Use pre-germinated divot mix for field repair

BY **MIKE ANDRESEN, CSFM, AND DR. DAVE MINNER**

Most cool-season grasses can be pre-germinated to speed establishment and recovery on athletic fields. Perennial ryegrass, Kentucky bluegrass, and tall fescue have been pregerminated and used in a divot mix to hasten seedling establishment. The Iowa State University turf management team uses the following program to manage the sand-based fields at Jack Trice Stadium and Johnny Majors practice facility:

Begin the pregermination process 4 or 5 days before the time you will actually apply seed to the field.

Submerge seed for 12 hours. Put a 50-pound bag of seed into a large watertight container. We keep four 50-gallon plastic trashcans on hand and mark them "for pregermination only." Woven plastic seed bags that seed typically are packaged in are perfect for pregermination because the water soaks through the bag and the seed remains contained during the draining cycle. Fill the container with water so that

Athletic field seeding schedule

BY **DR. DAVE MINNER**

Cool season grasses adapted to the northern half of the United States are typically seeded from 15 August through 15 October. Late summer temperatures are still warm enough to quickly germinate seed and the ensuing cool and moist autumn will promote dense growth by tillering. Many sporting activities unfortunately conflict with this ideal time for grass establishment. The following seeding scenarios are presented to establish or reestablish grass amidst a continuous field use schedule. The strategy is to seed often and at higher than normal seeding rates in an attempt to overcome the complete removal of grass cover and exposure of bare soil. For a download, see http://turfgrass.hort.iastate.edu/extension/seed.pdf

Field Use Scenario	***Monthly Activity and Seeding Schedule for Intense Traffic Areas***								
	March	**April**	**May**	**June**	**July**	**Aug**	**Sept**	**Oct**	**Nov**
New construction bare soil							* D,B KB 1.5-3#/M once	*	*
Fall Football		D,B KB Once	D,B KB+PR				* C,B,PD Weekly KB	* C,B,PD Weekly KB	* C,B,PD Final seeding KB+PR
Game Field Multiple Use Fall Football + Spring Soccer	* C,B,D KB	* C,B,D,P D Weekly KB	* C,B,D,P D Weekly PR	D once			* C,B,D,PD Weekly KB+PR	* C,B,D,PD Weekly KB+PR	* D, Dor once KB+PR
Football Practice Field	* C PR	* C PR	* D PR	D, Sprig Berm		*	* C PR	* C PR	* D, Dor KB+PR

*, Field being used PD, Pregerminated Divot Mix; TF, Tall Fescue; D, Drill seed; Dor, Dormant seeding; BR, Bermudagrass; B, Broadcast seed; KB, Kentucky bluegrass; C, Cleat-in-seed; PR, Perennial ryegrass

the seed is completely immersed. Add 4 ounces of Pana-Sea (or other biostimulant or organic fertilizer) to each container with the seed and water. A heated shop is preferred so that everything equilibrates to about room temperature or 70 degrees. Do not use chilled water or freezing conditions. Include a fungicide to the soaking mixture during the early football season if seedling damping off by Pythium is anticipated.

Drain seed for 12 hours. It is recommended to have a 12-hour soak cycle followed by a 12-hour drain cycle, followed by another 12-hour soak cycle. For convenience we remove the bags each morning and allow them to drain during the 8-hour workday. Before the end of the workday we set up another soak cycle for the night. Even when we have forgotten about the bags and allowed them to soak for 2 or 3 days there has still been good germination.

Pregerminated seed is alive. Even though you may not see root tips the seeds have begun to respire and are alive; there is no turning back now. If the pregerminated seed dries in storage or in the field after planting it will die. You can refrigerate, not freeze, the living seed for about a week to slow down the growth if you want to plant it later.

Make divot mix by combining pregerminated seed, sand, a calcined clay product, and green dye. Remove the seed bag from the pregermination container and allow a few minutes for drainage. A concrete or smooth blacktop surface works fine for mixing. Dump a 5-gallon bucket of sand on the surface and add some seed, calcined clay, and dye over the pile. Use plastic to avoid staining of the hard surface if desired. Continue adding sand, seed, calcined clay, and dye until you have a layered pile. Shovel the pile to one side and then back again to mix. The recipe is 15 pounds of perennial rye or 10 pounds of Kentucky bluegrass seed, 40 gallons sand, 50 pounds calcined clay product, and 32 ounces of Green Lawnger dye.

