, Nitrate, P	$12
Plant Tissue Analysis: N, P, K, Ca, Mg, Cu, Mn, Zn, B, Fe, Mo	$30

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 2. PDL and STL Budgets

Table A2.1. PDL approximate expenses, 2004.

Salaries and benefits	
(full and part time staff)	$151,951.70
Supplies and services	
Diagnostic supplies	
Printing and advertising	
References	
Equipment maintenance	
Office supplies	
Credit card fees	10,362.98
Capital equipment	
Microscopes and digital imaging	25,306.77
Communications	
Telephone/fax	
Postage	1,639.35
Travel	
Paid talks and professional meetings	1,137.99
Total operating costs	$190,398.79

Table A2.2. STL approximate expenses, 2004.

Salaries and benefits	
(full and part time staff)	$184,023.21
Supplies and services	
Office supplies	
Testing supplies	
Printing and advertising	
Rental	
Equipment maintenance	
Credit card fees	
Consulting	22,801.13
Capital equipment	
Soil blender	1,175.00
Communications	
Telephone	
Postage	5,799.25
Travel	
Trade shows and professional meetings	2,160.73
Total operating costs	$215,959.32

Table A2.3. Approximate operating costs for PDL and STL combined, 2004.

Plant Diagnostic Laboratory	$190,398.79
Soil Testing Laboratory	215,959.32
Total costs	$406,358.11

Table A2.4. PDL income, 2004.

Sample fees	$75,945.00
Lecture fees	
OCPE and other honoraria	19,836.47
Grants and contracts	
Federal SOD Trace Forward Survey	1,040.00
State Department of Ag SOD Survey	4,160.00
BLS grants	6,940.00
RCRE Fruit IPM	555.00
RCRE Vegetable IPM	560.00
NEPDN	26,000.00
Phantom Income	
No-charge request	<4,320.00>
Federal SOD discount	<520.00>
State SOD discount	<11,440.00>
BLS grant discount	<13,880.00>
Fruit IPM discount	<185.00>
Vegetable IPM discount	<2,775.00>
Total potential income	<168,156.47>
Total actual income	$135,036.47

Table A2.5. STL income, 2004.

Sample fees	$170,974.90
Cost recovery	
Turf Center and OCPE	10,781.25
Technicians salary and benefit	52,569.38
Phantom Income	
Value of research sample discount	<18,525.00>
Total potential income	<252,850.53>
Total actual income	$234,325.53

Appendix 2 (continued).

Table A2.6. PDL-STL actual income, 2004

Plant Diagnostic Laboratory	135,036.47
Soil Testing Laboratory	234,325.53
Total Income	369,362.06
Actual income plus discounts and no-charges	$420,007.06

Table A2.7. PDL and STL approximate combined expenses, 2005.

Salary and benefit costs	$350,000.00
Operating costs	50,000.00
Capital equipment	100,000.00
Communications, marketing and travel	10,000.00
Total potential cost 2005	$510,000.00

Table A2.8. PDL and STL approximate combined income, 2005.

Plant Health Samples	
3000 @ $65 average fee per sample	$195,000.00
Soil Analysis	
10,000 @ $20 average fee per sample	200,000.00
Lecture fees	
OCPE and other honoraria	25,000.00
Cost recovery	
Technician salary	55,000.00
Grant and contracts	50,000.00
Total potential income 2005	$525,000.00

Table A3.1. Complete listing of lectures presented by Richard J. Buckley, PDL Coordinator, 2004.

