



KENNETH F. BAKER

KENNETH FRANK BAKER—PIONEER LEADER IN PLANT PATHOLOGY

R. James Cook

Washington State University, College of Agricultural, Human, and Natural Resource Sciences, Pullman, Washington 99164-6242; email: rjcook@wsu.edu

Key Words history of plant pathology, soilborne plant pathogens, seed pathology, biological control, diseases of ornamental plants

■ **Abstract** Kenneth F. Baker (1908–1996) made major contributions to understanding diseases of ornamental plants, seed pathology, soilborne plant pathogens, biological control, and history of plant pathology. His work set the stage for the success of today's ornamentals and nursery industries. His leadership and writings created the scientific framework for research and teaching on soilborne plant pathogens and biological control. After B.Sc. and Ph.D. degrees from Washington State University in 1930 and 1934, respectively, and one year as a National Research Council Fellow with B.M. Dugger at Wisconsin, he took jobs in 1935 with the U.S. Department of Agriculture in Nebraska on establishment of shelter belts and 1936–39 with the Pineapple Producers Cooperative Association in Hawaii. He worked on diseases of ornamental plants at the University of California, Los Angeles, starting in 1939, moving to Berkeley in 1961 when the UCLA program closed. He retired in 1975 and moved to Corvallis, OR, as Emeritus Professor, Oregon State University, and Collaborator, U.S. Department of Agriculture, Agricultural Research Service. He spent four sabbatical leaves in Australia, and was elected fellow of the American Association for the Advancement of Science in 1950, fellow of the American Phytopathological Society in 1969, and the Horticultural Hall of Fame in 1976.

INTRODUCTION

Kenneth F. Baker was the epitome of a pioneer leader in plant pathology. His contributions over a 60-year period, from 1934 as a new Ph.D. until his death in 1996, included pioneer leadership of the fields of diseases of nursery and ornamental plants, seed pathology, thermal therapy of soils, ecology of soilborne plant pathogens, biological control of plant pathogens, and history of plant pathology. He was the accomplished practitioner yet tireless in his pursuit of the science and unifying principles of plant pathology. A 28-page term paper written as a graduate student at Washington State University (WSU), then Washington State College (WSC) at Pullman in 1931, entitled *Historical Landmarks of Phytopathology*, must have

alerted the faculty and especially his major professor, F.D. Heald, that this student was special.

Ken was also a student of classic literature, anthropology, archeology and early civilizations, Darwin's *Origin of the Species*, and the history of science and agriculture. He was a connoisseur of fine wines, especially fine wines from South Australia, a professional photographer, and a regular at the San Francisco opera (and probably the Sydney opera during his four study leaves in Australia). In 1962 on return from his first study leave in Australia (to the Waite Agricultural Research Institute, University of Adelaide, 1961–62), he spent 3 days photographing the ruins of Angkor Wat in Cambodia. His 1971 book of photographs, *Wild Flowers of Western Australia* (2), was completed through successive visits to Western Australia during his second study leave (to the New South Wales Department of Agriculture, Rydalmere, NSW, in 1969).

Ken was elected Honorary Fellow of the Hellenic Phytopathological Society, at Volos, Greece, on October 16, 1985. Excerpts of the minutes read “for a) his great scientific offer to the Science of Plant Pathology, especially as a leading world authority in Biological Control of Plant Pathogens and as a Great Teacher of the History of Plant Pathology, and b) his scholarly connection with the Ancient Greek Letters and Philosophy, academically, phytopathologically, and human-wise.” His 3-credit *History of Plant Pathology*, taught at Berkeley and a course I was privileged to take, started with the history of the universe, the ascent of man, and the role of agriculture in the emergence of civilizations, among other foundations that he considered necessary if we were to place the history of plant pathology in proper context.

Ken also archived and documented the professional and personal milestones in his own life. These include extensive well-organized files of personal notes, onion-skin copies of correspondence back to the 1930s, and numerous other documents passed on to me by his widow and third wife, Mrs. Kathryn Baker; these served as a primary source of my information for this chapter. It is my distinct honor to share the story of this pioneer leader in plant pathology.

THE FORMATIVE YEARS

Ken was born in Ashton, SD, on June 3, 1908. His family moved to Clarkston, WA, while Ken was still very young; there he attended first grade through high school from 1914 through 1926. He had one brother, Dr. G. Orion Baker, botanist and faculty member at the University of Idaho, Moscow, ID.

