C. Wendell Horne
Texas A&M University, College Station

Groundwork for Decision: **Developing Recommendations for Plant Disease Control**

Phytopathology as a discipline exists for developing an understanding of the nature, cause, and control of plant diseases. Its ultimate objective is to avoid disease loss and allow plants to produce to their optimum genetic potential. As the knowledge base of the discipline has expanded, so have the number and complexities of recommendations to producers. This article is intended to help establish a philosophical and informational framework for formulating disease control recommendations.

A formal recommendation is a carefully constructed guide for action that has been developed from existing knowledge and tailored to the precise needs of individual producers. It should be specific enough to be effective and flexible enough to permit adaptation under differing circumstances. Recommendations always should be formulated to initiate or stimulate constructive change. The title "Groundwork for Decision" emphasizes the need to prepare recommendations in a responsible and persuasive fashion. Factors that affect development of this framework are reviewed herein.

Philosophical Basis for Decision Making

The work of most scientists in phytopathology adds to the development and accumulation of new knowledge that results in an orderly publication and retrieval process. Fewer professionals are responsible for developing organizational systems for adoption of scientific information.

Effective disease control recommendations combine research-based information, experience-based knowledge, and good judgment. In the truest sense, they represent "collective wisdom" assembled to assist in avoiding disease loss and maintaining profitability. Individuals charged with development of effective recommendations for plant disease control must clearly understand grower psychology, production systems, economics, pathogen biology, and disease development as well as fundamental control strategies.

The appropriate use of knowledge creates wealth, drives our economic system, legitimizes our educational process, and gives integrity to our social structure. The "appropriate use" element transcends the mere existence of knowledge, even though the latter is essential to the basic consideration. Successful producers, especially, seem to have the ability to master the "appropriate use" concept to a much greater extent than their less successful colleagues.

Phytopathology is a well-grounded scientific discipline that has an almost limitless capacity for helping growers deal with plant problems. The microscopic nature of disease-causing organisms and the process of disease development represent phenomena that capture the imagination of growers and permit access to their sense of curiosity and need.

Economic Basis for Decision Making

Growers almost always underestimate the amount of income lost from disease because they are inclined to attribute that loss to unmanageable environmental factors. Individuals who advise growers also may fail to calculate losses properly because of the inherent difficulty in quantifying disease loss and the tendency to calculate from actual yield instead of potential yield. For example, a peanut grower who harvests 3,360 kg/ha after experiencing a 25% loss often is inclined to assume a 840-kg loss when in fact a 1,120-kg loss occurred. The grower's potential yield was 4,480 kg/ha.

Plant disease occurrence reduces net profit losses because production inputs have already been made and paid for when the loss occurs. When producers clearly understand this fact, they are more inclined to accept control recommendations, especially when they realize that combinations of suggested practices usually produce synergistic effects.

In many crops, disease is the major limiting production factor, and additional production inputs will not be beneficial unless this limiting factor is removed. In some instances, disease occurrence may even prevent profitable production of crops. Individuals responsible for formulating recommendations and educating growers always should know the potential economic benefits of practices they recommend. Demonstration of economic benefit captures the moment when producers are most teachable and likely to respond positively.

Organizing the Information

Recommendations are more likely to be successful when information from the commodity production system and the scientific community is merged. In the United States, traditional extension programs operated by land-grant universities have been highly successful in accomplishing this merger. Producers who serve as opinion leaders usually

The suggestions in this article for chemical use are not intended to substitute in any way for label recommendations, which should always be read and followed. Materials are included in this article on the basis of their performance in scientifically conducted field studies, clearance by the Environmental Protection Agency, and local availability. A mention does not guarantee or warrant the standard of a product and does not imply approval of the product to the exclusion of others that may be equally suitable.

