Ann. Rev. Phytopathol. 1980. 18:27–36

HERBERT HICE WHETZEL: PIONEER AMERICAN PLANT PATHOLOGIST

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The times were ripe for men like Whetzel, and he was made for the times. During the latter half of the 19th century, a descriptive approach to phytopathology was giving way to a mycological and etiological approach. Studies of etiology in turn provided the foundations for a modern, practical approach to the control of plant diseases. The pioneering investigations of DeBary, Kühn, Millardet, Tillet, Jensen, and Bolly coupled with the catastropic famine in Ireland, caused many people and governments to turn from the clergy to the scientists for facts about disease in plants. A few control measures had trickled down for the diseases of cereals, potatoes, and fruits. These were beginning to light up the horizon of a brighter day for the long-suffering farmer. Demands for practical information and its extension were increasing. The College of Agriculture at Cornell, under the extraordinary leadership of Liberty Hyde Bailey, responded eagerly to this challenge. Bailey was determined to make science useful; research and extension were to become the practical handmaid of the farmer. Bailey's success stemed largely from his exceptional ability to select the right people. H. H. Whetzel was one of the most able, the most motivated, and the most generally wise of these faculty.

Whetzel was of early German immigrant, pioneer, Pennsylvania Dutch heritage. His grandfather brought the family partly by horse and wagon through the woods to a farm in northern Indiana. Herbert learned at first hand the trials of the farmer at the turn of the century. He walked five
to school. He became deeply interested in flowers, insects, mushrooms, and fossils. He had initiative and developed self-confidence, earning his own way

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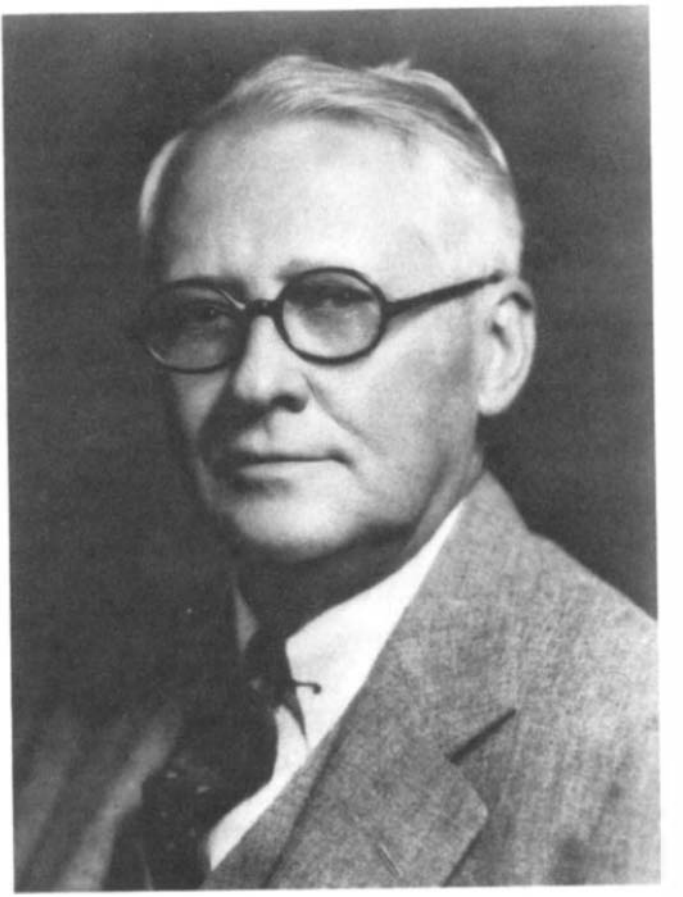

Figure 1 Herbert Hice Whetzel.

from age 15. He taught school for one or two years before entering Wabash College at 19. Part of the time at Wabash, Whetzel lived in the home of an exceptional investigator, scholar, and teacher of botany and mycology, Mason B. Thomas, a former student of Dudley at Cornell. Thomas fanned the fire of Whetzel's early interest in science and reported to G. F. Atkinson that "Whetzel was the best student of botany ever graduated from Wabash, by reason of his excellent high school preparation, his wide reading, and his extensive field work." While still an undergraduate working his way through college, Whetzel made a study of the phanerogamic flora of the region, collected and determined 80 slime molds, taught a class of city school teachers in nature study, delivered two papers before the Indiana Academy of Science on apple rust and on the genus *Stemonitis.*

