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Joseph C. Fitzharris

Comment: Roy V. Scott

ECONOMIC DEVELOPMENT CENTER
Department of Economics, Minneapolis
Department of Agricultural and Applied Economics, St. Paul

UNIVERSITY OF MINNESOTA

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JOSEPH C. FITZHARRIS

SCIENCE FOR THE FARMER: THE DEVELOPMENT OF THE MINNESOTA AGRICULTURAL EXPERIMENT STATION 1868–1910

Midwestern farmers in the later half of the nineteenth century faced a series of problems in livestock and crop production which the average farmer could not—for lack of time, money, skills, and other resources—solve. At best, the average farmer could experiment with different types of feed, seed, crops, or livestock. But trial-and-error experiments by an untrained and unorganized multitude of farmers offered few practical solutions. The average farmer, faced with such difficulties, had several options: he could experiment on his own or as part of a group (e.g., the State Horticultural Society); he could find experts who would devote themselves to solving farm problems; or he could make do with what he had.

For farmers as a group, the second alternative made the best use of scarce skills, funds, and time; and it was this alternative which, encouraged by the Morrill Act of 1862 and the Hatch Act of 1887, was offered by the colleges of agriculture. The University of Minnesota College of Agriculture and Agricultural Experiment Station provide an excellent case study of the attempt through federal and state cooperation to bring the science of the day to bear on the problems facing farmers.

Institutional Foundations

The University of Minnesota, although legally created in 1851, did not form a College of Agriculture with its own experimental farm until

Joseph C. Fitzharris is Instructor in History at the College of St. Thomas and Research Fellow in the Department of Agricultural and Applied Economics, University of Minnesota. This paper is a part of a larger study by V. W. Ruttan, W. L. Peterson, and J. C. Fitzharris entitled "Technology, Institutions, and Development: Minnesota Agriculture, 1880–1970," funded by a grant from the Rockefeller Foundation to the University of Minnesota Economic Development Center, Minnesota Agricultural Experiment Station Scientific Journal Paper Series, no. 8319.

1869. The University's College of Agriculture was the second attempt to provide formal agricultural training in the State. In 1858 the legislature authorized but did not fund an Agricultural College at Glencoe.[1]

The early years of the College of Agriculture bore considerable resemblance to the early years of the University: few students, a rapid turnover in faculty, distrust (at best) by the farmers, and neglect by the legislature. To the surprise of almost no one, the first two (assistant) professors of agriculture departed after brief tenures (D. A. Robertson, 1869–1870; D. P. Strange, 1872–1874). The third professor of agriculture, Charles Y. Lacy, remained for six years (1874–1880).[2]

Under Lacy, there had been some students, but apathy and a belief that the training had little usefulness in farming worked to deprive him of them almost as fast as he recruited. His efforts were devoted largely to the comparative trials of various seeds (sent by the United States Department of Agriculture), crops, shrubs, and trees. Even though the Regents were willing to pay him to do research while he waited for students, Lacy gave up and in 1880 left the University. During the Lacy years, while the Regents "awaited a new inspiration that might breathe life into the College of Agriculture, . . . [they] soothed their consciences by taking over an experiment begun by the State Horticultural Society. They assumed responsibility for the fruit farm at Lake Minnetonka and sponsored the experiments of Peter Gideon."[3]

In January of 1881, the Regents appointed Edwin D. Porter Professor of Agriculture. Porter began with a concerted effort to meet with all of the "recognized agricultural organizations in the state," with the legislators, and with "responsible men" to determine their views on the role of the College of Agriculture in the service of the state. This public-

1 James Gray, *The University of Minnesota, 1851–1951* (Minneapolis: University of Minnesota Press, 1951), 13–35, 55 ff.; University of Minnesota, Board of Regents, *Ninth Annual Report . . . , 1868*, 9 (hereafter, *Regents*); Andrew Boss, *Minnesota Agricultural Experiment Station, 1885–1935*, Minnesota Agricultural Experiment Station Bulletin 319 (St. Paul, 1935), 5–8; W. S. Chowen, "A Brief History of the Part Taken by the Patrons of Husbandry in the Establishing of the Experimental Farm and Farm School . . . ," and C. P. Bull, "An Unbalanced Credit for the Development and Establishment of the Central School of Agriculture, University of Minnesota," Supplement 7, Example 3b, AL1.1 #1 and Supplement 10, Example 6, AL1.1 #2, University of Minnesota Archives, Minneapolis; Agricultural College [Glencoe], Board of Regents, *First Annual Report . . . , 1867*, passim.

2 *Regents, 1868*, 10; *Regents, 1869*, 8; *Regents, 1871*, 6–7; *Regents, 1872*, 10, 35; *Regents, 1874*, 8–10; *Regents, 1881–1882*, 7–8; "Directors of the Station," Agricultural Experiment Station Info File, University of Minnesota Archives; Bill W. Kennedy, "The Land-Grant Movement and Its Influence on Scientific Agriculture in Minnesota," *The Minnesota Academy of Science Proceedings*, 30:1 (1962), 93.

