MISSISSIPPI STATE UNIVERSITY EXTENSION

Managing Mississippi Sports Fields

There are more than 2,000 sports fields in Mississippi, the majority being used for football, baseball, softball, and soccer. Cities and communities throughout the state are constructing new or improving existing sports complexes to meet the demand for safe recreational activities. This publication provides coaches, groundskeepers, league employees, and concerned citizens with the basics of caring for natural turfgrass in its most visible and, at times, most stressed scenario.

Natural Turfgrass Versus Synthetic Turf

Natural turfgrass provides a cost-effective and safe playing surface for all athletes. Cost of construction and maintenance varies considerably due to the amount and nature of use. Scheduling use of natural fields in order to allow for routine maintenance and recuperation is one of the most important characteristics of a useful and safe playing surface.

Some scenarios, such as those of highly used multipurpose fields, do not allow adequate time for recovery or routine maintenance. In these instances, synthetic fields are sometimes a cost-effective measure. However, for most Mississippi sports fields, natural turfgrass is the most cost-effective surface. When making the decision between natural and synthetic playing surfaces, a sports field architect should be consulted in order to assess previous use and balance expectations with costs.

Bermudagrass Selection for Athletic Fields

Most Mississippi fields are surfaced with bermudagrass (Cynodon species). Bermudagrass grows vigorously throughout the state, which allows it to withstand high traffic and recuperate quickly after use. Bermudagrass is the most suitable warm-season sports turf for our climate; thus, the advice in this publication is intended for bermudagrass sports fields only.

Vegetative Types (Planted from Sod, Sprigs, or Plugs)

Most bermudagrass varieties can be established from vegetative propagation; however, some are exclusively sold as sod, sprigs, or plugs. These grass types generally do not produce viable seed because they are interspecific hybrids of two separate species (*Cynodon dactylon* and *Cynodon transvaalensis*). Several older vegetative varieties are prevalent on athletic fields throughout the southeast, including 'Tifsport' and 'Tifway.' 'Tifway' (also known as Tifton 419) is the most commonly sold bermudagrass in Mississippi. Other varieties sold for sports turf include 'Celebration,' 'Latitude 36,' 'MS-Choice,' 'MS-Express,' 'Northbridge,' 'Patriot,' 'TifGrand,' 'Tifgreen' (also known as Tifton 328), 'TifTuf' (also known as GN-1), and 'Tifway II.'

Seeded Types

Most seeded bermudagrass varieties do not withstand athletic field wear as well as vegetatively established varieties; however, seeded establishment of bermudagrass is sometimes desirable for large-acreage facilities with reduced play and moderate expectations. Common seeded varieties include 'Riviera,' 'Princess 77,' 'Transcontinental,' 'Mirage,' 'Numex Sahara,' and 'Yukon.' 'Yukon,' and 'Princess 77' have been noted for reduced germination and establishment; however, 'Princess 77' has excellent leaf spot resistance relative to other varieties. 'Riviera' is relatively easy to establish and tolerates cold winters well once established. 'Numex Sahara' is highly susceptible to leaf spot and does not tolerate cold winters as well as several other varieties mentioned. 'Yukon' does not tolerate heavy traffic. Practitioners should be forewarned: many local feed-and-seed home lawn supply stores carry bermudagrass varieties that are ill-suited for athletic field use. Seed coatings are also routinely used to "bulk-up" or dilute seed per bag; for these reasons, buying from a reputable source is your best option.

Turfgrass breeders continue to develop improved seeded and vegetative varieties. For sports turf managers interested in the most up-to-date field evaluations, visit the National Turfgrass Evaluation Program website.

Routine Maintenance

Turfgrass cushions athletes from falls and provides traction to prevent slipping. The goal of any sports turf manager should be to maintain a smooth and uniform field that provides athletes with safe playing conditions throughout the season. The maintenance and cost of a sports field will depend upon location, weather, soil type, turf variety, pest activity, and amount of play.

All sports fields require routine maintenance. For this reason, staff should be trained to maintain the field, or an outside cooperator should be hired to maintain the facility. Sports fields must be well drained in order to allow play during or after precipitation events. Irrigation is almost always required to optimize playing conditions for safe and reliable turf. The following should be considered when maintaining a sports field.

Soil Management

The foundation of any sports field is the soil in which the turf grows. Three general types of soil are used for Mississippi sports fields: natural soil (soil that was on the site when the field was built); modified soil (natural soil mixed with sand, organic matter, or other amendments); and constructed or artificial soil (a mix of predominantly sand and other materials that do not contain natural soil).

Natural-Soil Fields

Most sports fields in Mississippi are built from natural soil because it is the least expensive construction material. Many fields are constructed of suitable loamy sand and sandy-loam soil with good internal drainage and a high infiltration rate, allowing water to move easily into (infiltrate) and through (percolate) the soil. Some fields are built with soils that contain a large amount of silt and clay. Although these fields present challenges during periods of high rainfall, an advantage is that they tend to retain adequate moisture levels for longer periods during drought. Yet other fields are built with soils containing significant amounts of clay. Soil nicknames "buckshot" and "gumbo" reflect their hardness when dry and soupiness when wet.

Modified-Soil Fields

Faced with an undesirable soil type, many people believe that by adding sand and organic matter, the infiltration and percolation rates of the native soil will change to acceptable levels. Although helpful, seldom will the results be what you expect.

The key to the success of modifying soil is an acceptance that the final product should contain at least 70 percent coarse sand or should be in the loamy-sand textural category. As an example of how far-fetched this may be: as much as 16 inches of sand may be needed in order to obtain a 2-foot modified-soil zone! For obvious economic reasons, soil modification is useful during construction or renovation only if the native soil is greater than 50 percent sand—which is highly unlikely unless previous efforts had added sand to an existing field, or unless the site was a river flood plain.

Soils with less than 50 percent sand should not be considered for modification but instead should be replaced with an improved root zone mix. The modified soil should be mixed off-site. Although the modified soil will not be a rapid-draining sand field, it will perform much better than the native soil and can be used under a wider range of moisture conditions. In addition, it may be easier to manage than a sand field. Modified-soil fields have better infiltration and percolation rates than many natural-soil fields, but most still require a sloped surface (crown) or drainage lines to prevent standing water.

Soil conditions can be improved by adding sand or organic matter as a topdressing following aerification (see "Improving the Soil"). The sand added to fill the holes acts as a chimney for air, water, and grass roots. Over several years, the physical attributes of the soil can be greatly improved.

Constructed-Soil Fields

State-of-the-art sports fields are constructed of sand and organic matter mixes above a system of drainage lines. These soils have excellent infiltration and percolation rates and do not have to be crowned to the extent of other fields. The drainage system removes water at a fast rate, and puddles seldom form on the field, even during severe thunderstorms. Excellent irrigation systems are required with these mostly sand soils because of the low water-holding capacity and necessary, frequent fertilizations.

Evaluating the Soil

The type of soil used to construct the sports field will have a significant impact on the management methods used to keep it at its best. The easiest way to tell which type of construction was used is to ask someone who was there when the field was first developed. If the field is so old that no one knows its origins, it is likely natural soil. If there is any doubt, dig a hole in a little-used area of the playing surface.

Four tools are needed to evaluate the soil in a sports field. The first two are a pair of observant eyes. After a heavy rain, examine the field for areas where water puddles. Notice how long it takes for puddles to disappear. Check the puddled areas to see if the turf is thin. During a dry spell, set rain gauges (or substitute other collection devices, such as tuna cans) on the field and turn on the irrigation. If the field doesn't have permanent irrigation, substitute with a hose and lawn sprinkler. Observe when the water starts to collect on the surface and when it moves off rather than soaks in. Measure the depth of water in the containers. If the water is more than 1 inch deep, the situation is satisfactory. If the water is between ⅜- and ¾-inch deep, it is a manageable situation. If the water is less than ⅜ inch deep, a problem exists that will require significant effort to correct.

The third tool needed is a thin-bladed knife or a screwdriver with a 4- to 6-inch blade. When the soil is moist, push the blade into the ground with only a thumb resting on top of the handle. If it requires a hard push, move over a few inches and try again, because roots and stones sometimes interfere. If the blade still can't be pushed in, a compaction problem probably exists. Compaction is a frequent problem in sports fields, and an aerification program can help (see next section). Compaction sometimes occurs naturally but is normally caused by foot and machine traffic, crushing and minimizing the pores (naturally occurring holes) in the soil.

The fourth tool needed is a shovel or soil probe. Use these to obtain soil from the top 3–4 inches at 10 to 20 locations in the field. Put all of the soil in a bucket, mix well, and fill a soil sample box or bag with 1 pint of soil. Send the sample to a soil-testing laboratory to have it analyzed for pH and nutrient content.

Improving the Soil

If the soil evaluation reveals problem areas, the site or the soil probably need to be changed or modified.

Site modification is meant to improve drainage. Methods to modify field structure are (1) sloping the field (crowning) and (2) installing drainage. The field should be sloped so water will travel across the playing surface. Preventing puddled water on the playing surface will provide a safer footing for athletes and a better medium for the grass to grow in. Figure 1 shows the 9- to 18-inch crown from the center of a football or soccer field to the sidelines. Figure 2 shows the 1 percent or less slope from the base of the pitcher's mound to the base lines. It is important to maintain a smooth grade, free of bumps or depressions, to prevent water from standing. It is also important to remove water from the sideline area via a drain or a continued slope away from the playing surface. Standing water on the sidelines is uncomfortable and unsafe for coaches and players.

