NATIONAL ACADEMY OF SCIENCES

GLENN WILLARD BURTON
1910—2005

A Biographical Memoir by
ARNEL R. HALLAUER

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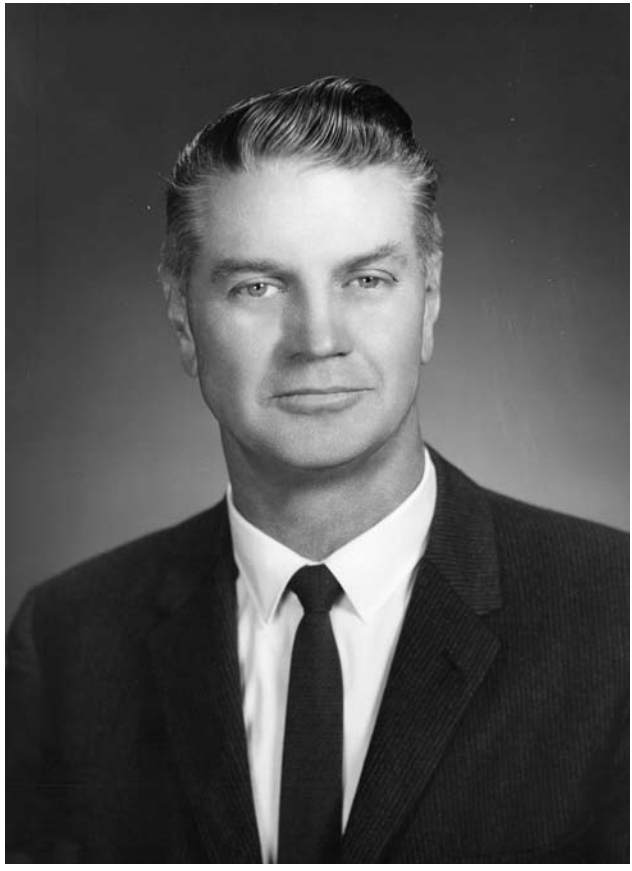
Biographical Memoir



Glenn W Burton

GLENN WILLARD BURTON

May 5, 1910–November 22, 2005

BY ARNEL R. HALLAUER

GLENN W. BURTON IS A prominent name in the recorded history of forage and turfgrass breeding during the 20th century. His formal research career of 61 years started with the application of the principles of Mendelian genetics for improvement of grasses to the application of molecular genetics for grass improvement during the latter years of his career. Burton made significant improvements in plant breeding and genetics of forage and turfgrasses, which had economic and social impacts on the forage-based cattle industry, the turfgrass industry, and agriculture of the southern areas of the United States and worldwide. He developed coastal bermudagrass and solved problems associated with its establishment and management. Coastal bermudagrass was officially released in 1943. Burton continued to make improvements in bermudagrass, with seven improved cultivars released during his career, including Tifton 85 (released in 1992).

The history of Burton's research on bermudagrass is a consistent theme throughout his 70 years in grass research: He integrated the different aspects of basic research with applied research to ensure that a product was delivered that was of benefit to the public. He had broad research interests, and he was convinced that both basic and applied research

were necessary to develop cultivars that would be of benefit to the livestock and turfgrass industries.

Burton began his research on bermudagrass for forage in 1936. At that time cotton was the principal crop in the southern United States, and bermudagrass was considered the worst weed that plagued cotton growers. Burton's first hybrid bermudagrass was produced between a local bermudagrass cultivar and a cultivar from South Africa and was officially released in 1943 as Coastal bermudagrass. Coastal was a very poor producer of seed and had to be propagated by sprigs, not seed. Propagation by sprigs was met with resistance, but eventually this limitation became an important trait. Because Coastal bermudagrass produced few, if any, viable seeds, its potential as a weed in cotton fields was reduced significantly. Transforming one of the South's worst weeds into the best forage grass became one of Burton's greatest legacies. Burton continued working with bermudagrass. The second hybrid released was designated Coastcross, which was more easily digested by cattle. Further research resulted in the subsequent release of six additional cultivars that are grown on more than 10 million acres (nearly 4 million hectares) across the southern United States as pasture and hay for beef cattle and other livestock. More than 60 years after the release of Coastal bermudagrass, it remains one of the preferred cultivars for top hay and forage farmers. Burton developed and released Tifton 85 bermudagrass cultivar in 1992. Today there is probably more total pasture acreage of Coastal, but Tifton 85 is more productive and digestible. As new pastures are planted Tifton 85 has become the recommended cultivar to replace Coastal.