Ken worked for the U.S. Forest Service in the Selway National Forest, Kooskia, ID, during the summers of 1926, 1927, and 1928—immediately following his graduation from high school and each of the summers following his freshman and sophomore years at WSC. Kooskia, ID, is about 50 miles east of Lewiston, ID, and neighboring Clarkston, WA. Photographs in his scrapbooks show him working

with mule teams. He did fire-reporting, trail maintenance, construction of a log lookout tower, telephone line maintenance and record keeping. The second and third summers in the Selways were also used to collect and identify plants on the west slope of the Bitterroots, an area referred to by Ken as “unbotanized.” He deposited his collections with the WSU herbarium.

Between his junior and senior years, Ken worked in a greenhouse and nursery at Elma, WA. It was probably this experience that sparked his interest in diseases of ornamental plants.

Ken obtained his B.Sc. in 1930. Phil Abelson and Edward R. Murrow were also in that graduating class. His high-school and college classmate, Glen “Turk” Edwards, played tackle on the WSC football team, was the first player at WSU to be selected as All American, and is listed today on the all-time, all-star WSU football team. Ken counted on Turk to protect him during the often no-holds-barred initiation activities when they were freshmen. While his good friend Turk excelled in football, Ken traveled the nation (literally) as a member of the WSC debate team, including as cocaptain with Paul Coie of today’s Perkins and Coie law firm.

Ken entered graduate school at WSU in the fall of 1930 on a fellowship that paid \$900 for the 9-month academic year. His summer employment included work as a laboratory assistant in the department in each of the summers of 1930–1932, and as Checker Foreman, U.S. Forest Service Blister Rust Control, Clearwater National Forest (*Ribes* eradication program), Orofino, ID, in the summer of 1933. He spent the summer of 1934, then a new Ph.D., as Supervising Technician, Division of Forest Pathology, Bureau of Plant Industry, scouting for *Cenagium* twig blight of western yellow pine in Oregon and Washington.

Well ahead of his time, and against the advice of the plant pathology faculty at WSU who thought he should go straight into a teaching and research position, Ken applied for and was awarded a 1-year National Research Fellowship in the Biological Sciences by the National Research Council, starting October 1, 1934, to conduct studies with B.M. Dugger in the Department of Botany, University of Wisconsin, Madison. Thirty years later, Ken advised Samuel H. Smith and me, then graduate students at U.C. Berkeley, to consider capping our graduate training with postdoctoral experience before applying for our first job. There was no shortage of pride on Ken’s part when he announced at a departmental seminar that we each had been selected to receive a NATO postdoctoral fellowship for 12 months during 1964–65, Sam to study at the Glasshouse Crops Research Institute, Littlehampton, U.K., and me to study at the Waite Agricultural Research Institute, Adelaide, Australia.

As another personal aside, it was near the end of my 12-month fellowship in Australia that Ken received a letter from C.S. Holton, his friend when both were single men at WSC in the early 1930s. Holton asked Ken if he knew of anyone who might be interested in a USDA-ARS position about to be added to the federal cereal disease research program at Pullman for work on soilborne pathogens of wheat. Ken wrote simultaneously to Holton and me, and 40 years later I am still at WSU.

FIRST CAREER APPOINTMENT—AND INTRODUCTION TO SOILBORNE PLANT PATHOGENS

Ken's many summers with the U.S. Forest Service can explain why, as his post-doctoral fellowship was ending, he looked almost exclusively to civil service jobs in forest pathology as the next step in his career. Hardly missing a day of pay, he accepted a temporary position as Junior Pathologist with the Division of Forest Pathology, Bureau of Plant Industry, U.S. Department of Agriculture, effective October 4, 1935, at an annual salary of \$2000 and stationed in the Department of Plant Pathology, University of Nebraska, Lincoln. His job was described as "emergency work, but not beyond June 30, 1937," to work on root diseases and soilborne plant pathogens of shelter belt trees, specifically damping off and other seedling diseases in the nurseries. His supervisor was Carl Hartley in Washington, D.C. Ken developed a lifelong professional relationship with Hartley, even though this would be his last job working on diseases of trees. On the other hand, this would be his first exposure to work on soilborne pathogens and seedling diseases, two areas that would eventually do much to define him as a pioneer leader in plant pathology.

