

NC STATE UNIVERSITY

# Carolina Athletic Fields: A Guide to Maintaining Quality Turf on Athletic Fields



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## A Guide to Maintaining Quality Turf on Athletic Fields

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## INTRODUCTION

Sports fields play a pivotal role in recreational and competitive outdoor athletic activities. A quality playing surface is appreciated by all participants, whether playing casual pick-up games or professional team sports, and produces a pleasing appearance to spectators. In addition, sports complexes are facing increasing legal questions and liability regarding injuries associated with a poorly designed, constructed, or maintained facility. To have a quality turfgrass playing surface in all seasons of use, sports fields must have the following:

- (1) Adequate surface and subsurface water drainage.
- (2) A properly designed, installed, and maintained irrigation system.
- (3) A vigorous, regular turfgrass maintenance program with an appropriate turfgrass.
- (4) Reasonable play and field use.
- (5) Basic equipment.

An unacceptable turfgrass stand often results when one or more of these elements are omitted or when uncontrolled or excessive play and traffic are allowed. Bermudagrass exhibits optimum growth during summer months; however, with the onset of play and traffic in fall, along with soil compaction, the turf may become excessively worn. For this reason, some fields will be overseeded with a ryegrass to provide a wearable surface during the winter and early spring seasons.

## FIELD DIMENSIONS

The first step in developing a turfgrass management plan is to understand the areas that make up the field. These figures are needed to budget for items such as appropriate time and amount of product to be applied. Certain sports place heavy traffic on specific areas of the field. Soccer fields are heavily worn at the goal areas, whereas football tends to be played between the hash marks and the 20-yard lines. Baseball and softball are played mostly on skinned areas. A comparison of athletic field dimensions and relative field sizes is listed in Table 1.

## FIELD USE CAPACITY

A common question relates to how much play a field can withstand. Every effort should be made to accommodate all participating groups, but not at the expense of the fields. Information related to field use parameters can be found in extension publication AG-726 Maximizing the Durability of Athletic Fields.



Softball field includes turf as well as clay surface.

## ATHLETIC FIELD DESIGN

Before construction, prepare a realistic timetable for every operation, from writing specifications and contractor bids to field completion. Most people unacquainted with the work involved are surprised at the length of time needed to complete the planning and construction of a field—anywhere from a couple of months to two years, depending on project size, contractor experience, and weather.

All athletic fields should be designed and constructed to meet standard dimensions of the game for which they will be used. Contours and drainage provisions are very important, as these provide for fast removal of surface water to maintain desirable playing conditions. If possible, orient fields to minimize time that players must look directly into the sun during games. Generally, the long axis of the field should be in a north-south direction, which also minimizes the field area shaded during the winter months if there are trees along the south side of the field. A good design will provide an adequate irrigation system, drainage, and proper orientation of the field.



High-capacity football fields are constructed with a sand base to have good internal drainage. Proper construction with drain lines allows for a flatter field.

**Table 1. Field dimensions and sizes of various sports fields.**

| Sport    | Dimensions (Feet) | Area   | General Comments   |
|----------|-------------------|--|--|
| Football | 360L by 160W      | 57,600 square feet (or 1.3 acres)  | This 1.3 acres is within the sidelines. Outside the sidelines is typically 20 or more feet or 30,000 square feet of space. Together these two areas comprise approximately 2 acres. Primary play is between the hash marks which comprise about 20,000 square feet.  |
| Baseball | 90 between bases  | 110,00 square feet (or 2.5 acres total) with approximately 11,500 square feet of skinned infield | Baseball fields vary in size depending on the depth of the fences (300 feet minimum fair line to 400 feet to center). A minimum of 12 feet in the outfield and 8 feet around the stands is used for the warning track. Professional fields are usually 15 feet in the outfield and 12 to 15 feet in foul territory. The infield receives heaviest play. (Note: Little League, Pony League, and Babe Ruth League have smaller dimensions than listed). See publication AG-725 Baseball Field Layout & Construction. |
| Soccer   | 360L by 225W      | 81,000 square feet (or 1.9 acres)  | Soccer fields contain an average of 78,000 square feet with an additional area of 8,000 to 10,000 square feet along the sidelines, which receive heavy traffic. A soccer field is larger than a football field, mostly in width, but soccer has many dimensions, depending on the age of the participants. Goal mouths, center field, referee sidelines, and the four corner kick areas have highest wear.   |
| Softball | 65 between bases  | 40,000 to 70,000 square feet   | Slow pitch softball has an average fence depth of 300 feet and approximately 70,000 square feet of turf, depending on the sideline areas. Fast pitch softball fields have an average depth of 200 feet and approximately 40,000 square feet of turf, depending on the sideline area. The 3 outfielder positions have most of the turf wear.  |

### What to Plant

It is best to consult with a state turf specialist or an established field construction contractor to discuss grass options. No one type of grass is best suited to all situations. A number of factors should be considered before deciding which grass to plant. Your decision should be based on region, climate, intended use or wear at the site, and desired appearance. For the most part, NC fields are grassed with a bermudagrass. There are some exceptions in the mountains, but even in much of western NC, bermudagrass is often used on fields.

Bermudagrass is desirable for athletic fields because it establishes quickly, withstands wear and traffic, and recovers rapidly from injury. Bermudagrass is extremely drought tolerant, grows rapidly on most soil types, and makes a good turf surface if fertilized and mowed low and often. Cultivar texture ranges from coarse to fine, and it forms a dense, durable surface when grown in full sunlight.

Most finely textured, high-quality turf-type bermudagrasses are planted using sod, sprigs, or plugs. Common bermudagrass, which is the most coarsely textured, can be seeded. Several newer cultivars that have a medium texture can also be seeded. Bermudagrass should be seeded at 1 to 2 pounds per 1,000 square feet (45 to 90 pounds per acre).

Currently, the best and most often used hybrid bermudagrass for sports fields is Tifway (also called Tifton 419). Other improved bermudagrasses sometimes found on athletic fields include TifSport, Patriot, Celebration, GN-1, and Tifton 10. These grasses must be established vegetatively, most commonly by sprigs and less so by plugs or sod. The initial cost of these planting methods is greater than seeding common bermudagrass; however, for the desired aesthetics, color, density, texture, and recuperative potential, these improved cultivars are superior to common bermudagrass.

Seeded bermudagrasses (common bermudagrass) are used primarily because they can be established by seed, which is relatively inexpensive. However, one should recognize that compared to Tifway bermudagrass, most seeded bermudagrasses produce a lower quality surface due to their lighter green color, coarser leaf blades and density, unsightly stem and seedhead production during summer, and slower recuperative potential. Princess 77 and Riviera are two cultivars that can be seeded and are of high quality, similar to the best vegetatively established cultivars. Riviera is also known for its excellent cold tolerance, as is the coarser textured Yukon.

Other improved common bermudagrasses that have better color and density compared to the old Arizona

common bermudagrass include: Blackjack, Blue-Muda, Bradley, Burning Tree, Cheyenne, DelSol, Guymon, Jackpot, LaPaloma, LaPrima (a blend of certified bermudagrasses), Majestic, Mercury, Mirage, Mohawk, Panama, Paradise, Primavera, Primo, Pyramid, Sahara, Savannah, Shangri-La, Soliel, Sonesta, Southern Star, SR 9554, Sultan, Sundance II, Sundevil II, SunStar, Sultan, Sydney, Transcontinental, Yukon, and Yuma.