Table 1. Continuum (left to right across columns) for the systems approach to formulation and adoption of recommendations, with home construction as an analogy

Item	Subcomponent	Component	Subsystem	System
Home construction	Clay	Brick	Room	House
Knowledge flow	Experiments	Composite facts	Control alternatives	Composite recommendations
Knowledge record	Scientific journals	APS compendia and books	State bulletins and fact sheets	Annual disease control recommendations
Knowledge processing	Hypothesis testing	Assimilation of facts	Demonstration of facts	Application of knowledge
Adoption by producer	Awareness	Interest	Evaluation and trial	Adoption of practice

characterize grower needs and determine what is possible in the production system. Plant pathologists traditionally supply conceptual information concerning pathogen development and provide needed experience relative to control. In the land-grant university framework, formulation of recommendations then becomes a partnership between growers and extension specialists.

Recently, the systems approach to problem solving has been used to integrate recommendations and education in the agricultural sector. In this context, a system is defined as a collection of parts, either conceptual or physical, that interact and behave as a whole to achieve a specific purpose or function. The systems approach then becomes a holistic study of all components that make up a system, their interrelationships, and the relationship between the system and its environment, with the whole being more than just a sum of the parts (7).

For this discussion, the completed recommendation represents the system, the control alternatives represent the subsystem, and research-based composite facts are analogous to the components. One may go one step further to consider knowledge gained from individual scientific tests as being subcomponents. The basic ingredient in knowledge generation originates in the reductionist scientific approach. The subcomponent begins with a testable hypothesis designed to deduce the cause-and-effect relationship. It represents the most distant point from knowledge use on a continuum scale (Table 1).

The systems approach is intended to streamline the flow of knowledge from discovery to application and usually functions as a step-by-step process. Exceptions can and do occur when innovative individuals span the continuum. The existence of this natural process of knowledge flow helps to explain the genius of the tripartite land-grant college concept: research, teaching, and extension.

Understanding the Crop and Its Diseases

An understanding of the crop and its culture is the point of departure in formulating recommendations. For the purpose of illustration, I shall use the peanut crop to explain the process of formulating recommendations.

Peanuts, or groundnuts (*Arachis hypogaea* L.), are grown in sandy soils throughout the temperate zone and some subtropical regions for consumption by humans, poultry, and livestock. Hundreds of cultivars are known, and all are subject to attack by a wide array of plant pathogens. The crop's vulnerability to attack by pathogens is due in part to its nature of growth and development. Abundant foliage is produced near the soil surface in a thick canopy that favors high relative humidity. Pegs produced at stem nodes penetrate the soil where pods are formed. This combination is ideal for the development of both foliar and soilborne pathogens. Estimated disease losses in the United States range between 23 and 33%, and this makes producers eager to adopt control practices on this high-income crop. It is not uncommon for one to realize a return of $3 to $5 for every dollar invested in disease control procedures.

Growers recognize maximum economic benefit when control alternatives are scientifically based, field-tested, and properly applied. True integration of practices can take place only in the grower's field because susceptibility of the cultivar being grown, pathogen(s) present, prevailing environmental conditions, yield potential, and existing economic factors differ widely.

Building Recommendations for Peanut Disease Control

Peanuts are susceptible to attack by almost 50 pathogenic organisms. Five of the most important diseases are discussed here to illustrate a process of formulating recommendations. The number of components used are limited to those necessary to serve as examples.

Fig. 1. Seedling disease and seed rot symptoms associated with low-quality or damaged peanut seeds.

