

The Origins of Plant Disease Research in the United States Department of Agriculture

CLAY S. GRIFFITH, Research Assistant, PAUL D. PETERSON, JR., Project Historian, C. LEE CAMPBELL, Professor, Department of Plant Pathology, North Carolina State University, Raleigh 27695-7616

On May 29, 1885, Frank Lamson-Scribner (Fig. 1) wrote a letter to University of Nebraska botanist Charles E. Bessey, in which he described his new position at the United States Department of Agriculture (USDA). Scribner explained that his "line of work" would involve "the investigation of parasitic fungi—those species that affect injuriously our field & garden crops" (21). With this mandate, he had become the first scientist employed by the USDA with a specific assignment to study plant diseases.

Plant disease research was a new endeavor for the USDA and the Department staff was ill-prepared to undertake such research in 1885. The Department had not been a truly scientific research organization since its establishment in 1862. Although the law creating the USDA directed that the chief of the Department, then called a commissioner, had the responsibility to "acquire and preserve...all information concerning agriculture" through "practical and scientific experiments," the USDA initiated very little scientific research in its first two decades. Employees of the Department concentrated instead on practical work such as collecting statistics, distributing seeds, and publishing bulletins that congressmen could send to constituents. The nation's agricultural press complained about the activities of the USDA. The editors of "The Country Gentleman" stated that they could not "entertain any very brilliant anticipations from the establishment of governmental laboratories..." (1). The editor of "The American Agriculturist" responded to the 1871 USDA Report by insisting that "Mr. Commissioner Watts labors under two difficulties: he has nothing to say, and he takes 14 pages to say it in" (2). Scientists with an interest in agriculture, namely botanists and chemists, waited in vain for a president to appoint a commissioner who was a scientist rather than a bureaucrat or an agriculturist with political connections (3).

During its first two decades the USDA did employ a number of noted scientists, however, and their experiences reflected the difficulties scientists faced in efforts to initiate scientific research. Charles M. Wetherill, a student of Justus Liebig, the world's leading agricultural chemist, was fired by the first Commissioner on charges that he spent too much time on chemical work for other departments (10,18). Charles C. Parry, the chief botanist, was forced to retire when the Commissioner charged that he had failed to add sufficiently to the "practical" mission of the USDA. Parry complained to his powerful scientific friends, including John Torrey and Asa Gray, and encouraged fellow scientists to initiate a letter-writing campaign complaining about the poor state of USDA science. The letters raised awareness of the plight of scientists at the Department, but did not succeed in restoring Parry's job (18). Later, Charles V. Riley, chief entomologist, also was forced to resign. His departure brought the issue of the status of USDA science to the forefront. He stated before the American Agricultural Association that scientific work at the Department was "inferior to...many private associations and State institutions" (15). Riley, unlike Parry, eventually returned to the USDA (18), demonstrating that by the late 1870s, the agricultural science community was gaining more power and influence.

It was a livestock disease that provided the impetus for the USDA to play a more active role in scientific research. Cattle pleuropneumonia disrupted the influential beef industry in the early 1880s. By 1884, business and science interests exerted pressure on a reluctant Congress to appropriate money to the USDA for the creation of the Bureau of Animal Industry. The law required that the Bureau chief be a competent veterinary surgeon, not just a political appointee (13,24).

In contrast, the Department's work on plant diseases developed slowly through the first 15 years. Most of this work consisted of repeating material from the nation's agricultural press, but there were some efforts made to produce original reports. William Saunders, superinten-

dent of gardens and grounds; Henri Erni, Departmental chemist; and Lewis Bollman, Departmental statistician, wrote a number of articles in the 1860s that included information on diseases, particularly of grapes. Saunders wrote in the first Departmental Report of 1862 that he considered the investigation of plant diseases to be one of his duties.

Thomas Taylor, however, who came to the USDA as microscopist in 1871, introduced the experimental study of fungal plant diseases to the Department. Taylor performed simple experiments in the Departmental greenhouses. For example, aided by William Saunders, he tested the communicability of grape mildew. Nevertheless, his reports largely consisted of summaries of the scientific work of others (11). Whereas he surpassed the Departmental work of Saunders and Erni published in the 1860s, his research, though recognized by noted mycologists M. J. Berkeley and Charles H. Peck, quickly looked amateurish in the 1870s in comparison to the expanding pathological writings of William G. Farlow, Thomas J. Burrill, and Charles Bessey.