### Winter-Kill Considerations

For those sports fields located in the upper piedmont and mountainous regions that are prone to winter low-temperature injury, the choices for bermudagrass become more of an issue of survival rather than aesthetics. Midlawn, Midfield, Midiron, Patriot, Quickstand, and Vamont are vegetatively propagated bermudagrass selections with increased cold tolerance primarily due to their deeper and more robust rhizomes. These selections also tend to retain color longer in fall and green-up sooner in spring, and they are more vigorous in their growth and recovery from damage or winter-kill. Yukon and Riviera are seeded bermudagrasses with improved cold tolerance and playing characteristics. In addition, winter-kill considerations determine which preemergence herbicide to use for crabgrass and goosegrass control. (See weed control section for further details.)

### Field Drainage

Reasonable water drainage from a field is important to minimize event cancellations as well as to protect the integrity of the field. Fields built with heavy native soils depend primarily on surface drainage to remove excess water. These fields hold nutrients and have a high water-holding capacity, thus, require less fertilizer and water. They also provide good stability, shear strength, and traction. On the downside, most provide inadequate drainage and may compact easily. Perimeter drain lines are needed to move surface run-off.

Sand-based fields can be built essentially flat, not heavily crowned, and have high infiltration rates. Their internal drainage may be designed to move large amounts of water away quickly. They have minimum compaction but require more irrigation and fertilization than native soils, are usually more expensive to build, and may be unstable until a mature root zone is established.

### Minimum Drainage Requirements

For many high school and local municipal fields, surface contouring is the most effective and economical means of providing surface drainage. If insufficient sloping of the surface occurs, water will stand (puddle), saturating the soil, and the field can be easily compacted and damaged



**A smaller laser-guided dozer used to spread soil mix. Note use of silt fence and plywood to protect sub-surface layers.**

by traffic. To provide surface drainage, high school football fields should have a 12-inch crown for sandy soils and 18 inches for clay soils from center to the sideline or a 1 to 2 percent slope. Slope at the sideline may be reduced, but the area should not be flat. Surface water movement in the areas where players stand is important to prevent puddling.

A minimum of four drainage tile lines should be installed, one running parallel to the center crown, typically down each hash mark, and the other set just off the field along each sideline. Drain lines are usually 6 inches wide and 12 to 36 inches deep. Two inches of gravel is placed at the bottom of the lines, a 4-inch perforated drain line laid on top of this gravel layer, and pea gravel ( $\frac{1}{4}$  to  $\frac{1}{2}$  inch) or coarse sand is used to fill the trench to grade. The tile should not be laid within 4 inches of the surface to prevent disruption from future aerifications. The tiles are laid on a continued  $\frac{1}{2}$  to 1 percent slope and are connected at their ends to allow water to drain away from the field. Surface catch basins (or culverts) should also be installed between the playing field and both sidelines (stands). These intercept surface drainage from the field as well as water draining from the spectator stands. At least three (preferably four or more) catch basins should be considered for each side of the field. Similar drainage schemes can be developed for soccer, baseball, or other types of sports fields. It is suggested that a contractor be consulted before constructing a baseball field due to the complexity of removing water from the infields without flooding dugout areas.

## ESTABLISHING A NEW FIELD

### Site Preparation

Proper preparation prior to planting is critical to ensure the establishment of a quality turf. Preparation will determine how quickly the grass becomes established and its long-term maintenance requirements. Soil should be



Installation of turfgrass sod on football field.

prepared whether you are planting a new field or replanting an old one, and whether you are seeding or propagating vegetatively. The following steps provide a general guideline for preparing an area for planting a sports field.

- 1. Clean and Rough Grade.** Remove all construction debris, brush, large roots, rocks, weeds, and old tree stumps. If extensive grading is needed, remove the topsoil and stockpile it for replacement after the rough grade is established. The site should be crowned 1 to 2 percent ( $\frac{1}{2}$ - to 1-foot fall per 50 feet) toward the sidelines. The rough grade should conform to the final grade after the topsoil is replaced. Poorly-drained soil may require the installation of drainage lines. Install them in a trench with at least a 1 percent fall for drainage. Seek professional advice if uncertain about the type and installation procedure. Perennial weeds should be controlled during site preparation. Several applications of a nonselective herbicide such as glyphosate (Roundup Pro) plus fluazifop (Fusilade II) may be necessary for complete weed control. Hard-to-control weeds may require the services of a professional.
- 2. Soil Analysis.** A soil analysis should be taken before planting. A representative soil sample can be submitted to NCDA Soil Testing service or to a private lab. A soil test will determine the pH value, and the report will indicate whether pH adjustment is necessary. The desired range of soil pH for bermudagrass is 6.0 to 6.5. Values below 5.0 and above 7.0 can restrict rooting and specific nutrient availability. If the soil is too acidic (pH too low), dolomitic limestone (dolomite) is recommended for increasing soil pH. Application should be based on a lime requirement that considers both soil buffering capacity and soil pH value. In lieu of a lime requirement analysis, the application of 1 ton of dolomite per acre or 50 pounds per 1,000



Clay areas of baseball fields require proper grading in relation to the turfgrass surfaces.

square feet is sufficient to increase the pH of most sandy soils one pH unit—for example, from pH 5.0 to 6.0. For clay soils, 100 pounds per 1,000 square feet may be necessary. Turf grown on alkaline soils (pH levels greater than 7.0) often displays deficiencies in minor nutrients such as iron and manganese. Further details on soil pH adjustment can be obtained from the Cooperative Extension Service in your county.

Based on soil test analysis, fertilizer should be applied to correct nutrient level deficiencies in the soil. If phosphorus is deficient, a fertilizer high in phosphorus (such as 0–20–0) should be added prior to planting. Potassium also should be added, if needed, prior to planting. A starter fertilizer (fertilizer with higher P content than the other nutrients) should be used at the time of establishment with vegetative plantings, but delayed until after germination if the area is seeded. Apply a fertilizer based primarily on soil test results and local product availability. A general recommendation is to use a turf-type fertilizer in 4:1:2 or 3:1:2 ratios with micronutrients. Apply at a rate of 1 pound soluble nitrogen per 1,000 square feet.

- 3. Installation of Irrigation Equipment.** The irrigation system should be designed by an irrigation specialist and installed according to design specifications. A poorly designed or improperly installed system will never operate satisfactorily. Operation must be in a manner consistent with sound principles of turfgrass culture.

### Clay soils

For heavy clay soils, sand can be added to improve physical properties. However, enormous amounts are typically necessary for a positive response. Typically, in a piedmont clay soil, up to 90 percent sand is required to make

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significant improvement in desirable soil characteristics such as drainage and air exchange. The sand used should also contain at least 75 percent of its particles in the medium-sized range to improve soil aeration and drainage. In reality, unless enormous amounts of sand are provided, fields consisting of clay soils are better off not being amended with sand. In lieu of sand, an organic material may be applied and incorporated prior to planting. In some instances a drier surface may be obtained with a 3- to 6-inch sand cap after construction.

### **Fertilization and Liming**

Apply the amounts of fertilizer and lime recommended by the soil test and work these into the upper 4 to 6 inches of soil. A general starter-type fertilizer contains higher amounts of phosphorus and is needed for establishment by turfgrass seedlings, while a slow-release nitrogen source is recommended prior to planting.

### **Deep Tillage**

Rototilling loosens compacted soil and improves the speed and depth of rooting. If soil amendments, lime, or a basic fertilizer have been added in the preceding steps, it is necessary to till the soil as deeply as possible, preferably 6 to 8 inches. A tractor-mounted or self-propelled rotary tiller will do an adequate job of tilling the soil, especially if used in several directions prior to planting.

