

Teaching Introductory Plant Pathology by the with Satellite Laboratory Options

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Teaching introductory plant pathology is a challenge for most plant pathologists. A student's first impressions of a discipline can have lasting effects on career goals and professional development. Thus, considerable emphasis is placed on instructor assignments for introductory courses.

The Traditional Approach . . .

The traditional approach to teaching introductory plant pathology centers on a lecture-oriented course that emphasizes principles and concepts of plant diseases. The lecture material may be reinforced by a laboratory, with disease specimens, experiments, and field trips. The instructor may concentrate on the lecture and give graduate assistants the responsibility for conducting the laboratory. The credit toward the overall course grade received by the student for time spent in the laboratory may be disproportionately little.

The traditional approach assumes that certain "classic diseases," such as late blight of potato, clubroot of cabbage, and stem rust of wheat, represent the nature and essence of plant pathology. Once the terminology and concepts of the classic diseases have been mastered, the student can apply them to the particular crop of interest, whether alfalfa, almonds, ash, asparagus, asters, or azaleas.

During recent years, we have perceived a changing student attitude toward this traditional approach. Students in land-grant universities are career-oriented and tend to specialize early in their college education. They want to be able to apply what they learn in plant pathology to

their specialized field. Most students feel uncomfortable—and may not be successful—in transferring the principles and concepts of the classic diseases to the crops of their specialty.

. . . and the Commodity Approach

At North Carolina State University, a flexible, commodity-oriented plan for teaching plant pathology has been developed. Lecture (three credits) still follows the traditional approach, using principles and concepts, but students now choose from five one-credit laboratory options, or "satellites," that relate to commodities as well as to the central lecture. With this approach, a completely new course for each commodity does not have to be developed.

The instructors of introductory plant pathology realized that coordination of the lecture course and the satellite laboratory options was very important. They chose a causal-agent presentation similar to that used by George N. Agrios in *Plant Pathology* (Academic Press, New York, 1978) as being most amenable to coordination and suitable for providing a framework wherein principles could be enunciated.

The transition from the traditional approach to the commodity approach with satellite laboratory options requires a commitment by six faculty to develop material for the appropriate option or lecture and to teach the option on a regular basis. Six faculty involved on a regular basis in one introductory course is a heavy investment in teaching for a department of plant pathology, an investment small departments would find difficult to make. At North Carolina State University, only three of the six faculty are involved every semester. However, none of the faculty are full-time instructors; all have at least a 60% research responsibility.

The Lecture Course

"Plant Pathology 315, Plant Diseases" is designed to impart to students

fundamentals and principles inherent in the discipline of plant pathology. Therefore, disease diagnosis as such is not emphasized, except to illustrate development of certain symptoms as related to pathogen activities in or on the host. Similarly, specific control practices are presented mainly to reinforce such concepts as inoculum survival and dissemination, infection processes, and epidemiology in general.

Recognized phytopathological principles are treated in the lecture course at times deemed most appropriate by the instructor. Hopefully, this provides the student with a meaningful reference on which to base and understand the concept. For example, pathogen variation, although mentioned in connection with various situations, is stressed in the discussion on rust diseases. Similarly, the influence of environment on disease development, although constantly acknowledged, is emphasized when potato late blight is being discussed. Various means for infection to occur are compared and contrasted as types of causal agents are introduced. Different approaches to disease control are presented with each causal agent type, along with logic as to whether and why the practices are or are not effective. The instructor continuously encourages students to appreciate the science of plant pathology and its discrete cause-and-effect relationships.