Remove divot debris before seeding. Load a 5-gallon bucket half-full of divot mix and work the field from sideline to sideline five yards at a time. After mechanically sweeping the field there may still be debris in the divot that can be swept out by hand to insure good placement and establishment of the divot mix. Simply work a handful of mix into the divot then firm and level with your foot. Turf that is pushed-up or bubbled is worked back in place and flattened by foot. Divots that are completely dislodged seldom root sufficiently so they are removed and replaced by a 4- or 6-inch plugs taken from a nursery or surrounding area of the field. Any remaining divot mix is spread in worn areas of the field.

Not all the seed survives but those that do represent mature plants for next year's field. Seeds that are visible after placing the divot mix will seldom establish, but those just below the surface will develop if watered. The seeding rates **(continued on page 14)**

Seed count per square inch and seed weight per 1000 square feet for various divot mix depths

Given: Perennial ryegrass has 225,000 seeds/lb and divot mix uses 15 lbs seed/40 gallons sand
Kentucky bluegrass has 1,500,000 seeds/lb and divot mix uses 10 lbs seed/40 gallons sand

	Perennial Ryegrass		*Kentucky bluegrass*	
Divot mix depth (inches)	**Lbs seed/ 1000sqft**	**Seeds/sq.in.**	**Lbs seed/ 1000sqft**	**Seeds/sq.in.**
1/16	15	23	10	104
1/8	30	46	20	208
1/4	60	92	40	416
1/2	120	184	80	832
1	240	368	160	1664

Indicates amount of seed that forms a seedling for each species.

Evaluating baseball field surface quality

BY **JIM BROSNAN AND DR. ANDY MCNITT**

Baseball is our national pastime. From Legion ball to the major leagues, interest in baseball remains strong. It seems that every town in America has a baseball diamond, and these diamonds require maintenance. Someone mows these fields, drags the skinned areas, and puts down chalk lines. In professional baseball, the techniques used by the field manager can impact the game itself.

The industry recognizes that baseball field management (specifically skinned infield management) is more of an art form than a science. Practices have been handed down from one field manager to the next, with what constitutes a quality field in the eye of the beholder.

As scientists, we would like to quantify how various management practices affect playability in the hopes that this knowledge would benefit players, coaches, and field managers. Understanding the effects of things such as **(continued on page 16)**

(continued from page 10) seem very high compared to the normal broadcast seeding rates for grass establishment on bare ground. With divot mix it is important to remember that seed is mixed throughout a volume of sand and then the mixture is placed at various depths into divots. Seed visible on the surface dries out and seldom establishes while seed below a certain depth (1/4-inch for perennial rye and tall fescue, and 1/8-inch for Kentucky bluegrass) is shaded and does not continue to develop.

For each home game we mix about eight 5-gallon buckets of sand with 15 pounds of perennial ryegrass or 10 pounds of Kentucky bluegrass seed. After filling divots we feel that we are getting about 100 seedlings/square inch. At this rate the divots fill quickly without a negative effect from seedling over crowding. Some seedlings get trampled and die but those that survive create biomass and a mature turf for the beginning of next year as opposed to bare spots with exposed and compacted soil.

We start the season in September using Kentucky bluegrass since it establishes well during September but may not fill divots when seeded in October. After the beginning of October we switch to perennial ryegrass because it establishes until the end of October and even into early November. Pregerminated Kentucky bluegrass divot mix seeded in early September will have nearly 90% of the divot covered with "green fuzz" in 7 days. Perennial ryegrass fills the divots about twice as fast as the Kentucky bluegrass. Pregermination fills the divots twice as fast as seeding without pregermination. One advantage of the pregerminated divot mix over non-germinated seed is that the pregerminated seed does not require excessive water to get the seeds started. They are already growing and it only takes a little more frequent watering to make the seedlings develop.

