Rutgers Plant Diagnostic Laboratory and Nematode Detection Service

1997 Annual Report
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Mr. Richard Buckley
Laboratory Coordinator

Introduction

The mission of the Rutgers Plant Diagnostic Laboratory and Nematode Detection Service (RPDL-NDS), a service of the New Jersey Agricultural Experiment Station (NJAES), is to provide the citizens of New Jersey with accurate and timely diagnoses of plant problems. These goals are achieved in cooperation with Rutgers Cooperative Extension (RCE) and research faculty at Cook College/NJAES. Since its establishment in April of 1991, the Plant Diagnostic Laboratory has examined over 7,152 samples submitted for plant problem diagnosis, nematode analysis, or identification. The laboratory has become an integral part of Rutgers Cooperative Extension and Cook College/NJAES programs by providing diagnostic and educational services and by assisting with research. This report summarizes the activities of the RPDL-NDS during the calendar year 1997, the laboratory’s sixth full year of operation and the fifth full year of operation for the nematode service.

History

The Rutgers Plant Diagnostic Laboratory was established in 1991 with an internal loan and is projected to become self-supporting. The laboratory was established by the dedicated efforts of RCE faculty members Dr. Ann B. Gould and Dr. Bruce B. Clarke, specialists in plant pathology, Dr. Zane Helsel, director of extension, and Dr. Karen Giroux, past assistant director of NJAES. Without their vision and persistence, this program would not exist.

On April 1, 1991, a laboratory coordinator was hired on a consultant basis to renovate laboratory space and order equipment. The laboratory is currently located in Building 6020, Old Dudley Road, on the Cook College campus. This space belongs to the department of plant pathology, who paid for renovations to the facility. We acknowledge the department’s generosity and thank them for their monetary support.

The Rutgers Plant Diagnostic Laboratory began accepting samples on June 26, 1991. At that time, the majority of equipment and supplies were in place. A full-time diagnostician (program associate) was hired September 1, 1991, and the laboratory coordinator was hired on a permanent basis on November 1, 1991.

Staff and Cooperators

Richard J. Buckley is the coordinator of the RPDL-NDS. He was promoted to this position from program associate in October of 1993. 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. Mr. Buckley is responsible for sample diagnosis, soil analysis for nematodes, and the day-to-day operation of the laboratory. Mr. Buckley’s former position of program associate remains unfilled.

The laboratory is also staffed, part time, by an undergraduate student, Ms. Sophie Penkrat. Ms. Penkrat has worked for the laboratory for four years and has become an integral part of the daily activities.
of the laboratory. The laboratory was also fortunate to receive the help of several graduate students from the department of plant pathology during the summer.

The laboratory benefits from the assistance of faculty in the departments of entomology, plant pathology, and plant science. In the department of plant pathology, Dr. Ann B. Gould (laboratory faculty coordinator) and Dr. Bruce B. Clarke have devoted hundreds of hours to laboratory business from the inception of the diagnostic laboratory concept through its eventual set-up and operation. Additional faculty and staff in this department who have provided substantial assistance during 1997 include: Dr. James White, mycology; Dr. Donald Kobayashi, phytopathology; Dr. Steve Johnston, vegetable pathology; Dr. Brad Hillman, virology; Dr. T. A. Chen, chair, plant pathology, for administrative assistance; and Pradip Majumdar, and Marshall Bergen for general assistance.

We would also like to thank Dr. John Meade, and Dr. Richard Ilnicki of plant science for assistance in weed identification and diagnosis of herbicide injury, Dr. George Wulster of plant science for assistance with problems on horticultural crops, Dr. Raul Cabrera for assistance with problems in nursery production, and Dr. Paula Shrewsbury of entomology for consultation on insect identifications. Our sincere gratitude goes to Ms. Ethel M. Dutky of the University of Maryland Plant Diagnostic Laboratory. Her advice and assistance has been instrumental in the set-up and operation of the RPDL-NDS.

**Laboratory Policy**

The RPDL-NDS receives samples from a varied clientele. According to laboratory policy, samples for diagnosis from residential clients may be submitted only after screening by appropriate county faculty or staff. If the sample requires more than a cursory diagnosis, it may be submitted, along with the appropriate payment, to the laboratory for evaluation. The county office provides the appropriate form, including instructions for proper sample selection and submission. Samples from professional clientele may be handled as above or may be submitted directly to the laboratory.

Detailed records are kept on all samples. A written response including the sample diagnosis, management and control recommendations, and other pertinent information is mailed or sent by fax to the client. Additionally, the client is billed if payment does not accompany the sample. Copies are forwarded to appropriate county faculty for their records. Commercial growers are contacted by telephone or fax to help them avoid delay in pest treatments.

**Operations**

**Diagnostics**

During 1997, the RPDL-NDS examined 1269 specimens submitted for diagnosis or identification (Table 1A) and assayed 147 soil samples for nematodes (Table 2). Compared to 1996 levels, this represents a 10% increase in plant samples and a 60% decrease in nematode samples. As expected, the majority of samples were submitted during the summer months and diminished in the fall and winter.

For comparison purposes, a listing of 1993 through 1997 sample submissions from the University of Maryland Plant Diagnostic Laboratory is included in Table 1B. From an agricultural perspective, New Jersey and Maryland are quite similar. Both states have similar demographics (a mix of major urban centers with surrounding suburban and rural areas), geographies, and agricultural crops. The University of Maryland Plant Diagnostic Laboratory has been in operation since 1979 and should serve as a predictive model for future sample submission to the RPDL-NDS. The University of Maryland Plant Diagnostic Laboratory does not assay soils for nematodes because the University has a separate Nematology Laboratory; therefore, these data are not presented.

