The "Cattle Disease" Outbreak in Vermont, 1902–1903

In November 1902, an outbreak of foot and mouth disease in Massachusetts spread to the nearby states of New Hampshire, Rhode Island, and Vermont. A prompt response first by the Vermont Cattle Commission and then the U.S. Department of Agriculture's Bureau of Animal Industry successfully contained and stamped out the disease. Despite having by far the largest cattle population of the four states, the impact to Vermont was proportionally the least. There are several possible explanations for this phenomenon, which have implications for the potential resilience of Vermont livestock to foreign disease challenges of today.

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In late November 1902, Mr. Charles J. Bell of Walden was passing a few pleasant weeks hunting in the wilds of Canada, when he unexpectedly received an urgent telegram from the Vermont secretary of agriculture summoning him home.[1] Several cattle shipped from Addison County to Rhode Island had fallen ill with an unusual set of signs: fever, lethargy, lameness, and blisters ("vesicles") on the tongue

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and the lips. Mr. Bell had been secretary of the state Board of Agriculture for the previous two years, and had just resigned to head the newly constituted Board of Cattle Commissioners, whose sole duty was to investigate and control outbreaks of contagious livestock diseases.[2] Upon returning to Vermont, Bell recruited the services of his fellow commissioner, Burlington veterinarian Dr. Frank A. Rich, and they proceeded to Middlebury on November 25 to begin their official investigation.[3] Their urgency arose from the resemblance of the illness to a foreign livestock scourge called foot and mouth disease (FMD).

FMD, also called aphthous fever, is a viral disease of cloven-foot animals, especially cattle and swine.[4] It is probably the oldest known livestock disease and is certainly the most feared, even today. This is not due to its lethality; mortality of adult animals is rarely greater than 3 percent in an infected herd. Rather, its impact arises from two characteristics. First, infected animals exhibit prodigious weight loss and, in dairy animals, cease milk production. Combined with very slow recovery, the economic loss is catastrophic. Second, it is among the most highly contagious infections known to medical science. Direct contact is not required. Infectious doses of virus can be transmitted by vehicles, on clothing, and even borne on the wind. It can be shipped to far-flung places not only by infected animals, but also by animal products such as meat and hides.

The first outbreak of FMD in the United States began in Oneida County, New York, in October 1870. It spread quickly as exposed cattle were transported by railroad to Albany and Dutchess counties, and thence to Connecticut, Massachusetts, and Maine. New York agricultural officials had limited authority to cope with the outbreak, but the New York Agricultural Society took one important step: It hired Professor James Law of Cornell University to "visit the infected district . . . [and to] bring the highest available veterinary skill to the aid of the State commissioners."[5] Highest skill indeed. Dr. Law (1838–1921), dubbed by Ezra Cornell "the Scotch horse doctor," was brought to the new university from Edinburgh in 1868,[6] and his influence on the development of the veterinary profession in the United States was to become immense. Dr. Law published a thorough report on the outbreak, recommending basic principles of control that still exist today: Recognize the highly contagious nature of the disease, prohibit all movement of livestock, quarantine all infected farms, and disinfect buildings and utensils.[7] Unfortunately, application of these principles with sufficient thoroughness was beyond the power of any agency or group. However, what the human laws and regulations of 1870 could not impose, nature was to accomplish. The winter of 1870–1871 was so severe that

all livestock movement was halted and virus survival reduced, so that by spring the disease had run its course and disappeared entirely.[8]

The last quarter of the nineteenth century saw FMD become firmly established in Europe, including Great Britain. Its ravages were broad and deep, with outbreaks striking new areas and recurring in old ones. The importance of this disease can be appreciated when no less a scientist than Dr. Frederick Loeffler, who unraveled the mystery of human diphtheria, turned his attention to FMD. In his 1897 paper, he pronounced the cause to be an "ultravisible, ultrafilterable substance,"[9] this being the first description of an animal virus. Decades of experience with this European strain of FMD left little doubt that quarantine and disinfection alone were no longer effective. As Loeffler stated at the Seventh International Congress of Veterinary Surgeons in Baden-Baden (1899):

> Foot-and-mouth disease is spreading more and more every year . . . Necessary measures had been taken with the greatest care; suspected grounds had been closely quarantined; . . . disinfection had been carefully carried out, and notwithstanding all this the disease kept spreading.[10]

Effective control of the disease was achieved only with the added measure of slaughtering all susceptible livestock on infected farms. This approach was officially endorsed at the Baden-Baden meeting[11] and came to be known as the stamping out process.