With Thomas's help Whetzel became Atkinson's graduate assistant at Cornell in 1904, the year after Bailey was made Dean of the College of Agriculture. Whetzel was hired on a special fund set up in 1893 for extension of information, and later of research on plant diseases. This opportunity presented a challenge which he met with extraordinary vigor and intelligence. He seemed to believe that constant activity would favor serendipity. He began a survey of the diseases of New York State, taught a winter course in farm botany that was two thirds plant pathology, outlined investigations on diseases of fruit, vegetable, medicinal, and ornamental plants, and wrote a bulletin on onion blight. In two years he was made assistant professor of botany. A year later, at his own request, he was designated professor and head of the new Department of Plant Pathology (1907). In explaining the request he effectively pointed out that 85 of the 224 bulletins issued by the college of agriculture since 1888 "dealt wholly or in part with plant diseases." It was time to institute a new department with specialists devoting full time on plant diseases. Whetzel and Bailey made many trips by train and horse to speak to farmers at meetings over the state. Whetzel's botanical knowledge, vigorous initiative, administrative ability, and especially his enthusiasm for teaching and for the application of scientific methodology to agricultural problems suited Bailey admirably. The rise to eminence of Whetzel and the NY State College of Agriculture became inevitable.

Exceptional Teacher and Organizer

Whetzel set to work to build a well-balanced department based on teaching, research, and extension. He soon turned the teaching of mycology over to Fitzpatrick and concentrated himself on plant diseases and their control. He taught the elementary course in plant pathology where he could discover promising students to entice into graduate work. He gained the reputation of being one of the best teachers on the agricultural campus; someone said "the best in his field during his lifetime." When applicants exceeded available laboratory space he selected them on the basis of their grades, to the consternation of some faculty and dismay of some students. His initials came to stand for HURRY HURRY WHETZEL. He believed the opening of a students eyes depended on plenty of "information and enthusiasm. . . . enthusiasm borne of knowledge is contagious" (8).

After ten years of teaching in the time-honored way of just "professing" he developed a unique system that placed much more responsibility on the student for his own learning and thinking. The method was based on the assumption the student came because he wanted to learn. Whetzel often said, "Nobody ever taught anyone anything." Learning took place as the result of the activity of the student, but could and should be encouraged and

stimulated by the teacher. "Prof" was a wonderful stimulator. He believed with President Andrew D. White that students are "not in college to be made, but to make themselves," and that "the mind is not (just) a receptacle to be filled, but a fire to be kindled." Whetzel thoroughly enjoyed the process of kindling; to him students were very important people. So in his laboratory, students worked on the diseases they chose, and at their own speed, any hours of the day or night, using texts, laboratory outlines, and materials all carefully prepared. When they felt ready, a private conference with Whetzel was requested. The questions and answers brought out the students' ability to reason and solve hypothetical problems with the facts he had absorbed. One student wrote "I always tried to get a good night's sleep before one of 'Prof's' conferences." Another bemoaned, after his first conference, "I thought I knew the stuff cold, but that old fossil never asked me any question I could answer." If the student thought he had done poorly he could postpone taking a grade until he had studied some more. He was made to feel he was working to please himself, not the professor. Students in time gained confidence and pride in their ability to acquire the right facts with which to reason logically. At the end of one conference a graduate student who was asked if he had any questions, replied, "What was the answer to that question I failed to answer?" Prof calmly replied, "I do not know the answer." "Then why did you ask me?" "Ha, Boy, some day a bright, ingenious young fellow is going to put the right facts together and solve that problem." Making a game out of learning was one of his ways of stimulating student enthusiasm. It helped to develop research-minded students, which were much needed. He played hard at learning and won the admiration and affection of students. "His inspiring enthusiasm and unique laboratory methods, made students think: which is one of the primary purposes of university instruction."[1] He colorfully and vigorously propounded his pedagogical improvements (16).