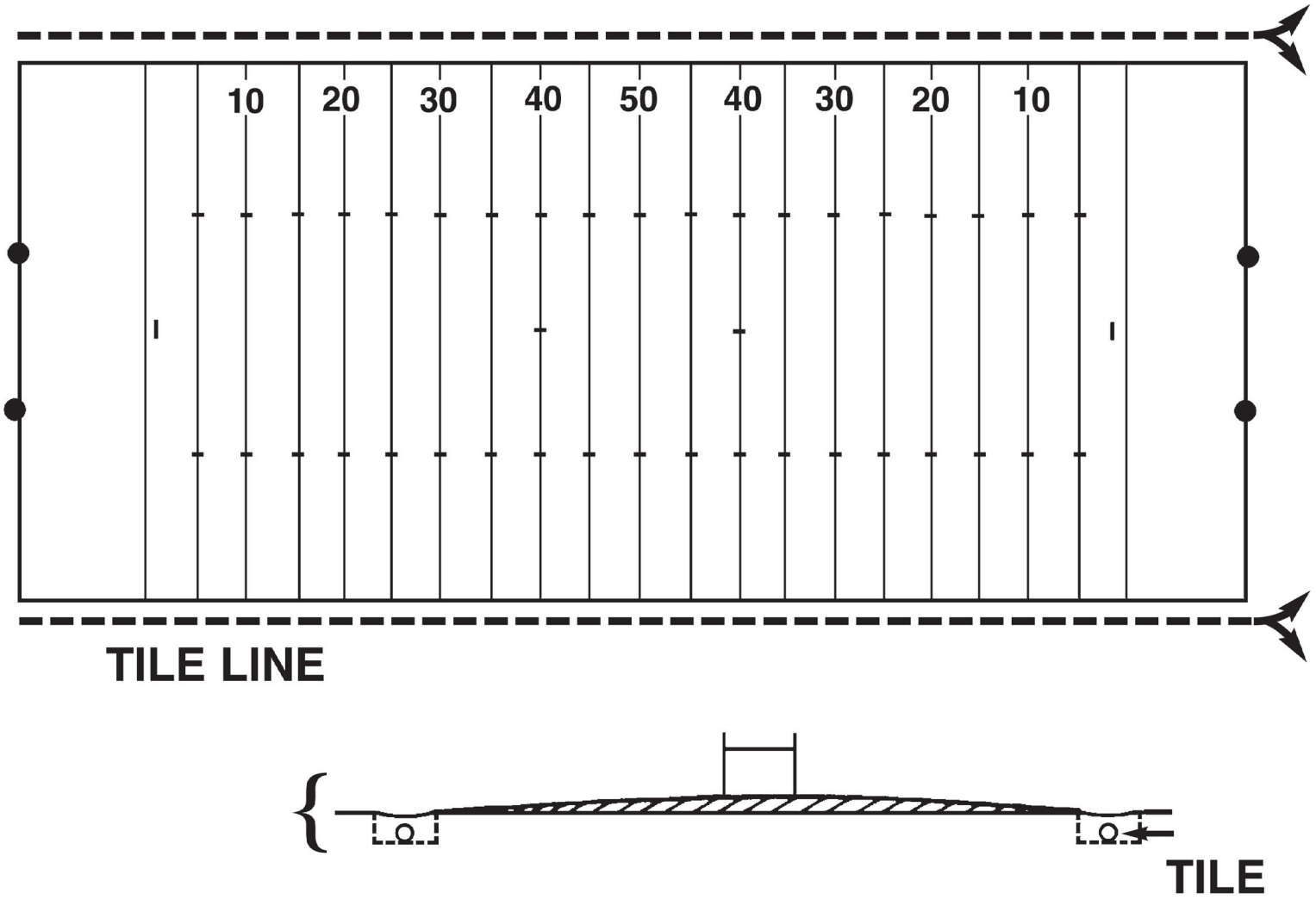

Figure 1. Football gridiron showing end section and tile lines for natural soil and modified soil fields.

Installing drainage lines is an exacting task and should not be attempted without a surveyor's level and an experienced crew. An agricultural or civil engineer may need to match percolation rates with the distances between drain lines to ensure proper drainage. The trench above the drain line is often back-filled with coarse sand to enable surface water to percolate into the drain line. Always plan for the outlet of the drain line to discharge a good distance from the playing field. To prevent nutrient loss and environmental harm, drainage lines should never discharge directly into flowing creeks or streams. Drained water should discharge into containment zones that slow storm water run-off and allow soil infiltration.

Soil modification can be done physically, chemically, or nutritionally.

During *physical modification*, amendments are added to improve the soil by changing its water relations. Ways to change soil in an existing sports field include aerification and topdressing. Aerification involves punching holes in the soil in order to relieve compaction, improve drainage characteristics, and increase air available to plant roots. This is commonly done with a machine called an aerifier. The aerifier may use solid tines to punch "holes," hollow tines to pull "plugs" or "cores," spoons to dig holes, or coulters to cut slits.

Regardless of aerifier type, the physical disruption of the soil allows air and water to enter the soil more easily. Core aerification and core removal are most effective when combined with topdressing. During topdressing, sand or sand plus organic matter is added in a thin layer to the turf. After ⅛ to ¼ inch of sand has been added to the surface, a steel mat or a section of chain link fence is dragged across the surface to pull sand off high places and fill low places. If topdressing immediately follows aerification and core removal, the sand is pushed into the holes and prevents the soil from sealing itself, making the effects of the aerification last longer.

During *chemical modification*, soil treatments are added to the soil to change the reactions that occur in it. The sole consideration is the soil's pH. Soil pH is expressed on a scale from 1 to 14 with 1 being highly acidic, 14 being highly alkaline, and 7 being neutral. Bermudagrass and ryegrass grow best at a pH between 6.0 and 6.5. If the pH falls a little below 6.0, minimal changes occur in bermudagrass: it grows

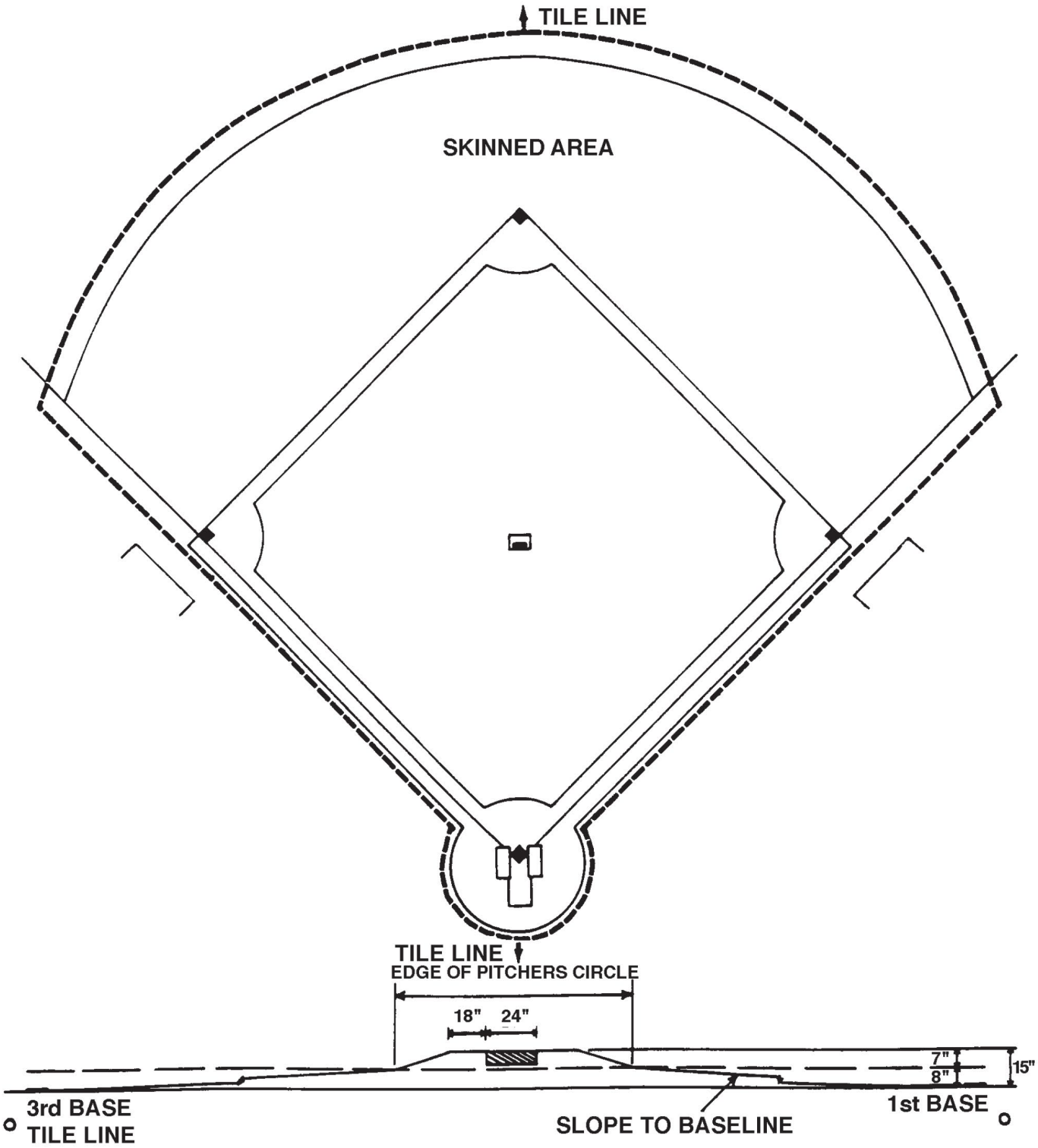

Figure 2. Regulation baseball diamond showing design of tile system.

slower and is less responsive to fertilizer. If the soil testing reveals an overly acidic soil (typically 5.8 or less), applications of limestone are recommended to bring the pH back into the proper range. Alkaline soils (those with pH above 7) are not uncommon in Mississippi. If soil testing reveals alkaline soils, addition of elemental sulfur (flowers of sulfur) is sometimes recommended. Other methods to lower soil pH include the use of ammonium sulfate fertilizers. The addition of gypsum (calcium sulfate) is not a recommended means of adjusting soil pH but may be implemented when soil sodium levels are excessive, which is rare in Mississippi.