Fig. 1. Frank Lamson-Scribner, first head of the Section of Mycology, USDA (1886-1888). First scientist appointed for plant disease research at USDA. Courtesy of the National Archives.

Although the USDA initially offered limited encouragement for plant disease research, the numbers of professional scientists and educators interested in the new field increased steadily in the late 1870s and early 1880s. They were located mainly at land-grant colleges and state agricultural experiment stations and appreciated the value of the developing science of plant pathology in understanding and possibly controlling the devastating effects of plant diseases. However, their work lacked coordination and a sense of mission, and fell victim to erratic funding. Many of them thought that for plant pathology to prosper, it needed increased attention, better organization, and more financial support. Private endowments from families such as Cornell, Purdue, and Bussey were limited and their maintenance required a certain measure of political acumen that scientists found distracting and often demeaning. The growth of land-grant colleges set an important precedent for the federal government as a source of funding for both agriculture and education.

Yet the lines of debate were drawn over what role the federal government should take in its support of agricultural science. Some proponents of federal agricultural science favored a limited role for government as a funding source to encourage original research at land-grant colleges and agricultural experiment stations. Others, whose argument would eventually prevail, thought that the USDA should have a more active and centralized role, in effect, as a national experiment station.

As one facet of this debate on science policy, some prominent voices called specifically for the government to support the study of plant diseases. William Beal, a professor of botany at the Michigan Agricultural College, remarked in 1883 that "in the study of effectual remedies against fungi...there is still much demand for more knowledge" (3). In view of this, Beal felt compelled to add that "a small sum, considering its importance, has been appropriated" to battle the effects from the ravages of plant diseases (3). Charles Bessey wrote (4) in 1883:

...if the investigation of injurious insects be considered a government duty, will not the same reasoning show it to be equally its duty to provide for the similar investigation of the numerous parasitic fungi which injure and often entirely destroy farm and garden crops?

Combined with the precedent of the pleuropneumonia crisis, these calls from important scientists in favor of government action on plant diseases continued to build momentum for expansion of research.

A powerful call for action came in 1884 and 1885 through the American Asso-

ciation for the Advancement of Science (AAAS), one of the major professional organizations for American scientists. In 1884, at the annual meeting in Philadelphia, the AAAS formed a "Committee on the Encouragement of Researches on the Health and Diseases of Plants," consisting of six noted botanists and horticulturists. Members included Charles Bessey, the secretary for the Biology Section of the AAAS, and William Beal, both already active supporters of greater federal patronage for plant disease research (16). Other Committee members were: William Farlow of Harvard; Thomas Burrill of Illinois Industrial University, vice-president of the Biology Section; Charles Peck, the state botanist of New York; and J. Thomas Rothrock of Pennsylvania. The Committee's chairman was Joseph C. Arthur, staff botanist at the New York State Agricultural Experiment Station.

All of these men were leaders in their fields; some well on their way to becoming American legends in the disciplines of botany and plant pathology. Bessey, a tireless proponent of the "New Botany," was often credited with founding the first botanical laboratory courses at an American college, Iowa Agricultural College at Ames. William Beal, who shared with Bessey a zeal for nonsystematic botany, had long been an outspoken advocate of scientific research and education. William Farlow, another proponent, was one of the most eminent botanists in the United States. He was an American pioneer in cryptogamic botany, one of the first Americans to make the pilgrimage to study in Germany under Anton DeBary, as well as a student and colleague of the venerable Asa Gray. Thomas Burrill was an early leader in the study of plant disease, not only in the classroom, but also with his groundbreaking work on the bacterial origins of fire blight in Illinois. Others included J. T. Rothrock, who was on his way to becoming a leader in forestry, and Charles Peck, one of the foremost American experts on fungi. J. C. Arthur, a protege of Charles Bessey, was in the process of perfecting and confirming Burrill's bacterial theories through the new pure culture techniques, the results of which he would present the next year before the AAAS. These were scientists at the pinnacle of their field—men of expertise and influence who were eager to use the status of the AAAS to move their science in new directions.