For downloads, see http://turfgrass.hort.iastate.edu/extension/preseed.pdf. ST

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(continued from page 12) soil conditioners and irrigation regimes would benefit the industry as a whole.

This past summer Jim traveled the country to conduct a survey of baseball field playing surfaces through the Turfgrass Research Project at Penn State. Characteristics of skinned surfaces, as well as natural and infilled synthetic turf surfaces, were catalogued at all levels of play ranging from little league, through the NCAA, and Major League Baseball. While we are still in the early stages of research, we have observed some interesting trends.

First, skinned surfaces are exceptionally hard. Frequently, these surfaces produced Gmax (hardness) values that were so high that resurfacing would be required in sports such as soccer or football. This may contribute to the wear and tear type injuries that are commonly reported by baseball trainers. We need to explore this issue further. Water applications will certainly soften these areas, but little is known about appropriate quantities. For example, do we need 10 gallons of water per 1000 square feet to soften the skinned areas by 10%, or do we need 15 gallons? Of course it will depend on your infield mix. Further research is being conducted at Penn State to try to answer these questions. Stay tuned.

Surprisingly, the moisture content of the infield mixes evaluated had very little effect on ball response after impact. The ball response was measured with a new device affectionately named PennBounce. PennBounce consists of an air cannon that propels baseballs, at various angles, towards the playing surface at speeds up to 150 mph. Infrared speed gates are used to measure ball speed before and after impact with the ground. On skinned infields, observations indicate that the subbase layer (the layer below the soil loosened by grooming equipment) plays an important role in ball reaction. Standard pre-game water applications do very little to soften this compacted base. Increasing the depth of loose material above the base will certainly slow down ball response, but may prohibitively reduce an athlete's traction. Researchers at Penn State are currently measuring changes in ball response, surface hardness, and traction that result from loosening infield mixes to varying depths. In the near future, we hope to equip athletes with devices that measure the amount of force that is exerted on the lower body as they perform on these various surfaces.

Surface characteristics across the diamond varied. Surface hardness was lowest at second base, with hardness increasing at third base and peaking at first base. This is likely due to the nature of the respective positions. First and third basemen tend to be more stationary than middle infielders during play. Also, players reach first base more than any other base on the diamond. This traffic may compact the soil to a greater degree, thus generating higher Gmax (hardness) values.

Baseballs approaching skinned surfaces at a 25-degree angle lost 43% of their initial velocity on the first bounce. For example, a ball leaving the bat at 100 mph

will strike the skinned area in front of the shortstop at roughly 88 mph (baseballs lose velocity at a rate of 1 mph for every seven feet of travel), and after the first hop it will approach the shortstop at roughly 50 mph. The skinned areas of the fields observed were quite a bit faster than both the natural and synthetic turf areas. Small differences were found when comparing infill systems to natural turfgrass. Balls striking those surfaces lost 48% and 53% of their speed after the first bounce, respectively. A ball moving 5% slower allows the player to travel approximately a foot further in the approach, which could be the difference between the ball hitting the center of the glove or screaming through the hole into the outfield.

Ball response on infilled synthetic turf surfaces was affected by surface hardness and infill depth, with softer, deeper surfaces having a slower ball speed after impact. Infilled synthetic turf surfaces exhibited a strikingly consistent bounce across the playing surface. Regardless of whether the ball struck in front of home plate, on the third base line, or down the left field power alley, the ball response was the same. This phenomenon was only true of fields greater than one year of age. Infilled synthetic turf fields younger than one year of age showed differences in ball response across the playing surface. Likely, the rubber and sand particles that comprise the infill need time to settle into place and firm up in order to produce this level of consistency. Outfield areas of infilled synthetic turf surfaces had higher Gmax (hardness) values than infields.