### **Final Grading**

Final grading just prior to planting provides a smooth planting bed. The site can be hand raked and dragged with a hand-pulled drag such as a brush attachment or metal door mat. Large areas can be smoothed by tractor-drawn laser equipment with a tiller rake or grading box, and then hand-finished. Soil particles should be no larger than golf-ball size, and smaller is even better. To achieve a uniformly firm planting bed and to reduce erosion, loose soil can be compressed with a water ballast roller. Take care not to add too much weight and cause soil compaction. Grass cannot develop a root system in an eroded or bulldozed soil, which becomes extremely hard and compacted. Irrigation can be used to settle the soil before planting. Hand raking to break up a crusty surface may be necessary prior to seeding.

### **Seeding**

Seeding normally is cheaper compared to vegetative planting methods; however, the time for establishment with seeding exceeds the time from vegetative means, and the area may be more prone to erosion and weed invasion. A general guide for seeding bermudagrass is to apply 1 to 2 pounds of seed per 1,000 square feet (or 45 to 90 lbs

per acre). Higher seeding rates usually result in weakened stands as inter-competition among seedlings is excessive and seedlings become spindly and weak. Turfgrass seeds are generally planted using either a mechanical seeder (also called a slit seeder), gravity flow drop seeder, rotary (or centrifugal) spreader, or hydroseeder. After planting, seeds are lightly incorporated into the top ¼-inch of the seedbed and the seedbed is firmed with a roller. Mechanical or slit seeders make a small furrow, drop seed into this furrow, cover the seed with approximately ¼-inch of root zone mix, and firm the seedbed by rolling.

Warm-season turfgrasses are normally seeded in late spring or early summer when soil temperatures are between 70° and 80° F. Earlier seeding of warm-season turfgrasses will delay their germination until soil temperatures reach the required germination range and may lose some of their viability. Planting too late may not allow sufficient plant maturity before cooler fall temperatures and shorter daylight days slows growth.

### **Sprigging**

Sprigging is simply the process of broadcast planting bermudagrass stems (rhizomes and stolons, referred to as sprigs). They can also be planted in narrow spaced furrows. Sprigs have little to no soil associated with them. Sprigging is considered to be the most economical means of vegetative turfgrass establishment. Best survival is by planting sprigs within 48 hours of harvest. Sprigs should be watered immediately after planting, and watered several times daily for several weeks until the turfgrass establishes a root system. Do not sprig more area than can be immediately watered. Generally, turfgrass sprigs will cover and become established within 6 to 16 weeks after planting. The length of time for establishment depends on the sprigging rate, time of the year planted, and maintenance practices implemented after planting.

Broadcast sprigging involves spreading sprigs over the area (like mulch) either by hand or by specialized mechanical equipment. After spreading, sprigs are then cut (or pressed) into the soil with a light disc, covered with ½-inch of topdressing, and then rolled to firm the seedbed to ensure sprig to soil contact. Sprigs are then immediately watered. This method of sprigging provides very fast coverage and establishment of the turfgrass. However, since sprigs are planted at a shallow depth, they are susceptible to drying out. Light, frequent irrigation (4 to 6 times daily) should be provided until the turfgrass roots become established (2 to 4 weeks).

### **Sodding**

Sodding provides instant grassing and excellent soil erosion control. Sodding, however, is more expensive

initially and can introduce different soil types or pests such as nematodes, weeds, or fire ants, from the harvested field into the root zone. As a minimum specification, sodding should be utilized for areas prone to soil erosion, such as steep slopes and areas surrounding culverts and irrigation heads.

Before installing sod, the seedbed should be watered. The sod should be installed soon, preferably within 48 hours, after harvest. Edges of the sod should butt against each other tightly without stretching. Avoid gaps or overlaps by using machetes or sharp knives to trim around corners and edges. Joints between the sod should be staggered in a brick-like fashion so none of the edges of adjacent pieces of sod are parallel. After installation, the sod should be rolled to ensure evenness and smoothness and immediately watered heavily to wet the entire depth of the sod and top portion of the rootzone. Topdressing should be implemented to fill in creases and low pieces and to help conserve moisture. Although sodding produces an almost instant green turf, it should be allowed to knit-down (or root) before subject to traffic and play. Four weeks is generally the minimum time necessary for this during periods of active turfgrass growth, longer when the turfgrass is not actively growing. One should not be able to lift the sod if it is fully rooted.

## CARING FOR A NEW FIELD

### Irrigation

Proper water management is critical for the first several weeks after turfgrass planting. To prevent drying of planting material, keep the top 1.5 inches of the soil moist. This may require light watering two or three times a day for 7 to 30 days. As the seedlings grow and root, water less often but for longer periods. Do not make the mistake of decreasing water as soon as the seedlings appear. Continue watering until the seedlings emerge. After the third mowing, water to a depth of 6 to 8 inches about once a week or when needed. Turfgrass establishment from sprigging, stolonizing, or plugging requires constant moisture due to the lack of soil associated with these vegetative materials. In contrast, sod requires the least amount of water because soil associated with sod provides some moisture. Irrigation or watering should continue on a frequent basis to maintain a moist soil surface for the vegetative plantings. Frequent surface irrigation should be continued for a two- to three-week period or until establishment occurs.

### Fertilization

Proper fertilization is essential for plant growth and development after seed germination. Prior to planting,



**Irrigation of newly installed turfgrass. The use of “big gun” irrigation provides quick coverage and removes heads from the playing surface.**

a starter fertilizer with a 1-2-2 ratio of N-P-K or similar should be incorporated into the soil mix. The nitrogen source should be slow release and applied at the equivalent of 1 lb N/1,000 square feet. This should provide between 1½ to 2 lbs P per 1,000 square feet. After planting, the new seedlings should be fertilized approximately 2 to 4 weeks after seeding, or as a general rule, after the second mowing. A complete fertilizer (one which contains N-P-K nutrients) designed specifically for use on turfgrass should be applied at an equivalent rate of 1 pound of nitrogen per 1,000 square feet of turfgrass. For bermudagrass sprigs, 1 lb N per 1,000 square feet applied every 7 to 10 days provides quickest establishment. With bermudagrass, a quick release fertilizer such as ammonium sulfate (21-0-0) or urea (45-0-0) should be alternated with each application with a 1-2-2 ratio fertilizer (such as 5-10-10, or equivalent). If additional color is needed or if growth slows, supplement these fertilizations as needed with a liquid nitrogen application at a rate of 1/5 lb nitrogen per 1,000 square feet. Potassium and phosphorus should be added with each alternate nitrogen application in a balanced ratio until establishment.

### Mowing

Begin mowing as soon as the grass is 50 percent higher than the desired height. A common mistake with mowing is waiting too long to mow the first time after planting. Proper mowing promotes lateral growth and plant maturity. Mowing of the newly established turfgrasses should begin as soon as the ground will support a mower. Mow fields when the bermudagrass reaches 1½ to 2 inches, then reduce the height over time as the turfgrass becomes established. It is imperative to use sharp blades to prevent turfgrass seedlings from being torn or pulled up during mowing. The best-quality cut can be achieved



**Using a reel mower to provide a superior quality playing surface and to stripe the field.**

with a reel mower. But in many circumstances, a well set-up rotary mower can provide an acceptable cut. Mow during midday when the turfgrass is dry. Turfgrass clippings should be returned to the soil surface for the first couple of mowings to promote rooting of any stolons which may have been cut during mowing.