In 1884, the Committee on the Encouragement of Researches on the Health and Diseases of Plants was assigned to write and address a petition to the Commissioner of Agriculture that would plead the case for government-sponsored plant disease research. After nine months of correspondence, under the leadership of J. C. Arthur, the Committee produced its memorial [The term "memorial" was

commonly used in the 19th century to describe letters or memoranda submitted to Congress either to address specific issues or to propose specific acts of legislation.] in April 1885 (17). All members, except Farlow, signed the official letter. The reason for the absence of Farlow's signature on the memorial is unclear, but he certainly supported the general aims. In fact, Farlow continued to offer his views privately to the Commissioner in support of federal plant disease investigations (9).

The petition was only three short paragraphs in length, but clearly expressed the expectations of its authors. Addressed to "The Honorable Commissioner of Agriculture," it declared (17) that the undersigned Committee:

...respectfully urge that in planning the work of the Department for the coming years, you make provision for a thorough scientific study of the diseases of plants, especially those due to the parasitic fungi, believing that by so doing you will greatly increase the efficiency and value of the Department.

The Committee further urged the Department to find "an officer" who would begin research on plant diseases and "whose training has been such as to enable him to call to his aid all the knowledge and appliances of the best modern scientific methods" (17).

Clearly, the Committee wanted a part of the USDA devoted to plant diseases that would be similar to the Bureau of Animal Industry. They wanted a qualified scientist in charge who would respond to the scientific imperatives of disease problems rather than the institutional pressures of political survival. They argued that the Department would profit by such an addition, as it would

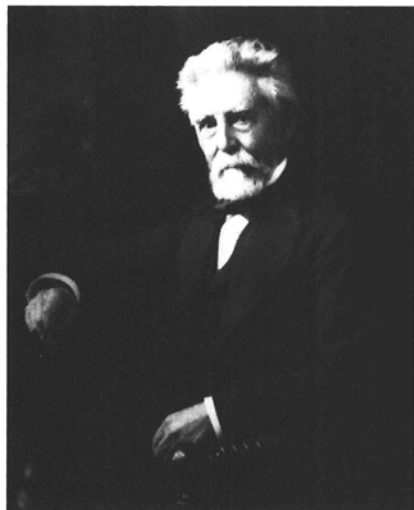


Fig. 2. Norman J. Colman, secretary of agriculture (1885-1889). Brought plant disease research to USDA. Courtesy of the National Archives.

bring valuable knowledge to farmers and expand agriculture in the United States. Unfortunately for plant disease interests, there were no horticultural producers' associations to equal the economically powerful cattlemen who benefited from Animal Industry nor was there a disruptive disease crisis to match pleuropneumonia.

However, those who wanted to see plant disease research supported by the federal government were aided by a need to develop controls for a number of serious diseases, particularly those endemic to the fruit industry, and by the appointment of a new Commissioner of Agriculture, Norman J. Colman (Fig. 2), who was sympathetic to their interests. The Committee's memorial came into Colman's hands, a man with a long record of involvement with agriculture in his native Missouri who supported the movement for agricultural science. Not only had he published and edited "Colman's Rural World," he also was a stock breeder, a pomologist, and the president of several agricultural organizations. In addition to his agricultural background, Colman was well versed in administrative and political areas. He was a trustee of Missouri State College and served four terms as a state legislator and one as lieutenant governor (13,15). All of this experience made him well-suited and highly motivated to increase the Department's scientific mandate. Although not a man of science himself, his appointment was widely applauded by agricultural scientists (14).

Colman replied promptly and positively to the AAAS Committee's petition and by May 1885, he had appointed Frank Lamson-Scribner as assistant botanist with an unofficial portfolio to study pathogenic fungi (Fig. 3). It is likely that Colman and the AAAS Committee coordinated their actions because they both

desired the same results. Since the employment of a new assistant botanist did not require new appropriations from Congress, Colman was able to establish an ad hoc USDA position for Scribner to deal with plant diseases. He had the Committee's petition to demonstrate that the American scientific community demanded and supported such action. With Scribner doing plant disease research, Colman hoped to show both the need and the value of such work at a federal level. This would help Colman in future budget struggles as he proceeded with his ideas to expand the USDA.