For the fourth year, the RPDL-NDS received more samples than the University of Maryland laboratory. Although more plant samples were submitted to the Rutgers Diagnostic Laboratory, they were submitted in a seasonal pattern similar to that of the University of Maryland. The large increase in the
Table 1A. RPDL-NDS plant sample submissions by month - Rutgers University, 1993 to 1997.

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<tr>
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<td>47</td>
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<td>59</td>
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<td>May</td>
<td>77</td>
<td>70</td>
<td>137</td>
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<td>161</td>
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<tr>
<td>July</td>
<td>244</td>
<td>172</td>
<td>147</td>
<td>271</td>
<td>221</td>
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<tr>
<td>August</td>
<td>110</td>
<td>135</td>
<td>246</td>
<td>192</td>
<td>178</td>
</tr>
<tr>
<td>September</td>
<td>92</td>
<td>75</td>
<td>106</td>
<td>155</td>
<td>173</td>
</tr>
<tr>
<td>October</td>
<td>43</td>
<td>55</td>
<td>61</td>
<td>82</td>
<td>95</td>
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<tr>
<td>November</td>
<td>34</td>
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<td>49</td>
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<td>15</td>
<td>29</td>
<td>7</td>
<td>22</td>
<td>30</td>
</tr>
<tr>
<td><strong>Totals</strong></td>
<td><strong>792</strong></td>
<td><strong>822</strong></td>
<td><strong>1068</strong></td>
<td><strong>1206</strong></td>
<td><strong>1269</strong></td>
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</table>

Table 1B. RPDL-NDS plant sample submissions by month - the University of Maryland, 1993 to 1997.

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<tbody>
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<td>27</td>
<td>14</td>
<td>10</td>
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<tr>
<td>February</td>
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<td>27</td>
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<td>32</td>
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<td>46</td>
<td>50</td>
<td>82</td>
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<td>April</td>
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<td>115</td>
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<td>78</td>
<td>71</td>
<td>117</td>
<td>114</td>
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<tr>
<td>June</td>
<td>134</td>
<td>112</td>
<td>157</td>
<td>148</td>
<td>136</td>
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<tr>
<td>July</td>
<td>134</td>
<td>101</td>
<td>141</td>
<td>101</td>
<td>122</td>
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<tr>
<td>August</td>
<td>121</td>
<td>143</td>
<td>177</td>
<td>133</td>
<td>114</td>
</tr>
<tr>
<td>September</td>
<td>89</td>
<td>84</td>
<td>96</td>
<td>115</td>
<td>72</td>
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<tr>
<td>October</td>
<td>53</td>
<td>46</td>
<td>71</td>
<td>66</td>
<td>57</td>
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<tr>
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<td>15</td>
<td>16</td>
<td>9</td>
<td>9</td>
<td>14</td>
</tr>
<tr>
<td><strong>Totals</strong></td>
<td><strong>805</strong></td>
<td><strong>785</strong></td>
<td><strong>1039</strong></td>
<td><strong>849</strong></td>
<td><strong>763</strong></td>
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sample load at the Rutgers laboratory in the summer reflects the large number of golf turf samples sent to the laboratory at that time. Maryland does not process turf samples in their laboratory. We expect that the number of samples submitted to Rutgers will continue to increase as we continue to advertise the laboratory and as more growers become aware of our services.

The Nematode Detection Service began accepting soil samples on July 1, 1992 after the retirement of Dr. Jack Springer. In 1997, the Nematode Detection Service processed 147 soil samples for nematode assays. The decrease in nematode samples is due in part to the success with nematode detection on golf courses. Many of the golf turf clients have identified nematodes as potential problems on golf greens and have begun to sample greens for nematodes as they develop integrated management programs. This active management by golf course superintendents, using laboratory services as part of their integrated pest management programs, initially resulted in an increase in sample submissions. As problem areas were identified and controlled, sample submissions subsequently dropped. Regular monitoring of the "hot spots" will be required, but large scale sampling may not be necessary for these clients.

Of the specimens submitted to the RPDL-NDS for diagnosis or identification in 1997, 67% were from commercial growers, 30% were from residential clientele, and 3% were submitted from research faculty at Rutgers University (Table 3). Of the samples submitted to the Nematode Detection Service, 88% were from commercial growers, 11% were from Rutgers research projects, and 1% were from residential clients. We expect that the number of nematode samples submitted from residential clients will remain low or be non-existent since much of this clientele is not familiar with nematode pests.

Whereas samples from research programs represent a relatively small percentage of the total number of plant and soil samples received, they are

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<td>0</td>
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<td>13</td>
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<tr>
<td>December</td>
<td>45</td>
<td>7</td>
<td>7</td>
<td>12</td>
<td>0</td>
</tr>
<tr>
<td>Total:</td>
<td>167</td>
<td>219</td>
<td>129</td>
<td>242</td>
<td>147</td>
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</table>
an extremely important component. Research samples allow the diagnosticians to cooperate with University faculty on problems often of great importance to the State of New Jersey. The problems associated with these samples are challenging and occasionally lead to the diagnosis of a new disease.

