are more appealing to consumers and more nutritious. Not only will techniques be developed that will detect the smallest amounts of agricultural, industrial, or natural toxicants in foods, but production techniques will assure these harmful substances do not get in our food.

Improving Human Nutrition, Health, and Well-Being. Americans have access to more high-quality, moderately priced, safe and nutritious food products, than any other people in the world. The metabolic relationship between nutrient intake and physiological response needs to be better understood. Adequate nutrition and proper dietary practices will reduce the risk of various diseases such as cardiac disease, diabetes, and some forms of cancer. A better understanding of the needs of pregnant and lactating mothers and newborn infants will reduce infant disabilities and mortality. We will have a better knowledge of the relationships between nutrient quality and human genetic potential and will have the ability to alter naturally occurring food ingredients via biotechnology. The opportunities are limitless.

Need for Trained People. The new opportunities in science require trained people. Many agricultural scientists received their formal education 20 to 30 years ago and are reaching retirement age. Areas of importance are molecular biology, systems analysis, and international marketing. These shortages were highlighted at a conference held in 1984 on "Brainpower for Agriculture"—cosponsored by USDA and the National Academy of Sciences. In addition to a continuing funding problem in higher education, the traditional images of agricultural fields need modification so that talented students will more objectively evaluate career opportunities in the agricultural sciences.

Jonathan Baldwin Turner—Evangelist of the Land-Grant University Movement

Patricia B. Lewis, *public information consultant, New Jersey Agricultural Experiment Station, New Brunswick*

With the livid language, sonorous prose, and grand manner of 19th century oratory, Jonathan Baldwin Turner devoted his life to the idea of general, practical education for the masses.

Turner was an evangelist of ideas in the three areas that consumed him—religion, politics, and education. In all three, his views were unorthodox and brought him severe criticism and some personal abuse. Still he would not modify his stands, and finally it was the melding of religious fervor with political skill that allowed Turner's educational philosophy to become the law of the land.

Ideas developed by Turner spread far beyond Illinois where he honed them and came to encompass the entire United States through the land-grant university movement. With the missionary fervor of a John the Baptist, Jonathan Turner never missed an opportunity to advance his ideas. He fought relentlessly for education for the sons and daughters of the working class; an education "suited to their aptitudes, interests and careers."

It was his philosophy that the "industrial universities" should exclude "no species of knowledge" whether practical or theoretical; unless, "those specimens of organized ignorance found in the creeds of party politicians and sectarian ecclesiastics should be mistaken by some for a species of knowledge."

Although described by his daughter, Mary Turner Carriel, as "sweet of temper" with a "mildness of manner," Turner was known to be brusque, direct to the point of offensiveness, and keenly sarcastic in dealing with the "evils of public affairs." In an 1873 address he remarked, "I have often thought, and sometimes said, that I can see no way by which the farmers of the West can get rid of the evils that now oppress them until we can contrive to get up several thousand first-class funerals of old judges, legislators, lawyers, editors, etc., etc. with a sprinkling of divines sent along with them to act as chaplains . . ."

A complex man whose ideas were a good 50 years before their time, Turner was unorthodox and imaginative. He was known beyond educational circles for his work with the mentally ill, the sick, and for his unique contributions to horticulture.

A native of Massachusetts, educated at Yale, and for years a professor at Illinois College, Jonathan Turner was constantly engaged in one revolutionary movement or another. From his challenge to the conventional wisdom of his religious demonization to his opposition to slavery, Turner never took the easy path.

Turner's influence among his students at Illinois College was strong, and through them he had still greater influence on leaders of that period. In writing about her father's life, Mary Turner Carriel says that among Turner's students were William G. Green and his brother, sons of a widow living in Menard County, Illinois. At the end of one school term, they walked home, and found that their mother had hired a tall, thin man with a rustic manner to help with the harvest.

After supper, the man asked the boys what they had learned at school and if they would show him their books. They told him about college, showed him their books, and he selected one on English grammar. Every night for weeks he studied that book, sometimes asking questions which the boys answered as best they could, always citing as their authority Jonathan Baldwin Turner, Professor of Belles Lettres, Latin and Greek at Illinois College.

The man was Abraham Lincoln. Years later when he and Turner had become well acquainted, President Lincoln would say to Turner, "My only instruction in the English language has been from you," referring to the Green brothers of Tellula, Illinois, while they were students at Illinois College where Turner taught and [Lincoln] was a hired hand on their mother's farm.

