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Plant Disease Clinics-

The concept of plant pest identification and control has existed for over 100 years, but the establishment of plant diagnostic clinics is relatively recent. Particularly within the last 20 years, plant diagnostic clinics have become integral parts of state cooperative extension services, state departments of agriculture, industry, regulatory agencies, and private consulting firms.

In an attempt to trace the roots of diagnostic clinics for a historical perspective and to assess the present status of clinics, I circulated questionnaires to all 50 states as well as to Guam, Puerto Rico, the Virgin Islands, Mexico, and Canada. Recipients included plant pathology department heads, extension plant pathologists, diagnosticians, consultants, and other individuals in industry or government associated with diagnostic clinics or services. Survey data have been incorporated into this article to portray what clinics were like in the past, where they stand today, and what their goals include for the future. There are numerous clinics associated with industries and private consultants, particularly in California. In this article, however, emphasis is on university-related clinics in the United States and reference to clinics will mean this type unless otherwise specified.

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No Two Alike

The word "clinic," according to Webster's dictionary, originates from a Greek term that means "medical practice at the sickbed" and is defined as "a facility . . . for diagnosis and treatment of outpatients." For the plant diagnostician, this task is often easier said than done because of the sketchy bits of information that accompany some samples. In addition to the diagnostic *service* offered to county extension agents, growers, and homeowners, clinics may fulfill several functions. These include: 1) training and instructing graduate students, county agents, and others, 2) recording disease occurrences, 3) providing insight into new disease situations and information for the possible initiation of related research programs, and 4) serving as a public relations function for the department, company, etc. The relative importance of each function and its existence as part of a clinic's rationale are determined by those directly involved with operation of the clinic. Each clinic tends to reflect the attitudes of its governing body, as well as geographic location, surrounding population makeup and density, and allocated funds. Thus, no two clinics are exactly alike.

The earliest report of a plant diagnostic clinic came from the Connecticut Agricultural Experiment Station. This clinic was established in 1888 to answer any and all questions related to agriculture from citizens of the state and to seek and disseminate knowledge of crops and crop production. This rationale has remained the same for the past 93 years. Early clinics associated with the Cooperative Extension Service were reported from Vermont (1890), Colorado (1935), North Carolina (1948), Oregon (1954), and Minnesota (1956). University- and extension-related clinics were among the first facilities to provide the service of disease diagnosis (Fig. 1). These were followed by the establishment of clinics within the structure of state departments of agriculture. For example, the Arizona State Department of Agriculture organized a clinic in 1917. Some 11 years later, private industry reports the existence of disease diagnostic services (Davey Tree Co., Ohio, 1928). However, nearly two-thirds of all existing clinics have been established within the last 20 years (Fig. 2).

Data from surveys made by W. Ridings (*personal communication*) in 1969 and by Aycock (1) in 1976 showed that 25 and 43 states, respectively, operated plant diagnostic clinics or services. Responses to my questionnaire (1981) showed that 51 of 55 university-related institutions operate diagnostic clinics or offer services, 17 of 30 state departments of agriculture operate diagnostic clinics, and 15 of 22 private companies offer diagnostic services. Most of these clinics not only do routine microscopic and cultural studies for identification of fungi and bacteria but also offer nematode assays (56 clinics) and use serologic or other studies for virus and/or bacterial determinations (33 clinics). In addition, 80% diagnose nutritional and chemical injury problems.

Most university-related clinics are supervised by either a department of plant pathology or a department that includes plant pathology, and most are run by extension personnel with professional and/or secretarial help.

Fig. 1. Ginseng school conducted by Cornell University at the town hall in Scott, New York, in March 1911. (Courtesy S. W. Westcott III)

Past, Present, and Future

Departmental faculty and/or graduate students also may be involved in the clinic's operation. At the University of California, Davis, graduate students, aided by a faculty advisor, assume responsibility for the clinic, which is primarily for homeowners. Similarly, the clinic at the University of New Hampshire is run by graduate students. The clinic at the University of Maine is staffed by two graduate students under the supervision of research staff in the department of plant pathology and just recently gained the support of the state cooperative extension service. In states that do not operate university-related clinics, such as Alaska and Delaware, inquiries are handled by the appropriate extension and/or research specialist or by the state's department of agriculture or regulatory agency. In California, Florida, Pennsylvania, Tennessee, Texas, and Wisconsin, the state department of agriculture or its equivalent plays a particularly strong and effective role pertaining to plant disease diagnosis and recommendations for control. This is especially so in California, where the responsibilities of the state department of agriculture include plant quarantines, disease surveys, and eradication of potential damaging diseases.