Since turfgrass and ornamentals represent the largest agricultural commodities in New Jersey, it follows that the vast majority of samples submitted for diagnosis (82%) were either turfgrass or ornamental plants (Table 4). The wide variety of turf and ornamental species grown under diverse environmental conditions results in a large number of problems not readily identifiable by growers or county faculty. In addition, pest diagnosis and plant identification for commercial growers of other crops are still handled by extension specialists and county agents in other parts of the state at no charge. Soil samples submitted to the laboratory for nematode analysis were roughly split between golf turf and from production agriculture. The majority of the samples from production agriculture were from several growers in southern New Jersey who specialize in small grains, potatoes, peaches, and carrots. Special thanks to the IPM agents in vegetable and field

Table 3. RPDL-NDS sample submissions by origin, 1997.

<table>
<thead>
<tr>
<th>Sample Origin</th>
<th>Number of Plant Samples</th>
<th>Percent of Total</th>
<th>Number of Nematode Samples</th>
<th>Percent of Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commercial Growers</td>
<td>852</td>
<td>67%</td>
<td>129</td>
<td>88%</td>
</tr>
<tr>
<td>Residential</td>
<td>385</td>
<td>30%</td>
<td>2</td>
<td>1%</td>
</tr>
<tr>
<td>Research Programs (Rutgers University)</td>
<td>32</td>
<td>3%</td>
<td>15</td>
<td>11%</td>
</tr>
<tr>
<td><strong>Totals</strong></td>
<td><strong>1269</strong></td>
<td><strong>100%</strong></td>
<td><strong>147</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

Table 4. RPDL-NDS sample submissions by crop category, 1997.

<table>
<thead>
<tr>
<th>Crop</th>
<th>Number of Plant Samples</th>
<th>Percent of Total</th>
<th>Number of Nematode Samples</th>
<th>Percent of Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Turf</td>
<td>478</td>
<td>48%</td>
<td>104</td>
<td>71%</td>
</tr>
<tr>
<td>Ornamentals</td>
<td>569</td>
<td>45%</td>
<td>4</td>
<td>3%</td>
</tr>
<tr>
<td>Field Crops</td>
<td>5</td>
<td>0.5%</td>
<td>19</td>
<td>13%</td>
</tr>
<tr>
<td>Vegetable</td>
<td>55</td>
<td>4%</td>
<td>16</td>
<td>10%</td>
</tr>
<tr>
<td>Fruit</td>
<td>29</td>
<td>2%</td>
<td>4</td>
<td>3%</td>
</tr>
<tr>
<td>Insect ID</td>
<td>74</td>
<td>6%</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Plant ID</td>
<td>50</td>
<td>4%</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Fungus ID</td>
<td>9</td>
<td>0.5%</td>
<td>0</td>
<td>0</td>
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<tr>
<td><strong>Totals</strong></td>
<td><strong>1269</strong></td>
<td><strong>100%</strong></td>
<td><strong>147</strong></td>
<td><strong>100%</strong></td>
</tr>
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</table>
crops for their support. It is hoped that, in the future, other state IPM programs will submit samples to the RPDL-NDS.

Samples were submitted to the RPDL-NDS from all of the counties in New Jersey (Tables 5A and 5B). The majority of samples, however, were submitted from counties in close proximity to the laboratory or from counties with dense populations that have disease problems associated with turf and ornamentals in residential landscapes or on golf courses. Disease problems on these commodities are difficult to diagnose and are subsequently submitted 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. This county profile also identifies the county faculty that are familiar with the RPDL-NDS and utilize its services.

Approximately 20% of the samples submitted for diagnosis to the laboratory were from out-of-state (Table 5A and 5B). Nearly all of these samples were turf. Because of his national reputation and his

| Table 5A. RPDL-NDS sample submissions by county, 1993 to 1997. |
|------------------|--------|--------|--------|--------|--------|
| Atlantic         | 8      | 20     | 40     | 42     | 57     |
| Bergen           | 59     | 60     | 62     | 71     | 85     |
| Burlington       | 51     | 31     | 54     | 67     | 97     |
| Camden           | 28     | 25     | 37     | 42     | 37     |
| Cape May         | 16     | 10     | 9      | 16     | 25     |
| Cumberland       | 6      | 14     | 7      | 8      | 15     |
| Essex            | 20     | 30     | 22     | 20     | 22     |
| Gloucester       | 22     | 26     | 61     | 19     | 21     |
| Hudson           | 5      | 0      | 6      | 1      | 16     |
| Hunterdon        | 19     | 37     | 31     | 22     | 27     |
| Mercer           | 36     | 65     | 47     | 44     | 28     |
| Middlesex        | 66     | 85     | 119    | 129    | 157    |
| Monmouth         | 79     | 59     | 77     | 58     | 87     |
| Morris           | 22     | 34     | 53     | 90     | 56     |
| Ocean            | 22     | 17     | 56     | 63     | 37     |
| Passaic          | 34     | 19     | 44     | 69     | 68     |
| Salem            | 0      | 9      | 11     | 12     | 6      |
| Somerset         | 52     | 51     | 52     | 54     | 91     |
| Sussex           | 18     | 6      | 13     | 15     | 13     |
| Union            | 45     | 20     | 56     | 27     | 63     |
| Warren           | 24     | 33     | 29     | 30     | 30     |
| Rutgers Research | 51     | 74     | 67     | 81     | 32     |
| **In-State Totals** | **683** | **725** | **953** | **981** | **1070** |
| **Out-of-State**  | **109** | **97**  | **115** | **225** | **199** |
| **Totals**        | **792** | **822** | **1068**| **1206**| **1269**|
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. Golf turf samples were submitted to the laboratory from 18 states, several from states as far away as Arizona, New Mexico, and California. Because there are very few laboratories in the country that diagnose turfgrass diseases, these superintendents have continued to submit samples to the RPDL-NDS. Furthermore, many golf turf professionals at other universities often refer their clients to Rutgers for second opinions or when they are on leave. The charge for out-of-state samples is substantially higher to help defray the cost of in-state samples. This area of client development is the fastest growing area in the laboratory.