Burton's bermudagrass hybrids increased U.S. liveweight beef production by at least 1 billion pounds. Coastcross permits farmers to produce 30 to 40 more pounds of beef per acre. Tifton 44 produced 50 more pounds of beef per acre

per year. By 1982 Coastcross was projected to be planted on 1 million acres and add 50 million pounds of beef at no extra cost. Tifton 44, released in 1978, has greater cold tolerance than previous cultivars, and permitted the growing of bermudagrass 50 to 100 miles farther north than previous cultivars. The source of greater cold tolerance in Tifton 44 was probably because of the source of germplasm used in the cross. Burton found one of the parents of Tifton 44 growing in a small patch along a railroad siding in Berlin, Germany. Other Burton bermudagrass hybrids are grown on golf courses, athletic fields, and lawns throughout the southern United States, the Caribbean, and Hawaii.

Burton and his fellow scientists conducted a broad research program in the improvement of grasses. Their research ranged from field selection to basic genetic studies of the fundamental nature of inheritance for different grass species. In addition to the highly successful acceptance of the bermudagrass hybrids, Burton's research program included sudangrass for forage, napiergrass for forage, bahiagrass, pearl millets for forage, pearl millets for forage and grain hybrids, and bermudagrass for turfs. A total of 44 cultivars were officially released for the different grass species. The development of better cultivars for each of the grass species was based on fundamental selection and genetic studies to determine the more efficient and effective improvement methods and agronomic field research to determine the husbandry practices that would maximize production and sustainability. These studies included methods to produce hybrids; estimation of the heritability of different traits; breeding and selection methods; recurrent selection methods for improvement of germplasm for breeding purposes; collection, evaluation, and maintenance of germplasm resources from all areas of world; cytological studies to determine the inheritance of traits; identifying sources of male-sterile germplasm for use

in hybrid production; identifying sources of pest resistance to use in developing cultivars with greater tolerance to common pests and improved consistency of performance over locations and years; and identifying husbandry practices for stand establishment, fertility requirements, grazing and traffic tolerance, and carrying capacities for livestock. Results from his research program were reported in 777 publications from 1936 to 2003.

PROFESSIONAL HISTORY

Few agricultural scientists have accomplished as much as Glenn Burton did during the nearly seven decades of his research career. His entire professional career was as a research geneticist with the Agricultural Research Service (ARS), U. S. Department of Agriculture, at the Coastal Plain Research Station, Tifton, Georgia. After the completion of his graduate studies at Rutgers University, Burton went directly to Tifton to begin his career in grass research, studying the cytogenetics, breeding, and evaluation of problems related to hay, pasture, and turfgrasses adapted to the southern United States. Burton became one of the most highly recognized plant scientists in the United States and the world. He became the leading authority in grass breeding and genetics and served as a consultant and adviser for other scientists in grass breeding and related fields, for officials of state and federal organizations, for scientists and officials of foreign countries, and for representatives of regional agricultural groups and associations. He was a trusted source of information for industry, farmers, and the general public, and his research was accepted without reservation. The ARS accepted his research findings and when data were lacking, management helped to provide funds to conduct research projects under his direction.