"In his peppery way he injected enough intellectual irritants into the minds of other teachers to at least make them think about improving their own methods even if they rejected his" (2). Whetzel never "bawled a student out." He believed praise to be far more stimulating than criticism. Five decades later, echos of his teaching philosophy are still reverberating in the halls of learning (3).

Whetzel's extensive knowledge was organized into two main courses under "Principles of Plant Pathology" and "Principles of Plant Disease Control." He invested much time and thought in improving plant pathology terminology which he found "incongruous to the point of absurdity." To

[1]Letter from A. B. Recknagle, head of forestry, to Amy Whetzel December 9, 1944. Recknagle's students in forestry were required to take Whetzel's Course I.

him the phenomenon of disease or "pathogenesis" was an interrelated series of processes, not just a condition, and included inoculation, incubation, and infection. He coined and defined many new terms to describe symptoms more accurately, such as *necrotic, hyperplastic, hypoplastic.* Control measures were grouped under such descriptive headings as "Exclusion," "Eradication," "Protection," or "Immunization." A fungicide could act as a "Protectant, Disinfectant, or Disinfestant," depending on where, when or for what it was used (14, 15). Not everyone has accepted *epiphytotic* for *epidemic* or *suscept* for *host.* But "his insistence upon clear thinking and precise expression was one of his most noteworthy contributions to his science" (4). He once said, "A broadly educated man is one who has a good stock of facts on a variety of subjects and is able to think with them intelligently and effectively."

Two other things he did for students were original. He gave a course (optional) on the history of plant pathology with the book he wrote for the text, so that students might know the early contributors and the background of their profession (12). He conducted an informal class in German based on a system of cognates he devised which permitted students to pass their reading examination in less time. He knew that good students, well educated, were very important for the future of plant pathology. He told his students that nobody but a genius ever had an original idea. Most of us get ours secondhand, so it behooves us to read widely, talk with many people, discuss many things, and thus enlarge the base from which our own ideas can emerge. He appreciated that good luck favors the well-stocked mind. Measured by what he said, taught, wrote, and got others to do, Whetzel had many of the abilities of both DeBary and Kühn whom some regard as the founders of modern plant pathology, the former, the teaching mycologist, the latter, the farmer turned scientist.

Plant disease surveys were an important part of Whetzel's teaching and research. On one return trip from Connecticut he and his assistant brought in over 500 specimens. He was demanding of himself and his assistants. During many summers, hundreds of specimens of diseased plants, insect injuries, and abnormal looking growths were laid on tables for staff and students of mycology and plant pathology to identify in their spare time. For those going into teaching or extension this was very useful training. The value of these "clinics" is still being vigorously discussed as plant pathology training again has veered away from the farm toward the ivory-towered laboratory (1).

The Eager Researcher

Whetzel was a mycologist at heart and a pathologist by profession. His mycological investigations were numerous and of high quality. They took

him to many countries in Europe, the Carribean Isles, Canada, and South America. Fitzpatrick summarized them well (4). Cornell's herbarium, an outgrowth of "Prof's" personal collecting from boyhood, totaled over 30,000 accessions at his death and is especially rich in tropical ones. He published many descriptions and controls for a wide variety of diseases of plants including those on fruit trees, ornamentals, medicinal plants, and wild flowers, many of which he grew in his extensive garden. He belonged to that little coterie of botanists who believed the time was ripe to cut umbilical cords and make the science of plant pathology grow, and stand on its own feet along side of bacteriology and medicine (14). He set to work not only to organize and teach the principles of plant pathology, but to train students in conducting investigations, and to extend the results of their efforts to farmers who could use them. He will long be remembered for his innovative ways of doing both of these things. The year after Whetzel came to Cornell, with Dean Bailey's approval, his assistant Don Reddick was placed in a temporary field laboratory on a grape farm 30 miles out of Ithaca to make a careful study of the black rot disease and develop a control, if possible. The results of two summers work were very successful and Reddick soon obtained his PhD degree. Both Whetzel and Bailey were convinced that field laboratories, manned by bright, inquisitive, open-minded students, under the direction of experienced staff members held great promise. At that time it was generally agreed the most important scientific problems in the field of plant pathology were those of plant disease control. Whetzel told fruit growers that "it was neither logical nor practical nor profitable to study such things a long distance from the diseased infested region." The diseases must be studied in the field and orchard in rain or sun, day and night, continually. The investigator must make the field his laboratory and take to it whatever he needs, such as weather instruments, microscopes, sterilizers, chemicals, glassware, and cameras. He must know the crop, methods of cultivation, and local conditions where the disease occurs. "Only in such field laboratories could many disease problems be solved quickly, effectively, and scientifically—scientific methods are not scientific unless they are practical, and they are not practical unless they are scientific" (11).

