TURFAX™

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The International Newsletter about Current Developments in Turfgrass

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CONTENTS:

JB COMMENTS - WATER MANAGEMENT

Some of the most difficult day-to-day agronomic decisions made by a turfgrass manager relate to the turfgrass irrigation practices. Evapotranspiration (ET) prediction models are now available for use in combination with a computer and microenvironmental sensor systems to provide baseline information on which to make sound day-to-day decisions. However, there are a number of critical principles that must be properly understood in order to maximize water conservation and achieve quality turfs with minimal disease problems. Two aspects that tend to be overlooked will be discussed herein.

Irrigation and the Root Zone Profile. It is a basic premise that the rate of water application through an irrigation system should be no greater than the soil water infiltration rate or the rate water is accepted into the soil. This approach is important in order to avoid puddling and an undesirable water saturation of the surface soil zone.

However, there are high-sand root zones that have a high soil water infiltration rate of 6 to 12 inches (150-300 mm) per hour. What is the principle in this case? The basic premise should be to apply only sufficient water to replace that lost by ET since the last irrigation. In the case of the perched hydration zone, such as the USGA Method, there is a reservoir of water held above the gravel drainbed that is readily available for uptake by the roots. Applications of water that exceed the amount lost by ET result in a waste of water that is flushed downward into the drainbed.

The perched hydration zone method of profile construction is a water conserving system, if proper irrigation practices are followed. Some turf mangers have claimed that the high-sand, perched hydration zone method results in high water use rates. This is most probably due to improper irrigation practices, such as watering daily in amounts that result in flushing of excess water down into the drainbed system. This also results in an increased fertilizer requirement because water-soluble essential elements, such as nitrate (NO_3) and potassium (K), also will be leached downward out of the root zone.

Another high-sand root zone situation is one built-up by frequent topdressings over an existing, impermeable, clayey soil. Again the key premise is to apply only sufficient water to replace that lost by ET since the last irrigation. Otherwise, there will be an accumulation of water to higher levels in the sand portion of the root zone due to a lack of underlying drainage. The result will be an anaerobic condition with subsequent formation of black layer symptoms and loss of rooting.

Irrigation and Turfgrass Species. It must be recognized that turfgrass species vary in their inherent ET rate and root system depth. For example, hybrid bermudagrass has a relatively low ET rate and a good genetic potential for deep rooting, especially during midsummer heat stress. In contrast, creeping bentgrass has a relatively high ET rate and a much poorer genetic potential for rooting, especially when root zone temperatures exceed 80°F (27C°).

Due to these inherent characteristics a bermudagrass should not have to be watered nearly as frequently or in as large a quantity as bentgrass, including putting green cultural conditions. Where bentgrass would require daily irrigation, a hybrid bermudagrass would require irrigation at only 3- to 4-day intervals, depending on the evaporative demand of the atmosphere.

An improper irrigation strategy can negate this advantage of the bermudagrass. For example, if daily, high rates of water application are practiced early in the growing season which result in a root zone environment that impairs rooting, it may necessitate daily irrigation throughout the midsummer to avoid turfgrass wilt caused by a lack of root system. A more appropriate irrigation strategy is at less frequent intervals of every 3 days early in the growing season that will encourage deeper, more extensive rooting. This may avoid the need for a daily irrigation regime during the peak evaporative demands of midsummer. An additional benefit to this irrigation strategy is a less favorable environment for disease development and more favorable surface playing conditions for turfs used on sporting facilities.

Note: Anaerobic conditions caused by a water saturated soil are especially detrimental, with the first negative plant response being a loss of the critical root hairs, which constitute over 80% of the water and nutrient absorbing surface area of the grass plant. The plant functional loss cannot be observed with the naked eye, as the root hairs can only be seen with the aid of a microscope.