Burton's research program included 12 grass species, of which five were studied intensively. Data collected and analyzed were published in a timely manner and is described in 777 publications from 1936 to 2003. In addition to the basic breeding and genetic studies, 15 improved cultivars or hybrids and 15 inbred lines for either forage or millet grain production were released for public use. Most releases had wide acceptance and use. He was very generous in sharing germplasm, released materials, and information with anyone interested in grass improvement. Burton's six turfgrass hybrids are planted on lawns, athletic fields, and most golf courses throughout the southern United States, as well as foreign countries. The released cultivars managed in accordance with his research findings and information distributed to the public have significantly changed the South from a row-crop cotton culture with its eroded fields and bare lawns to a profitable diversified agriculture with grasses adapted for reducing soil erosion, for greater economic benefits of the livestock industry, and for beautifying the environment.

Burton's comprehensive research program led to a better understanding of cultivar improvement in different grass species. Some examples of the extent of his research efforts were his discovery of the mode of reproduction, development of breeding methods, and solution to problems related to stand establishment and management of released cultivars of bermudagrass. Burton also discovered obligate apomixis in common bahiagrass and, with cytological assistance, determined the genetics of apomixis, and developed methods for its use in breeding. The methodology developed moved the germplasm to a sexual state for hybridization and recombination and back to the apomictic state to fix heterosis in hybrids, such as Tifton 54 bahiagrass. He developed techniques for the commercial production of hybrid seed in pearl millet. He developed four inbred lines that

were crossed to give Gahi 1 pearl millet. Gahi 1 yielded 50 percent more than common pearl millet and was the most widely grown summer grazing annual in the southern United States for many years, increasing yields 50 percent with a small extra cost of seed being the only additional input cost. Burton also found that mixtures of 75 percent hybrid and 25 percent parental pearl millet inbreds had yields similar to 100 percent hybrids. Pearl millet is grown on more than 40 million acres worldwide, with 27 million acres in India alone. Self-incompatibility was discovered by Burton in Pensacola bahiagrass and bermudagrass and proved very useful in producing crosses and polycrosses as well as hybrid seed on a commercial basis. Tifhi No. 1 was the first hybrid Pensacola bahiagrass cultivar produced by this technique. Burton also discovered cytoplasmic male sterility in pearl millet in 1956 and showed how reciprocal maintainer restorer relations between A_1 and A_2 sterile cytoplasms could be used in millet breeding and the production of hybrids for both forage and grain millets. Ancillary research also was conducted to enhance the basic discoveries for the different grass species, such as effects of radiation treatments to generate genetic variation; how to break dormancy in pearl millet seeds to permit greater flexibility in planting dates; used quantitative genetic models to determine the inheritance of different traits in different grass species; determined the effects of a single recessive pear millet gene (*tr*) on pleiotropy, including reduction of transpiration rates to increase drought tolerance; and developed the recurrent restricted phenotypic selection methods to reduce environmental effects in long-term selection for genetic improvement of germplasm.

Burton had other opportunities to change positions during his career, but he elected to spend his entire professional career as a plant geneticist with the U.S. Department of Agriculture at Tifton, Georgia. No single individual has

had greater impact on forage and turfgrass development, production, and utilization. His contributions to the advancement of forage and turfgrasses have been recognized by his colleagues and peers. Burton received 80 awards related to his contributions in grass breeding, starting with the American Society of Agronomy Stevenson Award in 1949 and the Crop Science Society of America Presidential Award in 1997. Burton was elected to the National Academy of Sciences in 1975, and he was a regular attendee and contributor to Section 62 (Plant, Soil, and Microbial Sciences), Class VI (Applied Biological, Agricultural, and Environmental Sciences). In 1983 Burton was one of eleven scientists and engineers (including Edward Teller, father of the hydrogen bomb) who received the National Medal of Science presented by President Reagan. He was inducted into the Agricultural Research Service Science Hall of Fame in 1987. Burton also was active in his professional societies, serving on a number of committees and as chair of the Crops Division (1952), and as vice-president (1961) and president (1962) of the American Society of Agronomy. He held memberships in the American Society of Agronomy, Crop Science Society of America, American Genetic Association, Society for Range Management, and American Forage and Grassland Council.