There were no surprises with natural turfgrass playing surfaces. As expected, surface hardness, moisture content, and thatch were all key factors in gauging ball speed after impact. Differences in surface hardness and moisture content varied with field positions. Centerfield was slightly softer than left and rightfield. Similar to what was observed with first and second basemen on the skinned areas, centerfielders tend be on the move more during play than left and right fielders. This likely reduces compaction enough to alter surface hardness. Outfields had higher moisture contents than infields. This makes sense, as outfields are left exposed to rain showers while the infield grass is tarped. Further research is being conducted to explore how cultural practices such as mowing height and verticutting, as well as irrigation affect ball response on natural turfgrass.

This survey of playing surfaces at all levels of competition has given us some idea of the range of surface conditions that currently exist. The next step at Penn State is to create field plots that mimic these surface conditions, and determine the degree to which we can manipulate those conditions with management practices. We plan to conduct a series of baseball related research projects at Penn State in the hopes of contributing to the playability and safety of the fields that host our national pastime. **ST**

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Cures for the "high traffic, low budget" blues

BY **DOUGLAS FIELDING**

When I read articles about the difficulties expressed by people maintaining fields that have 70 games a year or people stressing over 1/4"-inch of sand topdressing every two weeks I just shake my head. Most of the fields our group, Association of Sports Field Users (ASFU), maintains handle 470-750 practices and games per year, mostly for soccer, lacrosse, and rugby.

We are generally brought in to deal with fields around San Francisco Bay after user groups have given up on getting local authorities or school districts to cut the grass more than once every 2 weeks or turn on the sprinklers occasionally. By the time we see a field it is not uncommon that someone had been injured due to its condition.

Once I was talking with a parks director and six of her maintenance staff. The subject was fertilizer and she turned to her crew chief and asked, "What type of fertilizer do we use?" And he responded in all seriousness, "Oh we don't use fertilizer, it makes the grass grow."

The primary maintenance issue in the public sector is a lack of budget and overuse, coupled with the belief that it is impossible to have any impact on field use. But it doesn't have to be this way.

Grass isn't a policy it's a plant. We can bring a dirt patch field back to playing condition in 10 weeks if there is NO traffic. User groups and politicians have to accept a 10-week maintenance shutdown (or restricted use as outlined below) during a growing season (winter doesn't count) if they want decent fields. If they aren't willing to do this then they shouldn't complain about the quality of the fields.

Our organization is a non-profit coalition of sports field users, everything from youth soccer to women's rugby. We represent more than 17,000 players. We believe when you actually explain the maintenance reality to field user groups a majority will choose less playing time on better-maintained fields rather than more playing time on poorly maintained fields.

Field maintenance in a public sector environment requires speed and attention to detail. The minute the users' season ends, start your 10-week shutdown. If you wait, you lose time from your "growing season" and are headed toward failure. If you can't produce a decent field, why should the field users support your work?

Speed, speed, speed. Seven days before the season is over (end of November in the fall and mid June for spring) we slit seed the fields with perennial rye. We use perennial rye because it moves quickest from seed to top growth. We can't afford the luxury of grasses like Kentucky Blue, which take more time to establish. We don't care that the players are cleating up our newly seeded field because we don't yet have germination.

The day after the season is over we put about 30 yards of organic topdressing on every field, working morning to night. As soon as this is done, we put about 400 pounds of a high phosphorus (e.g. 18-24-12) product down to give the roots of the seedlings some help. Then we aerate every field. On our most heavily trafficked fields, we have seeded, topdressed, filled depressions, fertilized and aerated them within 3 days of season's end. And thanks to the early jump on slit seeding we are getting germination as the aerator is being taken off the field.

Once our maintenance is done all our fields have "Field Closed" signs on highway construction barriers in the middle of the field. Some local governments consider playing on a closed field to be destruction of public property with fines for abusing organizations and players. A few fines here and there and I can honestly say that playing on a closed field is not a major problem. But we also regularly patrol the fields to kick off the occasional transgressor. If it rained the night before but it's a sunny day, look for them.

Next we start working on problem areas. Almost every field we deal with relies on sheet drainage and the few sand based fields we work on have had so many maintenance people with so many different ideas over the years that the fields themselves are now really soil-based fields with a sand subgrade.

