TURFAX™

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CONTENTS:

JB COMMENTS - THE LIVING SOIL

Understanding the concepts of a living soil is important in the construction and culture of a turfgrass root zone ecosystem, in order to maximize turfgrass health and minimize disease and other stresses. A soil can be categorized into the physical, chemical, and biological components. The biological component includes a diversity of microorganisms, actinomycetes, fungi, worms, and insects. The physical and chemical components affect the types and quantities of organisms that compose the living biological root zone system.

High-sand root zones are becoming a necessity on intensively trafficked putting greens, sports fields, and similar areas. The construction is with washed sand and an organic matter source, with both usually lacking in the needed balance of biologically active organisms. There are a number of problems associated with high-sand root zones during the initial 3- to 5-year period that typically are associated with what is essentially a non-living root zone. They include the following:

Root Disease. A disease commonly associated with high-sand root zones is take-all patch (*Gaeumannomyces graminis* var. *avenae*) which is particularly active on roots of creeping bentgrass (*Agrostis stolonifera* var. *stolonifera*). The causal pathogen of this disease is very active on relatively non-living root zones (a) where a biological balance has not developed, and (b) where the antagonist organisms that affect and partially control this causal pathogen have not yet emerged. Typically, the severity of this disease gradually declines in high-sand root zones as the living biological ecosystem develops. This can range from 4 to 7 years, depending on the cultural strategies utilized.

Surface Organic Layer Problem. A properly constructed high-sand root zone is particularly favorable for turfgrass shoot and lateral stem growth. Unfortunately, an active population of decomposer organisms has not yet developed in this relatively non-living root zone medium. Consequently, there is the likelihood that a organic layer may build up on the surface of the high-sand root zone, particularly where excessively high nitrogen fertility rates are applied. It may be necessary to practice mechanical thatch removal techniques, along with a more controlled nitrogen nutritional program involving slow-release nitrogen sources, until a balanced living biological ecosystem develops. Then the rate of organic matter biomass accumulation and its allied rate of decomposition will stabilize.

Hydrophobic Problem. The basic cause of a hydrophobic soil problem involves soil basidiomycetes fungi which during the process of mycelial decomposition result in their residues forming organic coatings around the sand particles. The consequence is substantially increased surface tensions and typical hydrophobic soil symptoms. These basidiomycetes associated with hydrophobic soil conditions tend to be more active on sand root zones that are deficient in a balanced population of soil biological organisms.

Nitrogen Nutrient Availability. Newly constructed high-sand root zones tend to have a relatively high nutritional requirement for nitrogen. This problem is associated with the non-living soil condition. The turfgrass nitrogen requirement is lowered by as much as 50% when a balanced root zone biological population develops. The use of a slow-release nitrogen carrier during this early phase is important.

Fairy Rings. High-sand root zones constructed with an undecomposed organic matter source may exhibit extensive fairy ring development, especially in Europe during the initial 3 to 4 years. The basidiomycete fungi that cause fairy rings are particularly active on undecomposed organic matter. This fairy ring problem may be minimized by use of a well-decomposed organic matter source, especially if it is properly composted to contain a balance of living beneficial soil organisms. Also, the use of composted topdressing material containing a balanced range of beneficial soil organisms is probably beneficial. Unfortunately, research to fully understand the organisms involved and means of maximizing their use in root zone construction and topdressing has not yet been accomplished.

In Summary. These problems can be minimized by encouraging the rapid development of a living, biologically balanced root system.

UPCOMING INTERNATIONAL EVENT:

July 20 to 26, 1997. Eighth International Turfgrass Research Conference. The University of Sydney, Sydney, Australia.

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UPCOMING JB VISITATIONS:

Provided for Institute Affiliates who might wish to request a visitation when I'm nearby:

- Nov. 3 to 7 - Indianapolis, Indiana.
- Nov. 13 to 15 - Rochester, New York.
- Nov. 18 to 19 - Phoenix, Arizona.
- Dec. 3 to 6 - Providence, Rhode Island.
- Dec. 7 to 12 - New York, New York.

ISTI Chief Scientist: James B Beard
TURFAX™ Production Editor: Harriet J. Beard

The goal of the six issue per year TURFAX™ newsletter is to provide international turf specialists with a network for current information about turf. This newsletter is faxed to all Institute Affiliates that use the ISTI technical assistance services on an annual basis. Faxing is more costly, but ensures quick delivery to those outside the United States.