In *nutritional modification*, plant nutrients are added to the soil to enable the turf to grow better. Fertilizer is applied according to the levels determined by a soil test. Without a soil test, most sports fields will respond to the schedule outlined in Table 1a, but it would be risky. Don't guess—soil test. If the turf is not growing as well as expected, adjust the amount of fertilizer a little. If a problem persists, seek help. Tables 1b and 1c provide some guidelines.

Table 1a. Fertilization schedule for bermuda turf on soccer and football fields in Mississippi.[1]

Date	Fertilizer	Rate of Application	This rate of application	gives this amount of available NPK	Total Fertilizer Needed
May 15	13-13-13	10 lb per 1,000 sq ft = 440 lb per acre	1.3 lb-1.3 lb-1.3 lb per 1,000 sq ft	57 lb-57 lb-57 lb per acre	650 lb
June 15	33-0-0	3 lb per 1,000 sq ft = 130 lb per acre	1.0 lb-0 lb-0 lb per 1,000 sq ft	44 lb-0 lb-0 lb per acre	200 lb
July 15	33-0-0	3 lb per 1,000 sq ft = 130 lb per acre	1.0 lb-0 lb-0 lb per 1,000 sq ft	44 lb-0 lb-0 lb per acre	200 lb
August 15	33-0-0	3 lb per 1,000 sq ft = 130 lb per acre	1.0 lb-0 lb-0 lb per 1,000 sq ft	44 lb-0 lb-0 lb per acre	200 lb
September 15	33-0-0	3 lb per 1,000 sq ft = 130 lb per acre	1.0 lb-0 lb-0 lb per 1,000 sq ft	44 lb-0 lb-0 lb per acre	200 lb
October 15	0-0-60 muriate of potash[2]	1.6 lb per 1,000 sq ft = 70 lb per acre	0 lb-0 lb-1.0 lb per 1,000 sq ft	0 lb-0 lb-44 lb per acre	100 lb
December 15	TAKE SOIL SAMPLES				

[1] This schedule is based on field sizes 360 feet long and 180 feet wide (including the end zones and 10-foot sidelines on each side). Total square footage is 64,800 square feet, which is the same as 1.48 acres.

[2] Follow rates carefully with muriate of potash to avoid burn.

Table 1b. Soil test designations for levels of macro- and micronutrients in turfgrass soils.

	Existing Pounds per Acre and Soil Test Designation			
Nutrient	**Low**	**Medium**	**High**	**Very High**
Phosphorus	< 37	37–72	72–144	>144
Potassium	< 90	90–161	161–320	>320
*Calcium	< 500			
*Magnesium	< 40			
Sulfur	< 15	15–50	> 50	
Boron	< 0.5	0.5–1.5	> 1.5	
Copper	< 0.5	0.5–5	> 5	
Iron	< 15	15–120	> 120	
Manganese	< 10	10–50	> 50	
Zinc	< 2	2–5	> 5	

Adapted from *Sports Fields: Design, Construction, and Maintenance* by J. Puhalla, J. Krans, M. Goatley.

*These numbers are only guidelines. Acceptable limits vary depending on soil textures and soil cation exchange capacities. You should rely on soil test recommendations.

Table 1c. General tissue sufficiency ranges for bermudagrass and perennial ryegrass sports turf.

	Bermudagrass			Perennial Ryegrass		
Nutrient (unit)	**Low**	**Medium**	**High**	**Low**	**Medium**	**High**
Nitrogen (%)	2.50–2.99	3.00–5.00	> 5.00	4.00–4.99	4.50–5.00	> 5.00
Phosphorus (%)	0.12–0.15	0.15–0.50	> 0.50	0.30–0.34	0.35–0.40	> 0.40
Potassium (%)	0.70–0.99	1.00–4.00	> 4.00	0.70–1.99	2.00–2.50	> 2.50
Calcium (%)	0.30–0.49	0.50–1.00	> 1.00	0.20–0.24	0.25–0.30	> 0.30
Magnesium (%)	0.10–0.12	0.13–0.50	> 0.50	0.13–0.15	0.16–0.20	> 0.20
Sulfur (%)	0.12–0.14	0.15–0.50	> 0.50	0.22–0.26	0.27–0.32	> 0.32
Boron (ppm)	4–5	6–30	> 30	< 9	9–17	> 17
Copper (ppm)	3–4	5–50	> 50	4–5	6–7	> 7
Iron (ppm)	40–49	50–350	> 350	< 40	40–60	> 60
Manganese (ppm)	16–24	25–300	> 300	< 2	2-10	> 10

Adapted from Jones, J. B., Wolf, B., & Mills, H. A. (1991). *Plant Analysis Handbook*. Micro Macro Publishing, Inc.

Mowing

Mowing is the most important but most often mismanaged aspect of sports field management. Mowing is not difficult, but timing is critical. The correct time to cut the grass is when you remove no more than one-third of the leaf surface. For example, if target mowing height is 1 inch, mow when the grass reaches 1½ inch. Bermudagrass and ryegrass on a sports field should be maintained at ¾ to 1 inch in height. When temperature and moisture conditions are right, the grass will need clipping every 3–5 days. Allowing bermudagrass to grow to 2 inches and cutting it back to ¾ inch will stress the grass, the lawnmower, and the groundskeeper.

An easy way to check whether the turf is being mowed often enough is to check the color just above the soil surface. The grass should be green all the way to the ground. If a brown layer develops, increase the frequency of cutting. An advantage of frequent mowing is that the clippings may be left on the field, unless they are so thick they prevent seeing the unmown grass underneath. Clippings act as a slow-release source of nutrients and rarely cause thatch. If rain or vacation has caused a heavy accumulation of clippings, collect and compost them.

Reel mowers are preferred because they give a smoother look to the turf, but rotary mowers will provide satisfactory results. Many limited-resource fields are cut with rotary mowers and still maintain excellent turf. Whichever mower type is used, be sure to keep the blades sharp. Regularly check the mower for oil and hydraulic fluid leaks. Fluid leaks can damage the turf and leave brown lines through the field.

Watering

Bermudagrass requires approximately 1 inch of water per week. After a typical Mississippi wet spring, monitor weekly rainfall using a rain gauge at the field or by watching weather reports. Apply enough water to equal an inch during weeks without sufficient rain. The best method is to supply the inch of water in one watering once a week. However, if your soil will not accept a whole inch of water at a time, apply the water in as few applications as possible. Watering lightly and frequently is the worst method because it concentrates root growth at the surface, resulting in easily injured, slow-to-recover turf. During the warmer weather of spring and fall, overseeded ryegrass will also require approximately 1 inch of water per week. The same amount would be excessive when evaporation and plant water use are limited during cooler season growth. Pay attention to temperature during the growing season. If it has been so cold that the grass hasn't grown much, cut back to ½ inch per week. A good rule of thumb is to water ryegrass if two weeks pass without rainfall.

No irrigation system is perfect—irregularities are bound to occur. A leading contributor is inadequate water pressure. Check the water distribution system by placing containers on the field before watering. Any container will do (coffee cans, vegetable cans, pickle jars) if they are all the same size and will not fall over easily. After watering, measure the depth of water in each container. Make a note of any container that caught less than three-fourths of the average and watch that area of the field for signs of water stress. Check that irrigation heads are not clogged and that systems are routinely audited. Many large facilities with low budgets may also find that retractable hose reels are a viable solution where in-ground irrigation is not an option; however, adequate water pressure is paramount to good coverage and efficiency.

Water conservation may be enhanced by using a soil moisture meter. Soil moisture meters measure several variables that predict volumetric water content. Water content will vary with soil type, texture, and depth. For this reason, it is important that practitioners become familiar with what measurement necessitates an irrigation event: essentially, how dry the soil can get before water is necessary. It is also possible to irrigate too much, which leads to saturated soils that harbor disease and insects; in addition, soils that are too wet are depleted of oxygen, which plant roots need to survive.