However, in 1902, neither cattlemen nor veterinarians in America had any first-hand experience with FMD. When Bell and Rich arrived in Middlebury, the cattle dealer suspected of shipping the ill cattle to Rhode Island was conveniently out of town.[12] According to regulations enacted by the Vermont legislature in 1895, knowingly importing or selling animals "infected with an infectious or contagious disease" carried a fine of between 100 and 500 dollars.[13] Nevertheless, the commissioners pressed on, taking their investigation to Chester the next day (November 28). They determined that the disease had entered Vermont in cattle shipped from Massachusetts to a herd owned by George A. Boynton of Gassetts.[14] They found no fewer than nine infected herds that day and quarantined each one.

On December 1, the commissioners moved on to Windham County. With approximately 100 new reports of infected herds, it was fast becoming clear that this outbreak was already well advanced.[15] Again quarantine was imposed, which included prohibition of all milk sales from those farms, thereby compounding the hardships for the affected farmers. Failure to comply with the quarantine regulations could result in a fine or imprisonment or both.[16] This must have been a difficult, if

not contentious, task for George Bell. The previous decade had seen many inflamed tempers among farmers and officials alike, as the state struggled to control bovine tuberculosis using testing, quarantine, and slaughter. That controversy was what impelled the state legislature to take disease control out of the hands of the politically-influenced Board of Agriculture and repose it in a Cattle Commission.[17] Unfortunately, the terms of the commissioners were to expire on December 1, 1902, and their replacements had not yet been nominated.

Whatever the anxieties about the continuity of the control effort, the burden of responsibility was soon transferred to other shoulders. On November 14, Dr. Austin Peters, chief of the cattle bureau of Massachusetts, sent a letter to the U.S. Department of Agriculture (USDA) reporting that a disease resembling FMD had been discovered in Chelsea and that he would investigate.[18] Three days later, Dr. Peters dispatched a telegram confirming the diagnosis. Dr. John R. Mohler, chief of pathology of the USDA's Bureau of Animal Industry (BAI), traveled to Massachusetts. After examining infected herds and performing some inoculation experiments on sheep, he came to the same conclusion as Peters. Given the gravity of these findings, USDA Secretary James Wilson sought the expertise of Dr. Law (now dean of the Veterinary College), and, together with Dr. Leonard Pearson (head of the Veterinary Department at the University of Pennsylvania), visited the scene. On November 27, they pronounced without doubt that New England was indeed facing a full-blown outbreak of FMD.[19] Secretary Wilson immediately issued an order that "no cattle, sheep or other ruminants, or swine, shall be moved or be permitted to move" from the affected states, which included Vermont.[20] He also mobilized all the forces at his command within the USDA and requested from Congress $1,000,000 in funding.[21] Above all, he directed the chief of the BAI, Dr. D.E. Salmon, to personally take charge of the eradication program.[22]

Daniel Elmer Salmon (1850–1914) was in the entering class when Cornell University opened its doors in 1868.[23] Studying under Dr. Law, Salmon took a Bachelors of Veterinary Surgery degree in 1872, and after advanced research, became the first person in the U.S. to be awarded a Doctor of Veterinary Medicine degree in 1876.[24] After some years both in private practice and doing government-sponsored disease investigations, he was appointed chief of the new BAI in 1884. Its mandate was "to suppress animal diseases and to enter into cooperative relations with state authorities."[25] Unless otherwise noted, the following description of the 1902–1903 FMD eradication program is derived from Salmon's official report published in the *Nineteenth Annual Report of the Bureau of Animal Industry for the Year 1902.*

Dr. Salmon arrived in Massachusetts on the first day of December. Veterinarians employed by the BAI in other parts of the country were already on the ground, and Salmon appointed one person to lead the effort in each state. Dr. Frank Rich was put in charge of Vermont. Since the disease had a considerable head start, Salmon deployed his forces to the towns immediately surrounding the infected districts. Quarantine, slaughter, and disinfection were methodically carried out on infected farms and, as peripheral areas were secured, the work progressed deeper toward the epicenter of the outbreak in each state.

