TURFAX™
of the
International Sports Turf Institute, Inc.

Volume II Number 2 *March-April 1994*

TURFAX™ — The International Newsletter about Current Developments in Turfgrass

CONTENTS:

The goal of this 6 issue per year newsletter is to provide international turf specialists with a network for current information about turf. It is FAXed to all Institute Affiliates that use the ISTI technical assistance services on an annual basis. FAXing is more costly, but ensure quick delivery to those outside the U.S.

For non-affiliates, a TURFAX™ subscription is now available by an annual payment of U.S. $60.00. Payment may be made by sending a check to the address below. Foreign orders please send a check or money order on a U.S. bank.

Note: As of May 9 will move our summer office address to: **6900 E. Kelenski Dr., Cedar, Michigan, 49621, USA; phone: 616-228-6328; FAX: 616-228-2848.**

HIGH-SAND ROOT ZONES:

This issue starts a two-part series on the Texas-USGA System of high-sand root zone modification for intensively used turfs such as greens and sports fields. The method was developed in the 1950's at Texas A&M University under the direction of soil physicists Dr.'s Morris E. Bloodworth and J.B. Page. The research was partially funded by the United States Golf Association. Thus, the description Texas-USGA Method. Dr. Marvin H. Ferguson, then director of the USGA Green Section had interacted closely with Dr.'s Bloodworth and Page and their graduate students. He was the key leader in the transfer of this innovative technology to golf course users. Subsequent research conducted by soil physicist Dr. Kirk Brown, resulted in modifications of the specifications. For the first time detailed construction specifications for total root zone modification and a soil physical testing procedure were established to identify root zone components and their percentage compositions that met the specifications. While this method is named for the original research location and funding agency, it is uniquely designed for use throughout the world and has successfully functioned in a diverse range of climates for more than 30 years.

Production Editor: Harriet Beard
Direct inquiries to: International Sports Turf Institute, Inc.
1812 Shadowood Drive,
College Station, Texas 77840 USA.
Telephone: (409) 693-4066.
Fax: (409) 693-4878.

JB COMMENTS:

In my book **Turfgrass: Science and Culture** and those of many others since then, the zoysiagrasses (*Zoysia* spp.) are shown as having excellent drought resistance comparable to the bermudagrasses (*Cynodon* spp.). This has been the prevailing concept for many decades. However, recent research conducted by Sifers and Beard has shown otherwise.

For example, 3 years of investigations under droughty conditions in College Station, Texas, revealed that the zoysiagrass cultivars turned brown and entered dormancy between the 45th and 55th days, whereas most bermudagrass cultivars remained green for at least 120 days with a few cultivars retaining their green color for more than 150 days of severe drought stress. Green color retention during drought stress is referred to as dehydration avoidance. Once irrigation was applied the bermudagrasses readily recovered. A much higher percentage of the shoot meristems recovered from the bermudagrass turfs than from the zoysiagrass turfs.

These findings are supported by our evolutionary understanding of the two species. The *Zoysia* species evolved under the warm-very humid conditions of southeast Asia, whereas the *Cynodon* species evolved under the warm-semi-arid climates of southeastern Africa. Consequently, the bermudagrasses are very deep rooted while the zoysiagrasses are quite shallow rooted, causing the latter to be more prone to water stress problems. Under favorable growing conditions the bermudagrasses exhibit root depths of 6 to 7 feet (1.8-2.1 m), even at a 1 inch (25 mm) mowing height, while zoysiagrass rooting was typically no more than 20 inches (0.5 m).

It is very evident from these investigations that the zoysiagrasses possesses less than half the dehydration avoidance of the bermudagrasses, as well as substantially lower drought resistance. Our books need to be rewritten in this regard.

WINTERKILL AND ICE COVERS:

Winterkill is a term used to describe all types of death to turfs during the winter. Other authors frequently attribute one type of kill as being caused by extended ice covers. The mechanisms suggested involve the ice cover serving as a barrier that either prevents needed oxygen from reaching the underlying plants or trapping toxic gases around the plant causing their death.

Numerous investigations in the 1960's by this author at Michigan State University revealed turfgrasses tolerance to extended ice covers. Both creeping bentgrass (*Agrostis stolonifera*) and Kentucky bluegrass (*Poa pratensis*) survived 150 days in ice blocks at 25°F (-4°C). Annual bluegrass (*Poa annua*) was killed between the 75th and 90th day surrounded in a block of ice.