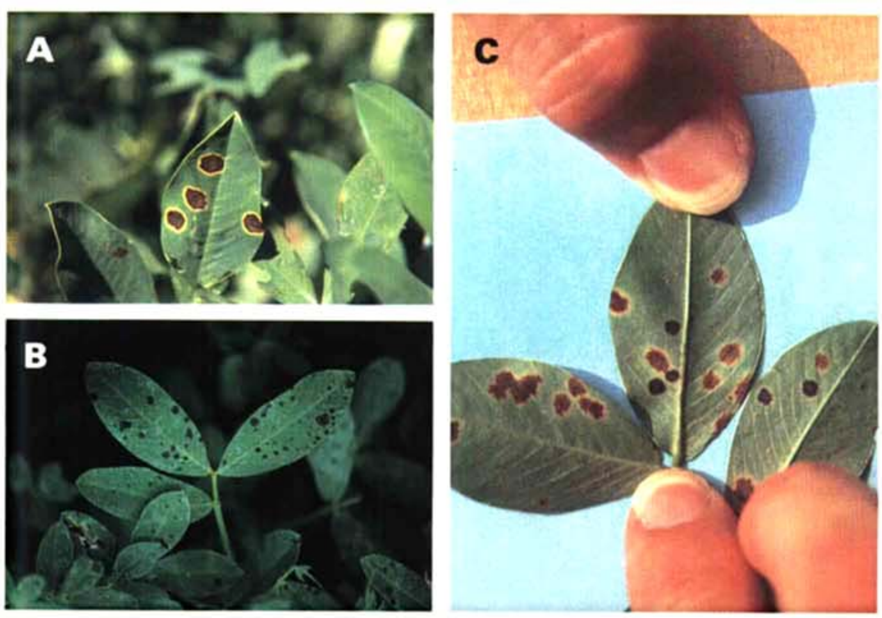

Fig. 2. Symptoms on peanut of (A) early leaf spot, caused by *Cercospora arachidicola*, and (B) late leaf spot, caused by *Cercosporidium personatum*. (C) Symptoms of both early (brown lesions) and late (black lesions) leaf spot on lower leaf surface.

Seedling disease. *Description.* Seedling disease is caused by a variety of soilborne organisms (10) that may cause preemergence or postemergence damping-off. The disease is exacerbated by unfavorable soil temperatures or low-quality seed. The major pathogens include *Aspergillus niger* van Tiegh., *Fusarium* spp., *Pythium* spp., *Rhizoctonia* spp., and *Rhizopus* spp.

Components. • Populations of pathogens that cause seedling disease vary among fields, depending on cropping practices and soil characteristics.
• Most organisms that cause seedling diseases may be seedborne.
• Low-quality or injured seed (Fig. 1) are vulnerable to soilborne pathogens.
• Seedling disease is more severe when soil temperatures or moisture levels favor the pathogen over the host.
• Seed-treatment fungicides effectively reduce the incidence of seedling disease.

Leaf spots. *Description.* Two major pathogens cause what most producers consider to be a single disease (5,9–11). *Cercospora arachidicola* Hori causes what is typically called early leaf spot, and *Cercosporidium personatum* (Berk. & Curt.) Deighton causes late leaf spot. All aboveground parts of the plant are susceptible. Distinct circular dark brown to black spots occur on leaflets; early leaf spots are brown on the lower leaf surface, and late leaf spots are black (Fig. 2). Epidemiological aspects are sufficiently similar that early and late leaf spots can be considered as one for the purpose of formulating recommendations.

Fig. 3. Symptoms of peanut rust, caused by *Puccinia arachidis*.

Components. • The fungi that cause leaf spots overseason in infested crop residue.
• Inoculum potential is greatest in fields where peanuts follow peanuts.
• Inoculum potential is adversely affected by growing unrelated crops in rotation with peanuts.
• The pathogens are host-specific to peanuts and do not infect other crop or weed species.
• The organisms require high oxygen levels and survive poorly when crop residues are buried 18 cm or more.
• The fungi develop most rapidly in laboratory culture at 30 C (86 F).
• The fungi may infect any aboveground tissue of the plant.
• Infection occurs in 4–12 hours, depending on temperature and relative humidity.
• Germ tubes produced by conidia enter through stomatal openings or by direct penetration of the leaf surface.
• Leaf spots become visible to the unaided eye approximately 10–12 days after infection.
• Leaf-spot fungi produce chemical compounds that hasten leaf drop.
• Secondary infections may occur when inoculum is produced and environmental conditions favor the pathogens.
• The pathogens are sensitive to certain fungicides that adversely affect their ability to cause disease.
• The pathogens have demonstrated the ability to build up resistance to certain fungicides, especially benzimidazoles.