Winter weather was both a help and a hindrance. As in 1870, snow, ice, and cold slowed movement of animals and vehicles, but it also presented obstacles to the eradication teams. Frozen ground made it difficult to excavate trenches in which to dispose of carcasses. In Vermont, cremation was more successful due to the fewer number of animals involved and the ready availability of fuel. The procedure was as follows:[26] Animals were euthanized by gunshot or a blow to the head. The internal organs were removed and the carcasses quartered. A trench was dug two feet deep by two feet wide and of sufficient length. A layer of logs was placed lengthwise in the trench, which was then filled with kindling. Four-foot lengths of wood were laid across the filled trench along with the carcasses "in cob fashion." One cord of hard dry four-foot wood was required to adequately cremate six to ten cattle. The USDA compensated the farmer with 70 percent of the value of the stock, but Vermont farmers considered this indemnity to be closer to 50 percent.[27] It was a severe financial blow when combined with a prolonged loss of revenue from milk and meat sales.

As arduous as carcass disposal must have been, the task of disinfecting the premises was even more challenging. Squads of eight men were set up and equipped with various tools, including a force pump to spray a mixture of lime wash and chloride of lime (what we now refer to as bleaching powder). All loose material was first swept out. All surfaces were scraped clean and rotten wooden parts removed. Floors sometimes had to be taken up. Manure had to be hauled away. Finally, all surfaces were saturated with disinfectant. The farm gate was then padlocked and no animals were to enter the premises for the prescribed period of several months.

While this effort shifted to high gear, official state support was being marshaled. In the temporary absence of a standing cattle commission, Governor John H. McCullough and University of Vermont President Matthew H. Buckham (ex officio as chairman of the State Board of Agriculture) signed an order on December 2 declaring the towns of Chester and Andover in Windsor County, and the towns of Windham

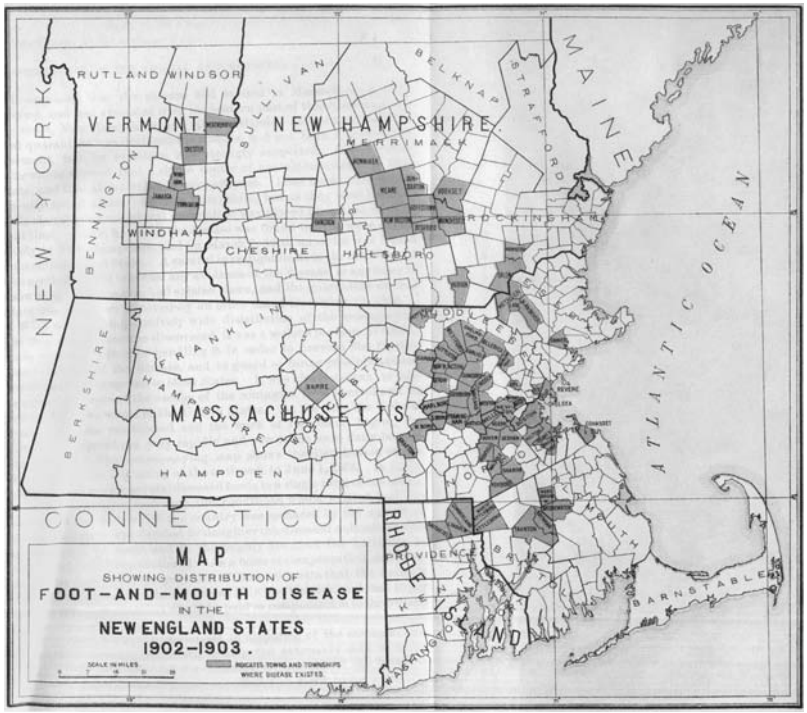
and Grafton in Windham County, to be in strict quarantine.[28] By December 5, however, the state senate had approved the governor's appointments to the cattle commission: Victor I. Spear of Randolph as secretary, and veterinarians Frank Rich and George H. Stephens of Hartford.[29]

By December 12, the stamping out was in full swing in Chester, beginning with the fifteen cattle, along with swine and sheep, belonging to Mr. H.M. Guild. On December 19, two herds were depopulated in Weathersfield, followed by a herd in Windham on the 21st. The largest herd slaughtered in Vermont was the one that began the Vermont outbreak: sixty-three cattle of G.A. Boynton in Gassetts.[30]

The new year of 1903 saw the FMD outbreak in Vermont under control, the active stamping out having taken approximately one month. The official BAI statistics are as follows: 351 cattle slaughtered comprising 22 herds, 35 hogs, and 74 sheep.[31] Compensation averaged $31.06 per head of adult cattle and $11.80 per calf.[32] On May 1, 1903, the statewide quarantine was lifted, but in the infected townships, animals could only be moved with an official permit from a BAI officer.[33] Final termination of restrictions occurred on May 12.[34]