3 Gray, *University of Minnesota*, 59; *Regents, 1881–1882*, 7–8; "Directors of the Station," Info File, University of Minnesota Archives; Kennedy, "Land-Grant Movement," 92–97.

relations tour gave Porter the opportunity to discover and allay many of the fears farmers had towards "intellectuals" from the University "ivory tower." Evidence indicates that by the time Porter retired in 1889, farmers viewed the College of Agriculture, its faculty, and its new Experiment Station more favorably.[4]

Under the new Professor of Agriculture, the "capacity of the farm in the production of the entire range of farm crops and garden produce [particularly of Minnesota]" was tested, and the comparative trials of potatoes, corn, and amber cane were expanded. The trial experiments convinced Porter that (as Lacy had earlier claimed) the University's land was unsuited for an experimental farm.[5]

Porter made two contributions to the future growth and prestige of the College and (later) the Experiment Station: first, he systematized the distribution of knowledge through the practice of visiting and lecturing to farmers' clubs and a formal "Farmers' Lecture Course"; and second, he convinced the Regents to acquire more suitable land for a farm in St. Anthony Park (then northwest of St. Paul). The Farmers' Lecture Courses developed into the Farmers' Institutes and (later) into the Agricultural Extension Division. Over two hundred people attended the first series of lectures in 1882—about seven times the number Porter had hoped for. His selection of the new farm was equally well received by the leading farm organizations, especially by the State Horticultural Society and the Grange. At the time of its establishment as the University Farm (in 1882), the land had been continuously cultivated for over twenty-five years, yet its productivity was much higher than that of the old farm.[6]

Institutional Development

In 1885, the state legislature directed the Board of Regents to establish an agricultural experiment station. The Regents immediately designated the University Farm as the new experiment station and the College of Agriculture faculty its staff. The station was to conduct original research or verify other work done on the physiology and morbidity of plants and animals, to determine remedies for various disease and insect problems, to determine the chemical composition and stages of

[4] University of Minnesota, Department of Agriculture, *Biennial Report, 1881–1882* in Agricultural Experiment Station, *Biennial Report, 1885–1886* (St. Paul, 1887), 113–14.

[5] Ibid., 116–27; *Regents, 1881–1882*, 12–14, 90–95.

[6] *Regents, 1878*, 9; *Regents, 1881–1882*, 12–13; *Regents, 1883–1884*, 12–14; University of Minnesota, Department of Agriculture, *Biennial Report, 1881–1882*, 116–27.

growth of plants, to analyze the soils and waters of the state, to develop plants, trees, and shrubs adapted to the soil and climate of the state, and to conduct other related research.[7]

Objectives

The objectives of the University Farm were three: first, to provide a laboratory (school) for training future farmers in practical agricultural techniques; second, to provide employment to aid students in financing their educations; and third, to provide a place to conduct the research work proper to an experiment station. While the practical training furnished in the preparatory School and the College of Agriculture could have been detrimental to the research orientation necessitated by the work of the Experiment Station (since the educational faculties comprised the research staff), the result of this union of functions in the same people was turned to advantage over time. The School and the College became the transmission agents for the experiment station as the students acted as private extension agents to their parents and neighbors. This personal contact helped promote acceptance of the work done at the University Farm.[8]

The fact that Minnesota established an Experiment Station two years before the Hatch Act of 1887, which provided federal funding, was an indication of the strength of state support for agricultural improvement. Farmers as individuals or as members of agricultural organizations supported the School and the College of Agriculture and the Experiment Station, and influenced the course of their development. In fact, the organized farmers in large measure determined what problems the institutions would examine.

Individual farmers, for example, initiated some flax wilt research in 1889 by appealing to Governor Merriam for assistance in solving a pressing problem. At the request of the governor, the Regents appointed Otto Lugger, the Station Entomologist, to investigate the causes of flax wilt—thought to be a soil deficiency of some kind. Dr. Lugger was already well known to the farmers of Minnesota for his expertise in combating crop-

7 University of Minnesota, Agricultural Experiment Station, *Biennial Report, 1886*, 133 (hereafter, Station, *Biennial*).

8 Station, *Biennial, 1886*, 128–29; *Regents, 1885–1886*, 27–28; *Regents, 1887–1888*, 7; C. P. Bull, "History of the School of Agriculture," typescript, Example 11b, AL1.1 #15, University of Minnesota, School of Agriculture Papers, 1885–1947, University of Minnesota Archives; Andrew Boss, "Achievements of the Minnesota Experiment Station," in *Agricultural Research Through Fifty Years, 1885–1935*, Minnesota Agricultural Experiment Station (St. Paul, 1936), typescript in the Agricultural Experiment Station Info File, University of Minnesota Archives; Kennedy, "Land-Grant Movement," 93–95.

destroying insects. Lugger reached the wrong conclusions about the causes of the wilt, but in creating an interest in the flax-wilt problem he made a considerable contribution to the ultimate solution. Other examples of farmers and farm organizations influencing activities of the Station abound.[9]

Organizational Structure

Under the Porter organization, the older College of Agriculture was joined by the new Experiment Station. To coordinate these two units, a Department of Agriculture (similar to an Institute) was created. In the early years, the Dean of the Department was also Dean of the College and Director of the Experiment Station. Later (1895–1900), the position of Dean of the College of Agriculture was separated from the position of Dean of the Department. Under the Department was the School of Agriculture (established in 1886–1887).

