SPORTS TURF RESEARCH: A FUTURISTIC AND REALISTIC LOOK

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Since 1988 there has been a concentrated research effort directed toward sports turf management at Michigan State University. While the efforts have been modestly fruitful, the reasons for the undertaking of this task are glaringly simple. The future of sports turf is quite bright. With the recreational activities of mankind constantly increasing and the public's perception of artificial surface on a steady decrease, the efforts of turfgrass researchers in this particular facet of the industry are warranted and now are often highlighted. It is my intention in these next few paragraphs to provide you with a *realistic* as well as *futuristic* look at sports turf research and the industry. These opinions are based on research efforts along with observations of sports turf situations.

Realism: Golf and sports turf are not the same animal.

Have you ever thought about the different types of turfgrass we manage? Take the difference between golf turf and sports turf. The game of golf is great and we all know there would not be a turfgrass industry as it is known today if not for this game and the challenges it provides turfgrass managers and researchers (myself included). However, the differences between managing the stands of golf and sports turf are vast. The first thing that comes to mind is the high traffic areas (is there anything else if your job is a turf manager?). Golf courses have the ability to move the major wear areas daily (pins and tee markers) provided the greens and tees are large enough. Sports fields do not have this luxury. Have you ever tried to move the 20 yard line? Rotating athletic fields is a nice concept, but one that can rarely be put into practice. A second difference between golf and sports turf, particularly in the cool season climates, is that the more difficult sports in which to provide quality turf surfaces are played during times of very low recuperative ability for the turfgrass plant. Soccer and football and other spring time sports are played during times when the turfgrass plant simply can not recover. Thankfully, most of us curtail our golf activities during these days, otherwise the effects could be brutal. **Future: There must and will be more sports turf specific research.**

Realism: The cool season grasses marketed for sports turf use are not perfectly suited for this purpose.

Golf course superintendents maintain 30 -60 acres of turfgrass at cutting heights less than 1 inch and 5-8 acres of this turf is usually under 0.5 inch cutting height. This is intense to be sure especially if this turf is under traffic. Although golf is played during warm times of the year, the plant will become severely stressed, particularly if its recuperative ability is not "up to par". One of the beautiful things about the golf course and these close mowing heights is that there are grasses perfectly suited for the situation. In the cool season climates we have creeping bentgrass *(Agrostis palustris)* and in the warm season there are the bermudagrasses *(Cynodon spp)*. These grasses posses the one attribute necessary for a perennial grass to withstand traffic and recover: **a stoloniferous growth habit.** If it can creep, it can recover. Bermudagrasses have had several varieties developed over the years

that were well adapted for sports turf and because of this athletic fields have benefitted nicely. Sports turf in the cool season areas have not been so fortunate. Creeping bentgrass can not be used because of its prohibitively low cutting height requirement. This has left us with Kentucky bluegrass *(Poa pratensis)* and perennial ryegrass *(Lolium perenne)* as the major turfgrasses in this area, and definitely on the short end of the stick from a manager's viewpoint as neither of these grasses are stoloniferous. Certainly it is recognized that Kentucky bluegrass like bermuda grass, has a rhizomatous growth habit, but it is not rhizomes that control recuperation, just look at a creeping bentgrass putting green. What the cool season sports turf manager lacks in their arsenal of weapons is a stoloniferous turfgrass that can be mowed between 1-2.5 inches.

At Michigan State University we have initiated an intensive research program to investigate management strategies of a stoloniferous bluegrass that we believe has tremendous potential. This grass is known as supina bluegrass *(Poa supina)*. Supina bluegrass is not a new species as there have been breeding efforts taking place in Germany for the past 25 years. However, it is new to the United States and research specific for our highly variable northern climates is absent. This grass is aggressive and grows well in cooler temperatures (a plus for the people managing turf in late fall and early spring), but does not tolerate heat well. The varieties currently available are all light green in color (this is the color they prefer in Europe), but color is relative, particularly when it is surrounded by 65,000 red seats. The challenges of this grass are how to *manage* it for sports turf in the cool season climates. We planted close to 10,000 ft^2 of supina bluegrass in 1995 to investigate these questions and are looking forward to the near future of planting this grass in a major arena. Because this grass is stoloniferous and can rapidly fill in worn areas, it could be an answer to several problems. Although the seed is currently available to use in the United States, it is quite expensive ($25/lb). This is primarily because all production of supina bluegrass is in Germany and the production costs are quite high as the most successful method for harvesting seed has been from mowed turf. The cost of the seed will be offset by its ability to be sown in mixtures and quickly dominate a stand because of its growth habit (we have several mixtures we are evaluating for this specific reason). **Future: There is potentially a turfgrass much better suited for sports turf in cool season climates.**

Realism: There are two types of drainage, neither of which should be compromised for sports turf.