Water conservation is enhanced by watering early in the day, before rising temperatures and sunlight. Both heat and sunlight exaggerate evaporation of water before it reaches the soil surface. However, withstanding reasons for water conservation, the best time of day to water is whenever it is convenient—as long as the grass is dry when the sun goes down. Watering in the afternoon can be used both to provide grass with necessary soil moisture, as well as to cool the playing surface for practices and games.

Pest Prevention and Control

Any outside agent that causes the grass not to grow well is a pest. Major pests are weeds, disease organisms, insects, and sports players. Because the field is being grown for the sports players, let's address them first. Certain sports place heavy traffic on certain areas of a field. Soccer fields are heavily worn at the goal mouths. Football tends to be played mainly between the hash marks and the 20-yard lines. A benefit of baseball and softball is that the base paths can remain bare, though outfield positions often become barren and compacted.

With this knowledge, pay special attention to these areas and try to keep them from developing problems. When resources are limited, prioritize spending on these areas. If an aerifier can't be rented or borrowed, use a pitchfork to aerify the goal areas. If enough sand can't be bought for the whole field, get enough to topdress the most heavily used areas first. Try to keep practice away from these areas by moving the soccer goals to a sideline or by practicing football in the end zone. See "Scheduling of Use" below for more information.

The best measure against pests is healthy turf; however, highly managed sports surfaces routinely need the addition of synthetic pesticides in order to withstand normal use and abuse. Always read and follow label directions and restrictions when using pesticides. Be sure the chemical is labeled for use on turf. Give special attention to restricted-entry intervals (REI), which tell how many hours or days must pass before people can be allowed back on the field. Always rely on a licensed and bonded professional for pesticide applications.

Weed Control

Weeds are just plants taking advantage of conditions. The best weed control is a thick, healthy turf that does not allow sunlight to strike the soil surface. One effective cure for weeds is to remove them physically. A hoe is sufficient if there aren't many weeds. Applying herbicides to control weeds is a normal part of maintaining natural fields in Mississippi. Tables 2a and 2b list common weeds found on sports fields and chemicals to help control them. The long-term cure is to alleviate the problem by determining what is preventing dense turf from growing in particular spots. Growing desired turfgrasses is more cost-effective in the long run than repeatedly removing weeds. For this reason, proper cultural practices, irrigation, and fertilization are necessities for weed-free turf.

Postemergence Herbicides

Perennial weeds like dallisgrass, white clover, and wild garlic require postemergence herbicides applied after emergence. Most other weeds can be prevented using preemergence herbicides. Tables 2a and 2b list herbicides that can be used for many common weeds in sports fields.

Preemergence Herbicides

Most annual weed problems, including crabgrass, goosegrass, spurge, and annual bluegrass, can be controlled with a preemergence herbicide applied at least once (ideally twice, 6–8 weeks apart) in the spring and once in the fall. Preemergence herbicides prevent weeds from establishing from seed; thus, they are applied preemergence. Spring treatments should be applied before crabgrass emerges, typically between February 15 and March 15, depending on latitude within the state. A second application is typically needed roughly 6–8 weeks after the first in order to ensure adequate weed control, particularly of goosegrass and annual sedges that emerge in warmer spring temperatures than crabgrass. Fall applications should be made before annual bluegrass emerges, usually between September 15 and October 15.

Table 2a. Estimated preemergence control of turfgrass weeds.

Weed	Atrazine R W (Aatrex)	Benefin (Balan)	Bensulide (Bensumec)	Benefin + Oryzalin (Amaze)	Benefin + Trifluralin (Ferti-Lome)	Dimethenamid W (Tower)	Dithiopyr (Dimension)	Flumioxazin W D (Sureguard)	Indaziflam W (Specticle)	Isoxaben (Gallery)	Metolachlor W (Pennant Magnum)	Oryzalin W (Surflan)	Oxadiazon D (Ronstar)	Oxadiazon D + Prodiamine	Pendimethalin (Pendulum)	Prodiamine R W (Barricade)	Pronamide (Kerb)	Simazine W (Princep)
Annual Bluegrass	G	G	G	G	G	-	E	G	E	N	-	-	G	E	E	E	E	E
Bahiagrass	-	G	G	G	-	-	-	-	-	-	-	G	G	-	G	-	-	-
Buttercup	N	N	N	N	-	-	-	-	-	-	-	N	F	-	N	-	-	N
Carpetweed	-	G	G	G	-		-	G	-	F	-	G	E	-	N	-	-	E
Chamberbitter	G	-	-	-	-		-	-	-	G	-	-	G	-	-	G	-	G
Chickweed	E	N	F	F	G		-	E	E	E	-	G	F	-	G	-	F	E
Clovers	G	N	N	N	-		-	-	-	G	-	N	N	-	N	-	-	F
Crabgrass	F	G	E	E	G	G	E	-	E	N	F	E	G	E	E	E	-	F
Dallisgrass	-	G	G	G	-	-	-	-	-	N	-	G	-	-	G	-	-	-
Dandelion	-	N	N	N	-	-	-	G	G	G	-	N	N	-	N	-	-	F
Dichondra	E	N	N	N	-	-	-	-	-	-	-	N	N	-	N	-	-	N
Florida Betany	E	N	N	N	-	-	-	-	-	-	-	N	N	-	N	-	-	-
Florida Pusley	E	N	F	F	-	-	-	-	-	F	-	N	-	-	N	-	-	G
Goosegrass	F	F	F	F	G	G	E	G	E	-	-	G	E	E	G	E	-	N
Ground Ivy	N	N	N	N	-	-	-	-	-	-	-	N	G	-	N	-	-	G
Henbit	-	N	N	N	-	-	-	E	E	G	-	N	G	-	N	-	-	E
Knotweed	G	N	F	F	G	-	-	-	-	G	-	F	-	-	N	-	-	G
Lawnburweed	G	N	N	N	-	-	-	-	-	-	-	N	F	-	N	-	-	E
Lespedeza	G	N	N	N	-	-	-	-	-	-	-	N	-	-	N	-	-	F
Nutsedge	N	-	-	-	-	G	-	-	-	-	G	-	-	-	-	-	-	-
Pennywart	-	N	N	N	-	-	-	-	-	G	-	N	-	-	N	-	-	N
Plantain	-	N	N	N	-	-	-	G	G	G	-	N	-	-	N	-	-	N
Prostrate Spurge	-	N	N	N	-	G	-	G	-	F	-	N	G	-	F	-	-	G
Sandbur	F	G	G	G	-	-	-	-	-	-	-	G	G	-	G	-	N	-
Shepherdspurse	-	N	N	N	-	G	-	-	-	E	-	N	G	-	N	-	-	E
Speedwell	E	N	N	N	-	-	-	-	G	G	-	N	G	-	N	-	-	F
Virginia Buttonweed	-	N	N	N	-	-	-	-	-	-	-	N	G	-	F	F	-	G
Wood Sorrel	G	N	N	N	-	-	-	G	-	-	-	F	G	-	F	-	-	G

E = Excellent, G = Good, F = Fair, N = No control, - = Data not available.

R = Restricted Use Pesticide: For retail sale to and use only by certified applicators or persons under their direct supervision, and only for those uses covered by the Certified Applicator's Certification.

W = This product is labeled for use primarily in warm-season turf. Read the label for a list of tolerant species.

D = Liquid formulations of this herbicide are for use only within dormant turf. Granular carriers may be used in green turf when labeled for such use.

Table 2b. Estimated postemergence control of turfgrass weeds.

