TURFAX™
of the
International Sports Turf Institute, Inc.

Volume II Number 3 *May- June 1994*

TURFAX™ — The International Newsletter about Current Developments in Turfgrass

CONTENTS:

- The Amazing Grass Plant.
- JB Comments.
- JB Visitations.
- Research Summary.
- Publications Available.
- Texas-USGA Root Zone Specifications - Part II

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 ensures quick delivery to those outside the United States.

For non-affiliates, a TURFAX™ subscription is available by 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.

Our perennial turfgrass species evolved over 50 million years. They have been cultured by humans to provide an enhanced environment and quality-of-life for more than 10 centuries.

The Amazing Grass Plant:

The grasses (*Poaceae*) are the most ubiquitous of the higher plant groups found on this earth. With an estimated 600 genera and 7,500 species, the *Poaceae* ranks third in number of genera among families of flowering plants. In respect to completeness of representation in all regions of the world and to percentage of the total world's vegetation, grasses surpass all other genera. Grasses are one of the first permanent vegetations to reappear after disasters, such as volcanic activity, extended droughts, floods, fires, explosions, abandoned urban ghettos, and battlefields. Without the forgiveness of the grasses, many ill-advised construction excavations and agricultural activities would have had far more disastrous effects on our vital natural resource, the earth's surface soil mantle, on which we live.

To humans, grasses are the most important of all plants. The cereal grains and corn, all members of the grass family, serve as food for humans and animals. A host of grazing ruminant animals use grasses as their major food source as forage, pasture, and prepared feeds. Bamboo is a major building material. Grasses of all types represent a large source of biomass for production of methanol, an energy source.

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:

This writer has spent many, many hours searching the publications and art work of earlier centuries in the British Museum, Victoria and Albert Museum, and Kew Gardens Libraries of London, England. Based on these investigations I've concluded that turfs as we know them today started to evolve more than 10 centuries ago. For many centuries people have been willing to devote time and resources to enhance their quality-of-life and recreational opportunities through turfgrasses. Equally important, throughout these many centuries turfgrasses have played a vital role in protecting our environment, especially in more populated urban areas, long before the quality of our environment became a major issue of national and international importance to modern societies. No other form of vegetation has been as effective in protecting our vital soil resources and water quality in these urban areas as have turfgrasses.

Why then have environmental radicals focused so much effort on allegations that turfgrasses are a major contributor to apocalyptic scenarios of environmental decline? These individuals use unsubstantiated "pseudo scientific" claims and broad accusations that amount to nothing more than scare tactics. These ill-founded claims are readily disseminated to the public through the popular information channels of television, radio, newspapers, and magazines. When will the producers/editors in charge of these scare-of-the-week efforts start to act in a responsible manner by determining the validity of such claims before their release is approved?

It should be noted that although these environmental radicals present themselves as representatives for the "little" people with limited funding. However, many of these organizations are very well funded.

Conclusions based on sensible results-oriented scientific assessments do not support the much bally-hooed, unsubstantiated claims of these environmental radicals. Unfortunately, the turfgrass industry has not formed an effective coalition to respond to the accusations. Based on extensive research conducted over the past six to eight years, we now have sound science-based information to offer authoritative counter responses to the unsubstantiated claims of the environmental radicals. However, there is still the important dimension of individuals communicating at the grass roots level. This is where the individual turfgrass practitioner can play a very important role.

It behooves each of one of us to carefully study the available published information on environmental benefits and the environmental protection dimensions wherein turfgrasses play an important role. Every opportunity should be taken to communicate the available science-based information to individuals at the local level. One of the best approaches can be made through presentations before classes at the local schools, as well as speaking before garden clubs and local business organizations. Specific published articles and information on the subject should be provided to the local press, newspapers, and magazines. In summary, it is important that each of us get involved.

Fables employed by the environmental radicals focus on the following allegations.