Several states have more than one clinic associated with the cooperative extension service. Canada reported at least one clinic in each of the provinces of Saskatchewan, Manitoba, and Ontario. Mexico has six working clinics at present, with seven more under construction.

The number of diseased specimens recorded annually by clinics varies considerably among states (Table 1) as well as among universities, departments of agriculture, and private companies. More than 10,000 samples are diagnosed annually in clinics run by the University of Georgia, Mississippi State University, the University of Minnesota, and the California State Department of Agriculture; the clinic at Mississippi State specified that most of the 17,000 samples handled were for nematode-related problems. Twenty-six university clinics handled between 600 and 1,200 samples annually, and 15 processed 3,000 to 8,100. Only seven university clinics processed fewer than 600 samples per year. Clinics in state departments of agriculture and private industry, on the

Table 1. Number of diseased specimens recorded annually by university-associated plant diagnostic clinics in the United States, Guam, and Puerto Rico

State	City	Established	Samples per year
Alabama[a]	Auburn	1967	5,100
Arizona	Tucson	1960	1,500
Arkansas	Fayetteville	1978	450
	Little Rock	1958	1,400
California	Davis	1971	...
Colorado	Fort Collins	1935	750
Connecticut	New Haven	1888	8,000
	Storrs	1965	500
District of Columbia	Washington	1973	1,300
Florida[a]	Gainesville	1958	3,000
Georgia[a]	Athens	1965	14,000
Hawaii[a]	Honolulu	1967	3,500
Idaho	Moscow	1956	300
Illinois[a]	Urbana	1976	4,000
Indiana[a]	West Lafayette	1960	1,600
Iowa	Ames	1950	2,500
Kansas[b]	Manhattan	1962	1,800
Kentucky[a]	Lexington	1966	4,500
Louisiana	Baton Rouge	1971	3,200
Maine	Orono	1970	...
Maryland[a]	College Park	1979	1,500
Massachusetts	Waltham	1978	400
Michigan[a]	East Lansing	...	3,000
Minnesota[a]	St. Paul	1956	10,074
Mississippi[a]	Mississippi State	1965	17,000
Missouri	Columbia	1965	1,500
Montana	Bozeman	1953	1,200
Nebraska[b]	Lincoln	1970	1,400
Nevada	Reno	1960	1,200
New Hampshire	Durham	1972	1,000
New Jersey	New Brunswick	1926	1,000
New Mexico	Las Cruces	1965	800
New York[a]	Ithaca	1971	3,800
North Carolina	Raleigh	1948	5,000
North Dakota[a]	Fargo	1965	2,000
Ohio	Columbus	1970	9,000
Oklahoma[a]	Stillwater	1970	1,800
Oregon[a]	Corvallis	1954	1,200
Pennsylvania[a]	University Park	1970	1,800
Rhode Island	Kingston	1975	5,000
South Carolina	Clemson	1969	5,000
South Dakota	Brookings	1962	800
Tennessee	Knoxville	1965	1,500
Texas	College Station	1956	5,000
Utah	Logan	1978	500
Vermont	Burlington	1890	750
Virginia	Blacksburg	1960	2,400
Washington	Pullman	1963	300
	Puyallup	1968	700
West Virginia	Morgantown	1965	800
Wisconsin[a]	Madison	1965	1,700
Wyoming	Laramie	1978	600
Guam	Mangilano	1981	...
Puerto Rico	Mayagüez	1958	1,400

[a] Full-time diagnostician.
[b] Part-time diagnostician.

whole, processed fewer samples annually (except Florida, 7,000) than university-related clinics. In general, ornamentals were the most common commodity received (60%), followed by agronomic crops (30%) and vegetables (10%).