The Satellite Options

The five satellite laboratory options are diseases of fruit crops (PP 310), of vegetable crops (PP 311), of woody ornamentals and turfgrasses (PP 312), of herbaceous ornamentals (PP 313), and of field crops (PP 314). Previous or concurrent registration in the lecture course (PP 315) is a requirement for taking the satellite options. Students are encouraged to take as many of the options as their schedules permit. Most students take only one, but as many as 10–15% have taken two or more options

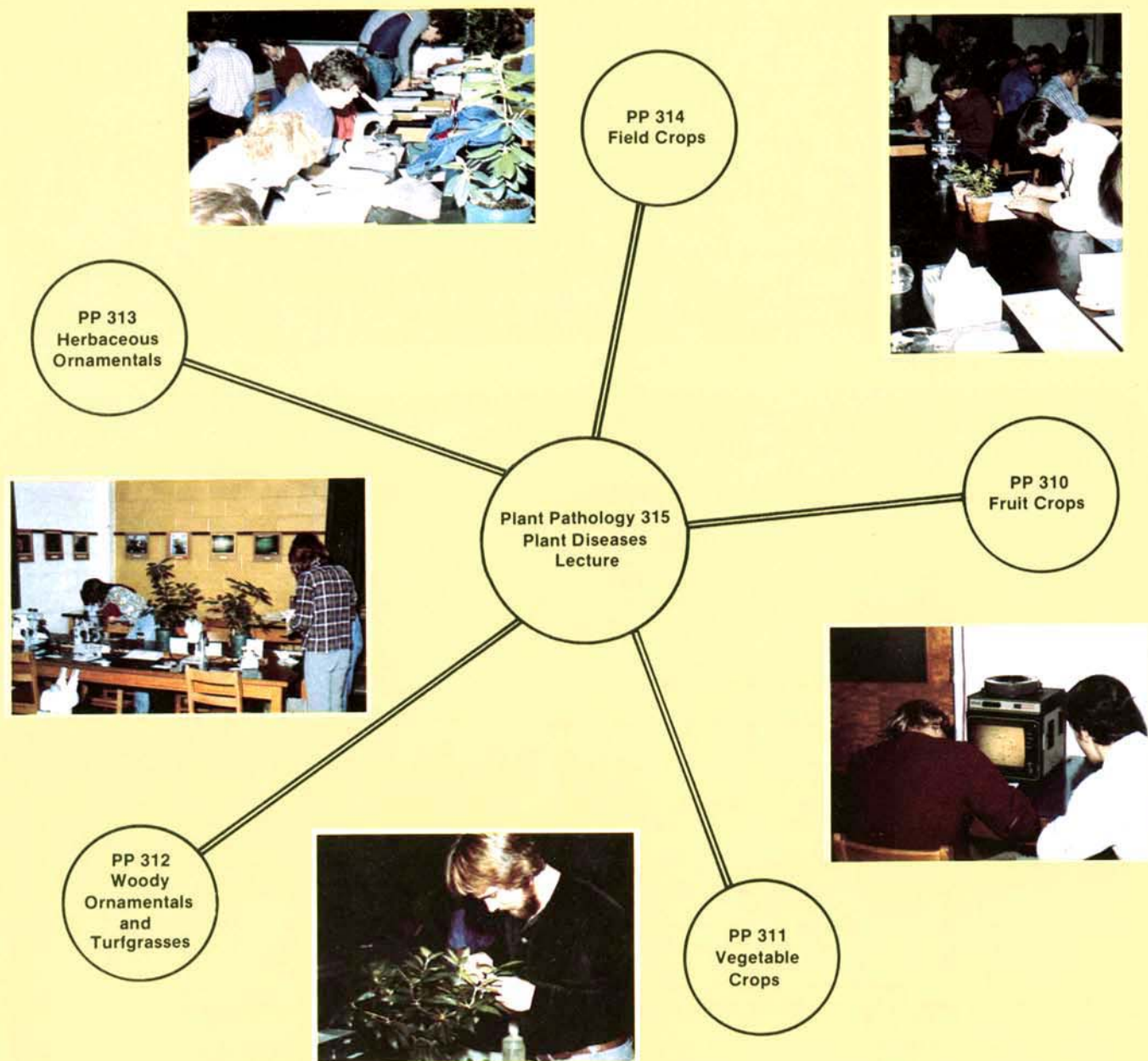
Commodity Approach

during their junior and senior years. Enrollment has been heaviest in the field crops and the woody ornamentals and turfgrasses options (Table 1), reflecting

the greater proportion of students majoring in agronomy and horticulture, respectively.