Death of turf frequently occurs in low depressional areas where an ice sheet has existed during the winter. However, it is far more common for the turf to be killed in association with the ice sheet in the following manner. First, standing water either before freezing or after thawing of the ice results in crown hydration of the plants. If this is followed by a rapid drop in temperature to below 20°F (-7°C) kill typically results. The species most prone to injury is annual bluegrass, especially if located on poorly drained sites.

UPCOMING JB VISITATIONS:

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

- April 14 to 15 - Columbus, Ohio
- May 14 to 24 - Australia
- June 7 to 8 - Orlando, Florida
- June 9 to 16 - Italy
- June 27 to 28 - San Diego, California
- July 1 to 21 - Scotland and England
- July 24 to Aug. 3 - Rhode Island

JB VISITATIONS:

North Carolina - January

Presented talks before the Northern Carolina Turfgrass Conference on xeriscaping issues and new trends in sports turfs. A report was presented by a graduate student at North Carolina State University involving the cooling of greens by mechanical fans. The studies involved comparisons of various types of fans and their placement relative to the amount and uniformity of cooling that can be achieved. Will report more to you as soon as the first research paper is available.

Arizona - January

Participated as a speaker in the American Sod Producers Annual Winter Conference in Scottsdale, including a panel discussion on environmental issues, plus a talk on international highlights in sod production. American growers are very much interested in developments in other parts of the world. They also are very optimistic that a turn-around in the sod market has finally occurred in the United States after several slow years.

Texas - February

Participated in the International Golf Course Conference and Show at Dallas, sponsored by the Golf Course Superintendents Association of America. Presented a two-day seminar on Basic Botany and Physiology of Turfgrasses followed by a lecture summarizing the second year of studies on rolling greens. A summary of that paper was included in the January-February Turfax™.

During the conference Dr. Jeff Krans presented a summary of some very interesting studies on algae problems of greens. The basic difficulties appear to be a diverse range of different species of algae that cycle in-and-out on putting greens throughout the growing season. Perhaps this is one of the reasons the algae problem has been so difficult to control in the past.

One item generating considerable interest at the equipment show was battery powered triplex greenmowers. Environmentalists are raising the issue of noise problems on golf courses. The state of California has passed a law limiting the noise levels of turf equipment. Time will tell how widely this new innovation is used. Battery driven mowers are not new and in fact date back as far as the 1930's when the first units were commercially marketed for use on lawns, plus one walk-behind greenmower.

Minnesota - February

Participated as a speaker in a one-day clinic on nitrogen carriers in Minneapolis, Minnesota. There are winterkill problems of the low temperature kill type in the area. It is highly variable depending on how the cold fronts passed through and whether the ground was covered with snow when the severe early freeze occurred in late fall. Exceptionally low temperatures occurred quite early, with *Poa annua* greens being particularly prone to kill, if not covered with snow.

Also visited Dr. Don White at the University of Minnesota to observe their breeding program on annual bluegrass (*Poa annua*). It is a very intriguing, one-of-a-kind program that has been under way for some time. Development of stable perennial cultivars is not a simple research problem. The on-going research is of great interest, but it will be some time before commercially available cultivars can be released.

DO THINGS EVER CHANGE?

"the putting greens have reached so high a standard that we have become spoilt and pampered" by Bernard Darwin in **Golf Courses**, Martin A.F. Sutton, editor, 1933.

UPCOMING INTERNATIONAL EVENTS:

May 9-12, 1994 New Zealand Turf Culture Institute. Palmerston North, New Zealand. Encompasses educational sessions in turfgrass culture for golf, bowls, and sports fields, plus a trade show.

Contact Keith McAuliffe, Director, New Zealand Turf Culture Institute. Box 347, Palmerston North, New Zealand. FAX: 64/6-3540081.

July 4-8, 1994 Second World Scientific Congress of Golf. St. Andrews, Scotland. Invitational and volunteer papers will be organized in 3 themes: Golfer; Equipment, and Golf Course. the last encompasses the turfgrass topics. Lodging available at the University of St. Andrews.

Contact Dr. Martin Farrally, Congress Director, Department of Physical Education, University of St. Andrews, St. Andrews, Fife, KY16 9DY, United Kingdom.
FAX: 334-74322.

July 27-29, 1994 American Sod Producers (ASPA) Summer Convention and Field Days. Newport, Rhode Island.

Tours will play a major role in this year's Summer Convention, with both ASPA-member farms and the University of Rhode Island (URI) Agricultural Experiment Station being featured in this day-long event. At URI alone, you'll see cultivar evaluations for high- and low-maintenance of Kentucky bluegrass, perennial ryegrass, tall fescue, fine fescues, and bentgrass. Other high-lights include commercial and experimental fungicides, nitrogen use, organic amendments, weed control, and low-maintenance areas.
The Newport Islander Doubletree Hotel will be headquarters for the Summer Convention.