NEW PUBLICATION AVAILABLE:

1995 Rutgers Turfgrass Proceedings, Rutgers University. 146 pages.

This proceedings is divided into two sections. The first section contains ten papers of lectures presented at the 1995 New Jersey Turfgrass Expo. The second section contains five technical papers of research conducted by the turfgrass scientists at Rutgers University. Included are performance evaluations for a broad range of cultivars and near-release selections of five cool-season turfgrasses: bentgrasses (*Agrostis* spp.), fine-leaf fescues (*Festuca rubra* and *longifolia*), Kentucky bluegrass (*Poa pratensis*), perennial ryegrass (*Lolium perenne*), and tall fescue (*Festuca arundinacea*). This research report is a must for anyone involved in specifying or selecting specific cultivars of cool-season turfgrasses for seeding or sodding turfed areas.

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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:

June - Oregon

Participated in a tour stop at the Turf Seed/Pure Seed Testing Field Day at their field research laboratory near Hubbard, Oregon. Over 400 attended from around the US and other parts of the world. The subject addressed was the interlocking mesh element system for sports fields presented on the site of a comparative test area constructed to high-sand, perched hydration zone specifications. The performance findings to date under the high rainfall conditions in Western Oregon have been very positive.

An aspect of the research of particular interest was the differential performance of turfgrass cultivars and species groupings when grown under the shade of different tree species.

July - Vancouver, British Columbia, Canada

Presented an invited afternoon Research Lecture following a morning Supplier Field Day held at Quatland College, sponsored by the Western Canada Turfgrass Association. The weather conditions were very rainy for the morning events. It did not dampen the enthusiasm of the 350 attendees.

July - Los Angeles

Presented an invited lecture on Agronomic Sports Turf Safety before a National Football League Players Association sponsored Turf Injury Seminar. Topics included artificial versus natural grass surfaces, shoe design, physiology of turf injuries, and turfgrass surfaces and their culture. These lectures were recorded on a two video tape set which can be obtained by writing Seminar organizer Mr. Leigh Steinberg, Steinberg and Moorad, 500 Newport Center Drive, Suite 820, Newport Beach, California, 92660, USA.

August - Coleraine, Northern Ireland

Presented two invited lectures before the First International "Golf-Theory in Practice" Conference sponsored by the University of Ulster. A diversity of golf topics including golf club design, the mechanics and psychology of the golf swing, marketing and golf course construction, and golf turf culture were addressed.

An interesting lecture was presented by Dr. Robert Price of Glasgow, Scotland. The approach to golf development in Ireland and Scotland are distinctly different. In Ireland the National Tourist Board has been very effective in promoting their golfing facilities internationally and has made funds available for the construction of new golf courses via European Development Fund grants. As a result there has been a major golf course construction boom in Ireland. A 40% increase in the last 15 years to 362 courses, with many being operated as commercial businesses.

In Scotland a very limited number of new golf courses have been constructed in recent years. A 12% increase in the last 15 years to 477 courses. The trend in this case is for private membership golf courses to offer more golfing opportunities to visiting tourists. The fees for this service are fairly high, which results in essentially a subsidization that keeps the cost to local golfing members low. But what are the long term costs?

I observed the same approach, as is being pursued in Scotland, during the 1960's in Northern Michigan. At that time there were many golf courses with beautiful unirrigated, fine-leaf fescue (*Festuca* spp.) fairways with a relatively low cost for course maintenance. This situation now exists on many golf courses in Scotland, particularly on linksland. In Michigan the opening of private golf courses to more summer tourist play resulted in increased worn turf and eventually bare ground. This necessitated installation of irrigation systems and additional nitrogen fertilization to stimulate turf recovery. As a result, the fine-leaf fescue disappeared and annual bluegrass (*Poa annua*) became the dominant grass on fairways. The net result eventually was a major increase in the cost of golf course turf maintenance.

The question is whether the same cycle will occur in Scotland under their current approach to marketing golf? This would be sad if it results in the loss of the classic fine-leaf fescue fairways on the older linksland courses that are an important heritage of golf in Scotland!

HISTORICAL PERSPECTIVES, EMERGENCE OF TURFGRASS SCIENCE, AND ENVIRONMENTAL ISSUES

by

Dr. James B Beard

Golf courses evolved and persisted over several centuries principally on the coastal areas along the seas around the United Kingdom. The construction of golf courses on upland clay soil areas was restricted for most of this period due to severe earthworm problems that made the putting greens unplayable for a major portion of the year. In the late 1800's several different organic and inorganic chemicals were identified that acted either as (a) irritants in which the earthworms emerged onto the surface and were physically removed or (b) as toxic agents. Other than the suppression of rabbits and the control of weeds, primarily by mowing, this was one of the earliest pest control practices employed on golf turf areas. As golfers demanded improved turf quality on greens a number of other problems, such as environmental stress and pest problems, were identified and appropriate plant protectant agents developed.