- Turfgrasses use far more water than trees and shrubs, thus, we should substantially reduce turfgrass areas and plant trees.
- Turfgrasses are a major contributor to the pollution of our surface waters via soil erosion and applied fertilizers.
- Turfgrasses are a major threat to ground water quality since they are one of the largest users of pesticides and fertilizers.
- Turfgrasses are much more costly to maintain than trees, shrubs, ground covers, and flowers; and thus should be reduced because society can not afford this expenditure.

J.B. VISITATIONS:

California - March.

Presented four talks before the Southern California Turfgrass Institute at the California Polytechnic University in Pamona. Attended a session on employee rights, workmans compensation, and hiring-termination laws of California. These laws combined with very liberal interpretations by the California agencies and subsequent judgements in the courts are extraordinarily complex and strongly in favor of the employee. It makes the extent of record keeping, written documentation, and continual monitoring of each employee very complex and costly, especially for a small business. Will this situation spread to other states in the United States and to other countries around the world? This may be of great concern to the many turfgrass businesses around the world that fall within the small business category.

Australia - May

Presented two invited lectures on xeriscaping and on turfgrass water conservation before the Australian Irrigation Association Exposition in Sydney. Unfortunately the xeriscaping promotion has reached Australia, specifically the Melbourne area.

Visited the Royal Sydney Golf Club in the company of John Odell, the golf course superintendent. He has devoted the last five years to a major upgrading-rebuilding program. John reports that Wintergreen bermudagrass (*Cynodon dactylon*) is performing quite on the fairways. Wintergreen was developed by Peter McMaugh. The key characteristics are good low temperature color retention and an elaborate lateral stem system of rhizomes and stolons that give superior sod strength. John also is actively involved in tests to introduce some native Australian grasses into the rough areas. These species are unique to Australia, but might have potential in other parts of the world under similar climatic conditions.

Visited the Parramatta Stadium where Graeme Lougan, is the Curator. The stadium was rebuilt the previous year to a high-sand + mesh element root zone construction. During the current playing season they have had a total of 48 games, including rugby union, rugby league, and soccer; in addition to baseball in the early part of the year. The turf was in excellent condition and according to Graeme was far superior to anything they have had in previous years. It is interesting to note that he also is providing leadership in the formation of a sports grounds manager organization.

In Melbourne visited the Melbourne Cricket Ground in the company of Tony Ware, Curator, and John Mitchell, the President. The grounds is one of the most intensely used in the world. In the summer they have a full cricket season on the field, while in the winter Australian rules football is played, plus some guest rugby games and major concerts. The field was reconstructed to a high-sand + mesh element root zone which was completed in December of 1992. The turf is a composed of bermudagrass (*Cynodon dactylon*) winter overseeded with perennial ryegrass (*Lolium perenne*). During the Australian rules football season they typically had 55 games, with little grass surviving by the end of the season. However, after reconstruction to the high-sand + mesh element root zone they increased the number of games to 104, almost double, and yet have been able to sustain a turf cover far superior to any in past years. This intense use typically represents 4 to 6 games per weekend. During the past year the longest time that Tony had between events to conduct maintenance and repair work was 5 days.

Visited Moonee Valley Race Course in the Melbourne area, where Mr. Ian Trevethan was my host. Had an opportunity to view an extensive set of large research plots involving various root zone constructions and turfgrass installations. For over a year they have been running horse racing tests over this track area. It is a very unique situation that will be yielding very important information.

RESEARCH SUMMARY:

Root Responses of Tifway Bermudagrass to Nitrogen Application Rates.

D.M. Gilstrap, J.B. Beard and F.M. Hons.
Texas A&M University.