## **Pest Management**

When establishing new turfgrass areas, pest problems such as diseases, insects, and weeds must be minimized. This is best accomplished utilizing a preventive pest management strategy coupled with routine pest monitoring.

As previously mentioned, irrigation or watering is required to achieve seed germination and turfgrass establishment; however, excessive irrigation can contribute to the development of disease problems. Most fungal pathogens require free water or very high humidity in order to infect a turfgrass plant. Irrigating in the evening before dew forms or in the morning after dew evaporates extends the duration of leaf wetness and increases the risk of disease outbreaks. Turfgrass seedlings, therefore, should be watered when dew or moisture



**Pulling a large plug to check root health and scouting for pests.**

is already present, such as in the predawn hours. If irrigation must be applied multiple times per day, ensure that the leaves dry completely in between applications to avoid constant leaf wetness that will stimulate the development of foliar diseases.

Vegetative planting operations disturb the soil, which can promote germination and establishment of weeds during grow-in. In addition, an ample supply of moisture and fertilizer provides optimum growing conditions for weeds as well. Preemergence control of annual grass weeds such as crabgrass and goosegrass without impeding new turfgrass growth can be achieved by applying a herbicide containing oxadiazon (such as Ronstar). Research has shown that, if weeds are present, bermudagrass can be established more quickly with the use of oxadiazon. Oxadiazon products should be applied before or immediately after vegetative planting at the recommended labeled use rate. Postemergence control of grassy weeds in bermudagrass is by MSMA (not labeled after 2011) or quinclorac (Drive). Normally, these products can safely be used six to eight weeks after turf seeds germinate. Postemergence control of seedling broadleaf weeds requires light rates of 2,4-D alone or mixed with MCPP, 2,4-DP, MCPA, clopyralid, carfentrazone, dicamba or metsulfuron (Manor, Blade, MSM, etc.). Trifloxysulfuron (Monument), bentazon (Basagran T/O), or halosulfuron (Sedgehammer) help control nutsedges.

Hand pulling or “roguing” will suffice if only a few weeds are present; however, if many weeds emerge, selective postemergence applied herbicides may be required. Consult herbicide labels for guidelines for application during establishment.

## **Topdressing and Rolling**

Frequent topdressing during turfgrass establishment from vegetative planting is recommended to achieve a smooth playing surface and enhance turfgrass establishment. Topdressing amount and frequency are dependent upon the existing smoothness of the surface. A light rate of 0.5 to 0.7 cubic feet per 1,000 square feet is a good starting point. Topdressing should commence four to six weeks after seeding and three to four weeks after sprigging. Topdressing also serves as a covering for vegetatively planted sprigs, stolons, or plugs, enhancing their establishment. Sodded areas should also be rolled throughout the grow-in period to push roots into the soil to settle or firm the rootzone and to smooth the surface to prevent mower scalping.

## **Irrigation systems**

Modern sports fields should have in-ground irrigation systems installed during construction. Most fields use pop-up sprinkler heads that will not interfere with the sporting events played on the field. Irrigation systems in summer should be able to deliver at least ½-inch of water within a reasonable period of time (1 to 2 hours). In

the absence of rainfall, most sports fields require 1- to 1½-inches of water per week during peak summer time use. In general, deeper and less frequent irrigation encourages the deep rooting and plant health that enables turfgrasses to withstand stresses, including stresses of play. Ideal time to irrigate is in the early morning hours. A soil probe should be used to monitor soil moisture depth and uniformity.

## MANTAINING AN ESTABLISHED FIELD

### Irrigating

Improper irrigation results in wasted water, added cost, and unhealthy plants. An irrigation water management program is available online through the NC State Turf-Files website: <http://www.turffiles.ncsu.edu/tims/>. General watering recommendations include the following:

1. Water in early morning if possible. This is the preferred time to water because it reduces the risk of disease, water loss through evaporation, and improper water distribution. Also, the demand for water by industry and municipalities is usually low at this time.
2. Water established fields to a depth of 6 to 8 inches to encourage deep rooting. Usually, 1 inch of water per week is adequate. Ideally, this would not be applied in one application. Applying 0.5 inch of water every three to four days is adequate for most situations.
3. Use cans or a rain gauge to determine how much water is being delivered in a certain period of time. It takes 640 gallons of water to apply 1 inch of water per 1,000 sq. ft. Because clay soils accept water slowly, water should be measured to prevent wasteful runoff. Water clay soils until runoff is about to occur. Wait 30 minutes for the water to be absorbed. Then apply more water until the desired depth or amount is achieved. This same technique can be used on compacted soils. Adjust any automatic irrigation system to supplement rainfall so that the field is not over-watered. Use a rain shut-off device on your irrigation system.

Take certain precautions if you do not plan to irrigate throughout the summer. Slowly ease a lush, actively growing field into dormancy. This can be accomplished by allowing the drought stress symptoms to appear between infrequent irrigation cycles, by mowing high, and by not over-fertilizing with nitrogen. Brown, withered leaves are normal signs of dormancy, so do not be alarmed by them. If the field is conditioned for this stress and has a reasonable level of maintenance, it should survive without permanent damage. Most turfgrasses can withstand 3 to 6 weeks (or longer) without rainwater or

irrigation and exhibit minimal or no damage, depending on the situation. In the absence of rain, water dormant fields with a minimal amount (about 0.25 inch) every three weeks to keep the growing points hydrated.

### Mowing

Bermudagrass performs best when mowed at 0.5 to 1 inch using a reel mower. However, good performance can be achieved with a rotary mower with sharp blades set as low as possible without scalping. Uneven ground can make mowing below 1 inch difficult. For this reason, a 1- to 1.75-inch mowing height is recommended when using a rotary mower. For best results, bermudagrass should be mowed often (at least twice per week), especially at the lower mowing heights.

1. Keep the mower blades sharp and balanced. The cleanest cut and best mowing are obtained when the mower blades are sharp. Dull mower blades reduce turf quality by tearing instead of cleanly cutting the grass. Tearing creates many ragged leaf ends that quickly wither and bleach and are easy ports of entry for disease. Using a sharp mower is especially important for a high-quality athletic field. A properly sharpened and balanced mower blade will also reduce mower vibration, lengthen mower life, and reduce fuel consumption by as much as 22 percent.
2. Mow at the proper height. The frequency of mowing is governed by the desired grass height and by the amount of growth, which depends on temperature, fertility, moisture conditions, season, and the natural growth rate of the grass. In most instances, this may amount to twice weekly and weekly mowing. To maintain a high-quality field, turfgrass should be cut often enough that less than 33 percent of the leaf surface is removed with each mowing. If the turf gets too high during wet seasons, raise the mower and cut off a fourth to a half of the present growth. Then lower the mower to its proper height and mow again in a day or two.
3. Leave clippings to decompose when they are short. Clippings that remain on the field quickly decompose and release valuable nutrients and can reduce fertilizer use by 20 to 30 percent. If clippings become excessive, they may need to be removed. In some cases, removal is preferred before game-preparation practices, like lining a football field.

### Fertilizing

Soil should be tested at least every two to three years to determine the amounts of lime, phosphorus, and potas-

sium needed by your established field. Proper fertilizer rates and timing are essential for wear resistance, quick turfgrass recovery from traffic damage, and for aesthetic considerations. A complete fertilizer with an N-P-K ratio of 4:1:2 or 4:1:3 can be used in lieu of a soil test, but it is a poor substitute. Determine the amount of fertilizer, ratio of nutrients or fertilizer elements, and time of application based on the grasses being grown.