Weeds	Atrazine R W (Aatrex)	Bentazon (Basagran)	Chlorsulfuron (Corsair)	Clopyralid (Lontrel)	Clopyralid + Triclopyr (Confront)	2,4-D	2,4-D + Mecoprop	2,4-D + Dicamba	2,4-D + Dicamba + Fluroxypyr (Escalade Ii)	2,4-D + Mcpp + Dicamba (Trimec)	2,4-D + Mecoprop + Dicamba + Carfentrazone (Speed Zone)	2,4-D + Mecoprop + Dicamba + Sulfentrazone (Surge)	Diclofop G (Illoxan)	Dicamba (Banvel)	Diquat N (Reward)	Fenoxaprop G (Acclaim)	Florasulam (Defendor)	Fluazifop G (Fusilade Ii)	Fluroxypyr (Vista Xrt)	Foramsulfuron (Revolver)	Glyphosate N (Round-Up)	Halosulfuron (Sedgehammer)	Imazaquin (Image)	Metribuzin (Sencor)	Metsulfuron (Msm-Turf, Manor)	Penoxsulam	Pronamide R W (Kerb)	Quinclorac (Drive)	Rimsulfuron (Tranxit)	Sethoxydim G (Segment)	Simazine (Princep)	Sulfentrazone (Dismiss)	Sulfosulfuron (Certainty)	Trifloxysulfuron (Monument)
Annual Bluegrass	E	N	N	N	N	N	N	N	N	N	N	N	-	N	G	N	N	-	N	E	E	N	N	G	N	N	E	-	E	F	E	N	G	E
Bahiagrass	N	-	-	N	N	N	N	N	N	N	N	N	N	N	-	G	N	-	N	N	E	N	N	N	E	N	N	-	-	G	N	N	N	F
Buttercup	N	-	-	-	G	F	G	G	G	E	E	E	N	E	F	N	-	N	G	-	E	-	-	G	-	-	-	-	-	N	N	-	-	-
Carpetweed	E	-	-	N	-	G	G	G	E	G	G	G	N	G	N	N	E	N	G	-	E	-	-	N	N	G	-	-	-	N	E	-	-	-
Chamberbitter	G	-	F	-	-	-	-	-	-	-	-	-	-	-	-	-	-	N	-	-	-	-	N	-	G	-	-	-	-	-	G	-	N	F
Chickweed	E	-	-	-	E	F	G	G	G	E	E	E	N	E	G	N	E	N	G	-	E	-	G	G	G	E	F	-	G	N	E	-	E	E
Clovers	G	-	N	E	E	N	G	E	E	E	E	E	N	E	P	N	E	N	G	N	E	-	N	N	G	G	-	-	-	N	G	F	N	G
Crabgrass	F	N	-	N	N	N	N	N	N	N	N	N	-	N	N	E	N	G	N	-	E	-	-	N	N	N	N	G	N	G	F	-	N	-
Dallisgrass	N	N	-	N	N	N	N	N	N	N	N	N	N	N	N	N	N	-	N	F	E	N	N	N	N	N	-	-	N	F	N	N	N	-
Dandelion	F	-	G	-	E	E	E	E	E	E	E	E	N	G	N	N	E	N	G	N	E	N	F	N	G	E	-	-	-	N	F	-	F	E
Dichondra	N	-	-	-	-	F	G	G	G	G	-	-	N	G	N	N	-	N	-	-	E	-	-	N	N	-	-	-	-	N	N	-	-	-
Florida Betany	N	N	N	-	G	N	-	G	G	G	G	G	N	G	N	N	-	N	-	-	E	N	N	N	E	G	-	-	-	N	-	-	-	-
Florida Pusley	N	-	-	-	-	N	N	-	-	-	-	-	N	-	N	N	-	N	-	-	E	-	-	-	G	-	-	-	-	N	N	-	-	-
Goosegrass	N	N	N	N	N	N	N	N	N	N	N	N	E	N	N	G	N	-	N	G	E	N	N	N	N	N	N	N	N	F	N	G	N	N
Ground Ivy	G	-	-	-	-	G	-	-	G	-	-	-	N	-	N	N	-	N	-	-	E	-	-	G	G	G	-	-	-	N	N	-	-	-
Henbit	E	-	-	-	E	F	G	G	G	E	E	E	N	E	G	N	-	N	G	E	E	-	F	G	G	E	-	-	E	N	E	-	E	E
Knotweed	G	-	-	G	-	F	G	G	G	G	-	-	N	E	N	N	G	N	-	-	E	-	-	N	E	-	-	-	-	N	G	-	-	N
Kyllinga	-	-	N	N	N	N	N	N	N	N	N	N	N	N	-	N	N	N	N	N	E	F	F	-	N	G	-	-	-	N	N	E	E	G
Lawnburweed	E	-	E	-	-	F	F	G	-	G	G	G	N	G	G	N	-	N	-	N	E	N	E	G	E	-	N	-	G	N	E	-	E	E
Lespedeza	F	-	-	-	-	F	G	G	E	G	G	F	N	E	N	N	N	N	E	-	E	-	-	N	G	G	-	-	-	N	F	-	-	-
Nutsedge, Purple	N	N	-	N	N	N	N	N	N	N	N	-	N	N	N	N	-	N	N	-	G	E	E	N	N	-	N	-	-	N	N	G	E	E
Nutsedge, Yellow	N	E	-	N	N	N	N	N	N	-	N	G	N	N	N	N	-	N	N	-	G	E	E	N	N	-	N	-	-	N	N	G	E	E
Pathrush	-	-	N	-	-	G	-	-	-	G	-	-	-	N	-	N	-	N	-	-	E	-	N	-	N	-	-	-	-	-	-	-	N	-
Pennywart	F	-	-	-	G	F	-	-	-	F	-	-	N	-	N	N	-	N	-	-	E	-	F	-	G	-	-	-	-	N	N	-	-	-
Plantain	F	-	-	G	F	E	G	G	G	G	E	E	N	F	N	N	-	N	F	-	E	-	-	N	G	G	-	-	-	N	F	-	-	-
Prostrate Spurge	F	-	-	N	E	N	F	G	G	G	G	G	N	F	N	N	-	N	F	-	E	-	-	N	G	-	-	-	-	N	G	-	-	-

Weeds	Atrazine R W (Aatrex)	Bentazon (Basagran)	Chlorsulfuron (Corsair)	Clopyralid (Lontrel)	Clopyralid + Triclopyr (Confront)	2,4-D	2,4-D + Mecoprop	2,4-D + Dicamba	2,4-D + Dicamba + Fluroxypyr (Escalade Ii)	2,4-D + Mcpp + Dicamba (Trimec)	2,4-D + Mecoprop + Dicamba + Carfentrazone (Speed Zone)	2,4-D + Mecoprop + Dicamba + Sulfentrazone (Surge)	Diclofop G (Illoxan)	Dicamba (Banvel)	Diquat N (Reward)	Fenoxaprop G (Acclaim)	Florasulam (Defendor)	Fluazifop G (Fusilade Ii)	Fluroxypyr (Vista Xrt)	Foramsulfuron (Revolver)	Glyphosate N (Round-Up)	Halosulfuron (Sedgehammer)	Imazaquin (Image)	Metribuzin (Sencor)	Metsulfuron (Msm-Turf, Manor)	Penoxsulam	Pronamide R W (Kerb)	Quinclorac (Drive)	Rimsulfuron (Tranxit)	Sethoxydim G (Segment)	Simazine (Princep)	Sulfentrazone (Dismiss)	Sulfosulfuron (Certainty)	Trifloxysulfuron (Monument)
Ryegrass	-	-	E	N	-	N	N	N	N	N	N	N	-	N	-	N	-	-	N	E	E	N	N	-	E	-	E	-	E	-	E	N	N	E
Sandbur	-	-	-	N	N	N	N	N	-	N	N	N	-	N	N	-	-	-	-	N	E	-	-	N	N	-	N	-	-	F	-	-	-	-
Shepherdspurse	E	-	-	-	-	G	G	G	G	G	G	G	N	G	G	N	E	N	-	-	E	-	-	G	G	-	-	-	-	N	E	-	-	-
Speedwell	-	-	-	G	-	N	F	F	-	F	F	F	N	N	G	N	-	N	N	-	E	-	N	N	N	-	-	-	-	N	-	-	N	-
Tall Fescue	N	N	F	N	N	N	N	N	N	N	N	N	N	N	N	-	N	N	N	-	G	N	N	N	N	N	N	-	-	F	N	N	F	G
Torpedograss	N	N	-	N	N	N	N	N	N	N	N	N	N	N	N	-	N	N	N	N	N	N	N	N	N	N	N	G	-	N	N	-	N	F
Tufted Lovegrass	N	-	N	N	N	N	N	N	N	N	N	N	N	N	-	G	-	G	N	N	E	N	N	N	N	N	-	N	N	N	N	G	N	N
Virginia Buttonweed	N	-	G	-	F	N	F	G	E	G	G	G	N	F	N	N	F	N	E	-	E	-	N	N	E	G	-	-	-	N	N	-	N	G
Wild Garlic	N	-	-	N	F	F	F	F	F	F	F	F	N	F	N	N	-	N	-	F	G	-	E	N	F	-	N	-	E	N	N	F	N	E
Wood Sorrel	G	-	-	-	-	N	N	F	F	F	F	F	N	G	N	N	-	N	G	-	E	-	F	N	G	-	-	-	-	N	G	-	-	-

E = Excellent, G = Good, F = Fair, N = No control, - = Data not available.

R = Restricted Use Pesticide: For retail sale to and use only by certified applicators or persons under their direct supervision, and only for those uses covered by the Certified Applicator's Certification.

W = This product is labeled for use primarily in warm-season turf. Read the label for a list of tolerant species.

G = At normal use rates, this product will kill desired bermudagrass turf.

N = This product is considered nonselective and should not be used on desirable turf unless turf loss can be tolerated or replaced.

Disease Prevention and Control

The best way to prevent disease is by maintaining thick, healthy turf. Both bermudagrass and overseeded ryegrass are susceptible to several fungal diseases. However, these diseases typically only become problematic when the grass is stressed due to factors such as over- or under-fertilization, excess moisture, heavy traffic, and similar conditions. Proper disease identification is crucial and should be conducted in consultation with an MSU Extension agent or another qualified expert. See Table 3 for effective control measures for most diseases.