Of the plant specimens submitted to the RPDL-NDS for diagnosis or identification, 41% were associated with biotic disease-causing agents (Table 6).

Table 5B. RPDL-NDS nematode submissions by county, 1993 to 1997.

<table>
<thead>
<tr>
<th>County</th>
<th>Number of nematode samples</th>
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<tbody>
<tr>
<td>Atlantic</td>
<td></td>
</tr>
<tr>
<td>Bergen</td>
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<tr>
<td>Burlington</td>
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<tr>
<td>Camden</td>
<td></td>
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<tr>
<td>Cape May</td>
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<td>Cumberland</td>
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<td>Essex</td>
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<td>Gloucester</td>
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<td>Hudson</td>
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<td>Hunterdon</td>
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<tr>
<td>Mercer</td>
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<tr>
<td>Middlesex</td>
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<td>Morris</td>
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<td>Ocean</td>
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<td>Passaic</td>
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<td>Union</td>
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<td>Warren</td>
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<tr>
<td>Rutgers Research</td>
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<tr>
<td><strong>In-State Totals</strong></td>
<td>150</td>
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<tr>
<td><strong>Out-of-State</strong></td>
<td>17</td>
</tr>
<tr>
<td><strong>Totals</strong></td>
<td>167</td>
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</tbody>
</table>
Injury to 11% of the samples was caused by insects and related arthropods, and 38% were associated with abiotic injuries and stresses (e.g., environmental extremes, nutrient deficiencies, poor cultural practices, poor soil conditions, etc.). Another 10% included insect, plant, fungal, and substance identification. The overall breakdown in sample submissions is typical of that reported by other diagnostic laboratories in the United States.

In 1997, the mean response time for samples diagnosed in less than 21 days was 2.04 days. This is a slight decrease in response time from the 1996 mean response time of 2.25 days. The rapid response time is attributed largely to the presence of Ms. Sophie Penkrat, an exceptionally competent helper who worked tirelessly in the laboratory during the summer months. Ms. Penkrat has developed into an assistant who can easily fulfill most of the responsibilities of a program associate or horticultural consultant. Adequately trained staff is essential to the efficient operation of the laboratory. The University of Maryland laboratory's response time increased by approximately one full day when a summer position went unfilled.

A laboratory response was prepared in less than three days for most (85%) of the samples submitted (Table 7), and 92% 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.

### Other Laboratory Activities

#### Teaching

In addition to providing diagnostic services, the staff of the RPDL-NDS provides educational services to Cook College/NJAES, Rutgers Cooperative Extension, and other agencies (Appendix II). Many of these educational activities generated additional income for the laboratory.

In 1997, Mr. Buckley 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 teaches three courses, Diseases of Turf and Diseases of Ornamental Plants, as well as, Insect Pests in Fine Turf in both the spring and fall sessions. This teaching commitment consisted of one two-hour lecture in each class per week for ten weeks. In 1997, Mr. Buckley also provided several other lectures on insect related topics and assisted in the development of a laboratory exercise for the students. Mr. Buckley's efforts in the Professional Golf Turf Management School generated $12,345 income for the laboratory in 1997.

Mr. Buckley participated in several other Office of Continuing Professional Education short courses in 1997. These courses include: the Professional Grounds Maintenance Short Course; Golf Turf Management School: Three Week Preparatory Course; the Home Gardeners School; Introduction to Golf Turf Management; Landscape Integrated Pest Management: An Intelligent Approach; Athletic Field Maintenance; Pest Management in Ornamental Landscape Plants; and the Home Depot Garden Center Management Workshop. The income gener-

### Table 6. RPDL-NDS plant sample submissions by diagnosis, 1997.

<table>
<thead>
<tr>
<th>Diagnosis</th>
<th>Number of Samples</th>
<th>Percent of Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disease (biotic)</td>
<td>517</td>
<td>41%</td>
</tr>
<tr>
<td>Insect</td>
<td>138</td>
<td>11%</td>
</tr>
<tr>
<td>Identification</td>
<td>133</td>
<td>10%</td>
</tr>
<tr>
<td>Other</td>
<td>481</td>
<td>38%</td>
</tr>
<tr>
<td><strong>Totals</strong></td>
<td><strong>1269</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>
Table 7. Sample response times, 1997.

<table>
<thead>
<tr>
<th>Response time</th>
<th>Number of samples</th>
<th>Percent of total</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 to 3 days</td>
<td>1080</td>
<td>85%</td>
</tr>
<tr>
<td>4 to 6 days</td>
<td>88</td>
<td>7%</td>
</tr>
<tr>
<td>7 to 10 days</td>
<td>41</td>
<td>3%</td>
</tr>
<tr>
<td>11 to 21 days</td>
<td>55</td>
<td>4%</td>
</tr>
<tr>
<td>&gt;21 days</td>
<td>5</td>
<td>1%</td>
</tr>
<tr>
<td><strong>Totals</strong></td>
<td><strong>1269</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

ated by these activities with the Office of Continuing Professional Education was $1,950.

Mr. Buckley also served as the course coordinator for the Pest Management in Landscape Turf Short Course. This was the fourth year for this one-day program. He also served as the coordinator for the Advanced Turf Management Symposium. A two-day program dedicated to current problems in fine turf under his direction for the third year. The income generated by these programs with the Office of Continuing Professional Education was $2,625.