A total of 5 to 7 pounds of nitrogen per 1,000 sq. ft. per year is generally required for bermudagrass turfgrass used for sports purposes. A general quick-release, less costly nitrogen source such as ammonium nitrate (33-0-0) or ammonium sulfate (21-0-0) can be used during normal summer fertilization to promote rapid growth and color response. Do not apply fertilizer to wet, dormant, or semi-dormant turf. This may cause leaf scorching and encourage nutrient leaching and weed infestation. Fertilization application frequency is dependent on the nitrogen source. Quick release nitrogen sources are applied more frequently at lower rates than slow-release nitrogen sources.

Many of the soils in North Carolina are acidic and will require the application of lime to provide a good growing medium. Soil pH should be between 6.5 and 7.0 for optimum nutrient availability. Lime may be put on any time during the year. Fertilizers and lime should be applied uniformly with a centrifugal (rotary) or drop-type spreader. Apply half the fertilizer in one direction and the other half moving at right angles to the first pass to ensure uniform coverage.

### **Coring (Aerification)**

Soils that are subject to heavy traffic are prone to compaction. Soil compaction is especially prevalent along player benches, between hash marks, along sidelines, and in front of goals, where traffic is very heavy. Coring (removing a soil core  $\frac{3}{4}$ - to 1-inch in diameter to a depth of 3 to 4 inches) will alleviate this condition. Core cultivation is one of the most important management practices for competitive playing fields, yet one of the least appreciated or implemented. Use a device that removes soil cores. Chop up the cores and, if possible, distribute them by dragging with a span of chain-link fence or a mat. Core when the turfgrass is actively growing so that it can recover from any injury. Fields should be cored a minimum of twice yearly, once in the spring (April or May), just before fertilization, and again in mid to late summer. For fields that see intensive practice and play, will be overseeded, or are constructed with a heavy soil profile, plan to core a minimum of 3 to 4 times per growing season. Begin in late April or early May and repeat monthly, or at least every other month, until cool fall temperatures halt bermudagrass growth or one month before anticipated fall overseeding time. Some

lawn care and landscape companies offer coring service if equipment is not available on site.



**Regular aerification of fields is one of the most important management practices for maintaining quality sports fields.**

### **Verticutting**

Bermudagrass tends to build up thatch when it is heavily fertilized and watered. When thatch exceeds 0.75 inch, the field should be verticut and cored. When not excessive, thatch buildup can be removed from warm-season grasses by cutting as closely as possible at spring green-up and then raking by hand. If the field is heavily worn, verticutting may not be necessary, or necessary only in less-used areas of the field. Some lawn care and landscape companies have specialized equipment and offer power raking services.

### **Topdressing**

Topdressing is a maintenance practice that helps control thatch and level (or smooth) out low spots or ruts in the playing surface. Topdressing (if affordable) should begin in early spring immediately following core aeration, vertical mowing, and fertilization. Routine topdressing rates may be up to  $\frac{1}{4}$  inch in depth per application (approximately 34 cubic yards per acre). Topdress with soil similar to the playing field profile to prevent the formation of layers. Use a pull behind steel dragmat or brushes to incorporate the topdressing material into the turfgrass.

### **OVERSEEDING**

Overseeding sports fields in fall with ryegrass serves two main purposes: (a) provides desirable green color during fall, winter, and early spring months for spectators and, (b) helps protect the bermudagrass from excessive wear during cooler months when it is not actively growing. Overseeding, however, is an expensive, time-consuming operation. Overseeded grasses are also very competitive

during spring green-up, slowing transition back to bermudagrass and often weakening the stand. Overseeding also encourages the buildup of winter grassy weeds such as annual bluegrass (*Poa annua*).

### Overseeding Timing

Plan to overseed when daytime temperatures in late summer or early fall consistently fall into the 70s F. This usually is late September for the piedmont and mountain regions to mid October for the coastal areas. Where field use is extremely heavy, it may be necessary to overseed when there is a break in the event schedule. In these cases, it is best to schedule overseeding earlier in the season to provide future opportunities to apply more seed if necessary.

### Grasses Used in Overseeding

Perennial ryegrass is the best choice for most athletic fields. Perennial ryegrass is noted for fast germination, finer leaf texture, darker green color, seedling vigor, thicker growth, and better disease and traffic resistance compared to annual ryegrass. Perennial ryegrass seed costs more than annual ryegrass, but is well worth the investment if a high-quality playing surface is desired.



Overseeding bermudagrass field with ryegrass is performed primarily to provide green color during the winter and spring.

### Seeding

One month before overseeding, core aerify in several directions to help relieve soil compaction. One to two days prior to overseeding, drop the mowing height by ½ inch, and mow the area in two directions to open the turfgrass canopy to ensure good seed-to-soil contact. Remove thatch as necessary before seeding.

Apply seed at a rate of 10 to 15 pounds per 1,000 square feet (or 430 to 650 pounds per acre, depending on desired appearance. Budget restraints may require that lower rates be used but should not be less than 6 pounds

per 1,000 square feet. Seed in two directions (at right angles) and go over the area with a dragmat to help work the seed into the soil. Irrigate the field frequently enough (two to four times per day) to promote seed germination. One-eighth inch per application is sufficient at this time. As seedlings emerge, reduce watering to once daily but increase the amount and eventually reduce watering to an as-needed basis (approximately once or twice per week). Reducing irrigation frequency will encourage deep rooting while discouraging disease development. Mow the overseeded ryegrass about two weeks after planting to a 1-inch height after it reaches 1½ to 2 inches. Use only a sharpened mower blade to avoid excessive shearing of the young, tender seedlings. Mowing frequency is generally weekly in winter but may be required twice per week in spring, when active growth resumes.

Do not fertilize with excessive nitrogen just prior to or during the overseeding process as this may encourage excessive late-season bermudagrass competition. Adequate levels of phosphorus and potassium, however, should be maintained during this period for good plant growth. Normally, ¼ pound to ½ pound of nitrogen per 1,000 square feet every 3 to 4 weeks using a soluble nitrogen source is adequate to promote desired growth and color without over stimulating growth and encouraging disease. Traffic during turfgrass establishment should be minimized whenever possible.

### Spring Transition

The main objective in spring is a gradual and smooth transition from overseeded grasses back to bermudagrass. Dormant bermudagrass shows signs of green-up when soil temperatures reach approximately 60°F. During transition, overseeded turfgrasses become very sensitive to management practices designed to encourage bermudagrass recovery. The three main means of providing a desirable spring transition are proper timing, gradual reduction in mowing height, and a corresponding increase in nitrogen fertilization.

### Turf Colorants

Using turf colorants rather than overseeding provides an aesthetic alternative on fields which receive only limited play. Appropriate dilution rates, mixing, and uniform application are critical for successful painting of fields. It is highly recommended for those inexperienced with painting to experiment on a non-overseeded practice field to perfect the technique before trying it on the playing field. Specialty paints for athletic fields are available and are highly recommended for desired quality and little long-term negative effects to the permanent bermudagrass.



Painting a logo on a field in preparation for a game. Only paints formulated for use on turfgrass should be used to minimize damage to the turf.

## INTEGRATED PEST MANAGEMENT

People are becoming more aware and concerned about the effects of chemicals on our environment. Research indicates that pesticide use poses a minimal threat to the health of humans, animals, and the environment when used appropriately. But because we can't be certain, many people choose to avoid pesticides. So how would you handle a pest problem that is destroying the appearance of your field? Do you use pesticides, change cultural practices, or both?