We locate problem areas by running the sprinkler system and checking all heads to check rotation and throw. Water ponds in depressed areas. We use field paint to circle the mini pond or the dry spot. We then put a flag in the center of the area with an analysis of the problem, i.e., "sprinkler riser too low" or "area about 1" below grade."

If we have problems we can't fix or see something we don't know about, we call Ali Harivandi, our local turfgrass specialist with the University of California Cooperative Extension. Ali has a network of people with specific expertise, for example a rep from the local water district, who does free evaluation of irrigation systems. Helpful people like these most likely exist in your community.

About 7 days after the season is over, we have completed both our general and our spot specific maintenance. Then we water once during the evening and then midday to keep the seeds and seedlings moist. Over the next four weeks we will stop by the field almost every day, adjusting and fine-tuning the water. After four weeks the grass is up and can take a little watering abuse.

During the summer shutdown we allow our grass

to grow to about 4 inches tall. Then about four weeks before the season starts we gradually bring down the height of the cut to 1 1/2 inches, our playing height. In mid-August, we apply a slow release fertilizer (22-5-8) that will carry us through the fall season.

Once the season starts, we line the field using a pressurized paint liner (rather than aerosol cans or lime), which we find cost effective if we are lining more than two fields in one day. Just this year we have experimented with using about a tablespoon of growth regulator per five gallons of paint on our first lining. We have found that this helps us hold our lines and reduces labor cost on future linings. However, we only use this on fields that are so tight that we don't have a lot of options for "moving" the field. In most instances, we prefer to "move" the high traffic areas every six weeks by relining the field to alter the location of these high traffic areas. No matter which form of lining we use, it is coupled with stopping by our fields during the first week of the season to educate users about not working teams in high traffic areas for regular practice.

During the season we fill holes, repair and adjust sprinklers, however, we have found that "in season" maintenance work aimed at growing grass (like over seeding), other than aerating, is generally pretty ineffective as anything we do is torn up by the players in a few days. We also work with user groups to have them educate their coaches about moving drills around so that they save the high traffic areas for games. We encourage that fixed or heavy goals be removed and replaced by lightweight movable goals.

If we aren't on the shutdown approach, we are on the "no cleated sports other than softball/baseball" from March 1 to June 15. In this case the field has no shut down period but we do the slit seeding and topdressing 2 weeks before the baseball season opens. We put out signs that say "No Rugby, Soccer, Lacrosse or Ultimate." The field is a little thin at the start of the season but it only takes a few weeks and the field looks great. Because baseball/softball is a holiday for our fields, by the middle of June, the fields are in great shape for the soccer season, which starts in mid August or early September.

Costs

With labor rates at about $20 per hour it costs us about $12,000 per year to maintain a field (excluding the cost of water which runs about $5,000 per year). Our maintenance includes, mowing once or twice a week, aerating and fertilizing about four times a year, topdressing twice a year, removing all trash a couple of times a week and field prep every week (including lining). We are also on the field about two or three times a week adjusting water and checking for problems. But the actual cost of maintaining a playing field versus any other public grass area is significantly less than $12,000 because every public grass area needs mowing, irrigation, etc. We figure the additional costs for an athletic field (compared to just public grass area) is only about $6,000 per year.

There are two things that set our maintenance approach apart. First, is that people who work on our fields have total responsibility for the quality of the playing surface. If the sprinklers are broken, or the grass is too long, or there is a gopher hole, there is a single individual who has 100% responsibility. They may need to call in a sprinkler mechanic, but if the field isn't in good shape, it's their problem.

Second is speed and attention to detail. We visit the fields every few days adjusting the water, looking for problems, etc. And the problems are fixed immediately. All of this is doable in most management programs; it just isn't done in most localities.

As for funding we often derive our maintenance revenue from field fees. On the fields we totally manage we charge youth teams about $10 per hour and adult teams $25 per hour. The basis for field fees is that athletic fields require a higher level of service than do other publicly maintained spaces (median strips, general park areas, etc.). At the above rates, two hours on one of our fields costs a youth player about $.67 and an adult player $1.66. Our users have no problem paying these fees, provided they get a decent field in return. **ST**

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