Factors that influence the number of specimens received include: 1) number and importance of agricultural crops in the state, 2) environmental conditions favoring disease development, 3) publicity of the clinic, 4) effective control measures in practice, 5) whether the clinic is integrated, ie, handles disease, weed, and insect problems, and 6) length of the growing season.

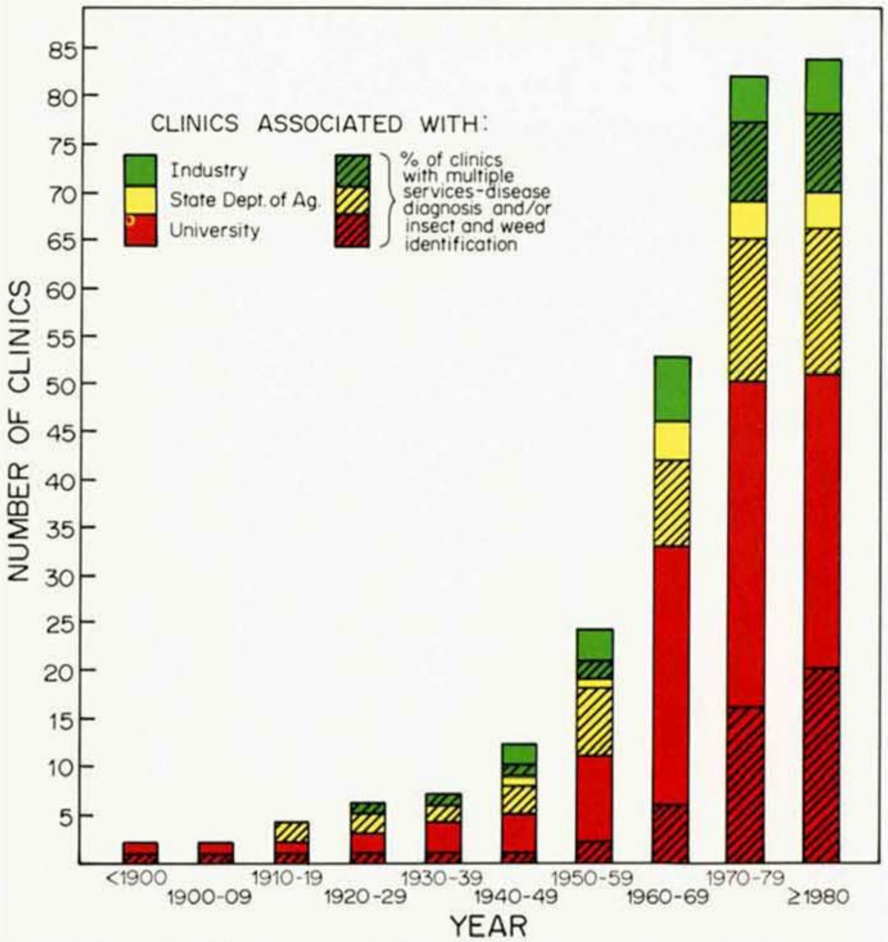

Fig. 2. Diagnostic clinics associated with universities, state departments of agriculture, and industry, from 1888 to 1981.

Increasing Visibility

Originally, the primary function of most diagnostic clinics was to assist county extension agents in diagnosing plant diseases and disorders. However, *direct* service to commercial growers and homeowners appears to be of increased importance in several states. This alteration of priorities seems to be partially due to the greater "visibility" of clinics within the last 20 years. Until recently, clinics maintained a relatively low profile. As farm units increase in size and complexity, however, extension clinics and related research functions must be improved and expanded in the growers' eyes. Growers are seeking advice from respected, unbiased sources, and clinics that have good reputations with growers and county extension agents can more adequately serve the public.

R. K. Jones of North Carolina State University (*personal communication*) mentioned that "a good clinic can be an excellent public relations tool in this time of government accountability." It can serve as a very practical application of academic knowledge by rapidly assisting growers to solve real problems. Clinics must be able to assist growers in the decision-making process of disease management. On the other hand, many clinics associated with state departments of agriculture were established to support pest detection and regulatory control programs and, in some cases, to act as a public service. Clinics associated with private industry tend to function more as a service to clientele and as a part of their breeding and research programs.