The balanced use of all available control methods is called Integrated Pest Management (IPM). The idea is simple. All available prevention and control methods are used to keep pests from reaching damaging levels. Pesticides are used only when necessary.

Planting the best-adapted grass and then watering, mowing, and fertilizing it properly form the basis for integrated pest management. Keeping the turf healthy enables it to tolerate low levels of pests and makes the area a good habitat for beneficial organisms that help control pests.

If chemical control is necessary, select the safest effective pesticide and follow label recommendations. Chemicals should be applied when the pest is most susceptible. Treat only those areas in need, and regard pesticides as only one of many tools available in turf care. Integrated pest management can be successful, but more time and labor are required and high expectations may not be met when pest pressures and environmental conditions are severe.

For specific weed, insect, and disease identification and control recommendations, readers are referred to the publications Turf Pest Management Manual and The Pest Control Recommendation Guide. These publications are

available through the NC Cooperative Extension Service. Alternatively, most of this information is available on the website [www.turffiles.ncsu.edu](http://www.turffiles.ncsu.edu).

## Weeds

Weeds do not kill healthy turfgrass but appear when turf density and competitiveness decrease. However, with the extensive damage from traffic on sports fields, weeds can become established, and control measures are usually necessary.

## Insects

Several insects can infest sports turf including mole crickets, white grubs, fire ants, armyworms, and sod webworms. Cultural practices such as over fertilizing with soluble fertilizers, irregular mowing, overwatering, and thatch build-up encourage lush succulent growth which can lead to insect damage. The turfgrass area should be checked weekly for insect damage. Further examination for sod webworms, armyworms (infestations always start along the edge of the field), and mole crickets can be done by a soap flush method based on insect life cycles. Mix one fluid ounce of dishwashing soap in a 2-gallon sprinkling can full of water and drench a 2 square feet area. Observe the area for several minutes, and, if present, insects will emerge. (The one exception is white grubs.) Follow the management guidelines in Turf Pest Management Manual to reduce these problems.

## Diseases

Very few diseases pose a serious threat to athletic fields when proper turfgrass management practices are followed. Spring dead spot, caused by the soil-dwelling fungus *Ophiosphaerella korrae*, is one disease that can cause severe damage to bermudagrass athletic fields in North Carolina. Symptoms of spring dead spot appear in the spring as circular patches or rings, from 6 inches to several feet in diameter, that remain dormant as the surrounding turf greens-up. The affected turf is completely dead and eventually collapses to leave sunken depressions that severely detract from the safety and playability of an athletic field surface. Since the affected turf is completely dead, recovery from spring dead spot is very slow and may take the entire summer in severe cases.

Fungicides can be used to prevent spring dead spot development. Products containing fenarimol (Rubigan) or tebuconazole (Torque) are the most effective but must be applied preventatively in the fall prior to the onset of winter dormancy. These preventive applications should be watered in immediately with  $\frac{1}{4}$  inch of irrigation to



Large patch disease may be a problem during periods of slowed turfgrass growth.

drive the fungicide into the soil where the pathogen is active. Curative fungicide applications, those made in the spring after the appearance of symptoms, have shown no benefit against spring dead spot.

Fungicide treatments for spring dead spot are expensive and not feasible in many situations, therefore, cultural practices are often the only practical means for spring dead spot management. Bermudagrass varieties with improved cold tolerance, such as TifSport, Riviera, and Yukon, have some resistance to spring dead spot and are generally affected by the disease less severely. Follow closely the guidelines for fertilization, irrigation, and cultivation presented in this manual, as spring dead spot is enhanced by excessive fertilization, heavy thatch accumulation, soil compaction, and over-irrigation. Regular spiking or aerification to break up the layer of thatch and dead turf that is left behind can facilitate recovery from spring dead spot damage. Also, avoid the use of dinitroaniline (DNA) herbicides in the spring for pre-emergent control of annual grasses as these products can slow bermudagrass recovery by preventing new root development.

Damping off is a seedling disease which may attack perennial ryegrass overseedings during their establishment. This disease is caused by a variety of *Pythium* and *Rhizoctonia* species that infect the foliage or roots of the developing seedling. Prudent watering practices are an important first line of defense since constant leaf wetness or soil saturation is necessary for disease development. Preventive fungicides are often beneficial during periods of warm weather with high humidity or heavy rains. If a disease problem is suspected, submit a sample to the NC State Turf Diagnostics Lab through your local county Cooperative Extension agent so that an effective management strategy can be determined.



Spring dead spot disease on surrounding areas of a football field.

## RENOVATING DAMAGED AREAS

Due to extensive play or winter injury, bermudagrass sports fields may require replanting (or renovating) to achieve an acceptable turfgrass cover. If large areas are dead, sprigging is the most cost effective method of reestablishment. If small areas are damaged, plugging is a good method. Sodding is the quickest way to get a field ready for play. Late April and May are the preferred times for planting bermudagrass. To maintain consistency, use planting stock from the exact location the original grass was obtained.

## For More Information

This and the following Extension publications about sports turf are available on the NC State TurfFiles Web site: <http://www.TurfFiles.ncsu.edu/>. Or contact your county Cooperative Extension center for copies.

*Maximizing the Durability of Athletic Fields* (AG-726)[http://www.turffiles.ncsu.edu/PDFFiles/005037/AG-726\\_Maximizing\\_the\\_Durability\\_of\\_Athletic\\_Fields.pdf](http://www.turffiles.ncsu.edu/PDFFiles/005037/AG-726_Maximizing_the_Durability_of_Athletic_Fields.pdf)

*Baseball Field: Layout and Construction* (AG-725)  
[http://www.turffiles.ncsu.edu/PDFFiles/005036/AG-725\\_Baseball\\_Field\\_Layout\\_Construction.pdf](http://www.turffiles.ncsu.edu/PDFFiles/005036/AG-725_Baseball_Field_Layout_Construction.pdf)

*Tall Fescue and Kentucky Bluegrass Athletic Field Maintenance Calendar*  
[http://www.turffiles.ncsu.edu/PDFFiles/000012/Tall\\_Fescue\\_and\\_Kentucky\\_Bluegrass\\_Athletic\\_Field\\_Maintenance\\_Calendar.pdf](http://www.turffiles.ncsu.edu/PDFFiles/000012/Tall_Fescue_and_Kentucky_Bluegrass_Athletic_Field_Maintenance_Calendar.pdf)

*Diseases of Warm-Season Grasses* (AG-360)  
[http://www.turffiles.ncsu.edu/PDFFiles/000033/Diseases\\_of\\_Warm\\_Season\\_Grasses.pdf](http://www.turffiles.ncsu.edu/PDFFiles/000033/Diseases_of_Warm_Season_Grasses.pdf)

*Diseases of Cool-Season Grasses* (AG-361)  
<http://www.turffiles.ncsu.edu/PDFFiles/000032/ag361-np.pdf>

*Controlling White Grubs in Turf* (AG-366)  
<http://www.turffiles.ncsu.edu/articles/tf00506.aspx>