Mr. Buckley was an invited speaker in several Rutgers Cooperative Extension programs. The following programs were included: the North Jersey Ornamental Horticulture Conference, landscape and tree days; the Central Jersey Turf and Ornamentals Institute, Monmouth, Middlesex, and Somerset Counties; the Insect Identification Inservice; Landscape IPM: Ornamental Insect and Disease Clinic; Christmas Tree Growers Twilight Meeting; and Basics of Landscape IPM in Union County. Lectures in support of the and the Mercer, Middlesex, Ocean, and Somerset County Master Gardener Programs were also given. The laboratory received compensation of $725 for these efforts.

Mr. Buckley also earned income for the RPDL-NDS as an invited speaker for the New Jersey Turf Expo, Prolawn Turf Products Golf Turf Care Clinic, the Michael Fisher and Sons Golf Turf Seminar, the Certified Tree Experts Educational Program, and in a life science class at Herbert Hoover Middle School in Edison, N.J. The income from these talks was $650.

Other educational services provided by the staff of the RPDL-NDS, for which the laboratory received no compensation, included lectures in several undergraduate and graduate courses including Fine and Sports Turf, and Principles of Plant Pathology. Mr. Buckley participated in the filming of “The Greener Thumb” video, and was also featured in several television shows developed by extension faculty in Middlesex County. Short presentations describing how to utilize RPDL-NDS services were given to several groups and at several Office of Continuing Professional Education short courses.

**Extension Publications.** During 1997, the RPDL-NDS 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 by Rutgers Cooperative Extension and the New Jersey Agricultural Experiment Station.

Three extension fact sheets were co-authored in 1997. Several other extension fact sheets were also written during the year and are currently under review.


Other Publications. Mr. Buckley published articles in two trade journals in 1997.


Service. Mr. Buckley served as a member of the Rutgers Cooperative Extension Home Horticulture Working Group. At Ag Field Day, he organized and staffed a well-attended “Plant Problem Question and Answer Booth.” He also volunteered to staff an information booth at the Display Gardens Open House.

Marketing

The RPDL-NDS developed a 15 minute slide presentation to help advertise laboratory services to various grower groups. Copies of this presentation are available on loan to anyone who wishes to advertise the laboratory’s services. Numerous presentations of this program were made throughout 1997 by the staff of the Plant Diagnostic Laboratory.

An advertising brochure was developed in 1992 for general distribution at county offices, grower meetings, and other activities. This brochure briefly describes the services of the RPDL-NDS and how to access them. To date, over 20,000 copies of this brochure have been distributed. The brochure is currently being reviewed and revised. Once again, special thanks goes to the Office of Continuing Professional Education, who 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 and utilized. This display unit briefly describes the services of the RPDL-NDS and how to access them, and is available on loan to anyone who wishes to advertise the laboratory services. The events at which the display was utilized included Ag Field Day, the Rutgers Gardens Open House, and Turf Field Day. Funding for the display unit was provided by Dr. G. David Lewis of the department of plant pathology. We wish to acknowledge his generosity and support.

Funding

The Plant Diagnostic Laboratory is expected to be self-supporting within five years of its establishment. Funding for the laboratory is generated by charging clientele for diagnostic services and educational activities (Table 8).

Over $51,935 was generated from diagnostic services and nematode assays during 1997, representing a 1% increase in income over 1996.

A sample submission form and the appropriate payment accompanied the majority of samples received from residential clientele. Most commercial samples were accompanied by a submission form;

<table>
<thead>
<tr>
<th>Client</th>
<th>Fee</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residential Clients</td>
<td>$20.00/sample</td>
</tr>
<tr>
<td>Commercial Growers:</td>
<td></td>
</tr>
<tr>
<td>Fine turf</td>
<td>$50.00/sample</td>
</tr>
<tr>
<td>All others</td>
<td>$20.00/sample</td>
</tr>
<tr>
<td>Out-of-State Growers</td>
<td>$75.00/sample</td>
</tr>
</tbody>
</table>
however, the majority of these submissions did not include payment. In most cases, commercial growers preferred to be sent a bill. Over 95% of the clients billed have remitted payment. The laboratory staff continues to collect outstanding accounts from previous years. Almost all of the samples diagnosed for research programs at Rutgers University were paid for by transfer of funds.

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 processed 182 of these “no charge” samples in 1997 (Table 9). These samples accounted for 13% of the samples processed. The value of these no charge requests was $3780.

Income generated from all laboratory activities covered 100% of the non-salary expenses incurred in 1997, 93% of salaries, or 82% of the laboratory’s total expenditures (including salaries and one-time costs for equipment). For more detailed budget information see Appendix I.

**Future Directions**

As in the past, the top priority for 1998 will be to generate more income. To accomplish this, we will continue to advertise laboratory services to increase sample number. Continued cooperation with the Office of Continuing Professional Education and other educational activities are expected to generate additional funds.

Other priorities in 1998 include: the development of additional educational materials in the form of bulletins, fact sheets, and slide sets in cooperation with extension faculty; focusing on ways to add and train labor for the laboratory during its busiest periods; finding and moving into suitable permanent facilities as soon as possible; and professional improvement (which includes participation in professional societies).

We are constantly evaluating the immediate and future needs of the State for additional services. Possibilities for additional services include assays for determining pest tolerance (apple scab, brown rot, and European red mite) for the Fruit IPM program, and expanded nematode, insect, and weed identification services.