Within the College and the Experiment Station, there were various divisions (elsewhere known as departments). The first divisions were (1888): Agriculture, Agricultural Chemistry, Entomology and Botany, Horticulture, and Veterinary. Dairy Husbandry (1891) and Animal Husbandry (1892) were created out of the Division of Agriculture, which was renamed the Division of Agronomy and Farm Management (1896). In 1908, the Division of Entomology and Botany was renamed Botany and Plant Pathology; and the Division of Agricultural Engineering was created. In 1909, the College of Forestry was created out of the Division of Horticulture and Forestry. The Farmers' Lecture Courses (1882) had become the Farmers' Institutes in 1885–1886, and in 1910, the Division of Agricultural Extension. Most of these organizations and new divisions reflected changes within the Experiment Station and (to a lesser degree) the College of Agriculture. In 1887–1888, Porter, as Director of the Station, proposed a plan of structural reorganization to fit the Station to the requirements of the Hatch Act and its newly increased role. With the approval of the Regents, authority was vested in the Director of the Station (who was also the Dean of the Department of Agriculture). The Board of Regents Agricultural Committee (which included the Director, ex officio) was to exercise general supervision. Under the Director came

[9] Station, *Biennial, 1887–1888,* and subsequent years, passim; University of Minnesota, Agricultural Experiment Station, *Annual Report, 1896,* viii, xiv (hereafter, Station, *Annual*); T. Kommedahl, J. J. Christensen, and R. A. Fredericksen, *A Half Century of Research in Minnesota on Flax Wilt Caused by Fusarium Oxysporium,* Agricultural Experiment Station Technical Bulletin 273 (St. Paul, 1970), 7–8; Corps of Experimentation, "Minutes of the Experiment Station Corps, 1885–1909," 30 January 1892, 1 (unpaged): [10], AL1.1, vol. 42, and ibid., 17 December 1888, 11:10, AL1.1, vol. 43, University of Minnesota, School of Agriculture Papers, 1885–1947, University of Minnesota Archives.

the Corps of Experimentation, composed of the Division Heads. The staff of the Station and the faculty of the College of Agriculture were identical.[10]

Porter resigned in 1889, and was succeeded by Nelson W. McLain who soon found the staff challenging his authority as he interpreted his duty and powers. Professor David N. Harper traveled to the Red River Valley to investigate wheat raising without McLain's approval. The Director, at the next staff meeting, made clear his opinion that he was the one responsible for all lines of work and was the one to authorize research selection and travel. Harper objected to this method of determining what work was to be done, and in explicit reference to the Regents' rules of 26 April 1888, stated that such authority was properly that of the Station Corps of Experimentation. The resulting loss of authority of the Director, and the decline of respect shown him by the staff led to McLain's departure before the end of his second year. His successor, Clinton D. Smith, served almost eighteen months before he too departed, in large measure because of conflicts with the staff.[11]

Between 1889 and 1893, decision making and authority rested not in the legally responsible Director but in the staff as a group. In an attempt to impose a central control and direction on factious staff, Regent William Liggett was appointed Chairman of the Experiment Station Staff in December 1893. Because of his unquestioned authority (as Regent-Chairman) and because of his diplomatic skills which the staff continually tested, Liggett was able to reestablish the authority and dignity of the office of Director by December 1896, when he was made Director of the Station. The staff voiced no unhappiness at the return to the directorship method of administration. Serving through July 1907, Liggett made possible the maintenance of a central authority in the Station. Combining the position of Director with that of the Dean of the Department and the College of Agriculture reinforced the power and prestige of the office. This joining of the positions with a Vice or Assistant Director to administer the Station under the Dean and Director's supervision continued for over fifty years until Dean Harold Macy's appointment, when H. J. Sloan was appointed Director of the Agricultural Experiment Station (1954).[12]

[10] *Regents*, 26 April 1888 in Station, *Biennial, 1887–1888*, 58–61; Station, *Annual, 1890*, 10.

[11] Station, *Annual, 1890*, 10; Corps of Experimentation, "Minutes of the Experiment Station Corps, 1885–1909," 22 October 1889, 11:43, AL1.1, vol. 43, University of Minnesota, School of Agriculture Papers, 1885–1947, University of Minnesota Archives.

[12] Conversations with Deans H. J. Sloan and H. Macy, 28 November 1972; and with Dr. W. Hueg, Director of the Minnesota Agricultural Experiment Station, 11 January 1973; "Faculty Letter, Spring 1964/65, College of Agriculture, Forestry and Home Economics, Appendix A, Comments by Director Sloan and Dr. Hueg Summarizing

Branch Stations

The Minnesota Agricultural Experiment Station established its first branch in 1893 (the "Coteau Farm") on land owned by O. C. Gregg, superintendent of the Farmers' Institute, at Lynd in the southwestern part of the state. This farm was abandoned in 1903. In 1896, the Station acquired land near Grand Rapids in the northeast and near Crookston in the northwest for use as experimental farms or substations. In 1907, the Fruit Breeding Farm at Zumbra Heights near Lake Minnetonka was established. In the 1907–1910 period, a forest experiment station was established near Cloquet, to support the work of the School of Forestry, headed by S. B. Green, professor of horticulture and forestry. In 1910, the U. S. Indian School and farm at Morris was transferred to the University and organized as the West Central Branch Station. In addition to the branch stations and University Farm, there were experimental fields of two to forty acres in size leased throughout the state by various Station divisions.[13]

The various branch stations tested the suitability of climate and soil for various crops and tested the effects of land-drainage schemes and fertilizers on productivity. The staffs of the branch stations conducted fruit-breeding and animal-breeding trials, produced certified potato seed, tested and promoted windbreaks and other forest management techniques and tree uses, and conducted studies of swine inbreeding, cattle breeding, and dairy, sheep, and poultry husbandry.[14]

Branch stations often initiated work at the suggestion of local farmers or in response to needs which the staff perceived even though the bulk of the farmers had not. The very location of the branches gave them a limited regional focus and thus offered opportunities for a close rapport with their constituents and theoretical employers. The superintendents of the branch stations participated in and often led local farmers' organizations. An effective interchange of ideas and criticisms was established between the branches and their neighboring constituents.[15] In the early years while the branch staffs were small, there were advantages of working directly with the larger, more diversified central station staff to bring an interdivisional approach to problems, although coordina-

Experiment Station Activities," Agricultural Experiment Station Info File, University of Minnesota Archives.