With his appointment defined as temporary, Ken began almost immediately after his arrival in Lincoln to apply for other positions, but still focused on the federal civil service. He took a Civil Service exam for Associate Conservationist, Forest Pathology and Mycology; Junior Forest Pathologist; Associate Pathologist (cotton); and Associate Pathologist (horticulture). He corresponded with B.L. Wade, Geneticist with the Bureau of Plant Industry, Division of Fruits and Vegetable Crops and Diseases, College of Agriculture, at Davis, CA, asking about USDA positions to work on fruit. He also asked Wade for his opinion of a position in Hawaii with the Pineapple Producer Cooperative Association (PPCA). Wade responded in a letter dated December 16, 1935: "My personal opinion of Hawaii is that it is a good place to be for a few years. Linford is an exceptionally good man to work with but the unchanging climate. . .may eventually rob one of the desire to work." Wade then closed this letter with: "I have always had great confidence in your ability and I am ready at any time to recommend you for any position you may seek."

In a letter to Wade dated February 8, 1936, Ken wrote: "...things are moving rapidly on the pineapple front. . ." that. . . "(Dr. Chapman, Director of the PPCA) had offered \$3200 plus passage to Hawaii, with an automatic \$200 raise per annum. . .I believe he will offer \$3400 . . ." No doubt it helped that Max Gardner, University of California, Berkeley, as well as F.D. Heald and B.M. Dugger all wrote letters of support to Linford for Ken. In another letter to Wade, dated February 29, 1936, Ken wrote: "Confidentially, the salary is \$3600 plus moving costs. I am leaving here about April 15 or May 15 for a May 2 or May 30 sailing from Vancouver . . ." One year later, he was certified by the Civil Service Commission as eligible for appointment to the position of Assistant Pathologist at a salary of \$2600 per annum, for work on tomato diseases either at Lafayette, IN, or New Brunswick, NJ.

While never again to be employed by the USDA, upon his retirement from the University of California, Berkeley, in 1976, Ken and his wife of more than 40 years, Katharine, also a plant scientist, moved to Corvallis, OR, where he joined the Horticultural Crops Research Laboratory, Agricultural Research Service with a USDA unpaid appointment as Collaborator, and also as Emeritus Professor (courtesy), Department of Botany and Plant Pathology, Oregon State University.

SHORT-TIMER IN HAWAII—AND MORE EXPERIENCE WITH SOILBORNE PLANT PATHOGENS

Ken's work with pineapple was on root rot caused by *Pythium* and *Phytophthora* and heart rot caused by *Phytophthora*. He found high degrees of resistance in progeny of three wild pineapples from South America. In describing to Wade the status of this germplasm and next steps for the breeding program, he wrote: "Of course they have the usual wild love of the diminutive and must get a shot of the commercial hallucinations of grandeur before they will be acceptable." Ken went on to describe for Wade the long and tedious process required even to scale up a single resistant line—"3 years from seed to fruit, 18 months for each vegetative generation which yields 3–6 pieces . . . I hardly expect to be here long enough to see them through." Continuing in his long letter of January 2, 1938, to Dr. Wade: "Largely because of the impact of climate . . . we" (Ken and his wife, Dorothy) "have decided that we should return to the mainland in 1939 or 1940, depending on the South American trip. If you have openings that might materialize in 1939 and that look interesting I should appreciate it if you would let me know of them. The people here do not know of my plan, but my oral agreement with Dr. (R.N.) Chapman before coming was for only a 3–4 year period."

Ken's reference to "the South American trip" was based on a decision that, not knowing whether the level of resistance to *Phytophthora* in the wild lines was the best available, he and geneticist J.L. Collins were to make a collecting trip in the fall of 1938 to Brazil, Paraguay, and the Guineas. The summers of 1927 and 1928, when Ken used his spare time to collect and identify plants while working in the wild of the Selway National Forest, and now his familiarity with variation among species of pineapple held at the PPCA, made him a logical choice for such a collecting trip into remote areas.

MOVE TO CALIFORNIA

In a letter dated January 31, 1938, Ken was contacted by H.S. Fawcett, Director of the Citrus Experiment Station at Riverside, enquiring as to his interest in a new position planned for UCLA on diseases of ornamental plants—with some teaching but mostly research. A salary of \$2000 per annum was mentioned, "for one who may have just finished his graduate work. I believe this could be increased to \$2400

for a man of some experience with probably a maximum of somewhere around \$2800 for an outstanding man.” Ken’s answer was dated February 8, 1938, with the comment: “The proposal outlined in your letter interested me very much and I should like to be considered for the position.” Ken commented further that he had long been interested in diseases of ornamental plants, but he was also concerned with leaving the PPCA before completing the 3 years agreed to with Chapman. As he wrote: “The station spent considerable time and money in looking over candidates” (in early 1936), “and naturally is not anxious to have that task again so soon.”