Table 3. Fungicides[1,2] for sports field turfgrass disease control[3].*

Fungicide/FRAC	Disease Controlled/Suppressed						
	Large Patch (Brown Patch)	Dollar Spot	Fairy Ring4	Melting Out (Leaf Spot)	Pythium Blight And Root Rot	Rust	Spring Dead Spot
Azoxystrobin[5] FRAC: 11; Mixes Available	G-E		P-G	G-E	F-G	E	P-F
Chlorothalonil[6] (Collegiate And Professional Fields Only) FRAC: M5; Mixes Available	G	G-E		F-G		G-E	
Cyazofamid[7] FRAC: 21					G-E		
Ethazole[8] FRAC: 14					P-F		
Fenarimol[9] FRAC: 3		G-E					F
Fludioxonil[10] FRAC: 12 Mixes Available				G-E		x	
Fluoxastrobin[11] FRAC: 11 Mixes Available		P-G	P-F	G-E	F-G	P-F	P-F
Fluxapyroxad[12] FRAC: 7 Mixes Available	P-F						
Flutolanil[13] FRAC: 7	E		P-G				
Fosetyl-Al[14] FRAC: 33					F-G		
Iprodione[15] FRAC: 2 Mixes Available	G-E	G-E		G-E			
Mancozeb[16] FRAC: M3	G-E	P-F		G-E	F-G	G-E	
Mefenoxam And Metalaxyl[17] FRAC: 4					F-G		
Metconazole[18] FRAC: 3	?		P-G			P-F	
Myclobutanil[19] FRAC: 3	F-G	E		P-F		P-F	F
Penthiopyrad[20] FRAC: 7		F-G		G-E			
Phosphonates[21] FRAC: 33					F-G (varies with trade name)		
Polyoxin D [22] FRAC: 19	F-G		P-G	P-F			
Propamocarb Hydrochloride[23] FRAC: 28					F-G		
Propiconazole[24] FRAC: 3 Mixes Available	F	G-E		F-G		G-E	P-F
Pyraclostrobin[25] FRAC: 11 Mixes Available	G-E	F-G	x	G-E	F-G	G-E	
Quintozene-Pcnb [26] FRAC: 14	G	P-F		F-G			
Thiophanate-Methyl [27] FRAC: 1 Mix Available	F-G	G-E		F-G		F-G	
Tebuconazole[28] (Collegiate And Professional Fields Only) FRAC: 3 Mixes Available	G-E[3]	G-E	P			F	F-G?
Triadimefon [29] FRAC: 3 Mixes Available	G-E	G-E	P-G			G-E	
Trifloxystrobin[30] FRAC: 11	G-E			F-G		F-G	
Trticonazole[31]	G-E	G		P-F		P-F	
Vinclozolin[32] FRAC: 2	F	G-E		G-E			

*Fungicides are organized alphabetically by the common name of the active ingredient. The footnote lists trade names using that active ingredient. Many turf fungicides employ mixes that contain multiple fungicides. This is good because many turf diseases rapidly develop resistance to fungicides. You should use mixes whenever possible. The FRAC codes next to each fungicide describe how the fungicide kills the fungus. You should rotate use of the FRAC codes to avoid pathogen resistance. FRAC codes containing an M kill fungi multiple ways (here coded M3 or M5 for mancozeb or chlorothalonil). Try to use a fungicide mix containing an M when possible. In general, a mix works as well as the sum of the individual ingredients, so a fungicide mixing two F ingredients may be as effective as a G good ingredient. Premixed fungicides are listed beneath the footnote for each active ingredient, then by the FRAC codes in the mixture.

[1]Fungicides labeled in the state of Mississippi as of December 2015. The information given here is for educational purposes only. References to commercial products, trade names, or suppliers are made with the understanding that no endorsement is implied and that no discrimination against other products or suppliers is intended.

[2]The label is the law. This table is a guide, and specific label instructions may differ or change. Always read and follow label instructions.

[3]The efficacy is estimated from trials and reports. The letters used here stand for: P=poor; F=fair; G=good; E=Excellent.

[4]Use of a wetting agent is suggested, but follow label directions.
[5]Azoxystrobin: Heritage, Heritage Action, Heritage G, Heritage TL, Mika Liquid, Mika WG, Strobe 2L, Strobe 50 WG, Willowood Azoxy 2SC.
Azoxystrobin mixes:
FRAC M5: Renown Fungicide (+chlorothalonil).
FRAC 3: Briskway (+difenconazole), Headway (+propiconazole), Strobe T (+tebuconazole).
Caravan G (+thiamethoxam insecticide).
[6]Chlorothalonil (use on collegiate and professional fields only): Chlorothalonil 82.5 WDG, PrimeraOne Chlorothalonil DF, PrimeraOne Chlorothalonil 720F SFT, Chlorostar DF, Daconil Ultrex, Daconil Weather Stik, Echo 6F ETQ, Echo 720, Echo 720 Turf and Ornamental, Echo Ultimate ETQ, Echo Ultimate Turf and Ornamental, Ensign 720, Ensign 82.5 Turf and Ornamental, Equus 500 ZN, Initiate 720 Flowable Fungicide, Mainsail WDG, Mainsail 6.0F, Legend Turf and Ornamental Fungicide, Lesco Manicure 6FL Turf & Ornamental Fungicide, Lesco Manicure Ultra Turf & Ornamental Fungicide, Mainsail 6.0 F, Mainsail WDG, Phoenix Pegasus 6L, Phoenix Pegasus DFX, PrimeraOne Chlorothalonil 720 SFT Fungicide, PrimeraOne Chlorothalonil DF Fungicide, PrimeraOne Platinum Chlorothalonil ETQ, Quali-Pro Chlorothalonil 500 ZN, Quali-Pro Chlorothalonil DF.
Chlorothalonil (FRAC M5) mixes:
FRAC 1: Nufarm TM+CTN SPC 66.6 WDG, TM+CTN SPC WDG, Phoenix Peregrine (+thiophanate-methyl), Spectro 90 (+thiophanate-methyl).
FRAC 2+1+3: Enclave Flowable Fungicide (+iprodione+thiophanate-methyl+tebuconazole).
FRAC 3: Concert (+propiconazole), Concert II (+propiconazole), Reserve Fungicide (+trticonazole).
FRAC 3+12: Instrata (+ propiconazole + fludioxonil).
FRAC 11: Disarm C (+ fluoxastrobin), Renown Fungicide (+azoxystrobin).
FRAC 3+12: Instrata (+ propiconazole+fludioxonil).
FRAC P1: Daconil Action (+Acibenzolar-S-methyl).
[7]Cyazofamid: Segway Fungicide.
[8]Ethazol: Terrazole L, Terrazole 35% Wettable Powder.
[9]Fenarimol: Rubigan.
[10]Fludioxonil: Medallion Fungicide, Medallion SC.
Fludioxonil (FRAC 12) mixes:
FRAC: M5+3+12: Instrata (+Chlorothalonil+propiconazole).
[11]Flutolanil: ProStar 70 WDG Fungicide, ProStar 70 WG, ProStar 70 WP.
[12]Fluoxastrobin: Disarm 480 SC, Disarm G.
Fluoxastrobin (FRAC 11) mix:
FRAC M5: Disarm C (+chlorothalonil) (use only on collegiate and professional fields).
FRAC 3: Disarm M (+myclobutanil).
[13]Fluxapyroxad: Xzemplar.
Fluxapyroxad (FRAC 7)Mix:
FRAC 11: Lexicon Intrinsic Brand (+pyraclostrobin).
[14]Fosetyl-Al (Note: Many fungicides are not compatible in a tank mix or within 14 days of use. Read the label): Lesco Prodigy Signature Turf Fungicide, Proplant, Signature Xtra Stressgard; Note: This is Aluminum Tris: Fosal Select.
[15]Iprodione: Iprodione (FRAC 2) mix:
FRAC 1: 26/36, (+thiophanate-methyl).
FRAC 11: Interface Fungicide (+trifloxystrobin), Interface Stressgard (+trifloxystrobin).
FRAC M5+1+3: Enclave Flowable Fungicide (+chlorothalonil+thiophanate-methyl+tebuconazole).
[16]Mancozeb: Dithane 75DF Rainshield, Dithane DF Rainshield, Dithane F-45 Rainshield, Dithane M-45, Dithane WF Rainshield, Fore 80WP Rainshield, Lesco Mancozeb 4 FL Broad Spectrum Fungicide, Lesco Mancozeb DG Turf & Ornamental Fungicide, Manzate Pro-Stick Fungicide, Manzate Pro-Stick T&O Fungicide, Pentathlon LF, Phoenix WingMan 4L, Protect DF.
[17]Mefenoxam & Metalaxyl: Fenox ME, Mefenoxam 2 AQ, Subdue GR, Subdue Maxx; Metalaxyl: MetaStar 2E, Regulate Select.
[18]Metconazole (Best not to apply when temperatures exceed 90°F): Tourney Fungicide.
[19]Myclobutanil (Best not to apply when temperatures exceed 90°F): Eagle 20 EW Specialty Fungicide, Hoist, Myclobutanil 20EW Turf & Ornamental.
[20]Penthiopyrad: Velista.
[21]Phosphonates (phosphorous acid; mono- and di-potassium salts of phosphorous acid): Alude, Confine Extra, Quanta Systemic/PGR & Fungicide, Quali-Phite.
[22]Polyoxin D: Affirm WDG, Endorse Wettable Powder Fungicide, Veranda T Water Dispersable Granules.
[23]Propamocarb: Banol, Proplant Turf and Ornamental Fungicide.
[24]Propiconazole (Bermudagrass can be sensitive to propiconazole. Do not exceed 4 fl. oz./1,000 sq. ft. every 30 days on any variety of