PERSONAL HISTORY

Glenn W. Burton was born May 5, 1910, in Clatonia, Nebraska. He was the only child of Joseph Fearn and Nellie Rittenburg Burton and was kept busy helping his parents with farm work when not in school. In 1915 they moved to a farm near Bartley, Nebraska, where he grew up helping his father farm with horse-drawn equipment. He attended a one-room country school for grades one through eight and graduated from the four-teacher Bartley High School in June

1927. Burton enjoyed school, had an insatiable curiosity, loved to solve problems, and graduated number two in his class. He participated in all high school sports, music, and drama programs.

He farmed with his father in 1927 and 1928, when he enrolled at the University of Nebraska. Ward Shores, his high school superintendent, convinced Burton that he should go to college to study to become a vocational agriculture teacher. He pursued this course of study while working part-time in the Department of Agronomy until the beginning of his junior year. At that time F. D. Keim, head of the Department of Agronomy, convinced Burton that agronomy and plant breeding should be his major fields of study. Keim directed the course of his life through graduate school. Burton graduated from the University of Nebraska in January 1932 in the upper 3 percent of his class. Upon graduation he accepted a half-time position at Rutgers University, where he earned his master of science (1933) and Ph.D. degrees (1936). Howard Sprague was his major professor and provided excellent training, experience, and inspiration for Burton to be a successful plant breeder.

Glenn Willard Burton and Helen Maureen Jeffryes were married in 1934. Helen had majored in home economics and became a dietician. They were the parents of five children. They celebrated their 60th wedding anniversary before her death in 1995. In April of 1936 they moved to Tifton, Georgia, where he took a position as principal geneticist with the Division of Forage Crops and Diseases of the Agricultural Research Service of the U.S. Department of Agriculture at the Georgia Coastal Plain Experiment Station. For more than 61 years Burton continued to lead the Grass Breeding Department at Tifton. After his formal retirement in 1997, he continued his research program with funding from his salary savings. In 1950 when the Coastal Plain Experiment Station

became a part of the University of Georgia, Burton became a member of the faculty of the College of Agriculture, serving as chairman of the Agronomy Division until 1964 when he was named Distinguished Alumni Foundation Professor. As a member of the university graduate faculty, he directed the research of 16 graduate students.

Glenn W. Burton died November 22, 2005, of natural causes in Tifton, Georgia, at the age of 95. He is survived by five children, eight grandchildren, and 12 great-grandchildren. He maintained an active research program to the time of his death, publishing more than 40 publications after his formal retirement in 1997. The Burton family was active in the First Methodist Church and was named Methodist Family of the Year in the United States in 1951. He enjoyed singing in the church choir and was a member of a quartet in his earlier years. He served as Sunday school teacher, was district lay leader, and held other leadership positions within the church. He also served on the Board of Stewards and as a lay speaker.

PUBLIC SERVICE

Plant breeding and the Methodist church received most of Burton's attention during his professional career. He was very active in the Methodist church, singing in the choir and serving on numerous committees. He was elected to the Tifton County School Board in 1952 and served on the board for four years. Burton was a member of five professional societies related to the breeding and genetics of plants. He was a regular attendee at the annual meetings and usually presented oral papers related to his research on forage and turfgrasses. Because of his preparation and speaking abilities, he played an active leadership role in the American Society of Agronomy (ASA), the largest professional society for all aspects of plant improvement and soils, serving as chair of

the Crops Division (1952) and the Fellows Committee (1963) as well as vice-president (1961) and president (1962). He was chair of the Agronomic Science Foundation from 1972 to 1982. He frequently served on special awards and other committees of the Crop Science Society of America and the ASA during most of his career. He was a member of the American Genetic Association Council from 1973 to 1975. Within the National Academy of Sciences, Burton was chair of Section 62, Class VI from 1978 to 1980 and also served on ad hoc committees. Perhaps, Burton's greatest public service was the attention and time given to fellow researchers within the United States and foreign countries. He was always open-minded and generous in discussing his research, and freely sharing his plant germplasm with other researchers. He was always interested in people and trying to make a better world to live in. Work was his hobby, his joy, and the focal point of his life.