Rust. *Description.* Peanut rust is caused by *Puccinia arachidis* Speg. (9–11). The disease progresses rapidly when the inoculum potential is high and conditions favor spore germination and infection. Urediospores are formed in pustules predominantly on the lower leaf surface (Fig. 3). Once heavy infection occurs, defoliation results and photosynthesis is reduced. Yield losses may be severe, especially if infection takes place well before plants are mature.

Components. • Spores of the pathogen are windborne primary inoculum coming from the Caribbean on low-level jet streams during periods of tropical disturbance.
• The pathogen has not been observed to overwinter in the continental United States.
• Infection is most likely to occur after 15 June in Texas.
• No alternate host is known.
• Spore germination is enhanced by temperatures of 20–25 C (68–77 F).
• Cultivars differ in susceptibility, but no commercially grown peanuts are immune.
• Free moisture on the leaf surface and high relative humidity favor spore germination.
• The pathogen is not seedborne.

Southern blight. *Description.* Southern blight, caused by *Sclerotium rolfsii* Sacc. (1,2,8), occurs throughout the peanut-producing areas of the United States. *S. rolfsii*, one of the most destructive soilborne pathogens, has a wide host range. It overseasons in the sclerotial stage and colonizes crop residue rapidly (Fig. 4). Infection of healthy plants occurs after the fungus has colonized organic matter in the soil and thus increased its inoculum potential. Oxalic acid produced by the mycelial mass facilitates host penetration. The organism is highly aerobic and develops mostly at the soil surface.

Components. • The pathogen is most active in warm soils and declines with the advent of cool weather in the autumn.
• Sclerotia are formed in abundance on infected plant tissue or crop residue.
• Sclerotia may persist in the soil for several years.
• Sclerotial germination is stimulated by alternate wetting and drying.
• The fungus utilizes crop residue as a food source to increase its inoculum

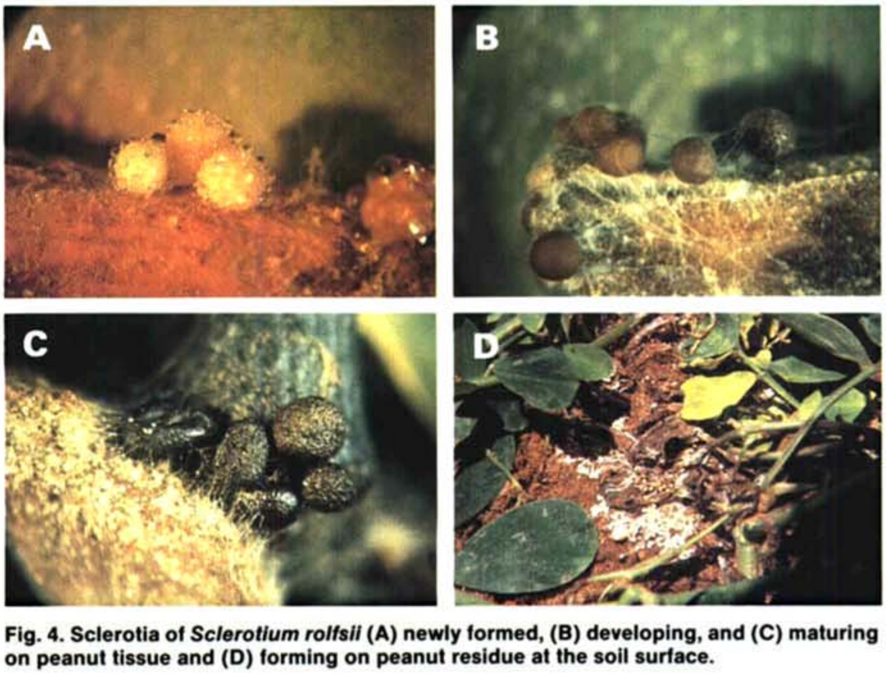

Fig. 4. Sclerotia of *Sclerotium rolfsii* (A) newly formed, (B) developing, and (C) maturing on peanut tissue and (D) forming on peanut residue at the soil surface.

Fig. 5. Shredding of peanut stem caused by *Sclerotinia minor*.