13 Station, *Annual, 1895*, iii; Boss, *Minnesota Agricultural Experiment Station, 1885–1935*, 12.

14 Boss, *Minnesota Agricultural Experiment Station, 1885–1935*, 70–78.

15 Boss, *Minnesota Agricultural Experiment Station, 1885–1935*, 11–13, 70–78; Station, *Annual, 1896*, vii; Station, *Annual, 1909*, xxiii.

tion of interdivisional and branch-central station work imposed strains upon the Station's administration.[16]

Staff

The staff of the Station in 1888 and in successive years consisted of: (1) administrators; (2) principal researchers; (3) technical, clerical and other support workers; and (4) research assistants. Although in the early years, the administrators of the college and station were the same people, this coincidence of functions did not last and station (i.e., research) administrators lost their connection to instructional administration in the college.

The principal researchers of the Station were also the teaching faculty of the College and (to a considerable degree before 1900) the School of Agriculture. The double function did not cease, and had the advantage of keeping many of the teachers abreast of research results that could be applied to teaching. Students might have relayed that knowledge to their farming parents and neighbors—acting as unpaid agricultural extension agents. The faculty-principal investigators in turn benefited from exposure to students who might raise questions of immediate concern to them or their parents as farmers or report results of previous research suggestions. This mutual interchange of questions, ideas, and results was, according to Andrew Boss and other contemporaries, especially common in the School of Agriculture.[17]

Responsibility for the selection of research topics was a chain function, with the faculty-staff suggesting, the division heads recommending, and the director approving. In the early years, as well as later, suggestions or requests came from farmers, farm organizations, cooperatives, and various industrial organizations and business firms, but since the faculty-staff were an increasingly important source of research suggestions, the

16 Station, *Annual, 1890,* 10; Corps of Experimentation, "Minutes of the Experiment Station Corps, 1885–1909," 22 October 1889, 11:43, AL1.1, vol. 43, University of Minnesota, School of Agriculture, Papers, 1885–1947, University of Minnesota Archives; Hays and his colleagues at Minnesota, at the USDA, and at the North and South Dakota Experiment Stations began cooperative work before 1900; Station, *Annual, 1900,* vii; ibid., *1902,* vii–viii.

17 Conversations with Deans Sloan and Macy, 28 November 1972; and with W. Hueg, Director, Minnesota Agricultural Experiment Station, 11 January 1973; and with the members of the Consultative Committee (Deans Sloan and Macy; Dr. Hueg; Professor W. Sundquist, Head, Department of Agricultural and Applied Economics; Professors W. Peterson, V. Ruttan, and W. Fishel, Department of Agricultural and Applied Economics; and Professor R. Loehr, Department of History, all University of Minnesota; Station, *Annual, 1890,* 10.

numbers, qualifications, and interests of the staff were of some importance.

In 1888, there were two members of the Division of Agriculture (including the Director, Porter), the other divisions having one member each. Only two Ph.D.'s were on the staff, and Porter soon resigned leaving one Ph.D.—Lugger. By 1909, there were two Ph.D.'s, H. J. Franklin and E. M. Freeman who left in 1910, again leaving only one Ph.D. The 1888 staff had two holders of the M.A. degree; the number increased to three (1892–1901), then to four, five, six, and then seven—clearly the master's degree was "a crown of many jewels," the normal end of formal training for the staff. By 1911, there were thirty-two holders of the bachelor's degree, seven M.A.'s, one Ph.D., three doctors of veterinary medicine, and ten who had no formal degree and no formal collegiate training. It is interesting to note that the two most distinguished members of this group did not hold degrees: Andrew Boss (Professor of Agriculture, later Vice Director of the Station) and T. L. Haecker (Professor of Dairy and Animal Husbandry) who became widely known for his research on feeding standards.[18]

The station support staff of technical, clerical, and other regular and temporary workers quite naturally increased in size, skills, and status over the years. From the very beginning, some students served as assistants, and this practice increased in frequency as more students needed financial support and the need of the Station for unskilled or semiskilled workers rose.

Research Types and Methods

Strongly influenced by farmers and farm organizations in its development, the Experiment Station from the beginning was problem oriented in its work. However, to draw a distinction in terms of (pure) basic research, applied research, and developmental research, the tendency over time was to move towards more basic research. The trend accelerated as the staff and station organization matured, and the staff role in the service of the agricultural community and the University became more clearly defined.[19]

[18] Station, *Biennial, 1885–1886*, 5; Station, *Biennial, 1887–1888*, 7; Station, *Annual, 1911*, iii–iv.