Where to get money and students to man such laboratories all over the state was ingeniously solved by cranking up industrial fellowships. Tradition never stopped Whetzel from doing anything useful. In those days distrust clouded the relations of college professors with agricultural businessmen. Whetzel recognized that salesmen for chemical companies often did more than did college scientists to induce farmers to try fungicides and insecticides. A consummate salesman himself, and with such aids as Reddick's success, the scalding of apples often caused by Bordeaux, and Cord-

ley's work with lime sulfur on the West Coast against apple scab, he was able in 1909 to obtain a $1500 grant from the Niagara Sprayer Co., makers of lime sulfur for insects, for a two-year investigation of lime sulfur as a fungicide (9). By ingenious laboratory tests and extensive orchard trials, improved controls for certain fruit diseases were achieved, which Whetzel quickly extended with zealous enthusiasm at horticultural meetings throughout the East. Requests for more such field investigations came quickly. By 1911 eight fellowships had been set up or promised, five of them financed by growers or their organizations. Whetzel successfully preached that it was only fair that farmers shoulder at least part of the expense investigations that benefited them first of all. Both farmers and agricultural businessmen wholeheartedly embraced this new partnership with the college. The first eight fellowships brought over $14,000 to the department at an opportune time, enabling Whetzel to pry money from the state for more staff, equipment, supplies, and travel funds. At his death in 1944 the number of grants had reached 58, by 44 donors, bringing over $263,968 for plant pathological investigations. He would have been a staunch advocate of cost accounting. He published a complete account of his stewardship of these fellowships (17).

L. R. Jones said that "Whetzel showed genius at solving old problems in new ways" (5). Much research was accomplished that would not have been undertaken for years, some of it of wide value. This was pioneer service in the development of the science of plant pathology. Furthermore he had performed another service in reversing the distrust that many farmers had for university scientists, and also in improving the good will between the university, the farmer, and agribusiness firms serving the needs of farmers. Perhaps of more importance to the future of plant pathology, 42 of the 67 fellowship holders earned their PhD degrees. Thirty-one became research professors or teachers of plant pathology or mycology in colleges or universities, and 18 more became investigators of professional status in federal service or commercial organizations (17).

Whetzel likened the field training given students to that received by interns in the field of medicine, under the direction of experienced doctors. He convinced the university faculty that field work, which often had to be started before the end of the spring semester, was as important as anything the investigator would learn by staying to complete the course. The student investigator soon learned that a control measure must be effective, economical, and practical for farmers to accept it. Solving the main problem was not always accomplished, but solving secondary ones sometimes saved the day and stimulated fellowship renewal. Saunders' development of copper lime dust and my results with it in New York on celery blight helped convince Whetzel that the dusting method of applying fungicides was the

wave of the future, because of the speed with which timely applications could be made before rains, so important in apple scab control. Convinced of its virtues and discounting its shortcomings, he championed it zealously (10). Many fruit growers, who would not have done so, thus were induced to begin using protectants for disease control. That dusting later became obsolete, owing to great improvements in spray equipment, materials, and methods of application, does not detract from the value of Whetzel's pioneering work with protectants, much of which was both timely and fundamental.