The phone rings at my office quite often with the question of specifications for building athletic fields. Inquiries regarding the best soil type are often asked, along with surface and internal drainage questions. We have known for quite some time the advantage of a sandy soil in that it provides superior drainage and resistance to compaction. These points need to addressed separately. Although there are sands available that can provide outstanding internal drainage, there is no field that should be built so that the movement of water is totally dependent on internal drainage. The fields must be built with a crown such that surface drainage can take place. If fields are built flat this lack of surface drainage will act as an 'Achilles' heel' in that at sometime the field will have severe problems or fail if the proper adverse conditions are present. Surface drainage no longer means a 2% slope (20 inch crown). Because we can depend on the internal drainage system of sands and installed drain lines, a much less severe and unobjectionable (from a playability standpoint) slope of 0.75-1.0% can be employed. Players can not detect this slope, but rest assured the turfgrass can and will benefit from its installation. Being without surface drainage is like playing a continual game of roulette with a gun. Eventually the gun will go off and you and the field will be the loser. **Future: Athletic fields will be specified with slopes for surface drainage.**

Realism: Sands are still the best choice for construction of high traffic turf areas, but have some limitations regarding sports turf use.

Soils used for sports turf that are all sand have the attributes mentioned in the previous paragraph, but there are also some disadvantages associated with this management choice, primarily nutrient holding capacity. Recently built fields have patterned their soil mixes after those involving the USGA for building putting greens, and have minimized or eliminated the use of silt and clay in mix for sports turf. This is a wrong approach in that sports fields need this nutrient holding capacity much worse than putting greens. We are not as intense in our overall management schemes, nor do we typically have the budgets that golf courses set aside for sand-based turf areas. Silt and clay are not bad. You can put in too much, and this has to and can be avoided by simple testing, but, silt and clay in a soil mix are not bad. In fact, because of the extra soil strength and stability the small amount of silt and clay (8-11% total by weight) provides, there is no recommendation for straight sand fields out of this office. From a financial standpoint (and arguably an agronomic one as well), the construction of a field with the

proper amounts of silt and clay can eliminate the need for other soil amendments mixed into the soil profile. It takes a little more effort on the front end of the project in terms of testing and quality control, but the results will far outweigh the initial costs.

Another reality that will never go away is the need to use the proper sand material and size separates. This is actually quite simple to achieve through physical soil tests and so very important for overall stability, drainage, and ultimately playability. If the wrong sandy material is put into the field the management of the turf can be a dreadful and futile task . One particular example is the use of a finely sized sand that is fairly uniform. The stability of a sand of this nature is quite poor (if unamended). If this sand is used in a cool season turfgrass setting (Kentucky bluegrass/perennial ryegrass) the situation is worsened because there is no stoloniferous turf to help mask the problem as there is with bermudagrass. The sand selection process needs to be deliberate, it needs to be planned with an expert, and it needs to be thoroughly tested. Technology has advanced with these soil mixing and sand separate washing devices such that any excuse for not doing a proper job is a poor one. These facts are here to stay. **Future: Sports turf construction is very complex and must have its own unique specifications.**

Realism: Sports turf in the cool season areas is utilized most during the lowest periods for turf recovery.

One inherent disadvantage of sand is its physical makeup. Most sands we recommend for use are primarily quartz in nature. They are great for resisting compaction, but they are also very detrimental to the turfgrass plant in that their sharp edges are constantly tearing and scuffing the plant. Most of the time this action is masked when favorable growing conditions exist. However, when there is traffic during periods of low recuperative potential (early spring and late fall), these sands can cause extensive damage to a plant that can no longer recover. If the turfgrass plant can be spared this damage, an increased wear tolerance will result providing all other existing conditions are favorable. The ideal material to use would have the favorable attributes of sand without its abrasive nature. One material we have been researching at Michigan State University that has given outstanding results is the used tire chopped into steel-free crumb rubber particles. These particles that tested favorably ranged from 6.0 mm down to 0.25 mm. They were topdressed into established turf at various rates, with the best rates being a range from 0.375 inch to 0.75 inch depth of crumb rubber (750 to 1500 lbs/1000 ft^2). Our results also show that this process is not necessarily annual as the rubber has a density (1.2g/cm^3) that prevents it from working into the soil profile and therefore it will stay around the crown of the plant, the intended area. The crumb rubber is excellent for use on sand-based fields, but because it also does an excellent job in improving impact absorption characteristics , it is effective in soils more prone to compaction. Another exciting aspect about using this product is that it takes a difficult to recycle product and finds another use for it. It has a bright future in the sports turf industry (and any turf area under heavy wear for that matter) as another useful management tool. **Future: Crumb rubber will be a valuable tool whose best uses will ultimately be determined by the end user, the sports turf manager.**

Realism: Topdressing is all too often a lost tool for the sports turf manager.