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JB VISITATIONS:

August-Michigan State University

Participated in an Open House for the new enlarged space for the O.J. Noer Memorial Turfgrass Collection and the Turfgrass Information Center at the Michigan State University Library. This was a much needed improvement that will greatly increase the efficiency of those working at the facility and also visitors doing literature searches and studies of the Noer Memorial Turfgrass Collection. The Turfgrass Information File is an excellent system that allows anyone throughout the world to conduct literature searches by subject area and acquire abstracts of the scientific and popular articles published in the turfgrass area since 1973. This assumes the availability of a computer, printer, and telephone modem access. The annual fee for access to the TGIF literature search system is extremely modest and is a technical support facility that all modern turfgrass managers should utilize. For more details please contact, Turfgrass Information Center, 3 West Main Library, Michigan State University, East Lansing, Michigan 48824-1048.
Phone: 517-353-7209
Fax: 517-432-3693
Web Address: http://www.lib.msu.edu/tgif

Also attended the Michigan State University Turfgrass Field Day and a reception ceremony for dedication of the Kenyon T. Payne Antique Turfgrass Collection the night before. This is a cooperative project with the Turfgrass Program at Michigan State University, the Golf Course Superintendents Association of America, and the Michigan State University Museum. It is a very important activity dedicated to preserving a part of our heritage as a turfgrass industry. Those having items they may wish to donate to the collection for refurbishment and future display should contact Dr. C. Kurt Dewhurst, Director, Museum, Michigan State University, East Lansing, Michigan 48824-1325.
Phone: 517-2370. Fax: 517-432-2846.
E-mail. dewhurst@museum.cl.msuedu

September - Milano, Roma & Torino, Italy.

Conducted an assessment visitation to the Turfgrass Research Plots near both Torino and Roma, Italy, organized by the Italian Golf Federation. At the creeping bentgrass (*Agrostis stolonifera* var. *stolonifera*) plots on a high-sand root zone, a significant fairy ring infestation had developed during the previous year. Two applications of the fungicide, flutalonil, were applied in late spring and in early summer of 1996, which resulted in total control of the fairy ring infestation. Attempts are still being made to identify the specific causal organism.

The warm-season turfgrass plots near Roma for fairway and sports field conditions have now been established for one year and are progressing quite well on a sandy native root zone. A fairly complete range of *Cynodon* and *Zoysia* cultivars are included. It was noted that a group of three seeded *Zoysia japonica* cultivars have not performed as well as Meyer Japanese zoysiagrass during the first year in terms of both rate of establishment and the shoot density achieved.

Also visited several golf courses north of Milano to guide putting green and fairway conversion programs from near 100% *Poa annua* to creeping bentgrass. On one golf course that had putting greens of *Poa annua,* a substantial thatch problem, and a heavy clay soil, a program of intense vertical cutting, frequent topdressing with a high-sand mix, and an annual interseeding with Penncross creeping bentgrass has been followed. It has resulted in a 95+% conversion to Penncross over a 4-year period, with the exception of two putting greens that are very small size and positioned in a dense shaded environment. A fairway conversion program resulted in only 10% Penncross the first year due to the learning process. The second year interseeding resulted in a 30% stand and the third year in excess of 65% Penncross, with some fairways being over 90%. The timing of the interseeding process relative to climatic conditions appears to be a critical factor determining the speed with which the bentgrass conversion occurs.

A NEW GENERATION HYBRID VERTICAL DWARF BERMUDAGRASS BREAKTHROUGH

by

Dr. James B Beard and Col. Samuel I. Sifers

Historical Perspective. The turfgrass species utilized on putting greens prior to 1956 in the warm climatic regions, especially under humid environments, was common seeded dactylon bermudagrass (*Cynodon dactylon*). A major breakthrough occurred in 1956 with the release of **Tifgreen** hybrid bermudagrass (*Cynodon dactylon* x *C. transvaalensis*). Tifgreen was greatly improved in terms of sustaining a reasonable shoot density at the ¼ inch (6.4 mm) mowing height used on putting greens at that time. Its superior characteristics led to the rapid conversion of putting greens to Tifgreen in the southern United States.

Nine years later the hybrid bermudagrass cultivar **Tifdwarf** was released. Tifdwarf sustained a better density than Tifgreen as mowing heights were lowered to 3/16 inch (4.8 mm) on putting greens, plus it had a slower growth rate and darker-green color. The slower growth rate did present some limitations in initial establishment when compared to Tifgreen. Also, a different cultural system evolved to bring out its desirable characteristics. Thus, there was a learning curve in understanding the cultural requirement of Tifdwarf. For the past 40 years Tifgreen and Tifdwarf have been the standard cultivars used on putting greens in warm to hot climates throughout the world.