Whetzel had many hunches—some amusing, some of great value. He once thought mushroom mycelium might improve the flavor of some breakfast foods so he brought samples to the laboratory for students to taste. Another time he had everyone looking for plasmodial bodies in the vascular elements of ailing plants. He advised some students to go into private practice on plant pathology; Cynthia Wescott was one of the first to succeed as a "plant doctor." One hunch I am happy to relate was his suggestion that I explore the possible roll of perennial Egyptian topet onions (*Alium cepa* var. *viviporum*) in the initiation of onion mildew in the spring. They turned out to be so abundant in some farm gardens and so often diseased as to be the key to early field infections and thus to the control of this disease in several onion growing regions in New York State (6). Comments in a few personal communications received from other former students are pertinent. "Whetzel was outstanding as a man of a million ideas, about how to study any disease problem." "The twinkle in his eye when he described a problem made a student want to jump in and find the solution. He always put the emphasis on the opportunity to do good things." "The best of his students are ready to acknowledge him as the "Prof" who had the greatest influence on their impact on the science of plant pathology." "He pointed the way, provided the spark than ran all our engines. All who were subjected to his charm, warmth, enthusiasm, generosity and sympathetic understanding, could not help becoming better individuals and better plant pathologists. His students have done honor to him, to the department, the university, and to the science of plant pathology." Westcott dedicated one of her books to him (7).

The Extension Advocate

No well-organized extension service had been established in 1907. The time was ripe to exhort growers to make more use of the few seed treatments and foliage protectants of proven effectiveness. Whetzel knew and aptly said, "Farmers cannot be driven. They must be enticed and led." His experience on the active end of his father's spray hose prepared him to talk to fruit farmers in language they could well understand. He could hold his audience

spellbound with his wit, his splendid exhibits, and his knowledge of investigations proceeding all over the country. It was said, "None of his colleagues put on a more entertaining show or more interest-compelling presentation of his subject." His conviction of the importance of extension was expressed in a letter to a former assistant. "The application of scientific discoveries to the solution of practical problems calls for quite as much ability and initiative as does pure research: I sometimes think more. Beware of getting into the frame of mind that puts extension work and practical application in a lower category than pure research. It is a false point of view and one that will handicap you in dealing with men and things." Whetzel knew that good plant pathology extension must be based on a solid scientific foundation. He insisted that students headed toward extension work, first obtain a PhD doing practical research to learn the value of adequate proof for any recommendations they were to make. He trained Barrus and Chupp, and they did monumental work in setting up cereal, vegetable, and potato seed treatment centers over the state, and promoting farmers' potato "spray rings" during World War I to make the best use of spray equipment that was in short supply. Likewise a "spray information service" for fruit growers was instituted in cooperation with the entomologists in different parts of the state, still in operation in modified form. Field inspections for elimination of potato virus diseases also was established during Whetzel's administration. By such activities our science moved rapidly in the direction of greater service to agriculture, based on a more solid scientific foundation.

As chairman of the American Phytopathological Society's war emergency board during World War I Whetzel made a characteristic impassioned plea for unselfish cooperation to speed up development of practicable controls for certain diseases. It included a detailed outline of how this could be accomplished, by men with a common interest coming together electing a leader, and putting "all their cards on the table face up." It called for "leadership of the highest order, strong, of broad vision, wholly devoted to the common good, above reproach" (13). The number of conferences of this kind on specific diseases, crops, and pathogens taking place each year all over the country attest to the soundness of his proposal.

The Total Plant Pathologist

For Whetzel plant pathology was FUN. He was its devoted enthusiast and most dedicated promotor. One of Whetzel's great admirers and close friends was E. C. Stakman, under whom I also studied. At some of the earlier society meetings he and Whetzel would stage knock down, drag out forensic, flamboyant disputations that electrified the members. In time these amusing sideshows, looked forward to by many, came to insure needed quorums for the business at hand. For 16 years he labored to build and

administer a strong well rounded department, bearing some original, outstanding characteristics. He did a superb and unique job of teaching, and of directing research of both practical and fundamental character. His name, as author or coauthor, appears on nearly 300 publications. Still he took time to help organize two scientific societies, to establish and edit the leading journal of his profession, write books, lecture widely, carry on a large correspondence and by all of these means to stimulate to do their best all who came within his reach. The advance of our science owes much to the vision, drive, and enthusiasm of this indefatigable, two-fisted champion of its progress. Still, to those who knew him best, "His sterling character, enduring friendship (and warm compassion) command respect and admiration quite as much as his intellectual accomplishments" (2).

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