While the fact that crumb rubber as a topdressing is an excellent way to protect the plant from damage, another aspect of crumb rubber as a topdressing is that it is a topdressing. This is a management tool that somehow all too often gets lost in the shuffle and left out of the program or not done on a frequent enough basis. This is the basic tool for smoothing the surface for playability. If this is not enough, consider that every time you smooth the surface properly and protect the integrity of the crown of the field you are actually aiding in the one thing that all fields must have; surface drainage. Topdress on a regular basis and the low spots will disappear as will the areas of thin and stressed turf from poor drainage. You must still topdress with the proper material and crumb rubber is certainly not the answer for all areas, but the effects of proper and continuous surface drainage can never be overstated. **Future: Surface drainage will always be a key to good sport turf.**

Realism: Sports turf is built to use today, not tomorrow, therefore the necessary establishment method is usually sodding.

Shifting gears somewhat, the next subject to address is turf establishment on athletic fields. This high profile, sometimes controversial subject is often the beginning of a nightmare for the turf manager. One thing about

establishing sports turf as compared to a golf course; there is a scheduled opening day and that day must be adhered to at all costs. The golf course has much more luxury in this area as disappointing 250 people is pale in comparison to refunding 65,000 tickets. Due to the nature of the beast the establishment game is always happening and therefore we will continue to see fields with periods of high use on relatively immature turf. Couple this with the usual short window for establishment due to the demand schedule and the ability to establish the field from seed (the most economical and long thought the most agronomically sound method) is severely hampered. In cool season climates this usually leads to the establishment from sod (as discussed earlier, we do not have the grass available to be stolonized or sprigged like bermudagrass), which in itself can be an adventure.

There are basically two ways to establish turfgrass via sodding. The first method is considered the conventional method of harvesting the turf with a relatively thin layer of soil. This method is usually cheap, but will only provide an 'Achilles' heel' free guarantee if the soil used matches the soil on the field or at least is of a coarser soil texture (almost an agronomic impossibility if your field is sand). If this does not happen you will have a soil layer and subsequently a perched water table that will not go away without some large and usually expensive effort in the area of cultivation. And until this is done the area will be susceptible, particularly in the first year as the field is still immature. Interestingly, when people read or hear these statements the response is one of two things. Either they have laid sod for hundreds of home lawns and never had a problem or there are no sod farms with sandy mediums in their area (or state for that matter). My answers are one, they are not playing a football game in that yard and as soon as they do in anything short of perfect weather you will sing a different tune, and two, if you can not get Mohammed to the mountain, take the mountain to Mohammed! Certainly with a little advance planning and money a person can locate a sod farm willing to grow your turf on your specific media, just take the soil to them! This takes planning, time and money, but it does work.

Another way to sod is without a soil media. In recent years the industry has utilized a method where the soil is actually washed off the sod, ridding the potential for any soil layering. The problem with washing the soil is you wash a majority of roots with it as well as expose the crown of the plant. Now the turf must regenerate this system again with very little to protect it environmentally until a thorough topdressing program is completed. If all the environmental conditions are good this can potentially work. The problem with this, again, is not the method, but the grass we are using to try to accomplish the task. Washed sod works best for stoloniferous turf such as bermudagrass or creeping bentgrass because of the protection of the crowns offered by the stolons. This natural protection does not exist for Kentucky bluegrass and therefore the product the turf manager has often is in a form similar to a powder keg in a room full of matches!

The previous paragraph should not dissuade you from utilizing a soil less sod in your management schemes. During the infancy of the Silverdome project we were introduced to the concept of growing sod on plastic. The method has been around for over 20 years and the inventor(s) are confusing. However, the method is outstanding for preventing soil layering as you can basically establish the sod in a media of your choosing with a biodegradable wood mulch or fiber providing an excellent environment and helping to keep the soil lightweight (1.0-1.2 lbs/ft^2). The other large advantage of this method is the minimal disruption to the turf system at harvest. This allows for extended life post-harvest as well as a turf capable of establishing at a faster rate as there is little to no regeneration necessary. This also means the sod will root in soil temperatures between 40-45 F, another major plus for sports turf.