Dwarf Terminology. The dictionary defines **dwarf** as a plant much below the normal size of its species or kind, which is formed as a result of genetic expression or by cultural techniques that suppress growth. The dwarfness of bermudagrasses discussed in this paper is primarily an expression of genetically controlled characteristics. These genetic controls of dwarf characteristics involve multiple components. Included are the (a) **vertical shoot components** such as potential vertical leaf growth extension rate per unit of time and the inherent relative leaf length and (b) **horizontal shoot components** such as the internode length genetic potential, internode density genetic potential, and outward growth rate potential per unit of time of the lateral stems, especially the stolons. Of course, the dwarf cultivar should also have a high shoot-leaf density and tolerance to extremely close mowing heights of 1/8 to 3/16 inch (3.2 to 4.8 mm) in order to perform adequately on putting greens.

Tifdwarf is a genotype that has morphological dwarfing and reduced growth rate potential in both the vertical and horizontal planes. This results in a very slow establishment rate, slow recuperative potential from divot openings, ball marks, and pest turf injury; plus less competitiveness against invading weeds and off-type bermudagrass species. From a putting green standpoint, it would be desirable to have a genotype that is not a full dwarf, but rather has vertical dwarf characteristics, but normal horizontal or lateral outward extension capabilities. The newer dwarf hybrid bermudagrasses have been described as "super" dwarfs or "ultra" dwarfs. Actually, most of these newer generation dwarf bermudagrasses appear to possess vertical dwarf characteristics but retain the desired more vigorous horizontal growth, particularly when compared to Tifdwarf. Thus, they could more correctly be termed **vertical, intermediate, partial or semi dwarfs**.

New Generation Vertical Dwarfs. Now a promising new generation of hybrid bermudagrass cultivars is emerging for putting greens. These cultivars tend to be dominated more by the *transvaalensis* characteristics of the hybrid, such as a higher shoot-leaf density, slower vertical leaf extension rate, and an increased dominance of stoloniferous growth relative to rhizomes. Historically the *C. transvaalensis* have tended to become puffy and prone to scalping at a cutting height of 1/4 inch (6.4 mm), especially when not frequently groomed and/or vertically cut. Now with the much closer mowing heights approaching 1/8 inch (3.2 mm) and development of the grooming attachment for greensmowers, the bumpiness and scalping problems on greens are greatly reduced if proper cultural practices are followed.

As with any new genotype possessing different morphological and growth characteristics, there will be a learning curve in development of the proper cultural system for each new cultivar. An individual not recognizing the importance of accepting and learning new approaches to the culture of a new generation cultivar for greens, but rather clings to practices that have been successful for them in the past with Tifdwarf or Tifgreen may experience problems. He or she may blame the failure on the cultivar, when in fact it may be their own inflexibility in adapting to the cultural needs of a new generation dwarf cultivar.

CHAMPION VERTICAL DWARF HYBRID BERMUDAGRASS

Champion is a triploid (2n=27) hybrid bermudagrass cultivar developed by Richard Morris, Michael A., and Scott D. Brown of Coastal Turf, Inc., Bay City, Texas. It was selected from a group of dwarf hybrids that had been collected and evaluated since 1987. Champion was selected in 1987 from a segregated patch on a Tifdwarf putting green in Southeast Texas.

DNA amplification fingerprint analyses indicates that Champion is distinctly different from both Tifdwarf and Tifgreen, and was either a somatic mutant out of Tifdwarf hybrid bermudagrass or a common ancestor from the two. A plant patent application was made in 1995 and is expected to be issued soon.

Morphological-growth parameter assessments were conducted during 1995 by J.B Beard and S.I. Sifers of ISTI in College Station, Texas. Seven types of measurements were made on four replicate sets of mature turfs in each of two experiments conducted in the spring and repeated again in the summer of 1995. These results are summarized in Table 1.

Leaf Characteristics. Champion exhibited a significantly slower vertical leaf extension rate, being in the order of 56% slower than Tifdwarf and 82.5% slower than Tifgreen. This characteristic contributes less resistance to ball roll and translates to a more rapid speed of ball roll on closely mowed turf surfaces.

Furthermore, the leaf width of Champion was found to be significantly more fine than the two hybrid bermudagrasses, being 13% more narrow than Tifdwarf and 36.3% less than Tifgreen.

Stem Characteristics. The growth habit is by both stolons and rhizomes. In terms of lateral stem development as measured by the number of stolons extending outward, Champion exhibited significantly greater stolon numbers in the order of 2.6 times greater than Tifdwarf and 2.8 times that of Tifgreen. This extraordinary rate of lateral stem development is the morphological mechanism that contributes substantially to more rapid rates of both turf establishment and turf recovery from damage.

The internode lengths and corresponding number of internodes did not vary significantly among Champion, Tifdwarf, and Tifgreen. This indicates that the higher shoot density is attributed primarily to a greater number of lateral stems.