A well-run clinic can greatly increase the "visibility" of plant pathology and plant pathologists. J. G. Horsfall (*personal communication*) believes that a clinic is an absolute essential in a

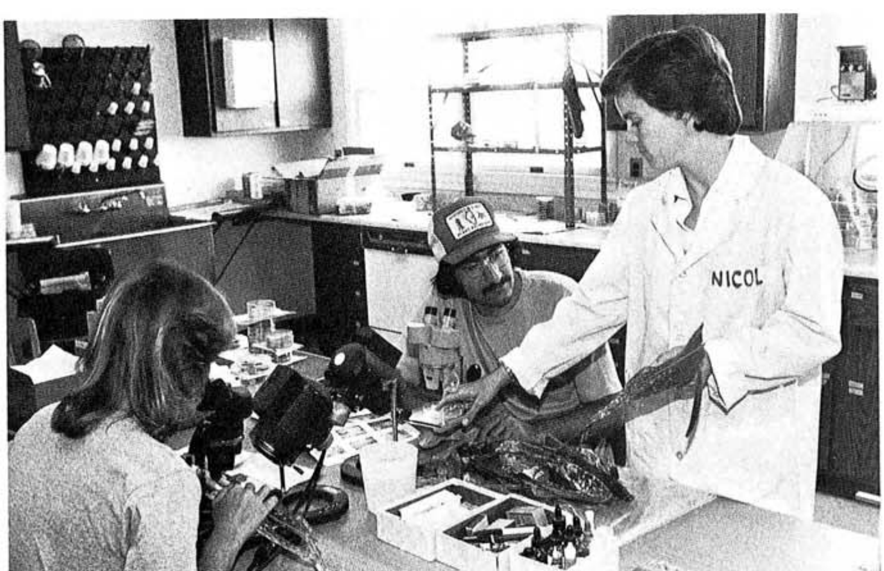

Fig. 3. Clinic diagnostician supervising students at the University of Illinois. (Courtesy P. Hixon)

Fig. 4. University of Illinois mobile diagnostic clinic at the site of a growers' meeting. (Courtesy M. Shurtleff)

department of plant pathology and defines a clinic as "a diagnostic service that citizens pay for and have a right to expect." Some agree that a clinic should be run as a public service to the residents in the state and help educate both county extension personnel and the public. Others believe a clinic should function as a "pay as you ask" service (L. H. Purdy, *personal communication*).

The Clinic Diagnostician

The clinic diagnostician evolved in an effort to increase credibility, decrease turnaround time, lessen the burden on a limited staff, improve educational services, and help give clinic operations a more permanent status. My data indicate that universities in 17 states have full-time diagnosticians and universities in two states have part-time diagnosticians (Table 1). Most diagnosticians have completed or are working toward an M.S. degree in plant pathology, and a few hold a Ph.D. degree. Although most felt the academic training they received was adequate, they stressed the need for a better background in botany and horticulture to handle the increased "traffic" in the ornamental area and for better preparation in recognizing nutritional disorders and chemical injury. Availability of a wide range of reference materials was considered important for accurate and efficient diagnosis and control recommendations.

The role of the diagnostician varies from state to state. Some have total reign over the responsibilities of the clinic and are expected to consult with specialists only when necessary. In some departments, diagnosticians discuss all samples with the crop specialists; in others, because of potential liability, diagnoses of samples from commercial growers are confirmed by specialists. Some diagnosticians are involved in teaching, eg, Master Gardener programs, graduate and undergraduate student supervision (Fig. 3), clinic classes, and county agent training. A full-time diagnostician can establish a permanent record system, herbarium collections, demonstration mounts, and slide collections. Often, meetings, field work, and other responsibilities require extension specialists to be away from the department. A clinic with a diagnostician can serve as a central receiving station for samples and inquiries, thereby increasing the efficiency of both the department and the extension service.

