

under sterile laboratory conditions was developed to conduct basic research studies and provide an additional screening technique to identify promising strains of mycorrhizae.

Turfgrass Breeding

The quality and stress tolerance of a turf is the product of environment, management practices and genetic potential of the grass plant. In many cases, the major limitations to quality turf is its inability to limit various stress effects, many of which can be modified or controlled through plant breeding.

Turfgrass breeding projects were directed toward reducing water use and maintenance costs, and developing resistance to several stresses. The intent was that scientists responsible for the breeding projects incorporate and utilize results of the stress mechanism and cultural practices studies.

The characteristics most desirable in potential new turfgrasses include:

- drought tolerance
- high and low temperature tolerance
- tolerance of non-potable water
- tolerance to acid, alkaline or saline soils
- reduced mowing and fertilization requirements
- traffic tolerance
- genetic stability of characters
- disease, insect and nematode resistance
- weed competition to reduce herbicide use
- tolerance to smog and other pollutants
- shade tolerance

The primary attention in turfgrass breeding focused on the improvement of zoysiagrass, native grasses, *Poa annua*, bermudagrass and bentgrass. Other turfgrass species and ground covers of potential merit also were considered. The quality of turfgrasses or other ground covers resulting from the proposed research were required to meet the needs of golf courses. In Table 15, the breeding projects, species, and status of varieties were summarized.

General - Cool Season Species

Rutgers University - Dr. C. Reed Funk

Kentucky Bluegrass, Tall Fescue, and Perennial Ryegrass

The USGA, golf and the entire turfgrass industry will be forever indebted to Dr. Funk for the turfgrass varieties his breeding program has

developed. His experience, methodology, keen eye and spirit of cooperation with industry has produced landmark varieties in our major cool-season turfgrass species. The USGA is very proud of the long and productive relationship with Dr. Funk, his research staff, graduate students, and colleagues at Rutgers University.

Dr. Funk, through the years, has had many significant accomplishments. He developed the first successful method of producing Kentucky bluegrass cultivars by intra-specific hybridization of apomictic parents. He revolutionized the use of perennial ryegrasses through the development of 'Manhattan' which is considered a landmark cultivar that significantly enhanced the usefulness of this species for golf and sports turf. Subsequent to the development of Manhattan, Dr. Funk has participated in the development of many widely used turf-type perennial ryegrasses.

In addition to breeding work with Kentucky bluegrass and perennial ryegrass, Dr. Funk developed the first and most widely used turf-type roughstalk bluegrass (*Poa trivialis*) in North America and ushered in a new generation of turf-type tall fescues. He has participated in the development of several strong creeping red fescues and hard fescues. During his travels and career, he has accumulated one of the most valuable collections of *Poa* and *Festuca* germplasm available in the world.

Dr. Funk participated in the discovery that endophytic fungi are associated with enhanced performance of perennial ryegrass, tall fescue, hard fescue, creeping red fescue, and Chewings fescue. This research demonstrated an association between the presence of endophytic fungi and resistance to chinch bugs, sod webworms and bill bugs. Within the fine and tall fescues, endophytic fungi produce resistance to chinch bugs, and also improve performance during summer stress. The breeding program has developed methods and procedures for creating turfgrass cultivars possessing endophyte enhanced performance.

Bentgrass

Creeping bentgrass (*Agrostis palustris*) and colonial bentgrass (*A. castellana*) are the two major types utilized in the United States. The major use of creeping bent is on golf greens and fairways. Colonial bent is used for golf course fairways, lawns and wherever there is a need for low growing, closely mowed turf. Greater activity in breeding colonial bentgrass was promoted by the Research Committee.