Contact Mr. Douglas H. Fender, American Sod Producers Association, 1855A Hicks Road, Rolling Meadows, Illinois 60008, USA. FAX: 708-705-8347.

PUBLICATIONS AVAILABLE:

Wisconsin Turf Research- Results of 1992 Studies.
University of Wisconsin and Wisconsin Turfgrass Association publication. Volume X. 42 pages (1993). Publication contains 9 reports of ongoing turfgrass research activities at the University of Wisconsin. They range from clippings removal versus mulching, turfgrass evaluations, snow mold control assessments, nitrogen carrier studies, fertilizer composition as related to nitrogen soil leaching, nutrient pesticide runoff losses from turf, organic amendments for putting greens and assessment approaches to stimulate thatch decomposition. Single copies available free of charge.

Contact Dr. Wayne Kussow, Department of Soil Sciences, University of Wisconsin, Madison, Wisconsin 53706.
FAX: (608) 262-4743.

1993 Turfgrass and Ornamentals Research Summary.
Cooperative Extension and Agricultural Experiment Station, University of Arizona, Tucson. Series P-95. Volume IV. 213 pages (1993). Contains 26 research reports on studies being conducted at the University of Arizona. They range from assessments of winter overseeding cultivars to the evaluation of buffalograss, tall fescue, and zoysiagrass cultivars; extensive studies on herbicide effectiveness and selectivity to the desirable species; use of PGR's on Tifway bermudagrass; soil thatch and microbial populations in high-sand root zones, water use rates of bermudagrasses for in arid climates, and turf irrigation with waste water. Single copies available free of charge.

Contact Dr. David M. Kopec, Department of Plant Science, Room 201, Building 36, University of Arizona, Tucson, Arizona 85721. Phone: (206) 621-5323.

TEXAS-USGA ROOT ZONE MIX SPECIFICATIONS

PART I

The greatest problem encountered in maintaining turfgrasses on sports fields and greens is soil compaction. This pressing together of soil particles into a more dense mass results in impaired drainage of excess water and a loss of proper aeration needed to provide oxygen for healthy root growth. As a consequence, there is a decline in turfgrass health, vigor, and recuperative ability following turf injury from traffic stresses.

Soil compaction and the resultant negative effects can be minimized by selection of a high-sand root zone of the proper particle size distribution and associated key physical and chemical characteristics. The result is minimum proneness to compaction, adequate drainage of excess gravitational water, and proper aeration to provide needed oxygen for root growth and related soil biological activity.

However, such high-sand root zones are very droughty due to poor water retention capacity unless a perched hydration zone, such as achieved through the Texas-USGA Method, is used in the construction specifications. In addition, high-sand root zones tend to have a low cation exchange capacity (CEC), thus, the leaching of essential plant nutrients is a greater concern, particularly during the initial years following construction. This potential problem can be minimized through the use of slow-release nutrient carriers and/or the timely use of foliar feeding techniques.

Composition of the 300 mm (12 in.) settled depth of root zone mix should be selected based on specific physical tests conducted in a reputable Physical Soil Test Laboratory. The test report specifies the particular materials and the percentages in which they are to be mixed.

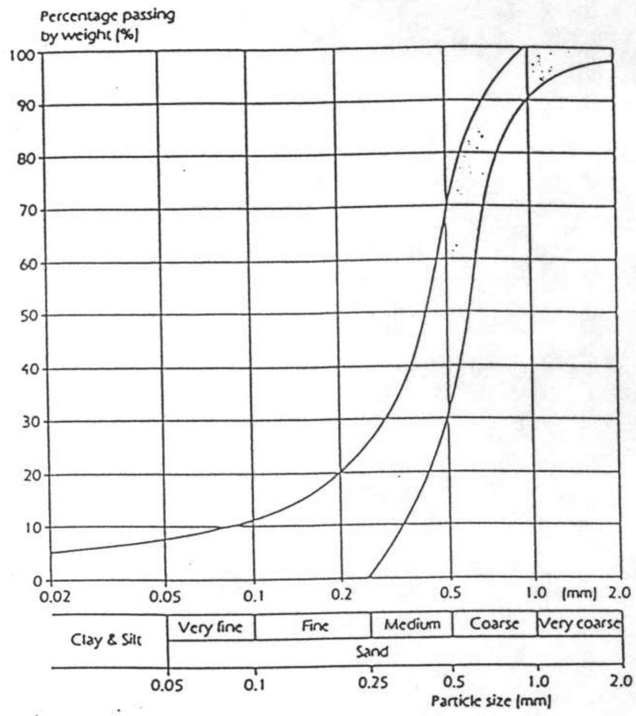

Figure 1. Grading analysis particle size distribution for the Texas-USGA root zone mix.