No doubt the Lincoln-Turner association helped the land-grant university movement. Before the campaign of 1860, Professor Turner had talked with Lincoln at Decatur, Illinois. Turner told Lincoln that he would be nominated by the Republicans and that he would win the election.

Lincoln is said to have responded, "If I am, I will sign your bill for State Universities."

No doubt that made Turner happy, but the story goes that he had further reason for jubilation. A little while later on a train to Peoria, Turner met Stephen A. Douglas. Douglas is said to have remarked, "If I am elected, I will sign your bill."

Turner understood the need for bipartisan support and whichever way the country voted—Republican or Democrat—he would realize his dream. It mu st have been a real

cause for celebration by Turner who had witnessed 10 years of Congressional maneuvering and a veto by President Buchanan.

Despite Turner's association with Lincoln, Douglas' support of the land-grant university concept was not idle. He had said, "This educational scheme of Professor Turner's is the most democratic scheme of education ever proposed to the mind of man!" And in June 1861, Douglas wrote Turner requesting a copy of his plan for an industrial university and its history. Douglas wanted to introduce the bill himself.

Turner complied, but, when his son delivered the materials to the post office, he found a telegram saying Douglas had died in Chicago. In grief and disappointment, Turner threw everything in the trash. The disappointment was short lived, because Justin Smith Morrill, a senator from Vermont whose earlier attempt at getting land-grant university legislation into law had failed, reintroduced the measure which President Lincoln signed July 2, 1862.

And so Jonathan Baldwin Turner, whose full flowing beard and stately appearance resembled the prophets he often called upon in making his point, had seen a vision realized.

It was a vision of which Dr. S. A. Forbes, while Dean of the College of Science at the University of Illinois, said, "That reaching upward of the masses for more power and light, spreading eastward, gave us later the long line of land-grant colleges, and gives us now the State experimental stations also, as a sort of second growth from the seed first sown, through recognized acceptance of the natural sciences as a necessary part of the course study in a true people's school . . ."

With his missionary mind, Jonathan Turner no doubt would have seen the creation of the State Agricultural Experiment Station system as a type of Second Coming. This movement, which celebrates its 100th anniversary in March 1987, gained its urgency from yet another man from Illinois. University of Illinois President John M. Gregory at an 1871 convention of agriculture educators called attention to the seemingly incidental role the Morrill Act had allotted to research.

Gregory said farmers, beset with problems they could not solve, were bringing questions to the college staff that could be answered only by astute, continuous, and productive experimentation.

National Archives

Jonathan Baldwin Turner, 1805–1899, agriculturist and early advocate of vocational education.

After considerable discussion in the press and at public meetings about State versus Federal responsibilities, the science and education leaders of the time were able to obtain Federal funding of agricultural research.

Eugene Hilgard, director of the California experiment station at Berkeley, was a forceful leader in this effort. Hilgard favored an increase in the appropriation to the Department of Agriculture which would by direct cooperation with the land-grant universities operate an experiment station in each State. Hilgard preferred this approach because it would produce a "radiating network" of scientific research linking the scientific capacity of a Federal research center at the Nation's capital to the existing collection of university talent in each State just waiting for formal organization.

It is this radiating network, combined with contributions from private industry, that provides the United States with the research results it needs to lead the world's agriculture.

Agricultural Research: Who Pays and Who Benefits?

John E. Lee, Jr., *administrator, and* Gary C. Taylor, *agricultural economist, Economic Research Service*

The triumph of modern agriculture over the Malthusian threat of global starvation is well known.

Contrary to the forecasts of 18th century doomsdayers, agriculture production has increased faster than global population, to the extent that more of the past century has been characterized by food gluts than by food shortages, especially in the industrial economies.

Chronic food shortages, where they exist in the world, are now recognized to be matters of policy, economic development, and, perhaps, distributive equity, because resources and the technology to use them are known to be more than adequate to eliminate the shortages.

The dramatic technological transformation of agriculture in the past century has made it possible to meet the food and fiber needs of our society with a declining portion of our total resources, freeing the remaining resources to provide the goods and services that constitute our higher standard of living.

Research has made a major contribution to modern agricultural technology. In the United States, research—together with the teaching and extension of agricultural sciences—has enabled us to 1) produce and deliver to consumers a greater variety of higher quality products for a declining portion of their incomes; 2) improve food safety and quality;