Historical Pesticide Perspectives. Some environmentalist point out that a very few pesticides were used on golf courses prior to World War II and that after 1960 there was a great expansion in the number of plant protectants used. This is correct! However, it should be recognized that most of the pesticides used from 1920 through 1960 were (a) nonbiodegradable, (b) applied at high rates, (c) persistent, (d) inorganic materials containing either arsenic, lead, mercury, cadmium, copper, sulfur, or nicotine compounds (Table 1), which are noted for their toxicities to humans (4). Since 1960 the modern trend has been to use biodegradable, short residual, low application rate, organic compounds having low toxicities to humans and animals.

During this same pre-WWII period the fertilizers used were either (a) manures, which were readily available from the many horses used for power and from animal agriculture widely distributed throughout the country-side, or (b) water-soluble materials such as ammonium sulfate, ammonium nitrate, and calcium nitrate. All these have rapid nutrient release times of only 3 to 5 weeks.

Table 1. Common pest controls used on turfs from 1900 to 1960:

Pesticide	Pest(s) Controlled
Lead arsenate	Insects and annual grasses.
Nicotine compounds	Insects
Carbon bisulfide	Ants
Copper Compounds (Paris green, Bordeaux mixture)	Diseases
Mercury chlorides (Corrosive sublimate)	Diseases
Cadmium compounds	Diseases
Sulfuric acid	Weeds
Sodium arsenite	Weeds
Sodium chlorate	Annual grasses
Strychnine	Animals
Calcium cyanide	Burrowing animals

Maintenance Intensity Issues. The speed of modern communications has lead to a global orientation for many activities of civilizations, including those of recreation. The turf maintenance philosophies have evolved to what some people like to describe as two distinct approaches. One is the "traditional" or so-called low-maintenance approach of the United Kingdom and the other is a "United States" approach frequently referred to as a high-maintenance approach. Point in fact, there is a wide range in the intensities of maintenance on golf courses from high to low in both the United States and around the world (2). However, this is not the perception derived from televised golfing events where the golf courses viewed typically have a very high turf-surface quality and associated intensity of turf culture.

A great diversity in climatic and soil conditions occurs in various countries around the world, as well as within individual countries. Maintaining comparable competitive turf conditions under these varied climatic and soil conditions of individual countries requires different intensities of cultural practices, especially the nutrient, water, and plant protection inputs.

Unfortunately, the standard many golfers use in assessing a golf course is the greenness of the playing surfaces. This evolved from the United Kingdom where the temperature and rainfall conditions are particularly favorable for grass growth throughout the golfing season and where serious attacks by a majority of the turfgrass pests are not a problem. When this dark green criterion was brought from the UK to hot, humid and/or arid regions of the world, such parts of the United States, it required a major increase in cultural inputs to produce a comparable, year-round greenness in the playing surfaces (1, 2).

Emergence of Turfgrass Science. To meet this demand for greenness and uniformity of playing surfaces, the golfers, through their national and regional organizations made a plea for technical information to achieve these objectives. This was accomplished by research conducted principally through the state land-grant university-college systems in the United States. The state agricultural experiment station researchers, along with innovative developments by the turfgrass manufacturing industry, resulted in numerous advances in turfgrass science that have in fact made golf course maintenance more environmentally friendly than in the past (1). Included are:

- The development of slow-release fertilizers that minimize nutrient loss by volatilization and leaching and a nutrient release profile two to three times longer, eg. methylene ureas, sulfur coated, IBDU, UF, and polymer coated nitrogen carriers.
- Irrigation systems that apply water more uniformly and efficiently, including computer monitoring and prediction modeling of evapotranspiration (ET) rates in order to apply water amounts that meet the specific needs of individual grass and soil conditions.
- Biodegradable, short residual, low application rate, organic pesticides specific to individual pests, thereby avoiding the use of broad spectrum, long residual chemicals that persist through one or more growing seasons.
- Turfgrass cultivars with improved resistance to environmental stresses, insects, and diseases.