Many states expressed the desire for a larger staff in the clinic, especially during the summer months or peak seasons. It was the consensus that extension plant pathologists should not be expected to operate the clinic and be responsible for all other extension activities as well. Additional staffing requests included a full-time extension professional/diagnostician, permanent laboratory technicians, and graduate student assistants. Access to a virologist for virus identification and involvement of more specialists were also mentioned. The general plea was for fully staffed facilities to provide better service, not only to expand the types of service but also to deal with the increasing volume of samples. With additional staffing in the clinic, the primary role of service to the public and such secondary roles as student education and data accumulation could be fulfilled.

Table 2. University-related clinics that provide multiple services and/or instruction

University or research station	Service in addition to disease diagnosis (year begun)[a]	Instruction[b]
Auburn	W,I(1978)	...
Arizona	W,I(1967)	G
Colorado State	...	G,U
Connecticut Agricultural Experiment Station (New Haven)	W(1888)	...
District of Columbia	W,I(1973)	...
Hawaii	W,I(1967)	...
Iowa State	W(1950)	G
Illinois	W,I(1976)	...
Purdue	W(1979)	G
Kentucky	...	G
Louisiana State	...	G
Maryland	W,I(1979)	G,U
Maine	W,I	G,U
Michigan State	...	G
Minnesota	...	U
Montana State	...	G,U
North Carolina State	I(1973)	G
Rutgers	...	G
Cornell	W,I(1971)	G
Oklahoma State	...	G
Oregon State	...	G,U
Pennsylvania State	...	G,U
Rhode Island	I(1975)	G,U
Clemson	W,I(1970)	...
South Dakota State	W,I	...
Tennessee	I(1975)	G
Western Washington Research and Extension Center (Puyallup)	W,I(1968)	...
West Virginia	W,I(1965)	G
Puerto Rico	W,I	G,U

[a] W = weed identification; I = insect identification.
[b] G = graduate; U = undergraduate.

Educational Function

Aycock (1) stated, "The value of clinics as teaching aids has never been fully appreciated or exploited, for the necessity of rapidly processing many plant disease specimens of varying quality and the time and patience required for teaching students are not mutually supportive." Five years later, this statement remains valid. Of 51 institutions with plant diagnostic clinics, only 21 utilize the clinic for teaching—undergraduate instruction by one, graduate instruction by 12, and both graduate and undergraduate instruction by eight (Table 2). The University of Arkansas and the University of Wyoming have plans for a graduate course in clinical plant pathology, whereas Texas A&M University, the University of Missouri, and the University of Hawaii had such a course but no longer offer it. The clinic course in Hawaii was canceled because of costs involved in field trips. Several other clinics also have had to curtail field trips because of funding problems.

Clinic participation is required by Colorado State University, the University of Arizona, and the University of Minnesota as part of their plant pathology graduate program. Iowa State University, Purdue University, and Louisiana State University provide classes in field diagnosis and clinic work. Graduate students volunteer time in exchange for experience without receiving credit at the University of Connecticut, the University of Illinois, and South Dakota State University, whereas credit is given for clinic work at Purdue University, the University of Nebraska, Oklahoma State University, Pennsylvania State University, the University of Georgia, and the University of Maryland. Colorado State and Virginia Polytechnic Institute and State University have a graduate research assistant who works in the clinic, and Texas A&M has an extension assistant position that is usually filled by a Ph.D. graduate student. Departments of plant pathology at Ohio State University, the University of Rhode Island, West Virginia University, and the University of Vermont maintain a graduate student clinic assistantship. Departments at the University of Massachusetts, Auburn University, North Dakota State University, and Washington State University do not use the clinic directly but rely on it for classic or unique disease examples for class use.

As a diagnostician once said, "The clinic is a place where students receive a truly classical education in applying everything they have ever learned about plant diseases on a day-to-day basis." Practical diagnostic experience in a clinic is an extension of formal classroom training. A clinic gives students an opportunity to recognize the complexity and variability of diseases other than the classic classroom examples and emphasizes the importance of a wide selection of reference materials and other diagnostic aids. Caution is advised, however, by W. N. Garrett (*personal communication*) as clinics develop new dimensions. He warns that "New dimensions such as student education must be encompassed in such a manner as to *not* interfere with the primary purpose of serving crop producers through the extension component of land-grant universities."