[19] For example, basic (fundamental) research is the work on how genes combine, applied research uses this knowledge of genes to develop breeding techniques, and developmental research applies these breeding techniques to the production and maintenance of new strains of plants or animals. Using all bulletins or bulletin sections (sample for 1888–1910 is 265), the average research type can be derived. For 1888–1892, n = 80, average research type = 7.4 (1 = basic, 6 = applied, 9 = developmental research), and for 1906–1910, n = 28, average research type = 5.8. The movement towards basic-applied research is noticeable.

Research Types

In 1888, with a staff of six researchers, most work was of two types—either the collection, adaptation, rephrasing and distribution of work done elsewhere, or developmental research. By 1910, with a staff of over fifty researchers, the reporting of work done by others was a very minor portion of the overall output of the station. Some basic research, a large amount of applied research, and a fair amount of developmental work was done. The trend is not clearly evident before 1920, but, on the whole, the station was becoming more interested in basic and applied research.[20]

An example of this trend in the Division of Animal Husbandry is Haecker's work on feeding standards for dairy cows. His experiments in animal nutrition—in the production of milk—were essentially basic in nature. The resulting feeding standard used for over forty years was clearly applied research. The testing of this standard was developmental. One man and his assistants did work involving all three research types.[21]

A similar development occurred in the Division of Agricultural Biochemistry, where research was first applied-developmental, but by 1910, such work was most frequently basic-applied in nature. Applied research in dairy chemistry and animal nutrition occurred more often after 1895. Agronomy and plant genetics was another case of basic-applied research. Out of this work came such varieties as Minnesota No. 163 and No. 169 Wheat, Minnesota No. 13 Corn, and numerous other wheat, oat, barley, flax, and corn varieties.[22]

The work of the Agronomy and Farm Management Division in farm management and costs of production (later transferred to the Division of Agricultural Economics) was of a developmental nature. Work that the Division of Agricultural Engineering later was to consider its own, but which was then distributed over a number of interested divisions, was also developmental.

Research Methods and Subjects

The methods of research also changed, reflecting the changing research type. Crop trials and other field experiments were supplanted by

[20] Analysis of all station bulletins and technical bulletins indicated that one group of staff preferred applied-developmental research, the other preferred basic research. Over time, the average research type for station bulletin reports moved towards basic-applied research. This reflected a stronger movement in the station staff's work. Station bulletins were intended for popular reference and did not report basic research in depth.

[21] Boss, *Minnesota Agricultural Experiment Station, 1885–1935*, 34–40; idem., "Achievements of the Minnesota Agricultural Experiment Station," 6; Kennedy, "Land-Grant Movement," 94.

[22] Boss, *Minnesota Agricultural Experiment Station, 1885–1935*, 14–19, 24 ff.; Bulletins 1 (1888) through 146 (1910), passim.

breeding experiments. Animal morbidity-mortality investigations moved from the farmer's barn to the Station barns and laboratories, and animal nutrition moved from comparing different feed mixtures to making chemical analyses of nutritional needs and the composition of meats and milk, and measuring the effect of diet composition on product composition and value.

The research conducted by the experiment station staff, regardless of the type or method of research utilized, had several objectives: producing higher yields, understanding morbidity-mortality, reducing costs, promoting efficiency, and improving facilities. Nutritional feeding standards for animals and plants, and human nutritional needs were also important research subjects.

From 1868 the experimental farm was used for comparative testing of seeds to find the varieties best suited to Minnesota, with the objective of improving yields. Attempts to prevent yield-reducing morbidities of otherwise suitable crop varieties led to insect life-cycle, habit, and extinction studies, as well as to disease and remedy investigations. In the course of the crop investigations, the staff began to collect cost data—though experimental plots were too small for a valid study without field surveys by route-men in various areas of the state. In the 1880s, the staff studied plant mineral needs and chemical deficiencies, and chemical compositions and nutritional values (for both animals and humans) of the various crops. Uses of crops—e.g., productivity in milling cereals—also became an early field of investigation, not a surprising occurrence given the large milling industry in nearby Minneapolis.[23]

In the early years of the University Farm, the staff also studied animals. Haecker's work on dairy cattle was extended gradually to sheep, poultry, and other farm animals. The effects of insects and diseases (some insect-borne) were other early subjects of investigation, and led to studies of animal morbidity and mortality and searches for remedies. There were some studies of the impact of ventilation in stock barns on livestock health (e.g., contagious abortion tuberculosis in cattle), of milk production costs, and later, of slaughter animal production costs.

Although studies of nutrition, disease, and production costs had limited impact at first, they led eventually to the development of home economics and food science and nutrition departments after 1910, the development of the Bureau of Agricultural Economics in 1912, and the

[23] Station, *Biennial, 1885–1886*, passim; Boss, *Minnesota Agricultural Experiment Station, 1885–1935*, 8–10, 14–34; University of Minnesota, Agricultural Experiment Station, *The Minnesota Agricultural Experiment Station* (St. Paul, University Farm, 1925), unpaged, [11, 17, 23–25]; "In all such work the Station has the close cooperation of the Minnesota Crop Improvement Association" (ibid., [7]).

cooperation between the Division of Veterinary Science and the School of (human) Medicine after World War I.[24]

By the 1890s, the increasingly varied nature of research questions, researcher expertise, and of outside factors such as climate and soil conditions in the state meant that no one person could successfully master all aspects of a problem, nor could one experimental farm location give satisfactory results for the whole state. As a result, the University established branches of the experiment station in other parts of the state and promoted team research efforts and interdisciplinary work. Because divisional and discipline boundaries were drawn very loosely or not at all in the first branch stations, men with a variety of training often worked jointly on projects. The project or group approach to problems was formalized in the experiment station by W. M. Hays in the late 1890s.[25]

Summary and Implications

By 1910, the Experiment Station existed within a political context. The legislature, urged on by the better farmers and farm organizations, created it and provided a large amount of funding for the operation of the branch stations and for certain designated projects. The farmers assumed, on the basis of twenty-five years of experience, that the Station would help them solve the various problems which beset them. They and their organizations frequently suggested research problems and benefited from much of the Station's work.