Composite Root Zone Mix
Particle Size Distribution

The suggested specifications for the particle size distribution of the root zone mix are shown in Table 1. Figure 1 is a graphic illustration of the same data as a grading analysis distribution.

Table 1. Suggested guidelines for particle size distribution of the Texas-USGA root zone mix.

Gravel	Very Coarse	Coarse Sand	Medium Sand	Fine Sand	Very Fine Sand	Silt and Clay
>2 mm	1 - 2 mm	1.0 -0.05 mm	0.50-0.25 mm	0.25-0.10 mm	0.10-0.05 mm	<0.05 mm
Maximum 3% Ideal 0%	Maximum 7%		Minimum 50%	Maximum 17%		Maximum 3% clay 5% silt
Maximum Not more than 10% of total		Desired range 65% Minimum 75% Optimum		Maximum Not more than 25% of total, preferably 10% of total		

COMPONENT DESCRIPTIONS OF ROOT ZONE MIX

It is important that the three components selected for the root zone mix be free of toxic levels of materials such as heavy metals, persistent crop herbicides, and industrial organic chemicals. Minimal amounts of soluble salts, boron (B), and sodium (Na) are preferred.

Sand Component. Angular, hard, washed, screened silica sand is strongly suggested. Avoid high pH calcarious sands. The preferred sand component particle size is: 100% below 1.0 mm (18 mesh), 65% below 0.5 mm (35 mesh), 25% below 0.25 mm (60 mesh), and 5% below 0.05 mm (270 mesh). Mesh sieve size refers to the US Standard of the (USDA).

Organic Matter Component. It is suggested that the organic matter source selected be well decomposed and have no more than 15% ash or mineral content, preferably less than 10% mineral content. Examples include peat humus and reed-sedge peat. The organic material should be shredded to ensure mixing uniformity, but not to the degree that the material is pulverized thereby causing reduced soil water infiltration.

Soil Component. A **sand, loamy sand,** or sandy loam topsoil is suggested. The soil should be shredded to insure mixing uniformity and should be screened to remove stones and other debris.

COMPOSITE ROOT ZONE MIX PHYSICAL AND CHEMICAL PROPERTIES CRITERIA

The physical or chemical properties preferred for the root zone mix are summarized in Table 2.

Mix Water Infiltration Rate. The preferred water infiltration rate for a laboratory compacted root zone mix is in the range of 150 to 300 mm per hour (6 to 12 in./hr.). The rate in the laboratory tests should not exceed 600 mm per hour (24 in./hr.). The upper limit is designed high enough to account for the normal on-site reduction in infiltration rate that occurs during the first 3 to 4 years, due to increases in roots and organic materials.

Mix Aeration Porosity. An acceptable total pore space volume is between 40 and 55%. The preferred distribution would be 22% capillary and 25% noncapillary pore space. Noncapillary pore space should be not less than 15%. The measurements are made on a root zone mix that has been allowed to percolate water for 8 hours and then is drained at a tension of 400 mm of water.

Mix Water Retention Capacity. An acceptable laboratory-established capacity would be between 12 and 25% by weight on a 105 to 111°C-oven dry soil basis. The available water in the soil is estimated to be that held at a tension of 400 mm of water, which is the approximate distance from the surface to the drain line.

Mix Bulk Density. The preferred root zone mix should have a bulk density of 1.4 grams per cc.

Table 2. Suggested physical and chemical guidelines for the composite root zone mix.

Physical/chemical property	Units	Acceptable range	Preferred
Infiltration rate of compacted mix	mm per hour (in./hr.)	150-600 (6-24)	150-300 (6-12)
Total pore space Noncapillary pore space Capillary pore space	% by volume	40-55 15-30 15-25	47 25 22
Water retention capacity	% by weieght (mm H_2O/10 mm of soil)	12-25 (1-2)	18(1.5)
Bulk density	grams/cc	1.2-1.6	1.4
Soil reaction	pH	6.0-6.5	5.5-8.0
Soil salinity (electrical conductivity)	EC x 10^{-3} (millimhos/cm)	<4	0-1
Soi sodium (Na)	ESP	<15	—