How one laboratory, diseases of

woody ornamentals and turfgrasses, relates to lecture is shown in Table 2. Coordination between lecture and laboratory is good through the first 6



The commodity-oriented approach to teaching introductory plant pathology at North Carolina State University. Students are encouraged to take as many of the five satellite laboratory options as their schedules permit. Students are shown in a general laboratory classroom scene, taking a lab practical examination, using a narrated slide set to review course material, inoculating a hybrid rhododendron in an experiment on *Phytophthora* dieback, and using demonstration materials.

weeks of the course. Class time lost to the lab practical and semester break causes laboratory topics to trail lecture 3 to 4 weeks during the second half of the course. Because more than one laboratory period is devoted to certain pathogen types that cause many important diseases, synchronization with lecture is affected. Depending on the commodity, the other laboratory options may give more or less time to specific pathogen types during the semester.

Information is organized somewhat differently than in a traditional laboratory approach. Specific organization below the causal agent level is left to the individual instructor, but the organization of diseases of woody ornamentals and

turfgrasses illustrates the general approach used in the laboratory options.

The transition from the principles and concepts of plant pathology in lecture is greatly enhanced by using examples of diseases on crops with which the students are familiar or interested, ie, applying the principles and concepts of classic diseases to diseases of a specific crop. Normally this is accomplished at the beginning of each laboratory period with a set of 2 × 2 slides illustrating the symptoms and signs of the diseases to be covered during the laboratory period. The transition from lecture to specific diseases is accomplished during the introduction at the beginning of the period. Effects of environment, cultural practices, and potential control

measures for a disease can be described and discussed within the framework of the crop production practices the students already understand for the most part. The slide sets are adapted to an audiotutorial system using a narrated tape so students can review the material for examinations or if a laboratory period is missed.

A lab guide is available each week to help the transition from lecture to specific diseases. The lab guide organizes useful information about diseases that may be scattered in several references and also raises questions about pathogens and the diseases they cause. During the latter portion of the laboratory period, students perform experiments, observe pathogens

Table 1. Enrollment in introductory plant pathology taught by the commodity approach with satellite laboratory options at North Carolina State University

Course	Semester taught	Number of students per academic year				
		76-77	77-78	78-79	79-80	80-81
Lecture^a						
PP 315 Plant diseases	Spring and fall, every year	148	154	171	158	119
Laboratory options^b						
PP 310 Diseases of fruit crops	Fall, odd years	...	10	...	22	...
PP 311 Diseases of vegetable crops	Fall, even years	22	...	17
PP 312 Diseases of woody ornamentals and turfgrasses	Spring and fall, every year	37	51	80	58	48
PP 313 Diseases of herbaceous ornamentals	Fall, every year	...	23	25	30	21
PP 314 Diseases of field crops	Spring and fall, every year	47	53	59	46	43

^aLecture meets twice a week for 75 minutes; 3 credits.

^bLaboratories meet once a week for 3 hours; 1 credit.

Table 2. Content and coordination of introductory plant pathology lecture (PP 315) and diseases of woody ornamentals and turfgrasses laboratory (PP 312) at North Carolina State University