Table 2. Subsystems derived from scientifically based components

Subsystems/alternatives	Diseases controlled: Seedling disease	Leaf spots	Rust	Southern blight	Sclerotinia blight
Rotate with unrelated crops	X	X	–	X	X
Manage crop residue	X	X	–	X	X
Use raised beds	X	–	–	X	X
Select appropriate cultivar	–	X	X	X	–
Use quality seed treated with suggested fungicides	X	–	–	–	X
Wait for favorable soil temperature before planting	X	–	–	–	–
Avoid moving soil to plant base	–	–	–	X	X
Use chemical control when needed:					
Foliar fungicides	–	X	X	–	–
Soil fungicides	–	–	–	X	X
Avoid pathogen transport on crop residue or equipment	–	–	–	–	X
Scout to monitor first evidence of disease	–	X	X	X	X
Monitor environmental conditions to schedule fungicide applications	–	X	X	–	–
Use prudent irrigation schedules	–	X	X	–	X

Table 3. Fungicides recommended for control of foliar disease

Fungicides	Suggested intervals (days)	Effectiveness[a]: Leaf spots	Rust
Chlorothalonil	10–14	Yes	Yes
Chlorothalonil + sulfur	10–14	Yes	Yes
Mancozeb	7–14	Yes	Yes
Benomyl + mancozeb	10–14	Yes	Yes
Thiophanate-methyl	10–14	Yes	No
Thiophanate-methyl + mancozeb	10–14	Yes	Yes
Copper hydroxide	7–10	Yes	No
Sulfur	7–10	Yes	No

[a] May vary among production areas.

potential. Leaf accumulation at the soil surface from leaf spot occurrence is especially conducive to pathogen development.

- The fungus requires a high oxygen supply, and sclerotia buried more than 12 cm survive poorly.
- The fungus is susceptible to selected fungicides.

Sclerotinia blight. *Description.* The causative pathogen, *Sclerotinia minor* Jagger (9,10), is soilborne and has the capacity for causing serious economic loss. The disease is recognized first by wilting of infected branches and later by development of stem lesions and shredding (Fig. 5). Sclerotia form inside and adjacent to infected stem and pod tissue. Plants die rapidly after becoming infected.

Components. • The pathogen is most active during cool periods (18 C, 64 F) that may occur in the mid to late part of the growing season. The optimum soil pH for fungal activity is 6.5.

- Disease development is most active with abundant moisture.
- Sclerotia are produced in great abundance on or in stem, pod, and root tissue, especially in the plow layer, and may persist indefinitely in soil.
- The pathogen is seedborne.
- The fungicides iprodione and DCNA help suppress disease development.

The Recommendations

Recommendations for control of these five diseases (Table 2) are devised from research-based information that has served as the basis for on-farm demonstrations conducted over a period of years. The degree of potential economic benefit that accrues from adoption of these recommendations depends on each grower's production system, soil conditions, climatic conditions, and timing of production inputs.

Seedling disease. High-quality, pathogen-free seed treated with a recommended seed protectant fungicide should be planted. Seedling disease is less severe when morning soil temperatures are 21 C (70 F) or more at the 5-cm depth. Recommended seed-treatment fungicides include: captan + DCNA (60-20), captan + maneb + etridiazole (Terrazole) + PCNB, captan + maneb, and DCNA + captan + carboxin. Certain planter-box treatments are labeled for use where seedling disease recurs frequently. Marginal leaf burn may occur if carboxin is used on Spanish peanut seed. Runner cultivars are not negatively affected by carboxin and may show increased vigor as a result of treatment.

Leaf spots. Cultural and chemical control should be combined to effectively prevent foliar disease development. Peanuts should be rotated with nonrelated crops, and peanut crop residue should be buried below plow depth to reduce inoculum potential. Approved foliar fungicides (Table 3) should be used when necessary to keep foliar pathogens from limiting production.