FOREIGN SERVICE

Burton had frequent requests to travel, lecture, and consult internationally. He traveled in 55 foreign countries, including the former Soviet Union (now the Russian Federation) and the Peoples Republic of China. In addition to lecturing and consulting with staff and students, he was an active collector of germplasm that could have value in crosses with domestic cultivars; collections were gathered in Nigeria, South Africa, Uganda, Kenya, Senegal, Brazil, Uruguay, Argentina, Germany, Switzerland, Italy, France, Great Britain, and India. During September and October of 1979, he chaired the meeting in India of the Advisory Committee on Sorghum and Millet Germplasm of the International Board of Plant Genetic Resources; discussed forage research at the Pasture Section of the Ministry of Agriculture in Greece; and consulted with forage research workers on a proposal for

cooperative research in Israel. In 1981 he led a committee to review the U.N. Development Programme on sorghum and millets at the International Crops Research Institute for the Semi-Arid Tropics in Hyderabad, India. The same year, Burton chaired the meeting of the Advisory Committee on Sorghum and Millet Germplasm of the International Board of Plant Genetic Resources in Senegal.

In 1961 Burton initiated cooperative research with scientists working for the Rockefeller Foundation to help increase India's millet production on 27 million acres of land too dry to grow other grain crops. Burton's suggestion was to make new hybrids by crossing his own Tifton 23A pearl millet hybrid and the best Indian cultivars. The suggestion was successful, and Indian pearl millet production increased from 3.5 million metric tons in 1965 to 8 million metric tons by 1970. From Burton's seeds the Indian scientists produced new hybrids that yielded 88 percent more grain than the native landrace millets. Although the original hybrids later were susceptible to disease, Burton said that the biggest thrill of his life was that millet production more than doubled from 1965 to 1970. Burton's work on pearl millet and Nobelist Norman Borlaug's work on wheat are credited with helping to prevent famine in India during the 1970s.

HONORS AND AWARDS

1949 American Society of Agronomy Stevenson Award
Fellow, American Society of Agronomy
1955 Honorary D.Sc. degree from Rutgers University
1962 Honorary D.Sc. degree from University of Nebraska
1968 Agricultural Institute of Canada Recognition Award
1973 DuPont Foundation Medal for Distinguished Service to Man
1975 Elected to the National Academy of Sciences
1979 DeKalb Crop Science Distinguished Career Award
1980 USDA Distinguished Service Award
Southern Turfgrass Association Honorary Member Award

1981 President's Award for Distinguished Federal Civilian Service
1982 University of Nebraska Alumni Achievement Award
University of Nebraska Master Alumni Award
1984 Elected into University of Georgia Agricultural Alumni Hall of Fame
1985 Fellow, Crop Science Society of America
1988 The Alexander von Humboldt Foundation Award
Honorary membership in the Grassland Society of Southern Africa
1994 Inducted into Georgia Turfgrass Hall of Fame
1995 Inducted into Georgia Golf Hall of Fame
1997 Inducted into Georgia Cattlemen's Hall of Fame
Crop Science Society of America Presidential Award

Sources of information used to summarize the long career of Glenn W. Burton were (1) Joe Burton, Glenn W. Burton's son, a soybean research geneticist at the Agricultural Research Service, U.S. Department of Agriculture, stationed at Raleigh, N.C., provided information from Glenn W. Burton's career records; (2) article by D. Wayne Hanna in *TPI Turf News* (March/April 2000, pp. 18-19); and (3) an article in the *Agricultural Research Newsletter* (2[1981]:15-16). Each of these sources provided information on his professional career, his personal interests, and his impact on the agriculture and turfgrass industries in the southern United States. My first contact with Glenn W. Burton was in 1962, when he was president of the American Society of Agronomy. I was very impressed with his organization, enthusiasm, and speaking abilities, qualities that had a lasting impact on me and others in the plant sciences. Although I did not have a close professional and personal relation with him, his dedication and interests in field plant research were those that I and others attempted to emulate.

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1966

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