Clinics associated with departments of agriculture in Florida, Pennsylvania, Tennessee, and Texas also offer practical experience for students. For example, the clinic associated with the Pennsylvania Department of Agriculture offers an internship for credit to students studying at Gettysburg College, and the clinic run by the Florida Department of Agriculture teaches a graduate course in plant disease diagnosis and involves students in clinic work. The clinic associated with the Tennessee Department of Agriculture has, on occasion, included students from local colleges in its activities. At DeLeon, Texas, the clinic associated with the state department of agriculture encourages classes to visit the lab to learn about the facility and its services.

Disease Detection

New or previously unrecognized disease problems have been detected in many clinics. Findings have led to new research projects and epidemiologic studies, as indicated in 62% of the returned questionnaires. Disease findings in clinics frequently influence both the direction and the emphasis of certain research programs, particularly in private companies where breeding programs are closely linked to new disease trends. Major programs that resulted directly from clinic observations include establishment of the North Carolina research laboratory to eradicate witchweed on corn; methods to control soybean cyst nematode and soybean seed quality; research on Verticillium wilt of alfalfa; potato late blight forecasting; pine wilt nematode studies; interaction studies of overfertilization and root rots; research on sunflower white mold and seedling blight; and, recently, research into the increased frequency of stunt and lance nematodes in golf greens. The list is too long to give in its entirety, but clinics and associated disease survey programs clearly have served a vital role in research, extension, and resident instruction programs.

The establishment of clinics and clinic records is important in the development of agricultural projects, particularly in less-developed countries (B. Brown, *personal communication*). Records pinpoint problem areas in disease control and indicate epidemiologic trends. In addition, host range indices for important plant pathogens may be updated through the incidence records of clinics. The reliance on the "Index of Plant Diseases in the United States" (4) illustrates the need for accurate records of pathogen-host relationships. Unfortunately, this index is now more than 20 years old and does not contain current disease reports. A University of Georgia feasibility study on updating this publication illustrated the versatility of a computerized index as well as the magnitude of such a revision (3).

Contribution of Computers

Compilation and storage of clinic records is often tedious and cumbersome. Thus, the recent introduction of computerization into the realm of the clinic system is a welcome addition. Ten of the 41 clinics responding to my questionnaire reported using computers as the primary means of record keeping for disease data, and six indicated future plans for computers. Clinics without computers attributed the lack to limited facilities, staff, funding, and/or numbers of specimens.

The main use of a computer in a diagnostic lab is to store a data base, ie, collected knowledge. The computer can organize the data (eg, alphabetize a list) or locate specific data (eg, produce a list of all corn diseases for June and July). The data are usually classified into key words that are general categories describing a common subject. Some of the common key words for a diagnostic lab are reference number, host, county, submitter's name, date in, date out, symptoms, and diagnosis. These key words define what the computer is to search for and organize. Computer records are used for quick referral, data compilation and summarization, and host-range indices.

The computer provides an efficient way to store a large amount of information in a small amount of space. With this backlog of readily available information, it is possible to more accurately determine disease incidence at a given location and particular time and the spread or regression of a pest from one year to another. The findings are only as accurate and relevant as the original source, however, and clinic data are only a subset of the total picture. For a fair representation of a particular epidemiologic situation, phone calls, field visits, agent reports, and information from neighboring states must be recorded periodically. Short forms and reports highlighting disease occurrences may provide incentives for extension personnel and others to report their findings to the clinic for computer filing (2). Such data can be used to model or predict the severity of a particular pest or the expected crop yield loss. Besides increasing the efficiency of record keeping, the computer can be used to return a diagnostic reply to the submitter. Some universities have data lines (telephone or direct lines) connected to county extension office computer terminals. Diagnostic requests and replies can be received and transmitted through these data lines much faster than by mail. Computer applications are broad-reaching when left to the imagination and needs of those involved.

Space, Equipment, and Services

An area of general concern among people associated with diagnostic clinics is the lack of adequate working space and facilities. Since most clinics originated after departments were already established, adding floor space or sharing available space was limited. Most clinics have been established in leftover lab space, walled-off hallways, and offices. Space was and is a limiting factor for diagnostic clinics, but there are signs that times are changing. For example, a new centralized pest diagnostic and advisory clinic was established at the University of Guelph in 1978, and the clinics at Ohio State University and Kansas State University moved to enlarged facilities in 1981.