The New England outbreak of FMD ended after six months of intensive effort and involved Massachusetts, Rhode Island, New Hampshire, and Vermont (see map). The one loose end left dangling was the uncertainty as to the specific source of the virus. Because the initial cases seemed to cluster around the docks of Chelsea, Massachusetts, it was assumed that the infection arrived in a shipment of hides, wool, ropes, etc., from Europe.[35] However, Dr. John Mohler, the BAI pathologist whose scientific investigation initiated the race against the virus, also made the last contribution to a successful conclusion. He found evidence that the virus arrived in a shipment of contaminated human smallpox vaccine of Japanese origin.[36] In the late nineteenth century, smallpox vaccine virus was harvested from the fluid ("lymph") from the skin vesicles of calves deliberately infected with a "humanized" strain of cowpox.[37] The quality of these vaccines was highly variable. Between 1900 and 1902, the British medical periodical, *The Lancet,* investigated the purity and efficacy of vaccine lymphs from fourteen manufacturers, and found all but one grossly contaminated with bacteria.[38] It takes little imagination to understand that a calf co-infected with FMD would produce skin vesicles containing both viruses. Once the vaccine was distributed for use, the highly contagious pathogen could easily escape.

When looking over the BAI statistics, one is struck by the comparatively low impact of the outbreak on Vermont. With 44.4 percent (using



Map of the distribution of foot and mouth disease cases by county in New England. From: Nineteenth Annual Report of the Bureau of Animal Industry for the Year 1902 *(Washington, D.C.: Government Printing Office, 1903), insert between pages 392 and 393.*

1898 statistics[39]) of the combined cattle population of the four affected states, Vermont FMD cases were a mere 7.4 percent of the total. Even more revealing is the proportion of infected cattle expressed as a percentage of the total cattle population of each state: Massachusetts (1.3 percent), Rhode Island (1.0 percent), New Hampshire (0.3 percent), and Vermont (0.08 percent). There are several possible explanations for the seeming resistance of Vermont cattle. Vermont was geographically the most distant from the epicenter of the outbreak, and thus less likely to experience multiple introductions of the virus. The combination of weather conditions and road quality may have made cattle traffic problematic. Lastly, there was prompt response by the Vermont Cattle Commission and, despite the controversial tuberculosis experience, farmers were willing to cooperate.

However, I would like to propose another hypothesis. First, one last scientist must be introduced: Sir Albert Howard (1843–1947). He was a professional university-educated agriculturist employed by the British government, and was sent to various places in the Empire to teach local farmers to grow crops for the global market. In each foreign assignment, he observed that traditional farming methods maintained good long-term soil fertility, and that, as he put it, those farmers had more to teach him than he them. His decades of research into soil science and the use of compost produced from recycled organic materials was published in book form in 1943.[40] Howard's profound insight was that fertility maintained by organic soil amendments gave rise to productive disease-free crops. He further showed that working oxen fed on forage and pasture grown on compost-nourished soil remained free of all diseases. He repeated his cattle experiments many times in different places, even in India, where his oxen were exposed to cattle carrying FMD virus in an adjacent pasture. This infected herd of cattle was part of an estate managed using the nascent industrial agricultural model: high inputs of synthetic agricultural chemicals and feeding highly processed concentrated foodstuffs.

The explanation for Howard's results goes beyond the maintenance of robust health. Virologists now know that the FMD virus has adapted its genome to a very high mutation rate (approximately one mutation per replication), allowing it to evolve rapidly within the animal host.[41] Research with other rapidly evolving viruses shows that the host can nudge that evolution either toward greater or lesser virulence, depending on such factors as nutritional status.[42] The question, then, is this: Were Vermont farmers of 1902 feeding and caring for their cattle in line with the methods of Sir Albert Howard?