The Station was part of the larger federal-state agricultural research network and acquired information of use to Minnesota farmers from stations in other states and from the various agencies of the U. S. Department of Agriculture. In turn, the Minnesota Agricultural Experiment Station passed on inquiries and results of its own work to the other members of the research network. In 1910, this exchange process was becoming increasingly significant as a source of answers to common problems facing farmers in several states. Through various cooperative projects initiated before the turn of the century, the Station helped to provide solutions to these common problems, and in turn received information of use to its constituents.

The Minnesota Experiment Station was also a part of the Department of Agriculture in the University of Minnesota. Within the Department, the Colleges of Agriculture and Forestry provided academic training in agricultural subjects, and their faculties provided the Station with its research staff. The School of Agriculture at University Farm, serving as

24 University of Minnesota, Agricultural Experiment Station, *The Minnesota Agricultural Experiment Station*, [17, 21–29].

25 Boss, "Achievements of the Minnesota Agricultural Experiment Station," 9–10.

a preparatory school for the College, was a useful means of disseminating information to parents and neighbors. By the turn of the century, various divisions in the Department had extension agents on their staffs. These agents, working closely with the Farmers' Institutes, reinforced the disseminatory efforts of the research staff and the students. By 1910, the need for a formal extension effort had been realized, and in that year the Division of Agricultural Extension was established to provide such an agency.

In the early development of the Minnesota Station, two important features stand out which would appear to be important for the success of agricultural research in developing nations at the present. First, the staff of the Minnesota Station strongly identified with the farmers of the state and, particularly in the period under examination, made personal efforts to learn of farm problems and to show farmers ways of solving those problems. It would appear that interaction with the students also contributed to the close association between the Station and farmers. Students brought pressing problems to the classroom and to the attention of the Station staff that might otherwise have gone unrecognized or ignored. Similarly, students upon returning to the farm carried solutions to these problems which they demonstrated to their families and neighbors.

Second, the gradual shift to a science-based institution made possible a more in-depth analysis of problems and the production of new techniques and inputs that were much more productive than the old. The Minnesota Experiment Station appears to have achieved a balance between practical problem solving and scientific inquiry.

The combination of staff identification with farm people (most of the staff came from farm or rural families), interaction with students, and utilization of scientific methods enabled the Minnesota Agricultural Experiment Station to gain acceptance among farmers while producing new inputs or techniques which increased farm output and reduced production costs.

ROY V. SCOTT

SCIENCE FOR THE FARMER: COMMENT

There is in print today a great deal of information concerning the land-grant colleges and their activities. Alfred C. True, long-time head of the U.S. Office of Experiment Stations, wrote on these topics a half century ago.[1] Earle Dudley Ross published his *Democracy's College* in 1942, and fifteen years later Edward D. Eddy surveyed the land-grant colleges and their development.[2] Since the end of World War II, there has been an outpouring of histories of individual land-grant institutions and of their colleges of agriculture.[3] The experiment stations in some states have attracted the attention of scholars,[4] and several agricultural scientists, professors, and others connected with the colleges and stations have felt

ROY V. SCOTT is Professor of History, Mississippi State University.

1 Alfred C. True, *A History of Agricultural Education in the United States, 1785–1923* (Washington, 1929); idem., *A History of Agricultural Experimentation and Research in the United States, 1607–1925* (Washington, 1937); idem., *A History of Agricultural Extension Work in the United States, 1785–1923* (Washington, 1928).

2 Earle D. Ross, *Democracy's College: The Land-Grant Movement in the Formative Stage* (Ames: Iowa State College Press, 1942); Edward D. Eddy, *Colleges for Our Land and Time: The Land-Grant Idea in American Education* (New York: Harper, 1957).

3 Among the better of these, but not excluding others, are John K. Bettersworth, *People's College: A History of Mississippi State* (University: University of Alabama Press, 1953); George H. Callcott, *A History of the University of Maryland* (Baltimore: Maryland Historical Society, 1966); Gould P. Colman, *Education and Agriculture: A History of the College of Agriculture at Cornell University* (Ithaca: Cornell University Press, 1963); Herman F. Eschenbacher, *The University of Rhode Island: A History of Land-Grant Education in Rhode Island* (New York: Appleton-Century-Crofts, 1967); Wilbur H. Glover, *Farm and College: The College of Agriculture of the University of Wisconsin* (Madison: University of Wisconsin Press, 1952); William C. Hunter, *Beacon Across the Prairie: North Dakota's Land-Grant College* (Fargo: North Dakota Institute for Regional Studies, 1962); Madison Kuhn, *Michigan State: The First Hundred Years 1855–1955* (East Lansing: Michigan State University Press, 1955); Richard G. Moores, *Fields of Rich Toil: The Development of the University of Illinois College of Agriculture* (Urbana: University of Illinois Press, 1970); Earle D. Ross, *A History of Iowa State College* (Ames: Iowa State College Press, 1942); Frank F. Stephens, *A History of the University of Missouri* (Columbia: University of Missouri Press, 1962).