Date	Title	Audience	Location	Partici-pants[1]
1/3/04	Diseases of Turfgrass (10 lectures)	Professional Golf Turf Management School	Cook College	T
1/3/04	Diseases of Ornamentals (10 lectures)	Professional Golf Turf Management School	Cook College	T
1/3/04	Principles of Pest Control on the Golf Course (10 lectures)	Professional Golf Turf Management School	Cook College	T
1/3/04	Insects of Turfgrass (10 lectures)	Professional Golf Turf Management School	Cook College	T
1/5/04	Basic Turf Disease: Pick Your Best Defense (1.5 h)	Lawn Doctor National Convention	Atlantic County	L,T
1/5/04	Leaf Feeding Insect Pests: The Silver Bullet (1.5 h)	Lawn Doctor National Convention	Atlantic County	L.T
1/6/04	Don't Be Bored By Your Borers (1 h)	North Jersey Ornamental Horticulture Conf.	Bergen County	A,L
1/7/04	Tale of a Rainy Season: Leaf Me Alone! (1 h)	North Jersey Ornamental Horticulture Conf.	Bergen County	A,L
1/13/04	Strawberry Disease Identification (0.5 h)	New Jersey Vegetable Assn. Annual Meeting	Atlantic County	G
1/14/04	Basic Turf Disease: Pick Your Best Defense (1 h)	Prof. Landscape Grounds Mgmt. Short Course	Cook College	A,L,T
1/14/04	Leaf Feeding Insects in Turf (1 h)	Prof. Landscape Grounds Mgmt. Short Course	Cook College	A,L,T
1/14/04	Understanding White Grubs in Turf (0.75 h)	Prof. Landscape Grounds Mgmt. Short Course	Cook College	A,L,T
1/15/04	Basic Nematology for Vegetable Crops (0.5 h)	New Jersey Vegetable Assn. Annual Meeting	Atlantic County	G
1/20/04	Basic Turf Diseases (1.5 h)	Landscape IPM Short Course	Cook College	L,T
1/20/04	Diagnosing Plant Problems (1.5 h)	Landscape IPM Short Course	Cook College	L,T
1/22/04	Basic Turf Diseases (2 h)	Pest Mgmt. Landscape Turf Short Course	Cook College	L,T
1/23/04	Turfgrass IPM Practice (3 h)	Professional Golf Turf Management School: Three Week Course	Cook College	T
1/29/04	Diagnosing Diseases of Ornamental Plants (1.5 h)	Pest Mgmt. Ornamental Landscape Plants	Cook College	A,L,T
1/30/04	The Complete Turf Disease for Golf Courses (6 h)	Professional Golf Turf Management School: Three Week Course	Cook College	T
2/3/04	Diagnosing Diseases of Shade Trees (1.5 h)	Penn/Del ISA Shade Tree Symposium	Lancaster, PA	A,I.L
2/3/04	Understanding Vascular Wilts (1.5 h)	Penn/Del ISA Shade Tree Symposium	Lancaster, PA	A,I,L
2/10/04	Diagnosing Plant Problems (3 h)	Master Gardener Training	Atlantic County	H
2/17/04	Basic Turf Disease (3 h)	Master Gardener Training	Atlantic County	H
2/25/04	Tale of a Rainy Season: Leaf Disease Update (1 h)	New Jersey Landscape 2004: Meadowlands	Bergen County	A,L
2/25/04	Basic Turf Diseases: Pick Your Best Defense (1 h)	Athletic Field Construction Short Course	Cook College	T
3/1/04	Turf Diseases You'll Never Forget (1 h)	Brooklyn Landscape Gardeners Assn. Meeting	New York, NY	A,L,T
3/3/04	Basic Turf Diseases: Pick Your Best Defense (1 h)	Nassau/Suffolk Pro Turf and Plant Conference	Huntington Sta., NY	T
3/4/04	Diagnosing Plant Problems (3 h)	Master Gardener Training	Monmouth County	H
3/8/04	Anthracnose: A Pitfall in the Quest for Optimal Turf (1 h)	Idaho Golf Course Superintendents Assn. Spring Meeting	Boise, Idaho	I,T
3/8/04	Billbugs and Sod Webworm (1 h)	Idaho Golf Course Superintendents Assn. Spring Meeting	Boise, Idaho	I,T

Table A3.1. (continued).