In general, survey information indicates a definite trend toward using more sophisticated equipment in diagnostic clinics and expanding the types of services offered. Most diagnostic clinics have standard lab equipment, such as dissecting and compound microscopes, wet lab facilities, refrigerators, photographic equipment, and transfer hoods. Other equipment—light bank, walk-in cold room, darkroom, elutriators, shakers and water baths, incubators, autoclaves, soil salt and pH meters, balances, scanning and transmission electron microscopes, high-pressure liquid chromatographs, fluorescent and interference microscopes, mobile units, and computers—varies from state to state. Even though some clinics have equipment that might be classified as "luxury items," most stated the need for more adequate laboratory and greenhouse facilities.

Mobile plant diagnostic clinics could provide an adjunct service to both research and extension with on-site inspection of plant problems (Fig. 4) but currently are in use in only seven states. Some states use the mobile clinic on a regular basis to visit growers, but most units have been used primarily as training aids for county extension personnel, fair demonstrations, and 4-H presentations and occasionally for yearly intrastate disease survey work. Unfortunately, because of high maintenance and operating costs, mobile clinics have not been used to their fullest potential. Many have fallen by the wayside, like dinosaurs in the Ice Age, unable to survive a changing climate, which in today's society is economic instability. Small equipment, however, like a pH meter and solubridge, are easily transported to grower workshops for on-site diagnosis.

With the move toward more sophisticated equipment and techniques, at least by some states, routine diagnostic work is beginning to include nematode assays, identification of viruses and bacteria via serology (ELISA and immunofluorescence), the use of specific media for isolation and identification of pathogens, and toxin tests. Techniques have concentrated on rapid identification of disease-causing agents.

One example of advanced clinic technology is the Extension Plant Pathology Service Center in Athens, Georgia. The Georgia legislature appropriated more than half a million dollars in 1977 to build and equip this center. The facility was completed in early 1979 and has approximately 7,000 sq ft of lab and office space. It consists of a plant disease clinic with all the necessary equipment and facilities, including a $12,000 microscope with camera attachment; a nematode assay laboratory with a connecting cold room for storing samples and an automatic elutriator; an aflatoxin laboratory equipped with a high-pressure liquid chromatograph for detecting aflatoxins at a level of 1 ppb, hoods, grinders, etc.; and a well-equipped darkroom. Naturally, a facility of this type requires an equally large staff. The center is staffed with five full-time technicians and two or three part-time technicians. These people process an estimated 14,000 samples per year (11,000 nematodes, 3,000 plant diseases). Nine full-time extension plant pathologists reply to all inquiries and specimens submitted.

The services provided by the center are available only through the county agent. Samples received from people other than agents are not answered directly; rather, results are sent back to the appropriate county agent. This system discourages growers and homeowners from sending samples directly to the center and thus promotes the county delivery system.

Most states will agree that a good county delivery system can add to the accuracy and efficiency of answering inquiries, but some still feel a clinic should be more accessible to the general public. This is usually decided by the extension specialists and others involved with operating a clinic. Policies relating to advertising clinic services to the general public differ from state to state. Factors involved in deciding whether a clinic should be directly accessible to the public include: 1) the philosophy of the institution operating the clinic, 2) the makeup of the population served, ie, metropolitan vs. rural, 3) the financial status of the clinic, and 4) the technical help available.

Some clinics are adopting an integrated approach, identifying insect and weed problems as well as diagnosing diseases and recommending control measures. Clinics or other services in 13 states are integrated in this way, three institutions offer disease diagnosis plus weed identification, and three offer disease diagnosis plus insect identification (Table 2). By contrast, 30 of 55 institutions (in 50 states) replied that their clinics are not integrated and they have no plans to do so. The University of Massachusetts, the University of Vermont, the University of Nevada, and the University of Guam indicated an interest in eventual integration of their clinics. The Tennessee state legislature is considering a plant diagnostic clinic for weeds, diseases, insects, and nematodes, to be handled by the state cooperative extension service.