4 Vernon Carstensen, "The Genesis of An Agricultural Experiment Station," *Agricultural History* 34 (January 1960): 13–20; Samuel Proctor, "The Early Years of the Florida Experiment Station, 1888–1906," ibid. 36 (October 1962): 213–21; Carl R. Woodward and Ingrid N. Waller, *New Jersey's Agricultural Experiment Station, 1880–1930* (New Brunswick: New Jersey Agricultural Experiment Station, 1932).

moved to recount their experiences or to write the histories of the institutions to which they gave much of their lives.[5]

Professor Fitzharris's paper fits well into this body of literature. It supplements James Gray's twenty-year-old history of the University of Minnesota[6] and it expands our knowledge of the Minnesota agricultural experiment station during its formative period. Many of the general patterns that Fitzharris shows us in Minnesota can be found equally well in the early history of experiment stations in other states.

For that reason, part of Fitzharris's story is a rather familiar one. Minnesota established its university prior to the Civil War, and when land-grant funds became available the state took the easy course of attaching the agricultural college to the university. Results were about the same as elsewhere. Professors were poorly prepared, there was little agricultural science to teach, and for all practical purposes students in agriculture were nonexistent. Farmers who milked cows and shocked wheat either ignored the colleges or criticized and ridiculed them. Not uncommon was the old fellow who lived down the road from Michigan Agricultural College but who did not know whether the place was a college or a mental institution.[7] Rejected by those whom they were supposed to serve, professors of agriculture found themselves teaching household economy and natural philosophy while in their spare time they puttered around the college farm trying to find some justification for their existence.[8] In short, there is little reason to suppose that for the first twenty years of their histories the land-grant colleges were anything but failures.

The creation of a system of agricultural experiment stations was one of several necessary steps leading to the development in time of an effective system of agricultural education. Drawing upon precedents from Germany and Great Britain, pioneers in Connecticut and later in other states established stations. The enactment of the Hatch Act of 1887 spawned others, so that there was a total of fifty-six in the United States by 1900.[9]

[5] See, for example, G. H. Aull, *The South Carolina Agricultural Experiment Station: A Brief History, 1887–1930*, South Carolina Experiment Station Circular 44 (Clemson, 1931); Leland E. Call, *Agricultural Research at Kansas State Agricultural College before the Enactment of the Hatch Act*, Kansas Agricultural Experiment Station Bulletin 441 (Manhattan, 1961); F. B. Mumford, *History of the Missouri College of Agriculture*, Missouri Agricultural Experiment Station Bulletin 483 (Columbia, 1944); Joel E. Ricks, *The Utah State Agricultural College: A History of Fifty Years, 1888–1938* (Salt Lake City: Deseret News Press, 1938).

[6] James Gray, *The University of Minnesota, 1851–1951* (Minneapolis: University of Minnesota Press, 1951).

[7] Kuhn, *Michigan State*, 137–38.

[8] Kansas State Agricultural College, *Biennial Report, 1876–78* (Topeka, 1878), 4; Carstensen, "Genesis of an Agricultural Experiment Station," 15.

[9] Carstensen, "Genesis of an Agricultural Experiment Station," 13.

Fitzharris deals with these developments in Minnesota, tells us of some of the early scientists who served the Minnesota station and something of their work, and recounts the establishment of branch stations. He discusses the growth of the station staff and the increasing sophistication of the work conducted by station personnel, and expresses the view that over time the tendency was to move toward basic or pure research. He also mentions some of the problems of administration and seems to find that station personnel and college professors were prima donnas then as they are now. Finally, Fitzharris shows what he believes to have been the close relationship and the significant flow of information between the station and the farming population it was established to serve.

All in all, Professor Fitzharris's paper is a worthwhile contribution. However, his efforts may be criticized on at least two grounds. First would be the nature of the sources upon which Fitzharris has based his story. In the main, his footnotes indicate that he has relied rather heavily upon items issued by the University of Minnesota and by the experiment station itself. These are perfectly good sources, but excessive reliance upon them gives a rather thin account. It is like writing a history of a business firm from the annual reports of the company, a procedure that would certainly inspire book reviewers to eloquence. In the 1880s and 1890s Minnesota was well supplied with farm magazines, including *The Farmer* (St. Paul), *Northwestern Agriculturist* (Minneapolis), and *Farm, Stock, and Home* (Minneapolis), to say nothing of such widely known regional papers as *Hoard's Dairyman* (Fort Atkinson, Wisconsin) and *Prairie Farmer* (Chicago). If I remember correctly, the agricultural library at the University of Minnesota contains files of these periodicals, and Fitzharris's paper would have been fuller had he consulted them. For that matter, a decade ago the archives of the University of Minnesota had among its holdings the papers of some of the early staff members of the College of Agriculture; presumably, the utilization of these materials would have made possible the placing of more flesh on the skeleton.

One might also raise some questions concerning what seems to be one of the major thrusts of Fitzharris's paper. According to the author, during the formative period of the Minnesota experiment station relations between the station and farmers were quite close. "Farmers as individuals or as members of agricultural organizations supported . . . the College of Agriculture and the Experiment Station, and influenced the course of their development," he tells us. By 1910 the "farmers assumed, on the basis of twenty-five years of experience, that the Station would help them solve the various problems which beset them." The reader is left with the impression that large numbers of farmers urged the estab-

lishment of the station, helped to direct its activities, and waited patiently for station personnel to tell them what ailed their cows and crops.