Date	Title	Audience	Location	Participants[1]
3/8/04	The Battle Beneath: Current Concepts in Snow Molds (1 h)	Idaho Golf Course Superintendents Assn. Spring Meeting	Boise, Idaho	I,T
3/12/04	The Complete Turf Disease (6 h)	Advanced Turf Disease Mgmt. Short Course	Cook College	I,L,T
3/17/04	Diagnosing Plant Problems (3 h)	Master Gardener Training	Gloucester/ Camden County	H
3/25/04	Diseases of Trees and Shrubs (3 h)	Master Gardener Training	Ocean County	H
3/30/04	Key Insects of Shade Trees (3 h)	Master Gardener Training	Ocean County	H
4/1/04	Diagnosing Plant Problems (3 h)	Master Gardener Training	Ocean County	H
4/3/04	Diseases of Shade Trees (2 h)	Certified Tree Expert Training Program	Cook College	A,L
4/19/04	Diagnosing Plant Problems (1.5 h)	General Plant Pathology (11:770:301)	Cook College	C
4/29/04	Insect Pests in the Landscape (3 h)	Master Gardener Training	Monmouth County	H
5/24/04	Hands On Disease and Insect Pest ID (2 h)	Master Gardener Helpline Training	Cook College	H
5/27/04	Diagnosing Plant Problems (3 h)	Master Gardener Training	Passaic County	H
7/28/04	Diagnostic Hints for Landscape Turf Disease (1 h)	Rutgers Turf Field Day	Monmouth County	L,T
8/12/04	Nursery Disease Diagnostic Clinic (0.5 h)	Cream Ridge Nursery Growers Meeting	Burlington County	N
9/21/04	What's Buggin' Your Plants (0.5 h)	RCE Annual Conference	Cook College	H
9/27/04	Diagnosing Plant Problems (3 h)	Master Gardener Training	Morris County	H
10/7/04	Gray Leaf Spot and Other Common Sports Field Diseases	Sports Field Managers Assn. Turf Workshop	Cook College	T
10/20/04	Identification and Control of Ornamental Diseases (1 h)	Emergency Pesticide Recert. Short Course	Cook College	A,T,L
10/20/04	Reducing Turf Disease Through Culture (1 h)	Emergency Pesticide Recert. Short Course	Cook College	A,T,L
10/21/04	Diagnosing Plant Problems (3 h)	Master Gardener Training	Hunterdon/ Somerset County	H
11/3/04	Managing Diseases in Woody Ornamentals (1.5 h)	NJGCSA Crystal Conference	Sussex County	I,T
11/12/04	Diagnosing Plant Problems (3 h)	Master Gardener Training	Middlesex County	H
11/16/04	Diagnosing Plant Problems (3 h)	Master Gardener Training	Union County	H
12/2/04	Disease Problems in the Landscape 2004 Review (1 h)	South Jersey Landscape Conference	Gloucester County	I,L,N
12/8/04	Unusual, Devastating, and Hard to Control Turf Diseases (0.5 h)	New Jersey Turf Expo	Atlantic County	I,L,T
12/9/04	Diagnosing Plant Problems (3 h)	Master Gardener Training	Mercer County	H
12/14/04	*Poa annua* and the Triumvirate of Evil (1 h)	Fisher and Sons, Inc. Winter Turf Seminar	Landisville, PA	I,L,T
12/15/04	*Poa annua* and the Triumvirate of Evil (1 h)	Fisher and Sons, Inc. Winter Turf Seminar	ElliCott City, MD	I,L,T
12/16/04	*Poa annua* and the Triumvirate of Evil (1 h)	Fisher and Sons, Inc. Winter Turf Seminar	West Chester, PA	I,L,T

Table A3.1. (continued).

Date	Title	Audience	Location	Participants[1]
10/12/04	Diseases of Turfgrass (10 lectures)	Professional Golf Turf Management School	Cook College	T
10/12/04	Diseases of Ornamentals (10 lectures)	Professional Golf Turf Management School	Cook College	T
10/12/04	Principles of Pest Control on the Golf Course (10 lectures)	Professional Golf Turf Management School	Cook College	T
10/12/04	Insects of Turfgrass (10 lectures)	Professional Golf Turf Management School	Cook College	T

[1]Audience Addressed: A=Arborist; C=College (Academic); G=Greenhouse; H=Residential Clientele; I=Industry; L=Landscape Professionals; N=Nursery Growers; T=Turfgrass Managers; X=Christmas Tree Growers

Table A3.2. Complete listing of lectures presented by Sabrina Tirpak, PDL Principal Laboratory Technician, 2004.