Week	Lecture	Laboratory
1	Introduction; significance of plant diseases. Parasitism and disease; identification of plant disease.	Orientation
2	Introduction to fungi. Mycomycetes as plant pathogens; eg, clubroot disease. Phycomycetes as plant pathogens; nature and characteristics; eg, potato late blight, downy mildews, <i>Pythium</i> diseases, <i>Rhizopus</i> rots.	Signs and symptoms
3	Phycomycetes (continued). Plant-pathogenic Ascomycetes; nature and classification; eg, powdery mildews, apple scab, brown rot of stone fruits.	Phycomycete diseases; nursery field trip
4	Ascomycetes (continued).	Ascomycete diseases I
5	Basidiomycetes as plant pathogens; nature and characteristics; eg, smut and rust diseases.	Ascomycete diseases II; campus field trip
6	Fungi imperfecti causing plant diseases; eg, <i>Rhizoctonia</i> diseases, anthracnose diseases, Fusarium wilt.	Basidiomycete diseases
7	Bacterial diseases of plants; nature of bacteria and bacterial diseases; eg, fire blight, bacterial wilt, crown gall.	Lab practical
8	Plant viruses and viroids; nature and characteristics; architecture, symptomatology, and transmission; eg, tobacco mosaic and potato mosaic viruses.	Semester break
9	Plant diseases caused by mycoplasmas; eg, aster yellows.	Fungi imperfecti diseases I
10	Plant-pathogenic nematodes; morphology and anatomy. Types of nematodes and host-pathogen relationships. Sedentary endoparasitic nematodes; eg, root-knot and cyst nematodes.	Fungi imperfecti diseases II
11	Migratory endoparasitic and ectoparasitic nematodes; eg, lesion and sting nematodes. Disease complexes involving nematodes. Parasitic seed plants; eg, dodder, mistletoes, witchweed.	Bacterial diseases
12	Abiotic diseases. Climatic damage; air, water, and soil pollution; chemical injuries.	Virus and mycoplasma diseases
13 & 14	Disease control strategy and tactics. Regulatory and cultural approaches; use of chemicals, including soil treatment, seed treatment, sprays, and dusts; biological control measures, including host resistance; epidemiology and pest management concepts.	Nematode, parasitic plant, and abiotic diseases

and diseased plant specimens, and take field trips to find answers to the questions raised by the lab guide. Lab guides are collected at the end of the laboratory period, scored, and returned to the students the next week.

Advantages and Disadvantages

Several advantages are apparent in using the commodity approach with satellite laboratory options for teaching introductory plant pathology. First and foremost is the student's ability to relate to the class material based on experiences with the commodity. A line of communication between instructor and student is established quickly and efficiently. When planning control strategies based on their commodity experiences, students are able to understand the disease cycle and to identify the "weak links" that can be attacked.

Another advantage is that the instructors are also conducting research on diseases of crops in the various commodity areas. Hence, a more complete and up-to-date account of the various diseases is given in the course. After graduation, when they begin their careers in the farming or nursery business in the state, many students will be clientele. Finally, the commitment of actual contact hours each semester is usually less per instructor, since each instructor is responsible for only one or two sections of a single option rather than multiple sections.

As with any change in the way things are run, however, a few pessimists will condemn the change to failure. Certain disadvantages are inherent in changing from the traditional approach, including a feeling that the commodity approach with satellite laboratory options detracts from the importance of understanding the basic principles and concepts of plant pathology. Another disadvantage is the greater total departmental commitment because more time is required to plan five different options than to plan one

laboratory. Also, each laboratory option is independent of the others, and instructors may have different requirements for the same 1-hour credit.

The Student Response

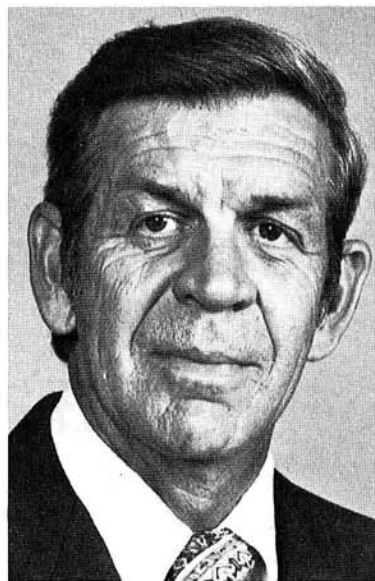
We feel that the student response at North Carolina State University to introductory plant pathology taught by the commodity approach with satellite laboratory options has been fully worth the effort of course reorganization. Students are stimulated and interested in

studying plant pathology by this plan. Interest in new diseases each week is great. For instance, even though more than 55 diseases are covered in the diseases of woody ornamentals and turfgrasses option, students, in their evaluation of the course, requested that more diseases be included. Many students rate the course as one of the best they have taken. In any event, both student and instructor seem to profit when introductory plant pathology is taught by the commodity and satellite laboratory option approach.



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