From a scientific point of view, Scribner's appointment elicited little open criticism from other botanists and horticulturists despite the fact that he had little experience in some mycology. While at the University of Maine in the early 1870s, Scribner had studied some mycology. Like most American botanical students exposed to the subject, he had studied from Gray's Manual of Botany and learned about rusts and smuts from M. C. Cooke's work (23,12). Still, this limited instruction hardly made him the most qualified figure to undertake an exhaustive study or indexing of injurious fungi. Perhaps no other qualified scientist was interested in an uncertain position with an organization that had as poor a scientific reputation as the USDA. On the other hand, because of a mutual interest in agrostology, it is also likely that George Vasey, the USDA botanist under whom Scribner served, was instrumental in his selection. Scribner himself would reminisce later in his life that Colman polled the botanical science community to find the right man for the assignment and his name was the overwhelming favorite (23).

The exact nature of Scribner's new duties, aside from arranging the Department's collection of fungi and preparing a circular for distribution, was unclear. Within a month of his appointment, Scribner wrote to Charles Bessey and asked him to "kindly draw up a plan of operations that will, in your opinion, make the work most effective" (22). Scribner told Bessey that the help of mycologists was "essential to the accomplishment of valuable results" for the USDA's new undertaking (22). Scribner's letters show the poor state of institutional preparation at the dawn of federal plant disease research. But they also indicate his good judgement in seeking help from Bessey, a leader in the field. This is a precursor of the close association that the USDA was to forge with plant pathologists at universities and experiment stations around the nation.

After securing some advice, Scribner began his work by preparing a long chapter on fungus diseases of plants in the USDA Report for 1885. In his report, Scribner outlined the basics of fungal life history and discussed several diseases

such as smuts, blights, rusts, and mildews. He also wrote on disease control measures, but most of this information, in the years just prior to the use of Bordeaux mixture as an effective fungicide, involved altered cultivation practices. He did discuss briefly some specific chemical treatment recommendations for grape diseases including the application of lime solution and copper sulphate (20). In the same annual report, William Saunders, USDA horticulturist and superintendent of gardens and grounds, wrote on fungus diseases of fruit and potatoes (19). The primary purpose of both Scribner's and Saunders' reports was to introduce the subject of plant disease, specifically fungal diseases, to the readers of the USDA publications.

Over the latter half of 1885, the members of the AAAS Committee corresponded frequently with Commissioner Colman and Scribner to help define the direction that USDA work should take. During the period when Scribner was seeking advice from Charles Bessey on studying fungi, William Farlow wrote to Commissioner Colman to advocate that Scribner become not just another USDA pamphleteer, but rather a true scientific researcher. Colman (9) answered Farlow:

I fully recognize the correctness of your view that the requirement of a completed knowledge of many of those plant diseases is a slow and tedious process and an investigator should not be judged wholly by the amount of work he may present to the public as much of the time spent in investigation may give only negative results.

This was an interesting admission by a commissioner of agriculture, the chief of a department that had been founded on the promise of practical service. Colman clearly supported those agricultural scientists who wanted to do more than identify weeds and analyze fertilizer samples. However, he was not so visionary that he failed to realize the political liabilities inherent in embracing the nascent field of agricultural science. The Department had existed for 20 years by fostering expectations of immediate, concrete benefits to America's farmers. Fundamental scientific research did not yet fit clearly into that mission. Colman had to balance powerful political constituencies with a growing scientific one. He embarked on a year-long strategy, together with AAAS Committee members and other botanical and horticultural groups, to convince Congress that Scribner's ad hoc position was an economic necessity and must be funded as a permanent component of the Department (8,17).

Colman wanted the 1886 USDA budget to include a provision creating a "Section of Mycology" within the existing



Fig. 3. Office of the Botanist, USDA. Plant disease work originally took place in the Division of Botany. Courtesy of the National Archives.

Division of Botany. To press the case, he solicited the support of botanists around the country. The Botanical Club of the AAAS, organized in 1883, advised Colman in 1886 that "the members of the club hereby pledge themselves to use their influence in inducing their representatives in Congress to make liberal appropriation...in accordance with your estimates" (6). George Vasey, the chief of the Botany Division, wrote to Charles Bessey to ask for "any influence that can be brought to bear...from men who are not directly connected with the Government, but who are known for their scientific work" (25). Vasey also included a list of pertinent congressmen to whom Bessey should direct his opinions as a noted spokesman for agricultural science.