On February 1, 1938, F.D. Heald wrote to Ken from Los Angeles where he and Mrs. Heald were spending their winters. The letter arrived on the same day that Dr. Faucett’s initial letter to Ken arrived.

My Dear Dr. Baker:

Very recently I learned that the University (of California) was ready to appoint a man to do experimental work on the diseases of ornamentals and that he would be located at U.C.L.A. I wrote to Dr. Gardner to find out more about the job as I thought it might be just the kind of work that you would like. I told him what a fine command of the literature, etc. you would be able to bring to the position. I was somewhat disappointed when I received his reply that the salary would not be over \$3000.

Heald then wrote on February 23 of the possibility of Ken coming back to Pullman,

... at a salary the same as the U.C.L.A. job pays, with the strong probability of Head of the Department when I am ready to retire. The truth is that I am so delighted with the California climate that I would even be willing to consider the U.C.L.A. job myself if they would consider a man of my age. You see salary is not such an item with me as I have sufficient income to live even without a salary if I have to. If you turn down the job have them. . . offer it to me.

In response to many questions raised by Ken as to how UCLA interrelated with Riverside and Berkeley, Faucett wrote on March 4, 1938:

Dean C.B Hutchison at Berkeley has three assistant deans—one at Berkeley, one at Davis, and one at U.C.L.A. (Dr. W.H. Chandler recently appointed). . . the Division of Plant Pathology in Southern California has its staff at both Riverside and U.C.L.A and is responsible for all the work in that subject—research, teaching, etc. in both places. It is the plan to station the man in the new position at U.C.L.A. as the center of his activities. As to the rank . . . that would be Assistant Professor in Plant Pathology, and after taking up the matter again with the dean, I am in a position to make the salary in your case \$3300. With regard to the time of your coming here, we can delay this until either January 1, 1939 or July, 1939 depending on whatever arrangements you wish to make.

The final decision to send Ken and geneticist Collins on the collecting trip to South America during the first 6 months of 1939 was made at the PPCA in early August, 1938. Ken and his wife Dorothy sailed from Honolulu on August 19 for Victoria, BC, and then went by train to Berkeley on August 30 and Los Angeles by September 1 where he would spend 3 days. They then went by train to New York where Ken made stops at the Harvard University Field Museum and New York Botanical Garden before he and Dorothy set sail from New York for Rio on September 17, 1938. Dr. Collins was to go there via the Panama Canal.

Interestingly, Ken's only publication based on his work with the PPCA would be with J.L. Collins on the distribution and ecology of *Ananas* and *Pseudoananas* in South America, published in the *American Journal of Botany* (5).

Chandler then wrote to Ken on February 3, 1939, asking him to begin work June 1, 1939, and further, because of space issues that would be remedied but not before the start date, of spending July to January 1940 at Berkeley "...with Professor Gardner and his associates and getting acquainted with the work they are doing on ornamental plants in northern California." Ken was in Trinidad when this letter caught up with him on March 8. He welcomed this opportunity and suggested that the time at Berkeley be extended to a full year. "From the more personal viewpoint, Mrs. Baker and I are naturally a bit weary of frequent moves after our trip in South America and would welcome a longer period in one place."

MAKING HIS MARK AS A RESEARCHER AND EDUCATOR

With his arrival at UCLA as assistant professor responsible for research and teaching on diseases of floricultural and other ornamental plants, Ken had found his calling as a practicing plant pathologist. He published nine papers alone or with Heald on postharvest apple diseases, one paper on dodder of forest nurseries, and the one paper mentioned above with Collins on pineapple in South America. Starting in 1940, and during the next 21 years before the program at UCLA was closed out and Ken transferred to Berkeley in 1961, he authored or coauthored 109 publications on the fungal, bacterial, and virus diseases of floricultural and other ornamental plants and their control. His awards included recognition by the California State Florist Association, 1956; the American Association of Nurserymen with the Norman J. Colman award, 1966; the Federation of Australian Nurserymen's Association, 1969; and the International Plant Propagators Society, 1984. In addition, he was elected fellow of the American Association for the Advancement of Science in 1950, fellow of the American Phytopathological Society in 1969, and the Horticultural Hall of Fame, Society of American Florists, in 1976.