Date	Title	Audience	Location	Participants[1]
1/3/04	Turf Disease Laboratory (10 lectures)	Professional Golf Turf Management School	Cook College	T
1/3/04	Turf Insect Laboratory (10 lectures)	Professional Golf Turf Management School	Cook College	T
1/22/04	Insect Identification Lab (2 hours)	RCE Garden Center Training Program	Somerset County	L,N,T
1/29/04	Disease Detection Techniques (1.25 h)	Managing Diseases of Ornamental Landscape Plants	Cook College	A,L,G,N
2/4/04	Visual Clues for Insect Pest Diagnosis (1.5 h)	Professional Parks Management School	Cook College	L,T
4/20/04	Household Insects (3 h)	Master Gardener Training	Ocean County	H
10/12/04	Turf Disease Laboratory (10 lectures)	Professional Golf Turf Management School	Cook College	T
10/12/04	Turf Insect Laboratory (10 lectures)	Professional Golf Turf Management School	Cook College	T

[1]Audience Addressed: A=Arborist; C=College (Academic); G=Greenhouse; H=Residential Clientele; I=Industry; L=Landscape Professionals; N=Nursery Growers; T=Turfgrass Managers; X=Christmas Tree Growers

Table A3.3. Complete listing of lectures presented by Dr. Stephanie Murphy, STL Coordinator, 2004.

Date	Title	Audience	Location	Partici-pants[1]
1/06/04	Exercises in Soil Testing (1.5 h)	Soil and Plant Relationships Short Course	Cook College	L, N, T
2/03/04	Water Movement in Soil (1.5 h)	Water Mgmt. and Drainage Short Course	Cook College	I, L
2/24/04	Nutrient Values of Organic Soil Amendments (0.5 h)	Central Jersey Turf and Ornamentals Institute	Mercer County	A,L,T
2/25/04	Nutrient Values of Organic Soil Amendments (0.5 h)	Central Jersey Turf and Ornamentals Institute	Monmouth County	A,L,T
3/8/04	Understanding Soils: Physical Properties (1 h)	Athletic Field Construction Short Course	Cook College	T
4/19/04	Lead in Soil: Screening Data from NJ (0.5 h)	New Brunswick Lead Coalition Symposium	New Brunswick, NJ	C,H,I
8/4/04	Incorporating Organic Recommendations into Soil Test Reports (15 min)	Sustainable Agriculture Workshop	Cook College	C, I
9/18/04	Understanding Soils (1 h)	Home Gardeners School	Cook College	H
9/29/04	Agriculture Best Management Practice #1: Soil Testing (1 h)	Soils and Society (11:375:102)	Cook College	C
10/12/04	Soil Texture and the Textural Triangle	Soil and Site Evaluation for Septic Systems Short Course	Cook College	E,Co,Hf
10/13/04	Soil Morphology and Treatment of Septic Effluent	Soil and Site Evaluation for Septic Systems Short Course	Cook College	E,Co,Hf
10/19/04	Field Exercises: Soil Profiles (3 h)	Soil and Site Evaluation for Septic Systems Short Course	Cook College	E,Co,Hf
10/20/04	Field Exercises: Writing a Soil Log (3 h)	Soil and Site Evaluation for Septic Systems Short Course	Cook College	E,Co,Hf
11/18/04	Understanding Soils for Best Management (3 h)	Master Gardener Training	Passaic County	H

[1]Audience Addressed: A=Arborist; C=College (Academic); Co=Construction; E=Engineers; G=Greenhouse; H=Residential Clientele; Hf=Health Officers; I=Industry; L=Landscape Professionals; N=Nursery Growers; T=Turfgrass Managers; X=Christmas Tree Growers

Revised: April 2005

RUTGERS COOPERATIVE RESEARCH & EXTENSION
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RUTGERS, THE STATE UNIVERSITY OF NEW JERSEY
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