I wonder if Fitzharris has not overstated his case. He mentions quite correctly the beneficial results of interaction between station personnel and agricultural students; unfortunately, students were few and fewer still returned to the farm after graduation. The establishment of branch stations was certainly a useful if limited step toward creation of the desired rapport between the scientists and the countryside. Most assuredly, personnel of the "Minnesota Station strongly identified with the farmers of the state." But did farmers identify with them?

Perhaps at issue is who we count as farmers. It is no doubt true that the Minnesota State Horticultural Society sought answers to the problems plaguing major fruit growers; it is certainly true that Oren C. Gregg induced the experiment station to undertake studies dealing with southwest Minnesota when he turned over the use of his Coteau Farm to the state. But neither Gregg nor the members of the horticultural society were typical Minnesota farmers; the latter were in fact highly atypical and constituted a small elite of the rural population, while Gregg was one of the best known Minnesotans of his time. What of the masses—ordinary farmers growing wheat on their homesteads—did they go to the station with their problems? In view of their attitudes toward the colleges generally, it is difficult to believe they did. James J. Hill knew what the Red River Valley needed when he gave 480 acres for a branch station, and probably both the people and the Great Northern Railway were well paid for his investment in the future, but the Empire Builder had to provide reduced fares or free transportation to induce farmers to visit experiment stations in the Northwest.[10]

The reverse side of the coin deals with the question of how influential the station was among ordinary farmers. To what degree did ordinary farmers in Minnesota accept and put into practice the findings of station personnel? An examination of the evidence would seem to suggest that in the main the experiment stations nationally had little or at best only an indirect influence on farming practices until years after their establishment.

The Hatch Act specifically directed the experiment stations to make their findings available to farmers. How to do so was the question. Farmers were notoriously indifferent to what went on at the colleges and the experiment stations. Book farming had no great appeal. When Oren C. Gregg, superintendent of farmers' institutes in Minnesota, went out to

10 Andrew Boss, *Minnesota Agricultural Experiment Station, 1885–1935*, Minnesota Agricultural Experiment Station Bulletin 319 (St. Paul, 1935), 12; Hunter, *North Dakota's Land-Grant College*, 55.

locate lecturers for his programs, he studiously avoided academic types because he knew that farmers would not come out to hear them.[11] Nor was the distribution of station bulletins a satisfactory means of reaching the mass of farmers, a fact that generated a great deal of concern and discussion at the early meetings of the Association of American Agricultural Colleges and Experiment Stations.[12] By 1900, according to Alfred C. True, an average of 400 bulletins and reports went out to over a half million addresses each year,[13] but few farmers read them, either because they could not understand them or because they were convinced that nothing coming from the agricultural colleges could be of much value. Apparently, more of the bulletins were used to start fires in kitchen stoves than were read and used by farmers.

The primary methods by which the great majority of farmers came into contact with experiment stations were through the farm papers which regularly printed distilled versions of station results and through the messages carried into the countryside by institute lecturers. But the impact of these means of contact may be discounted, since it seems clear that both the printed and spoken word were quite ineffective as teaching devices for ordinary farmers.

Of course, no one could deny that in time the experiment station system has had a tremendous impact on American farming. In Mississippi, for example, experiment station personnel point with justifiable pride to the development in 1947 of the use of anhydrous ammonia, an innovation that sharply reduced fertilizer costs in that state and indeed throughout the nation. The discovery of methods for producing hybrid seed corn is but another example of the experiment stations' role in revolutionizing American agriculture. Even before 1910—the years with which Fitzharris deals—the stations were building a body of scientific knowledge that could be taught in the classrooms and that would ultimately constitute the foundations of modern farming.

But during those early years did the stations have any marked impact upon the practices of ordinary American farmers? In a report issued by the U.S. Bureau of Plant Industry in 1913, a poll of some 4,000 farmers in different sections of the country showed that 44 percent thought that experience was still the only valuable teacher. A mere 6 percent reported that they found station literature to be useful, and an even smaller per-

[11] Roy V. Scott, *The Reluctant Farmer: The Rise of Agricultural Extension to 1914* (Urbana: University of Illinois Press, 1970), 98.

[12] Association of American Agricultural Colleges and Experiment Stations, *Proceedings, 1889* (Washington, 1889), 32–33, 41–43, 65–67, 117–18; ibid., *1894*, 69–71; ibid, *1910*, 154–55.

[13] Alfred C. True, "University Extension in Agriculture," *Forum* 28 (February 1900): 702.

centage claimed that they learned much at farmers' institutes.[14] These dismal figures, of course, ignore some of the results of experiment station work, but there was no noticeable jump in yields per acre of major crops in the years prior to World War I.[15] The conclusion, it seems, must be that the experiment stations had little direct impact on the practices of ordinary farmers until there was an effective method for taking the new discoveries to the countryside. That was the great task of modern agricultural extension with its demonstration technique and its county agents.

14 C. Beaman Smith and K. H. Atwood, *The Relation of Agricultural Extension Agencies to Farm Practices*, U. S. Bureau of Plant Industry Circular 117 (Washington, 1913), 22.

15 See, for example, figures for corn in U. S. Department of Agriculture, *Agricultural Statistics, 1940* (Washington, 1940), 45–46.

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