The letters poured into Washington from botanists and horticulturists around the country. Bessey arranged for the Nebraska Horticultural Society to address a resolution to that state's congressional delegation in support of an increased appropriation to the USDA for "the study of fungi injurious to vegetation" (5). Thomas Burrill wrote the Chairman of the House Agriculture Committee, William Hatch of Missouri, that "the losses by fungous parasites equal, aye surpass, those by insects." Burrill then asked, "Shall not Congress recognize this fact?" (7). Many other letters from scientists and educators supported the expansionist plans of Commissioner Colman. The campaign succeeded. In 1886, Congress voted for the appropriations that officially created the Section of Mycology, with Frank Lamson-Scribner as its chief.

The Section's name, tied as it was to fungal diseases, was already outdated at its creation. Because of the influence of Thomas Burrill and J. C. Arthur, plant disease research had shifted from the exclusive domain of mycologists. Thus, two years later the name was changed to the Section of Vegetable Pathology to reflect the expanding research potential of plant pathology. However, in 1886, it made little strategic sense for Colman to make his strong political and economic argument more difficult. Injurious fungi were simply better understood than bacteria.

In fact, most disease control in which the Section of Mycology had its early successes was related to fungi, particularly downy mildew and black rot of grapes. The Section won early public praise through practical service with technical advances on fungicide sprayers. This work pleased agricultural and political interests and brought the Section a measure of institutional security. The Section of Mycology would never com-

pletely replace constituent service to farmers with basic research, but it managed a somewhat more comfortable balance between both missions.

Scribner served two years as section chief, setting the stage for the steady growth of federal plant pathology in the United States. In 1888, he left government service to join the University of Tennessee as a professor of botany, as well as the director of the University's agricultural experiment station. Scribner returned to the USDA in 1894 as an agronomist.

During his absence from the Department, his able deputy, Beverly T. Galloway, a horticulturist from Missouri, succeeded him as head of the Section. Galloway continued Scribner's work, gathering an astute group of bright, young phytopathologists such as Erwin F. Smith and Merton B. Waite, and guiding the expansion of the Section into the Division of Vegetable Pathology. In the 1890s the USDA emerged from decades of uncertainty and indecision to become an influential scientific agency that would contribute significantly to plant disease research in the United States and the world.

ACKNOWLEDGMENTS

We thank O. W. Barnett, Arthur Kelman, Department of Plant Pathology, and William C. Harris, Department of History, North Carolina State University, for comments on earlier drafts of this manuscript. We also appreciate the research assistance of Patricia Sullivan, former graduate student, Department of History, North Carolina State University.

LITERATURE CITED

- Anonymous. 1863. Department of Agriculture. The Country Gentleman, a Journal for the Farm, the Garden and the Fireside. 21:9-10, 25-26.
- Anonymous. 1872. The Department of Agriculture—Report for 1871. *Am. Agric.* 31:49.
- Beal, W. J. 1883. Agriculture: Its needs and opportunities. *Science*. 2:328-333.
- Bessey, C. E. 1883. A government duty. *Am. Natural*. 17:543-544.
- Bessey, C. E. to A. J. Weaver, January 27, 1886. Records of the Agricultural Committee on Agriculture (HR 49A-H2.7). 49th Congress. Records of the U.S. House of Representatives, Record Group 233. National Archives, Washington, DC.
- Botanical Club, American Association for the Advancement of Science. [1886]. To the Honorable Commissioner of Agriculture. The Microfilm Edition of the Charles E. Bessey Papers, 1865-1915. Joseph G. Svoboda, and Patricia Churray, eds. University of Nebraska Studies: New Series No. 67. University of Nebraska Press, Lincoln.
- Burrill, T. J. to W. H. Hatch, March 23, 1886. Records of the Agricultural Committee on Agriculture (HR 49A-H2.7). 49th Congress. Records of the U.S. House of Representatives, Record Group 233. National Archives, Washington, DC.
- Colman, N. J. to C. E. Bessey, January 8, 1887. Letters Sent (General), 1882-1897. Records of the Immediate Offices of the Commissioner and

