Sportsturf Under Reduced Light Conditions

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In March 1992 the World Cup Organizing Committee announced the Pontiac Silverdome located near Detroit Michigan, U.S.A. as one of the nine sites to host the 1994 World Cup Soccer matches. The announcement was spectacular in itself as never before had a World Cup match been played indoors. This was to be a World Cup of "firsts": the first time the event would be held in the U.S., the first time a World Cup game was to be played indoors, and the first time a World Cup game (or any other large event) was to be played on a portable field of natural turfgrass.

The announcement signified the "official" beginning of the challenge to the turfgrass scientists at Michigan State University to place a natural grass field indoors and keep it in excellent condition for multiple World Cup soccer matches and practices. Originally we were under the pretense that we would have 26 months from the announcement date to produce this field. Using portable turfgrass plots inside the Pontiac Silverdome, we immediately started conducting research with different grass species, soil types and amendments, management schemes, and lighting regimes. Insufficient lighting (the Pontiac Silverdome roof transmits only 10% sunlight) and turfgrass diseases were the greatest obstacles we faced. Although several combinations of treatments produced good results after six weeks inside the stadium, the grass in the plots which were managed by conventional techniques died after two weeks, making some World Cup organizers nervous about the viability of the project. About 4 months into the project, FIFA and the World Cup officials approached us with the necessity of conducting a rehearsal in June 1993 (with our now decided upon but unbuilt metal, hexagonal shaped modular field), by hosting the final US Cup 1993 game between England and Germany. Obviously, this sped up operations and cost as well as modified our original plans (such as growing the sod for the modules in Michigan instead of the eventual site, California), in addition to putting a tremendous amount of pressure on a truly untested system as well a few scientists. However, the cutting of the timeline in half did have a silver lining as the officials agreed to construct on the Michigan State University campus a 600 m^2 simulator dome complete with the same Sheerfill II fabric used on the Pontiac Silverdome, as well as an asphalt floor with drainage. The media immediately dubbed this new indoor turfgrass research facility the "Silverdome West".

The reasons and effort to construct Silverdome West has never been questioned as the research conducted prior to the US Cup and World Cup games certainly provided for the success of the turf inside the Silverdome. The research also gave all those involved complete confidence that our concepts and ideas would indeed work on a long term basis. The efforts of all involved in the Silverdome project for World Cup 1994 were well chronicled and many accolades were bestowed upon the group. Two important results came from the indoor turf project for the 1994 World Cup: First, the proof that a portable turfgrass system could work for sporting events in partially or fully enclosed (i.e. shaded) stadiums, **provided the proper management techniques are in place**. The portable turf system used is now often emulated and has become the standard by which other similar systems are judged. The second important result is the remaining indoor facility on the Michigan State University campus. This facility has allowed us to continue the research on turfgrass maintained under reduced light conditions (RLC) with the goal of keeping the turfgrass under these conditions for extended periods of time (> 6 months). For the US Cup 1993 and the World Cup 1994 our requirements for turf under RLC for a period of 30 days.

The research inside the Silverdome West has revolved around determining the minimum energy requirements for maintaining turfgrass suitable for sports fields under RLC. Since 1992 we have assessed the performance of several turfgrass species under multiple levels of RLC, ranging from approximately 2% to over 30% sunlight. Other environmental parameters such as temperature, humidity, and moisture have also been investigated. Turf growth and response to traffic have been evaluated for temperatures ranging from 10 to 30°C. Irrigation (water) requirements and frequency have been investigated for several levels of lighting, temperature, soil types, and turf species. Irrigation control is especially critical for turf in RLC as too much moisture can quickly lead to divesting levels of diseases as well as resulting in a poor (soft) playing surface. Conversely, too little moisture leads to decreased plant growth which inhibits turf recovery from damage.

We have also conducted research on turfgrass disease control, growth and development, wear tolerance and recuperation, and species/variety adaptation. Aside from insufficient light for turf growth, diseases are the other primary obstacle to maintaining turfgrass under RLC. We have documented the diseases likely to occur on several turfgrass species, including both warm and cool-season grasses. We have also investigated the methods necessary to control the various diseases under RLC. This work, combined with our earlier experiences (some dating back to 1990 for indoor turfgrass for golfing and driving ranges), has enabled us to define the parameters necessary to have a quality sports turf under RLC on a long term basis.

When Silverdome West was constructed in 1992, the fabric used was a fiberglass material sold by Birdair, Inc., Buffalo, New York. As interest and reality of turfgrass under domed stadia grew, Birdair returned to Michigan State University in 1994 with a proposal to replace the original cover with a new fabric designed to allow more photosynthetically active radiation (PAR) transmitted. This concept is important because if the light levels necessary for the turfgrass plant can be achieved without supplemental lighting, which would substantially reduce construction and maintenance costs. To this end we continue to work with Birdair, Inc. with the goal to provide the appropriate cover that, when combined with the turfgrass management program necessary for sports fields under RLC, will provide a high quality sports turf for an indefinite

period inside domed stadia. We are confident through our research and experience in the environmental parameters necessary for maintaining turfgrass under RLC. The management scheme under RLC requires specific turfgrasses as well as chemical and fertility programs. Other critical elements include the soil mix and wear protection devices (e.g. crumb rubber from used tires). We continue to suggest the use of a modular field and have a preference for a particular design. We have recently concentrated research efforts on the use of turfgrass grown on a wood fiber mat for replacing worn areas without moving modules.

Through our research efforts and experiences we operate under three principles or assumptions:

1) There are multiple ways to install grass under RLC, but the ways to keep it alive and in acceptable playing quality are limited.

2) Grass will die indoors or outdoors regardless of environmental conditions or resources if it is abused.

3) No one has built a domed stadium with the assumption that turfgrass will be maintained under these conditions for extended or permanent time frames.

Existing domed stadiums are limited in their construction to provide for rapid installation and removal of portable turfgrass fields. In 1993, it took 44 hours to move the entire field inside the Pontiac Silverdome. In 1994, having learned from our first installation, only 30 hours were required to move the field inside the Silverdome, and it was playable immediately. While more mechanized systems are available that could speed up this timeframe, the design of the Silverdome would never allow for a rapid installation of six hours or less, a timeframe not unreasonable for a stadium with the correct design. If a stadium is built with a modular turfgrass field in mind, the ability to keep it indoors and play sporting events is an economic and timely reality. Through our efforts and experiences we feel the idea of a portable or modular field makes the most sense as it maximizes stadium flexibility (and subsquently profitability) and minimizes potential damage or unrecoverable abuse to turf. The beauty of building a domed stadium with the intention of maintaining turfgrass and combining it with a modular turf is the stadium people have control and are not limited in their abilities to profit from stadium use. If a turf is not abused under these conditions it can remain indoors for an indefinite period, but if conditions arise where the condition of the turf will or even potentially will be compromised, the modular field concept can be employed and the integrity of the field will remain intact.

Through our success at the Pontiac Silverdome and World Cup 1994 we have set the goal to providing turfgrass indoors on a long term or permanent basis. We know the efforts required to achieve this goal and continue to work at several levels of developing this concept for covered stadia, including cooperating with Birdair, Inc., the company responsible for building most of the covered stadia and similar structures in the world. Based on our past experiences with the Pontiac Silverdome, indoor golf domes, and especially our dedicated research for maintaining turfgrass under RLC, we are confident in our ability to be successful.