**Table 2. Suggested weed management calendar for bermudagrass sports fields. Note that recommendations vary depending on overseeding status.**

| Month                               | Weed Control Practice  |
|-------------------------------------|--|
| February 1 to March 15              | Apply a preemergence herbicide for crabgrass and goosegrass control. Repeat in 8-10 weeks. If severe traffic damage, spring dead spot, or winter kill to the bermudagrass is evident or suspected, use a herbicide containing oxadiazon (e.g., Ronstar or Regalstar). If the field is not severely worn or damaged, any preemergence herbicide is safe.  |
| May through June                    | Repeat preemergence herbicide use 8 to 10 weeks following the March application for season-long control. If crabgrass or broadleaf weeds emerge, use a postemergence product. Repeat in 7 to 10 days as directed by label.   |
| May through July                    | For purple or yellow nutsedge, or other perennial sedges, use a postemergence product. Repeat in 4 weeks or as directed by label.  |
| Late July through mid-August        | If the field is to be overseeded, a preemergence herbicide for annual bluegrass control should be considered. Consult label for overseeding intervals.   |
| Mid-August to September 1           | Apply preemergence herbicide for <i>Poa annua</i> control for sports fields not to be overseeded. Use label rates of Barricade, Dimension, Pendimethalin, or Surflan .   |
| 7 days prior to overseeding         | For overseeded fields, apply foramsulfuron (Revolver) or rimsulfuron (TranXit) for annual bluegrass control.   |
| Mid-September to end of September   | For non-overseeded fields, apply indazaflam (Specticle) for annual bluegrass control.  |
| October 15 to December 15           | On non-overseeded fields, apply simazine liquid (Princep or other formulations) or atrazine (Aatrex 4L or other formulations) to control winter annual weeds such as annual bluegrass, common chickweed, henbit, and most other winter annual broadleaf weeds. A repeat application can be made 60 days after initial application so long as yearly rate does not exceed 2 lbs ai/A. Do not apply to bermudagrass after Jan 15. Do not apply to sports fields which are overseeded. These herbicides will not satisfactory control wild garlic and some other perennial broadleaf weeds.   |
| Early November through December     | Apply 2,4-D or a three-way or four-way product, imazaquin (Image), metsulfuron, trifloxysulfuron (Monument) to control wild garlic, spurweed, clover, dandelions, and plantains. Add 0.25% v/v of a nonionic surfactant. Three-way products, four-way products, or 2,4-D may be used on overseeded ryegrass that has been mowed at least 3 times. Image also may be applied with a 0.25% v/v nonionic surfactant to control wild garlic, henbit, and common chickweed. Image, metsulfuron, or Monument should not be used on overseeded sports fields. Products containing clorpyralid (Confront) are especially active on clover. |
| Late November until end of December | On overseeded fields for annual bluegrass control, ethofumesate (Prograss, others) can be used in areas where bermudagrass goes dormant. A split application usually works best. If a hard frost has occurred, the first application should be made around the end of November with a split application 3 weeks later. If a hard frost has not occurred by late November, a single application in December after a hard frost should be used. Do not apply ethofumesate in NC after January 1.   |
| Mid-January to Mid-February         | Repeat 2,4-D or three-way combination product application 2 to 4 weeks after the first for wild garlic control. If the field is not overseeded and the bermudagrass is completely dormant, Glyphosate (Roundup Pro 4 lb/gal + others) may be applied at 1 pint per acre to provide nonselective weed control. Glyphosate should be used on warm winter days with an air temperature greater than 60 degrees. Application with colder temperatures significantly reduces control.   |

|   | JAN                | FEB  | MAR   | APR   | MAY                                  | JUN                                  | JUL  | AUG                                  | SEP                                  | OCT  | NOV                | DEC  |
|---|--------------------|--|---|---|--------------------------------------|--------------------------------------|--|--------------------------------------|--------------------------------------|--|--------------------|--|
| <b>Bermudagrass (Not Overseeded)</b>      |                    |  |   |   |                                      |                                      |  |                                      |                                      |  |                    |  |
| Fertilization                             |                    |  | 1 lb N/M<br>*include P and K based on soil test | 1 lb N/M  | 1 lb N/M                             | 1 lb N/M                             | 1 lb N/M   | 1 lb N/M                             | 1 lb N/M                             |  |                    |  |
| Preemergence weed control                 |                    | Crabgrass<br>Pre-emergence                     |   |   |                                      | Pre—<br>if split apps                |  |                                      | Pre— for<br>winter<br>weeds          | Atrazine<br>or Sima-<br>zine for<br>pre and<br>early post<br>control |                    | Atrazine<br>or Sima-<br>zine for<br>pre and<br>early post<br>control |
| Postemergence weed control<br>(as needed) |                    | Glyphosate at 1 pt/<br>acre, dormant turf only |   |   | Post ctrl<br>as needed               | Post ctrl<br>as needed               | Post ctrl<br>as needed                             | Post ctrl<br>as needed               | Post ctrl<br>as needed               |  |                    |  |
| Insect control                            |                    |  |   | Scout for white grubs, mole<br>cricket, fire ants – treat as needed |                                      |                                      | Scout for fall army-<br>worms — treat as<br>needed |                                      |                                      |  |                    |  |
| Disease control (as needed)               |                    |  |   |   |                                      |                                      |  |                                      | Treat if<br>previous<br>SDS          |  |                    |  |
| Irrigation (as needed)                    |                    |  | ≤½ inch/<br>week                                | ≤1 inch/<br>week  | ≤1 inch/<br>week                     | ≤2 inch/<br>week                     | ≤2 inch/<br>week                                   | ≤2 inch/<br>week                     | ≤1 inch/<br>week                     | ≤ ½ inch/<br>week  |                    |  |
| Aerification/Topdress                     |                    |  |   | Core Aeration (topdress<br>optional)                                | Core Aeration (topdress<br>optional) | Core Aeration<br>(topdress optional) | Core Aeration<br>(topdress optional)               | Core Aeration<br>(topdress optional) | Core Aeration<br>(topdress optional) |  |                    |  |
| Mowing (as needed)                        | ¾ - 1" 1x/<br>week | ¾ - 1" 1x/<br>week                             | ¾ - 1" 1x/<br>week                              | ¾ - 1" 2x/<br>week  | ¾ - 1" 2x/<br>week                   | ¾ - 1" 3x/<br>week                   | ¾ - 1" 3x/<br>week                                 | ¾ - 1" 2x/<br>week                   | ¾ - 1" 2x/<br>week                   | ¾ - 1" 1x/<br>week   | ¾ - 1" 1x/<br>week | ¾ - 1" 1x/<br>week   |
| Other                                     |                    |  |   | Slicing   | Slicing                              | Slicing                              | Slicing  | Slicing                              |                                      |  |                    |  |