Irrigated production. In areas where leaf spot occurs consistently, fungicide applications for Spanish-type peanuts should begin 35–40 days after planting and continue at regular intervals until 21 days before harvest, depending on the fungicide used and prevailing weather conditions. For runner types, applications should begin 50–65 days after planting; the recommendations for Spanish cultivars should be followed if late leaf spot occurs during the early stages of plant development.

Dryland production. The recommendations for irrigated peanuts should be followed if rainfall favors continuous plant growth and disease development. In years of low rainfall and low relative humidity, fungicide applications should begin when disease symptoms are first noted or when rain or dew favors disease development. Early detection of leaf spot requires careful observation because the first symptoms are difficult to detect. Fungicide applications should be continued at suggested intervals when moisture conditions favor leaf spot development.

Development of resistance. In some production regions, the fungi causing leaf spots have developed resistance to benomyl and thiophanate-methyl. Resistance may develop when a fungicide with a single mode of action is used repeatedly. Development of resistant strains can be minimized by: 1) alternating single-mode-of-action fungicides, such as benomyl and thiophanate-methyl, with multiple-mode-of-action fungicides, such as chlorothalonil and mancozeb; 2) tank-mixing a single-mode-of-action fungicide with a multiple-mode-of-action fungicide; or 3) using only fungicides with multiple modes of action.

Rust. Peanut rust is sporadic in occurrence. Once established locally, the pathogen may develop rapidly and spread throughout a production area. Rust is controlled only by good spray coverage of the foliage with effective fungicides (Table 3); when the potential for disease development is great,

Table 4. Variations and evolutionary trends in the recommendation process

Grower involvement in technical decision making	University involvement in giving assistance	Cost of service or assistance
Producers make all technical decisions based on individually acquired knowledge	University representatives (usually agents or specialists) explain conceptual reasoning and alternatives for decision making in planning and executing plant disease control strategies	Continuing education programs are supported cooperatively by different levels of government
Producers make routine decisions and rely on consultants for technical decisions	University scientists assist with problem solving but growers must rely on consultants for certain types of decision-making information	Cost of information or assistance is shared by users and public agencies
All decision making is within a corporation utilizing specialized consultants to make appropriate decisions	Universities develop technology that can be purchased by the corporate farm in the form of improved cultivars, animal breeds, or biocontrol agents	Cost of information acquisition is borne by the corporate farm

intervals between applications should be shortened. The cultivar Southern Runner is more resistant than Florunner to the rust fungus.

Southern blight. Southern blight can be controlled effectively in most fields with the timely use of appropriate cultural practices based on the ecological behavior of the organism and how it causes disease: 1) Rotate with unrelated crops; 2) bury crop residue with a moldboard plow below plow depth; 3) control foliar diseases to prevent fallen leaves from serving as a food source for the pathogen; 4) plant on raised beds; 5) use herbicides to prevent weed residues from serving as a food source for the fungus; 6) avoid moving soil to the base of plants during cultivation; and 7) do not delay digging.

The extent of southern blight development varies from one year to another depending on environmental conditions. In certain years and on some fields, producers may need to rely on chemical control procedures. PCNB and carboxin are effective when used within the limits of their capabilities.

Sclerotinia blight. Sclerotinia blight can be devastating once the pathogen becomes established in a field. Strenuous efforts should be made to prevent its introduction into uninfested fields or production areas. Since *S. minor* can be seedborne, seed fields should be inspected rigorously and not used for seed production if the pathogen is found. Care also should be taken to avoid spread of the organism on contaminated equipment or in peanut crop residue that may be used for livestock feed (sclerotia can remain viable after passing through an animal's digestive system). Iprodione is moderately effective in fields where the disease limits production.

Changes Occurring in the Use of the Recommendation Process

In the United States, traditional extension recommendations are most appropriate when one's objective is to help producers decide on the most suitable strategy for plant disease control. These recommendations have less utility for growers who transfer that responsibility to consultants. During the last two decades, individuals from inside and outside the land-grant universities have advocated movement toward commercialization of traditional recommendations. Under this system, the recommendation process becomes proprietary and is available to producers as a service, usually by consultants. Whether this movement is in the best interest of the food and fiber production industry is a matter of debate.