In 1949, at the 21st Annual Rural Electric Conference held at the University of California, Davis, Ken presented what is apparently his first paper on pasteurization

of soil for elimination of plant pathogens (1)—and the first of his pioneering work on soil treatments so important to the nursery industry. The paper describes the use of free-flowing steam, batch and continuous bulk soil pasteurizers, and direct heating by use of electric current passed through the soil (which is probably why the topic was of interest to a conference on rural electrification). However, it was not until 1960 that he and Carl Olsen (10, 20) described their method for selective treatment of soils with moist-heat produced by mixing air with live steam to produce, with precision, any temperature between that of the ambient air and live steam for any length of time.

Ken took his first sabbatical leave during 1947–48 with Watt Dimock at Cornell. Dimock was a pioneer in the production of pathogen-free planting material by use of shoot-tip meristem culture, patterned after the embryo-culture methods used by cytologists for wide crosses. As elementary as it may seem today—more than 50 years later—the combination of pathogen-free planting material planted into pathogen-free soil revealed for the first time what healthy nursery and other container-grown plants should look like and opened the way for an avalanche of genetic improvements followed by mass production and marketing of these plants (7). Today, when I see a bench of chrysanthemums or other potted flowering plants in the super market, perfect in every respect and uniformly in flower, I think of the pioneering work of Ken Baker and his good friend and colleague Watt Dimock.

During his 22 years at UCLA—from 1939–61—Ken progressed through the ranks of assistant, associate, and full professor, taught introductory plant pathology, and served as Head of the Department of Plant Pathology starting in 1942. When the UCLA program was closed out, he chose to relocate at Berkeley, but did so by way of the University of Adelaide as a Fulbright Senior Research Fellow from 1961–62.

I first learned of Ken and his eminent arrival at Berkeley when I arrived there myself in the spring of 1961 to begin work toward my Ph.D. My first recollection of his arrival was the size of his personal library of scientific journals, books, and reprints—larger than most departmental libraries and accommodated only in the basement of Giannini Hall on a cement floor. Upon his retirement in 1976, that library, by then expanded by another 15 years of journals, books, and reprints, would be moved to the USDA Horticultural Crops Research Laboratory in Corvallis, OR, where it remains to this day.

THE U.C. SYSTEM FOR PRODUCING HEALTHY CONTAINER-GROWN PLANTS

Ken's most enduring and greatest contribution as a practicing plant pathologist was his leadership in development of the methods and principles compiled in Manual 23 (1a), *The U.C. System for Producing Healthy Container-Grown Plants*, published

in 1957 by the University of California College of Agriculture and sold for \$1.00. The first printing was snapped up almost immediately, and the College agreed to produce a second printing. This cycle was repeated several times, until, according to a number I heard quoted by W.C. Snyder, the College had printed 125,000 copies and it was still out of print. When the College refused to produce another printing, the Australian Nurserymen's Association obtained the rights and reprinted Manual 23 for their industry.

Manual 23 has all the trademarks of Ken as an author, editor, scholar of the literature, and master of editorial details. Most noteworthy, the 332 pages of this book include a 26-page index with every key word imaginable. Having coauthored two books with Ken (6, 14), I can attest to his strong belief that an index needs to be useful. I can add that the focus of Manual 23 on plant health rather than plant diseases served more than 30 years later as the inspiration for my book with Roger Veseth on *Wheat Health Management* (15) as the inaugural book in the APS Press series on plant health management.

THE PACIFIC COAST RESEARCH CONFERENCE ON CONTROL OF SOIL FUNGI

The first of the informal Pacific Coast Conference on Control of Soil Fungi was held December 3, 1953. It was hosted by the Shell Agricultural Experiment Station at Modesto, CA, and organized by W.C. Snyder from U.C. Berkeley (my Ph.D. advisor) and W.A. Kreutzer of the Shell Oil Company. Ken was one of 39 from four states who participated in this first conference. In his general announcement dated November 3, Snyder wrote: "Although there will be no formal program, it is hoped that in the spirit of a round table meeting, there will be free discussions reflecting the present status of experimental progress in the different areas, an evaluation of current problems, and a consideration of new approaches, developments and techniques for future research." Snyder's request of Ken was outlined in a handwritten letter dated November 29, 1953: "I have included you at the end, to pick up anything not covered by preceding topics, to philosophize or briefly summarize reactions as to what has gone on. . . and something on the outlook for the future, and where greater emphasis may be given etc." Clearly, Ken's special ability to synthesize and pull out principles and place subjects in perspective was well-known and appreciated at that time among his peers in California.

Ken's own notes on the occasion of the fifth conference held in Berkeley on August 12–13, 1958, described the conference "as an informal, decidedly unorganized (not disorganized) research group. This year it has an International flavor, there being people here from more than 25 stations in 5 states and 14 foreign countries. . . . In fact, this group has been fighting the battle of the bulge, and a losing one, as evidenced by the figures. This is due to tremendous interest of the subject rather than an effort to grow."