These four major groupings are representative of the larger number of advances achieved through turfgrass science. These contributions have made turfgrass culture on golf courses very environmentally friendly.

Environmental Issues. Certain environmental activists have made unsubstantiated allegations about pesticide and fertilizer usage on golf courses, primarily concerning adverse effects on ground and surface water quality (3). Research during the past eight years has demonstrated that the turfgrass ecosystem in the upper 6 to 12 inches (150-300 mm) of the soil has a root system which in the process of ongoing decomposition supports one of the most diverse, large decomposer organism complexes known (5). Further, that the pesticides legally registered for use on turfs in the United States are readily decomposed by this turf ecosystem, with the exception of a few nematicides used primarily in Florida. Also, research has shown that the same fine, fibrous root system with extensive root hair development is highly efficient in the uptake of applied nutrients. On-site research has shown no significant problems with surface or ground water quality if the fertilizer is applied (a) while the turfgrass roots are actively growing and (b) in amounts commonly recommended (5).

A third issue relates to accusations that turfgrasses are very high users of water. However, research has shown the evapotranspiration rate of plants, including grasses, trees and shrubs, is related to the amount of leaf area. Subsequent studies document that trees and shrubs use far more water than mowed turfgrasses (5). For example, a 12-inch (300 mm) diameter tree used 80 times more water than the turfgrass area under the tree canopy. World plant distributions further support this premise in that the great grasslands are found principally in the semi-arid portions of the world, whereas the great forests are found in high rainfall areas.

Another perception that often is misunderstood is the assumption by many that pesticides and fertilizers are applied to the entire area of the golf course. However, a survey has shown that on average only 21% of the golf course area is maintained as closely mowed, high quality turfgrass surfaces; while the remainder of the area or 79% is maintained as high cut rough, woodland, water and wetland areas (3). Thus, the environmental status for much of the golf course area provides a favorable habitat for wildlife.

Studies have shown the diversity and number of wildlife found on the golf course exceeds that of both adjacent urban areas and animal-crop-horticultural production areas (5). This should be kept in mind, as many activists would argue that the golf course should have a wildlife species population and diversity similar to the original native landscape. However, this is an idealistic approach that does not recognize the reality of the situation where the alternative more likely is that the land would be used for urban development or production agriculture.

Note: These same historical perspectives and trends may also be considered in relation to other types of turf facilities, such as sports fields and lawns.

References:

1. Beard, J.B. 1973. Turfgrass: Science and Culture. Prentice-Hall, Inc., Englewood Cliffs, New Jersey, USA. 658 pp.

2. Beard, J.B. 1982. Turf Management for Golf Courses. Macmillan Publishing Co., New York, N.Y., USA. 642 pp.

3. Beard, J.B. 1994. Environmental protection and beneficial contributions of golf course turfs. Science and Golf II. Proceedings of the World Scientific Congress of Golf. E&FN Spon, London, England, UK. p. 399-408.

4. Beard, J.B., H.J. Beard, and D.P. Martin. 1977. Turfgrass Bibliography From 1672 to 1972. Michigan State University Press. East Lansing, Michigan, USA. 730 pp.

5. Beard, J.B and R.L. Green. 1994. The role of turfgrasses in environmental protection and their benefits to humans. Journal of Environmental Quality. 23(3):452-460.

Clarification: Concerning the Earthworm Happenings article in the May-June issue the phrase "the environmental quality agency in the United Kingdom has essentially eliminated the use of all effective materials utilized in earthworm control," change all to most. Currently, carbendazim and gamma HCH + thiophanate methyl have registration for the control of worm cast formation in turfs. The question being asked in the UK is whether these remaining registrations may also be rescinded.

UPCOMING JB VISITATIONS:

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

- Sept. 23 to 25 - Columbus, Ohio.
- Sept. 28 to Oct. 4 - Rome and Turin, Italy.
- Oct. 18 to 25 - Tokyo, Japan.
- Nov. 3 to 7 - Indianapolis, Indiana.
- Nov. 13 to 15 - Rochester, New York.