Since the retirement of Dr. Louis Vasvary in 1995, there has been an increased need for insect identification services, particularly in the area of household and structural pests. In cooperation with the department of entomology the Plant Diagnostic Laboratory has added a graduate student to the staff to assist in this capacity. The student, as a condition of his funding, will dedicate 15 hours a week to the laboratory. It is hoped that with the added staffing,

<table>
<thead>
<tr>
<th>Client Category</th>
<th>Number of Samples</th>
</tr>
</thead>
<tbody>
<tr>
<td>RCE County Faculty/Program Associates</td>
<td>70</td>
</tr>
<tr>
<td>RCE Specialists</td>
<td>20</td>
</tr>
<tr>
<td>Rutgers Research Programs (not RCE)</td>
<td>15</td>
</tr>
<tr>
<td>Rutgers Non-Research Faculty/Staff</td>
<td>18</td>
</tr>
<tr>
<td>Direct Mail/Walk-ins</td>
<td>63</td>
</tr>
<tr>
<td>Other Government Agencies/University</td>
<td>3</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>182</strong></td>
</tr>
</tbody>
</table>
the laboratory will be able to effectively improve the insect identification function traditionally offered by the lab. Tick identification and Lyme disease testing may also be added as services.

**Plant Disease Highlights**

The occurrence and severity of plant diseases are strongly influenced by environmental conditions. The 1997 growing season was greatly affected by a year with a cool, wet spring, a dry summer, and a wet fall. Diseases favored or enhanced by these conditions were especially prevalent.

**Ornamentals**

As usual, a vast majority of ornamental plants submitted to the laboratory were affected by abiotic agents. The symptoms of these problems appeared as leaf scorch, premature defoliations, branch dieback, or early and late fall color, and an overall decline in plant vigor. Planting problems and poor site conditions were a primary cause of many plant failures. The cumulative effects of several seasons of erratic and extreme weather also strongly contributed to many plant failures.

Of the diseases that were caused by biotic agents, several leaf spots, anthracnose, needlecasts, and rusts were diagnosed. These leaf diseases are enhanced by frequent spring rains. Cankers caused by the fungi *Botryosphaeria*, *Acreopilis*, and *Cytospora*, were prevalent in trees and shrubs injured during the drought of 1995. Root-infecting pathogens detected this year on a variety of ornamental plants included *Phytophthora*, *Pythium*, *Fusarium*, and *Rhizoctonia*.

The insect problems most commonly diagnosed were caused by spruce mites and various scales; however, many samples also had evidence of bark beetle or borer activity. Like the cankers, borer problems originated with drought conditions in 1995. White pine had a particularly tough season with borers. Presumably these trees were predisposed by excess moisture in the root zone from spring rains.

In the greenhouse, *Pythium* and *Rhizoctonia* root rots continue to be the most common problem. *Botrytis* gray mold is always a problem. Nutrient and salt problems are also prevalent. Several growers submitted samples to the laboratory of a variety of plants that tested positive for the tospoviruses, impatiens necrotic spot or tomato spotted wilt.

**Turf**

It was an easy year for fine turf in New Jersey and the mid-Atlantic region. Cool, wet conditions in the spring held up the normal spring green-up. Many impatient superintendents sampled their turf for fear of pathogen activity at that time. Once the temperatures stabilized the turf responded nicely. Heat and drought stress were not a problem this summer so most turf did quite well. The height of cut on the greens of many courses has crept below .25 inch. This is an extremely stressful situation for turfgrasses and should make for an interesting 1998 if there are heat and drought stress problems. Anthracnose continues to increase in the state and may be the most common golf turf disease. As usual, red thread, brown patch, and *Pythium* diseases were also very prevalent.

**Vegetables**

In vegetables, root knot nematode in carrot and lesion nematode in potato continue to be primary problems. Nematodes have also been problematic for several small grain growers in south jersey. The cooler, wet weather early in the season enhanced bacterial activity in the tomato and pepper crops in 1997. Bacterial spot and canker were the most common submissions.
APPENDIX I. Rutgers Plant Diagnostic Laboratory and Nematode Detection Service Budget.

Table 10. RPDL-NDS expenditures in 1997.

<table>
<thead>
<tr>
<th>Category</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Salaries &amp; Benefits</td>
<td>$75,272.28</td>
</tr>
<tr>
<td>Supplies and Services:</td>
<td>$7803.84</td>
</tr>
<tr>
<td>Diagnostic supplies</td>
<td></td>
</tr>
<tr>
<td>Printing/advertising</td>
<td></td>
</tr>
<tr>
<td>References/publications</td>
<td></td>
</tr>
<tr>
<td>Equipment maintenance</td>
<td></td>
</tr>
<tr>
<td>Office supplies</td>
<td></td>
</tr>
<tr>
<td>Photographic services</td>
<td></td>
</tr>
<tr>
<td>Communications</td>
<td></td>
</tr>
<tr>
<td>Telephone/Fax</td>
<td></td>
</tr>
<tr>
<td>Postage</td>
<td>$1424.00</td>
</tr>
<tr>
<td>Travel: (includes)</td>
<td></td>
</tr>
<tr>
<td>Travel to give paid talks</td>
<td>$1101.06</td>
</tr>
<tr>
<td>Travel to professional meetings</td>
<td></td>
</tr>
<tr>
<td>Travel for training</td>
<td></td>
</tr>
<tr>
<td><strong>Total Expenditures:</strong></td>
<td><strong>$85,601.18</strong></td>
</tr>
</tbody>
</table>

Table 11. RPDL-NDS income in 1997.