- Secretary of Agriculture. Records of the Office of the Secretary of Agriculture, Record Group 16. National Archives, Washington, DC.
- Colman, N. J. to W. G. Farlow, October 21, 1885. Letters Sent (General), 1882-1897. Records of the Immediate Offices of the Commissioner and Secretary of Agriculture. Records of the Office of the Secretary of Agriculture, Record Group 16. National Archives, Washington, DC.
- Gates, P. W. 1965. Agriculture and the Civil War. Alfred A. Knopf, New York. 383 pp.
- Grace, J. K. 1988. The role of Thomas Taylor in the history of American phytopathology. *Annu. Rev. Phytopathol.* 26:25-28.
- Gray, A. 1863. Manual of the Botany of the Northern United States, including Virginia, Kentucky, and all east of the Mississippi (the mosses and liverworts by William S. Sullivant), to which is added Garden Botany, and introduction to a knowledge of cultivated plants. 4th rev. ed. Ivison, Phinney & Co., New York. 743 pp. [Scribner's notes and an index prepared by him while a student at Orono were found by the authors in a copy of this edition of Gray's Manual at the University of Maine.]
- Harding, T. S. 1942. Some Landmarks in the History of the Department of Agriculture. U.S. Dep. Agric. Agriculture History Series No. 2. Washington, DC. 94 pp.
- Knoblauch, H. C., Law, E. M., and Meyer, W. P. 1962. State Agricultural Experiment Stations: A History of Research Policy and Procedure. U.S. Dep. Agric. Misc. Pub. 904. Washington, DC. 262 pp.
- Marcus, A. I. 1985. Agricultural Science and the Quest for Legitimacy: Farmers, Agricultural Colleges, and Experiment Stations, 1870-1890. Iowa State University Press, Ames. 269 pp.
- Putnam, F., ed. 1885. Proceedings of the American Association for the Advancement of Science, thirty-third meeting, held at Philadelphia, PA., September, 1884. Salem, MA. 359 pp.
- Putnam, F., ed. 1886. Proceedings of the American Association for the Advancement of Science, thirty-fourth meeting, held at Ann Arbor, MI., August, 1885. Salem, MA. 567 pp.
- Ross, E. D. 1946. The United States Department of Agriculture during the commissionership: A study in politics, administration, and technology, 1862-1889. *Agric. Hist.* 20:129-143.
- Saunders, W. 1885. Report of the Superintendent of Gardens and Grounds. Pages 33-46 in: Report of the Commissioner of Agriculture. 1885. U.S. Dep. Agric. Washington, DC.
- Scribner, F. L. 1885. Report of the Botanist, Fungal Diseases of Plants. Pages 76-88 in: Report of the Commissioner of Agriculture. 1885. U.S. Dep. Agric. Washington, DC.
- Scribner, F. L. to C. E. Bessey, May 29, 1885. The Microfilm Edition of the Charles E. Bessey Papers, 1865-1915. Joseph G. Svoboda, and Patricia Churray, eds. University of Nebraska Studies: New Series No. 67. University of Nebraska Press, Lincoln.
- Scribner, F. L. to C. E. Bessey, June 28, 1885. The Microfilm Edition of the Charles E. Bessey Papers, 1865-1915. Joseph G. Svoboda, and Patricia Churray, eds. University of Nebraska Studies: New Series No. 67. University of Nebraska Press, Lincoln.
- Scribner, F. L. conversation with A. E. Jenkins. April 12, 1937. F. L. Scribner Miscellaneous Papers. U.S. Dep. Agric. Systematic Botany and Mycological Laboratory. Beltsville, MD.
- True, A. C. 1937. A History of Agricultural Experimentation and Research in the United States, 1607-1925. U.S. Dep. Agric. Misc. Pub. 251. Washington, DC. 321 pp.
- Vasey, G. to C. E. Bessey, [1886]. The Microfilm Edition of the Charles E. Bessey Papers, 1865-1915. Joseph G. Svoboda and Patricia Churray, eds. University of Nebraska Studies: New Series No. 67. University of Nebraska Press, Lincoln.