Turfgrass specialists recommend that one-time applications of water soluble nitrogen (N) not exceed 1 lb per 1,000 sq. ft. (49 kg N ha^{-1}). This recommendation is supported mainly by research on cool-season turfgrasses. This field study assessed root growth of Tifway bermudagrass [*Cynodon dactylon* (L.) Pers. x *C. transvaalensis* Burt-Davy] following ammonium nitrate fertilization. Seven N rates of 0.0, 0.5 1.0, 1.5, 2.0, 3.0, and 4.0 lbs N per 1,000 sq ft. (0, 24, 49, 73, 98, 146, & 195 kg N ha^{-1}) in 4 replications were applied once to an established turf grown on a high-sand root-zone and mowed frequently at a 1 inch (25 mm) height of cut, with clippings returned. The experiment lasted from late spring until fall, with measurements taken bi-weekly.

Visual turf quality, clippings yield, and concentrations of leaf-blade tissue N, soil nitrate, and soil ammonium increased initially with increasing N rates. Root mass, root length, root density, and tissue total nonstructural carbohydrates showed little or no differences among N treatments. Root growth did not decrease significantly with one-time applications of a water soluble N fertilizer at up to 4 times the generally recommended upper rate for cool-season turfgrasses.

The findings show that root impairment from high nitrogen fertilization rates is not a problem on the warm-season bermudagrass, which is in distinct contrast to the negative effects on rooting of cool-season turfgrasses.

As with most research, this work raises more questions. For example, do all warm-season, C-5 turfgrasses respond similar to bermudagrass in terms of no negative rooting effects from high N rates? It is this author's guess that they do.

PUBLICATIONS AVAILABLE:

Rutgers Turfgrass Proceedings. Volume 24, 164 pages (1993). The first 55 pages contain 16 articles of speakers who participated in a Turfgrass Expo held in December of 1992. The main 110 pages contain 7 research reports summarizing the work of Rutgers University turfgrass researchers. They include comparisons of endophyte incidence in seed lots of various cultivars; performance of bentgrass, fine fescue, Kentucky bluegrass, perennial ryegrass, and tall fescue cultivars and selections in New Jersey; and assessments of Kentucky bluegrass cultivars for resistance to powdery mildew. Note that this is probably one of the best sources of up-to-date cool-season turfgrass cultivar assessments. Thus, it should be an important reference document in your turfgrass library.
Contact: Department of Plant Science, Cook College-Rutgers University, New Brunswick, New Jersey 08903, USA; FAX: (908) 932-8899.

Turfgrass Research Results 1992. 124 pages (1993). Contains 38 reports of research conducted at Pennsylvania State University. Encompasses 1 on soils characterization, 4 on cool-season turfgrass cultivar evaluations, 6 on weed control, 12 on insect control including 5 biological control studies, 4 on disease control, and 11 on roadside vegetation management including 3 on plant growth regulators.
Contact: Department of Agronomy, Pennsylvania State University, University Park, Pennsylvania, 16802, USA; FAX: (814) 863-7043.

The Role of Turfgrasses in Environmental Protection and Their Benefits to Humans. A nine page, scholarly review paper published in the Journal of Environmental Quality. Volume 23, pages 452 to 460, 1994.
Contact: James B Beard, International Sports Turf Institute, 1812 Shadowood Dr., College Station, Texas, 77840, USA. FAX: (409) 693-4878.

THE TEXAS-USGA METHOD SPECIFICATIONS

PART II

Suggested specifications for the Texas-USGA Method are based on the 1960 specifications, with subsequent evolutionary refinements (USGA Green Section, 1960; USGA Green Section, 1973; Beard, 1982). It consists of a 300 mm (12 in.) settled high-sand root zone over a 50 mm (2 in.) intermediate coarse sand zone, over a 100 mm (4 in.) gravel or crushed stone drainage bed that overlays a drain line network (Figure 1). It is important that the final surface grade ensures drainage of excess water across and off the surface, usually in multiple directions. The construction method for sports field and green construction is as follows:

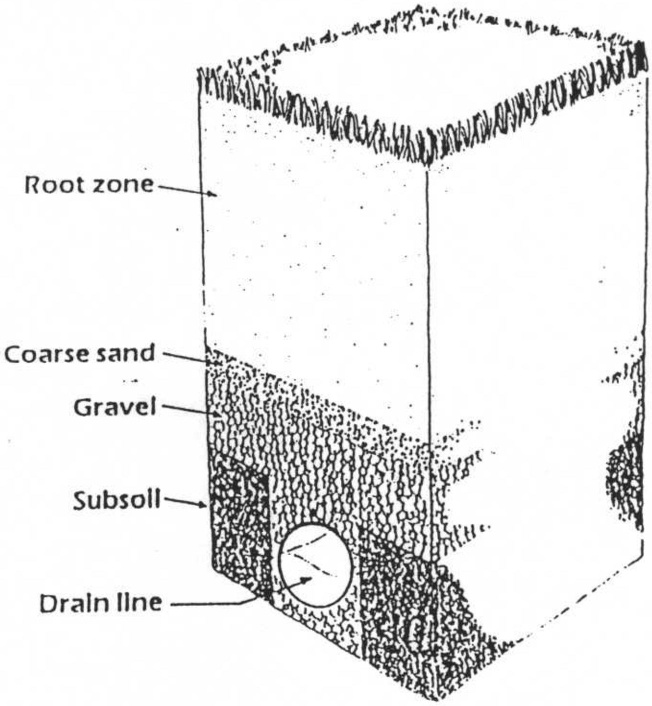

Figure 1. Profile of a Texas-USGA Method high-sand root zone modification with a water-conserving perched hydration zone.

Subgrade

Contour the subgrade base so it conforms to the proposed finished grade, with a tolerance of ± 25 mm (± 1 in.). The subgrade should be 450 mm (18 in.) below the planned finish grade and should be firmed to prevent settling. Care should be taken to ensure that the final subgrade base contours, within the overall slope, drain the gravitational water to the nearest drain line.

Subsurface Drainage System

A herringbone or gridiron design is used, with **100 mm (4 in.) diameter drain lines spaced at 4.6- to 6-meter (15 to 20 ft.) intervals at a minimum grade of 0.5%.** The drain line trenches should be cut into the subgrade at as shallow a depth as possible. A 38 to 50 mm (1.5 to 2.0 in.) depth of 6 to 10 mm (0.24 to 0.38 in.) diameter crushed stone or gravel is placed in the bottom of the trenches and the drain lines laid. Then additional stone or gravel is placed around and over the drain lines to fill the trenches.

Stone Drainage Layer

Angular, hard, noncalcarious, washed, screened gravel or crushed stone of 6 to 10 mm diameter should be selected for covering the subgrade to a minimum settled depth of 100 mm (4 in.). The proper sized crushed stone or gravel must be obtained to prevent migration of the sand into the gravel or stone bed and thereby preserve the integrity of two distinct layers: the upper high-sand mix over gravel or crushed stone. This drainage layer functions in the rapid lateral movement of gravitational water to the drain lines. Also, the porous crushed stone or gravel base prevents the upward capillary rise of salts from the soil base into the root zone. During installation, the crushed stone or gravel typically is dumped from the delivery trucks on the outside perimeter and then distributed over the construction site by a small, tracked crawler tractor, being careful to avoid driving over and crushing the drain lines.

Coarse Sand Zone

A 50 mm (2 in.) deep layer of **washed, screened, hard, angular coarse sand of 1 to 2 mm diameter** is carefully spread over the drainage layer. The specific size of the sand particles must be within **5 to 7 diameters** of the underlying crushed stone or gravel. Thus, if 6 mm stone or gravel is used, the particle size of the coarse sand zone should be not less than 1 mm in diameter. This coarse sand zone has two key functions: (a) To prevent infiltration of the high-sand root zone mix into the spaces between the drainage layer stone particles and (b) To create a perched hydration zone of plant-available water immediately above the drainage layer in the lower portion of the high-sand root zone mix. The distinct interface between the coarse sand zone and the upper 300 mm (12 in.) of settled high-sand root zone mix disrupts the continuity of surface interfaces among the particles and in turn the downward movement of water. When the perched hydration zone above the interface approaches water saturation, the force of gravity overcomes the interface perched effect and the excess water is released downward.