<table>
<thead>
<tr>
<th>Category</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample fees:</td>
<td>$46,910.00</td>
</tr>
<tr>
<td>Unpaid sample fees:</td>
<td>$1245.00</td>
</tr>
<tr>
<td>Lecture fees:</td>
<td></td>
</tr>
<tr>
<td>Professional Golf Turf School</td>
<td>$12,345.00</td>
</tr>
<tr>
<td>O.C.P.E. Short Course Coordinator</td>
<td>$2,625.00</td>
</tr>
<tr>
<td>O.C.P.E. Short Course Instructor</td>
<td>$1,950.00</td>
</tr>
<tr>
<td>Other</td>
<td>$1,375.00</td>
</tr>
<tr>
<td>Value of no-charge samples</td>
<td>&lt;$3780.00</td>
</tr>
<tr>
<td><strong>Potential Total Income:</strong></td>
<td>&lt;$70,230.00</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Category</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Actual Total Income:</strong></td>
<td><strong>$66,450.00</strong></td>
</tr>
</tbody>
</table>

Table 12. RPDL-NDS estimated expenditures for 1998.

<table>
<thead>
<tr>
<th>Category</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Salaries and benefits:</td>
<td>$68,600</td>
</tr>
<tr>
<td>Seasonal labor:</td>
<td>$10,000</td>
</tr>
<tr>
<td>General operating:</td>
<td>$7,500</td>
</tr>
<tr>
<td>One-time equipment cost:</td>
<td>$15,000</td>
</tr>
<tr>
<td>Educational development and travel</td>
<td>$1,500</td>
</tr>
<tr>
<td>New facility renovation?</td>
<td>$?</td>
</tr>
<tr>
<td><strong>Total Estimated Expenditures 1998:</strong></td>
<td><strong>$102,600</strong></td>
</tr>
</tbody>
</table>

Table 13. RPDL-NDS estimated income for 1998\(^1\).

<table>
<thead>
<tr>
<th>Category</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Estimated Turf Sample Income:</td>
<td>$30,000</td>
</tr>
<tr>
<td>40% @ $50</td>
<td></td>
</tr>
<tr>
<td>Estimated Out-of-State Sample Income:</td>
<td>$22,500</td>
</tr>
<tr>
<td>20% @ $75</td>
<td></td>
</tr>
<tr>
<td>Estimated All Other Sample Income:</td>
<td>$12,000</td>
</tr>
<tr>
<td>40% @ $20</td>
<td></td>
</tr>
<tr>
<td>Estimated Lecture Fee Income:</td>
<td>$20,000</td>
</tr>
<tr>
<td><strong>Total Estimated Income 1998:</strong></td>
<td><strong>$84,500</strong></td>
</tr>
</tbody>
</table>

\(^1\) based on 1500 samples submitted in 1998.
### Appendix II. Complete Listing of Lectures Presented During 1997.