|  | JAN                 | FEB                     | MAR   | APR  | MAY                               | JUN   | JUL  | AUG                               | SEP                               | OCT                                     | NOV            | DEC                 |
|--|---------------------|-------------------------|---|--|-----------------------------------|---|--|-----------------------------------|-----------------------------------|---|----------------|---------------------|
| <b>Bermudagrass (Overseeded with Ryegrass)</b> |                     |                         |   |  |                                   |   |  |                                   |                                   |   |                |                     |
| Fertilization (N per 1000 sq ft)               | ½ lb N/M            | ½ lb N/M                | 1 lb N/M<br>*include P and K based on soil test |  |                                   | 1 lb N/M  |  | 1 lb N/M                          |                                   | ½ to 1 lb N/M using Complete Fertilizer |                | ½ lb N/M            |
| Preemergence weed control                      |                     | Crabgrass Pre-emergence |   |  |                                   | Pre— if split apps                                  |  |                                   |                                   |   |                |                     |
| Postemergence weed control                     | Post ctrl as needed |                         |   |  | Ryegrass removal                  | Post ctrl as needed                                 | Post ctrl as needed                        | Post ctrl as needed               | Post ctrl as needed               |   |                | Post ctrl as needed |
| Insect control                                 |                     |                         |   | Scout for white grubs, mole cricket, fire ants — treat as needed |                                   | Scout for white grubs, mole worms — treat as needed | Scout for fall armyworms — treat as needed |                                   |                                   |   |                |                     |
| Disease control                                | As needed           |                         |   |  |                                   |   |  |                                   |                                   | Pythium control on young seedlings      |                | As needed           |
| Irrigation (as needed)                         | ≤½ inch/week        | ≤½ inch/week            | ≤1 inch/week                                    | ≤1 inch/week   | ≤1 inch/week                      | ≤2 inch/week  | ≤2 inch/week                               | ≤2 inch/week                      | ≤1 inch/week                      | ≤1 inch/week                            | ≤½ inch/week   | ≤½ inch/week        |
| Aerification/Topdress                          |                     |                         |   | Core Aeration (topdress optional)                                | Core Aeration (topdress optional) | Core Aeration (topdress optional)                   | Core Aeration (topdress optional)          | Core Aeration (topdress optional) | Core Aeration (topdress optional) |   |                |                     |
| Mowing (as needed)                             | ¾ - 1" 1x/week      | ¾ - 1" 1x/week          | ¾ - 1" 1x/week                                  | ¾ - 1" 2x/week   | ¾ - 1" 2x/week                    | ¾ - 1" 3x/week                                      | ¾ - 1" 3x/week                             | ¾ - 1" 2x/week                    | ¾ - 1" 2x/week                    | ¾ - 1" 1x/week                          | ¾ - 1" 1x/week | ¾ - 1" 1x/week      |
| Other  |                     |                         |   | Slicing  | Slicing                           | Slicing   | Slicing                                    | Slicing                           |                                   | Overseed (70°F)                         |                |                     |

|                        |  |
|------------------------|--|
| <p>Fertilization</p>   | <p>Contact your local Extension agent about conducting a routine soil test in the spring each year for phosphorus, potassium, and lime recommendations. Proper fertilization rates and timing are essential for wear resistance and quick turfgrass recovery from traffic damage. For a newly sodded turf, apply a complete fertilizer (e.g., 6¼ pounds of 16-4-8 per thousand square feet or 275 pounds per acre for a rate of 1 pound of N per thousand square feet) before planting and then another 2 weeks later. Once established, a total of 5 to 10 pounds of nitrogen and 3 to 5 pounds of potassium per one thousand square feet per year is generally required for bermudagrass used for sports purposes. If there is extreme wear, the fertility program should be supplemented with two to three ¾-pound N applications per one thousand square feet with a soluble source of nitrogen (such as urea, ammonium sulfate or ammonium nitrate) during periods of heavy use to aid in bermudagrass recovery. Slow release or controlled released products are excellent if your budget allows.</p>  |
| <p>Weed control</p>    | <p>The first line of defense against weeds is a good healthy stand of turf. But with an actively used athletic field, that is often not enough, meaning chemical control might be necessary. Controlling traffic so that you do not have bare areas is a great help. Remember, always read label precautions and always follow label directions on chemicals applied to turf. Be sure sprayer or spreader is properly calibrated.</p> <p>For specific products and timings, refer to the calendar outlined in Table 2 of this publication.</p> <p>Additional products are suitable for use. For a more complete list, refer to the Pest Control Recommendation Guide that can be found at <a href="http://www.turffiles.ncsu.edu">www.turffiles.ncsu.edu</a>.</p>  |
| <p>Insect control</p>  | <p>There is little that can be done for preventive control of insects on athletic fields. The insecticide must come in contact with the insect in sufficient concentration for control (there must be a population present to control). Several chemicals can be used on athletic fields that are effective for controlling a number of common turf insects. Products may be available in different formulations (granular or liquid) to suit your application needs. Several products are available as granular bait or attached to a fertilizer carrier and applied dry. Granules are ready-made insecticides that you apply dry. You can spread the granules with either a rotary (centrifugal) or drop (gravity) spreader. Check labels for application directions and precautions.</p> <p>This is a period of rapid change in insecticide product development. For a complete list of current products, refer to the Pest Control Recommendation Guide that can be found at <a href="http://www.turffiles.ncsu.edu">www.turffiles.ncsu.edu</a>.</p>   |
| <p>Disease control</p> | <p>Grasses that receive good irrigation, mowing, and fertilization practices are less susceptible to turf diseases. Due to the expense of fungicides, an athletic field turf manager may want to approach disease control on a curative basis (rather than a preventive basis) unless they have had a history of disease incidence. The exception may be with overseeded grasses. Due to our warm, humid weather in the fall and winter, a more proactive approach may be warranted. Many of our fungicides are broad spectrum in nature, but labels should be checked for the targeted pathogen before application. The Pest Control Recommendation Guide found at <a href="http://www.turffiles.ncsu.edu">www.turffiles.ncsu.edu</a> website is an excellent resource to use in selecting the appropriate product.</p> <p>If the disease history is unknown, an initial disease diagnosis may be necessary. Contact your local Cooperative Extension office. Alternatively, diagnosis of turfgrass diseases is available for a minimal charge from the NC State Turf Diagnostic Lab. <a href="http://www.ncstateturfdiagnostics.com">http://www.ncstateturfdiagnostics.com</a></p> |

|                       |   |
|-----------------------|---|
| Irrigation            | <p>Supplemental irrigation is necessary to maintain a desirable playing surface. During the spring and summer (in the absence of rain), irrigation will be necessary a minimum of one to two times weekly. The general guidelines provided in the calendar represent estimations based on long-term weather patterns. Adjust the irrigation needs as appropriate for the current conditions. Do not irrigate between 10 am and 4 pm to promote water conservation, and follow local ordinances. Be aware that more rigorous water restrictions may be imposed by the county.</p>  |
| Aerification/Topdress | <p>Suggest that fields be aerified a minimum of three times yearly, once in the spring (April or May), again in mid summer, and then in fall. This relieves compaction, allows better soil-oxygen penetration, and encourages deeper rooting. Cores can be redistributed with a dragmat. Topdressing would be very useful to level out low spots in the playing surface. Topdressing should begin in early spring immediately following core aeration and fertilization. The topdressing sand should ideally be spread consistently and worked into the turf with a dragmat. A routine topdressing rate is ¼ inch in depth. Exercise care when choosing a topdressing material to meet your objectives (drainage, water retention, etc.).</p> |
| Slicing/Verticutting  | <p>Slicing can be used during the growing season for some alleviation of compaction and to improve turf growth. Verticutting should only be done if thatch is excessive, and only during the summer when the grass can rapidly recover.</p>   |
| Mowing                | <p>Proper mowing promotes deeper rooting and a more stress-tolerant plant. Mow often so that no more than 30% of the foliage is removed at one mowing. Highly maintained bermudagrass fields require two to three mowings weekly. A reel-type mower produces the finest cut, but rotary mowers may be used if the blades are sharp. Bermudagrass fields are normally mowed to a height of ¾ to 1½ inches. An overseeded field should be mowed a little higher (1 to 2½ inches).</p>   |
| Overseeding           | <p>Overseeding provides fall and winter color and protects bermudagrass when it is dormant. Overseeding can add a significant expense to a maintenance budget so it should not be performed unless time, effort, and money are allocated. Normal overseeding time is when the daytime temperatures are in the low 70s. This is usually mid September to early November in NC. Perennial ryegrass is the best choice. Annual or Intermediate ryegrass may be used but expect lower quality, especially in the spring. A typical seeding rate for these grasses is 8 to 20 pounds of seed per 1,000 square feet (350 to 870 pounds per acre), depending on desired appearance and budget constraints.</p>                                       |

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