Regardless of one's philosophy, recommendations are formulated in essentially the same way. The conceptual framework is structured to utilize disciplinary research findings that complement crop production components and achieve control of plant diseases (Table 4).

Multiple Players in the Process

To this point, the roles of the research scientist, the extension specialist, and the grower have been paramount in formulating recommendations. Many others are involved, however, and the system will not work as intended without their support and concurrence. Some of these are the county extension agents, bankers, seedsmen, equipment manufacturers, pesticide suppliers, and purchasers of the commodity.

Recommendations seldom dictate the immediate actions of any group, including growers. Almost all commodity groups operate with a degree of independence that fosters gathering of information from many sources and avoids their dependence on a single knowledge source. Recommendations from the land-grant university system do, however, represent a standard respected by all participants in the production system.

Consultants have given a new dimension to the recommendation process. They study and utilize recommendations formulated in the public domain, but they must also formulate their own to offer a competitive service. Theoretically, at least, they must offer a service that is as good as or better than that offered by competitive consultants and one that will improve profits for their client(s).

The ultimate test for the extension specialist responsible for recommendations is that of scientific accuracy, appropriateness, legal compliance, and consistency with the goals for the producers of the commodity. Unlike their counterparts in private practice, extension specialists are not responsible for choosing among alternatives, even though their credibility depends on the performance of alternatives in the formal recommendation system.

Steps in Making Decisions

Most authorities in the field of management agree that individuals in the decision-making mode almost unconsciously go through five distinct steps to reach an informed decision: 1) problem definition, 2) problem analysis, 3) development of alternatives, 4) evaluation of alternatives, and 5) selection of the best alternative.

One may assume that rational individuals make correct decisions when they have appropriate information for doing so. The mere existence of information, however, does not ensure they will have the right ingredients for decision making. Scientific information must be interpreted and combined with other relative facts before it has utility in the decision-making process. The traditional extension plant disease control recommendation designed by incorporating research-based information with knowledge of the production system serves as a base for decision making.

The recommendation is not an end in itself, because progressive decisionmakers desire to pursue facts beyond that point. Publications such as compendia produced by the American Phytopathological Society (10) and color atlases produced by states (3) fill such needs.

Responsibility, Accountability

A scientific discipline such as plant pathology has a responsibility to its science, supporters, and clientele to see that the pathway from knowledge discovery to application is open and functional. Over 4,000 members of the American Phytopathological Society individually and collectively share this responsibility.

The establishment by APS in 1980 of PLANT DISEASE as the successor to *Plant Disease Reporter* ensured the continued publication of applied research manuscripts in plant pathology. This refereed scientific journal utilizes a format that is highly beneficial to individuals responsible for the control of plant diseases. The establishment by APS in 1984 of APS Press was a significant development for assuring a flow of decision-making information in plant disease control. Compendia describing diseases of the various crops are especially helpful as reference sources, as are books on specialized topics related to plant pathogens.

Most states have developed color atlases to aid producers in problem diagnosis and analysis (3). Some states have combined resources to produce regional publications. These publications have done much to aid decisionmakers in selecting proper courses of action.

Expert systems and artificial intelligence programs are decision support resources (6) that have potential to assist individuals in the decision-making process. Their innovative potential permits consideration of large amounts of information in a short period of time. In some cases, they may be used for "control practice" selection when problems are well defined and repetitive.

Responsible decision making for plant disease control in commercial agriculture requires inputs from knowledgeable individuals ranging from trained producers to consultants to professional plant pathologists. Producers still make most decisions, but a trend is developing toward greater reliance on consultants.

How does one know when success has been achieved and the final recommendation has met its objective? One can measure change in the clientele by one or more criteria: 1) knowledge gained—what people learned, 2) attitudes changed—what people think, 3) skills developed—what people can do, and 4) practices adopted—what people have applied. Some may wish to evaluate change in different terms, such as increased income, additional yield, or a more healthful food supply—all of which are consequences of change.