bermudagrass. Best not to apply when temperatures exceed 90°F.): Propiconazole 1.3 ME Turf & Ornamental Fungicide, AmTide Propiconazole 41.8 EC Fungicide, Banner Maxx, Banner Maxx II, Dorado, Fathom 14.3 MEC, Lesco Spectator Turf and Ornamental Fungicide, Nufarm Propiconazole SPC 14.3 MEC, PPZ 41.8 Select, PrimeraOne Propiconazole 14.3, Procon-Z Fungicide, Propensity 1.3 ME, Propiconazole 3.6EC Fungicide, Propiconazole 14.3 Select, Strider Fungicide, Tide Propiconazole 41.8 EC Fungicide, Vigil.
Propiconazole (FRAC 3) mixes:
FRAC M5: Concert (+chlorothalonil), Concert II (+chlorothalonil).
FRAC 1: Protocol (+thiophanate-methyl).
FRAC 11: Headway (+azoxystrobin).
FRAC M5+3: Instrata (+chlorothalonil + fludioxonil).
[25]Pyraclostrobin: Insignia fungicide, Lexicon Intrinsic™ brand fungicide.
Pyraclostrobin (FRAC 11) mix:
FRAC 7: Lexicon Intrinsic Brand Fungicide (+fluxapyroxad).
[26]Quintozene (PCNB) (Best not to apply when temperatures exceed 85°F): Turfcide® 10G Turf & Ornamental, Turfcide® 400.
[27]Thiophanate-methyl: 3336, 3336 DG Lite, 3336 EG, 3336 F, 3336 Plus, 3336 WP, Fungo Flo, Lesco T-Storm Flowable Turf & Ornamental, Phoenix T-Bird 4.5L, Phoenix T-Bird 85 WDG, PrimeraOne 4.5 Flowable Turf and Ornamental Fungicide, SysTec 1998 FL, Systec 1998 WDG, T-methyl SPC 50 WSB Fungicide, TM 4.5 F Select, TM 4.5 Turf and Ornamental Fungicide, TM 85 WDG, Tee-Off 4.5F, T-methyl SPC 4.5F Liquid Flowable Systemic Turf and Ornamental Fungicide, Transom 4.5F, Transom 50 WSB.
Thiophanate-methyl (FRAC 1) mix:
FRAC M5 (collegiate and Professional fields only): Quali-Pro TM/C WDG (+chlorothalonil), Phoenix Peregin (+chlorothalonil), Spectro 90 (+chlorothalonil).
FRAC M5+2+3 (collegiate and Professional fields only): Enclave Flowable Fungicide (+chlorothalonil+iprodione+tebuconazole.
FRAC 2: 26/36 (+iprodione), Lesco Twosome (+iprodione), TM+IP SPC (+iprodione).
FRAC 3: Protocol (+propiconazole).
[28]Tebuconazole (collegiate and professional fields only) (Best not to apply when temperatures exceed 90°F): Albaugh Tebuconazole 3.6 F Turf & Ornamental, Tebuconazole 3.6 Select, Tebu-Turf 3.6F, Tide Tebu 3.6F Foliar Fungicide, Quali-Pro Tebuconazole 3.6F, Torque Fungicide, Willowood Teb 3.6SC.
Tebuconazole (FRAC 3) mix:
FRAC 11: AZTEB Select (+azoxystrobin), Strobe T (+azoxystrobin).
[29]Triadimefon (Best not to apply when temperatures exceed 90°F): Bayleton 50 Turf & Ornamental Fungicide, Bayleton Flo Turf & Ornamental Fungicide.
Triadiamefon (FRAC 3) mix:
FRAC 11: Armada 50 WP (+trifloxystrobin), Armada 50 WDG (+trifloxystrobin), Tartan (+trifloxystrobin), Tartan Stressgard (+trifloxystrobin).
[30]trifloxystrobin: Compass.
[31]triticonazole (Best not to apply when temperatures exceed 90°F): Trinity.

Insect Control

Sports turf managers should be especially aware of the need for extra caution when selecting insecticides for use on sports turf. Just because an insecticide is labeled for use on turfgrass does not necessarily mean it is approved for use on sports turf or athletic fields. Some products are labeled for use on golf courses only, or on sod farms only, and may not be used on athletic fields. Due to the nature of many outdoor athletic events, participants often come into close contact with treated turf, increasing their potential exposure to recently applied pesticides. **Always check pesticide labels carefully before applying to sports turf!** Be sure the product is specifically labeled for use on sports turf/athletic fields and that you can comply with the required re-entry interval. Although there are many species of insects that can damage sports turf, most insect problems on Mississippi sports fields are caused by three insects: fire ants, fall armyworms, and mole crickets.

Fire ants are one pest that must be controlled both on the playing field and in areas frequented by spectators. The most effective and economical method of controlling fire ants is a preventive application of granular fire ant baits such as Amdro, Advion, Award, Siesta, or Extinguish. However, baits alone will only provide 80–90 percent control. Control can be improved by supplementing with individual mound treatments and/or applications of appropriately labeled broadcast insecticides.

Fall armyworms are light tan to green to nearly black caterpillars that can damage sports fields anytime from mid-June in south Mississippi until September. These caterpillars can strip a playing field quickly, so be watchful and spray with an appropriate insecticide at the first sign of infestation.

Mole crickets are serious pests of sandy fields, especially in South Mississippi. These crickets tunnel through the soil just beneath the surface and eat roots and stems. If mole crickets are suspected, check for them by dissolving 1 ounce of

dishwashing detergent in 2 gallons of water and pouring the mixture over 4 square feet. The light brown crickets will crawl to the surface.

Refer to Table 4 for a list of recommended insecticides for use on sports turf and the pests they control. See MSU Extension Publication 1858 *Insect Control in Commercial Turf* online at extension.msstate.edu for more detailed information on the identification, biology, and recommended control methods for fire ants, mole crickets, and fall armyworms, as well as less-common turfgrass insect pests. Information on application rates and optimum timing for insecticide applications for pests is also provided. Another source for more detailed information can be found on the MSU Extension Fire Ants page.

Table 4. Insecticides for use in sports turf/athletic fields.*

Insecticide (Brand Name)	Fire Ants	Chinch Bugs	Fleas, Ticks, and Chiggers	Mole Crickets	Turf Caterpillars	White Grubs and Billbugs
Granular Fire Ant Baits						
Hydromethylnon (Amdro Fire Ant Bait)	×					
Fenoxycarb (Award Fire Ant Bait)	×					
Abamectin (Award Ii Fire Ant Bait)	×					
Indoxacarb (Advion Fire Ant Bait)	×					
Methoprene (Extinguish Fire Ant Bait)	×					
Metaflumizone (Siesta Fire Ant Bait)	×					
Pyrethroid Insecticides						
Bifenthrin (Talstar P, TalstarOne)	×	×	×	×	×	
Beta-cyfluthrin (Tempo SC Ultra)	×	×	×	×	×	
Deltamethrin (DeltaGard T&O)	×	×	×	×	×	
Lambda-cyhalothrin (Scimitar CS)	×	×	×	×	×	
Neonicotinoid Insecticides						
Imidacloprid (Merit 75 WP, Merit 0.5 G)				×		×
Dinotefuran (Zylam Liquid Systemic)		×		×		×
Clothianidin (Arena 50 WDG)		×				×
Thiamethoxam (Meridian 25WG, 0.33G)	×	×				×
Imidacloprid + bifenthrin (Allectus SC)	×	×	×	×	×	×
Diamide Insecticides						
Chlorantraniliprole (Acelepryn)					×	×
Cyantraniliprole (Ference)					×	×
Other Insecticide Classes						
Carbaryl (Sevin SL)	×	×	×		×	×
Fipronil (Top Choice)	×			×		
Indoxacarb (Provaunt)					×	
Spinosad (Conserve SC)	×				×	

*Check product labels carefully before applying any insecticide to sports turf/athletic fields to be sure the product is labeled for use in the site being treated and to be sure you can comply with the re-entry interval.

Field Marking

Sports fields need to be marked in order for the players to use them. Always consult league rules for proper dimensions for the specific sport, because dimensions vary from league to league. The material used to mark the lines has changed greatly from the days when powdered chalk or limestone was metered onto the field just before a game. Although powders are still used on baseball diamonds, most fields currently are painted with specially formulated turf paints. Using bargain-brand latex house paints can cause the turf to die. Although this may seem desirable in the short term, dead grass along yard stripes will develop trenches and will lead to an uneven field that can cause player injury.

Wait as long as possible before a game to mark the field. The turf paints can slow grass growth and cause weak turf, allowing weed invasion. Try to wait until just before the first game to mark the field; the turf will be much more even and attractive. Anticipate restriping the field every 3 weeks. Applying a growth regulator such as Primo (see "Plant Growth Regulators") to painted areas will slow grass growth and cause the mower to remove less of the painted grass. One marking may last 4–6 weeks using these chemicals. Use 1 fluid ounce of Primo per 1 gallon of mixed paint.

Skinned-Area Care

The base paths on diamonds require as much attention as the grassed areas during the season. They should be dragged with a steel mat, length of fence, or other implement to prevent the surface from sealing and to create a smooth surface. First- to third-base paths and the pitcher's mound should be done with a hand rake often enough to prevent problem areas from occurring, especially around second base and in the areas where defensive players stand.