An integrated clinic will not function properly unless all departments or disciplines represented participate. In June 1976, Illinois organized one of the first university clinics where all plant science departments, as well as the Illinois Natural History Survey and the Department of Agricultural Engineering, cooperated in such a venture. The clinic is equipped to diagnose plant diseases, nutritional problems, and herbicide injury and to identify plants, weeds, insects, and nematodes. Clinics in some other states, eg, South Carolina, are also interdisciplinary, involving personnel from agronomy, horticulture, entomology, forestry, and plant pathology. E. Palm (*personal communication*) suggested that a trained "superintendent" correlate the multidisciplinary efforts of the clinic and that staff members from various departments have part of their salary designated for involvement in the diagnostic functions of the clinic. In other words, a separate clinic budget should be established.

Multidiscipline clinics staffed with qualified specialists are what most believe will be necessary to meet future needs. M. Huddleston (*personal communication*) points out that "A team approach is not only more effective and efficient, but timesaving to producers where answers to problems are needed quickly to reduce potential economic losses." In this time of severe budget constraints, an integrated diagnostic clinic is something with which taxpayers can identify. S. Perry (*personal communication*) believes that "A functional, meaning well funded and staffed multidiscipline diagnostic clinic, would help save [this aspect of] extension from extinction." The need for multipurpose clinics continues to increase in many states. Ideally, as certain clinics develop special techniques for identifying particular problems associated with their geographic region, service could be extended to neighboring states. A *mutual* exchange of services would promote cooperation and improve interstate communications. Such a system would likely save money and increase efficiency and accuracy of the diagnostic process. However, such stumbling blocks as source of funds, salaries for technicians, unequal use of services, and sample charges would have to be addressed before the concept could become a working reality.

Costs and Funding

Because the operating budgets of most plant clinics are limited, the question of charging for diagnostic services has been a growing concern. Some clinics feel that fees for services may be necessary to offset operational costs. Clinics in 13 states now charge for nematode assays because of the time and equipment involved, and four states foresee charging for such assays. Fees vary from $2 to $20 per sample, with an average of $10. Clinics at the University of Illinois, Oklahoma State University, and the University of Maine charge for both nematode and disease samples, and 12 other clinics foresee charging for all samples. The University of Minnesota charges for mycotoxin tests, and South Dakota State University charges for embryo smut tests. The Idaho Department of Agriculture charges $15 for serological identification of bacteria from snap and dry bean seed, and other states noted that fees may become necessary if state tax funds are reduced. Private consultants and companies dealing specifically with pest control charge a fee for their services, whereas clinics associated with seed and plant industries do not.

Since the majority of university plant clinics are extension facilities intended primarily as a service to extension personnel in each county, some feel there should be a charge for any sample submitted directly to the plant clinic by individuals who do not use the county extension service. Many states feel that a charge might discourage walk-ins, while others feel a charge is needed to help maintain and update the clinic facilities.

The problems encountered through instituting fees for diagnosis are numerous. Clinics at Colorado State University and Pennsylvania State University attempted to charge for samples but discontinued the practice. C. Westcott (*personal communication*) recalls that she gave up charging for specimens received in the mail after she mistakenly diagnosed gnawing on lilacs as squirrel damage when it was actually vespa hornet damage. Undoubtedly, similar experiences abound throughout the nation. Charges also add a source of pressure for clinic personnel. When money is paid for a service, the emphasis can too easily be placed on "getting your money's worth." With the pressure of a monetary contract, it may not be as easy to say "I don't know"—three very important words! In addition, without secretarial help, bookkeeping can become a nightmare.

It seems that once a clinic is established, everyone expects premium work with little or no financial support. Taxpayers are supporting the extension system through their tax dollars, so it is up to the university administration to realize the need for a plant diagnostic clinic and its many potential functions, including positive public relations, and to support the clinic with adequate funding.

Clinics can play an increasingly important role in service to the agricultural community and to the general public. They also can serve as a medium for the training of students in the art and science of diagnosing plant problems. With adequate facilities, staffing, and funding, plant diagnostic clinics can meet the ever-increasing challenge to serve modern agriculture and the needs of the general public.

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