C. Wendell Horne

Dr. Horne is an extension program leader for plant pathology and microbiology at Texas A&M University. His program group consists of 10 full-time professional plant pathologists who are responsible for making disease control recommendations on all crops, including shade trees and ornamentals. Over the 26 years that span his professional career, he has been especially interested in programming for rapid adoption of improved practices by using appropriate combinations of educational techniques. He served for 6 years as Editor-in-Chief of PLANT DISEASE, and this year he was elected a Fellow of APS.

Conclusions

"Groundwork for Decision" becomes a symphony of parts and processes brought together by people who share a variety of roles and responsibilities. Much like a symphonic orchestra, the parts and processes blend to form a melody for positive change. The desired change or objective is to help individuals engaged in plant production avoid disease loss and to allow plants to produce their genetic potential.

The recommendation system for plant disease control is structured from scientific concepts and knowledge of crop production to form a disease-control strategy. It represents a partnership between the scientific community and producers who share the mutual goal of plant disease control.

Knowledge flow from discovery to application follows a distinctive process and works best when all parties understand their responsibilities to the system. It begins with a testable hypothesis designed to deduce the cause-and-effect relationship and ends when the effects of plant pathogens have been ameliorated at the growing site.

Producer acceptance of new technology follows the adoption process: awareness, interest, evaluation, trial, and adoption (4). Educators who are aware of this natural process can shorten the time required for adoption of proven practices. Even then, however, approximately 7 years are required to gain acceptance of a new, proven practice.

Individuals in the scientific community should remain aware that they are not the only players in "Groundwork for Decision." County extension agents, bankers, pesticide suppliers, and commodity buyers all influence the rate of acceptance of improved practices. Professional consultants are playing a greater role in decision making, even though growers still make most production decisions.

The processes for practice adoption can and should be evaluated. When commodity producers represent the target clientele, one can measure knowledge gained, attitudes changed, skills developed, and practices adopted. If practice adoption fails to occur at a desirable rate, some aspect of the "Groundwork for Decision" process may be in need of repair. Once the problem is identified, individuals responsible for the program can restore it to its original effectiveness.

Phytopathology is an exciting discipline with much opportunity to assist plant producers in disease control decisions. Individual professionals, as well as the discipline as a whole, have a responsibility to keep the knowledge flow pathway open and functional.

Literature Cited

1. Garren, K. H. 1961. Control of *Sclerotium rolfsii* through cultural practices. Phytopathology 51:120-128.
2. Harrison, A. L. 1966. Pentachlorobenzene for the control of southern blight on peanuts. Plant Dis. Rep. 50:855-858.
3. Horne, C. W. 1974. Peanut diseases atlas. Tex. Agric. Ext. Serv. (MP-1170). 15 pp.
4. Horne, C. W. 1981. Extension: The face of plant pathology. Annu. Rev. Phytopathol. 19:51-67.
5. Jenkins, W. A. 1938. Two fungi causing leaf spot of peanut. J. Agric. Res. 56:317-332.
6. Latin, R. X., Miles, G. E., and Rettinger, J. C. 1987. Expert systems in plant pathology. Plant Dis. 71:866-872.
7. Lippke, L. A., Ladewig, H. W., and Taylor-Powell, E. 1987. National assessment of extension efforts to increase farm profitability through integrated programs. Tex. Agric. Ext. Serv., U.S. Dep. Agric. Rep. 42 pp.
8. McLintock, J. A. 1917. Peanut-wilt caused by *Sclerotium rolfsii*. J. Agric. Res. 8:441-448.
9. Patee, H. E., and Young, C. T. 1982. Peanut Science and Technology. American Peanut Research and Education Society, Yoakum, TX. 825 pp.
10. Porter, D. M., Smith, D. H., and Rodríguez-Kábana, R. 1984. Compendium of Peanut Diseases. American Phytopathological Society, St. Paul, MN. 73 pp.
11. Smith, D. H., and Littrell, R. H. 1980. Management of peanut foliar diseases with fungicides. Plant Dis. 64:356-361.