**ON TO AN INTERNATIONAL SYMPOSIUM ON FACTORS
DETERMINING THE BEHAVIOR OF PLANT PATHOGENS
IN SOIL—AND THE FIRST INTERNATIONAL CONGRESS
OF PLANT PATHOLOGY**

The popularity of the Pacific Coast conferences led in 1958 to the appointment of Snyder and Baker as chairman and cochairman, respectively, of the Committee on Biological Control of Soilborne Plant Pathogens under auspices of the Agriculture Board of the National Research Council, National Academy of Sciences. All nine members of this committee were regulars at the annual Pacific Coast conferences. With the experience and success of these conferences as their springboard, the committee organized *An International Symposium on Factors Determining the Behavior of Plant Pathogens in Soil*, held on the Berkeley campus in April 1963. Ken worked on little else upon his return from Adelaide to his new office at U.C. Berkeley in 1962.

I doubt that any previous symposium had been better organized, gave more attention to details that defined the difference between good and outstanding, or was carried out with greater grandeur and style. It was funded jointly by the National Science Foundation, the National Institutes of Health, and the U.S. Department of Agriculture, Agricultural Research Service, and was attended by 310 participants from 24 countries. Each symposium paper was followed by a generous period for discussion—following the format set by the Pacific Coast conferences. I was one of several graduate students responsible for handing 3×5 index cards to all the discussants, for them to write out their comments or questions, which were then published with the speaker's response at the end of each chapter of the proceedings.

The symposium was cochaired by Bill Snyder and Ken Baker. Snyder had the imagination and flare for grandeur and Ken took care of the details. Ken then took charge of editing the proceedings published by the University of California Press, Berkeley (11). Ken personally edited every manuscript as well as the scores of abstracts representing the discussion, wrote the preface and introduction, and of course produced another classic Baker index to the book. Like Manual 23, this is a timeless book.

At the end of the symposium, Professor S.D. Garrett, University of Cambridge, agreed to take the lead in organizing a second symposium, to be held five years later in the United Kingdom. Rather than a second symposium, a committee of U.K. plant pathologists chaired by Garrett decided instead to organize the first International Congress of Plant Pathology, held in 1968 at Imperial College in London. The second international symposium on soilborne plant pathogens was included as part of this first congress and, like the first symposium, Ken arranged to have the proceedings published by the University of California Press, Berkeley. As a further commitment to consistency with the first proceedings, Ken began his 1969 study leave to Rydalmere, NSW, by going first to Pennsylvania State University in

1968, as Visiting Professor to work with T.A. Toussoun and Paul E. Nelson, who together with Bob Bega served as editors of these second proceedings (21).

BIOLOGICAL CONTROL OF PLANT PATHOGENS

It is difficult to know when Ken first developed his interest in biological control of plant pathogens. The ability of a “retarding organism” such as *Myrothecium*, *Trichoderma*, or *Penicillium* added to flats of steamed soil to prevent damping off of bedding plants caused by *Rhizoctonia solani* is described in Manual 23 by John Ferguson [based on his Ph.D. thesis work (16)]. And having worked on the shelter belt project in Nebraska, Ken was familiar with Hartley’s early attempts to control damping off of pine seedlings by inoculation of forest nursery soils with antagonistic fungi (17). Moreover, his aerated-steam method for selective elimination of pathogens from soil by pasteurization was designed to leave a resident heat-tolerant microbiota to buffer against the establishment of any pathogen that might then be introduced into the soil. But it was not until the 1963 Berkeley symposium that Ken began to focus his interests on biological control. Indeed, the first publication in his CV that includes the words biological control is in the title of the two-page Foreword to the proceedings of this symposium (11)—*Ecology of Soil-borne Plant Pathogens—Prelude to Biological Control*.

Ken’s contributions as a researcher, author, and scholar during his last 10 years at Berkeley, and well into his retirement at Corvallis, were devoted to the development of theory and his style of principles as the framework and foundation for biological control of plant pathogens as a science in its own right. During his second trip to Australia, in 1969, he and Patricia Broadbent undertook an ambitious project to screen a wide range of randomly selected soils for antagonists against a standard panel of soilborne plant pathogens. Their approach was modeled after that long-used for pesticide discovery: Screen thousands or tens of thousands of candidate products to find one that works and then improve on or select more like that one. *Bacillus subtilis* strain A-13—the thirteenth strain isolated from the first soil sample—was discovered using this approach (13). The growth-promoting effects of strain A-13 applied to seeds were subsequently shown in Victoria, including in field studies with cereals (18, 19). Ken was particularly interested in *Bacillus* species as antagonists because of their ability to survive his aerated steam treatment of soil.