By the turn of the twentieth century, the industrial model was being promoted by the mainstream science of the agricultural colleges. Bulletin no. 81 of the Vermont Agricultural Experiment Station at the University of Vermont (published in 1900) recommended feeding standards utilizing cottonseed meal and gluten meal to increase milk production and expand the size of the dairy herd.[43] Two factors militated against the widespread adoption of this practice. First, there was resistance from even the most progressive farmers. In an article entitled "Farm Fertility" that appeared in the 1895 Vermont Agricultural Report, the author stated:

> [B]uying commercial fertilizers at the ruling prices . . . if deducted from the usual price of hay would leave a small margin, probably too small for profit . . . [A]nother system follows, whereby the farm products are fed to animals upon the farm, and the manurial elements of the crops grown are returned to the soil.[44]

At the 1904 meeting of the Vermont Dairymen's Association, Mr. M.W. Clark of Williston gave his opinion on promoting dairying as a specialized industry. He advocated reliance on pasture and retaining a diversified farm model, offering sheep as an example:

> Vermont farmers must take into consideration Vermont conditions in order to succeed. Our acreage of pasture is way in excess of our suitable tillage land . . . [T]here is that back pasture that has been growing poorer on his hands every day, that he can improve with sheep.[45]

Because sheep can improve the soil and provide a secondary income with modest investment of labor, they have been called "Golden Hoof."[46] Around 1900, Vermont was home to 28 percent more sheep than the other three New England states combined.[47]

A second factor is that Vermont, owing to its distance from major urban markets, exported its dairy produce in the form of butter and, to a much lesser extent, cheese. At the turn of the twentieth century, there were between 200 and 250 creameries and cheese factories in the state, which produced from 20,000 to 25,000 pounds of butter per day.[48] There was lively discussion on the topic of feeding protein supplements (i.e., cottonseed meal and gluten meal) at the Vermont Dairymen's Association meeting in January 1900. Many of the progressive farmers made the plunge on a trial basis. They had little doubt that milk output was enhanced, but had poor results with their crucial butter product. Two comments illustrate the problem. The first is from Mrs. Carrie J. Nelson of Ryegate, who was introduced as having "won more prizes than any dairy man":

> In a few weeks the butter dealer wrote on the bottom of my weekly return "What are you doing to the butter? It is off on flavor."[49]

She went back to feeding corn and bran to supplement the grass forage, and the dealer's next missive was: "Butter is good." The second comment is from no less a dairyman than George Aitken of Woodstock, who was a vice-president of the association, and marketed his butter to Philadelphia, New York, and Boston. He described his experience with cottonseed meal this way:

> The [Philadelphia] buyer wanted to know what was the trouble with my butter stating it was "off" flavor.[50]

He also resumed feeding his own farm-produced grain. Thus it seems that the valuable butter market constrained new feeding practices. Mr. Aitken went on to say that he even avoided feeding silage:

> [The silage] smelled so much like a distillery to me, that, being a temperance man, I could not think of feeding it to my cattle . . . I believe that I consider it is largely the cause of the epidemic of tuberculosis that we had here in Vermont.[51]

This last sentence returns to the subject of disease susceptibility. According to Mr. Aitken, silage feeding and the overall husbandry conditions of many Vermont dairies contributed to the spread of disease. Perhaps the tuberculosis eradication campaign of the mid-1890s resulted in cleaner, better-managed dairies, setting the stage for greater resilience against the challenge of FMD.

The danger of FMD introduction remains prevalent today, especially with the added threat of a bioterrorist attack. According to a 2011 report, New England is certainly vulnerable.[52] The statistics in that document suggest that some of the characteristics of dairy farming in Vermont have changed little over the past century: small herds (20–200 cows) predominate and Vermont still has the majority of the region's cattle. As to dairying itself, the precepts of "temperance" have been replaced by those of "sustainability"; new progressive organizations like the Northeast Organic Farmers Association and the Vermont Grass Farmers Association have taken the lead; the creamery has largely yielded to artisan cheese making as a value-added product; and new market forces arising from "locavore" preference and personal health concerns have supported the diversified family operation. While well-informed vigilance remains central to meeting the challenge of exotic diseases, so also is an appreciation of Sir Albert Howard's Great Wheel of Life—"soil, plant, animal, and man: the health of these four is one connected chain."[53]

Notes

[1] *Rutland Herald,* 27 November l902, 3.

[2] Edwin C. Rozwenc, *Agricultural Policies in Vermont, 1860–1945* (Montpelier: Vermont Historical Society, 1981), 38.

[3] *Rutland Herald,* 27 November 1902, 3.

[4] John Timoney, et al., *Hagan and Bruner's Microbiology and Infectious Diseases of Domestic Animals* (Ithaca, N.Y.: Comstock Publishing Associates, 1988), 647–665.

[5] *Transactions of the New York State Agricultural Society—1870* (Albany, N.Y.: The Argus Company, 1871), 4–5.

[6] Albert H. Wright, *Pre-Cornell and Early Cornell IV, Biology at Cornell University 1868–1928* (Ithaca, N.Y.: Published privately by A.H. Wright, 1953), 3–4.