Installation of the coarse sand zone is best accomplished manually, taking care to not mix the sand with or into the stone drainage bed. The coarse sand is dumped from the delivery trucks on the outside perimeter, and is typically moved across the crushed stone or gravel by wheelbarrows over a path of plywood boards. This thin coarse sand layer presents some difficulties in installation. However, this intermediate zone is critical to the overall concept and is a modest long term investment compared to turf failure and rebuilding costs if improperly constructed.

Caution. Substitution of a nonbiodegradable screenlike material for the coarse sand intermediate zone has been proposed. Problems have been observed with these geofabrics which tend to become clogged to the extent that they are impermeable to water and may cease to drain. However, a more open, non-filter mesh or netting may be used between the intermediate coarse sand zone and the drainage layer when using gravel to provide a stabilizing effect during construction. This netting should not be necessary when using angular crushed stone due to the stability of this material.

Ringing the Perimeter

Polyethylene sheeting should be permanently inserted as a vertical barrier between the outer native soil and the root zone mix. This barrier prevents lateral water transfer into the adjacent dry soil, which would cause inner perimeter turf water stress. When the sheeting is extended 100 to 150 mm (4 to 6 in.) above the surface during construction, it also will function in preventing erosion of unwanted soil onto the construction area.

Root Zone Mix Installation

Quality control is the key to successful execution of root zone modification. All root zone mixing should be completed off the construction site, termed off-site mixing. Although it sounds good, in practice the procedure of in-place rotary tilling of the organic and/or soil components into the high-sand component has not been successful. Every truck load of each component in the soil mix, as well as the gravel and coarse sand, should be checked at delivery to ensure that the specifications are met.

Off-site mixing includes soil shredding, screening to remove any objectionable stones, and addition of the specified proportions of each mix component. Because of the narrow range in acceptable limits of the physical properties, it is very important that the laboratory recommendations be explicitly followed in mixing the components of the root zone mix. Upon laboratory confirmation that the root zone mix has met the specifications, it is transported to the construction site and dumped around the perimeter onto the coarse sand zone. A small, crawler tracked tractor with blade then pushes the mix over the area, being careful to avoid crushing the drain lines. Be sure the unit is operated with its weight on the root zone mix. This reduces the chance of disturbing the lower construction profile.

Caution: Use of wheeled tractors causes rutting and they are more likely to crush the drain lines than are tracked vehicles.

Grade stakes placed in a grid pattern at 3 to 4.5 meter (10 to 15 ft.) intervals will aid in constructing the final contours to the specified root zone depth. Success has been achieved by careful adherence to the construction guidelines.

CONSTRUCTION PLAN

Proper green and sports field construction usually involves an extensive subsurface drainage system, specialized root zone modification, and subtle surface drainage contours. It is a critical aspect, since improper construction due to cost cutting results in higher long-term maintenance costs, problems in maintaining a quality playing surface, frequent loss of turf, and costly reconstruction (Beard, 1973 and 1982). The steps in construction are:

(1) Survey and stake
(2) Construct subgrade
(3) Install a subsurface drainage system
(4) Modify root zone:
    (a) construct stone drainage layer
    (b) construct coarse sand zone
    (c) mix and install specified root zone
(5) Install irrigation system
(6) Finish surface contours
(7) Plant:
    (a) soil pH adjustment, if needed
    (b) fertilization based on soil tests
    (c) plant
    (d) post-plant turf care

By following the suggested specifications of the Texas-USGA Method, tens of thousands of greens have been constructed during the past 30 years and, more recently, many sports fields have been constructed and successfully used throughout the world.

<u>Note</u>: The suggested specifications for the upper 300 mm (12 in.) high-sand root zone were presented in the March-April, 1994 issue of Turfax™. Further, the July-August, 1994 issue will address the soil physical analyses procedures.