One of the drawbacks to sod on plastic is the cost ($0.30-0.50/ft^2 not including shipping.) This is in part due to the extremely small number of sod farms offering this product. The reasons for this are complex but suffice it to say if you like this method and do not have the means or access to a source, then consider becoming your own source. All you need is a relatively hard surface (parking lot), plastic, irrigation, and a media. We have been researching seeding into a wood fiber mulch blanket (the width and length of the blanket used is variable, 4-8 ft by 25-50 ft.) grown on plastic. The beauty of this system is the ease in harvest and its convenience. If this management option is available to the turf manager, they will be more effective and the overall playing conditions will improve dramatically. **Future: Soil less sod grown on plastic is a good tool to have readily available for high use areas.**

Realism: Indoor turf on a long term basis is only a phone call away.

Because of the Silverdome project we have become the leaders and somewhat the spokesmen for portable and indoor turf. Whenever there is any propaganda against artificial turf regarding injuries, the idea of turf indoors and our research efforts come to the minds of the sportswriters. This is very flattering and complimentary. Always the question is, 'can you grow grass inside and keep it in for the whole football season? Our answer is yes, the

ability to grow grass on a long term basis is within reach. We make this statement based on three assumptions or premises which are the very heart of our research program.

1. *There are several ways to install a turfgrass field inside a domed stadium but the ways to keep it alive and at acceptable playing quality are limited.*

2. *Grass will die indoors or outdoors regardless of environmental conditions or resources if it is abused and/or mismanaged.*

3. *There has not been an indoor stadium built to date that has the necessary environment for maintaining turfgrass on a long term or permanent basis.*

Many of the new techniques mentioned in this paper will transfer nicely to turf grown under reduced light conditions (rlc) and become valuable tools in this management scheme. However, the fact that no domed stadium exists today that could maintain natural turf on a long term basis means an architect is going to have to step up and become the first to design a domed stadium with grass in mind. The knowledge, experience, and research bases for maintaining grass under rlc are in place at Michigan State University and continuing to grow. Michigan State University is committed to the project from the administration down to the faculty. We are simply waiting for the call.

If you wonder what a domed stadium with grass in mind will look like, do not get a picture of the Pontiac Silverdome. The people at the Silverdome were a pleasure to work with and a large part of the success, but the environmental conditions were atrocious. Lighting, climate control, and stadium access were all substandard. We definitely learned from that experience what environmental design and considerations would be needed to be successful long term, and, along with our continuing research program at the 7000 ft^2 research dome on the campus, we have been able to determine a minimum light requirement that the turfgrass plant must achieve in order to recuperate from damage and stress, an amount much less than full sunlight. This has given tremendous confidence in our abilities to be successful.

When we put a field indoors on a long term basis we are still going to strongly suggest to the owner that they design the field to be portable. This only makes sense both economically and agronomically. We assume that the parameters will be there to have the turf in the full season if it is unabused. However the reality is that it will be abused (ever see grass die outdoors from abuse?) and you want an easy way to replace the turf through a module system. Besides, the real beauty of a module field lies in the off season when you can pull the field and hold all the events you want with no worries regarding turf damage. Maximum stadium flexibility with minimum potential damage or unrecoverable turf due to abuse. There are lots of module designs floating around, the real key is to be able to leave a field under rlc for an extended period. This is the program we have produced and are ready to put into action. **Future: Indoor turf is already a reality as the tools exist to be successful. The architects and owners are the keys.**

Realism: There is still not a scientifically based study that points to artificial turf causing more injuries than natural grass.

As a closing note, a few comments on the artificial vs. natural turf debate. Perception is a funny thing. As a person who has been on the downside of public perception (remember pesticides and the environment?), I sympathize with the artificial turf people. Do not get me wrong, there is no pro-synthetic turf blood in my body, its just that they are correct that no hard research data has ever found their turf the injury king the public makes it out to be. The problem is that the people who play on the two field types much prefer the natural grass, the media prints their preference, and the public has chosen their sides. So why is there no conclusive evidence? The studies beginning in 1971 to date have all made comparisons between injury numbers. This is such a complex method of comparison because of the violent nature of football that numbers of injuries will never spell the doom for artificial turf. There must be a study done that goes beyond injuries that occur on the field. The study must look at days to recover following injury between field types as well as longevity of careers, for examples. These types of comparisons, when compared via valid statistical methods, will mark the beginning of the end of artificial turf as we know it today. The National Football League and the NFL Players Association have commissioned the Center for Disease Control to do a study, hopefully along these lines of comparison. Expect their results in late 1997. The reality is that there are differences that the body can detect between artificial and natural turf as we have

noticed on numerous occasions taking measurements with our impact absorption equipment. It is these differences the players complain about during their careers. It is up to the scientists to correlate these numbers to their observations. **Future: If the correct parameters are studied in the battle between artificial and natural turf the future of the sports turf industry is bright, very bright.**