[7] James Law, "Contagious Foot and Mouth Disease," *Journal of the New-York State Agricultural Society,* 21 (January 1871): 1–7.

[8] *Transactions of the New York State Agricultural Society—1871* (Albany, N.Y.: The Argus Company, 1872), 19.

[9] Joern Klein, "Understanding the Molecular Epidemiology of Foot-and-Mouth-Disease Virus," *Infection, Genetics and Evolution,* 9 (2000): 153–161.

[10] *Nineteenth Annual Report of the Bureau of Animal Industry for the Year 1902* (Washington, D.C.: Government Printing Office, 1903), 398. Hereafter referenced as *BAI Report.*

[11] Ibid., 402.

[12] *Rutland Herald,* 27 November 1902, 3.

[13] *Fifteenth Vermont Agricultural Report of the State Board of Agriculture for the Year 1895* (Burlington, Vt.: The Free Press Association, 1896), 9.

[14] *Rutland Herald,* 2 December 1902, 3.

[15] Ibid.

[16] *Fifteenth Vermont Agricultural Report for 1895,* 11.
[17] Rozwenc, *Agricultural Policies in Vermont,* 38.
[18] *BAI Report,* 391.
[19] *Rutland Herald,* 2 December 1902, 3.
[20] *BAI Report,* 392.
[21] *Rutland Herald,* 2 December 1902, 3.
[22] *BAI Report,* 391.
[23] Rafaele Roncalli, "Salmon—Parasitology and Beyond," *Journal of the American Veterinary Medical Association,* 172 (1998): 1859.
[24] Ibid.
[25] Fred Wilbur Powell, *The Bureau of Animal Industry: Its History, Activities and Organization* (Baltimore: Johns Hopkins Press, 1927), 10.
[26] *Brattleboro Vermont Phoenix,* 19 December 1902, 2.
[27] Ibid.
[28] Ibid., 5 December 1902, 2.
[29] Ibid.
[30] Ibid., 26 December 1902, 2.
[31] *BAI Report,* 409.
[32] Ibid., 410.
[33] *Rutland Herald,* 4 May 1903, 1.
[34] *BAI Report,* 407.
[35] M.S. Shahan and J. Traum, "Foot and Mouth Disease," *Animal Diseases—Yearbook of Agriculture 1956* (Washington, D.C.: Government Printing Office), 190.
[36] *American Druggist and Pharmaceutical Record,* 54–55 (1909): 307.
[37] J. A. Dudgeon, "Development of Smallpox Vaccine in England in the Eighteenth and Nineteenth Centuries," *British Medical Journal* (May 25, 1963): 1367–1372.
[38] Anonymous, "Glycerinated Vaccine Lymph," *The Chemist and Druggist* (June 14, 1902): 927.
[39] *Yearbook of the United States Department of Agriculture, 1898* (Washington, D.C.: Government Printing Office, 1899), 703.
[40] Albert Howard, *An Agricultural Testament* (New York: Oxford University Press, 1943).
[41] Klein, "Understanding the Molecular Epidemiology of Foot-and-Mouth-Disease Virus."
[42] S. Alizon, et al., "Epidemiological and Clinical Consequences of Within-Host Evolution," *Trends in Microbiology,* 19 (2011): 24–32.
[43] *Fifteenth Vermont Agricultural Report for 1895,* 50.
[44] Ibid.
[45] "Report of the Thirty-Fourth Meeting of the Vermont Dairymen's Association," *Twenty-Fourth Vermont Agriculture Report, 1904* (Troy, N.Y.: Press of the Economist Company, 1904), 30.
[46] P.V. Ewing, ed., *Golden Hoof* (Chicago: Breeders Publications, 1943).
[47] *Yearbook of the United States Department of Agriculture, 1898,* 704.
[48] "Report of the Thirtieth Annual Meeting of the Vermont Dairymen's Association," *Twentieth Annual Report of the Vermont State Board of Agriculture for the Year 1900* (Bradford, Vt.: Press of the Opinion Publishing Company, 1900), 47.
[49] Ibid., 41–42.
[50] Ibid., 76.
[51] Ibid., 77.
[52] R.P. Horwitz, *Foot and Mouth Disease (FMD) as a Hazard for New England Dairies* (Washington, D.C.: United States Department of Agriculture, 2011).
[53] Albert Howard, *The Soil and Health: Farming and Gardening for Health or Disease* (New York: Devin-Adair Co., 1956), 12.