It was during his second and third visits to Australia that Ken and Pat Broadbent carried out their studies of the biological basis for the absence of root rot of avocado caused by *Phytophthora cinnamomi* in two groves in a rainforest on Mount Tamborine in southeastern Queensland, where avocado trees in all other groves in this same area were severely damaged by this fungus (12). The two groves were managed by the same owner whose strategy was to introduce enough fresh organic matter (chicken manure, corn stalks, green manure) to maintain the level of soil organic matter in the orchard soil similar to the 12% level in the

surrounding native rainforest. Groves with severe root rot were on sites where soil organic matter levels had been depleted and not restored—typical of tropical soils when cultivated. This particular example of a pathogen-suppressive soil would later serve to illustrate one of his and my (6) three models of pathogen-suppressive soils, namely, the pathogen is present but fails to cause disease. The fusarium wilt suppressive soils exemplified the model whereby the pathogen fails to survive in soil; take-all decline exemplified the third model in which the pathogen produces disease but then declines as the soil become suppressive.

Sometime during the late 1960s, the W.H. Freeman and Company of San Francisco decided to publish a series of books on the biology of plant pathogens, with Arthur Kelman and Luis Sequeira as editors of the series. Ken was invited to write the first book, which was to be on biological control of plant pathogens. It was at the 1969 annual meeting of the American Phytopathological Society in Spokane, WA, that Ken invited me to join him as coauthor of this book. Then in my fourth year with the USDA-ARS at Pullman, I had hardly begun to develop my program on epidemiology and control of root diseases of wheat. Another trademark of Ken was to mentor, work with, and help set the direction of careers of young scientists. My decision to be his coauthor set the course for my personal and team research program on take-all decline as a model system for biological control—a program continued at Pullman in the ARS Root Disease and Biological Control Research Unit by Dave Weller, Linda Thomashow, Tim Paulitz, and Pat Okubara.

It took 5 years to write our first book, which was published April 1, 1974. Ken had a partner's desk, custom-built of solid cherry wood, where we worked in the basement of his home in the Berkeley hills. I will never forget the nine uninterrupted days we worked face to face at that partner's desk, each of us with the edited copies from nine reviewers spread out behind and around us, revising the text sentence by sentence and chapter by chapter. As with Ken's previous books, the 433 pages of this book includes a 42-page classic Ken Baker index.

Ken had many ways to put our book and concepts on biological control in perspective. While reflecting on the potential impact of our book, he commented, "it could be like dropping a feather in the Grand Canyon and waiting for the echo." When the late R.R. Baker took exception to our broad definition and decided to take a poll among pathologists worldwide on whether they agreed with us or thought a suitable definition was still needed, Ken remarked, "ignorance does not become wisdom by multiplying it."

By 1980, our first book was out of print and Freeman and Company indicated that a second printing would not be in the offering. Ken and I considered updating this book as a second edition but decided instead to write a second book. Meanwhile, Ray Tarleton, then Executive Vice President of the American Phytopathological Society (APS), proposed that APS reprint our first book. Freeman agreed and the reprinting equal to the quality of the first printing was produced by APS in 1982. Our second book, also published by APS, was out the next year on September 15, 1983. By this time, Ken and Katharine were living in their new

home on Vineyard Mountain north of Corvallis, but the marathon face-to-face session at his partner's desk were the same as with the first book. Ken then decided that this desk should be mine and had it shipped to me. Five years later, Roger Veseth and I would begin our face-to-face sessions at this same desk, now in my basement at Pullman, writing our book on *Wheat Health Management*.

ANNUAL REVIEW OF PHYTOPATHOLOGY

Considering his interests in identifying principles and scientific milestones, his familiarity with the plant pathology and wider scientific literature, and his skills as an author and editor, Ken was a natural to serve on the 1962 committee that launched ARP, and also on the Editorial Board—as Associate Editor from 1962–1971 and Editor from 1971–1977. Under his leadership, and during a period of unprecedented proliferation of symposia with published proceedings, ARP emerged and remains as the most widely cited source of reviews in plant pathology worldwide. Ken also was a five-time author for ARP (3, 4, 7–9), all but one (9) provided after his retirement. It is fitting that the last citation in a list of 239 citations in his CV is a chapter in ARP on biological control of plant pathogens (4).