Traffic Stress. Wear simulation experiments showed Champion to be considerably more wear tolerant than Tifdwarf at a 1/8 inch (3.2 mm) cutting height. Champion had 32% more surviving green leaves/shoots by weight than Tifdwarf after 1,900 revolutions of the simulator.

Weekly assessments of the turf recuperative rate following mechanical divot simulation injury to the mature turfs revealed Champion to be significantly superior. It exhibited 1.8 times more rapid turf recovery than Tifgreen and 3.4 times more rapid recovery than Tifdwarf. This improved turf recovery rate will provide a better quality turf surface under intense use, including damage from ball marks and also will result in less proneness to weed invasion.

Table 1. Morphological-growth parameter comparisons among three triploid hybrid bermduagrass cultivars.

Genotype	Vertical Leaf Extension Rate (mm per day)	Leaf Blade Width (mm)	Stolon Number (per linear 100 mm)	Turf Recovery Rate (percent)	
				Week 3	Week 4
Champion	0.7 a*	1.00 a*	12.2 a*	68.3 a*	95.0 a*
Tifdwarf	1.6 b	1.16 b	5.4 b	20.0 c	76.7 ab
Tifgreen	4.0 c	1.57c	4.4 b	38.3 b	65.0 bc

* Numbers followed by the same letter in a column are not significantly different based on the Duncan Test (p=0.05).

Shoot Density. Champion has been maintained under modern putting green conditions of a 1/8 inch (3.2 mm) cutting height and daily mowing since September of 1994 . Under these conditions it has sustained a distinctly higher shoot density than Tifdwarf, and a much greater density than Tifgreen, with stimpmeter ball roll assessments being above 9 feet (2.75 m). At a 1/8 inch (3.2 mm) cutting height Champion had a significantly greater shoot density of 2,133 per sq. dm. versus 1,104 for Tifdwarf, or 93% more shoots, plus a 58% greater shoot dry weight.

Low Temperature Stress. Assessments of low temperature hardiness in a cold stress simulation chamber revealed Champion to be distinctly more low temperature hardy than Tifgreen and slightly better in low temperature hardiness than Tifdwarf (Table 2).

In terms of fall low temperature color retention or chill tolerance, Champion turns distinctly purple and was indistinguishable from Tifdwarf in terms of color during winter dormancy.

Culture. Champion has a very good establishment rate from vegetative sprigs. Over an 8-year period the formation of seedheads has not been observed on Champion.

As with most vertical dwarf hybrid bermudagrasses, Champion can become thatchy if the appropriate cultural practices are not followed.

To date, no extraordinary disease or insect problems have been observed on Champion.

Winter overseeding of Champion was successfully accomplished in the fall of 1995 and 1996 at multiple locations in Texas. Champion exhibited a superior ability in spring transition from the winter overseeded turf when compared to Tifdwarf.

Use. One or more putting greens have been established and are currently in use on 25 golf courses, ranging from Texas to California, with nine full 18-hole and two 9-hole course conversions.

Table 2. Comparative low temperature stress resistance assessments of Champion and Tifdwarf hybrid bermudagrasses maintained at a mowing height of 3.2 mm (1/8 inch). Stress was imposed via an environmental simulator, and was the temperature of the total turf-soil column. Turfgrass recovery is assessed based on regrowth as a percent of the potential. ISTI - College Station, Texas, 1996.

Shoot Recovery Assessment		Cold Stress Temperature of Turf-Core				
Week	Cultivar	30° F	25° F	20° F	15° F	10° F
1	Champion	40 a*	3 c	0 c	0 c	0 c
	Tifdwarf	33 b	3 c	0 c	0 c	0 c
3	Champion	95 a	95 a	96 a	0 c	0 c
	Tifdwarf	60 b	60 b	63 b	0 c	0 c
4	Champion	100 a	98 a	100 a	3 c	0 c
	Tifdwarf	80 b	68 b	65 b	0 c	0 c

*Means of four replications. Means followed by the same letter in the same week and column are not significantly different at the 5% level LSD t-Test.

Note. There are three other dwarf hybrid bermudagrasses that are in various stages of release. Morphological-growth characteristizations as to their dwarfness relative to Tifdwarf and Champion are yet to be completed.

One is FloraDwarf which has been patented and released, with significant quantities of vegetative material projected to be commercially available in 1997. The developer is Dr. Al Dudeck at the University of Florida - Gainesville.

The second is MS Supreme, which is in the process of being released with projected commercial availability in 1998. It has been developed by Dr. Jeff Krans at Mississippi State University.

The third is currently known by the experimental number TW72 and is in the least advanced stage of development, with projected commerical availability in 1999. It is being developed by Dr. Wayne Hanna at the Georgia Coastal Plain Experiment Station.