**Richard J. Buckley, Laboratory Coordinator, Plant Diagnostic Laboratory**

<table>
<thead>
<tr>
<th>Date</th>
<th>Title of Presentation</th>
<th>Audience</th>
<th>Location</th>
<th>Number of handouts</th>
<th>Type of participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-3/97</td>
<td>Diseases of Turfgrass (10 Lectures)</td>
<td>Professional Golf Turf Management School</td>
<td>Cook College</td>
<td>20</td>
<td>T</td>
</tr>
<tr>
<td>1-3/97</td>
<td>Diseases of Ornamentals (10 Lectures)</td>
<td>Professional Golf Turf Management School</td>
<td>Cook College</td>
<td>20</td>
<td>T</td>
</tr>
<tr>
<td>1-3/97</td>
<td>Insects of Turfgrass (10 Lectures)</td>
<td>Professional Golf Turf Management School</td>
<td>Cook College</td>
<td>20</td>
<td>T</td>
</tr>
<tr>
<td>1/9/97</td>
<td>Managing Diseases in Landscape Turf</td>
<td>Professional Grounds Maintenance Short Course</td>
<td>Cook College</td>
<td>2</td>
<td>T, L</td>
</tr>
<tr>
<td>1/30/97</td>
<td>Diseases of Turfgrass</td>
<td>Golf Turf Management School: Three Week Preparatory Course</td>
<td>Cook College</td>
<td>2</td>
<td>T</td>
</tr>
<tr>
<td>2/4/97</td>
<td>Diagnosis of Plant/Pest Disorders</td>
<td>Landscape IPM: An Intelligent Approach</td>
<td>Cook College</td>
<td>2</td>
<td>A, T, L</td>
</tr>
<tr>
<td>2/12/97</td>
<td>Plant Diagnostic Laboratory Landscape Disease Update</td>
<td>North Jersey Ornamental Horticulture Conference</td>
<td>Bergen County</td>
<td>2</td>
<td>A, J, L, T</td>
</tr>
<tr>
<td>2/28/97</td>
<td>Turf Disease Problems and Their Control</td>
<td>Athletic Field Maintenance Short Course</td>
<td>Bergen County</td>
<td>3</td>
<td>L, T</td>
</tr>
<tr>
<td>2/27/97</td>
<td>Turf Disease Diagnosis</td>
<td>Lasco North Jersey Golf Turf Seminar</td>
<td>Bergen County</td>
<td>3</td>
<td>I, T</td>
</tr>
<tr>
<td>3/4/97</td>
<td>Effective Use of the Plant Diagnostic Laboratory</td>
<td>Introduction to Golf Turf Management Short Course</td>
<td>Cook College</td>
<td>2</td>
<td>T</td>
</tr>
<tr>
<td>3/4/97</td>
<td>Common Spring Diseases in the Landscape</td>
<td>Central Jersey Turf and Ornamentals Workshop</td>
<td>Monmouth Co.</td>
<td>2</td>
<td>A, T, L</td>
</tr>
<tr>
<td>3/5/97</td>
<td>Common Spring Diseases in the Landscape</td>
<td>Central Jersey Turf and Ornamentals Workshop</td>
<td>Mercer Co.</td>
<td>2</td>
<td>A, T, L</td>
</tr>
<tr>
<td>3/6/97</td>
<td>Common Spring Diseases in the Landscape</td>
<td>Central Jersey Turf and Ornamentals Workshop</td>
<td>Somerset Co.</td>
<td>2</td>
<td>A, T, L</td>
</tr>
<tr>
<td>3/11/97</td>
<td>Fungicide Use of Shade Trees</td>
<td>North Jersey Ornamental Horticulture Conference</td>
<td>Morris Co.</td>
<td>2</td>
<td>A, L</td>
</tr>
<tr>
<td>3/15/97</td>
<td>Managing Diseases in Landscape Turf</td>
<td>Home Gardeners School</td>
<td>Cook College</td>
<td>3</td>
<td>H</td>
</tr>
<tr>
<td>3/20/97</td>
<td>What is a Plant Disease</td>
<td>Herbert Hoover Middle School</td>
<td>Middlesex Co.</td>
<td>1</td>
<td>H</td>
</tr>
<tr>
<td>3/31/97</td>
<td>Diagnosing Plant Disease</td>
<td>Home Depot Management Training Program</td>
<td>Cook College</td>
<td>3</td>
<td>H</td>
</tr>
<tr>
<td>4/7/97</td>
<td>Insect Problems in Sports Turf</td>
<td>Fine and Sports Turf 11:775:451</td>
<td>Cook College</td>
<td>4</td>
<td>C</td>
</tr>
<tr>
<td>4/14/97</td>
<td>Insect Problems in Sports Turf</td>
<td>Fine and Sports Turf 11:775:451</td>
<td>Cook College</td>
<td>4</td>
<td>C</td>
</tr>
<tr>
<td>4/11/97</td>
<td>Plant Pest Diagnosis</td>
<td>Master Gardener Training</td>
<td>Ocean Co.</td>
<td>3</td>
<td>H</td>
</tr>
<tr>
<td>5/9/97</td>
<td>Plant Diagnostic Lab Insect Identification Services</td>
<td>RCE Insect Identification Services</td>
<td>Cook College</td>
<td>1</td>
<td>I</td>
</tr>
<tr>
<td>5/9/97</td>
<td>Turf Diseases</td>
<td>ISA Training Program</td>
<td>Monmouth Co.</td>
<td>3</td>
<td>A</td>
</tr>
<tr>
<td>6/12/97</td>
<td>Diagnosing Plant Problems in the Landscape</td>
<td>Ornamental Insect &amp; Disease Clinic</td>
<td>Monmouth Co.</td>
<td>1</td>
<td>A, T, L</td>
</tr>
<tr>
<td>6/12/97</td>
<td>Christmas Tree Disease Problems</td>
<td>Christmas Tree Growers Twilight Meeting</td>
<td>Cook College</td>
<td>2</td>
<td>A</td>
</tr>
<tr>
<td>9/20/97</td>
<td>Insect Problems in Landscape Turf</td>
<td>Home Gardeners School</td>
<td>Cook College</td>
<td>3</td>
<td>H</td>
</tr>
<tr>
<td>10/1/97</td>
<td>Nematomes</td>
<td>Principles of Plant Pathology 16:765:531</td>
<td>Cook College</td>
<td>10</td>
<td>C</td>
</tr>
<tr>
<td>10/21/97</td>
<td>Fungicide Use on Shade Trees</td>
<td>Basics of Landscape IPM</td>
<td>Union Co.</td>
<td>3</td>
<td>A, T, L</td>
</tr>
<tr>
<td>10/23/97</td>
<td>Diagnosing Plant Problems</td>
<td>Master Gardeners Training Program</td>
<td>Somerset Co.</td>
<td>3</td>
<td>H</td>
</tr>
<tr>
<td>11/7/97</td>
<td>Diagnosing Plant Problems</td>
<td>Master Gardeners Training Program</td>
<td>Middlesex Co.</td>
<td>3</td>
<td>H</td>
</tr>
<tr>
<td>11/12/97</td>
<td>Turf Disease Diagnosis in the Laboratory</td>
<td>Michael Fisher &amp; Sons Golf Turf Seminar</td>
<td>West Chester, PA</td>
<td>3</td>
<td>T</td>
</tr>
<tr>
<td>12/3/97</td>
<td>Disease Management and Control in the Landscape</td>
<td>Past Management of Ornamental Landscape Plants Short Course</td>
<td>Cook College</td>
<td>3</td>
<td>A, T, L</td>
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<td>12/4/97</td>
<td>Turf Diseases</td>
<td>Post Management in Landscape Turf</td>
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<td>Diagnosing Plant Problems</td>
<td>Ocean County Vocational School</td>
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<td>Diagnosing Plant Problems</td>
<td>Master Gardeners Training Program</td>
<td>Mercer Co.</td>
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<td>10-12/96</td>
<td>Introduction to Entomology Diagnosis</td>
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<tr>
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<td>Diseases of Turfgrass (10 Lectures)</td>
<td>Professional Golf Turf Management School</td>
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<td>Cook College</td>
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</tbody>
</table>

Audience Addressed: A = Arborists; C = College (Academic); H = Residential Clientele; I = Industry; L = Landscape Professionals; T = Turfgrass Managers.