The biggest problem is preventing the formation of a "lip" at the interface of the grass and the bare areas. When dragging the base paths, try not to pull the soil toward the grass. Always keep an eye on the interface, and if it looks like there may be a problem, do something while the buildup is small. Often, all you need to do is move the soil back into the base path with a high-pressure hose or backpack blower. If labor is available, the soil can be raked out of the grass, back into the path. If a lip forms, it takes several days to strip the sod at the interface and to relevel and sod the area.

Whether base paths need amending with calcined clay, brick dust, or other amendments depends on soil type, management, and budget. If the field drains well and the skinned area is not hard, some native soils will make acceptable base paths, as long as they are free of rocks and stones. However, if game days are postponed after rains because base paths won't dry, it is time to look at modifying the mix. Pregame maintenance of infield skinned areas shouldn't take more than 30 minutes, including adding packing clay to the front of the mound to fill in the hole made by pitchers.

Overseeding

Many high-budget facilities will "overseed" bermudagrass with perennial ryegrass, a cool-season plant, in the fall. This requires agronomic skill and should not be undertaken unless you are well informed of the added upkeep and maintenance costs. Overseeding is the seeding of one grass into an established stand of another grass. On sports fields, it usually means perennial ryegrass is sown into bermudagrass. Annual ryegrass is an alternative but is not as cold-hardy, has poorer color, tends to clump, and is more prone to staining uniforms.

Why overseed? The most common reason is for fall and spring color when bermudagrass is dormant. Ryegrass is a cool-season grass, which provides green color from fall to spring. The second reason for overseeding is playability; because the grass is growing, it can recover from cleat divots. The third reason is protecting the bermudagrass from wear.

Why doesn't everyone overseed? The major reason is that it is expensive. Although it is called perennial ryegrass, it acts as an annual on Mississippi playing fields and must be reseeded every year. It has to be fertilized, watered, and mowed all winter. Additionally, it really isn't good for the bermudagrass. After trying all summer to get a pure stand, millions of foreign seeds are then introduced into the turf. The perennial ryegrass also will compete with bermudagrass in May and June and may weaken it so that weeds and diseases are more of a problem in the summer.

To maintain a healthy bermudagrass stand, you should give it 100 days of noncompetitive growth following ryegrass removal, which means during some years, ryegrass will have to be removed using an herbicide (sometimes called "chemical transition"). And, finally, there frequently is no reason to overseed. Bermudagrass often remains green long enough in the fall for all but the last one or two football games, and it may green up in time for the end of the baseball season.

Overseeding normally is done when air temperatures decline to the mid-70s. "Normal" dates are mid-October through November on the coast, October through mid-November south of Highway 82, and mid-September through October in North Mississippi. Seeding rates are 10–20 pounds per thousand square feet, so a football/soccer field will take 650–2,000 pounds and a baseball field will take 100 pounds

for the infield and 500 pounds for the outfield. Many baseball diamonds are overseeded at a higher rate in the infield than in the outfield.

For successful overseeding, the perennial ryegrass seed needs to come in contact with the soil surface. This can be done by lightly verticutting the bermudagrass before seeding. A good practice is to seed in two directions, then drag a mat or topdress with sand to get the seed in contact with the soil. Water frequently (twice a day to begin with), but lightly until the seedlings are visible, then cut back. Be sure to follow fertilizer recommendations from the soil testing laboratory. Keep mowing height just slightly higher than the normal height for bermudagrass.

Scheduling of Use

For the healthiest turf, allow play only once a week on game fields. This is not possible unless there are practice fields nearby. Try to practice on the parts of the field that do not receive much use during games. For instance, have baseball and softball teams practice in right field. Practice football in the end zones and use the coaches' boxes only on game day. Use temporary soccer goals set up at the midlines on either sideline so that practice goes across the field. Keeping practice away from problem areas will result in a much healthier turf.

Plant Growth Regulators

Plant growth regulators (PGRs) are widely used in sports field management, primarily because they result in reduced mowing and increased turf density. Trinexapac-ethyl (Primo MAXX and other generic formulations) is the primary PGR used for sports fields, but there are many others. This product can be used to promote desirable turf while reducing mowing and labor inputs. Trinexapac-ethyl is a foliar-applied product that needs at least 1 hour of drying time before irrigation and rainfall. Visible results should be evident within three to five days after application. Results should last up to fourweeks in most circumstances.

PGRs should only be applied to healthy, actively growing turfgrass, usually after summer temperatures commence and nighttime temperatures remain above 70 degrees. PGRs can increase tillering and rooting while leading to a more dense turf that handles stress better. PGRs should not be sprayed if the turfgrass is under stress conditions such as drought, pest injury, and heavy traffic, or if grass is being established from sprigs, seed, sod, or plugs. A flush of growth can be expected once PGR effects wear off. To prevent this, reapply according to label recommendations (typically every 21 days). Secondary uses of PGRs are to suppress seed head and to reduce turf paint application interval.

Appendix

Accurate Sprayer Calibration

Calibrating sprayers involves selecting the proper nozzles, spraying pressure, and speed of travel. There are several different ways to accurately calibrate a sprayer, but the simplest is the 1/128-acre method, also called the "baby bottle" method. The spray collected from a single nozzle measured in ounces directly converts to gallons per acre regardless of the number of nozzles on the boom. Because there are 128 ounces in a gallon, the ounces collected from 1/128 of an acre will equal gallons of solution per acre. Follow the 10 easy steps below to avoid needless chemical waste, improper application, and potential turf injury.

1. Fill sprayer with water. Use only clean water to calibrate sprayer.
2. Measure the distance (in inches) between nozzles on the spray boom. If your sprayer has only one nozzle, this number equals the expected spray width. Then refer to the chart below to obtain test course distance (in feet).
3. Measure the course distance (in feet) according to the chart, and flag it for easy visibility.
4. Drive or walk the test course at an acceptable spraying speed with the sprayer on. Make note of the engine RPMs, and, most importantly, record the seconds it takes to travel the measured distance between the two flags. Be sure to take a "moving start" to the beginning flag, and continue moving beyond the ending flag to maintain a uniform speed within the flagged distance.
5. Park the tractor/sprayer, set the brakes, but keep the engine RPMs at the same setting used to drive the test course.
6. To check the uniformity of all nozzles on the boom, collect the spray from each nozzle for exactly 1 minute. If the flow rate of any spray tip is 10 percent greater or less than that of the others, replace it. Whatever type of sprayer tips you use, be sure they are all the same type. And make sure strainers are present within the nozzle body, as the absence or presence can significantly impact tip output. Strainers also protect spray tips and prevent clogging.
7. Make any final sprayer pressure adjustments (this will vary with the type of spray tips you use and the gallons per minute you wish to spray through them).
8. Using a plastic measuring container that is marked in ounces, collect the water sprayed from one nozzle for the same amount of time it took to drive the test course.
9. The amount of water collected in ounces will equal the gallons applied per acre.
10. Last but not least, be sure to read all product labels for proper application information.

Nozzle spacing and distance for 1/128 acre.

Nozzle Spacing (in)*	Distance (ft)
6	681
8	510
10	408
12	340
14	292
16	255
18	227
20	204
22	186
24	170
26	157
28	146
30	136

How Much Field Area Does Your Core Cultivation Program Actually Impact?

Use the following table to determine how much of the field area is being affected by your coring program. Did you realize that using a ¾-inch hollow tine more than doubles the area of the field affected, compared to a ½-inch tine?

Example: Your goal is to remove 50 percent of the field area to a depth of your aerifier tine. The field is mostly clay, and you want to begin to remove it from the field and replace it with sand. If you remove cores on 3-inch centers, it will require 22 passes over the field using ½-inch hollow tines to meet your goal of removing 50 percent of the clay soil.

At two core aerifications per year, this would require 11 years. That may be too long to wait. By using ¾-inch tines, you can achieve the same goal in 10 passes over the field. If you increase your aerification and topdressing to three times per year, you can achieve your goal of replacing 50 percent of the surface in nearly 3 years. In the case of soil modification, the most effective modification—the greatest change in physical properties with the least amount of added sand—has been obtained from sands in the very coarse to coarse size range. Select a uniform coarse sand (80 percent of the particles between 1.0 and 0.5 mm and 95 percent between 2.0 and 0.5 mm) to maximize large pore space when modifying native soil fields high in silt and clay.

Amount of coring required to remove various amounts of soil or sod from a sports field.*

Diameter hollow tines	Core spacing (inches)	Topdressing sand needed to fill holes (tons/1000 sq ft)	Topdressing sand needed to fill holes + ¼ in on top (tons/1000 sq ft)	Number of holes/ sq ft	% area removed each pass	Number of passes over field for 50% removed	Number of passes over field for 25% removed	Number of passes over field for 10% removed
½-inch diameter (0.2 sq in)	2	0.66	1.77	36	5.0	10	5	2
	3	0.29	1.41	16	2.2	22	11	5
	4	0.165	1.25	9	1.3	40	20	8
	6	0.073	1.19	4	0.5	90	45	18
¾-inch diameter (0.44 sq in)	2	1.47	2.60	36	11	5	2	1
	3	0.65	1.77	16	5	10	5	2
	4	0.37	1.48	9	2	18	9	4
	6	0.16	1.28	4	1.3	40	20	8

*Calculations based on 100 percent efficiency on successive passes over the field. Assume core holes are 3 inches deep and sand weight equals 1.45 tons/cubic yard. Adapted from D.D. Minner, Iowa State University.

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