In 1990, Ken and Katharine Baker established an endowment with Annual Reviews as a means to promote the field of plant pathology worldwide through ARP. These funds provide a complimentary copy of the latest volume of ARP to each new graduating Ph.D. in plant pathology in North America each year, and also to departments of plant pathology in developing countries. In addition, and consistent with Ken's interest in always promoting the latest technologies in publishing, ARP became the first of the series published by Annual Reviews to be provided to subscribers in CD-ROM format—another pioneering and timeless contribution of Kenneth Frank Baker.

**The *Annual Review of Phytopathology* is online at
<http://phyto.annualreviews.org>**

LITERATURE CITED

1. Baker KF. 1949. Purposes and methods of pasteurizing soil. *Farm Electr. Mag.* 3(2):1–4
- 1a. Baker KF, ed. 1957. *The U.C. System for Producing Healthy Container-Grown Plants*. Calif. Agric. Exp. Stn. Ext. Serv. Manual 23:1–332
2. Baker KF. 1971. *Wildflowers of Western Australia*. Adelaide, South Aust.: Rigby. 32 pp. 73 color plates
3. Baker KF. 1982. Meditations on fifty years as an apolitical plant pathologist. *Annu. Rev. Phytopathol.* 22:1–25
4. Baker KF. 1987. Evolving concepts of biological control of plant pathogens. *Annu. Rev. Phytopathol.* 25:57–85
5. Baker KF, Collins JL. 1939. Notes on the distribution and ecology of Ananas and Pseudoananas in South America. *Am. J. Bot.* 26:697–702

6. Baker KF, Cook RJ. 1974. *Biological Control of Plant Pathogens*. San Francisco: Freeman. 433 pp. Reprinted 1982. St. Paul, MN: APS
7. Baker KF, Linderman RG. 1979. Unique features of the pathology of ornamental plants. *Annu. Rev. Phytopathol.* 17:253–77
8. Baker KF, Fischer GW. 1983. Pioneer leaders in plant pathology: F.D. Heald. *Annu. Rev. Phytopathol.* 21:13–20
9. Baker KF, Smith SH. 1966. Dynamics of seed transmission of plant pathogens. *Annu. Rev. Phytopathol.* 4:311–34
10. Baker KF, Olsen CM. 1960. Aerated steam for soil treatment. *Phytopathology* 50: 82
11. Baker KF, Snyder WC, eds. 1965. *Ecology of Soil-borne Plant Pathogens: Prelude to Biological Control*. Berkeley, CA: Univ. Calif. Press. 569 pp.
12. Broadbent P, Baker KF. 1974. Behaviour of *Phytophthora cinnamomi* in soils suppressive and conducive to root rot. *Aust. J. Agric. Res.* 25:212–37
13. Broadbent P, Baker KF, Waterworth Y. 1971. Bacteria and actinomycetes antagonistic to fungal root pathogens in Australian soils. *Aust. J. Biol. Sci.* 24:925–44
14. Cook RJ, Baker KF. 1983. *The Nature and Practice of Biological Control of Plant Pathogens*. St. Paul, MN: APS Press. 539 pp.
15. Cook RJ, Veseth RJ. 1991. *Wheat Health Management*. St. Paul, MN: APS Press. 151 pp.
16. Ferguson J. 1958. *Reducing plant disease with fungicidal soil treatment, pathogen-free stock, and controlled microbial colonization*. PhD thesis, Univ. Calif., Berkeley. 169 pp.
17. Hartley C. 1921. Damping-off in forest nurseries. *US Dep. Agric. Bull.* 934:1–99
18. Merriman PR, Price RD, Baker KF. 1974. The effect of inoculation of seed with antagonists of *Rhizoctonia solani* on the growth of cereals. *Aust. J. Agric. Res.* 25: 213–18
19. Merriman PR, Price RD, Kollmorgan F, Piggott T, Ridge EH. 1974. Effect of seed inoculation with *Bacillus subtilis* and *Streptomyces griseus* on the growth of cereals and carrots. *Aust. J. Agric. Res.* 25:219–26
20. Olsen CM, Baker KF. 1968. Selective heat treatment of soil, and its effect on the inhibition of *Rhizoctonia solani* by *Bacillus subtilis*. *Phytopathology* 58:79–87
21. Toussoun TA, Bega RV, Nelson PE, eds. 1970. *Root Diseases and Soil-Borne Pathogens*. Berkeley: Univ. Calif. Press. 252 pp.